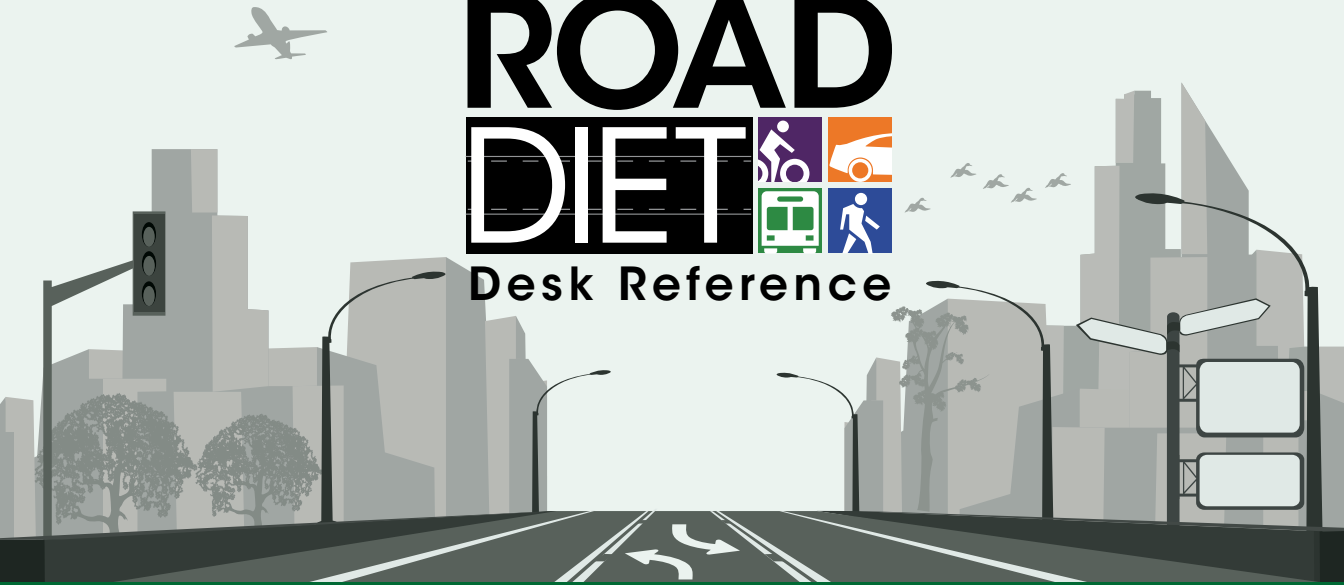
U.S. Department of Transportation
Federal Highway Administration

ROAD DIET

Desk Reference



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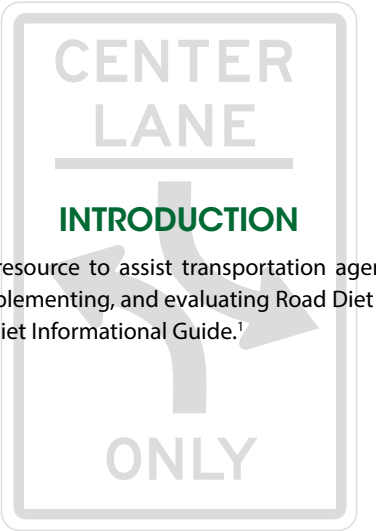


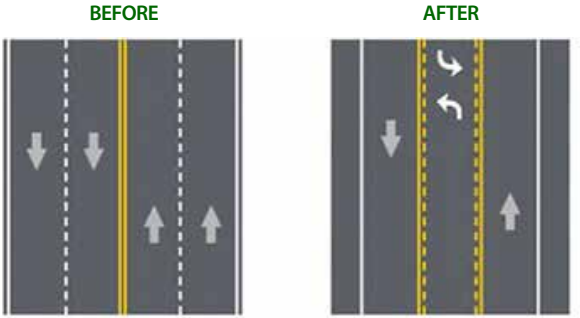
INTRODUCTION

The Road Diet Desk Reference is a resource to assist transportation agencies during their decision-making process in regards to considering, implementing, and evaluating Road Diet conversions. The information in the document is derived from the Road Diet Informational Guide.[1]

WHAT IS A ROAD DIET?

Four-lane undivided highways have a history of crashes as traffic volumes increase due to the inside lane being shared by higher-speed through vehicles and left-turning vehicles. One option for addressing this concern is a Road Diet.

A typical Road Diet is the conversion of an undivided four-lane roadway to a three-lane undivided roadway made up of two through lanes and a center two-way left-turn lane (TWLTL). The reduction of lanes allows the roadway cross section to be reallocated for other uses such as bike lanes, pedestrian refuge islands, transit uses, and/or parking.



Typical Road Diet Basic Design

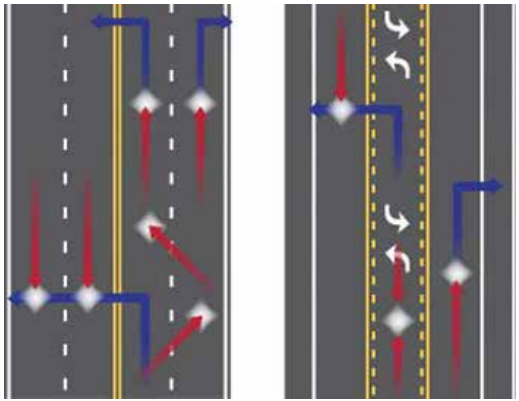
HISTORY OF ROAD DIETS

The focus of roadway projects during the 1950s and 1960s was on system capacity expansion. Whenever and wherever traffic volumes on a section of road outgrew what a two-lane road could accommodate efficiently, the next step in roadway design in most cases was to increase the cross-section to four lanes. No engineering guidance during that period encouraged consideration of a three-lane alternative. Consequently, four-lane roadways became the norm throughout the country.

IMPROVED SAFETY

Road Diets reduce vehicle-to-vehicle conflicts that can contribute to rear-end, left-turn, and sideswipe crashes by removing the four-lane undivided inside lanes that serve both through and turning traffic. Studies indicate a 19 to 47 percent reduction in overall crashes when a Road Diet is installed on a previously four-lane undivided facility as well as a decrease in crashes involving drivers under 35 years of age and over 65 years of age. [2, 3]

An analysis of 45 Road Diet sites in California, Iowa, and Washington showed a 29 percent reduction in total crashes[2]



Mid-Block Conflict Points for Four-Lane Undivided Roadway and Three-Lane Cross Section (Adapted from Welch, 1999)[4]

Road Diets also improve safety by reducing the speed differential. On a four-lane undivided road, vehicle speeds can vary between travel lanes, and drivers frequently slow or change lanes due to slower or stopped vehicles (vehicles stopped in the left lane waiting to turn left). Drivers may also weave in and out of the traffic lanes at high speeds. In contrast, on three-lane roads with TWLTLs the vehicle speed differential is limited by the speed of the lead vehicle in the through lane, and the left-turning vehicles are separated from the through vehicles. Thus, Road Diets can reduce the vehicle speed differential and vehicle interactions, which can reduce the number and severity of vehicle-to-vehicle crashes. [3]

OPERATIONAL BENEFITS FOR MOTOR VEHICLES

A Road Diet can provide the following operational benefits:

- **Separating Left Turns.** Separating left-turning traffic has been shown to reduce delays at signalized intersections.
- **Side-street Traffic Crossing.** Side-street traffic can more comfortably enter the mainline roadway because there are fewer lanes to cross. This can reduce side-street delay.
- **Speed Differential Reductions.** The reduction of speed differential due to a Road Diet provides more consistent traffic flow and less "accordion-style" slow-and-go operations along the corridor.

On some corridors the number and spacing of driveways and intersections can lead to a high number of turning movements. In these cases, four-lane undivided roads can operate as de facto three-lane roadways. The majority of the through traffic uses the outside lanes due to the high number of left-turning traffic in the inside shared through and left-turn lane, in which a conversion to a three-lane cross section may not have much effect on operations.

In Santa Monica, California, speeding, crash history, and high pedestrian activity led to a Road Diet along Ocean Park Avenue.

PEDESTRIAN AND BICYCLIST BENEFITS

Road Diets can be of particular benefit to non-motorized road users. They reallocate space from travel lanes—space that is often converted to bike lanes or sidewalks, where these facilities were lacking previously. These new facilities can have a tremendous impact on the mobility and safety of bicyclists and pedestrians.


PHOTO: JENNIFER ATKINSON

Even the most basic Road Diet has benefits for pedestrians and bicyclists, regardless of whether specific facilities are provided for these modes. As mentioned above, the speed reductions that are associated with Road Diets lead to fewer and less severe crashes. The three-lane cross section also makes crossing the roadway easier for pedestrians, as they have fewer travel lanes to cross and are exposed to moving traffic for a shorter period of time. Incorporating a pedestrian refuge island – a raised island placed on a street to separate crossing pedestrians from motor vehicles – makes crossing the roadway even shorter and less complicated. Pedestrians only have to be concerned with one direction of travel at a time.

LIVABILITY BENEFITS

Added to the direct safety benefits, a Road Diet can improve the quality of life in the corridor through a combination of bicycle lanes, pedestrian improvements, and reduced speed differential, which can improve the comfort level for all users. Livability is, "about tying the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, quality schools, and safer streets and roads."[5]

SYNERGIES AND TRADE-OFFS

Synergies between improvements for one mode and their impact on another have been discovered with the implementations of Road Diets. The following table shows examples of how some primary features of Road Diet installations may have both positive and negative secondary (or unintended) impacts.

Summary: Road Diet Installation Observations

ROAD DIET FEATURE	PRIMARY/ INTENDED IMPACTS	SECONDARY/UNINTENDED IMPACTS	
		POSITIVE	NEGATIVE
Bike Lanes	• Increased mobility/safety for bicyclists, higher bicycle volumes • Increased comfort level for bicyclists	Increased property values	Could reduce parking, depending on design
Fewer Travel Lanes	Reallocate space for other uses	• Pedestrian crossings are easier, less complex • Can make finding a gap easier for cross-traffic	• Transit vehicles/mail trucks can block traffic when stopped • May reduce capacity • Potential to negatively affect maintenance budgets if agency's funding is tied to lane-miles
Two-Way Left Turn Lane	Remove left-turning traffic from through lane	Makes efficient use of limited roadway area	Could be difficult for drivers to access left turn lane if demand for left turns is too high
Pedestrian Refuge Island	Increased mobility and safety for pedestrians	Prevents illegal use of the TWLTL to pass slower traffic or access and upstream turn lane	May create issues with snow removal
Buffers (grass, concrete median, delineators)	Provide barriers and space between travel modes	• Increases comfort level for bicyclists • Barriers can prevent users entering a lane reserved for another mode	Grass and delineator buffers will necessitate ongoing maintenance

While Road Diets can improve safety and accommodate motorized and non-motorized transportation modes along a corridor, they may not be appropriate or feasible in all locations. There are many factors to consider before implementing a Road Diet. Agencies should consider the objective of the Road Diet, which could be one or more of the following:

- Improve safety
- Reduce speeds
- Mitigate queues associated with left-turning traffic
- Improve pedestrian environment
- Improve bicyclist accessibility
- Enhance transit stops

Seattle DOT has developed a flow chart to support its Road Diet decision-making process.

The City of Grand Rapids, Michigan, takes a holistic view of Road Diet implementations by first identifying all 4-lane facilities within their jurisdiction.

Identifying the objective(s) will help determine whether the Road Diet is an appropriate alternative for the corridor that is being evaluated. Some example evaluative questions to answer when considering a Road Diet are shown:

FACTOR	QUESTIONS	FACTOR	QUESTIONS
Roadway Function and Environment	• What is the current, expected, and desired function of the roadway? • Is the right of way limited? • Will the adjacent land use remain relatively stable throughout the design period? • Does the jurisdiction have a context sensitive or Complete Streets policy?	**Pedestrian and Bike Activity**	• What is the pedestrian and bicyclist friendliness of the roadway? • Do pedestrians and bicyclists have safety concerns? • Will the addition of a TWLTL assist pedestrians and bicyclists? • Can a bike lane be added after the conversion?
Crash Types and Patterns	• Can the crashes that are occurring be reduced with a conversion? • Will a reduction in speed and speed variability increase safety?	**Frequent-Stop and/or Slow Moving Vehicles**	• What is the acceptable delay with respect to frequent-stop and/or slow-moving vehicles? • Are there locations for pull-outs for these vehicles?
Level of Service	• What is an acceptable increase in minor street or signal-related delay? • What is an acceptable change in queues at intersections? • Does the signal timing or phasing need to be changed or optimized? • What is the impact on parallel roadways?	**Traffic Volumes and Patterns**	• What are the existing and design year daily traffic and peak hour volumes? • Does the current roadway primarily operate as a "de facto" three-lane cross section? • Are right-turn lanes needed at particular locations? • Does the proposed marking allow the design vehicle to turn properly?

Table adapted from Knapp, Welch, and Witmer, 1999[6]

FUNDING

Road Diets can be funded from a number of different sources based on the needs of the agency. Road Diets are typically eligible for Surface Transportation Program (STP), Highway Safety Improvement Program (HSIP) or other Federal-aid funds where data support the expenditure. Agencies may also have the opportunity to use funding from Safe Routes to School, pedestrian, bicycle and transit programs. A Road Diet can also be implemented cost-effectively by incorporating it into a planned resurfacing project by simply adjusting the striping plans.

"We planned our Road Diet installation as part of the overlay, so there was no additional cost to the construction budget." Robert Rocchio, Rhode Island DOT

OUTREACH

According to the Delaware Valley Regional Planning Commission's Regional Road Diet Analysis Feasibility Assessment, "Education and outreach play a critical role in the success of a Road Diet. Many projects have demonstrated that public opposition can be strong in the early stages of a project. However, with committed stakeholders and an organized education and outreach program, the public can be better informed about the advantages and disadvantages of Road Diets."[7]

Agencies can also use the trial basis approach to appeal to communities where Road Diets may be feasible but are not embraced locally. During the trial basis time period, a series of before-and-after operational studies can be completed; some preliminary crash analysis can be performed; and surveys can be conducted among adjacent land owners, first responders, etc. If the trial yields positive results, consider implementing a more permanent Road Diet conversion. The trial basis approach is an effective way to demonstrate the safety countermeasure to a community.

The Genesee County Metropolitan Planning Commission uses an educational outreach approach for Road Diets and involves representatives from all modes of traffic, elected officials, and local agency partners from the beginning of the planning process.

DESIGN

As with any project development process, practitioners designing a Road Diet should take into account the principles and practices that guide design decisions, including geometric design and operational design. Common geometric and operational features or characteristics that should be considered during Road Diet design are:

- Road Function and context - rural, urban, suburban neighborhood, etc.
- Design controls – design vehicles, drivers, non-motorized users, speed
- Elements of design – sight distance, horizontal and vertical alignment, superelevation, access management
- Cross sectional elements and allocation – lane widths, median, pedestrian refuge island, shoulders, bicycle facilities, parking, bus turnouts, drainage, etc.
- Intersection design – alignment and profile of intersection approaches, intersection sight distance, right turn lanes, bicycle and pedestrian design considerations, signal timing changes, adjustment of signal heads, roundabouts, corner radii
- Pavement marking and signing

A Road Diet on Ingersoll Avenue in Des Moines, Iowa, included bus turn outs in the design

PHOTOS: STACEY MEEKINS

On 55th Street in Chicago, the Road Diet design included parking-protected bike lanes and a shared lane at intersections for transit and bicycles.

Additional resources to assist designers in the completion of Road Diet plans:

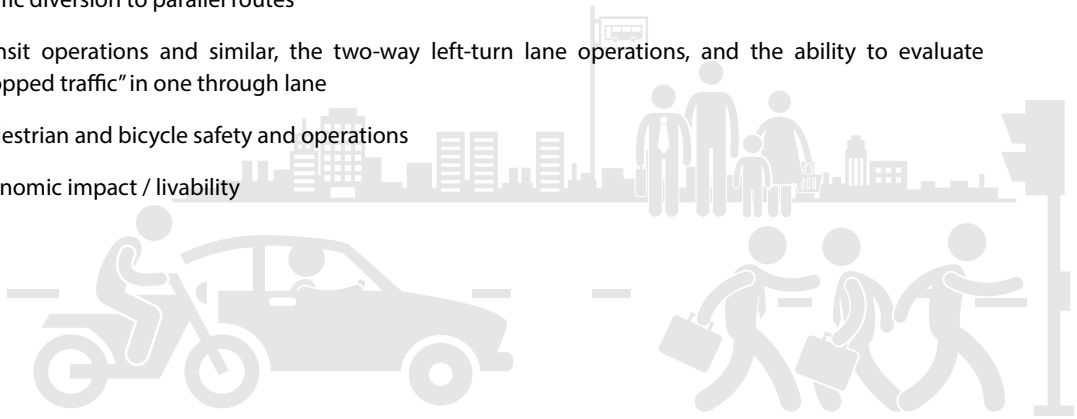
- FHWA's Functional Classification Guidelines and Updated Guidance for the Functional Classification of Highways
- AASHTO's A Guide for Achieving Flexibility in Highway Design
- FHWA's Flexibility in Highway Design
- FHWA's A User's Guide to Positive Guidance
- FHWA Handbook for Designing Roadways for the Aging Population
- AASHTO's Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO's Guide for the Development of Bicycle Facilities
- NACTO Urban Bikeway Design Guide
- ITE Designing Walkable Urban Thoroughfares
- TCRP Report 19 Guidelines for the Location and Design of Bus Stops

5. IS THE ROAD DIET EFFECTIVE?

Once implemented, it is important to evaluate the effectiveness of the Road Diet. This typically occurs through studying pre- and post-installation crash data, operating speeds, and operational levels of service.

In addition to the basic vehicular operational and safety studies, other conversion impacts an agency may consider evaluating include:

- Traffic diversion to parallel routes
- Transit operations and similar, the two-way left-turn lane operations, and the ability to evaluate "stopped traffic" in one through lane
- Pedestrian and bicycle safety and operations
- Economic impact / livability



In Pasadena, California, a Road Diet improved Cordova Street's multi-modal level of service which is how well a street serves the needs of all users.

WHERE TO LEARN MORE

Additional information on Road Diets is available on FHWA Office of Safety website: http://safety.fhwa.dot.gov/road_diets.

REFERENCES

1. FHWA "Road Diet Informational Guide." November 2014.
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3. Stout, Thomas B., Before and After Study of Some Impacts of 4-Lane to 3-Lane Roadway Conversions. March 2005.
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6. Knapp, K., T. Welch, J. Witmer. Converting Four-Lane Undivided Roadways to a Three-Lane Cross Section: Factors to Consider.
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