ROAD DIETS

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MUNICIPAL IMPLEMENTATION TOOL #16

NOVEMBER 2008

Delaware Valley Regional Planning Commission

About Road Diets

The demand for safe and pleasant transportation facilities that serve all modes of travel continues to grow. Today, more communities are finding that many of their roads are not accommodating to non-automotive modes of travel. In particular, most four-lane arterial roads tend to encourage higher speeds than roads with two or three travel lanes and typically present more conflict points among modes. In many cases, a road diet can be a cost- and time-effective means of satisfying the need for safer multi-modal roads while still maintaining an adequate level of service.

A typical road diet strategy reduces the number of travel lanes on a roadway cross-section. The most common application of a road diet is the conversion a four-lane roadway into three lanes, with one travel lane in each direction and a two-way left-turn lane in the center.

Road diet projects have been around for several decades and are in use on roadways all across the world. Good road diet locations include transit corridors, popular bike/pedestrian routes, commercial reinvestment areas/enterprise zones, historic streets, scenic roads, and entertainment districts/main streets.

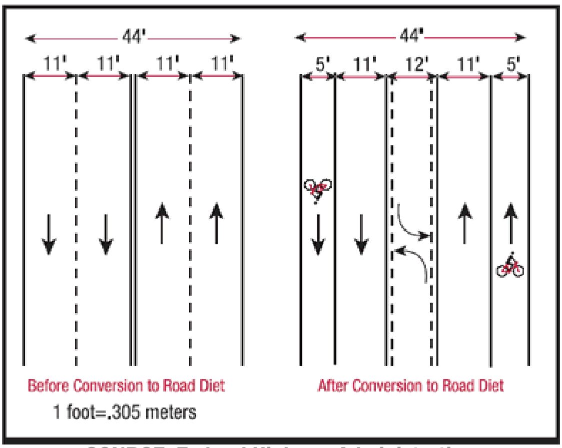
Road diets can help achieve safety, access, or design objectives. Research indicates that correctly-implemented road diets rarely reduce roadway capacity or divert traffic. Road diets are increasingly popular as communities and traffic engineers embrace safety and the need for multi-modalism on their roadway network.

This image shows a road diet project with a two-way left-turn lane, bike lanes, and parking. The popularity of techniques such as context-sensitive design, complete streets, place-making, and traffic calming have all contributed to an interest in road diet projects. **SOURCE: Justin Dula, Delaware County Planning Commission**

Characteristics

Road diets are usually conversions of four-lane undivided roads into three lanes (two travel lanes and a continuous two-way left-turn lane (TWLTL)), as shown in *Figure 1*. The remaining pavement width from the eliminated lane can be converted to bicycle lanes, sidewalks, on-street parking, or some combination of these elements.

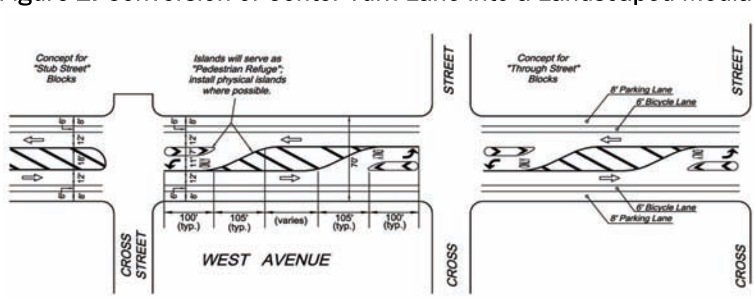
Figure 1: A Typical Road Diet Conversion



SOURCE: Federal Highway Administration

Other road diet applications will convert the center turn lane into a landscaped median with left-turn bays only at intersections. *Figure 2* shows this application in the conceptual plan for West Avenue in Ocean City, NJ. The configuration will depend on the width of the roadway, number of left turns, speeds, and adjacent land uses.

Figure 2: Conversion of Center Turn Lane into a Landscaped Median



SOURCE: Kueper, Daniel. 2007. Road Diet Treatment in Ocean City, NJ, USA. *ITE Journal*, 77(2) February.

03 BENEFITS OF ROAD DIETS

Safety

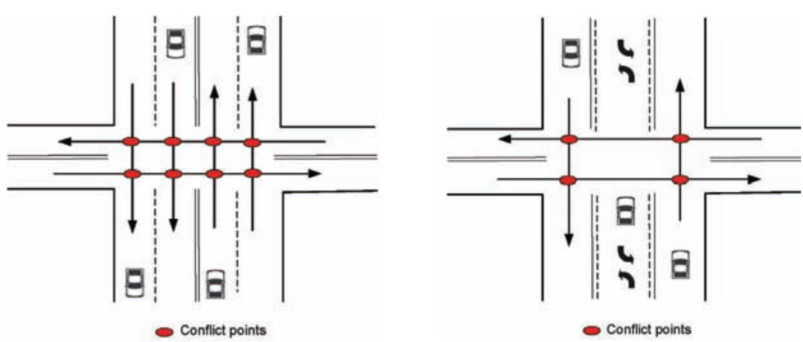
There is evidence that road diets improve roadway safety. In a study from Iowa, 15 road diet sites were compared to 15 control sites (Stout et al. 2006). Two different approaches were used to analyze and examine the effectiveness of the road diets compared to the control sites. Overall, the study found a 25% reduction in crash frequency per mile, 19% reduction in crash rate, and 34% reduction in injury crashes. The study also found a reduction in the severity of crashes, and a significant reduction in the number of crash types related to left turns and stopped vehicles. Other case studies have shown an average reduction of crashes as high as 75%.

The safety benefits of road diets primarily result from a reduction in conflict points facilitated through roadway configuration conversions. *Figure 3* shows how a road diet reduces conflict points at intersections. The three-lane configuration of the road diet allows for improved sight distance for turning and crossing traffic, making these maneuvers safer, as illustrated in *Figure 4.* In addition, mid-block conflicts related to lane changes, prevalent with four-lane roadways, are typically reduced, as illustrated in *Figure 5*.

The reduction in crash severity is primarily a function of the reduction in speed and speed variability. A reduction in rear-end and side-swipe crashes can be attributed to reduced variability of speed.

Figure 3: Intersection Conflict Points

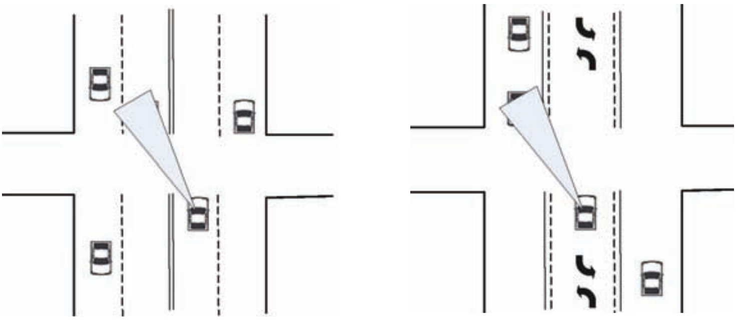
4-Lane Intersection Conflict Points   3-Lane Intersection Conflict Points



SOURCE: DVRPC

Figure 4: Intersection Sight Lines

Four Lanes | Three Lanes



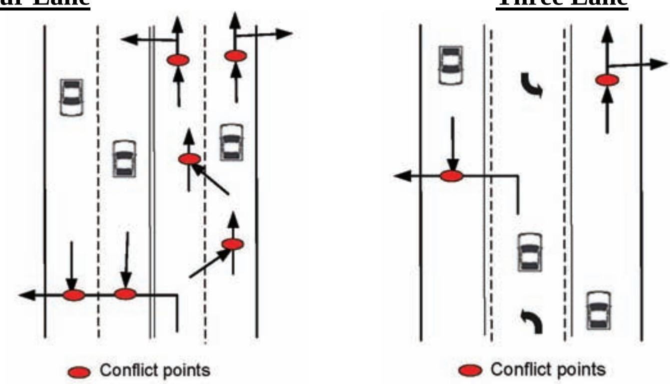
SOURCE: DVRPC

The safety benefits of road diets are not limited to automobiles. Pedestrians and bicyclists benefit from the enhanced safety provided through road diets. Road diets often cause traffic to move more slowly due to narrowed lanes and/or design solutions, increasing the comfort level of pedestrians and bicyclists. Pedestrian safety is also enhanced through reduced speeds and improved sight distances. The three-lane configuration can provide a pedestrian refuge, allowing pedestrians to focus on crossing one lane of traffic at a time.

When road diets incorporate the addition of a bicycle lane, cyclists are also safer because they can travel in a separate lane from motor vehicle traffic. Road diets often convert excess right-of-way into dedicated bike lanes. Additionally, bike lanes or on-street parking can serve as a buffer between pedestrians and motorized traffic.

Figure 5: Mid-Block Conflict Points

Four Lane | **Three Lane**



SOURCE: DVRPC

Capacity

A frequent concern raised about road diets is that a lane reduction will mean a reduction in vehicle capacity and a lower level of service. Experience has shown this is not always the case. Successful road diet projects are roads with an excess of capacity that can be reconfigured to accommodate other modes of travel and improve overall safety. Most successful road diet projects can maintain or improve the throughput of a roadway. For example, in Seattle, several projects actually increased average daily traffic (ADT) volumes after the project.

Studies of successful road diet applications have shown that there is minimal effect on roadway capacity. In a four-lane configuration, the left lanes can be blocked by left-turning vehicles, resulting in most of the through-trips being conducted in the right lane. Thus, only one lane is active most of the time. Depending on volumes, as travel speeds slow, throughput increases because the roadway is then able to accommodate shorter gaps between vehicles.

Sample Road Diet Projects in Seattle

Project	ADT Before	ADT After
8th Ave. NW	10,549	11,858
Martin Luther King Jr. Way	12,336	13,161

Reproduced from *Road Diets: Fixing the Big Roads*

Sample Road Diet Projects in Philadelphia

Project	ADT Before	ADT After
Ogontz Avenue	15,535	16,295
Verree Road	*13,495*	*15,659*

SOURCE: City of Philadelphia, DVRPC Traffic Count Data

Intersection queues may appear longer for a road diet roadway than for a typical four-lane roadway; however, in most cases, average queue length decreases. In the four-lane roadway, through traffic is able to stack in both travel lanes, but the left lane carries both through and left-turning traffic. Under the road diet, all through traffic is separated from the left-turning traffic and can flow into the intersection unimpeded. Any increase in queue length and/or delay can be minimized through optimization of signals, adding right-turn lanes where necessary, and redesign of driveway or intersection curb radii.

In general, the level of service will remain adequate for roadways converted through road diets. Only when average daily traffic surpasses 20,000 vehicles might congestion and the potential for diversion to other routes occur.

Place-making and Economic Benefits

When a road diet project is proposed, many community members are initially concerned about impacts to local businesses. Business owners may worry that the reduction in travel lanes will mean a reduction in traffic volume and a loss in business. However, in many cases the effects of road diets on businesses have been positive. For example, the Fourth Plain Boulevard project in Vancouver, Washington resulted in measured economic growth along the corridor (Rosales 2006). One reason for this may be that road diets tend to reduce travel speed without reducing level of service. Travelers using the road have more opportunities to observe their surroundings and this may lead to a greater likelihood that a traveler will patronize a business along a converted roadway.

If curbside parking is included in the road diet project, stopping becomes more convenient. Many road diet projects result in improved streetscapes and convey a greater sense of place than the four-lane road before conversion. This may also influence travelers' behavior. Some areas have found a positive relationship between property values and the walkability of a street. Due to these economic benefits, road diets may be applicable in revitalization projects.

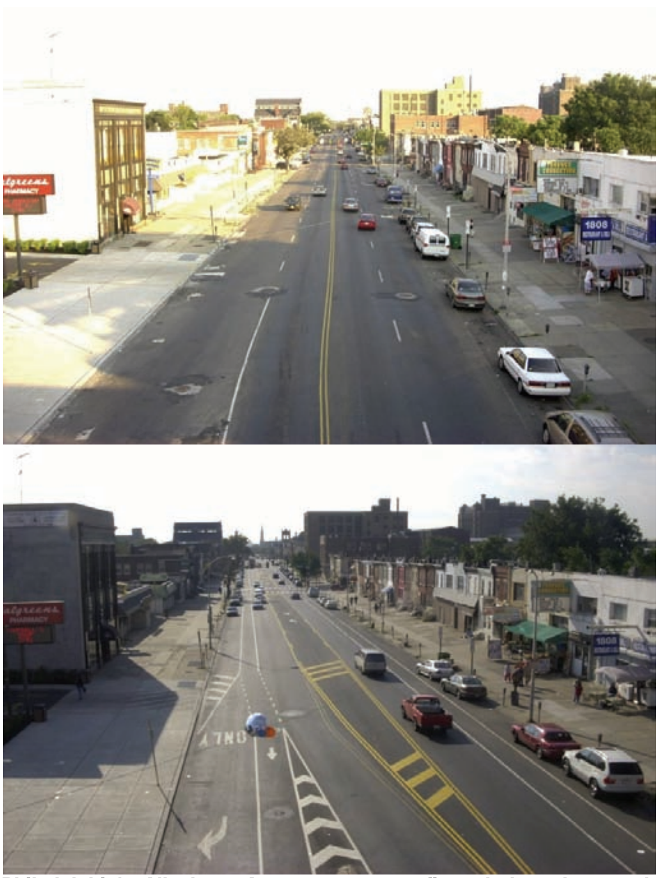
Passing

Conflicts arise when drivers change lanes to avoid being stuck behind left-turning traffic. Due to the lack of passing opportunities with road diets, aggressive drivers may use the center turn lane or bike lane to get around slower-moving vehicles, an unsafe practice. However, studies conducted on existing roadways with road diet applications in place demonstrate that this is not a problem.

According to Burden and Lagerwey, transit corridors make good candidates for road diets because they are more user-friendly for pedestrians than typical four-lane roadways. However, problems with the lack of passing opportunities can be exacerbated by transit vehicles (such as busses) that make frequent stops and have short headways. In this situation, bus pull-out areas should be considered.

Costs of Implementation

Although costs vary, road diets are a relatively economical technique for improving roadways. This is because the road diet is, in most cases, a reconfiguration of an existing road. A road diet will typically involve a re-striping of the road to reduce it from four lanes to three lanes. Road diets may also include other features such as crosswalks, bike lanes, sidewalks, and/or a raised center median. In many instances, the primary cost is the cost of pavement markings. Optimally, the road diet conversion would be completed at the time the roadway is being repaved to enhance cost-effectiveness.



Philadelphia's Allegheny Avenue was reconfigured through a road diet. At the top is the roadway prior to the road diet. Below is the roadway after the road diet, with pedestrian pockets, a turning lane, and a bike lane. **SOURCE: John Boyle, Greater Philadelphia Bicycle Coalition**

The following factors should be considered in determining the feasibility of a roadway for a road diet:

- roadway function and environment
- traffic volumes and level of service
- access points, turning volumes, and turning patterns
- frequent-stop and slow-moving vehicles
- weaving and speed
- parallel routes
- vehicle delay and queue
- cost
- pedestrian and bicycle activity
- crash types and severity
- education and outreach

Roadway Function and Environment

The function of the roadway must be evaluated, specifically with regard to possible trade-offs between mobility, access, and safety. The surrounding land uses should support the conversion. The feasibility of converting a four-lane undivided roadway to three lanes is more likely to succeed if the roadway is already acting as a de facto three-lane roadway. Careful study of the potential for increases in modes is usually necessary.

Traffic Volumes

Before a four-lane undivided to three-lane conversion can be recommended, knowledge of existing and future average daily traffic and peak-hour volumes is needed. The peak-hour volumes typically represent 8 to 12 percent of average daily traffic (ADT) on the roadway. In general, road diets operate most successfully on roadways with less than 20,000 ADT. Roadways carrying higher volumes may experience congestion and diversion to parallel routes. The literature on road diets suggests conversion feasibility as follows:

- Operationally feasible at or below 750 vehicles per hour per direction directional peak;
- At 750 – 875 vehicles per hour per direction directional peak, consider more cautiously; and
- At 875 – 1000 vehicles per hour per direction directional peak, expect reduced arterial level of service (LOS).

Access Points, Turning Volumes, and Patterns

The safety and operations of four-lane roadways tend to decrease with increased through and turning volumes. Turn volumes and patterns should be assessed when considering a roadway conversion to determine operational impacts. Four-lane undivided roadways tend to operate similar to a three-lane road as access points and left-turns increase. As a result, roadways with a greater number of access points will be better candidates for road diet conversions.

Frequent-Stop and Slow-Moving Vehicles

The number and frequency of slow-moving vehicles using the roadway and/or those making frequent stops must be considered when evaluating for road diet application. These vehicles will have a greater impact on the operation of a three-lane roadway than a four-lane roadway. The primary reason for the increased impact along three-lane roadways is a result of the inability of other automobiles to legally pass frequent-stop and/or slow-moving vehicles. A road diet conversion may be more challenging if there are a large number of these vehicles using the roadway, especially during peak travel periods. One potential mitigation measure to minimize the impact of frequent-stop vehicles is to provide pull-out areas at specific locations along the corridor.

Weaving and Speed

The need to “calm” or reduce vehicle speeds is often a reason for road diet conversions. Four-lane roadways typically demonstrate greater variability in weaving and vehicle speeds compared to three-lane roadways. Likewise, the average vehicle speed and speed variability usually decreases with a road diet conversion from a four-lane cross section to a three-lane. Lane changing along four-lane undivided roadways is usually done for lane positioning purposes and to bypass turning vehicles. The ability to make these maneuvers decreases as volumes increase. Weaving or lane changing should not occur along a three-lane roadway.

Parallel Routes

Depending on the traffic volume, a road diet may result in slower speeds and some decrease in level of service. If parallel routes exist which offer an alternative, there may be some diversion. Therefore, the potential impacts to parallel routes should be considered when evaluating for road diets.

Delay

The road diet conversion includes geometric changes that can impact through vehicle delay and queues. Whereas, through vehicle delay related to left-turn traffic can be expected to decrease, the reduction in through lanes may result in a larger increase of peak-hour segment and/or intersection through vehicle delay. This difference in delays and queues can be mitigated by several engineering design elements including optimizing and coordinating signals, adding right-turn lanes, consolidating driveways, and redesigning intersection curb radii.

Cost

In most cases, converting from four lanes to three does not require additional right-of-way; the existing cartway is reallocated and requires only re-striping. Occasionally, limited right-of-way acquisition may be needed for right-turn lanes or intersection reconstruction to enhance the roadway operation. The cost for road diet conversion is significantly lower when compared to a roadway widening.

Pedestrian and Bicycle Activity

The level and safety of existing or potential pedestrian and bicycle activities should be evaluated when considering a road diet conversion. Separate bike lanes and/or sidewalks can be added using extra right-of-way. For pedestrians and bicyclists, the somewhat slower and more consistent speeds of the road diet conversion are more desirable. A three-lane roadway produces fewer conflict points between vehicles and crossing pedestrians, and the complexity for a pedestrian crossing the roadway is reduced.

Crash Volume, Type, and Severity

Roadways converted through road diets have experienced a reduction in crashes and crash severity. The reduction in crashes and crash severity that results from a road diet conversion may primarily be the result of a reduction in automobile speed and speed variability along the roadway, a decrease in the number of conflict points between vehicles, and improved sight distance for left-turn vehicles on the converted roadway.

Education and Outreach

Education and outreach play a critical role in the success of a road diet. Many projects have demonstrated that public opposition is strong in the early stages of a project. However, with committed stakeholders and an organized education and outreach program, community members may be better able to understand the benefits of road diets.

West Avenue, Ocean City, New Jersey

On West Avenue in Ocean City, New Jersey, the major transportation issues were speeding and difficulty of crossing roadways for pedestrians. Before the road diet implementation, West Avenue was a four-lane roadway with curbside parking and a painted median. After the road diet, West Avenue is configured as two lanes (one travel lane in each direction) with a painted median, bicycle lanes, and curbside parking.

In this conversion, the two-way left-turn lane was not implemented because there were no opportunities for mid-block left-turns. Left-turns were only accommodated at the intersections with exclusive left-turn lanes separated from the through lanes with painted islands (pedestrian refuge).


West Avenue in Ocean City, New Jersey is shown before (left) and after (right) a road diet was implemented. The road diet resulted in improved pedestrian movement.
SOURCE: Daniel Kueper, Orth-Rodgers & Associates Inc.

Fort Dix Road, Pemberton, New Jersey

A road diet project on Fort Dix Road in Pemberton, New Jersey was conducted by the Burlington County Department of Engineering. Before the conversion, the roadway was four lanes with very narrow shoulders. Ditches and utility poles were located in close proximity to the edge of the pavement. In considering the conversion, the Burlington County engineers did a forecast of average daily travel for 20 years into the future. There were no left-turns in this stretch of roadway. Therefore, the roadway was converted to two travel lanes with bike lanes and shoulders.

A road diet project on Fort Dix Road in Pemberton, New Jersey added shoulders and bike lanes. SOURCE: DVRPC

River Road, Cinnaminson, New Jersey

The Burlington County Department of Engineering implemented a road diet project on River Road in Cinnaminson, New Jersey. River Road (CR 543) runs parallel to the New Jersey Transit RiverLINE route in Cinnaminson and Riverton.

Between major intersections, there were numerous opportunities for left-turns for traffic traveling north. For southbound traffic, no left-turn movements were available because of the rail line. Therefore, the roadway was converted to two travel lanes with a bike lane and shoulders. The center lane in these areas accommodates left-turns in one direction only. The stacking of southbound left-turn volume in the through lane during signal preemption for the RiverLINE was considered for all constructed traffic signals.

A road diet was implemented along River Road in Cinnaminson, New Jersey. The image on the left shows the roadway before the conversion. The image on the right shows the roadway after the road diet, in which a center turn lane was created. SOURCE: DVRPC

Conclusions

Road diets, when used appropriately, fit well within the principles of Smart Transportation. Smart Transportation is a collaborative approach to providing transportation solutions that encourages looking beyond level of service to consider the local context. Smart Transportation aims to enhance communities and accommodate a mix of modes. The Pennsylvania and New Jersey Departments of Transportation support the concepts of Smart Transportation.

Road diets can be an effective way to increase the safety and accessibility of a road while maintaining capacity. In many locations, road diets are part of an overall Smart Transportation strategy of traffic calming, place-making, complete streets, and/or corridor revitalization.

The feasibility of a road diet application should be considered on a case-by-case basis. Jurisdictions considering road diets for the first time should start with simple conversions. Not every four-lane roadway is a suitable candidate for a road diet. The guidelines in this document can serve as a starting point in the process of establishing whether a road diet will work for a specific roadway. Any analysis of road diet feasibility should include an engineering study to determine potential operation after conversion. Additionally, early public education and outreach should be included in the planning process.

A road diet project on Stenton Road in Philadelphia consisted of a two-way center left-turn lane, one travel lane in each direction, and bike lanes in each direction. Curbside parking along the roadway was retained. SOURCE: DVRPC

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Welch, Thomas. 1999. The Conversion of Four Lane Undivided Urban Roadways to Three Lane Facilities. Paper prepared for TRB/ITE Urban Street Symposium, June 28-30, 1999.

A road diet conversion for Ogontz Avenue in Philadelphia was completed in 2003. **SOURCE: DVRPC**

15 ABOUT DVRPC

The Delaware Valley Regional Planning Commission is dedicated to uniting the region's elected officials, planning professionals and the public with a common vision of making a great region even greater. Shaping the way we live, work and play, DVRPC builds consensus on improving transportation, promoting smart growth, protecting the environment and enhancing the economy. We serve a diverse region of nine counties: Bucks, Chester, Delaware, Montgomery and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester and Mercer in New Jersey. DVRPC is the federally designated Metropolitan Planning Organization for the Greater Philadelphia Region - leading the way to a better future.

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