PARTICIPANT NOTEBOOK

Date: January, 2017

Location: Newark, NJ

Workshop Sponsor: NJTPA

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Description

Four-lane undivided highways experience relatively high crash frequencies–especially between high-speed through traffic, left-turning vehicles and other road users. One option for addressing this safety concern is a Road Diet, which typically involves converting an existing four-lane undivided roadway segment to a three-lane segment consisting of two through lanes and a center two-way left-turn lane. A Road Diet has many benefits:

Safety–Road Diets can make the roadway environment safer for all users. Studies indicate a 19 to 47 percent reduction in overall crashes when a Road Diet is installed. For pedestrians, Road Diets result in fewer lanes to cross and provide an opportunity to install refuge islands.

Low Cost–Road Diets make efficient use of limited roadway area. When planned in conjunction with reconstruction or overlay projects, the safety and operational benefits of Road Diets are achieved essentially for the cost of restriping pavement lanes.

Quality of Life–Road Diets can make shared spaces more livable and contribute to a community-focused, “Complete Streets” environment. On-street parking and bike lanes can also bring increased foot traffic to business districts.

The Federal Highway Administration Resource Center will present a workshop on this proven safety countermeasure and highlight how agencies are using this low cost safety countermeasure to improve safety, operations, and livability in their communities.

Participants will be introduced to the Road Diet Informational Guide, research, as well as guided through a decision-making process to determine if a Road Diet is appropriate for a given roadway segment.



Who Should Attend

This Workshop will be of interest to Engineers, Transportation Planners, Pedestrian and Bicycle Coordinators, Safe Routes to School Coordinators, Local Public Agency Coordinators, and Transportation Alternatives Program Managers.

Workshop Agenda

Module 1 - Introductions and Overview

- What is a Road Diet?
- What are the benefits of a Road Diet?
- Safety Benefits (for all users)
- Operational Benefits (for all users)
- Livability and Other Benefits
- Relationship to “Complete Streets”
- Examples and case studies

Module 2 - Road Diet Feasibility Considerations and Guidelines

Module 3 - Design Considerations for Road Diets

Lunch Break

Module 4 - Evaluating a Road Diet Candidate Project

- Form Teams
- Exercise Background and Instructions
- Field Visit (if available)
- Team Evaluation of a Real Road Diet Candidate Project
- Teams Document Findings, Make Recommendations and Prepare a Presentation
- Team Presentations

Module 5 - Assessing Road Diet Effectiveness

Wrap-up / Closing Discussion

ROAD DIET WORKSHOP

Every Day Counts

January, 2017
Newark, NJ

Introduction to Road Diets

Hosted By:

NJTPA NORTH JERSEY TRANSPORTATION PLANNING AUTHORITY
Defining the Vision. Shaping the Future.

Course Instructor

Mark Doctor, PE

Safety & Design Engineer
Federal Highway Administration
Atlanta, GA
(404) 562-3732
mark.doctor@dot.gov

ROAD DIET

Self Introductions

- Your Name, Organization & Position

- What you would like to learn from this workshop

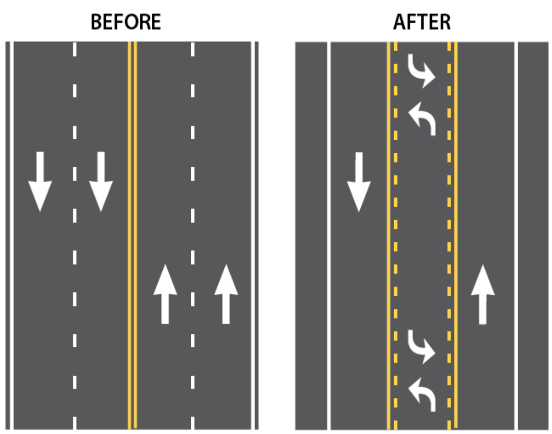
Logistics

- Please silence cell phones
- Please ask questions
- Breaks / Lunch
- Sign-in sheet

Learning Objectives

- What is a Road Diet?
- What are the benefits of a Road Diet?
- How do Road Diets relate to “Complete Streets”?

What is a “Road Diet”?



Reconfiguring the existing cross section (travel lanes) and utilizing the space for other uses such as bike lanes, parking, transit stops, etc.

A ***typical*** Road Diet converts an existing four-lane undivided roadway to two through lanes and a center two-way left-turn lane (TWLTL)

A Typical Road Diet

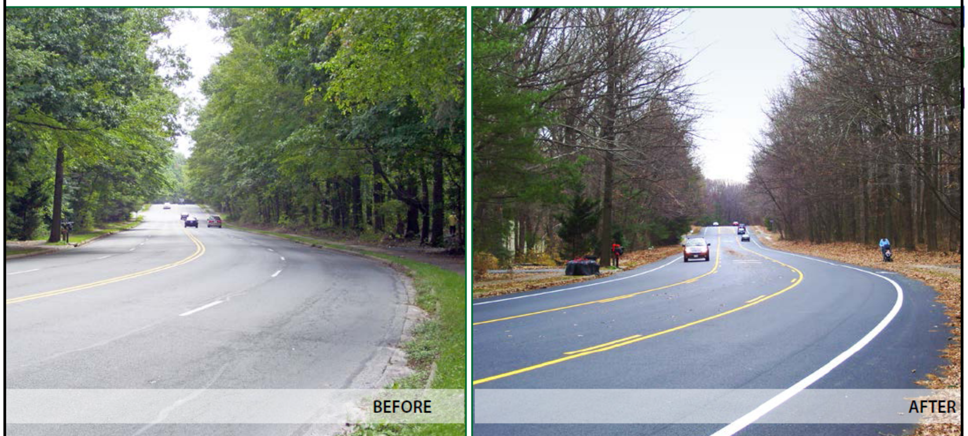
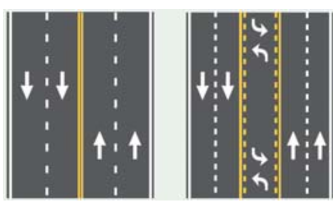


Photo Source: Virginia DOT

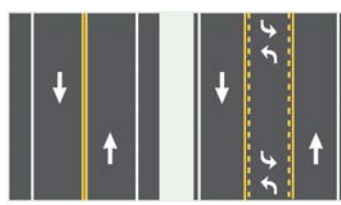
- *Four-lane undivided highways have relatively high crash rates*
- *Inside lanes are shared by higher speed through traffic and left-turning vehicles*

Other Reconfigurations

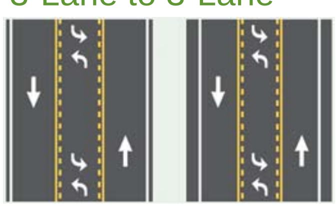
4-Lane to 5-Lane



2-Lane to 3-Lane



3-Lane to 3-Lane



5-Lane to 3-Lane

Common Characteristics

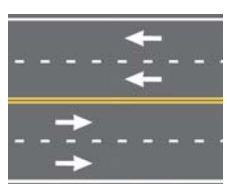
- Utilize existing footprint
- Rebalance / reallocate street space
- Add two-way left-turn lane (TWLTL) or raised median
  - Does not need to be continuous


Photo: Richard Retting

What a Road Diet is <u>NOT</u>

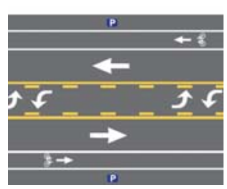
A Road Diet does not need to:

- Reduce the corridor's cross sectional width
- Reduce lane widths



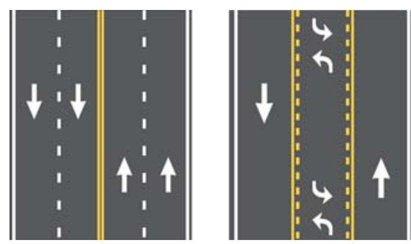
Think about it like this:

- Lane reallocation
- Lane rebalancing
- Conversion

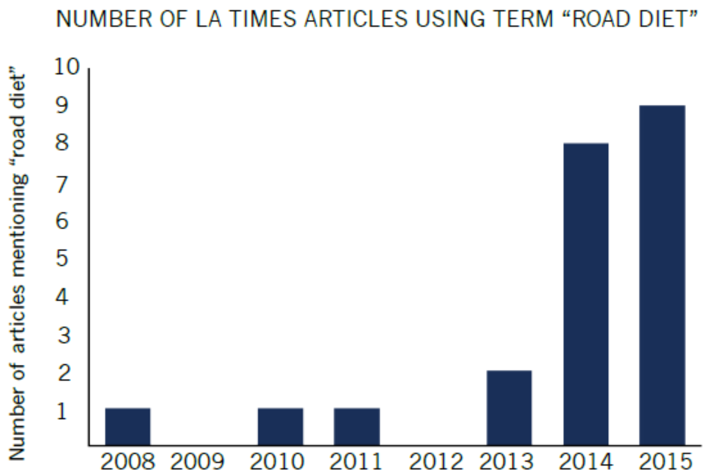


History of Road Diets

- First known conversion: Billings, MT - 1979
  - 4 lane undivided to 3 lanes (TWLTL)
  - ADT = 10,000 vehicles
  - Reduced crashes
  - No increase in vehicle delay
- Gained popularity in the 1990s

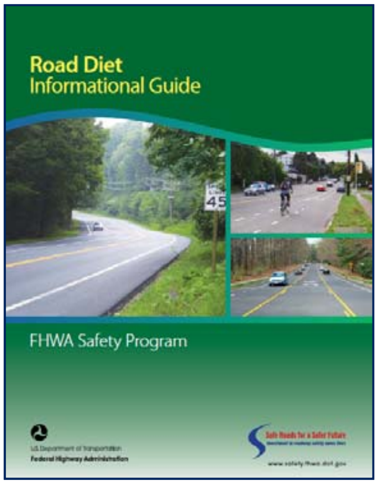


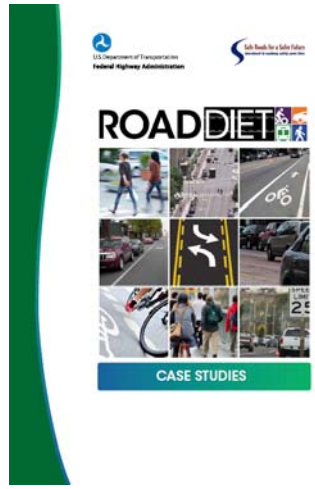
What's in a name???



Source: Who Wins When Streets Lose Lanes?: An Analysis of Safety on Road Diet Corridors in Los Angeles

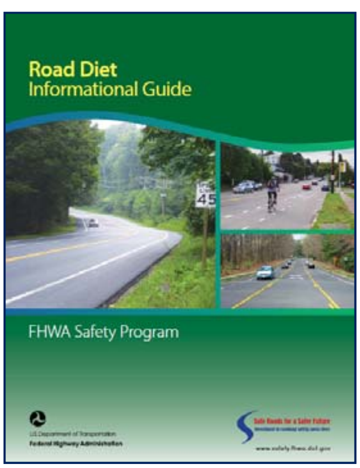
FHWA Resources





http://safety.fhwa.dot.gov/road_diets/info_guide/

Road Diet Informational Guide



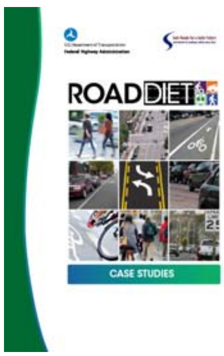
Chapter 2: Why consider a Road Diet?

Chapter 3: Should a Road Diet be used here?

Chapter 4: How do I design a Road Diet?

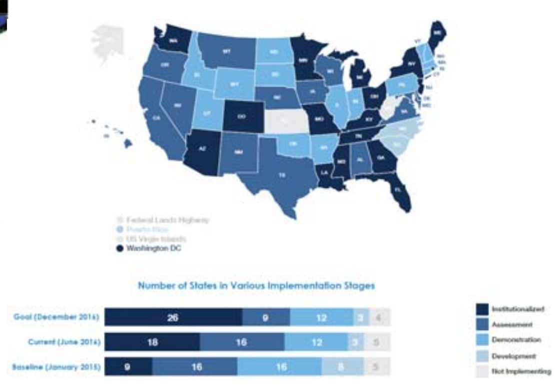
Chapter 5: How do I know if the Road Diet is working?

Road Diet Case Studies Report



Agency	Location	Title	Key Focus of the Case Study
Genesee County Metropolitan Planning Commission	Genesee County, Michigan	Communities Embrace Widespread Road Diet Use	Assessment and ranking of all 4-lane roads to determine Road Diet potential
City of Grand Rapids	Division Street Grand Rapids, Michigan	Livability Improves as Number of Lanes Decreases	Trial-basis Road Diet; highlights the positive outcomes and trade-offs of Road Diets
City of Grand Rapids	Burton Street Grand Rapids, Michigan	Road Diet and Transit Working Together	Traffic congestion concerns; transit stops
City of Chicago	55th Street Chicago, Illinois	Road Diet Includes Parking-Protected Bicycle Lanes	Improving bicycle safety and connectivity while maintaining efficient bus operation
City of Chicago	Franklin Boulevard Chicago, Illinois	Road Diet Improves Bicycle Connectivity, Enhances Livability	Livability benefits; improving safety and mobility for bicyclists
City of Chicago	Wabash Avenue Chicago, Illinois	Capacity Improved After Road Diet	Before-and-after capacity analysis; buffered bicycle lanes; signal optimization
City of Pasadena	Cordova Street Pasadena, California	Road Diet Improves Multimodal Level of Service	Improvement in multimodal level of service; addressing speeding issues
City of Santa Monica	Ocean Park Boulevard Santa Monica, California	Road Diet Improves Safety Near School	Addressing safety issues near school
City of Los Angeles	Seventh Street Los Angeles, California	Road Diet: Key Ingredient in Los Angeles' Bicycle Master Plan	Improving bicycle mobility and encouraging bicycle ridership
Virginia Department of Transportation	Lawyers Road Reston, Virginia	All-Around Success for Safety and Operations	Community input and public perception survey; crash reduction; bicycle connectivity
Virginia Department of Transportation	Soapstone Drive Reston, Virginia	There's More Than One Way to Complete a Road Diet	Multiple configurations of Road Diets; crash reduction; bicycle connectivity
Virginia Department of Transportation	Oak Street Dunn Loring, Virginia	Improving Safety and Livability	Reducing aggressive driving behaviors; providing consistent lane configuration
City of Des Moines	Ingersoll Avenue Des Moines, Iowa	Temporary Road Diet Becomes Permanent	Trial-basis Road Diet; public perception survey
Regional Transportation Commission of Washoe County	Reno, Nevada	Educating the Public on Road Diets	Public outreach method for education on Road Diet projects
Regional Transportation Commission of Washoe County	California Avenue Reno, Nevada	A Feasibility Evaluation Using Traffic Simulation Software	Using traffic simulation software to determine feasibility of a Road Diet
Regional Transportation Commission of Washoe County	Wells Avenue Reno, Nevada	Road Diet Improves Safety for Motorized and Non-motorized Users	Evaluating the safety and operational effects of the Road Diet
New York City Department of Transportation	Luten Avenue Staten Island, New York	Safety Solution Near School is a Road Diet	Addressing safety issues near school; reducing speeds
New York City Department of Transportation	Ninth Avenue Manhattan, New York	Road Diet on One-Way Street Designed for All Users	One-way street; parking-protected bicycle path; bicycle signals; pedestrian refuge islands
New York City Department of Transportation	Empire Boulevard Brooklyn, New York	Road Diet Improves Pedestrian Safety	Increasing pedestrian safety; reducing speeds and calming traffic
New York City Department of Transportation	West Sixth Street Brooklyn, New York	NYCDOT Responds to Tragedy with Road Diet	Addressing pedestrian safety issues
Seattle Department of Transportation	Dexter Avenue Seattle, Washington	Two-Stage Road Diet	4-lane to 3-lane to 2-lane Road Diet; bus bulb-outs, buffered bicycle lanes; high bicyclist volume and bus ridership
Seattle Department of Transportation	Nickerson Street Seattle, Washington	Safety Improved & Extreme Speeding Virtually Eliminated	Reducing speeds; improving overall safety; pedestrian safety features
Seattle Department of Transportation	Stone Way Seattle, Washington	Despite Early Opposition, Road Diet Produces Great Results	Public sentiment on Road Diet project; increased bicycle use
City of Indianapolis	Indianapolis Cultural Trail Indianapolis, Indiana	Road Diets Lead to Economic Development	Public outreach, planning, and design; economic development success

Every Day Counts – Round 3



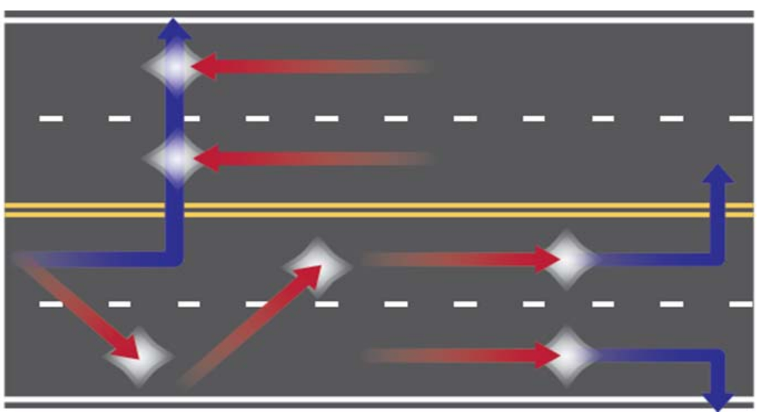
ROAD DIET

Why Consider a Road Diet?

Photo: Richard Retting

ROAD DIET

Why? – To Improve Safety !!!



- *Four-lane undivided highways have relatively high crash rates*
- *Inside lanes are shared by higher speed through traffic and left-turning vehicles*

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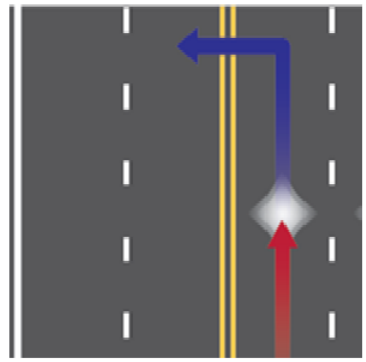
4-Lane Undivided Highways

Left-turning vehicles stopped in the inside travel lane are at risk for rear-end collisions



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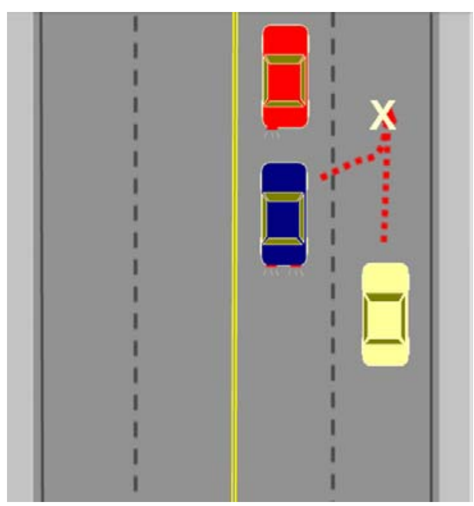
4-lane Undivided Highways

Frequent and sudden lane changing between the two through lanes contributes to sideswipe and rear-end collisions



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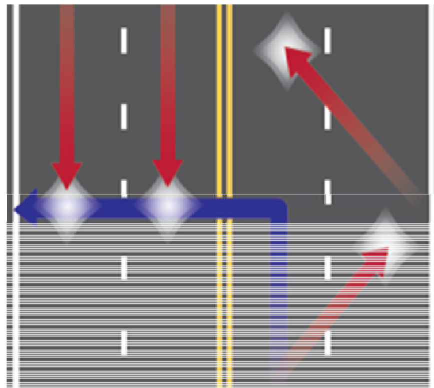
4-lane Undivided Highways

Left-turning drivers may make poor judgements in gaps or feel pressure to vacate the lane contributing to angle collisions



These safety problems become more evident as traffic volumes and turning movements increase

ROAD DIET

Safety Benefits

Based on safety studies, installing a Road Diet has an expected crash reduction of 19-47% *

* Variables affecting safety effectiveness include pre-installation crash history, installation details, traffic volumes, and the urban or rural nature of the corridor

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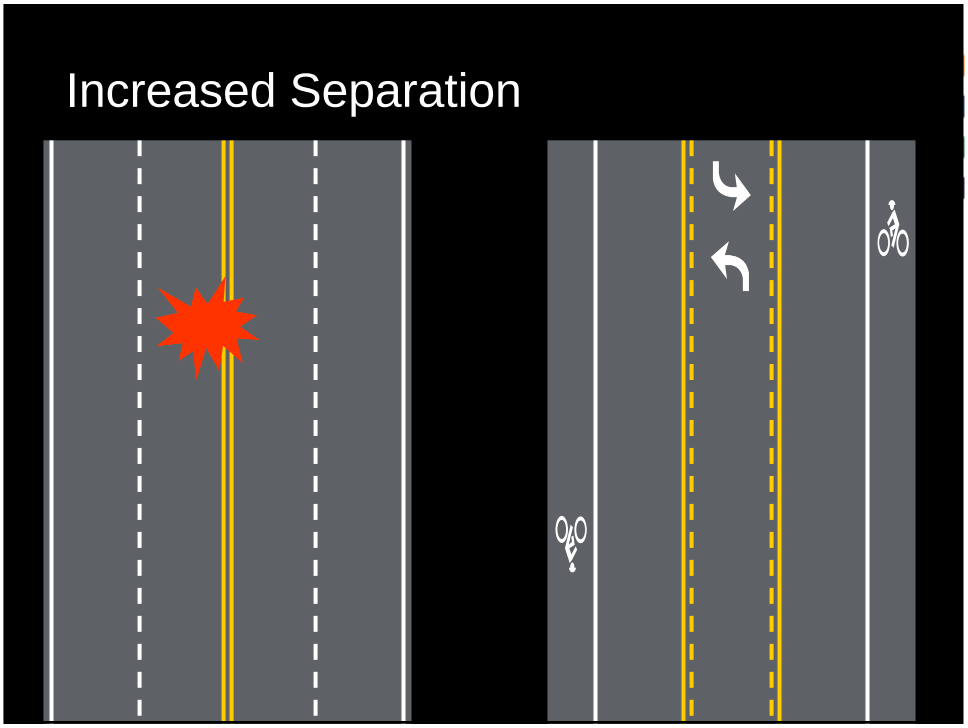
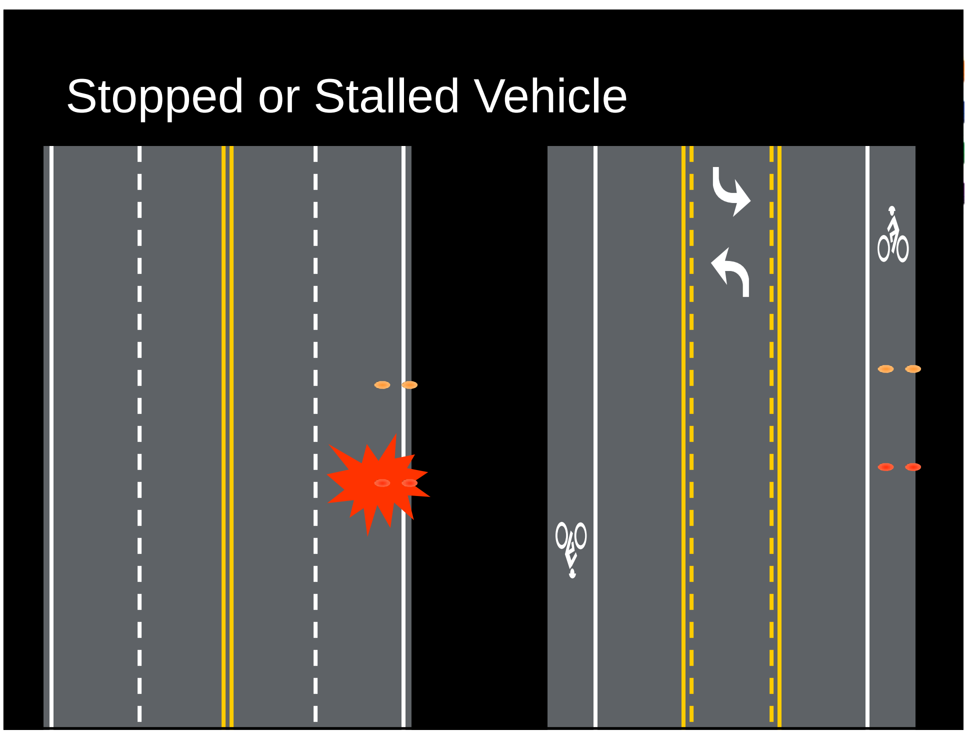
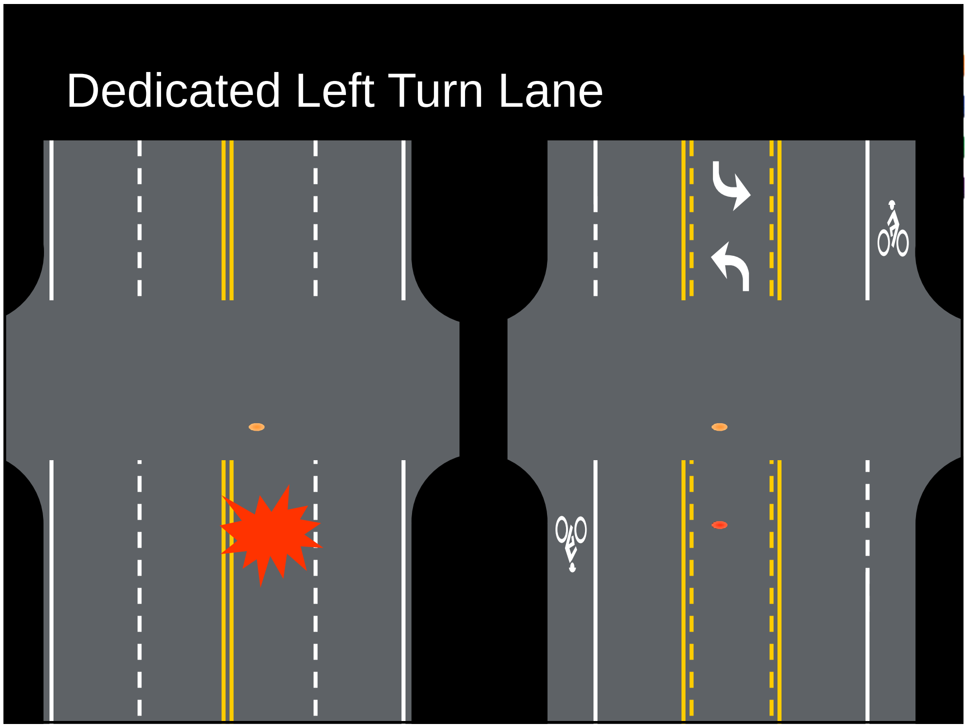
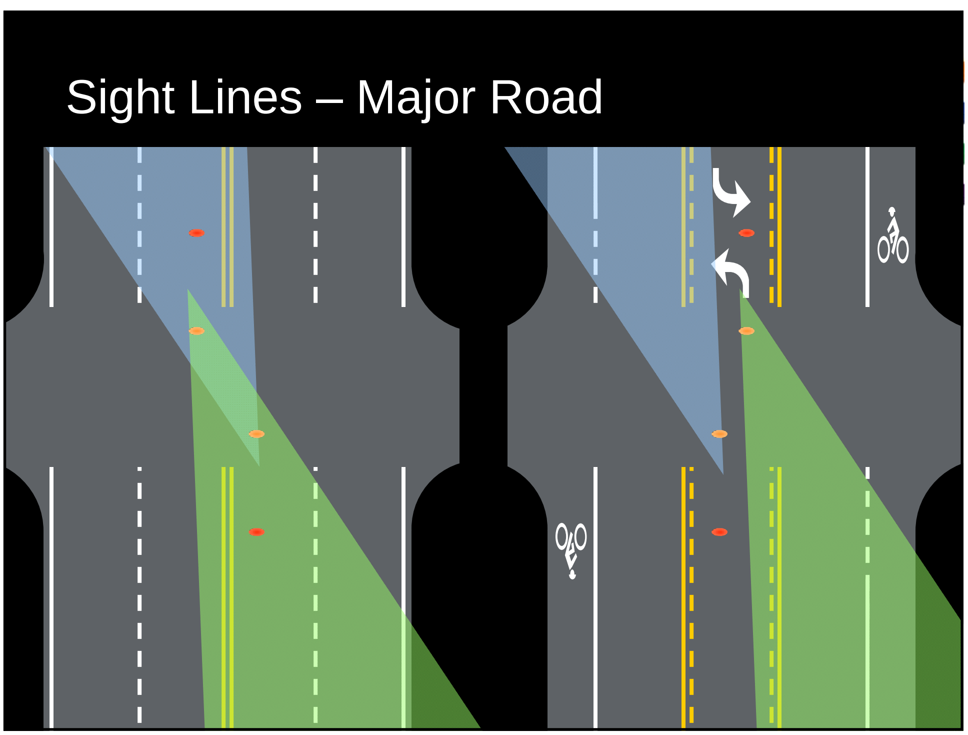
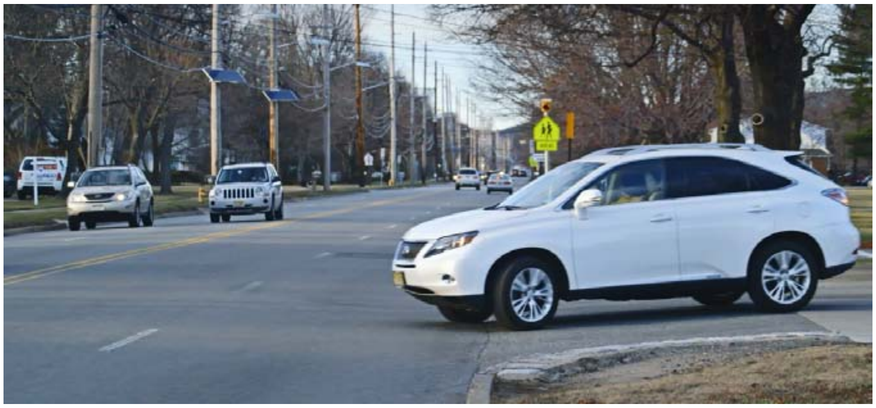

Increased Separation


Stopped or Stalled Vehicle

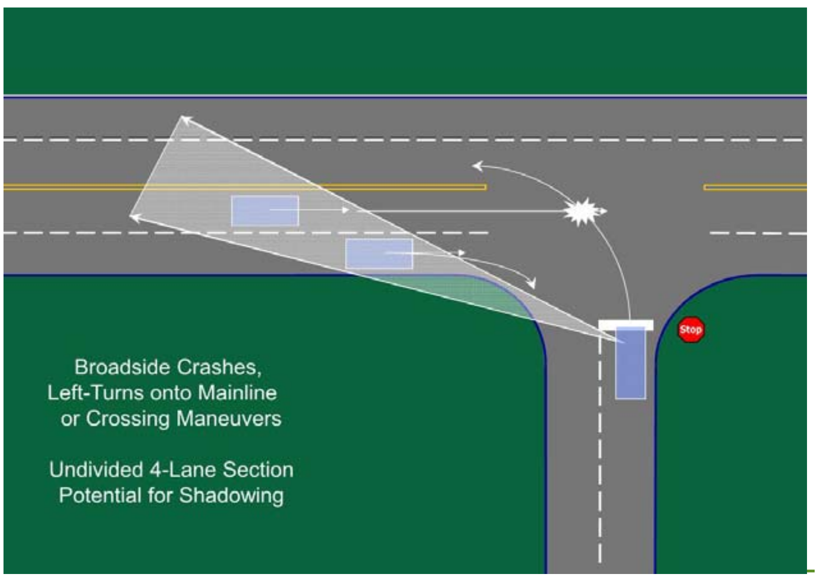

Dedicated Left Turn Lane


Sight Lines – Major Road

Side Street Left-Turn Challenges



Sight Line – Left Turn from Minor Street



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What if …?

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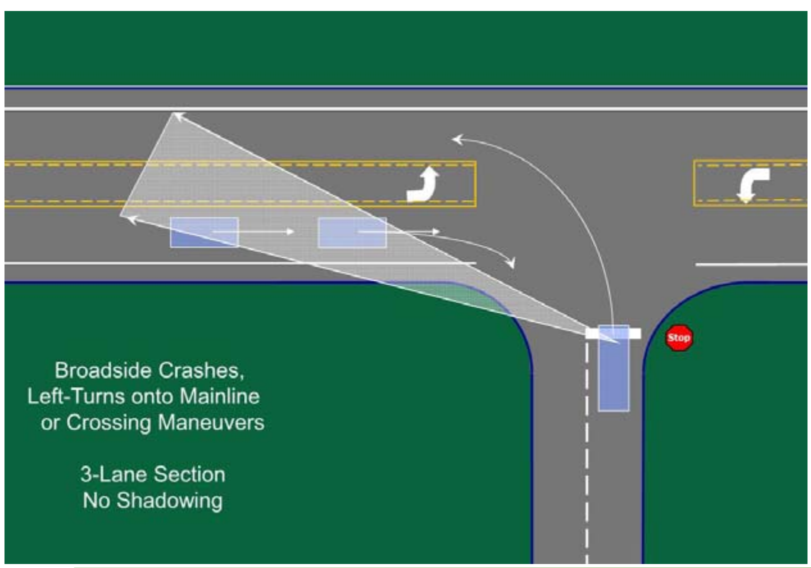
Sight Line – Left Turn from Minor Street



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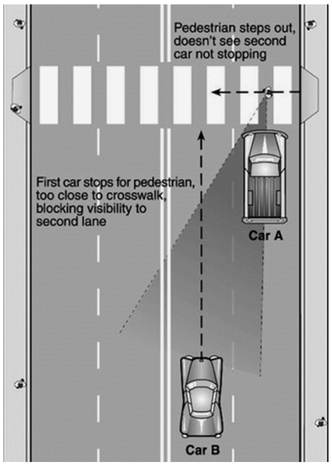
Improved Sight Lines at Unsignalized Crosswalks

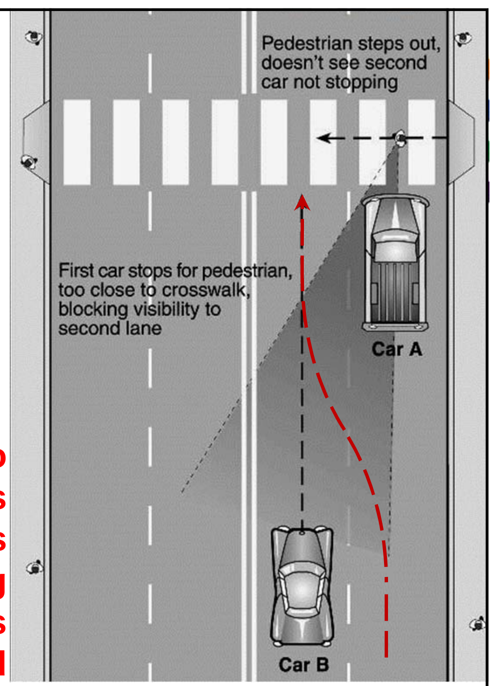


Multiple Threat Crash Problem

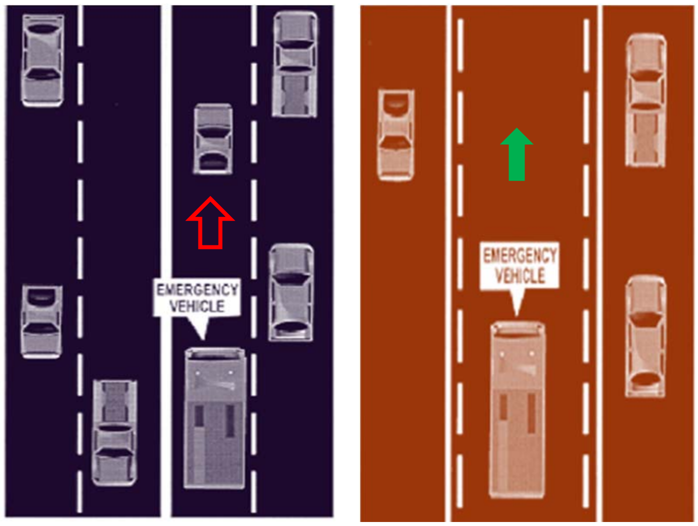
1st car stops to let pedestrian cross

1st car masks 2nd car, which doesn't stop, hits pedestrian at high speed

2nd car B changes lanes to get around car A that is braking, driver B is focused on maneuvering around car A, hits pedestrian at high speed



Emergency Vehicle Access



Operational Benefits

The number and spacing of driveways and intersections may lead to a high number of turning movements and four-lane undivided roads may operate as de facto three-lane roadways (with the majority of through traffic using the outside lanes)

- Separating left turns from through traffic may avoid "de facto" left-turn lanes
- Side-street traffic can more comfortably cross or enter the mainline roadway because there are fewer lanes to cross and this may reduce side-street delay
- Reductions of speed differentials due to a Road Diet provides more consistent traffic flow and less "accordion-style" slow-and-go operations

Traffic Demands Still Met

What about Capacity?

The effective capacity reduction is much less than the theoretical reduction assumed before implementation.

- Through volume traffic demands can often still be met
  - Signalized intersections are often the "pinch points"
  - Intersection improvements may minimize adverse impacts
  - Some traffic may be diverted
- May lend focus to efficiency of other modes including transit

ROAD DIET

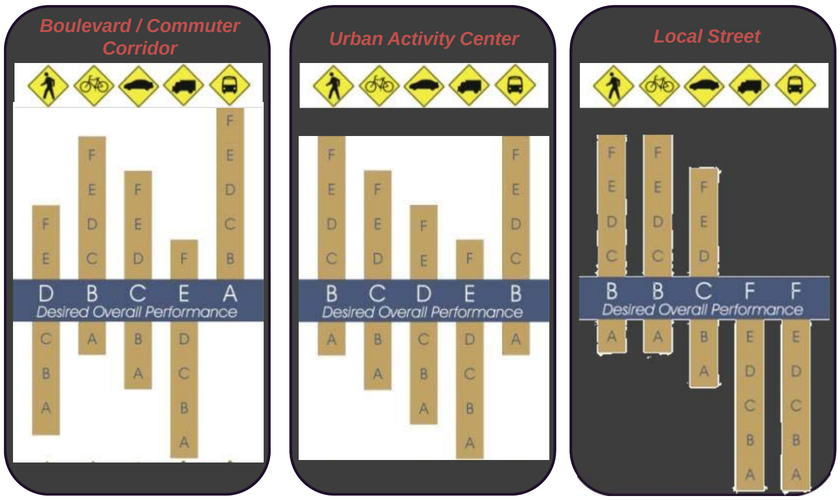
Pedestrian & Bicyclist Benefits

- Opportunities to provide facilities that may not currently exist
- Speed reductions lead to fewer and less severe crashes
- Three-lane cross-section makes crossing the roadway easier for pedestrians (fewer travel lanes to cross and they are exposed to moving traffic for a shorter period of time)

By adding pedestrian refuge islands - the crossing becomes shorter and less complicated (pedestrians only have to be concerned with one direction of travel at a time)

ROAD DIET

Modal Based Performance Goals



City of Lansing, MI Comprehensive Plan

Complete Streets

- The concept of Complete Streets suggests the street should accommodate all users of the road and its surroundings
- Being "complete" is context inherent and will differ depending on the street's intended function
- Many communities have embraced this concept by adopting Complete Streets policies, establishing the expectation that future roadway projects will be designed with all users in mind rather than simply providing enough capacity for vehicle through-put

Complete Streets

- Some Complete Streets efforts may require redesign and Right-of-Way

Source: New York State Complete Streets Report
www.dot.ny.gov/programs/completestreets/repository/Complete%20Streets%20Final%20Report_NYSDOT.pdf

ROAD DIET

Supports Local Business

- Access critical for customers and suppliers

Figure 3. Delivery Trucks on Dexter using TWLTL (Photo: Google)

ROAD DIET

ROAD DIET CASE STUDIES

Photo: Richard Retting

ROAD DIET

Reston, Virginia – Lawyers Road

ALL-AROUND SUCCESS FOR SAFETY AND OPERATIONS

OBJECTIVE

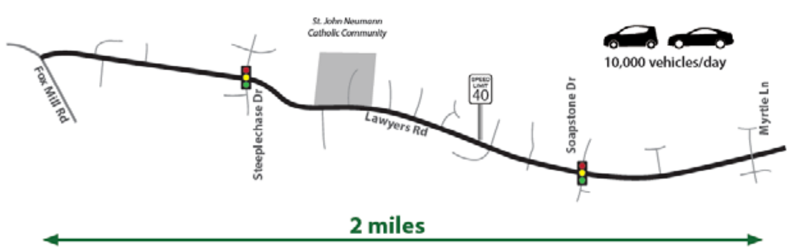
- Reduce crashes and speeding
- Improve safety and connectivity for bicyclists

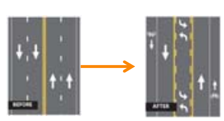
FEATURES

- Suburban area
- Public meetings
- Community "after" survey

RESULTS

- 70% reduction in crashes
- Travel time remained consistent
- Bicycle use increases



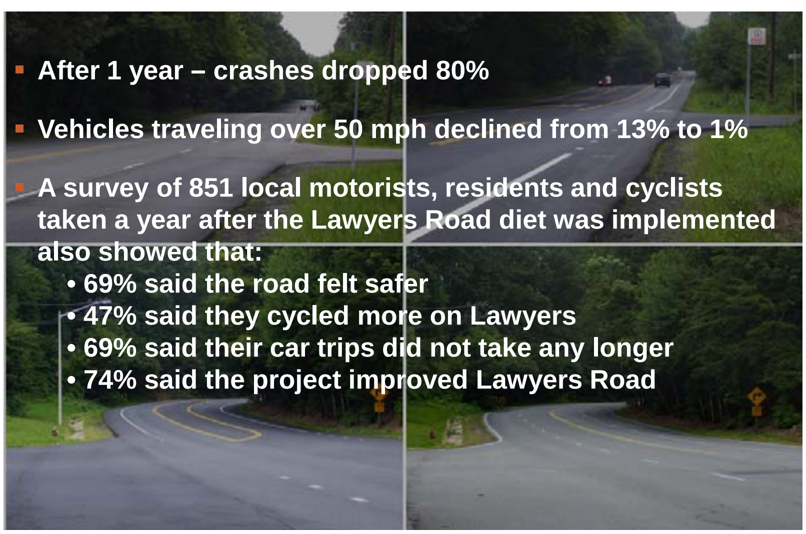


ROAD DIET

Lawyers Road - Reston, VA

ROAD DIET

Lawyers Road - Reston, VA



- After 1 year – crashes dropped 80%
- Vehicles traveling over 50 mph declined from 13% to 1%
- A survey of 851 local motorists, residents and cyclists taken a year after the Lawyers Road diet was implemented also showed that:
  - 69% said the road felt safer
  - 47% said they cycled more on Lawyers
  - 69% said their car trips did not take any longer
  - 74% said the project improved Lawyers Road

ROAD DIET

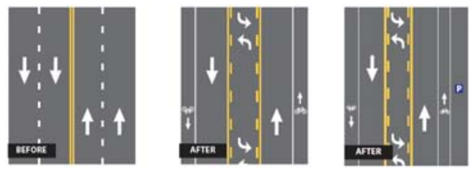
Reston, Virginia – Soapstone Drive

THERE'S MORE THAN ONE WAY TO COMPLETE A ROAD DIET

OBJECTIVE
- Improve safety/mobility for pedestrians/bicyclists
- Reduce crashes
- Address issues with street parking

FEATURES
- Three different reconfigurations
- Nature center, parks, recreational trails
- Rural/suburban

RESULTS
- 70% crash reduction
- Improved access to transit station for bicyclists



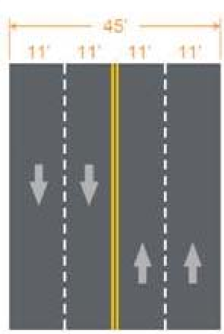
- Differing land uses and varying speed limits required different reconfigurations along the corridor
- Implemented during a regularly-scheduled repaving project

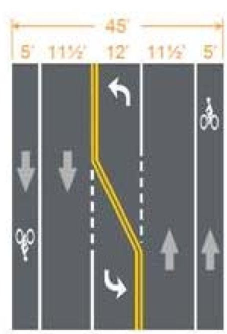
ROAD DIET

Soapstone Drive - Reston, VA

VDOT Virginia Department of Transportation

Crashes on Soapstone Dr. were reduced by 67% after three years





ROAD DIET

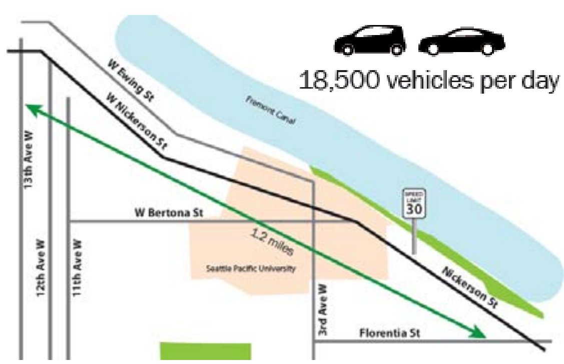
Seattle, Washington – Nickerson Street

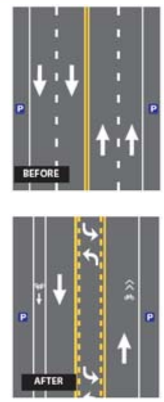
SAFETY IMPROVED & EXTREME SPEEDING VIRTUALLY ELIMINATED

OBJECTIVE
- Improve pedestrian safety
- Increase driver compliance with speed limit

FEATURES
- Reintroduction of crosswalks
- Addition of curb bulb-outs and pedestrian refuge islands

RESULTS
- 23% reduction in collisions
- More than 90% drop in top-end speeders





ROADDIET

Seattle, Washington – Nickerson Street

SAFETY IMPROVED & EXTREME SPEEDING VIRTUALLY ELIMINATED

- Speeding decreased dramatically
- Collisions were reduced
- No significant diversion of traffic to parallel routes

TOP END SPEEDERS HAVE BEEN REDUCED BY MORE THAN **90%**

TOP END SPEEDERS
Percent 10+ mph over the speed limit

	Before	After	Change
Westbound	17%	1.4%	-92%
Eastbound	38%	1.5%	-96%

CHANGE IN NUMBER OF COLLISIONS
from 13th Ave W to N Florentia St

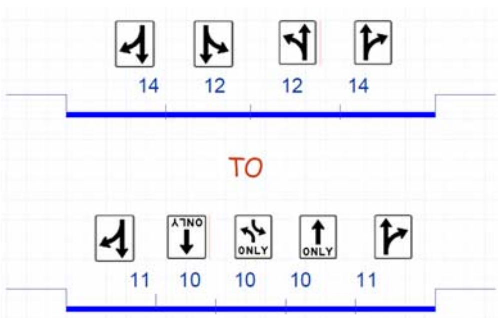
5-Year Average	One Year Post Project	Change
33.6	26	-23%

Nickerson Street only experienced a 1% decrease in traffic volumes

ROADDIET

Lexington, KY - Euclid Ave.

Initial Proposal

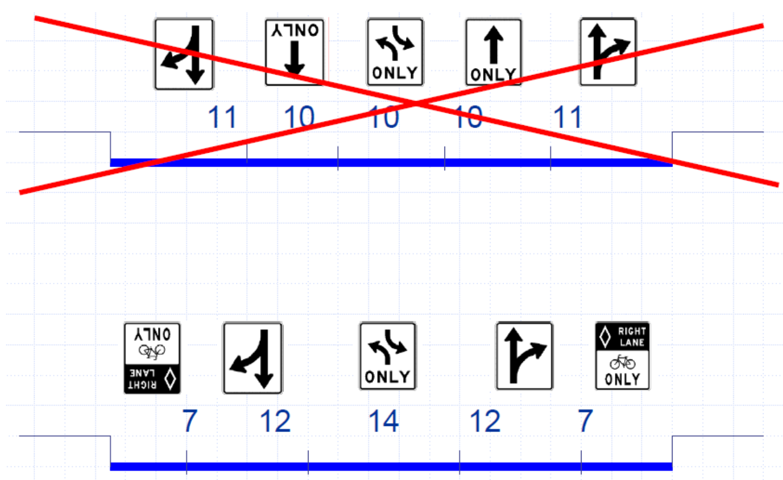


Before Photo

ADT 15,900

ROAD DIET

Euclid Avenue – After Public Input



ROAD DIET

Euclid Avenue – Lexington, KY

ROADDIET

Can a bike lane be too wide?

ROADDIET

LaJolla Blvd – Bird Rock Community (San Diego, CA)

- **Prior to 2003, La Jolla Boulevard was a four-lane boulevard moving 20,000 cars per day with average speeds of 38-42 mph.**
- **The roadway configuration and speed of traffic created a setting uninviting for pedestrians and unable to stimulate growth among local businesses.**
- **In response to numerous community members demanding a safer walking environment, the City of San Diego, in partnership with the community, embarked upon a project to improve safety along the boulevard.**

ROAD DIET

Source: Arnold, M., Chui, G., and Lupo, D., P.E. "Roundabout Product Demonstration Showcase" Presentation on December 10, 2008, City of San Diego Engineering & Capital Projects Department

LaJolla Blvd – San Diego, CA

ROAD DIET

LaJolla Blvd – Bird Rock Community (San Diego, CA)

- Narrower travel lanes, five roundabouts, landscaped medians and angled parking have slowed traffic speeds, improved pedestrian safety, and also revitalized the businesses!!!

ROAD DIET

Southern Blvd. – Bronx, NY - BEFORE

ROAD DIET

Southern Blvd. – Bronx, NY - AFTER

ROAD DIET

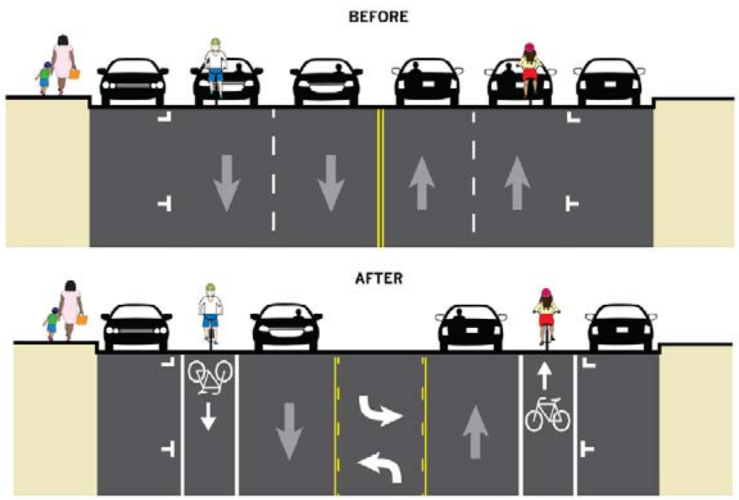
Knowledge Check

What are some common characteristics of Road Diets?

ROAD DIET

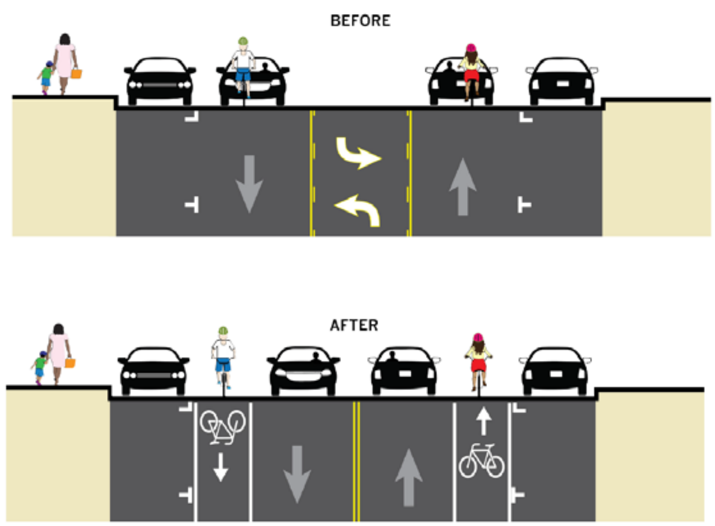
Knowledge Check

Could this be considered a Road Diet?



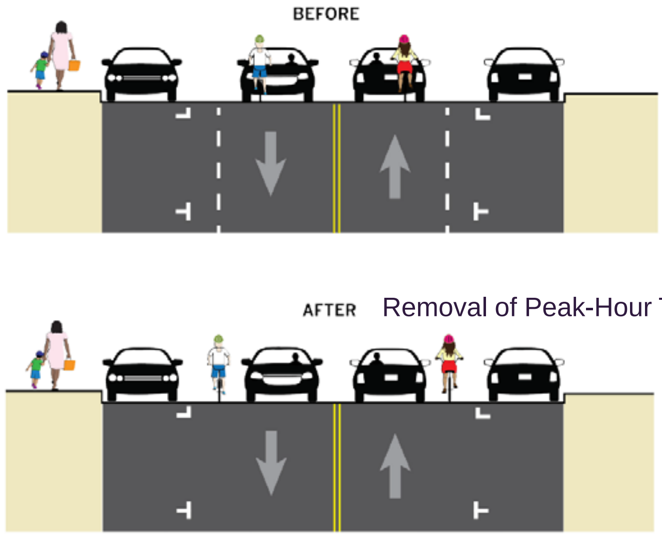
Knowledge Check

Could this be considered a Road Diet?



Knowledge Check

Could this be considered a Road Diet?



Removal of Peak-Hour Travel Lane

ROAD DIET

Knowledge Check

What are some potential benefits of Road Diets?

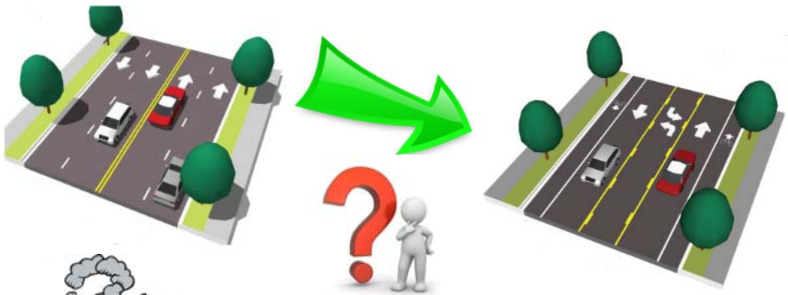
ROAD DIET

Knowledge Check

What is the relationship between Road Diets and Complete Streets?

Questions? Comments?

MODULE 2
ROAD DIET FEASIBILITY ASSESSMENT



EVALUATIVE FACTORS & CHARACTERISTICS

Learning Objectives

- Describe the major factors influencing the feasibility of implementing a Road Diet
- Apply an evaluative worksheet tool to assess an actual Road Diet case study

Evaluative Factors

Resources

Appendix B of the FHWA ***Road Diets Informational Guide*** contains sample evaluative questions and factors for considering Road Diet feasibility.

Appendix B – Feasibility Determination Factors, Characteristics, and Sample Evaluative Questions

Factor	Characteristics	Sample Evaluative Questions
Roadway Function and Environment	• Actual, Expected, and Desired Primary Function (Access, Mobility, or a Combination of the Two) • Community Objectives or Goals for the Roadway • Available Right-of-Way • Current and Expected Adjacent Land Use • Jurisdictional Plan or Policy for Conversions • Jurisdictional Context Sensitive or Complete Street Policy	• What is the primary current, expected, and desired function of the roadway? • Is the roadway primarily a collector or minor arterial roadway? • Does the current roadway primarily operate as a "de facto" three-lane cross section? • Is the goal for the roadway improvement increased safety with somewhat lower mobility? • Is the right-of-way limited? • Will the adjacent land use remain relatively stable throughout the design period? • Will the proposed cross section match the desired function of the roadway? • Will the answers to the above questions remain the same throughout the design period of the project? • Does the jurisdiction have a plan or policy related to these types of conversions? • Does the jurisdiction have a context sensitive or Complete Streets policy that may apply?

ROAD DIET

Evaluative Factors

Resources

Worksheet from FHWA Road Diet Workshop

FHWA Road Diets Workshop

WORKSHEET for Assessing a ROAD DIET Candidate Project

This worksheet is intended to provide a list of potential issues and evaluative questions for use in assessing a road diet project. It provides a beginning point for examining topics often relevant to road diet assessments. Additional issues or more information about specific proposals may be needed and adapting this worksheet to meet your agency or project needs is encouraged. Exercising professional judgement is critical to any assessment. Many items are interrelated and there are trade-offs in addressing these issues in relation to the desired goals and objectives of the project.

Basic Information

Project Name/Location: ____________________

Project Limits/Length: ____________________

Project Goals and Objectives

Intent: *By first identifying the objective(s), this will help determine whether a road diet is an appropriate alternative for the corridor being evaluated.*

Are there established safety improvement goals for this project? ____________________

Is there a desire to achieve reduced travel speeds and/or traffic calming? ____________________

Are there established mobility goals for this roadway improvement project? ____________________

Have any multimodal level of service goals been established? ____________________

Does the local jurisdiction have a Complete Streets policy that may apply? ____________________

Are there any economic enhancement or livability goals for this project? ____________________

Does achieving the project goals involve making changes to the current cross section (e.g., bike lane, on-street parking, etc.)? ____________________

Is the proposal consistent with the applicable Long-Range Transportation Plan (LRTP), Transportation Improvement Program (TIP), Transit Development Plan (TDP), comprehensive plan, and/or any applicable bicycle plans, pedestrian safety plans, and Complete Streets initiatives?

Notes: ____________________

____

Safety Considerations

Intent: *If safety improvement is the major objective, practitioners should determine if the identified crash patterns are those that can be addressed with a road diet.*

What are the current safety issues/problems on the road? ____________________

Will the types of crashes that are occurring likely be reduced with a Road Diet conversion? __________

ROAD DIET

Feasibility Worksheet Steps

Step 1
Identify Goals & Objectives

Step 2
Consider Road Function & Context

Step 3
Traffic Operations

Step 4
Special Conditions

Step 5
Design & Cost Considerations

Step 6
Early Stakeholder Engagement

Project Goals & Objectives

Background Image Source: NASA

Project Goals & Objectives

Project Goals and Objectives

Intent: *By first identifying the objective(s), this will help determine whether a road diet is an appropriate alternative for the corridor being evaluated.*

Are there established safety improvement goals for this project? ____________________________

Is there a desire to achieve reduced travel speeds and/or traffic calming? ______________________

Are there established mobility goals for this roadway improvement project? _____________________

Have any multimodal level of service goals been established? ______________________________

Does the local jurisdiction have a Complete Streets policy that may apply? _____________________

Are there any economic enhancement or livability goals for this project? _______________________

Does achieving the project goals involve making changes to the current cross section (e.g., bike lane, on-street parking, etc.)? ____

Is the proposal consistent with the applicable Long-Range Transportation Plan (LRTP), Transportation Improvement Program (TIP), Transit Development Plan (TDP), comprehensive plan, and/or any applicable bicycle plans, pedestrian safety plans, and Complete Streets initiatives?

ROADDIET

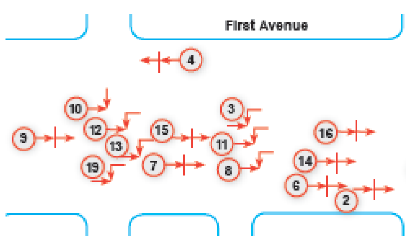
Safety Considerations

Intent: *If safety improvement is the major objective, practitioners should determine if the identified crash patterns are those that can be addressed with a road diet.*

What are the current safety issues/problems on the road?

Will the types of crashes that are occurring likely be reduced with a Road Diet conversion?

- **Crash types:**
  - Rear-end
  - Angle
  - Same Direction Sideswipe
- **Crash causes:**
  - Stopping in travel lane
  - Speed differentials
  - Limited sight distance



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Bicycle Safety Considerations

- Improves bicycle safety
  - Adds/increases buffer
- Increases bicycle usability
- May help complete regional bicycle network

Pedestrian Safety Considerations

- Are pedestrians walking in the road?
- Are bicyclists riding on the sidewalk?

Project Goals & Objectives

- Understanding the project goals and objectives (along with their relative importance) is critical for evaluating the trade-offs that are often inevitable when reallocating valuable road space

Feasibility Worksheet Steps

Step 1

Identify Goals & Objectives

Step 2

Consider Road Function & Context

Functional Classification

- Functional classification historically emerged as the predominant method for grouping streets and highways by their “character of service” and has been an important planning tool

Functional classification categories are related to “hierarchies of travel movements”

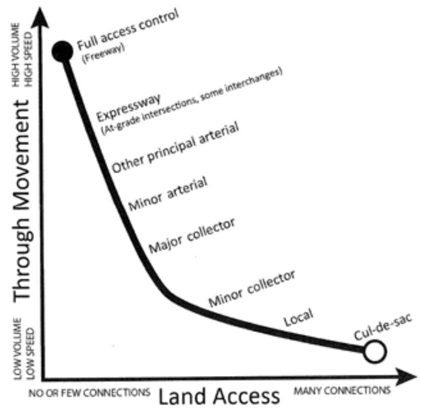

Figure Source: TRB Access Management Manual Second Edition

ROADDIET

Functional Classification

Function classification helps define the street’s “role” in the network and may be indicate:

- Typical trip purposes and trip lengths accommodated by the thoroughfare
- Appropriate level of access management
- Type of freight service

“While the accommodation of bicyclists, pedestrians, and transit users is an important consideration in the planning and design of highways and streets, the functional classification of a highway or street is primarily based on motor vehicle travel characteristics and the degree of access provided to adjacent properties.”

AASHTO 2011 Green Book p 1-1

ROADDIET

Roadway Function and Context

- Functional classification influences the design criteria for the project
- Functional classification alone may not indicate the **<u>context</u>** of the corridor
  - Purposes the roadway serves

Actual roadway function should (but may not) match its *intended* or *designed* function

Potential Functions

- What is the level of freight operation?
  - Is this a designated Truck Route?
- Is this an Emergency Evacuation Route?
- Is this a heavy transit corridor?
- Along the route, are there any:
  - Hospitals?
  - Fire stations?
  - Schools?
  - Major event trip generators?
- Is the adjacent land use expected to remain relatively stable?

Feasibility Worksheet Steps

Step 1

Identify Goals & Objectives

Step 2

Consider Road Function & Context

Step 3

Traffic Operations

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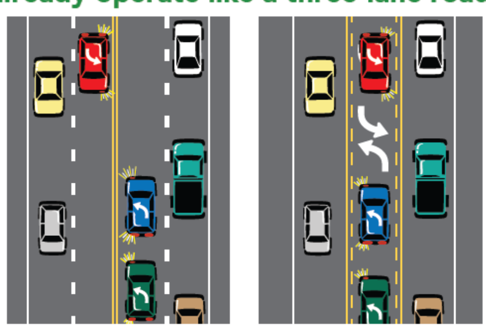
Operational Considerations

A four-lane roadway may already operate like a three-lane road.

Some four-lane undivided roads operate essentially like a three-lane road (defacto one lane in each direction)



Before
A four-lane undivided road operating as a de facto three-lane cross section.

After
A Road Diet providing a two-way left-turn lane.

When a corridor contains a large number of access points (driveways) the majority of through traffic will tend to utilize the outside lanes to avoid being delayed by left-turning vehicles slowing and stopping in the inside lanes.

ROAD DIET

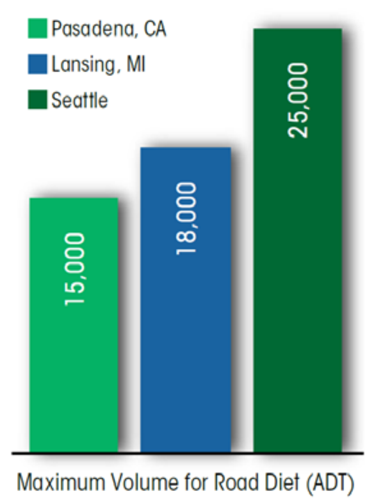
General Guidelines for Traffic Volumes

LESS THAN 10,000 ADT	10,000 – 15,000 ADT	15,000 – 20,000 ADT	GREATER THAN 20,000 ADT
Great candidate for Road Diet	Very good candidate for Road Diet	Good candidate for Road Diet	Potential candidate for Road Diet
In most instances traffic will likely not be negatively affected.	Agencies should conduct intersection analysis to study potential traffic operational effects and consider signal retiming as needed.	Agencies should conduct a corridor analysis since traffic operations may be affected at this volume depending on the "before" condition.	Agencies should complete a feasibility study to determine whether this is a good location for a Road Diet. Operations may be affected at this volume.

There are examples across the country where Road Diets have been successful with ADTs as high as 26,000.

Feasibility Thresholds Based on Average Daily Traffic (ADT)

- KY Guidance – up to 23,000 ADT
- If ADT is near the upper limits, conduct further analysis.



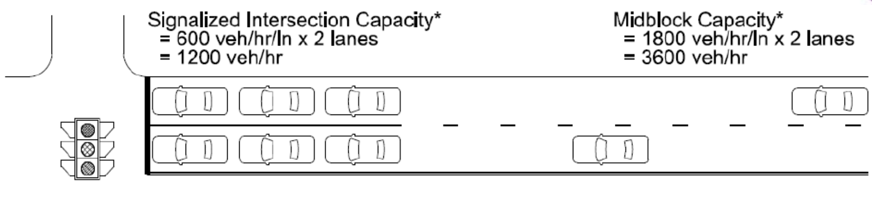
Thresholds Based on Peak Hourly Volume

- Typically feasible at or below 750 vphpd *
- Consider carefully between 750 – 875 vphpd
- Feasibility still possible between 875 – 1000 vphpd, but likely to noticeably increase congestion

* vphpd = vehicles per hour per direction

Reference: *Guidelines for the Conversion of Urban Four-lane Undivided Roadways To Three-Lane Two-Way Left-Turn Facilities,* (2001*)* Keith Knapp, CTRE, Iowa State University

Intersection Operations

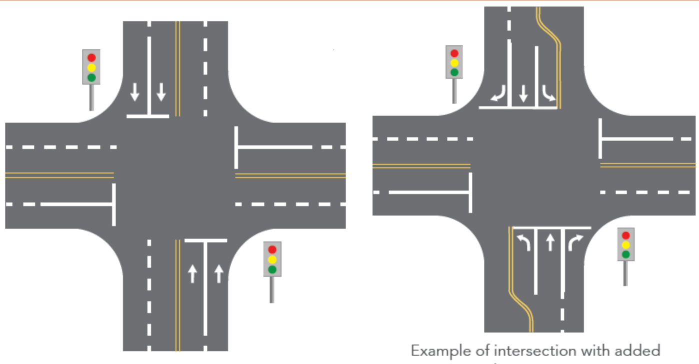


- The “capacity” of a street is determined by the operations at its signalized intersections (or stop-controlled).
- Capacity “rules of thumb”
  - single mid-block travel lane : 1,800 vehicles per hour
  - single travel lane through a signalized intersection: 600 vehicles per hour (dependent on the time allocated in the signal cycle)

Unless the street has 3x as many lanes at the intersections as it has mid-block, the intersections will be the limiting factor in terms of capacity.

Intersections May Determine True Capacity

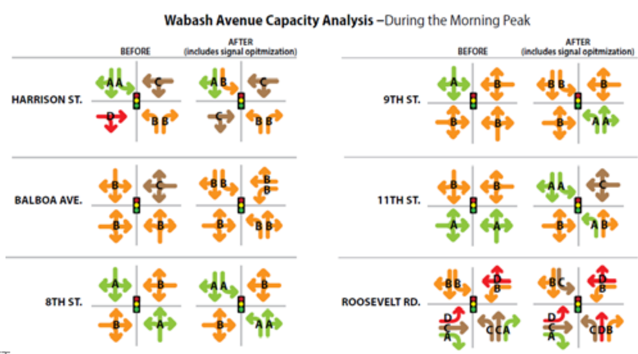
Converting four through lanes to two through lanes may make it possible to install dedicated turn lanes at the intersection



Example of intersection with added turning movements.

Turn Lane Reconfigurations and Signal Timing Changes

- By carefully analyzing and improving operations at intersections it may be possible to reduce the number of lanes mid-block on a street without increasing delay for motor vehicle traffic.



Road Diets and Roundabouts


North Decatur Rd – Decatur, GA

ROAD DIET

Non-Intersection Turning Volumes and Patterns

Considerations:

- Number and Location of Minor Side Roads and Access Points
- Peak Period Turning Volumes
- Presence of Left-turn and Right-turn Lanes
- Minor Street and Access Point Vehicle Delay

ROAD DIET

Considerations for Urban Corridor

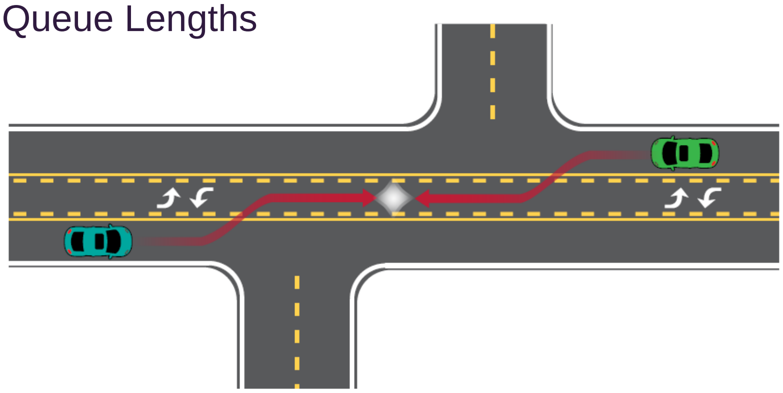
- The operational impacts (such as significantly more queuing and delay) may be greater in a busy downtown setting due to heavy side street volumes and loss of left-turn capacity caused by the short block lengths

ROAD DIET

Offset Minor Street Intersections

Considerations:

- Volume of Left Turns
- Distance Separating Minor Street Approaches
- Queue Lengths



ROAD DIET

Frequently Stopping and Slow-Moving Vehicles

- Transit buses
- School buses
- Curb-side mail delivery
- Trash pick-up
- Agricultural equipment
- Horse-drawn vehicles

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Transit Considerations

- Transit should not cause undue additional delay to general purpose traffic
  - Include bus pullouts
  - Reassess bus stop location and spacing
  - Add physical barriers to prevent passing

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Parking

Consider:

- Impact on parking maneuvers
- Parking spot design (parallel vs diagonal)
- Interactions between bicyclist and parking vehicles

Freight Considerations

- Current and future routine deliveries and transport
  - How will stores and restaurants receive deliveries?
- Freight related through-traffic
- Engage freight stakeholders
  - Business owners, commercial and industrial property owners

Delivery Zones

Consider the current and future needs for delivery zones and loading areas. Removal or relocation of delivery zones may impact truck access to businesses. Where there is only one through lane per direction, trucks that stop for deliveries are likely to block auto traffic.

Feasibility Worksheet Steps

Step 1
Identify Goals & Objectives

Step 2
Consider Road Function & Context

Step 3
Traffic Operations

Step 4
Special Conditions

Parallel Roadways

- Road Diets may cause some diversion of traffic to parallel routes. Considerations include:
  - Distance to parallel route
  - Amount of increased delay from Road Diet
- Can apply traffic calming on parallel routes to offset impact

Photo Resource: Jennifer Atkinson

ROAD DIET

Traffic Volumes Sustained

Roadway Section	Change	ADT (Before)	(After)	Notes
1. Lake Washington Blvd., Kirkland, Washington South of 83	4 lanes to 2 + TWLTL + bike lanes	23,000	25,913	
2. Lake Washington Blvd, Kirkland, Washington Near downtown	4 lanes to 2+ TWLTL + bike lanes	11,000	12,610	
3. Electric Avenue, Lewistown, Pennsylvania	4 lanes to 2 + TWLTL + bike lanes	13,000	14,500	
4. Burcham Road, East Lansing, Michigan	4 lanes to 2 + TWLTL + bike lanes	11-14,000	11-14,000	
5. Grand River Boulevard, East Lansing, Michigan	4 lanes to 2 + TWLTL + bike lanes	23,000	23,000	
6. St. George Street, Toronto, Ontario, Canada	4 lanes to 2 + bike lanes + wide sidewalks	15,000	15,000	
7. 120th Avenue, NE Bellevue, Washington	4 lanes to 2 + TWLTL	16,900	16,900	
8. Montana (commecial street) Bellevue, Washington	4 lanes to 2 lanes + TWLTL 4 lanes to 2 + median + bike lanes	18,500	18,500	
9. Main Street Santa Monica, California	4 lanes to 2 lanes + TWLTL 4 lanes to 2 + median + bike lanes	20,000	18,000	

ROAD DIET

At-Grade Railroad Crossings

- May double the queue length at railroad crossings impacting other intersections
- May cause turning lane backup at parallel railroad crossings

Feasibility Worksheet Steps

Step 1
Identify Goals & Objectives

Step 2
Consider Road Function & Context

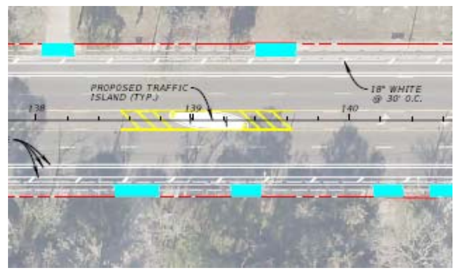
Step 3
Traffic Operations

Step 4
Special Conditions

Step 5
Design & Cost Considerations

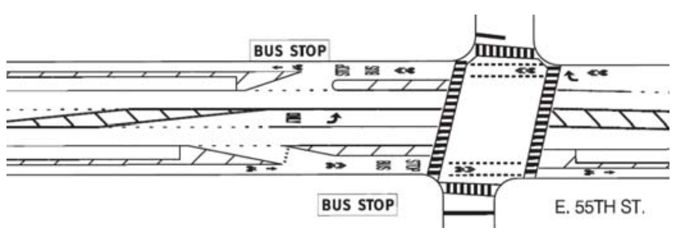
Design Considerations

Covered in detail in next module



Right-of-Way Availability

- Most Road Diets can be completed within the existing curb-to-curb roadway
- May need periodic changes in road width
  - Pull outs for buses
  - Right-turn lanes at intersections



Cost Considerations

- Typical cost for restriping from four-lane to a three-lane road diet is $25,000 to $40,000 per mile
  - If a reconfiguration is done after repaving or an overlay, and curbs don't need to be changed, there may be no additional costs
- Extending sidewalks or building raised medians can cost about $100,000 per mile or more

ROAD DIET

Source: http://www.pedbikeinfo.org/cms/downloads/Countermeasure_Costs_Summary_Oct2013.pdf

Feasibility Worksheet Steps

Step 1 Identify Goals & Objectives

Step 2 Consider Road Function & Context

Step 3 Traffic Operations

Step 4 Special Conditions

Step 5 Design & Cost Considerations

Step 6 Early Stakeholder Engagement

ROAD DIET

Public Outreach, Public Relations, and Political Considerations

- May encounter initial public opposition
  - Treatment is new and unfamiliar

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Stakeholder Engagement Considerations

- Is there any known controversy associated with the project?
- Have endorsements or documented project support been made by appropriate city, county, and/or regional bodies (e.g., a commission or board resolution)?
- Have any concerns or supportive comments been voiced at public meetings from local businesses, residents and other stakeholders?
- If a TWLTL is proposed as part of the road diet, do area drivers have a familiarity with proper use of TWLTLs or are they rare in the region?

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Community Support

Gaining public support for a road diet project is extremely important - but can be challenging

Common concerns:
- More congestion
- More crashes
- Bad for emergency response
- "Bicycles vs. Automobiles"
- Bad for business

Coordinate public participation with outreach to elected officials.

ROAD DIET

ROAD DIET

Charlotte Observer, June 2004

ROAD DIET

Media Tools

- Create a project web page
- Interactive blogs for public comments
- Social media to keep the community up-to-date on the project
- Webinars
- Education videos
- Visualizations

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Public Workshops

Workshops offer a more engaged form of public participation and educational outreach.

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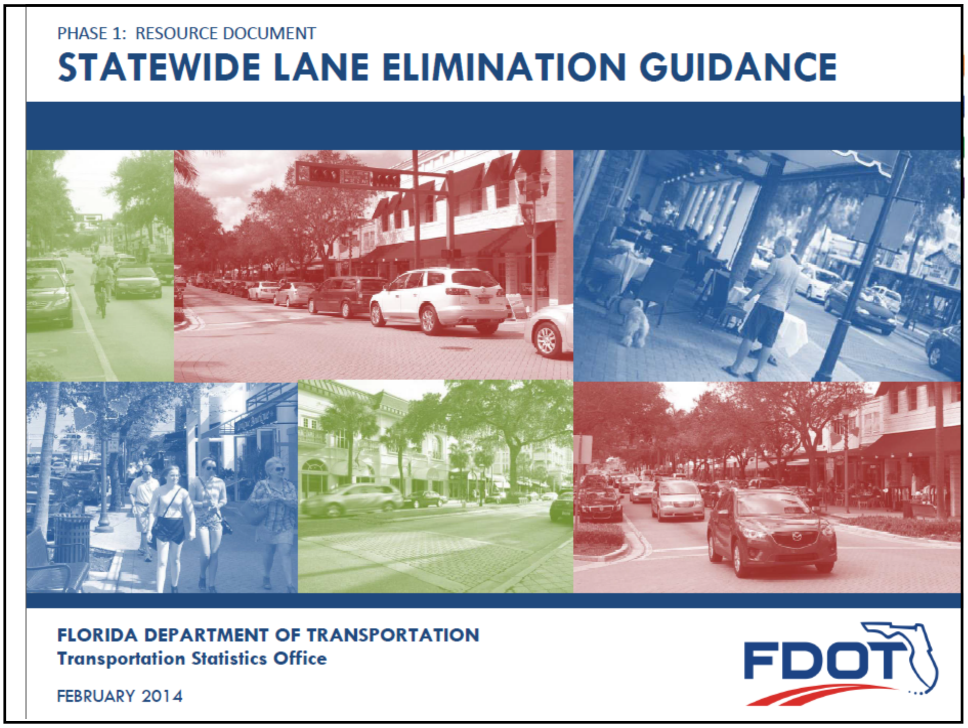
Trial Period

- Powerful tool to “disarm” public concerns
- Opportunity to “validate” studies and analyses
- Can uncover unidentified issues and provide an opportunity to address them before final roll-out
- An effective means of monitoring should be developed

ROAD DIET

Sample Guidelines from Transportation Agencies


PHASE 1: RESOURCE DOCUMENT

STATEWIDE LANE ELIMINATION GUIDANCE

FLORIDA DEPARTMENT OF TRANSPORTATION
Transportation Statistics Office

FEBRUARY 2014

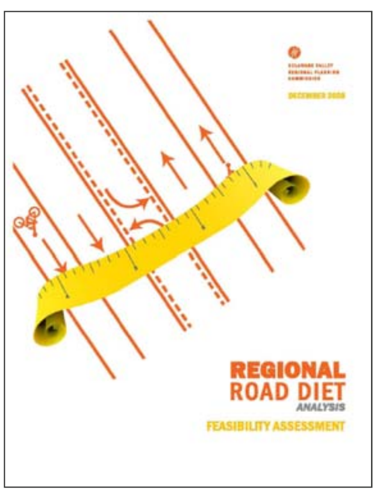
Florida Guidelines
"Issue Profiles"

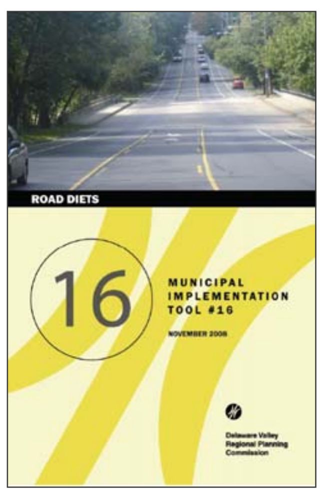
Safety impacts	Design variances and exceptions	Freight routes/access
Traffic operations impacts	Consistency with plans and programs	Extra-jurisdictional impacts
Pedestrian and bicyclist activity	Functional classification	Structure/utility impacts
Impacts to transit routing/stops and ridership	System designation	Costs and funding sources
Impacts on parking supply and activity	Access management	Community support
Sales tax revenue and property value impacts	Emergency evacuation and response	Other issues
Environmental issues	Jurisdictional transfers	

Other Implementation Guidelines

- Delaware Valley MPO
- Genesee Co. MPO
- Iowa DOT
- Kentucky Transportation Cabinet
- Michigan DOT
- Seattle DOT
- Austin Transp. Dept.

Delaware Valley Regional Planning Commission (DVRPC) Guidelines





Genesee County Metropolitan Planning Commission (GCMPC), MI

4-star rating system to measure compatibility of each road segment, based on:

- Crash data
- Lane width
- Surface type
- ADT
- No. of traffic signals
- Land use

RECOMMENDATION/RATING

★	Not recommended
★★	Not recommended without adjustments
★★★	A good candidate
★★★★	A very good candidate

ROAD DIET

Kentucky Transportation Cabinet Guidelines

- Mainly based on main and side street volumes at signalized intersections

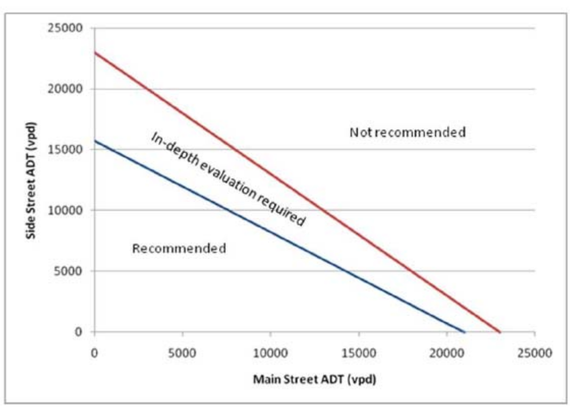
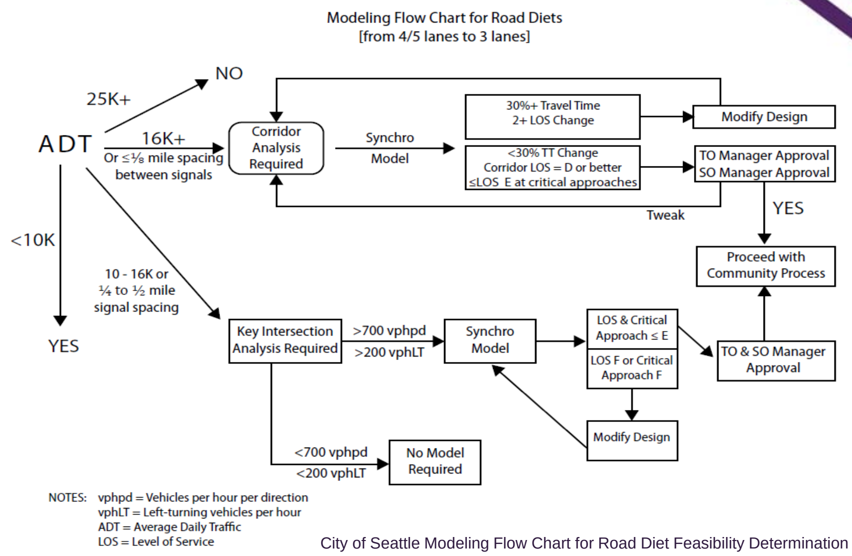


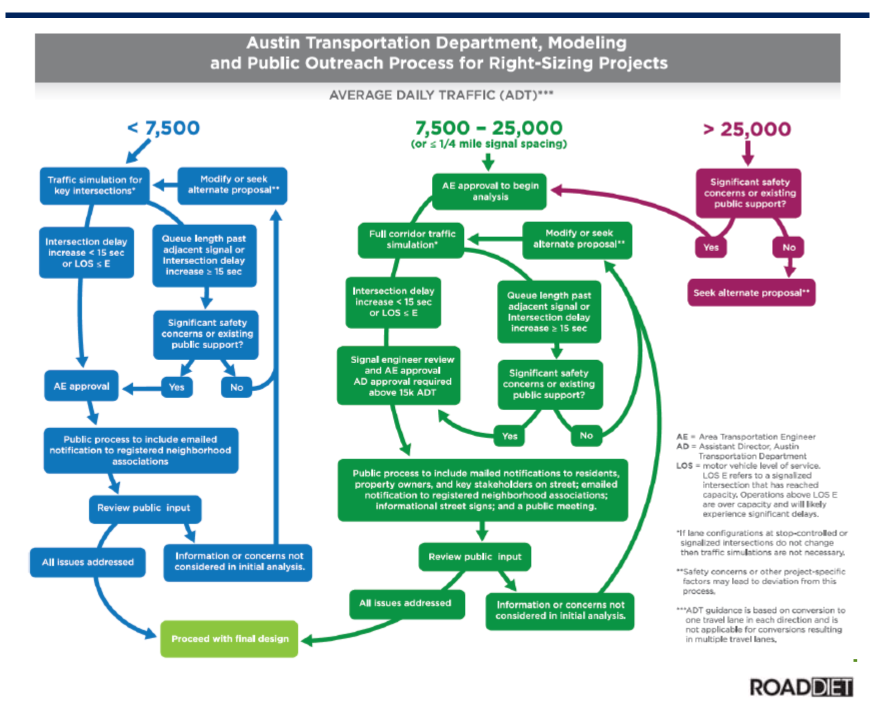
Fig. 2. Guideline for operational performance at signalized intersections

ROAD DIET

Seattle DOT



City of Seattle Modeling Flow Chart for Road Diet Feasibility Determination



Questions? Comments?

Road Diet Feasibility Assessment Worksheet

This worksheet provides a list of evaluative questions for assessing a potential road diet project. It is intended as a tool for examining the issues often relevant to road diet feasibility. Additional issues or more information about specific proposals may be needed and adapting this worksheet to meet your agency or project development needs is encouraged. Exercising professional judgement is critical to any assessment and it is critical to consider the trade-offs associated with these interrelated factors and to the desired goals and objectives of the project.

Project Name/Location: ____

Project Limits/Length: ____

Project Goals and Objectives

Intent: *By first identifying the objective(s), this will help determine whether a road diet is an appropriate alternative for the corridor being evaluated.*

Safety: Are there safety improvement goals for this project? ___________________________________

If safety improvement is a major objective, determine if the identified crash patterns are those that can be addressed with a road diet.

What are the current safety issues/problems on the road? ____________________________________

Will the types of crashes that are occurring likely be reduced with a Road Diet conversion? ___________

Will a reduction in speed and/or speed variability likely improve safety on the road? _________________

Are there safety concerns related to pedestrians and/or bicyclists? ______________________________

Other Goals & Objectives

Is there a desire to achieve reduced travel speeds and/or traffic calming? __________________________

Are there established mobility goals for this roadway improvement project? ________________________

Have any multimodal level of service goals been established? __________________________________

Does the local jurisdiction have a Complete Streets policy that may apply? _________________________

Are there any economic enhancement or livability goals for this project? ___________________________

Does achieving the project goals involve making changes to the current cross section (e.g., bike lane, on-street parking, etc.)? ____

Is the proposal consistent with the applicable Long-Range Transportation Plan (LRTP), Transportation Improvement Program (TIP), Transit Development Plan (TDP), comprehensive plan, and/or any applicable bicycle plans, pedestrian safety plans, and Complete Streets initiatives?

Notes: ____

____

Road Function and Context

Intent: *The major functions and objectives of the road should be evaluated with regard to possible trade-offs between mobility, safety, and access for all users. The functional classification of the roadway influences the design standards and criteria specific to the proposed project. The functional classification of the road may indicate the historical intended purpose of the corridor, but may not be indicative of the present context or the various purposes the roadway serves. The existing and intended function of the roadway and the surrounding land uses are important considerations for the feasibility of a Road Diet.*

What is the road's current Functional Classification? ____

Is a future change in Functional Classification expected or desired? _______________________________

Is this a designated Truck Route? ____

What is the level of freight/large vehicle operation along the road? _________________________________

What are the current and expected future levels of transit operation along the road? _________________

____

Is the adjacent land use expected to remain relatively stable? ____________________________________

Is this a designated Emergency Evacuation route? ____

Along the route, are there any:
- hospitals?
- fire stations?
- schools?
- major trip generators?

If YES to any of the above, consider involving these entities early in your project discussions.

Notes: ____

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Summary of Context and Function Considerations

Is a Road Diet consistent with the context and function of this road?

☐ YES ☐ NO ☐ MAYBE

Notes: ____

____

Traffic Operational Considerations

What are the current average daily traffic volumes? ____

What are the current peak hourly directions volumes? ____

Are these volumes within guidelines for a Road Diet? ____

Does the corridor periodically function as a "relief" route to a freeway or principal arterial and experience high volumes when those other facilities are congested? ____

What is the projected future ADT (based on historical growth and/or the regional travel demand model)?

____

What is the current posted speed limit? ____

What are the current travel speeds along the road? (e.g., mean, 85th percentile, percent of vehicles traveling at high speeds) ____

Is a change in the posted speed limit proposed with a road diet? __________________________________

What are the characteristics of the driveways along the route (commercial, residential, density)? ______

____

What are the patterns and turning volumes for vehicles to/from minor streets and driveways?
____

Is the existing roadway operating as a de facto three-lane roadway? ______________________________

What are the truck and large vehicle volumes along the roadway and intersecting roads? _____________

How frequent is the presence of slow-moving or frequently stopping vehicles, such as transit, school busses, curb-side mail delivery, etc.? ____

____

____

If applicable, how are truck deliveries made to businesses along the route? _________________________

____

____

Pedestrian Counts: ____

If counts are unknown, provide a general classification such as high, moderate, or low

Bicycle Counts: ____

If counts are unknown, provide a general classification such as high, moderate, or low

Intersection Operational Considerations

How many signal (or All-Way STOP) controlled intersections are within the project study road segment?

List their locations and describe their existing operations in terms of signal phasing operations and presence of turn lanes: ____

____

____

____

Are there any plans to add, remove, or modify traffic signals within the corridor? ___________________

Are there any mid-block pedestrian crossings existing or proposed? ______________________________

Are any of the existing intersections experiencing operational problems such as excessive delays? If known, list the volume/capacity ratios of the intersection approaches: ____________________________

____

____

When was the last time the signal timing or phasing was changed or optimized? ____________________

For current and future volume conditions, what are the results of a peak hour level of service (LOS) and queuing analyses for intersections under the build and no-build scenarios?

Notes: ____

____

____

CAUTION: A greater risk of operational impacts such as significantly more queuing and delay may occur with lane elimination in a busy downtown setting due to heavy side street volumes and loss of left-turn capacity caused by the short block lengths.

Transit Operational Considerations

Intent: *Depending on the bus frequency and headways, road diets may negatively impact the speed and reliability of bus services. With just one travel lane per direction, frequently stopping busses may have a significant impact on traffic flow. Constructing bus bulbs or pull-outs can mitigate these effects, although use of bus pull-outs may result in delays for busses when trying to merge back into the through lane.*

What are the bus volumes and headways in the corridor? _____________________________________

If a Road Diet is implemented, will stopping transit buses in the one through lane significantly impact traffic? ____

Are locations for bus pull-outs possible? ____

Do transit routes make turns within the corridor (appropriateness of turn radii and lane widths)?

On-Street Parking Considerations

Intent: *On-street parking may offer multiple benefits, including creating a "tunnel effect" that naturally slows motorists' speeds. Providing on-street parking may also allow for construction of curb extensions at crosswalks, which reduce crossing distance for pedestrians.*

Does on-street parking currently exist? ____

Is on-street parking proposed (parallel, angle, back-in, mix)? ________________________________

Note: *Angled parking uses less linear curb length per parking space than parallel parking (so more spaces may be provided on the same block). However, angled parking takes up more distance perpendicular to the curb. Back-in angled parking (as opposed to head-in angled parking) is beneficial to bicyclists as it is easier to make eye contact with drivers as they pull out of their parking spots.*

Will on-street parking reduce the ability of vehicles to turn in and out of minor streets and access points?

Intent: *On-street parking should not impede visibility for pedestrians, bicyclists, and other vehicles. This means that on-street parking spaces should be located carefully relative to intersections and crosswalks.*

Freight and Delivery Considerations

Consider the current and future needs for delivery zones and loading areas. Removal or relocation of delivery zones may impact truck access to businesses. Where there is only one through lane per direction, trucks that stop for deliveries are likely to block auto traffic.

Summary of Project Operational Impacts

What is the projected increase in travel delay due to the Road Diet conversion? ___________________

Are any intersections projected to experience a significant reduction in level of service? _____________

Is a Road Diet consistent with the vehicular operational needs of this road?

☐ YES ☐ NO ☐ MAYBE

Notes: ____

____

____

Special Conditions

Is the Road Diet conversion expected to divert significant traffic to parallel roadways? ______________

Intent: *Traffic diversion to parallel streets may not be problematic for arterials or collectors with adequate reserve capacity, but could be very problematic for diversion to neighborhood residential streets.*

Are there any at-grade railroad crossings along the roadway? _________________________________

Do trains regularly cross during peak travel periods? _______________________________________

What is the typical delay from a train crossing? ____

Is doubling the current queue length (compared to four-lane undivided cross section) at the crossing acceptable? ____

Are there any special conditions along this road that jeopardize the feasibility of a Road Diet?

☐ YES ☐ NO ☐ MAYBE

Notes: ____

____

Design Considerations

What is the existing cross-sectional width (typically measured curb-to-curb): ______________________

Describe the existing cross-sectional elements of the road (such as lane widths, presence of shoulders, bike lanes, on-street parking, curbs, etc.): ____

____

____

What are the appropriate cross-sectional elements of the Road Diet project that will meet the desired project goals? : ____

____

____

Careful consideration of the geometric requirements of trucks and other large vehicles should be given when considering a road diet implementation. Curb extensions or other non-traversable areas that are added as part of a road diet project can be problematic for large vehicles if these treatments are not designed for the turning needs of the design vehicle. Decreased curb radii may limit truck movements and/or cause trailer off-tracking that can put pedestrians at risk.

If lane widths are decreased during a road diet, large trucks may have increased risk of involvement in sideswipe and mirror crashes, depending on the resulting width of the lane and the curvature of the road. Additionally, narrower lanes mean that there is less space between trucks and other road users, which can create a sense of discomfort in all users.

Intent: *Consider the potential impacts on trucks (including appropriateness of turn radii and lane widths and possible relocation of designated truck routes).*

Are there any problematic issues related to the existing intersections (e.g., intersection sight distance deficiencies, skew, approach grades, approach alignment and profile, proximity to adjacent intersections, etc.)? ____

____

Would the proposed cross-section require additional right-of-way? ______________________________

Are there any design constraints that jeopardize the feasibility of a Road Diet?

☐ YES ☐ NO ☐ MAYBE

Notes: ____

____

Early Stakeholder Engagement

Is there any known controversy associated with the project?

Have endorsements or documented project support been made by appropriate city, county, and/or regional bodies (e.g., a commission or board resolution)?

Have any concerns or supportive comments been voiced at public meetings from local businesses, residents and other stakeholders?

If a TWLTL is proposed as part of the road diet, do area drivers have a familiarity with proper use of TWLTLs or are they rare in the region?

Notes: ____

Are there any known concerns or controversies that jeopardize the feasibility of a Road Diet?

☐ YES ☐ NO ☐ MAYBE

Notes: ____

____

Workshop Exercise: Evaluating a Road Diet Candidate Project

Instructions

1. Divide into your work group teams. Identify at least one team member (can be several) to serve as "note taker" and another to serve as a "presenter". At the conclusion of this exercise, each team will be asked to present on your group's assessment.

2. Read the Project Background Information below on this Road Diet candidate case study.

3. As a team, evaluate and assess the described scenario conditions and discuss if this location is a viable candidate for a Road Diet. You are encouraged to use the Road Diet Assessment Worksheet included in your workshop Participant Workbook to guide your assessment.

4. Each team will be asked to make a short presentation on their assessment.

Project Background Information

The City of Clarendon (population 9,000) completed a Downtown Area Improvement Study (DAIS) with grant funding through the Regional Commission's Strong Livable Communities Initiative. The DAIS was the basis for a Downtown Improvements Master Plan that included several transportation recommendations, including a Road Diet project. The city procured an engineering firm to conduct a feasibility study for a Road Diet and improvements along the Clarendon Avenue corridor.

The DAIS identified improvements to Clarendon Avenue as being vital for improving pedestrian conditions in the downtown historic district and introducing safer pedestrian and bicyclist access between residential neighborhoods south of Clarendon Avenue and the commercial properties along the corridor's north side. The study also identified a need to calm traffic passing through the City's downtown area and how the existing right-of-way along Clarendon Avenue might be repurposed to better match travel demand and improve conditions for other users of the street.

The study was developed with significant involvement from the local community. Area residents and business owners have expressed strong desires for many years to improve walkability and safety for bicyclists by controlling speeds through the community. The recommendations from the study and elements of the Master Plan were categorized based on these primary objectives:

1. Make the historic downtown area more inviting for people to walk and frequent area shops and restaurants.

2. Calm traffic through the downtown area and improve the ease for pedestrians to cross from the residential area to the opposite side commercial area.

3. Add bicycle lanes from the downtown area along the Clarendon Avenue corridor west to the Ingleside Light Rail Transit Station and the Frost College Campus.

Existing Conditions

Clarendon Avenue is a State Highway (SR 78) and is classified by the State DOT as a minor urban arterial. The corridor serves as the primary commercial area within the City of Clarendon with mostly retail (small shops and restaurants) uses along the north side of the street within the small historic downtown area. The figure below shows the location area.

The eastern limits of the corridor study area begin 500 feet east of the intersection of Clarendon Avenue with Arcade Boulevard. To the east of this location, Clarendon Avenue is currently a 2-lane roadway with primarily residential land use on both sides. There are no plans to widen this section of Clarendon Avenue. The left photo below shows the existing 2-lane section of Clarendon Avenue just east of the study limits looking east. The right photo is looking west along Clarendon Avenue entering the study limits just east of the intersection with Arcade.

Clarendon Avenue

Existing 2-lane Section just east of the Corridor Study Limits

Clarendon Avenue - looking west entering into study limits

Existing 2-lane Section transitioning to wider section at intersection with Arcade

At the intersection with Arcade Boulevard just inside the eastern limits of the study area, the typical section of Clarendon Avenue abruptly changes. Heading westbound, a second lane forms at the intersection with Arcade. The right lane is a shared thru/right turn and the left lane a shared thru/left turn. In the eastbound direction there are three lanes on Clarendon approaching the intersection with Arcade. These lanes become a left turn only lane, a single thru lane, and a right-turn only lane. The photo below is looking west from a location just west of the intersection with Arcade. The typical section transitions to five lanes (two travel lanes in each direction with a center TWLTL). Note the existing angle parking along the north side of the street within the downtown historic district.

Clarendon Avenue - looking west just west of Arcade intersection

Existing eastbound 2-lanes transitions to one thru lane at intersection with Arcade

The most recent traffic counts from the State DOT for Clarendon Avenue range from 17,500 vpd for the segment west of the downtown historic district to a high of 21,100 vpd recorded by a 2007 traffic count taken just outside the study area west of the downtown area where Clarendon Avenue is a two-lane highway (one lane in each direction). The state DOT Planning Office projects a design year (2040) travel demand volume of 23,300 vpd within the corridor.

Within the downtown historic district from the intersection at Arcade going west approximately 1400 feet, the commercial area is on the north side of the road only. There are no commercial parcels along the south side of Clarendon Avenue. The south side features a continuous vegetation hedge planted in a narrow parkway with no driveway cuts or intersecting streets for the entire hedge’s length. Due to this, left turns to access cross streets or private property only occur in the eastbound direction between Pine Street and Arcade Boulevard.

Minor side streets along the corridor do not add significant traffic volumes to Clarendon Ave. Most side streets only extend short distances. On the north side they end before the railroad corridor and on the south are limited by breaks in local streets. East of the Pine Street intersection and west of Arcade Boulevard, there are no intersecting streets on the south side of the corridor due to the historic hedge row. For this reason, the minor intersections along the corridor do not experience congestion and no additional signalized intersections are anticipated to be needed in the future. Currently there are four signalized intersections within the study limits at the intersections with Arcade Blvd, Pine Street, Sycamore Street and Frost Street. East of the intersection with Sycamore Street, Clarendon Avenue transitions from a 5-lane section to a 4-lane section (no TWLTL). The transition occurs over 250 feet with the TWLTL tapering away in the center of the road as shown in the picture below.

Clarendon Avenue - looking west just west of Pine Street intersection

Existing 5-lane section transitioning to 4-lane section (no TWLTL) east of Sycamore Street intersection

From a point approximately 600 feet east of the intersection with Sycamore to the western end of the study area at Frost Street, the basic cross-section on Clarendon Avenue is 4-lanes. Just west of the intersection with Sycamore Street is the Ingleside Light Rail Transit Station. The station itself lies on the north side of Clarendon Avenue and a park and ride lot is on the south side with a pedestrian bridge over Clarendon Avenue providing access between the station and adjacent parking area.

From west of the light rail station to the western end of the study area (at the intersection with Frost Street), the rail line runs directly north of Clarendon Avenue. There are no cross streets or access points along the north side of Clarendon Avenue between Frost Street and the Ingleside transit station. Various commercial properties and apartment complexes are on the south side of Clarendon Avenue within this section. The photo below shows an example.

Clarendon Avenue (looking west) between Sycamore Street and Frost Street

Existing 4-lane section with no access on north side (due to RR track) and commercial properties and apartment complexes on south side

At the western end of the study area, Clarendon Avenue transitions to a 2-lane roadway at the intersection with Frost Street. Frost Street provides the main access to Frost College, a 90-acre liberal arts college with an enrollment of 2100 students. About half of the students live off campus, many in nearby apartment complexes east of campus along Clarendon Avenue. Frost College has committed to becoming a carbon-neutral institute by the year 2030 and is taking steps to reduce its impact on the local environment. One such step has been to partner with the Regional Clean Air Campaign to implement strategies reducing the number of single-occupant vehicle trips made to and from the campus. The College is very supportive of proposals to provide bicycle lanes on Clarendon Avenue that will connect the campus with nearby apartment complexes, the light rail station, and the downtown Clarendon shopping district.

The regional transit authority operates four bus lines within the corridor. All four bus routes begin and end at the Ingleside Light Rail Station that is adjacent to Clarendon Avenue. Two of the routes go east (toward Frost College) from the station along Clarendon Avenue and two go west (toward historic downtown area). Each route operates on 40 minute headways staggered so there is a bus approximately every 20 minutes operating on Clarendon Avenue within the study area.

The total length of the study corridor (from Frost Street to just east of Arcade) is 1.45 mile.

Safety Analysis

According to the State DOT Safety Office, there were 98 crashes recorded on Clarendon Avenue within the study limits in the three year period between 2011 and 2013. The prevailing causes were rear-end and right-angle collisions caused by cars turning left into driveways or side streets. The table below summarizes the crash data by crash type.

Crash Data Summary (2011-2013)

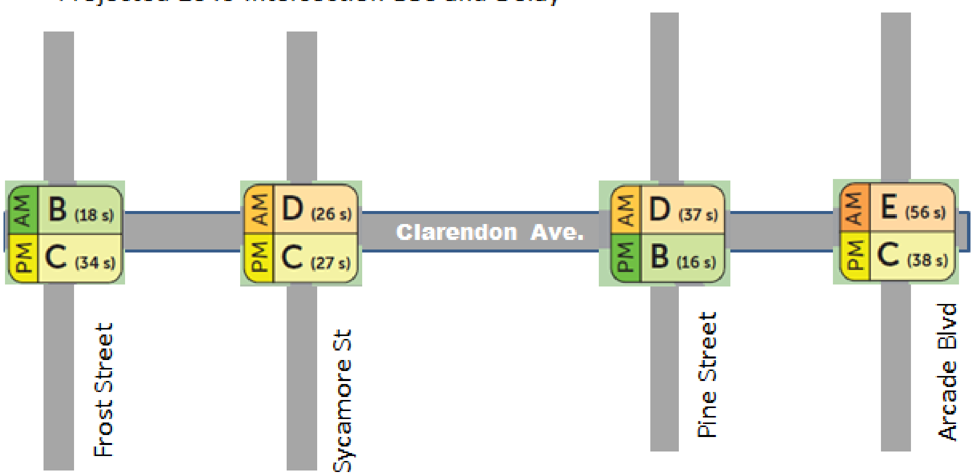
	Segment 1		Segment 2		Segment 3	
Crash Type	Crashes	%	Crashes	%	Crashes	%
Rear End	5	33%	15	34%	16	41%
Right Angle	1	7%	9	20%	7	18%
Left Turn/U-turn	1	7%	5	11%	4	10%
Side Swipe	2	13%	5	11%	3	7%
Head On	0	0%	2	5%	2	6%
Fixed Object	0	0%	4	10%	3	7%
Pedestrian	2	13%	1	2%	1	3%
Bicyclist	0	0%	0	0%	1	3%
Parking/Backing	4	27%	0	0%	0	0%
Other	0	0%	3	7%	2	5%
Total	15	100%	44	100%	39	100%

The speed limit within the corridor is 35 miles per hour and would remain so after the road diet.

<u>Operational Analysis</u>

There are four signalized intersections within the study corridor. The traffic signals are maintained by the County and operate on an actuated-coordinated system with a cycle length of 100-seconds. The feasibility study used traffic simulation to evaluate how the current and projected future traffic levels would operate if a lane reduction were implemented. The traffic models assumed current signal timing plans, however, the study recommended revised timing plans for the road diet implementation. The traffic analysis comparing current traffic volumes under a road diet scenario did not show any decline in intersection levels of service compared to current operations. When analyzing the road diet with future traffic volumes, the analysis results showed a change in level of service at the intersections under both the road diet scenario and under the existing configuration with both being very similar. The levels of service of all four intersections would meet the state DOT standards for a corridor of this type. The figure below shows the intersection level of service and delay under the projected 2040 traffic volumes in the roadway reconfiguration proposed in the Road Diet Feasibility Study.

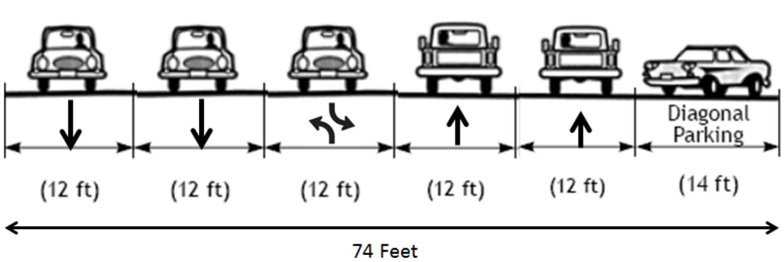
Projected 2040 Intersection LOS and Delay



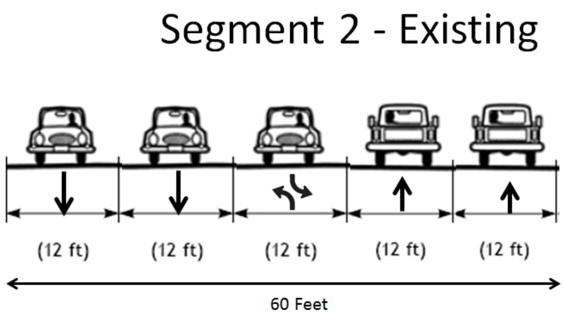
<u>Design Data</u>

The Road Diet Feasibility Study made suggested changes to the existing roadway configuration based upon the three different typical sections that currently exist. Segment 1 is the eastern portion of the corridor where the current configuration of Clarendon Ave is a 5-lane section with on-street angle parking.

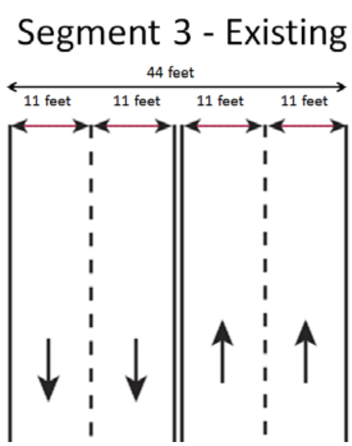
Segment 1 - Existing



Segment 2 is the middle portion of the corridor where the current configuration of Clarendon Ave is a 5-lane section.



Segment 3 is the western portion of the corridor where the current configuration of Clarendon Ave is a 4-lane undivided section.



The table below provides design information for the existing conditions, the applicable State DOT design standards and the proposed design criteria for a Road Diet implementation.

Design Feature	Existing Condition	State Design Standard (if applicable)	Proposed Design
Typical Section			
- Lane Width(s)	10-12 ft	11-12 ft	10-11 ft
- Median Width(s) and Type	10-11 ft Flush	14 ft Flush	10-14 ft Flush
- Outside Shoulder Width	No shoulder	10 ft	No shoulder
- Inside Shoulder Width	n/a	n/a	n/a
- Auxiliary Lanes	10-11 ft	11-12 ft	10-11 ft
- Bicycle Lanes	None	4 ft min	5 ft
- Sidewalks	Intermittent 5-ft wide w/ 2-ft buffer	5-ft wide w/ 6-ft buffer	Variable
Posted Speed	35 mph		35 mph
Design Speed	n/a	45 mph	35 mph
Design Vehicle	n/a	WB-40	WB-40

Other Considerations

The findings and preliminary recommendations from the City's Road Diet Feasibility Study were shared with the general public, state DOT and Regional Commission. Due to the potential increase in corridor travel times, the State DOT advised the City that it is agency policy to "not fund projects that have adverse impacts unless a unique level of benefit from a traffic and transportation standpoint is demonstrated." However, the newly appointed State DOT Commissioner has recently indicated that the Department is re-examining this position.

As part of the public involvement process for this project, the City developed a project web site and invited people to express their opinions and concerns regarding the project. Below are excerpts from public comments regarding the proposed Road Diet.

"Are you people nuts!!! - Clarendon Ave is a major thoroughfare, and it's a state route. This is just another example of our city officials catering to the downtown business owners. They want to slow people down thinking that will cause people to stop and shop and spend money. But in the morning and afternoon, that's not what people are doing. They're just trying to get somewhere. This is not only a waste of money, but will make traffic worse!!!"

"I really don't see the point of this. I think you're just going to have lots of traffic bottled up all through Clarendon. Fortunately the state agrees with this and since this is a state highway they have a say in this."

"Traffic is already bad on Clarendon east of downtown and that's only two-lanes. How much worse will it really be since traffic has to squeeze down anyway? I think this is an acceptable tradeoff for a more pedestrian-safe and attractive street. We need to revitalize downtown."

"I like this idea. Traffic already gets slowed from people weaving in and out of lanes when there is someone making a left turn."

"Another show of incompetence by our beloved Mayor - The only diet needed is the City fasting off our taxpaying dollars."

"It's about time we have bike lanes on Clarendon Road. I'm a student at Frost College and would love to be able to bike into town. But it is currently way too dangerous."

"As someone who lives in the middle of this area and has to drive this stretch daily, I want the addition of a left-turn lane since I've come close hundreds of times to being rear-ended while turning left. The bike lane is fine, but I rarely see any bicyclists ride in the area. Having only one travel lane in each direction frightens me, however, because drivers in the area are generally aggressive speed demons, and are not going to want to slow down for anyone! They'll be passing in the left-turn lane."

"I've had it with all the pro-car comments on this site from a bunch of road-raging traffic experts. Everyone needs to chill the heck out. This is a good idea, especially on this stretch of road. The traffic isn't very thick, and when it is, accidents result when people turn, from either lane. This will be safer and generally flow just fine. Ok, so one or two hours per day may see a slightly lower average speed. Big f'in deal, it's safer, get over it. I used to ride my bike along Clarendon but stopped because the drivers were too rude, didn't give me any room and generally threatened my life. The bike lanes are needed and traffic needs to slow down."

<u>Instructions for Exercise Part 1</u>

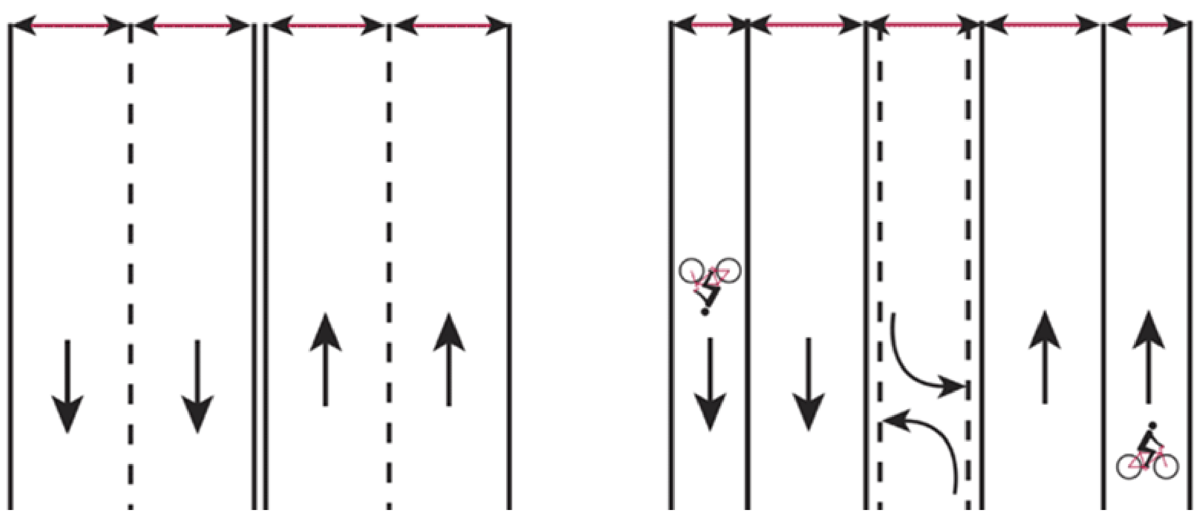
Each team will be asked to make a short presentation on their assessment and recommendations.

- Based on the information available, do you recommend implementing a Road Diet?
  - Why or why not?
  - What additional information would you like to have?
  - If information not available, explain your assumptions

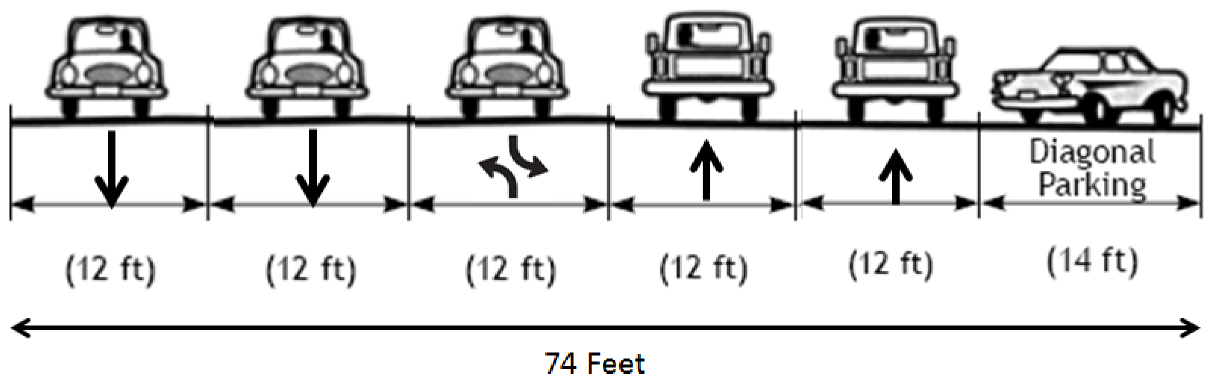
<u>Instructions for Exercise Part 2</u>

If the decision to move forward with a Road Diet is approved, using the existing available pavement width (curb-to-curb), design your suggested typical section for each of the three study segments. Sketch out your suggested typical section for each of the three study segments using simple sketch diagrams as shown below.

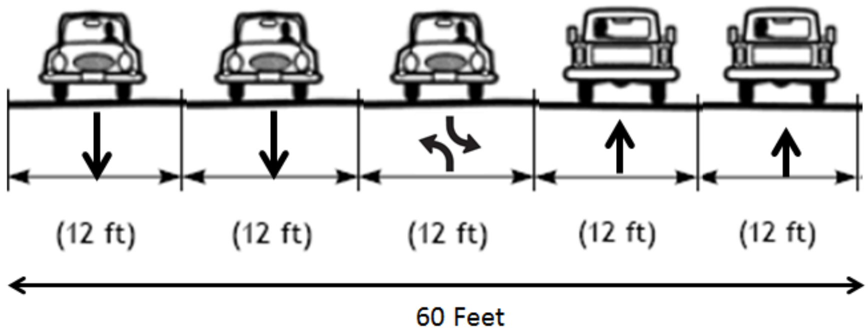
Sample Sketches



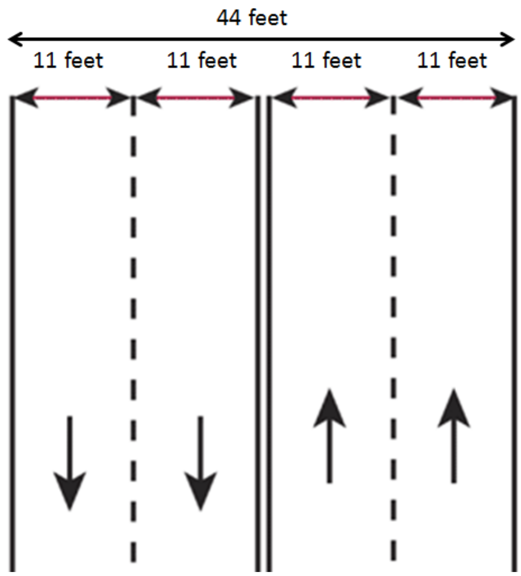
Segment 1 - Existing



Segment 2 - Existing



Segment 3 - Existing



Road Diet Feasibility Assessment Worksheet

This worksheet provides a list of evaluative questions for assessing a potential road diet project. It is intended as a tool for examining the issues often relevant to road diet feasibility. Additional issues or more information about specific proposals may be needed and adapting this worksheet to meet your agency or project development needs is encouraged. Exercising professional judgement is critical to any assessment and it is critical to consider the trade-offs associated with these interrelated factors and to the desired goals and objectives of the project.

Project Name/Location: ____

Project Limits/Length: ____

Project Goals and Objectives

Intent: *By first identifying the objective(s), this will help determine whether a road diet is an appropriate alternative for the corridor being evaluated.*

Safety: Are there safety improvement goals for this project? ___________________________________

If safety improvement is a major objective, determine if the identified crash patterns are those that can be addressed with a road diet.

What are the current safety issues/problems on the road? _____________________________________

Will the types of crashes that are occurring likely be reduced with a Road Diet conversion? ___________

Will a reduction in speed and/or speed variability likely improve safety on the road? _________________

Are there safety concerns related to pedestrians and/or bicyclists? ________________________________

Other Goals & Objectives

Is there a desire to achieve reduced travel speeds and/or traffic calming? ___________________________

Are there established mobility goals for this roadway improvement project? __________________________

Have any multimodal level of service goals been established? ____________________________________

Does the local jurisdiction have a Complete Streets policy that may apply? __________________________

Are there any economic enhancement or livability goals for this project? ____________________________

Does achieving the project goals involve making changes to the current cross section (e.g., bike lane, on-street parking, etc.)? ____

Is the proposal consistent with the applicable Long-Range Transportation Plan (LRTP), Transportation Improvement Program (TIP), Transit Development Plan (TDP), comprehensive plan, and/or any applicable bicycle plans, pedestrian safety plans, and Complete Streets initiatives?

Notes: ____

____

Road Function and Context

Intent: *The major functions and objectives of the road should be evaluated with regard to possible trade-offs between mobility, safety, and access for all users. The functional classification of the roadway influences the design standards and criteria specific to the proposed project. The functional classification of the road may indicate the historical intended purpose of the corridor, but may not be indicative of the present context or the various purposes the roadway serves. The existing and intended function of the roadway and the surrounding land uses are important considerations for the feasibility of a Road Diet.*

What is the road's current Functional Classification? ______________________________

Is a future change in Functional Classification expected or desired? ______________________

Is this a designated Truck Route? ______________________________________

What is the level of freight/large vehicle operation along the road? ______________________

What are the current and expected future levels of transit operation along the road? __________

____

Is the adjacent land use expected to remain relatively stable? _________________________

Is this a designated Emergency Evacuation route? ______________________________

Along the route, are there any:
- hospitals?
- fire stations?
- schools?
- major trip generators?

If YES to any of the above, consider involving these entities early in your project discussions.

Notes: ____

____

____

____

____

____

Summary of Context and Function Considerations

Is a Road Diet consistent with the context and function of this road?

☐ YES ☐ NO ☐ MAYBE

Notes: ____

____

Traffic Operational Considerations

What are the current average daily traffic volumes? ____

What are the current peak hourly directions volumes? ____

Are these volumes within guidelines for a Road Diet? ____

Does the corridor periodically function as a “relief” route to a freeway or principal arterial and experience high volumes when those other facilities are congested? _______________________________________

What is the projected future ADT (based on historical growth and/or the regional travel demand model)?

____

What is the current posted speed limit? ____

What are the current travel speeds along the road? (e.g., mean, 85th percentile, percent of vehicles traveling at high speeds) ____

Is a change in the posted speed limit proposed with a road diet? _________________________________

What are the characteristics of the driveways along the route (commercial, residential, density)? ______

____

What are the patterns and turning volumes for vehicles to/from minor streets and driveways?
____

Is the existing roadway operating as a de facto three-lane roadway? ______________________________

What are the truck and large vehicle volumes along the roadway and intersecting roads? _____________

How frequent is the presence of slow-moving or frequently stopping vehicles, such as transit, school busses, curb-side mail delivery, etc.? ____

____

____

If applicable, how are truck deliveries made to businesses along the route? _________________________

____

____

Pedestrian Counts: ____

If counts are unknown, provide a general classification such as high, moderate, or low

Bicycle Counts: ____

If counts are unknown, provide a general classification such as high, moderate, or low

Intersection Operational Considerations

How many signal (or All-Way STOP) controlled intersections are within the project study road segment?

List their locations and describe their existing operations in terms of signal phasing operations and presence of turn lanes: ____

____

____

____

Are there any plans to add, remove, or modify traffic signals within the corridor? ___________________

Are there any mid-block pedestrian crossings existing or proposed? ______________________________

Are any of the existing intersections experiencing operational problems such as excessive delays? If known, list the volume/capacity ratios of the intersection approaches: ____________________________

____

____

When was the last time the signal timing or phasing was changed or optimized? ____________________

For current and future volume conditions, what are the results of a peak hour level of service (LOS) and queuing analyses for intersections under the build and no-build scenarios?

Notes: ____

____

____

CAUTION: A greater risk of operational impacts such as significantly more queuing and delay may occur with lane elimination in a busy downtown setting due to heavy side street volumes and loss of left-turn capacity caused by the short block lengths.

Transit Operational Considerations

Intent: *Depending on the bus frequency and headways, road diets may negatively impact the speed and reliability of bus services. With just one travel lane per direction, frequently stopping busses may have a significant impact on traffic flow. Constructing bus bulbs or pull-outs can mitigate these effects, although use of bus pull-outs may result in delays for busses when trying to merge back into the through lane.*

What are the bus volumes and headways in the corridor? _____________________________________

If a Road Diet is implemented, will stopping transit buses in the one through lane significantly impact traffic? ____

Are locations for bus pull-outs possible? ____

Do transit routes make turns within the corridor (appropriateness of turn radii and lane widths)?

On-Street Parking Considerations

Intent: *On-street parking may offer multiple benefits, including creating a "tunnel effect" that naturally slows motorists' speeds. Providing on-street parking may also allow for construction of curb extensions at crosswalks, which reduce crossing distance for pedestrians.*

Does on-street parking currently exist? ____

Is on-street parking proposed (parallel, angle, back-in, mix)? ______________________________

Note: *Angled parking uses less linear curb length per parking space than parallel parking (so more spaces may be provided on the same block). However, angled parking takes up more distance perpendicular to the curb. Back-in angled parking (as opposed to head-in angled parking) is beneficial to bicyclists as it is easier to make eye contact with drivers as they pull out of their parking spots.*

Will on-street parking reduce the ability of vehicles to turn in and out of minor streets and access points?

Intent: *On-street parking should not impede visibility for pedestrians, bicyclists, and other vehicles. This means that on-street parking spaces should be located carefully relative to intersections and crosswalks.*

Freight and Delivery Considerations

Consider the current and future needs for delivery zones and loading areas. Removal or relocation of delivery zones may impact truck access to businesses. Where there is only one through lane per direction, trucks that stop for deliveries are likely to block auto traffic.

____

____

Summary of Project Operational Impacts

What is the projected increase in travel delay due to the Road Diet conversion? __________________

Are any intersections projected to experience a significant reduction in level of service? _____________

Is a Road Diet consistent with the vehicular operational needs of this road?

☐ YES ☐ NO ☐ MAYBE

Notes: ____

____

____

Special Conditions

Is the Road Diet conversion expected to divert significant traffic to parallel roadways? _____________

Intent: *Traffic diversion to parallel streets may not be problematic for arterials or collectors with adequate reserve capacity, but could be very problematic for diversion to neighborhood residential streets.*

Are there any at-grade railroad crossings along the roadway? ______________________________

Do trains regularly cross during peak travel periods? _____________________________________

What is the typical delay from a train crossing? ____

Is doubling the current queue length (compared to four-lane undivided cross section) at the crossing acceptable? ____

Are there any special conditions along this road that jeopardize the feasibility of a Road Diet?

☐ YES ☐ NO ☐ MAYBE

Notes: ____

____

Design Considerations

What is the existing cross-sectional width (typically measured curb-to-curb): ______________________

Describe the existing cross-sectional elements of the road (such as lane widths, presence of shoulders, bike lanes, on-street parking, curbs, etc.): ____

____

____

What are the appropriate cross-sectional elements of the Road Diet project that will meet the desired project goals? : ____

____

____

Careful consideration of the geometric requirements of trucks and other large vehicles should be given when considering a road diet implementation. Curb extensions or other non-traversable areas that are added as part of a road diet project can be problematic for large vehicles if these treatments are not designed for the turning needs of the design vehicle. Decreased curb radii may limit truck movements and/or cause trailer off-tracking that can put pedestrians at risk.

If lane widths are decreased during a road diet, large trucks may have increased risk of involvement in sideswipe and mirror crashes, depending on the resulting width of the lane and the curvature of the road. Additionally, narrower lanes mean that there is less space between trucks and other road users, which can create a sense of discomfort in all users.

Intent: *Consider the potential impacts on trucks (including appropriateness of turn radii and lane widths and possible relocation of designated truck routes).*

Are there any problematic issues related to the existing intersections (e.g., intersection sight distance deficiencies, skew, approach grades, approach alignment and profile, proximity to adjacent intersections, etc.)? ____

____

Would the proposed cross-section require additional right-of-way? _______________________________

Are there any design constraints that jeopardize the feasibility of a Road Diet?

☐ YES ☐ NO ☐ MAYBE

Notes: ____

____

Early Stakeholder Engagement

Is there any known controversy associated with the project?

Have endorsements or documented project support been made by appropriate city, county, and/or regional bodies (e.g., a commission or board resolution)?

Have any concerns or supportive comments been voiced at public meetings from local businesses, residents and other stakeholders?

If a TWLTL is proposed as part of the road diet, do area drivers have a familiarity with proper use of TWLTLs or are they rare in the region?

Notes: ____

Are there any known concerns or controversies that jeopardize the feasibility of a Road Diet?

☐ YES ☐ NO ☐ MAYBE

Notes: ____

____

Road Diets Workshop

Module 4 – Assessment Exercise

Clarendon Avenue Case Study

Project Background

- The City of Clarendon (population 8,000) completed a Master Plan of improvements including a Road Diet project.
- The city procured an engineering firm to conduct a feasibility study for a Road Diet and improvements along the Clarendon Avenue corridor.
- The study was developed based on significant involvement from the local community. Area residents and business owners have expressed strong desires for many years to improve walkability and safety for bicyclists by controlling speeds through the community.

Clarendon Ave Characteristics

- Study area 1.45 mile section of Clarendon Avenue (SR 78)
- Functionally classified as an urban minor arterial and runs in a east-west direction
- Study area begins just east of Arcade Blvd adjacent to Clarendon downtown commercial district (historic)
- Three study segments based on different existing typical sections
- Posted speed limit 35 MPH

Project Goals

1. Make the historic downtown area more inviting for people to walk and frequent area shops and restaurants.
2. Improve the ease for pedestrians to cross from the residential area to the opposite side commercial area.
3. Calm traffic through the downtown area.
4. Add bicycle lanes from the downtown area along the Clarendon Avenue corridor west to the Ingleside Light Rail Transit Station and the Frost College Campus.

Clarendon Avenue (SR 78) Corridor Study Area

Clarendon Ave. Study Limits
Clarendon Ave. Existing 2-lane
Major Intersections w/ Clarendon Ave.
Historic Downtown District
Frost College
Ingleside Light Rail Transit Station

Existing Corridor Virtual "Drive-through"

Clarendon Avenue - looking east (away from beginning of study limit)

Existing 2-lane Section just east of the Corridor Study Limits

Clarendon Avenue - looking west entering into study limits

Existing 2-lane Section transitioning to wider section at intersection with Arcade


Clarendon Avenue - looking west entering into study limits

Existing 2-lane Section transitioning to wider section at intersection with Arcade

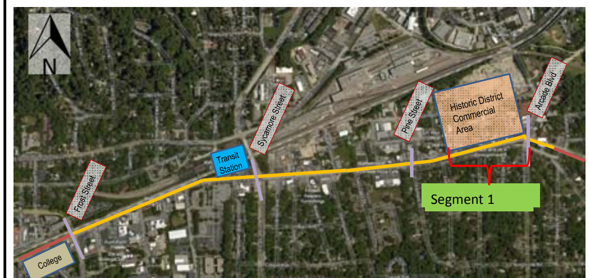

Clarendon Avenue - looking west at Arcade Blvd intersection

Two lanes: LT & Thru / RT & Thru

Clarendon Avenue - looking west just west of Arcade intersection

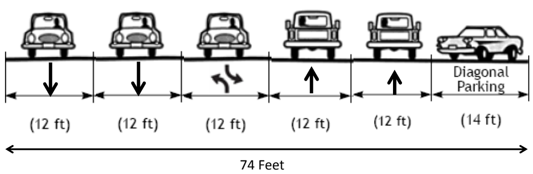
Existing eastbound 2-lanes transitions to one thru lane at intersection with Arcade

Clarendon Avenue (SR 78) Corridor Study Area



- Clarendon Ave. Study Limits
- Clarendon Ave. Existing 2-lane
- Major Intersections w/ Clarendon Ave.
- Historic Downtown District
- Frost College
- Ingleside Light Rail Transit Station

Segment 1 - Existing



Clarendon Avenue (SR 78) Corridor Study Area

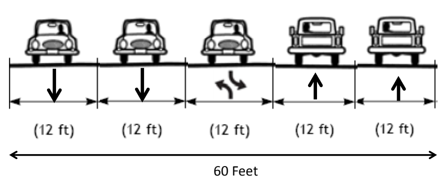
- Clarendon Ave. Study Limits
- Clarendon Ave. Existing 2-lane
- Major Intersections w/ Clarendon Ave.
- Historic Downtown District
- Frost College
- Ingleside Light Rail Transit Station

Clarendon Avenue - looking west just west of Pine Street intersection

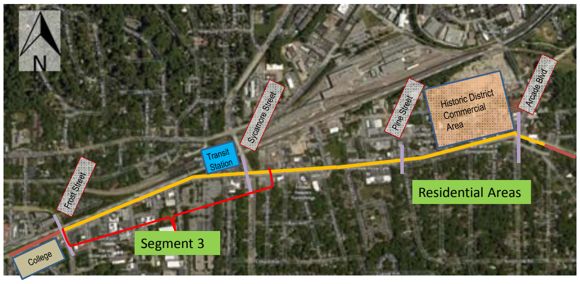
Existing 5-lane section transitioning to 4-lane section (no TWLTL) east of Sycamore Street intersection

Clarendon Avenue (SR 78) Corridor Study Area

Segment 2 - Existing



Clarendon Avenue (SR 78) Corridor Study Area



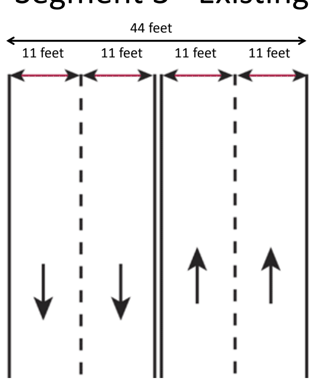
Clarendon Avenue (looking west) between Sycamore Street and Frost Street

Existing 4-lane section with no access on north side (due to RR track) and commercial properties and apartment complexes on south side

Clarendon Avenue (SR 78) Corridor Study Area

Clarendon Ave. Study Limits
Clarendon Ave. Existing 2-lane
Major Intersections w/ Clarendon Ave.
Historic Downtown District
Frost College
Ingleside Light Rail Transit Station

Segment 3 - Existing

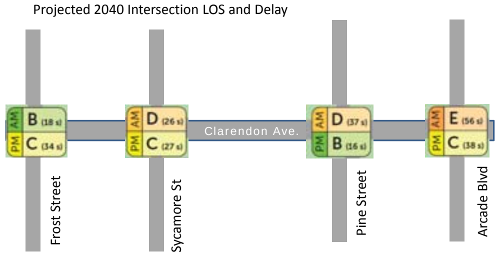


Crash Data Summary (2011-2013)

	Segment 1		Segment 2		Segment 3	
Crash Type	Crashes	%	Crashes	%	Crashes	%
Rear End	5	33%	15	34%	16	41%
Right Angle	1	7%	9	20%	7	18%
Left Turn/U-turn	1	7%	5	11%	4	10%
Side Swipe	2	13%	5	11%	3	7%
Head On	0	0%	2	5%	2	6%
Fixed Object	0	0%	4	10%	3	7%
Pedestrian	2	13%	1	2%	1	3%
Bicyclist	0	0%	0	0%	1	3%
Parking/Backing	4	27%	0	0%	0	0%
Other	0	0%	3	7%	2	5%
Total	15	100%	44	100%	39	100%

Findings of the Traffic Study

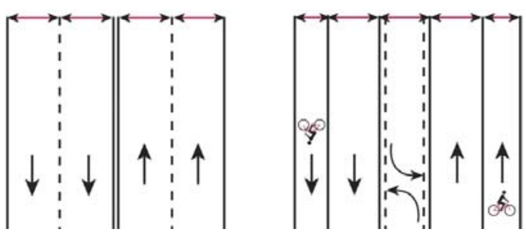
Projected 2040 Intersection LOS and Delay



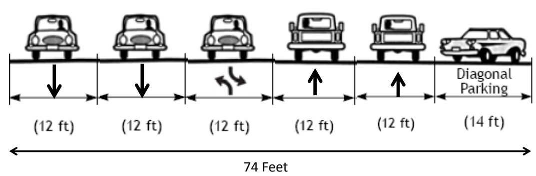
Group Presentation Task

- Based on the information available, do you recommend implementing a Road Diet?
  - Why or why not?
  - What additional information would you like to have?
  - If information not available, explain assumptions
- For whatever decision selected (yes/no to a Road Diet), using the existing available right-of-way, design your suggested typical section for each of the three study segments

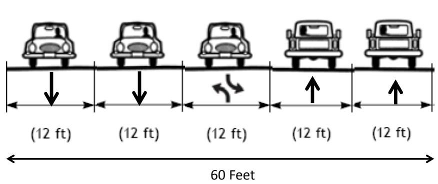
Sample Sketches



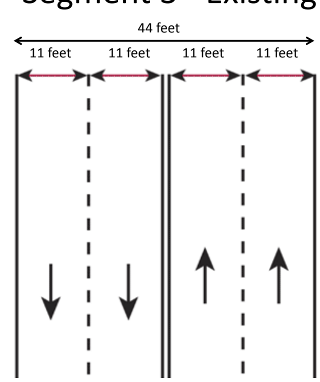
Segment 1 - Existing



Segment 2 - Existing

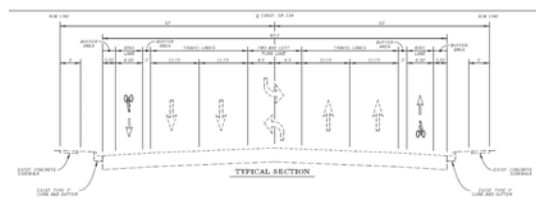


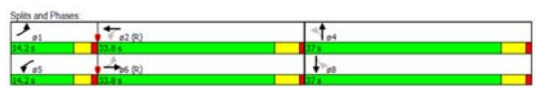
Segment 3 - Existing



Module 3

Road Diet
Design &
Operational
Considerations





Objectives

- Locate important references for implementing the design of a Road Diet
- Assess the important issues and trade-offs that may be involved in designing a Road Diet
- Select the appropriate geometric and operational design values and practices to guide project design decisions

Module Outline

Geometric Design

- Context and functional classification
- Design vehicle
- Design speed
- Cross-section elements
- Intersection design
- Sight distance
- Access management

Operational Design

- Intersection control changes
- Pavement marking and signing

Geometric Design

- Geometric design involves developing details for the project's cross section, plan and profile
- Design policies and "typical" criteria serve as guidance, but they are not intended to be inflexible

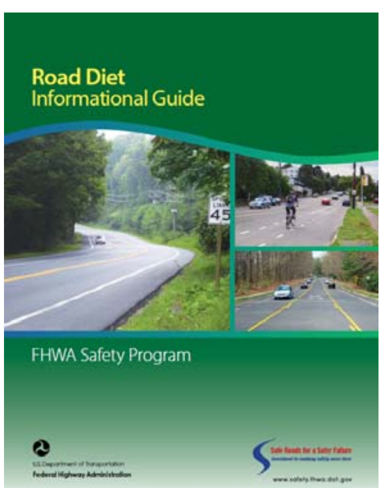
"***Geometric design*** *has meaning and value only as it is applied to the context in which the designer is working – the geography, topography, land use, political, and environmental features within and adjacent to the roadway in question."*

Source: NCHRP 15-47 – A Performance-Based Highway Geometric Design Process

Contextual Design

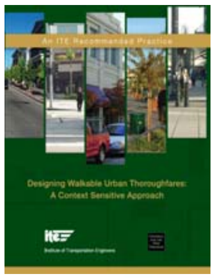
- A critical element of the design process is to ensure the design fits the "context" and intended purpose of the street
- Geometric design is evolving towards more performance-based approaches, where analysis of the expected outcomes of design choices are quantified and used to support informed design decision-making

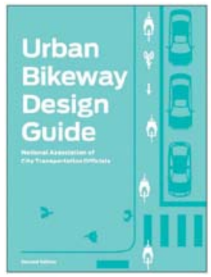
Designing a Road Diet

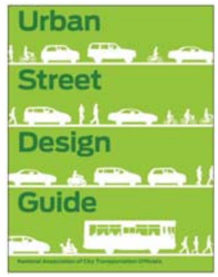


ROAD DIET

Other Important Resources



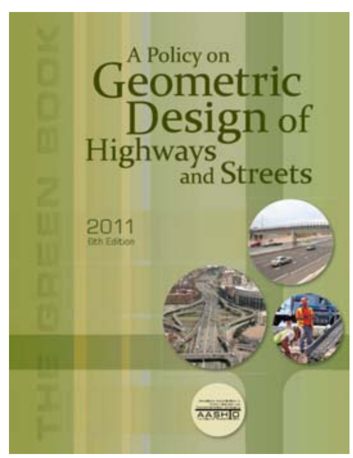




Roadway Functional Class

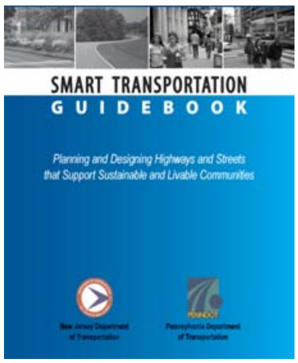
- Functional classification is often used to establish design criteria
  - AASHTO Green Book is organized based on classifications

Chapter 5 Local Roads and Streets
Chapter 6 Collector Roads and Streets
Chapter 7 Rural and Urban Arterials
Chapter 8 Freeways

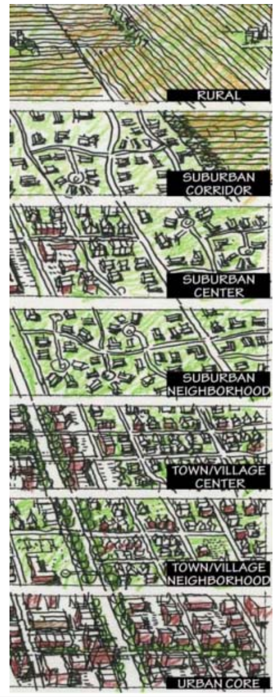


Alternative Classifications

Seven “Context Areas” based on land use from least- to most-developed



NJDOT/PennDOT Smart Transportation Guidebook



Smart Transportation Guidebook

Figure 4.3 Defining Contexts

	RURAL	SUBURBAN			URBAN		
	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town Center	Urban Core
Density Units	1 DU/20 ac	1 DU/ac - 8DU/ac	2 - 30 DU/ac	3 - 20 DU/ac	4 - 30 DU/ac	8 - 50 DU/ac	16 - 75 DU/ac
Building Coverage	NA	< 20%	20% - 35%	35% - 45%	35% - 50%	50% - 70%	70% - 100%
Lot Size/Area	20 acres	5,000 - 80,000 sf	20,000 - 200,000 sf	25,000 - 100,000 sf	2,000 - 12,000 sf	2,000 - 20,000 sf	25,000 - 100,000 sf
Lot Frontage	NA	50 to 200 feet	100 to 500 feet	100 to 300 feet	18 to 50 feet	25 to 200 feet	100 to 300 feet
Block Dimensions	NA	400 wide x varies	200 wide x varies	300 wide by varies	200 by 400 ft	200 by 400 ft	200 by 400 ft
Max. Height	1 to 3 stories	1.5 to 3 stories	retail -1 story; office 3-5 stories	2 to 5 stories	2 to 5 stories	1 to 3 stories	3 to 60 stories
Min./Max. Setback	Varies	20 to 200 feet	20 to 80 ft	20 to 80 ft	10 to 20 ft	0 to 20 ft	0 to 20 ft

ROAD DIET

Roadway Categories in Context Zones

Smart Transportation Guidebook

Table 6.2 Matrix of Design Values

	Regional Arterial	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town/Village Center	Urban Core
Roadway	Lane Width[1]	11' to 12'	11' to 12' (14' to 15' outside lane if no shoulder or bike lane)	11' to 12' (14' to 15' outside lane if no shoulder or bike lane)	11' to 12' (14' outside lane if no shoulder or bike lane)	10' to 12' (14' outside lane if no shoulder or bike lane)	10' to 12' (14' outside lane if no shoulder or bike lane)	10' to 12' (14' outside lane if no shoulder or bike lane)
	Paved Shoulder Width[2]	8' to 10'	8' to 10'	8' to 12'	4' to 6' (if no parking or bike lane)	4' to 6' (if no parking or bike lane)	4' to 6' (if no parking or bike lane)	4' to 6' (if no parking or bike lane)
	Parking Lane[3]	NA	NA	NA	8' parallel	8' parallel; see 7.2 for angled	8' parallel; see 7.2 for angled	8' parallel
	Bike Lane	NA	5' to 6' (if no shoulder)	6' (if no shoulder)	5' to 6'	5' to 6'	5' to 6'	5' to 6'
	Median	4' to 6'	16' to 18' for LT; 6' to 8' for pedestrians only	16' to 18' for LT; 6' to 8' for pedestrians only	16' to 18' for LT; 6' to 8' for pedestrians only	16' to 18' for LT; 6' to 8' for pedestrians only	16' to 18' for LT; 6' to 8' for pedestrians only	16' to 18' for LT; 6' to 8' for pedestrians only
	Curb Return	30' to 50'	25' to 35'	30' to 50'	25' to 50'	15' to 40'	15' to 40'	15' to 40'
	Travel Lanes	2 to 6	2 to 6	4 to 6	4 to 6	2 to 4	2 to 4	2 to 6
Roadside	Clear Sidewalk Width	NA	5'	5' to 6'	5' to 6'	6' to 8'	6' to 10'	6' to 12'
	Buffer[4]	NA	6'+	6' to 10'	4' to 6'	4' to 6'	4' to 6'	4' to 6'
	Shy Distance	NA	NA	NA	0' to 2'	0' to 2'	2'	2'
	Total Sidewalk Width	NA	5'	5' to 6'	9' to 14'	10' to 16'	12' to 18'	12' to 20'
Speed	Desired Operating Speed	45-55	35-40	35-55	30-35	30-35	30-35	30-35

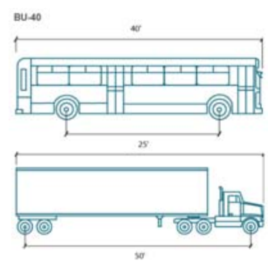
1 12' preferred for regular transit routes, and heavy truck volumes > 5%, particularly for speeds of 35 mph or greater.
2 Shoulders should only be installed in urban contexts as a retrofit of wide travel lanes to accommodate bicyclists.
3 Buffer is assumed to be planted area (grass, shrubs and/or trees) for suburban neighborhood and corridor contexts; street furniture/car door zone for other land use contexts. Min. of 6' for transit zones.
4 Curb return radius should be as small as possible. Number of lanes, on street parking, bike lanes, and shoulders should be utilized to determine effective radius.

Design Vehicle

- May affect:
  - Curb/ turning radii
  - Lane and shoulder widths
  - Queue storage lengths

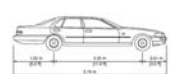
"… consider the largest design vehicle that is likely to use the facility with <u>considerable frequency</u>"

AASHTO 2011 Green Book p 2-1

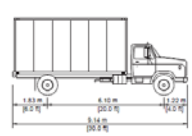


Design Vehicle Selection

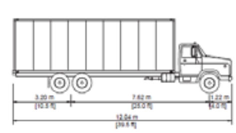
AASHTO Green Book Guidance:



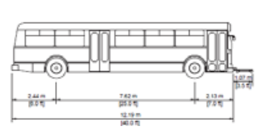
- The passenger car (P) may be used when the main traffic generator is a parking lot



- A two-axle single-unit truck (SU-30) may be used for residential streets



- A three-axle single-unit truck (SU-40) may be used for the design of collector streets and facilities where larger single-unit trucks are likely



- A city transit bus (CITY-BUS) may be used in the design of state highway intersections with city streets that are designated bus routes

Design Vehicle vs. Control Vehicle

Design Vehicle

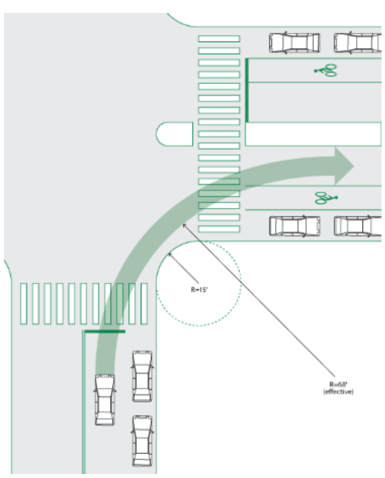
User with considerable frequency that dictates the minimum required turning radius into the appropriate receiving lane without encroachment

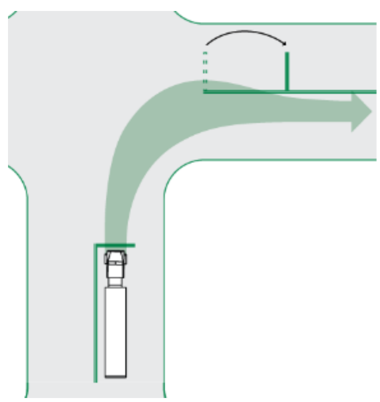
Control Vehicle

A large but infrequent user that may require a “multiple-point” turn, using multiple lane spaces, or encroachment into opposite direction lanes

Turning Radii Considerations

Consider the available “effective” turning radius





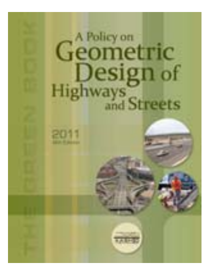
Various methods to accommodate large vehicles while restricting the turning speed of smaller vehicles may be used at intersections

Mountable Corner Curbs

Design Speed

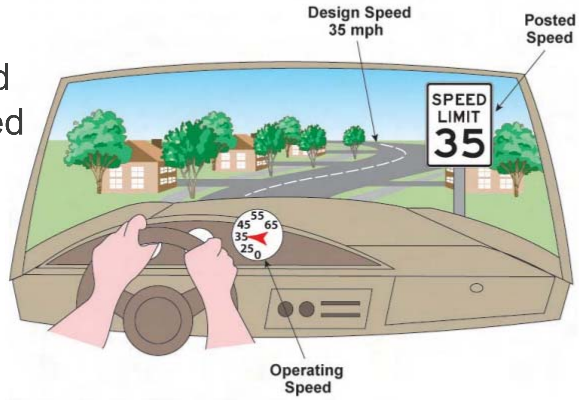
- Design speed is a selected speed used to determine the various geometric design features of the roadway
- The selected design speed should be a logical one with respect to the anticipated operating speed, topography, the adjacent land use, and the functional classification of the highway

"In selection of design speed, every effort should be made to attain a desired combination of safety, mobility, and efficiency within the constraints of environmental quality, economics, aesthetics, and social or political impacts."



Speed Harmony

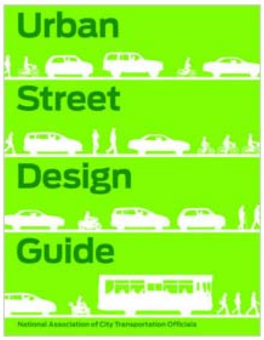
- Design speed is ±5 mph of the observed 85th percentile operating speed
- The 85th percentile operating speed is ±5 mph of the speed limit
- The posted speed is ≤ the designated design speed.



Cross-Section Elements

- Lane Widths
- Bicycle Facilities
- On-street Parking
- Bus Turn-outs
- Shoulders
- Curbs and Drainage
- Pedestrian Facilities
- Median
- Pedestrian Refuge Islands
- Cross Section Transitions

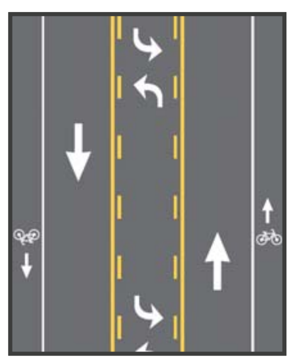
Lane Widths



"Lane width should be considered within the overall assemblage of the street. Travel lane widths of 10 feet generally provide adequate safety in urban settings while discouraging speeding. Cities may choose to use 11-foot lanes on designated truck and bus routes (one 11-foot lane per direction) or adjacent to lanes in the opposing direction."

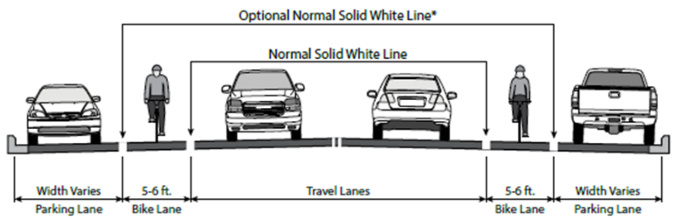
Common Lane Widths

- Through lanes: **10 – 12ft.**
- Turn lanes / auxiliary lanes: **10 ft.**
- TWLTL width: **10 – 16ft.**
- Bus lane width: **11 – 15ft.**

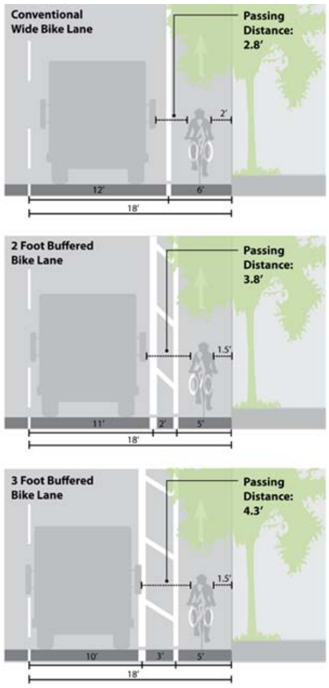


Bicycle Facilities

- Typical bike lane: 5 ft
- Min. width: 4 ft
- If space is **≥ 7ft.** consider adding buffer or protected bike facility



Consider drainage inlets and manholes

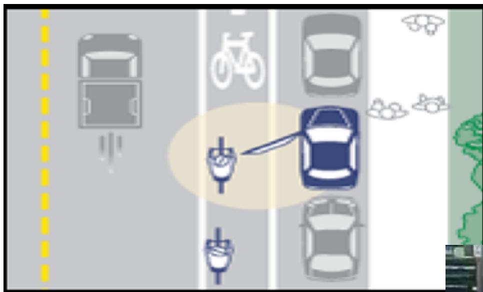


Buffered Bike Lanes

- Provides greater shy distance between motor vehicles and bicyclists
- Provides more space for bicycling without making the bike lane appear so wide that it is mistaken for a travel lane or a parking lane
- Encourages bicyclists to ride outside of the door zone when buffer is between parked cars and bike lane

Painted Buffer Zones Adjacent to Bike Lane

Cyclists “Doored”



Separated Bike Lanes


Source: New York City Department of Transportation

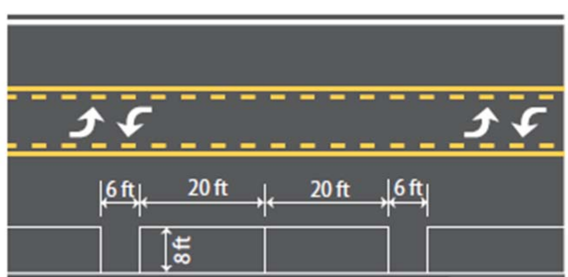
Two-way separated Bike Lane

Seattle, WA

On-Street Parking

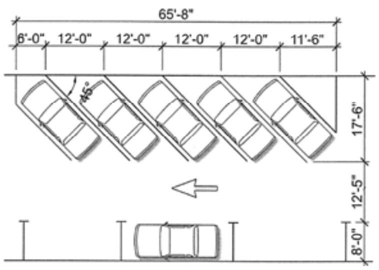
- Minimum width: 7-8 ft
- Desirable width: 10-12 ft
- Shared bicycle and parking = **13ft.**
- Solid white line between bikes and parking

Figure showing "Paired" Parallel Parking



Angled Parking

- Provides 60-75% more spaces than parallel parking
- Angled parking depth (measured perpendicular to the street) is dependent on the stall angle (17.5 feet for 45°, 19.0 feet for 60°, 19.5 feet for 75°)
- "Back-in" has advantages over "Head-in"



Source: ITE Traffic Engineering Handbook

Limit Parking Near Intersections

On-street parking should be restricted at least 20 feet in advance of the crosswalk to allow for good visibility of pedestrians

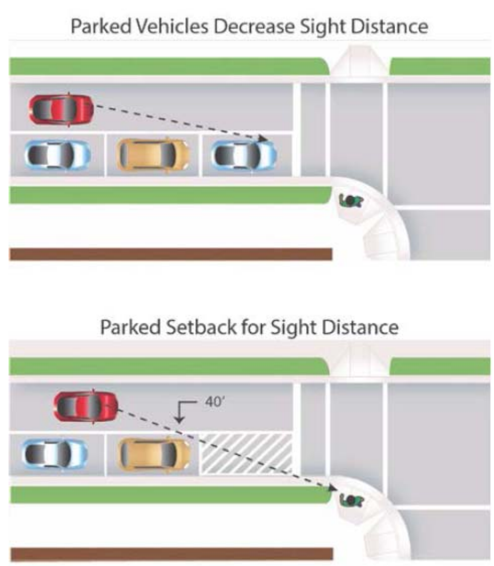
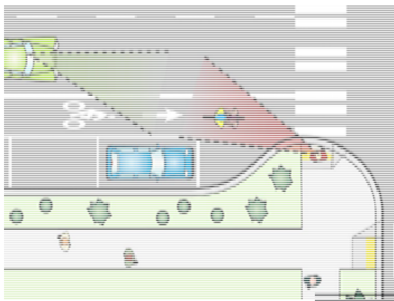


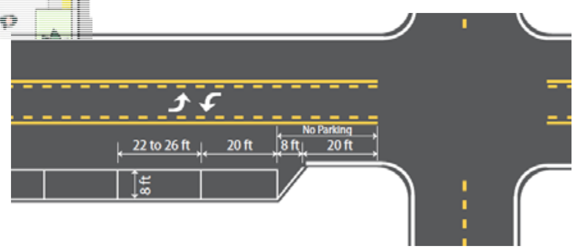
Figure Source: City of Honolulu Complete Streets Manual

Introduction to Road Diets
January 2017

Curb Extensions Improve Sight Distance Between Pedestrians and Motorists

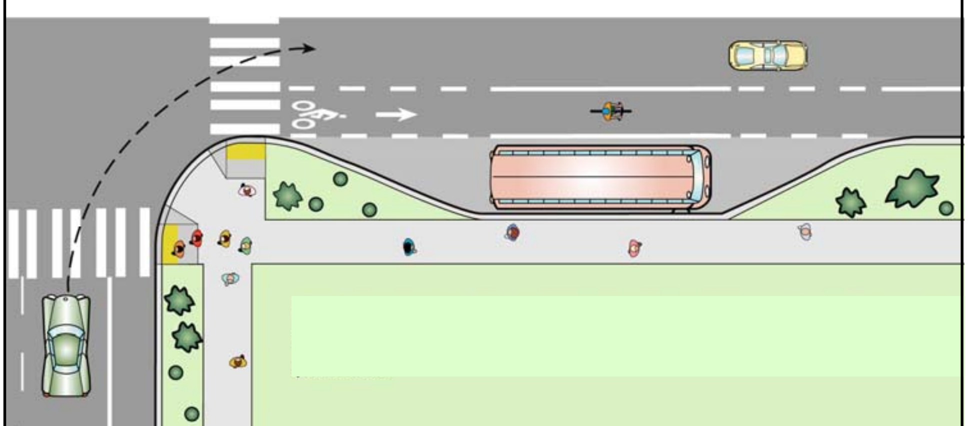


Consider using a "bulb out" curb extension



Bus pullouts should work for pedestrians, bicyclists, and drivers

- With curb extension for bus pullout, intersecting drivers will turn cautiously



ROAD DIET

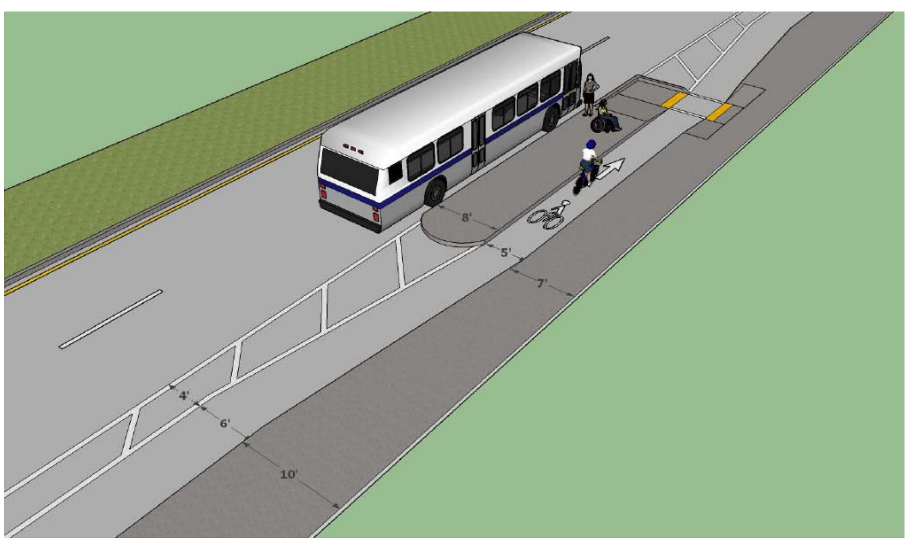
Introduction to Road Diets
January 2017

Mid-Block Bus Turnouts

Desirable to provide turnouts about 50 feet in length for each bus with deceleration and entry tapers of about 5:1

ROADDIET

Bus Stop / Bike Lane Buffer Concept



ROADDIET

Seattle, WA – Dexter Avenue Road Diet

ROADDIET

Shoulders

- In most Road Diets, shoulders are not provided since curb-to-curb width is allocated to the vehicular lanes, bicycle lanes, bus pullouts or parking
- Painted buffers between the traveled way and bicycle lane may offer similar advantages as shoulders

Curbs and Drainage

- Curbs may already be present
- Used for:
  - drainage
  - delineation
  - right-of-way reduction
  - delineation of pedestrian walkways

Photo: Randy Dittberner, VDOT

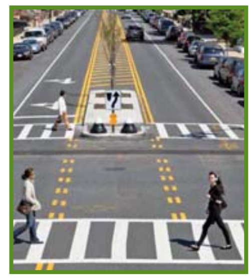
- Road Diet conversions usually do not require significant changes in drainage design

Pedestrian Facilities

- Typical Road Diet conversions do not involve changes to the pedestrian sidewalk facilities outside the curb, but pedestrians may benefit if:
  - on-street parking is created offering a buffer between pedestrians and moving vehicles
  - the reconfigured cross section results in fewer travel lanes for pedestrians to cross
  - the TWLTL provides space for a refuge island at pedestrian crossing locations
  - dedicated bike lanes may get bicyclists off the sidewalk

Median

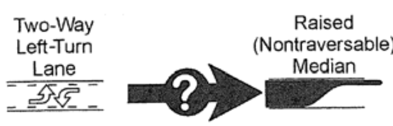
- The area between opposing travel lanes
- Can be a TWLTL
- If a flush median is used, expect crossing and turning movements around the median.



Medians & TWLTLs

TWLTLs may be appropriate for:

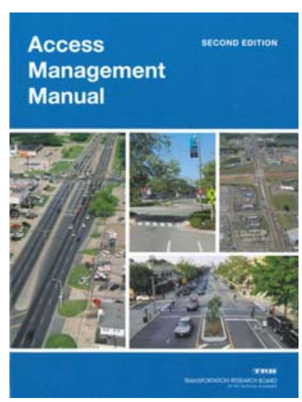
- ADT < 24,000 vpd
- Direct access to small abutting properties with ingress volumes < 100 vph



A non-traversable median is desirable for:

- Multilane roadways with ADT > 24,000 vpd
- Areas desirable to limit left turns to improve safety

TRB Access Management Manual



State Laws Regarding TWLTLs

Common laws among some States include:

- Can only use TWLTL when turning left
- Max distance allowed in TWLTL:

Distance	State
150 Feet	Virginia
200 Feet	California, Louisiana, Oklahoma, Rhode Island
300 Feet	Georgia, Washington
500 Feet	Missouri
Shortest practicable distance/safe distance	Maryland, Tennessee

ROAD DIET

Example State Laws Regarding TWLTLs

Common laws (continued):

- Can only turn left from a TWLTL
- TWLTLs shall not be used for passing/ overtaking
- 1st vehicle to enter has ROW


Photo: Richard Retting

ROAD DIET

Pedestrian Refuge Islands

- Minimum 6 ft. wide / Preferred 8 – 10 ft. wide
- Include detectable warning tiles
- Can use the TWLTL space where turns are prohibited or at mid-block locations

Cross Section Transitions

- Changes in number of lines should occur over a smooth transition
  - Taper ratio for reductions (long:trans): 15:1
  - Taper ration for added lanes: 10:1

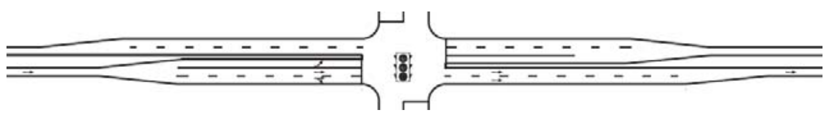
Transitions should be visible to drivers:
- On tangents
- Not blocked by crests

Cross Section Transitions

Choosing the transition locations for Road Diet projects needs special attention and consideration:

- Avoid features within the transition area that would add complexity such as major driveways or side streets
- Dropping and adding lanes at intersections may offer good transition locations

Additional through lanes (auxiliary through lane) at signalized intersections (shown below) are generally not recommended for Road Diet projects



ROAD DIET

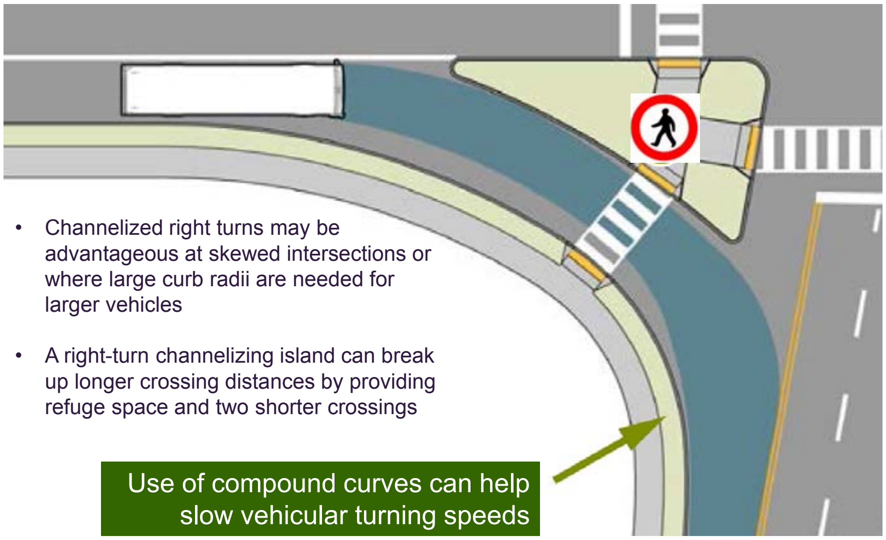
Intersection Design

- Right Turn Lanes
- Channelization
- Roundabouts
- Curb Ramp Design
- Curb Extensions
- Intersection Sight Distance
- Offsets
- Bicycle Design Considerations

Photos: Rundell Ernstberger Associates, LLC

ROAD DIET

Right Turn Lane Channelization



- Channelized right turns may be advantageous at skewed intersections or where large curb radii are needed for larger vehicles
- A right-turn channelizing island can break up longer crossing distances by providing refuge space and two shorter crossings

Right Turn Lanes

- May reduce delay impacts on right turning vehicles
  - Keep pedestrian safety in mind
  - Consider large vehicle turning radii

Photo shows a combined bike lane/turn lane in Billings, MT

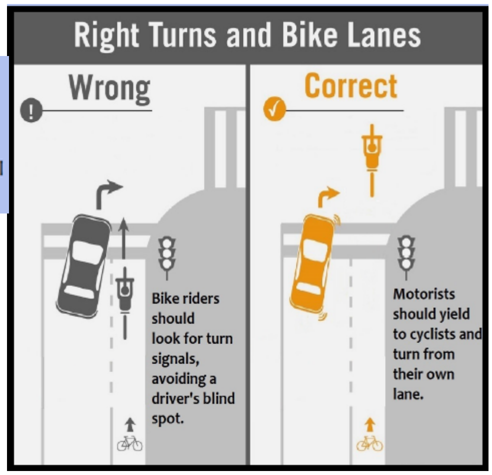
Shared lane markings or conventional bicycle stencils with a dashed line can delineate the space for bicyclists and motorists within the shared lane or indicate the intended path for through bicyclists.

ROAD DIET

Right Turns & Bike Lanes

How do Motorists Make Right Turns when a Bicycle Lane is Present?

When turning right, a motorist should always yield to bicyclists going straight and wait until after they clear the intersection or driveway.

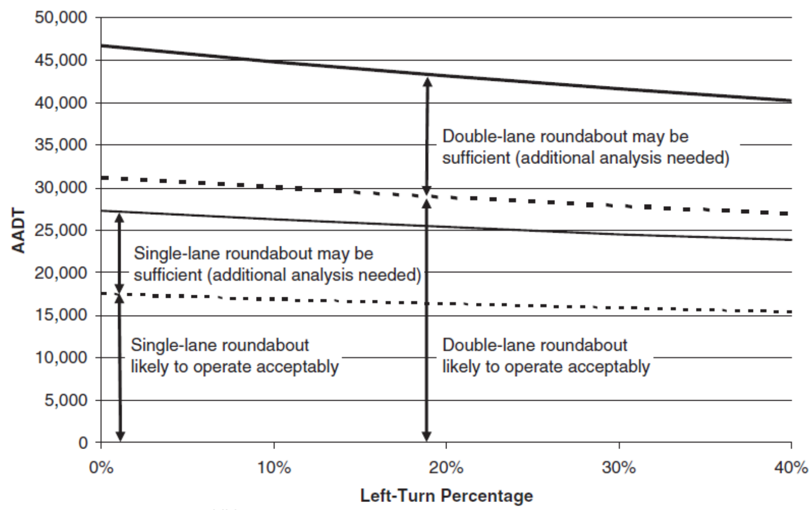


Source: http://burnsideave.com/wp-content/uploads/2016/04/Driver-Pamphlet-PI.pdf

Roundabouts

- Greatly improves safety by:
  - Eliminating angle and head-on crashes
  - Reducing speeds
- Adding roundabouts to Road Diets may impact cost and contribute to public resistance

Planning Level Volume Threshold for Single Lane Roundabouts



Source: NCHRP Report 672 Exhibit 3-12

Ashville, NC - College Street
“Before” as 5 lane

Ashville, NC - College Street – Current 2 lane

Overland Park, KS – “Before”

Overland Park, KS – “After”

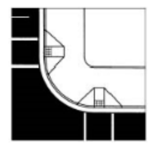
Mini-Roundabouts

Ft Collins, CO
Remington Street

Curb Ramp Design

- Curb ramps provide access for people using wheelchairs who would otherwise be excluded from the sidewalk because of the barrier created by the curb
- For people with vision impairments, a detectable warning is needed to identify the transition point between sidewalk and street

Determining which curb ramp design is most appropriate depends on the exact conditions of the site. Designers that understand the advantages and disadvantages of each type of curb ramp are best qualified to make this decision.



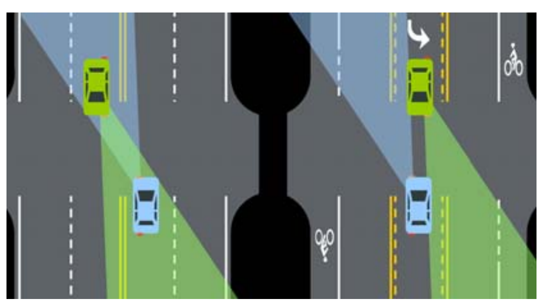
Source: fhwa.dot.gov/environment/bicycle_pedestrian/publications/sidewalk2/sidewalks207.cfm

https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/guidance-and-research/accessible-public-rights-of-way-planning-and-design-for-alterations/chapter-6%E2%80%94curb-ramp-examples

Sight Distance

Types of sight distance to consider:

- Stopping
- Decision
- Intersection
- Other
  - Ped X-ing
  - Transit Stops
  - Parking



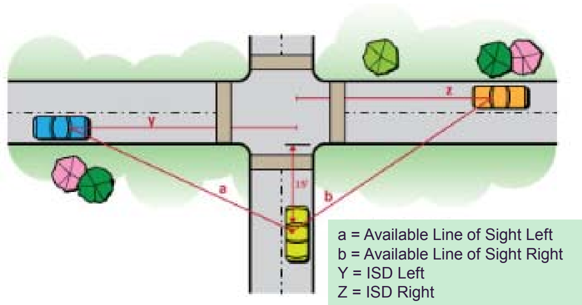
- Road Diets typically improve sight distance by removing negative offsets

Intersection Sight Distance

- Re-check intersection sight distances under Road Diet configuration
  - Unobstructed views for both parked and moving vehicles

Sight Triangle Resource:

AASHTO's *A Policy on Geometric Design of Highways and Streets*



Access Management

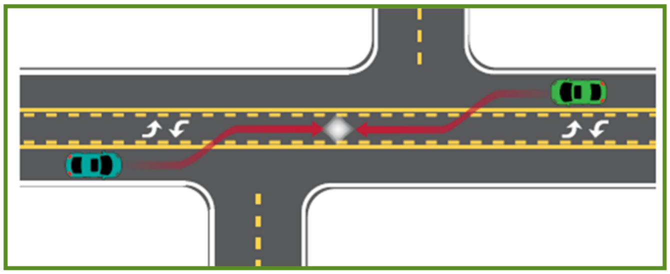
Items to Analyze:

- Driveway offsets
- Combining driveways
- Access to property via other intersecting roads
- Sight distances for turning
- Sidewalk continuity
- Accessibility requirements
- Bus stop locations

Offset Intersections and Driveways

Possible conflicts with:

- "Through vehicles" on offset minor roadway
  - May want to enter/stop in TWLTL during crossing
- Left turning vehicles on major roadway



Traffic Signalization

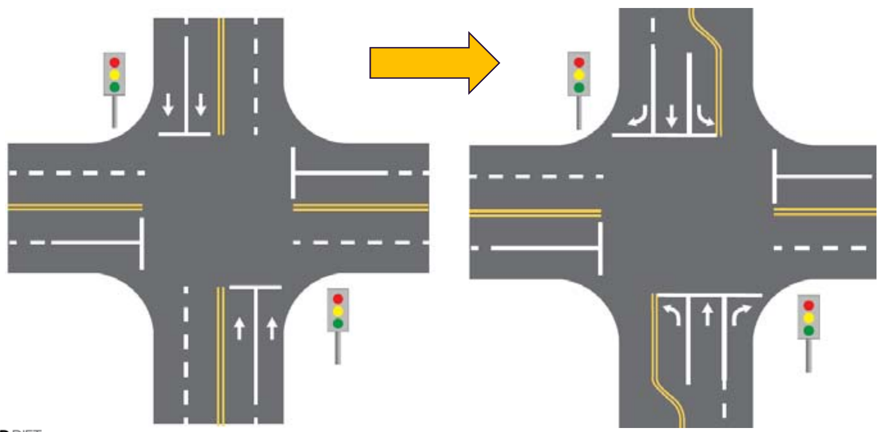
Re-evaluate:

- Traffic signal phasing and timing
  - Mainline traffic may need additional green time
- Type and number of lanes on intersection approaches
  - Turn lane needs
- Signal head positioning

- Quantify and compare additional delays and queues

Turn Lane Reallocation

Road Diets may make it possible to install dedicated turn lanes at the intersections

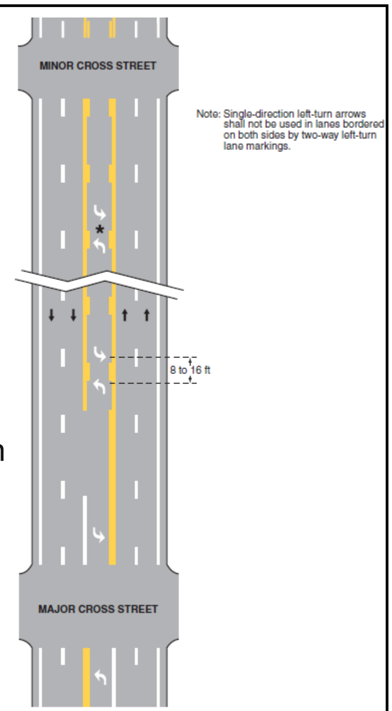


ROAD DIET

Pavement Markings

- Reference MUTCD for pavement markings (lane lines, edge lines, and the TWLTL)

- Important Considerations:
  - Turning radii and stop bar position
  - Painted buffers
  - Removal of old lines



Objectives

- Locate important references for implementing the design of a Road Diet
- Assess the important issues and trade-offs that may be involved in designing a Road Diet
- Select the appropriate geometric and operational design values and practices to guide project design decisions

ROAD DIET

Questions? Comments?

ROAD DIET

Module 5
Institutionalizing Road Diets

Efficiency through technology and collaboration

Every Day Counts — innovation, ingenuity, imagination, invention

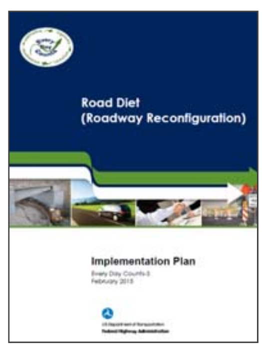
ROAD DIET

U.S. Department of Transportation
Federal Highway Administration

FHWA EDC Goals

- **Institutionalized:** Road Diets are adopted by the State's transportation community and used regularly on projects or there is a process for selecting highways that can be reconfigured.

- Is there a guidance or policy on implementing/installing a Road Diet?
- Are Road Diets included in the State's Strategic Highway Safety Plan as a safety countermeasure?

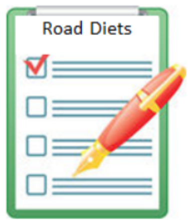


ROAD DIET

Road Diet Policies

Standalone Policies

Standalone policies turn Road Diets into one of an agency's first-tier solutions. The following resources are examples of standalone Road Diet policies and guidance documents developed by State and local agencies.



This roadway configuration, incorporating a protected bike lane and a raised bus stop, could be achieved by implementing a Road Diet

Florida Department of Transportation's (FDOT) *Statewide Lane Elimination Guidance*[2, 3] provides Road Diet and space reallocation guidance (referred to as lane eliminating). These documents include examples and impacts of Road Diets in Florida, a description of FDOT's Road Diet review process, and a discussion of issues associated with the improvement.

Maine Department of Transportation's (MaineDOT) *Guidelines to Implement a Road Diet or Other Features Involving Traffic Calming*[4] provides Road Diet guidance for Maine municipalities. The document includes a brief overview of the treatment, Maine specific implementation guidance, an overview of the countermeasure's limitations, and a list of minimum study requirements.

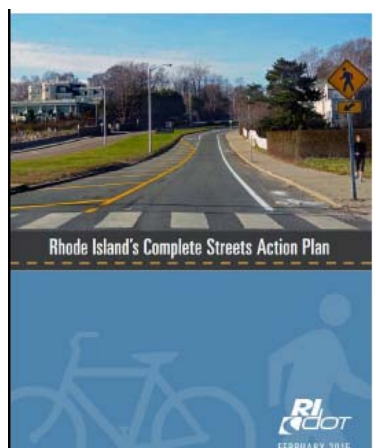
Michigan Department of Transportation's (MDOT) *Road Diet Checklist*[5] is a step-by-step list used by agency personnel when considering a Road Diet's appropriateness and applicability in a given situation.

St. Louis County's (Missouri) *Road Diet Policy*[6] provides factors to consider when determining if a Road Diet is feasible for a location, including average weekly traffic (AWT) volumes, directional peak hour volumes, left turns, intersection impacts, alternate bypass routes, bus transit, bicyclists, and pedestrians.

ROAD DIET

Road Diet Policies

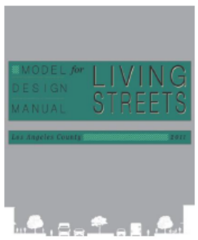
Incorporating Road Diets into Agency Complete Streets Policy or Action Plan

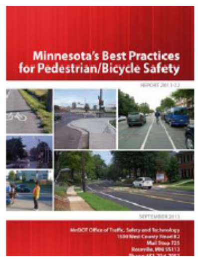


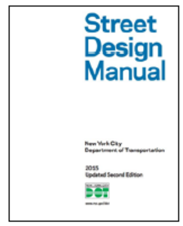
ROAD DIET

Road Diet Policies

Incorporating Road Diets into Agency Planning and Design Guidance







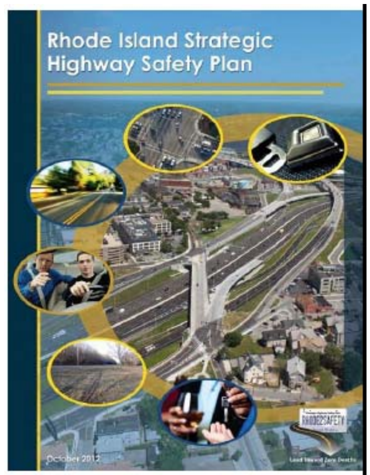
ROAD DIET

Road Diets Routinely Screened for all Resurfacing Projects

ROAD DIET

Road Diets as a Strategy Identified in the SHSP

Rhode Island's 2012 SHSP mentioned Road Diets as one of the DOT's safety accomplishments and promoted the countermeasure's crash reduction benefits.



ROAD DIET

POST-IMPLEMENTATION EVALUATION

Every Day Counts

ROAD DIET

Determining if the Road Diet is Effective

- Road Diet impacts may include:
  - Safety
  - Travel speeds
  - Arterial level of service, delay, queuing
  - Intersection operations
  - Traffic volume
  - Corridor and transit operations
  - Pedestrian and bicycle safety/ operations
  - Economic impact/ livability

ROAD DIET

Example: Seattle DOT

Compares the before/after conditions for the following:

- Volume of the principal street's peak hour capacity
- Speed and collisions
- Traffic signal level of service
- Volume of traffic on parallel arterials
- Travel times
- Bicycle volumes

ROAD DIET

Safety Analysis of a Road Diet

Typically a minimum of 3 years of crash data before and after treatment is preferred

- Observational before-and-after studies
- Surrogate measures of safety for road diets
- Observational field evaluations:
  - Pedestrian-vehicle
  - Bicycle-vehicle

ROAD DIET

Surrogate Measures of Safety for Road Diets

- Safety surrogate measures must show a causal relationship between the measure and the change in safety
- Common surrogate measures:
  - Traffic conflicts
  - Speed
  - Level of comfort

ROAD DIET

Speed

Changes in speed magnitude and variability and indicate changes in safety

- Higher speeds increase crash severity
- Large speed differentials increase crash likelihood

ROAD DIET

Level of Comfort

Often used for:

- Speeds on horizontal curves
  - Max. side friction factor
  - Max. rate of superelevation
- Pedestrians
- Bicyclists

- Conduct systematic visual assessments


Photo: NYCDOT

ROAD DIET

Analyzing Vehicle Operations

Consider analyzing changes in:

- Traffic volumes
- Level of service
- Speed
- Two-way left-turn lane operation
- Queue lengths
- Trucks, slow-moving vehicles, and buses
- Turning traffic

Traffic Volumes

Has the Road Diet affected:

- Daily traffic volumes or patterns?
- Peak hour traffic?
- Traffic diversion?

Photos: NYCDOT

- Several non-Road Diet factors may impact traffic volumes and patterns

Level of Service

Consider re-analyzing:

- Intersection LOS
  - Signal timing
  - Signal phasing
- Vehicle LOS
- Pedestrian LOS
- Bicycle LOS

- Compare possible LOS changes to safety improvements.

Trucks, Slow-Moving Vehicles, and Buses

Concerns with one through lane:

- Buses with frequent in-lane stops
  - Coordinate with transit to determine if bus pull-outs are desired
- Mail trucks
- Large trucks on grades
- Other slow moving or frequently stopping vehicles

Non-Motorized Operations

- Can be measured with respect to pedestrian and bicyclist use and accessibility.
- Consider evaluating:
  - Pedestrian wait time
  - Vehicle yield/ stop compliance rate for pedestrians crossing the street
  - Increased bicycle and pedestrian volumes

ROAD DIET

Increased Bicyclist and Pedestrian Volumes

- Improved comfort level will encourage increased use.
- Consider adding buffered or protected bicycle lane between it and the vehicle travel lane. This may include:
  - Painted barrier
  - Raised barrier
  - Median
  - Parking lane


Photo: Seattle DOT

ROAD DIET

Complexities with Analyzing Three-lane Sections

- Analyze at and between signalized intersections
- Factors to consider:
  - Parallel parking maneuvers
  - Bus maneuvers
  - Left-turning vehicles
  - Cross-street traffic
  - Pedestrian crossing
- Observe corridor before and after treatment

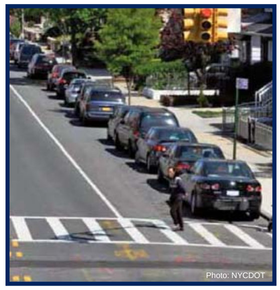


Photo: NYCDOT

ROAD DIET

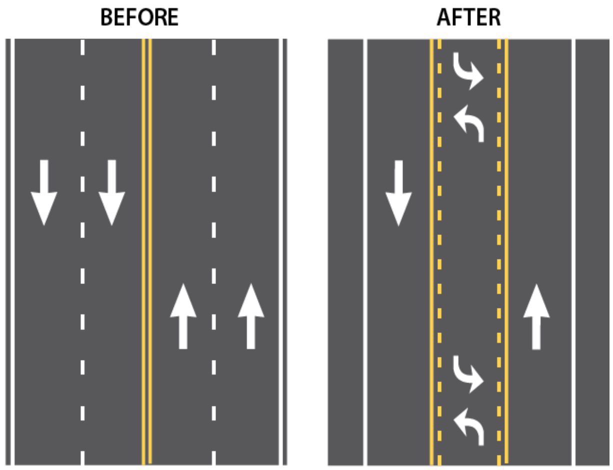
CONCLUSIONS AND WRAP-UP

Photo: Richard Retting

ROAD DIET

ROAD DIET

Typical Road Diet



Road Diet Benefits

- Safety for all users
- Low cost
- Relocation of cross-section for:
  - On-street parking
  - Bicycle lanes
  - Transit stops

Road Diet Considerations

Feasibility factors include:

- Need for improved safety
- Desire to incorporate CSS and CS features
- Desire to better accommodate bicycles, pedestrians, and transit service
- Right-of-way availability and cost
- Existence of parallel roadways, parallel parking, and at-grade railroad crossings.
- Public outreach, public relations, and political considerations.

ROAD DIET

Road Diet Considerations

Operational considerations, include:

- Existing roadway operates as a de facto three-lane roadway
- Need for reduced speed or traffic calming
- Average daily traffic
- Multimodal level of service
- Peak hour volumes and peak direction
- Turning volumes and patterns
- The presence of slow-moving or frequently stopping vehicles

ROAD DIET

Operational Decisions

Common Road Diet decisions:

- Cross-section allocation
- Pedestrian accommodations
- Signalization changes
- Transition points
- Pavement marking and signing

ROAD DIET

Geometric and Operational Design Features

A few to consider:

- Road functional classification
- Design vehicles, driver characteristics, and presence of non-motorized users
- Corridor sight distance, grade, horizontal curvature, and superelevation
- Cross-sectional elements
- Intersection design elements

ROAD DIET

Measure Road Diet Effectiveness

- Road Diet conversion can create changes in :
  - Safety
  - Travel speeds
  - Arterial level of service, delay, queuing
  - Intersection operations
  - Traffic volume
  - Corridor operations (e.g., transit, TWLTL, stopped traffic)
  - Pedestrian and bicycle safety and operations
  - Economic impact / livability

Course Evaluation

- Honest and constructive feedback
- Read the directions carefully, especially the values associated with numerical rankings
- FHWA takes your comments seriously and uses them continuously improve the course


QUESTIONS
?
ROAD DIET