An Evaluation of “Road Diet” Projects on Five Lane and Larger Roadways

Introduction

“Road Diets,” or road lane reallocations, have been increasingly utilized by agencies to improve roadway safety, multi-modal accessibility, and traffic operations in a cost-effective manner. Agencies have also implemented these projects as a tool for stimulating the local economy and achieving broader environmental goals. To-date, the majority of road diets have been implemented on low to moderately-trafficked four-lane bi-directional roadways, converting these to three lane cross-sections (two through lanes and center turn-lane). These often utilize the additional space from this conversion for on-street parking, bike lanes, or other uses increasing the overall utility of the roadway. In the correct context, four to three lane road diet projects have shown to have substantial benefits, including vehicle collision reductions, reduction in speeding, traffic flow improvement, and increased bicycle and pedestrian safety, to name a few (K. Knapp et al., 2014).

While there have been many studies on the characteristics that make a roadway a good candidate for four to three-lane road diets, as well as post-implementation evaluations showing their positive impacts on safety, multi-modal accessibility, and traffic operations, little research exists that evaluates the potential benefits of road lane reallocations on bi-directional roadways with more than four lanes. This is not due to a lack of interest; a demand for such information has been indicated by several agencies and organizations studying and implementing these types of conversions such as the National Association of City Transportation Officials (NACTO) and its member cities. Resources providing design guidance, implementation strategies, and estimated benefits would be beneficial to many cities studying roadway space reallocations on roads over four lanes.

An Evaluation of "Road Diet" Projects on Five Lane and Larger Roadways

This research strives to understand how roadway lane reallocation projects on five lane and greater roadways affect roadway safety, operations, and multimodal accessibility. The strategies employed to achieve these goals will be to first, evaluate existing literature on the subject, and second, evaluate examples of five-lane or greater road lane reallocations from around the United States as case studies, studying changes in safety conditions, traffic operations, and multimodal use between before and after designs. The final document provides a useful resource for agencies studying the potential application of road diets on five lane and greater roadways, and recommends future areas of research to better understand the effects on safety, operations, and multimodal use.

Since existing literature mainly concentrates on four to three-lane road diets, the literature review will seek to understand the general lessons-learned from such road-diets that could be applied to road lane reallocations on roadways five lanes and greater. The evaluation of road lane reallocation case studies reviews common types of roadway analyses conducted by implementing agencies on roadway reallocation projects to serve as indicators of corridor safety, traffic operations, and multimodal performance before and after the project. Examples of these analyses include, but are not limited to, before and after crash data as an indicator of roadway safety, Bicycle and Pedestrian Level of Service analyses (BLOS and PLOS) as an indicator of multimodal accessibility, and Level of Service analysis (LOS) as an indicator of traffic operations performance. Because road lane reallocation projects can also be sensitive projects politically, the research also investigates the public outreach processes and qualitative surveys that took place during project development.

Literature Review

Studies specifically looking at the safety, operational, and multimodal impacts of roadway lane reconfigurations on roadways five lanes or greater have not been conducted to date. For this reason, this study focuses on reviewing the extensive body of existing literature on 4 lane to 3 lane road diets to see where lessons from this research can be applied to roadways of five lanes or greater. In addition, this study reviews literature on roadway operational characteristics and safety countermeasures applicable to roadways five lanes or greater to see what lessons and guidelines can be applied in this context.

Applicable traffic safety countermeasures

Existing literature on four to three-lane road diets revealed many safety benefits that likely would apply to lane reconfiguration projects on five-lane or greater roadways. The following sections describe these benefits and in what contexts they would apply on five-lane or larger roadways.

Reduce incidence for rear-end crashes with left-turning traffic: Several studies have shown that the addition of a two way left turn lane (TWTL) to the roadway removes mid-block left-turning cars from the traffic stream reducing the chance of rear-end collisions (D. W. Harwood, 1990), (Hovey, Chowdhury, Zhou, & Fries, 2009). This benefit would be applicable to five lane or greater road reconfigurations where a TWTL is added by repurposing through lanes.

Slow Traffic: Studies have indicated that four to three lane road diets reduce the speed of traffic owing to the concept that reducing through traffic to one lane in each direction limits traffic speeds to that of the leading vehicle. Reduced traffic speeds lead to reductions in crash severity for both vehicle on vehicle and vehicle on non-vehicle collisions (Stamatladis, Kirk, Wang, Cull, & Agarwal, 2011), (K. Knapp et al., 2014). This benefit could be applicable to five to three lane road reconfigurations since through lanes are reduced to one lane in either direction, but it's unclear whether this benefit would apply to reconfigurations where two or more through lanes are maintained in either direction.

Reduce the potential for sideswipe crashes: Reducing the number of lanes has been shown to reduce opportunities for vehicles changing lanes (also known as weaving), and the conflict points between changing vehicles (K. Knapp et al., 2014). While it's generally understood that roadways with fewer lanes have fewer crashes associated with sideswipes, the magnitude of improved safety as a result of removing through lanes is unclear but likely depends on before/after configurations and congestion levels (Kononov, Bailey, & Allery, 2008), (D. W. Harwood, 1990).

Add Bicycle Facilities: Adding bicycle facilities has been shown to improve safety for non-motorized users along a roadway (Jensen, 2008), (L. Chen et al., 2012). Traditional four to three lane road diets often have the added benefit of adding bicycle lanes along a roadway. Lane reallocations on five lane and greater roadways can also include bike lanes, with sufficient roadway width often available for adding buffered bike lanes or separated bike lanes. Buffered bike lanes are designed and operate like standard bike lanes except they have a painted buffer from traffic, on-street parking, or both. Separated bike lanes are separated from vehicular traffic by both a horizontal buffer and vertical element like parking, flex-post bollards, or concrete curb (Goodman et al., 2015). Both have been shown to provide additional safety and comfort benefits for bicyclists, especially on higher volume and speed roadways (Monsere, Dill, Clifton, & McNeil, 2014).

Pedestrian benefits: Four to three lane road diets have been shown to benefit pedestrian safety in several ways. They reduce the effective distance and number of vehicular lanes a pedestrian has to cross, they allow for median pedestrian refuges at midblock crossings along some corridors, and they can slow vehicle speeds reducing potential crash risk and severity (K. Knapp et al., 2014), (Zegeer, Stewart, Huang, & Lagerwey, 2001). The addition of bike lanes or on-street parking creating greater lateral separation from moving vehicles has also been shown to increase pedestrian comfort (D. Harwood et al., 2007). All of these benefits are transferrable to road lane reallocations on five lane or greater roadways.

Reduction in conflict points: Traditional four to three lane road diets reduce the number of potential vehicular conflict points on a roadway, as shown in **Figure 1** (Knapp et al., 2014), (Stamatladis et al., 2011). Reducing the number of lanes on a roadway five lanes or greater also has this effect.

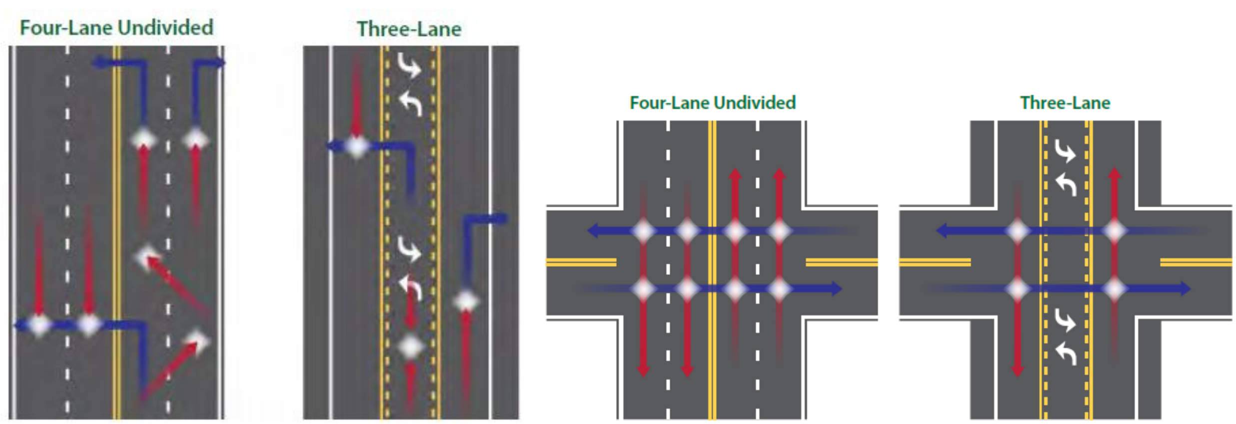


Figure 1: Representation of conflict point reduction on four to three lane road diets (K. Knapp et al., 2014)

Side street traffic crossing: One noted benefit of four to three lane road diet projects is the benefit to left-turning traffic at unsignalized side streets and driveways. The addition of a two-way center turn lane (TWTL) provides an opportunity for turning vehicles to cross the roadway in two stages and the reduction in the number of lanes increases a turning driver’s ability to see oncoming traffic and, in theory, find a gap in traffic to cross (Kirk, 2014), (Stamatladis et al., 2011). This benefit would also likely be applicable to projects on five lane and greater roads that add TWTLs and/or reduce the number of traffic lanes.

Improved sight distance: The reduction in the number of lanes on four to three lane road diets has been shown to improve the sight distance for turning vehicles by reducing the potential for a vehicle on an inside lane blocking the view of vehicles or other roadway users further from the roadway’s edge. This benefit would likely be applicable to road lane reallocations that add TWTLs and/or reduce the number of traffic lanes on roadways five lanes or greater as well. **Figure 2** below shows how four to three lane road diets improve sight distance.

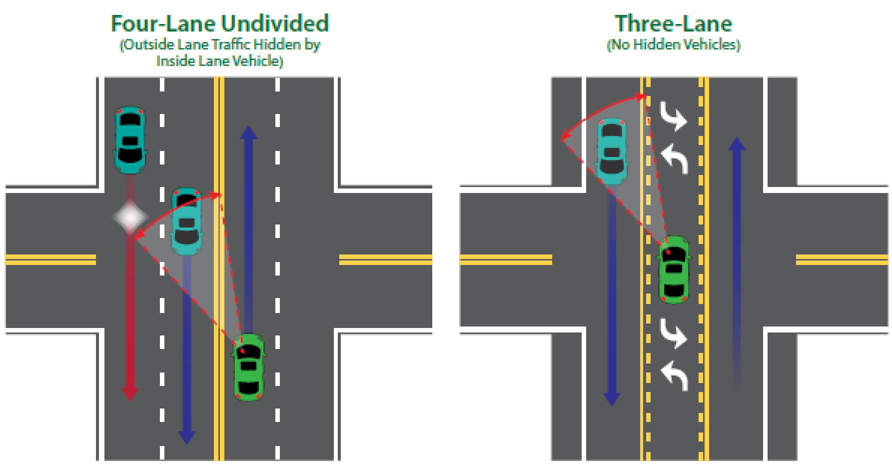


Figure 2: *Representation of sight line improvement on four to three lane road diets (K. Knapp et al., 2014)*

Adjusting lanes to appropriate widths: Lane widths along a road can have significant impacts on safety and operations depending on the operational characteristics and context of a corridor (Potts, Harwood, & Richard, 2007), (Petritsch & PTOE, 2009), (D. Harwood et al., 2007). Road lane reductions and reallocations often have the potential to adjust existing lanes that are deemed too wide for the context, or widen lanes that are deemed too small for the context. This is true of both four to three lane road diets and lane reallocations on roadways five lanes or more.

Applicable traffic operations improvements

Existing literature on four to three-lane road diets also indicated many operational benefits that could apply to lane reconfiguration projects on five-lane or greater roadways. The following bullets describe these benefits, to what contexts they would apply on five-lane or larger roadways, and provide the source(s) they originated from:

Reduced delays as a result of reduced weaving: On streets with high volumes of left turning vehicles and no TWTL, inside lanes often function as de-facto turn lanes, with many through vehicles avoiding them because of the presence of queued vehicles. As discussed above, adding a TWTL removes left-turning traffic from through lanes, freeing up a lane's worth of roadway width that can be utilized for bike lanes, parking, etc. In some cases, adding the TWTL has shown to improve traffic flows due to a reduction in lane weaving (K. Knapp et al., 2014), (Stamatladis et al., 2011).

Reduced side street delays: As mentioned above, The addition of the TWTL provides an opportunity for turning vehicles to cross the roadway in two stages and the reduction in the number of lanes increases a turning driver's ability to see oncoming traffic and, in theory, find a gap in traffic to cross (Kirk, 2014), (Stamatladis et al., 2011). This has been shown to both increase safety and reduce delay for vehicles exiting side streets and driveways.

Bus pullouts: One of the cited disadvantages of four to three lane road diets can be delays as a result of stopped traffic (such as busses) in the through lane (Rosales & Brinckerhoff, 2006). On five lane or greater road lane reallocations, this is may be a non-issue either because there is more than one through lane in either direction or there is room for a bus pullout to be nested within the bike lane or parking lane (see **Figure 3** below for example).

Figure 3: A bus stop/separated bike lane mixing zone on Milwaukee Ave. in Chicago (Vance, 2013)

Wider effective turn radii at intersections: bike lanes or parking lane buffers allow for effectively wider turning geometries at intersections, facilitating turning movements and reducing the necessary curb radius. This is particularly helpful for vehicles with large turning radii like trucks and busses (K. Knapp et al., 2014).

Driveways: Improvements to driveways in conjunction with road lane reallocations can help to improve both traffic flow (Gluck, Levinson, & Stover, 1999) and safety (D. Harwood et al., 2007). Taking measures to formalize driveway entrances and consolidate driveways among multiple properties can help to reduce the overall number of ingress/egress points and increase their spacing, improving traffic operations on road lane reallocation projects of all types.

Signal optimization: One study showed that signal optimization along traditional four to three lane road diets can mitigate the effects of delay as a result of capacity reduction (K. K. Knapp, Giese, & Lee, 2003). Such treatments should generally be applicable to lane reconfiguration projects on roadways five lanes or greater.

Potential Consequences

While the list of potential benefits resulting from road lane reallocation projects is great, there are a number of cautions and potential consequences that should be considered as well.

Freight and bus operations: Project development should consider whether the corridor is part of a transit line or freight corridor and how impacts to traffic operations will affect the movement of large trucks and busses. A project that increases vehicle travel time along the corridor could impact freight and bus reliability (K. Knapp et al., 2014). However, as discussed above, road reallocation projects can have benefits for freight and bus operations as well.

Functional classification and network designation: Projects should consider impacts on the functional classification network to ensure that changes to specific corridors don’t induce wider transportation system impacts. Similar considerations should be taken into account if the corridor is part of a larger network such as the state or US highway system (Taylor, 2014).

Intersection Level of Service and stacking: One common area of concern in implementing road lane reallocation projects is intersection Level of Service. Intersections with high volumes of turning traffic should be studied carefully as these can substantially impact operations on corridors with road lane reallocation projects. Also, corridor segments with short-spaced, high-volume signalized intersections could experience intersection stacking, where traffic backs up across intersections (Sprague, 2015a). However, lane reallocation projects on five lane or greater roadways may not be as susceptible to these issues due to the possibility of reallocating space from bike lane or parking for dedicated turn lanes at intersections.

Case Study Findings

Table 1 below provides a list of completed and proposed road lane reallocation projects on five lane or greater roadways that were studied for this report. The investigations were conducted by collecting articles and presentations, reviewing technical documents such as traffic analysis and striping plans, and discussion with implementing agency representatives. This study investigates projects that had readily available data, are located in urban areas, are over .5mi in length, and were completed within the last 10 years. As **Table 1** indicates, he projects reviewed ranged across 9 mid-sized to large cities, on five-lane to nine-lane roads ranging from 7,000 average vehicles per day to 45,000 average vehicles per day. Most roadways reviewed are classified as collector or arterial roadways. Common design elements among many of the projects reviewed include center turn lanes, pedestrian safety features such as mid-block crossing islands, bulb-outs, and traffic calming, and all projects add or improve bike lanes.

The purpose of these case studies is to identify common trends in network operations and safety impacts as well as design characteristics among these projects that could be the subject of future, more detailed investigations. The following sections present the major impacts that emerged from the review of the case studies. A separate appendix document provides detailed analyses of the projects highlighted in **Table 1**.

Status	Year	State	City	Street	Miles	Owner	ADT	Width	Lanes Before	Lanes After
Completed	2015	CA	Los Angeles	Venice Blvd.	0.8	City	45k	100'	7	5
Completed	2015	TN	Memphis	US 51, Danny Thomas Blvd	1.9	TDOT	20k	87'	7	5
Completed	2015	TN	Chattanooga	Broad	0.8	City	8.1K	96'	6	4
In Progress	2015	GA	Atlanta	Peachtree Rd.	2.8	GDOT	40k	60'	6	5-6
Completed	2015	UT	Salt Lake City	200 West	1.5	City	15-30k	88'	5	3
In Progress	2015	CA	Oakland	Telegraph	0.6	City	10-15k	67'	5	3
Proposed	2015	SC	Columbia	Farrow	1.8	SCDOT	13.7K	64'	5	3
Proposed	2015	SC	Columbia	Sumter	0.9	SCDOT	8.2K	78'	5	3
Completed	2014	CA	Oakland	E 12th St.	1.4	City	10-15k	74'	6	4
Completed	2014	UT	Salt Lake City	300 South	1.4	City	10-15k	70-90'	5	3
Proposed	2014	CA	Los Angeles	Figueroa	5.1	City	25K	58'	5	3
Completed	2013	CA	Los Angeles	Colorado	3	City	34K*	94'	7	5
Completed	2013	GA	Atlanta	Ponce de Leon	1	GDOT	35k	68'	7	5
Completed	2013	OR	Portland	Multnomah	0.8	City	10K	59'	5	3
Completed	2012	TX	Austin	Shoal Creek	1.2	City	7.5k	60'	5	3
Completed	2012	TX	Austin	Harris Ridge	0.75	City	6k	60'	5	3

Status	Year	State	City	Street	Miles	Owner	ADT	Width	Lanes Before	Lanes After
Completed	2011	DC	Washington	Pennsylvania Ave	1	City	35k	100'	9	7
Completed	2010	NC	Charlotte	East Blvd	0.7	City	18.8k	70'	5	3
Completed	2009	TX	Austin	Dean Keeton	1	City	13.5k	78'	6	4
*Indicates Average Weekday Traffic										

Table 1: 5 lane and greater lane reallocation projects reviewed for the report. Highlighted rows are projects included as case studies. Data sources include project analyses referenced in this report, as well as ADT data, historical photos, and measurements obtained from Google Earth.

Impacts to Corridor Operations

One of the common goals of agencies implementing lane reallocation projects is to encourage travel by non-motorized modes of traffic. However, a common concern are the potential impacts of these projects on vehicular traffic operations. This research investigated the operational impacts of 5+ lane reallocation projects on both motorized and non-motorized roadway users.

Mode shift from single-occupancy vehicles to other modes can be an indicator of how effective a project is in achieving this goal. Measuring mode shift is often done through user counts over a period of time. While before and after counts are a commonly-used measure for meeting mode shift goals, it is unclear whether changes in user counts indicate actual shifts from motor vehicle travel to other modes as a result of a roadway reallocation project, or whether this indicates other factors such as changes in travel patterns and/or exogenous influences (such as increases in fuel price).

Pennsylvania Avenue and Multnomah Street both showed an increase in bicycle ridership after completion of the road lane reallocations on these corridors. While no significant impacts to corridor travel time were observed, there were significant decreases in motor-vehicle traffic volumes for both corridors. However, the traffic operations studies conducted after the Ponce de Leon Avenue and East Boulevard projects show no significant impacts to traffic throughput or travel time speed. This conflicting evidence may indicate that motor vehicle reductions and/or bicycle ridership increases signify a shift in vehicle and bike travel patterns rather than mode shift. More information on these studies is presented in the following sections.

Pennsylvania Avenue – Washington, DC

Pennsylvania Ave is an iconic corridor in Washington DC connecting parks, museums, and governmental buildings in the center of the City. In 2010, the City of Washington reconfigured the roadway to install bi-directional buffered bike lanes in the center of the roadway for the segment of the road that connects the US Senate building to the White House (3rd St. NW to 15th St. NW). This reconfiguration resulted in the loss of two vehicular travel lanes to accommodate the width needed for bicycle facilities. Prior to the installation of bike lanes, the corridor had an ADT of about 35,000 cars per day.

Following the roadway reconfiguration, DDOT conducted a robust evaluation of the project conducting surveys asking local businesses, residents, and corridor users their opinions on the new roadway configuration, surveys evaluating user comprehension of the new bikeway traffic control devices, bicycle and pedestrian analyses, and vehicular level of service and volume analysis (Parks et al., 2012). The study indicated that vehicle Level of Service on Pennsylvania Avenue wasn't significantly affected. However, motor vehicle volumes showed a decrease of 15%-21% as a result of the project (Parks et al., 2012). In addition, bicycle ridership along the corridor showed a substantial increase from before the reconfiguration to after. Bicycle counts were conducted for the AM peak and the PM peak, and all count locations showed a 221-315 percent increase in bicycle ridership from before to after conditions (Parks et al., 2012).

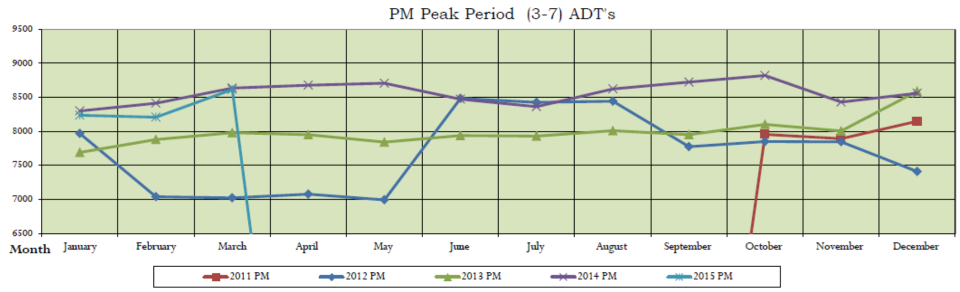
Multnomah Avenue – Portland, OR

The city of Portland initiated a road lane reallocation project on Multnomah Street as a pilot project to create a "main street" for the Lloyd District ("NE Multnomah Street Pilot Project," n.d.). The pilot project included NE Multnomah St. from NE 16th Ave. to NE Wheeler St as well as several blocks of Holladay St, which runs parallel to NE Multnomah. The majority of Multnomah was converted from four lanes with a center turn lane and approximately 4.5' bike lanes to 3 lanes with a center turn lane, separated bike lanes, and on-street parking on one side of the street. Pedestrian refuge islands were also installed intermittently along the corridor.

The project was one of the focus corridors in the 2014 study *Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the US* (Monsere et al., 2014). The study included resident surveys, bicyclist surveys, video collection and review, count data analysis, and an economic impact analysis. Bicycle ridership data from the study and vehicular ADT data were collected before and after the project. The counts showed that on the corridor, ADT decreased from 10,000 to 7,600 vehicles and bicycle ridership increased by 68% one year after installation (Monsere et al., 2014).

Ponce de Leon Avenue – Atlanta, GA

Ponce de Leon Ave. is classified as a principal arterial providing an important east/west connection in the Midtown neighborhood of Atlanta. The approximately two-mile section between Juniper St and Moreland Dr. underwent a road lane reconfiguration in 2013 to convert two of the through lanes into four through lanes with a center two-way turn lane (TWTL) and buffered bike lanes on a one-mile portion. GDOT conducted post-project traffic and safety evaluations of the Ponce de Leon project and found indications that traffic flow along the corridor have improved (Heath, 2015). As **Figure 4** shows, peak and average vehicular volumes in 2014 and 2015 have increased by approximately 500 vehicles. **Figure 5** shows that in 2014, peak travel time speeds have been minimally impacted, if not improved along the corridor.



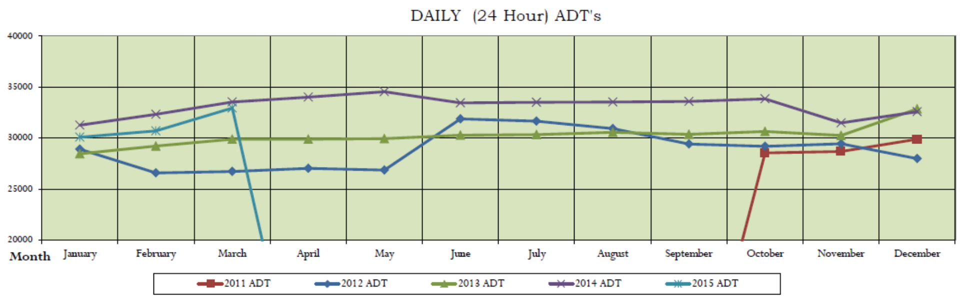


Figure 4: 2011-2015 PM peak and ADT traffic volumes for Ponce de Leon (Heath, 2015)

	Travel Time (min)	Speed (mph)
2012-2013 average	4.22	27.99
Spring 2014	3.69	31.88
Difference	*-0.53 min*	*+3.89 mph*

2012-2013 average	6.36	18.66
Spring 2014	7.75	16.26
Difference	*+1.39 min*	*-2.4 mph*

Figure 5: *Before and after traffic speeds for Ponce de Leon (Heath, 2015)*

East Boulevard – Charlotte, NC

East Boulevard is classified as a major collector roadway with an ADT of 18,800 in the Dilworth neighborhood, a relatively low-density historic residential neighborhood ("NCDOT Go!NC GIS Clearinghouse," n.d.). East Boulevard serves as a hub of mixed and higher-density land-uses for the neighborhood including offices, retail, grocery stores, restaurants, multi-family housing, a major hospital, and a park and greenway trail (Wagner & Searcy, n.d.). A city bus route is also located on the corridor. In 2010, the section of the roadway with a cross-section of four through lanes with a TWTL and on-street, parallel parking was reconfigured to two lanes with a TWTL, bike lanes, and on-street parking as phase II of a three phase roadway reconstruction project.

A considerable amount of before and after traffic flow, speed, and crash data was collected for project. Since the data analyzes both roadway segments that the City converted from four to three lanes as well as those that the City converted from five to three lanes, this allows for some ability to control for speed limits, traffic volumes, land-use, safety, etc. when comparing the two segments. As indicated in **Figure 6**, traffic throughput was not significantly impacted as a result of the project for both the four to three lane section and the five to three lane section.

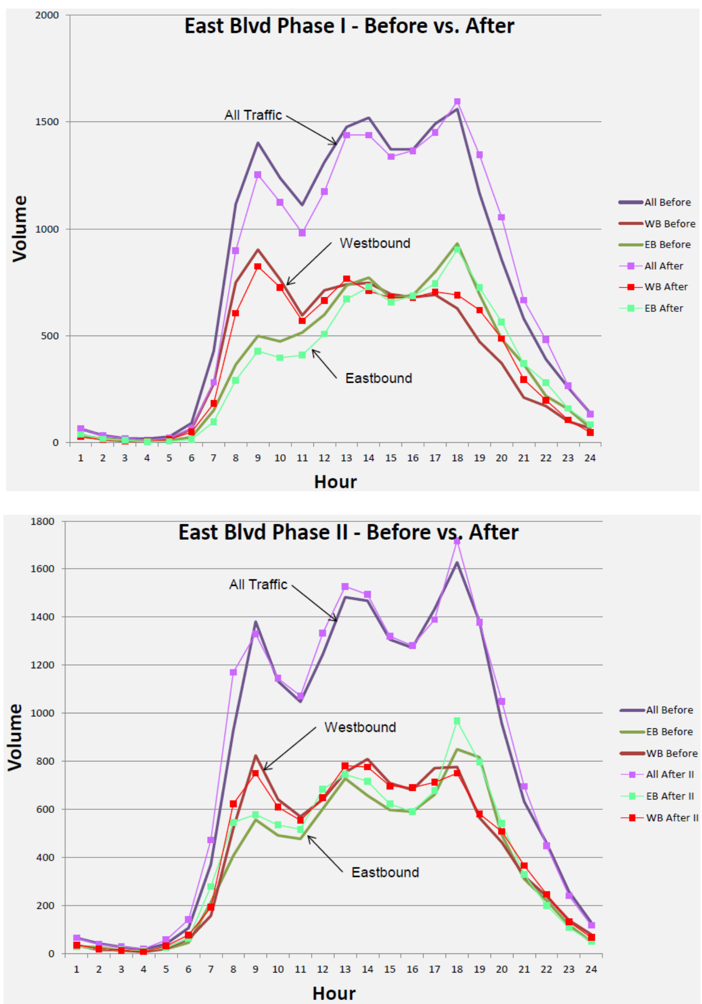


Figure 6: Traffic Volume Measurements on East Blvd before and after Phase I (4 to 3 lane road diet) and Phase II (5 to 3 lane conversion) (Saak, 2013).

Inconclusive Safety Impacts

Another common goal of road lane reallocation projects is to improve overall corridor safety. Four to three lane road diets have generally shown safety improvements, however the evidence gathered on five lane and greater lane reallocation projects has been inconclusive. Crash data is a commonly-used metric for evaluating changes in roadway safety. The analysis looked at crash data analyzed for Ponce de Leon Avenue, East Boulevard, Pennsylvania Avenue, Multnomah Street, and Colorado Boulevard generally showed similar numbers of reported crashes before and after project implementation. The East Boulevard and Pennsylvania Avenue projects showed increases in bicycle and pedestrian crashes, but this is likely a product of increased bicyclist and pedestrian use rather than a reduction in safety.

Speed reduction is a commonly cited objective in order improve safety and comfort for roadway users, especially bicyclists and pedestrians. The only case study that measured changes in before and after speeds was conducted on the East Boulevard project. The City conducted an analysis of 85th percentile speed before and after phase I and phase II of the roadway reallocation project. Both sections had a 35mph speed limit both before and after the conversion, and the five to three lane section experienced a larger drop in off-peak 85th percentile speed (4-7mph reduction) compared with the four to three lane section (3-4mph reduction) as seen in **Figure 7.**

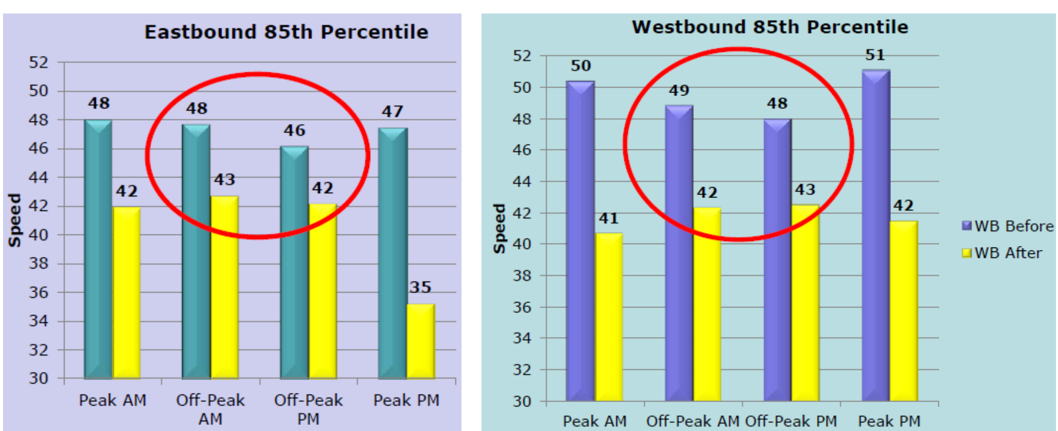


Figure 7: 85th percentile speeds on Phase II of East Boulevard roadway reconfiguration (Saak, 2013).

Public Support for Projects

Road lane reallocation projects on five lane and larger roadways can be potentially controversial due to the relatively high use and visibility of the corridors. For example, various articles and reports on the Colorado Boulevard and East Boulevard projects noted sizeable controversy surrounding initial project planning and design. However, surveys on the satisfaction of corridor users and surrounding residents and tenants for the Pennsylvania Avenue and Multnomah Street projects reported general satisfaction in the project outcomes.

Among individuals surveyed regarding the Pennsylvania Avenue project, 90% of cyclists believe separated bike lanes are safer, 94% believe they are easier, 92% believe they are more convenient, and 86% would go out of their way to ride them. 75% of pedestrians notice fewer cyclists on the sidewalks, 84% of motorists like that bicycles are separated from the motor vehicle traffic, and 71% of residents think the separated bike lane is a valuable neighborhood asset (Goodno, 2013).

Residents surveyed about the Multnomah Street project indicated that they were more likely to shop along the corridor after the improvements and they felt the aesthetic character of the street had generally improved. Most residents surveyed also felt that the project had positive or no impacts on corridor operations, as seen in **Figure 8** (Monsere et al., 2014).

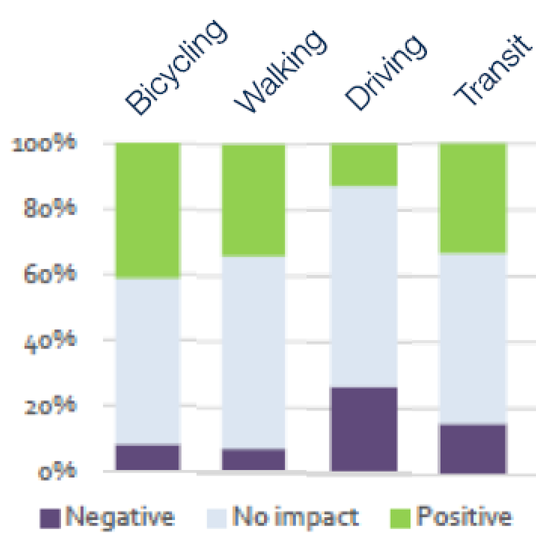


Figure 8: Results from a resident survey asking perceptions of impacts to corridor operations on Multnomah Street (Monsere et al., 2014).

Discussion of Findings

The findings of the study show that road lane reallocation projects on five lane and larger roadways can have many of the same benefits of those on four lane roadways. Some of the interesting highlights from the case studies analyses and literature review include:

- All projects which resulted in the addition or upgrade of bike lanes and that conducted before and after bicycle ridership counts noted significant increases in bike ridership.
- Crash data analysis is inconclusive on whether the projects positively or negatively affected corridor safety. However, one study suggests that road lane reallocation projects on roadways five lanes and greater can reduce unsafe corridor speeds.
- Vehicular LOS was generally only minimally impacted as a result of the projects.
- Two of the case studies suggest that vehicular traffic volumes decrease as a result of the road lane reallocation projects. However, it is unclear whether this is due to vehicular traffic shifting to other routes, mode-shift, or a reduction in overall trips.

In spite of the interesting observations, it is still unclear from the case studies and literature review what types and combinations of design treatments and corridor conditions are associated with specific safety and operational improvements. Furthermore, because the potential design solutions are more varied and potentially more complex among five lane or greater roadway reallocation projects than their four to three lane counterparts, it is more difficult to generalize rules, such as ADT thresholds, that determine the feasibility/minimize the risk of impacts of projects. For example, in the cases of East Boulevard in Charlotte and Ponce de Leon Avenue in Atlanta, the safety benefits and minimal impact on vehicular operations observed on these corridors could be attributed to creating more consistency in cross-section design along the corridor rather than the reduction of a travel lane in either direction. East

Boulevard also showed a higher safety improvement where a TWTL was added as part of the four to three road diet compared with where it already existed on the five to three lane reallocation section. This may indicate that much of the safety benefits associated with four to three lane reallocation projects are due to the addition of a TWTL.

In addition, one of the issues noted in the Colorado Boulevard and Ponce de Leon Avenue case studies was that Level of Service analysis predicted poorer results than were actually realized once the project was implemented. As a result, an evaluation of the applicability of Level of Service analysis for five lane or greater road lane reallocation projects should be investigated. Because such projects are often along corridors that are important for pedestrian, bicycle, transit, freight, and car traffic, a more appropriate metric for evaluating the need and feasibility of such projects may be one that weighs the benefits among all modes, such as Multimodal Level of Service.

Ultimately, further study with more data and examples is needed, as well as studies that control for specific before/after characteristics of the project. These could include 5 to 3 lane projects, 6 to 5 lane projects, 7 to 5 lane projects, projects adding center turn lanes or TWTL’s, projects adding bike lanes, projects adding separated bike lanes, projects adding on-street parking, projects with differences in intersection spacing, and projects that include access management improvements, to name a few. Controlling for such characteristics may allow for the identification of general conditions that help determine project feasibility, such as ADT thresholds commonly cited with four to three lane roadway reallocation projects. Also, studies to evaluate the potential impact of specific countermeasures such as signal timing and phasing and right-hand turning pockets could be beneficial for addressing commonly cited issues with road lane reallocation projects such as intersection queuing and intersection LOS impacts.

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