Incorporating Bicycle Networks into Resurfacing Projects

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Wednesday, May 10, 2017

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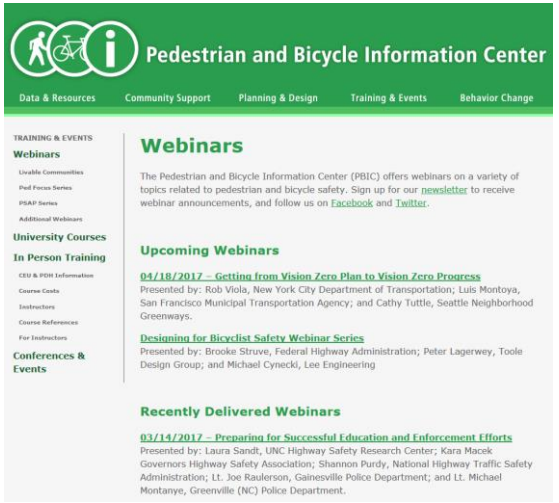

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Measuring and Visualizing Multimodal Networks

May 17, 1:00 – 2:30 PM Eastern Time

Dan Goodman
Federal Highway Administration

Eliot Rose
ICF

Eli Glazier
Toole Design Group

Discussion

- Send us your questions 
- Follow up with us:
  - Becky Crowe rebecca.crowe@dot.gov
  - Peter Lagerwey plagerwey@tooledesign.com
  - Jeremy Chrzan jchrzan@tooledesign.com
  - General Inquiries pbic@pedbikeinfo.org
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Incorporating On-Road Bicycle Networks into Resurfacing Projects

Source: Randy Dittberner, VDOT

Welcome & Introduction

Becky Crowe, FHWA

Source: Randy Dittberner, VDOT

Instructors

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Objective

Understand how to integrate bicycle facilities into routine resurfacing programs

- Process and timeline
- Effective methods
  - Road Diets
  - Lane Diets
  - Parking
  - Shoulders

Agenda for Today

1. Resurfacing Process and Timelines
2. Road Diets and Other Methods for Including Bikeways

Incorporating On-Road Bicycle Networks into Resurfacing Projects

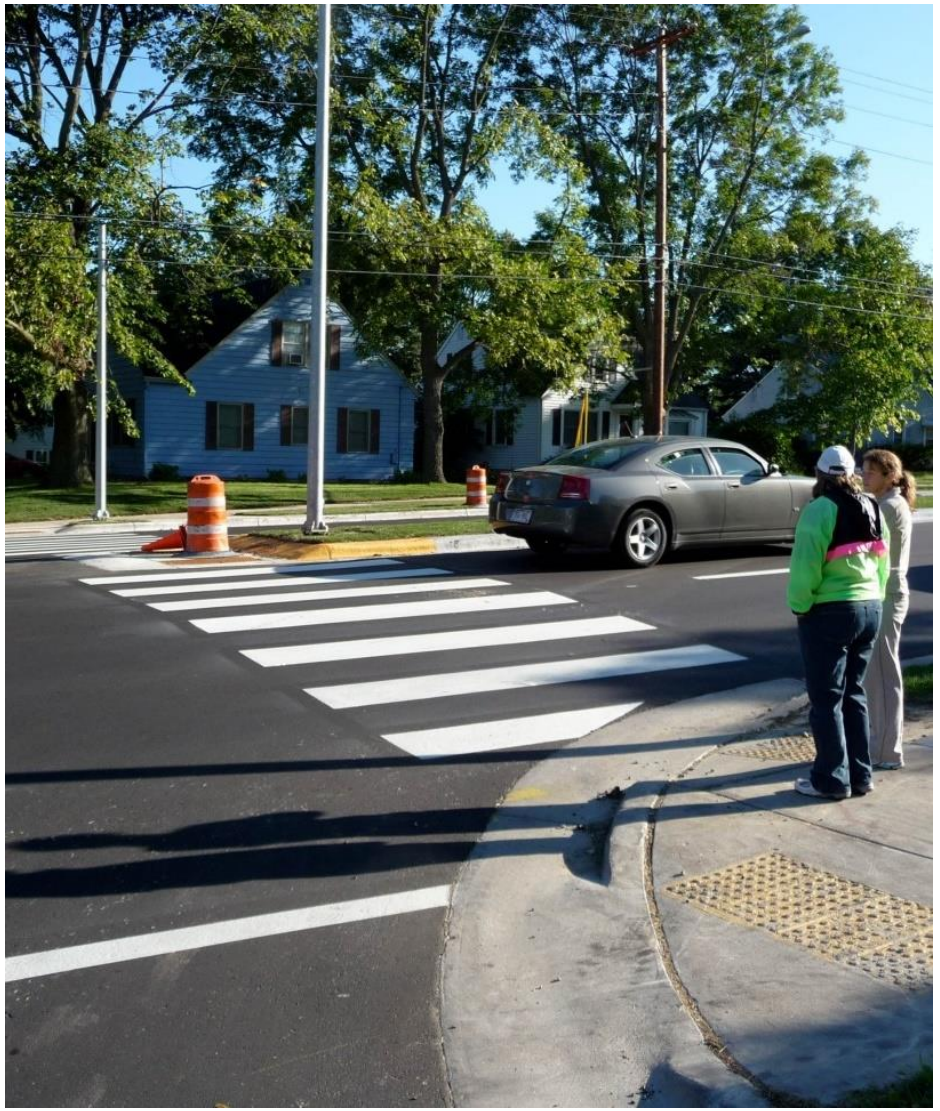
Source: Randy Dittberner, VDOT

Process and Timeline

Source: Randy Dittberner, VDOT

Resurfacing Defined

- Definitions vary by state & agency
- Broad definition used for workbook
  - Micro-surfacing to pavement replacement
  - Focus on mill-overlays or simple overlays
  - Curbs are not moved
  - Shoulders are not enlarged



Programming for Resurfacing Projects

Operations & Pavement Maintenance

- Respond to pavement quality rating
- Relatively simple scope – micro-surfacing, mill/overlay, overlay
- Shorter timeframe
- Program is part of the Capital Improvement Program (CIP), but not individual projects

Capital Projects

- Respond to a variety of issues
- More significant scope – extensive overlays to pavement replacements
- Involves plan sets
- Longer timeframe
- Included in CIP because of cost and/or scope of project

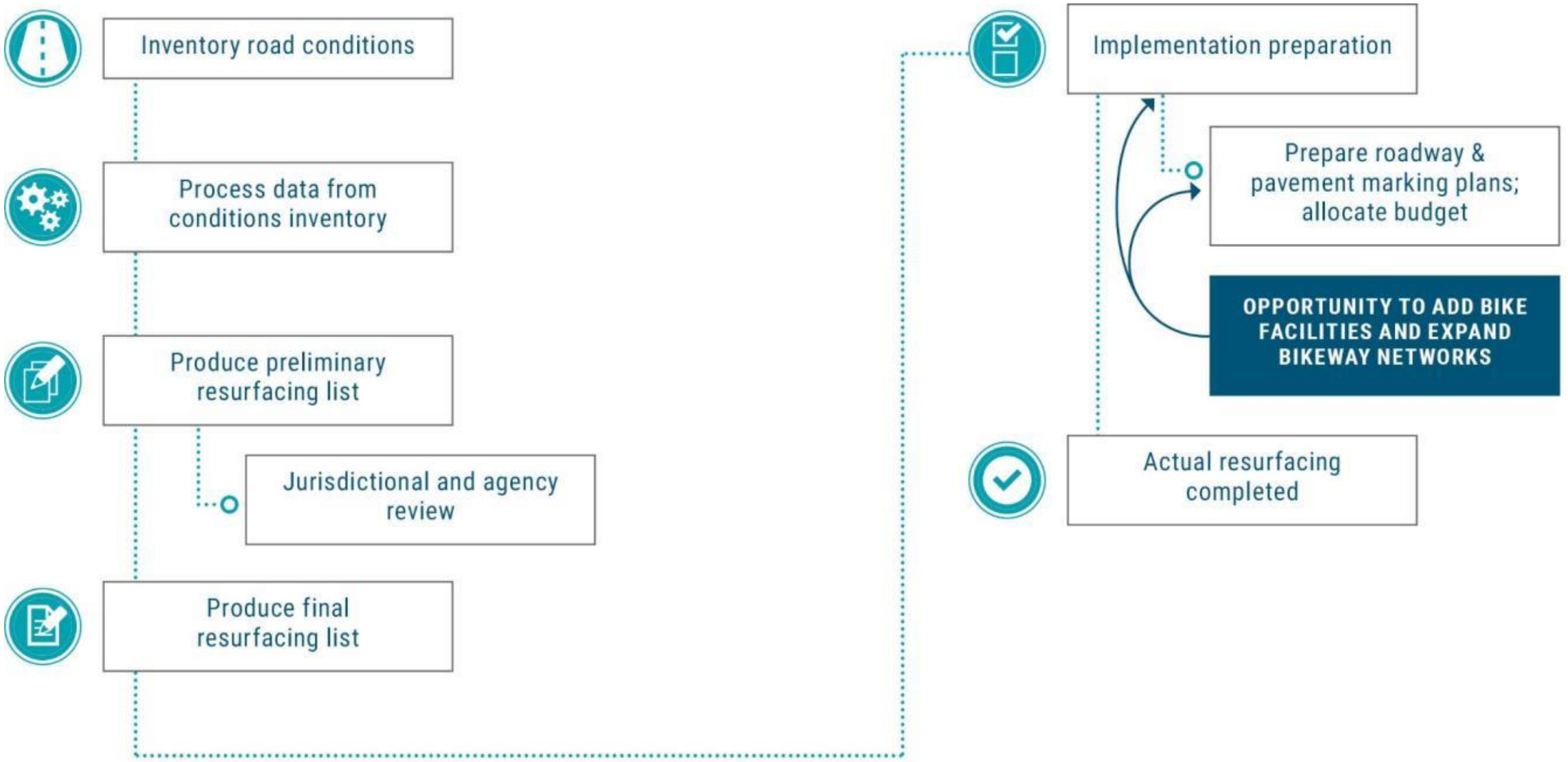
State DOTs typically have a 5-year plus highway improvement program that handles all resurfacing projects.

When is Resurfacing Considered to be an Alteration?

- *"Resurfacing is an alteration that triggers the requirement to add curb ramps if it involves work on a street or roadway spanning from one intersection to another, and includes overlays of additional material to the road surface, with or without milling. Examples include, but are not limited to the following treatments or their equivalents: addition of a new layer of asphalt, reconstruction, concrete pavement rehabilitation and reconstruction, open-graded surface course, micro-surfacing and thin lift overlays, cape seals, and in-place asphalt recycling."*

  https://www.fhwa.dot.gov/civilrights/programs/doj_fhwa_ta.cfm

Typical Process

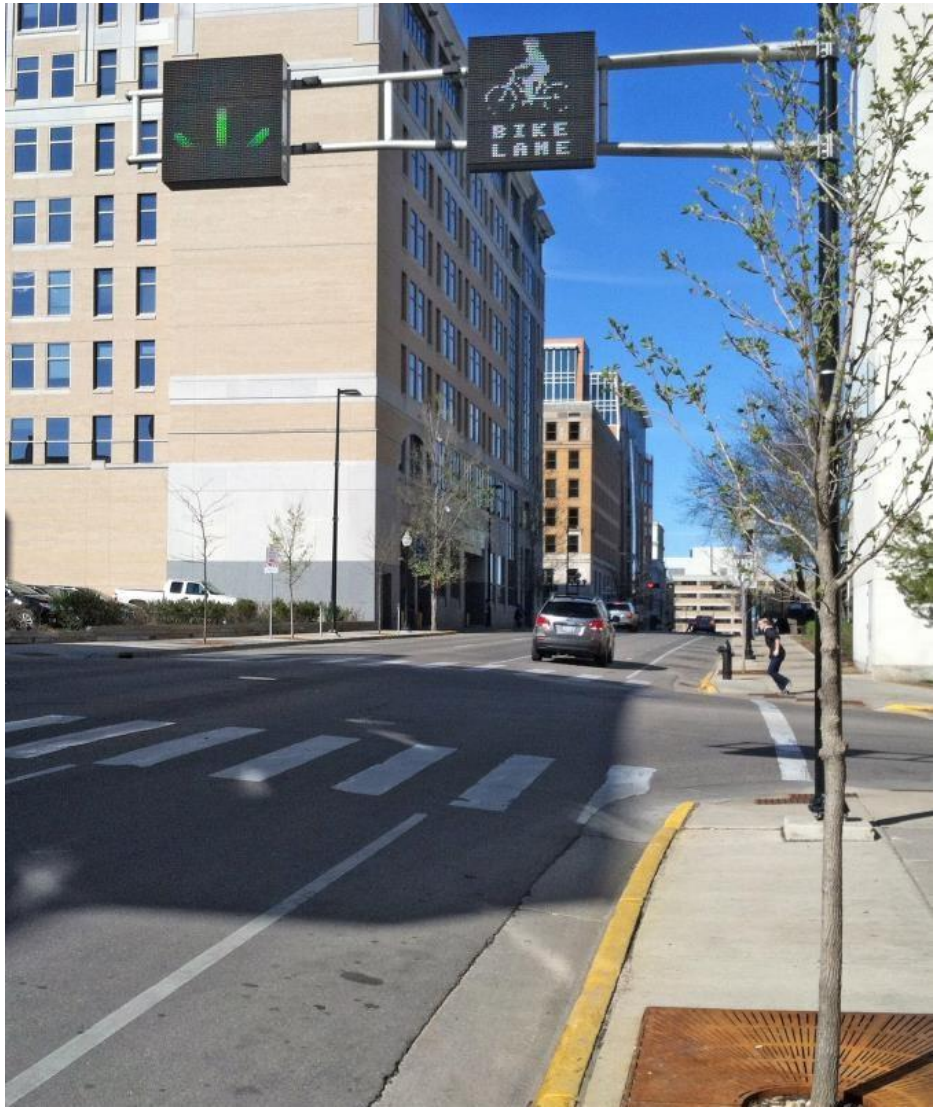


Limitations of Typical Process

- Resurfacing projects strongly tied to pavement surface rating
- Often done in a separate silo from other roadway projects
- Often resurfacing program is part of CIP while individual projects are not
- Fast paced program; slowing down may mean not getting to key projects before major deterioration occurs

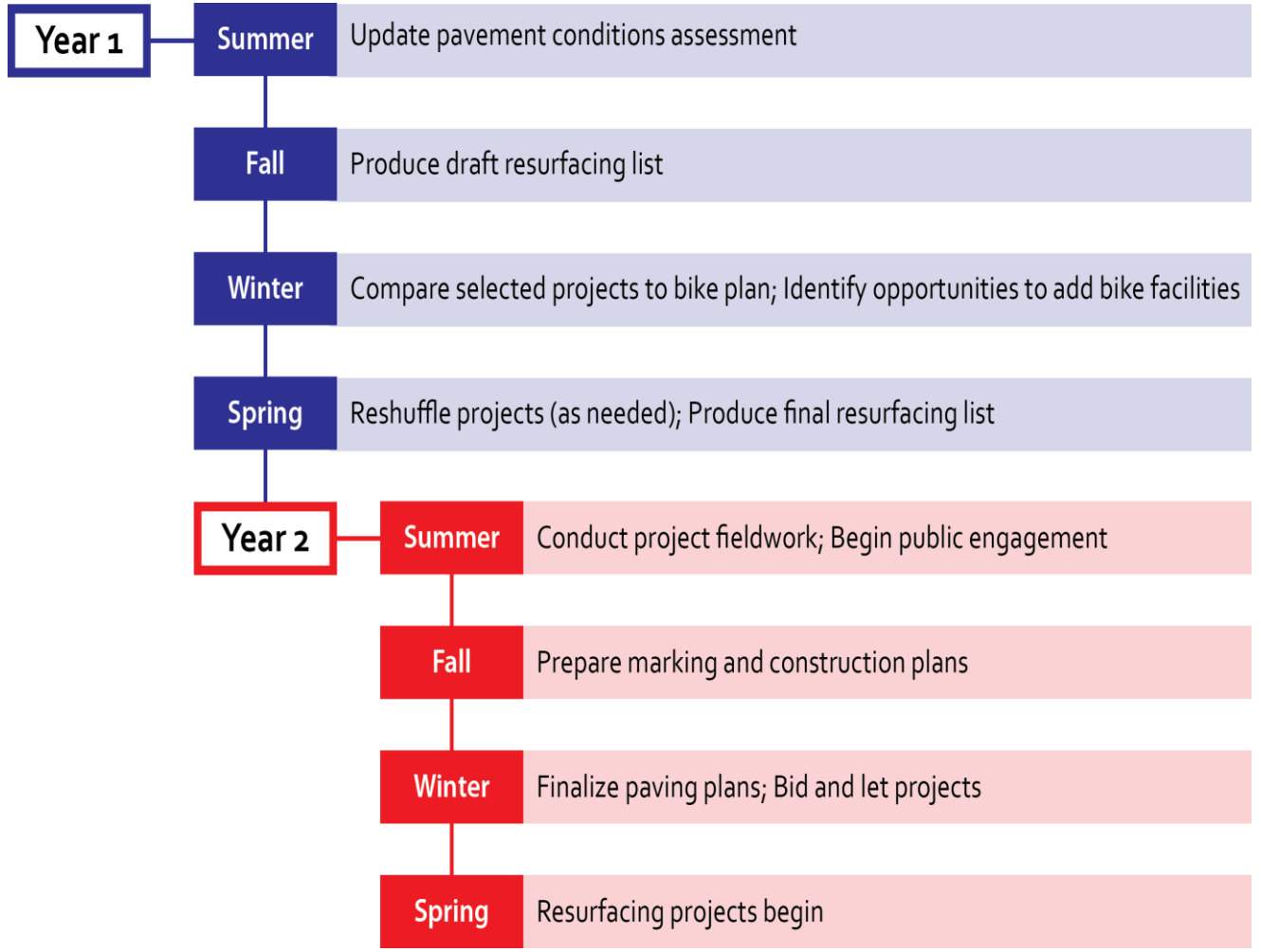
Key Recommendations of Workbook

- Extend timeline
- Use multi-modal approach
- Include bicycle staff
- Review the bike plan
- Be flexible with design



Extended Timeline

- Review resurfacing candidate projects for bikeway feasibility
- Include time for potential changes to a remarking plan (e.g. including bike lane striping)
- Provide time to consider public comments
- Successful agencies were willing to delay projects by a year or even two



Multimodal Approach

- Consideration of multiple modes
- Space for bikeways?
- Curb ramps to be added or replaced?
- Crosswalk Markings to be added or replaced?
- Transit stops to be enhanced or moved?

Include Bicycle Staff

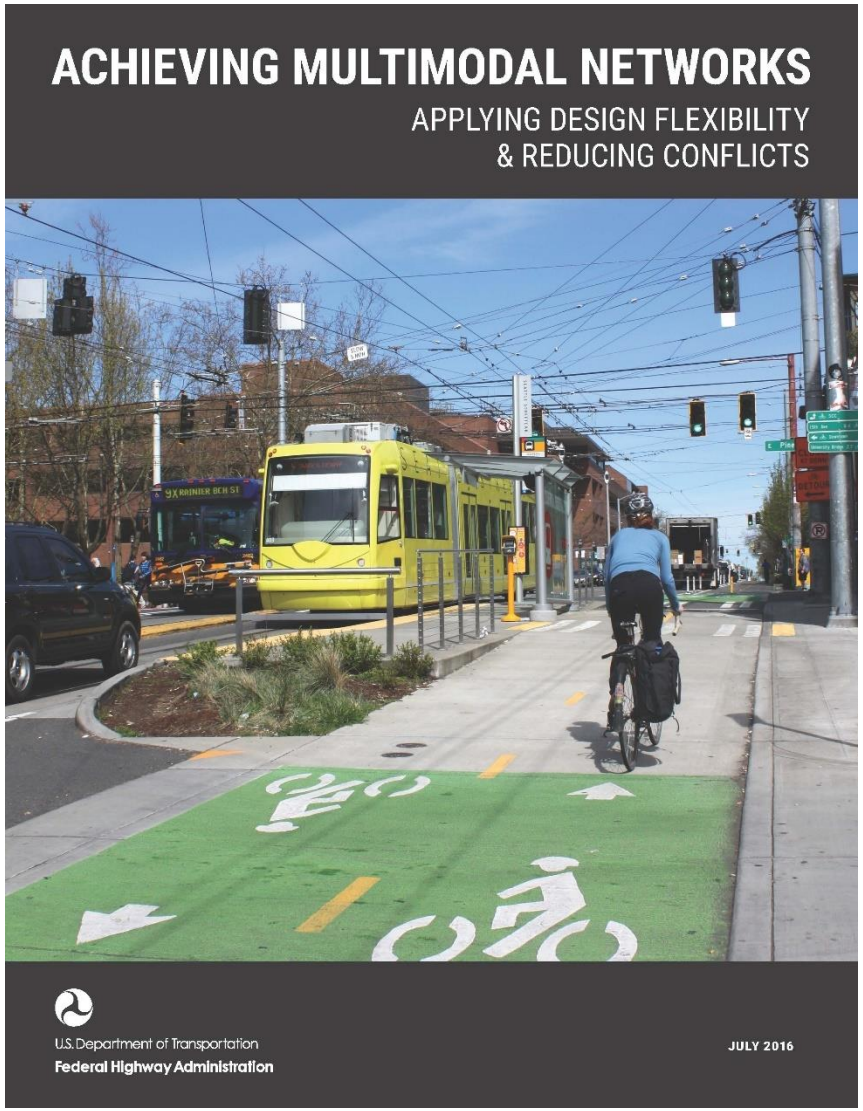
- Most familiar with bicycle plan(s)
- Most familiar with key bikeway connections – existing and future
- May not be familiar with pavement ratings and lists of potential resurfacing candidate streets

Review the Bike Plan

- Key resource with bikeway network shown on map
- Often will include priority and phasing of bikeway needs
- Plans often include general policy support for improving all streets, even if not on the bikeway map

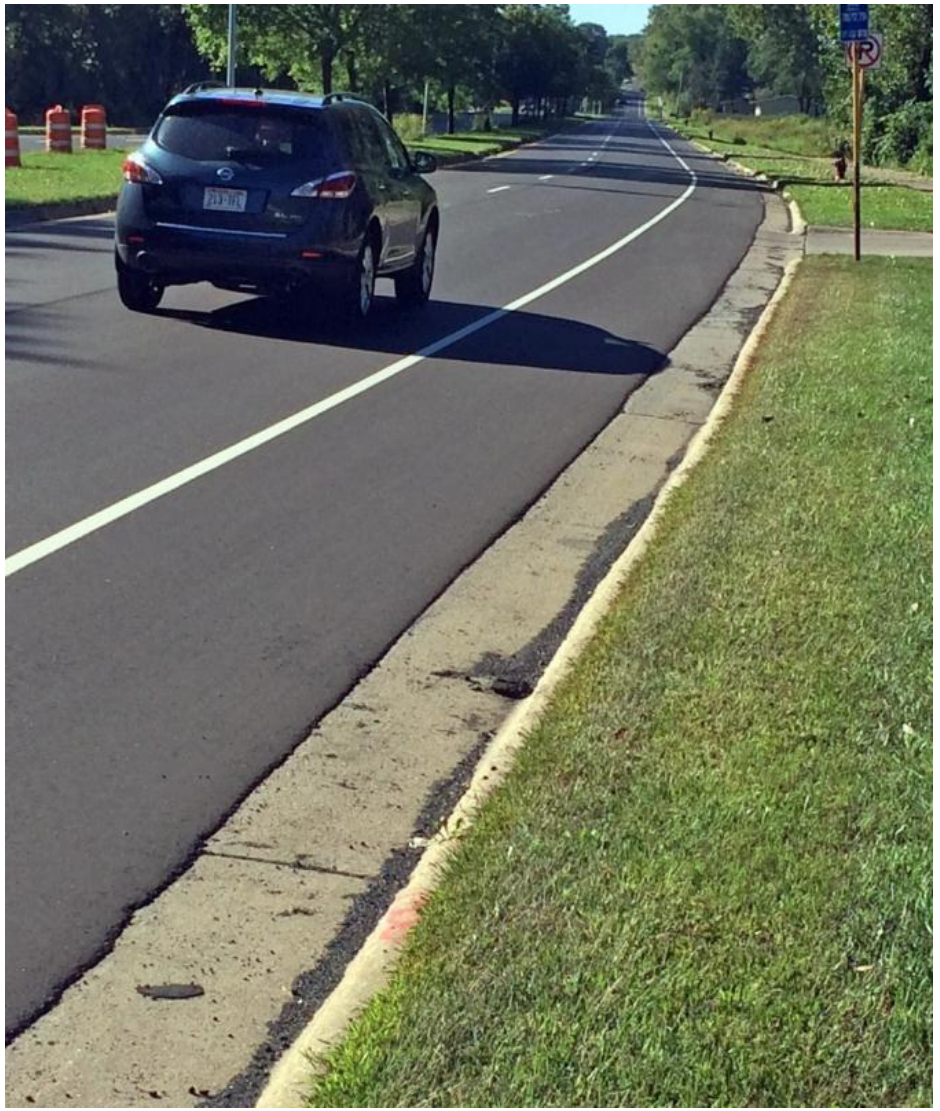
Be Flexible with Design

- Safety always key
- Often finding space is relatively easy
- More often space can only be found through road or lane diets
- Many national resources encourage flexibility, but sometimes state limitations exist



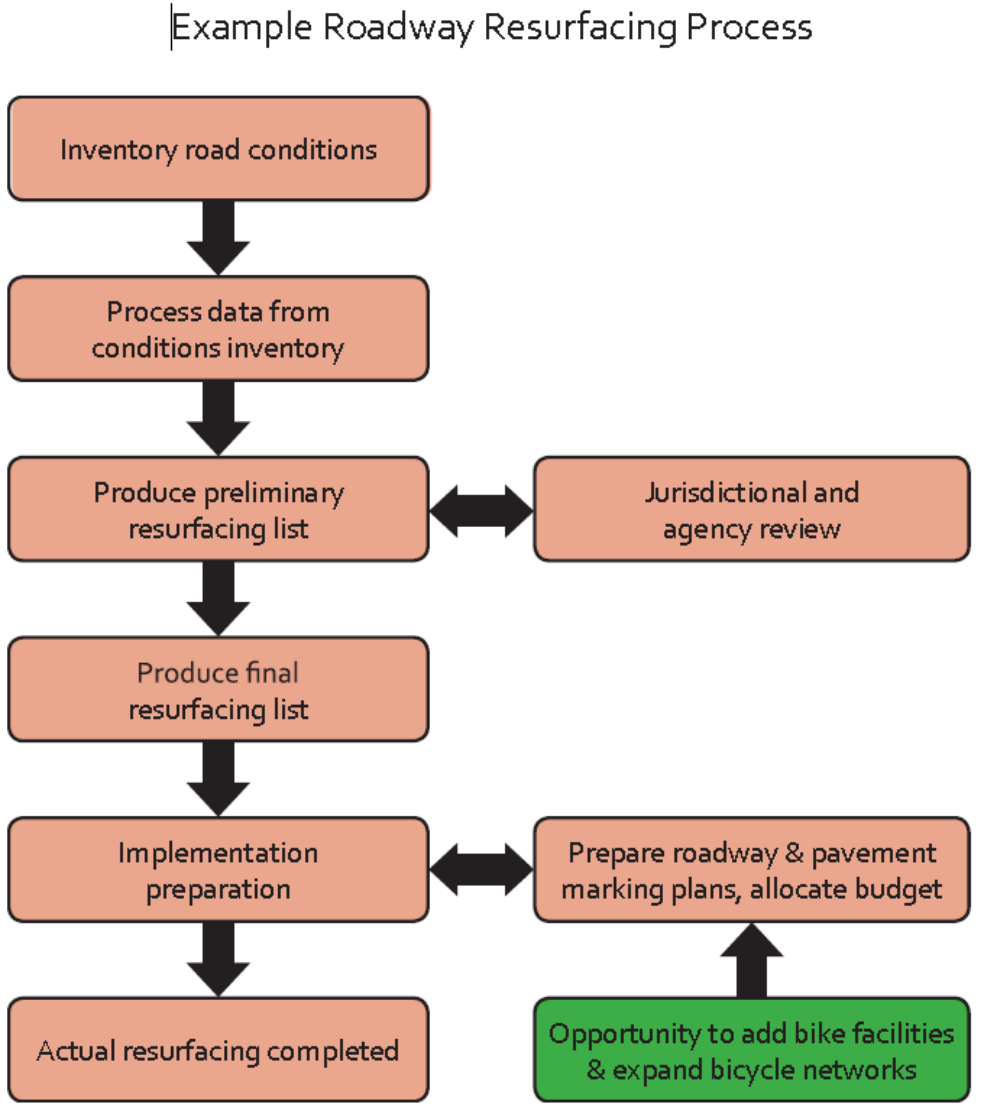
Common Pitfalls

- Short timeline
- Inadequate public participation
- Design constraints
- Lack of logical project extents
- Loss of existing bicycle facilities



Issue: Short Timeframe

- A leading cause of inability to create bikeways
- Most resurfacing programs - set up as routine delivery systems
- Rely on quick turnarounds with contractors
- Often city is playing catchup - delays are not acceptable



Solutions: Short Timeframe

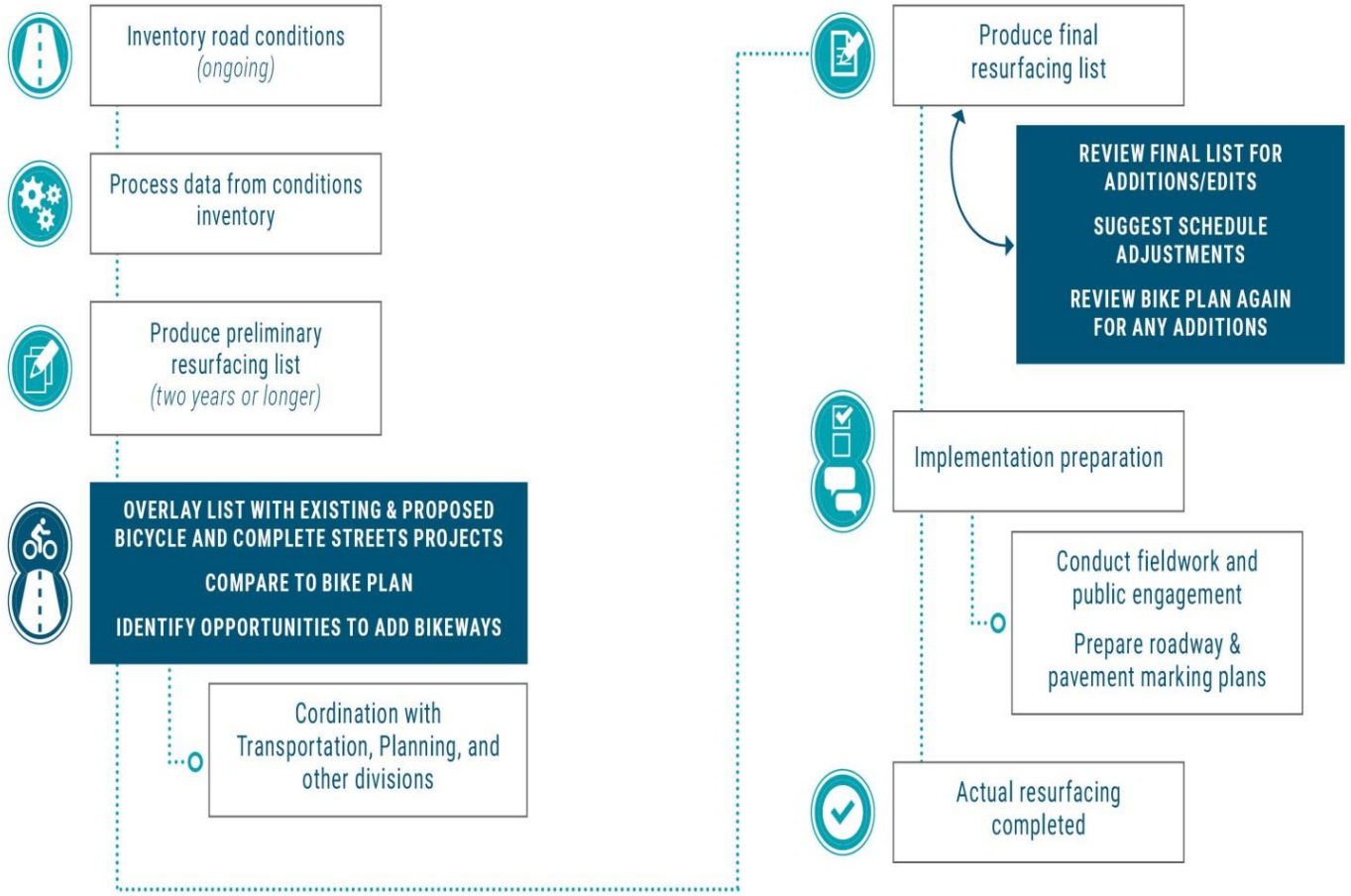
Plan Ahead

- Options for bicycle facilities should be considered before street projects are selected for next cycle of resurfacings.
- Identify good bikeway prospects several years in advance of the anticipated project, similar to most capital improvement programs.

Solutions: Short Timeframe

Design

- Bikeway design and a pavement marking plan
- Complete when a project is placed in the final project list



Issue: Lack of Logical Project Extents

Bicycle Facility Beginning & End Points

- Resurfacing projects coincide with pavement conditions, not planned bikeway network
- Isolated and short bike lanes may confuse users

Solutions: Lack of Logical Project Extents

- Identify and incorporate connections when planning the project
- Extend a connection to a nearby bikeway by extending the resurfacing project
- Leave resurfacing limits as planned but extend markings
- Coordinate projects so one connection leads to another from one year to next

Issue: Design Constraints

- Repurposing streets to include bicycle facilities will present design challenges
- When travel or parking lanes have to be removed, analysis may have to be performed, and designs and decision-making may be more difficult
- Many projects will be clear-cut one way or the other

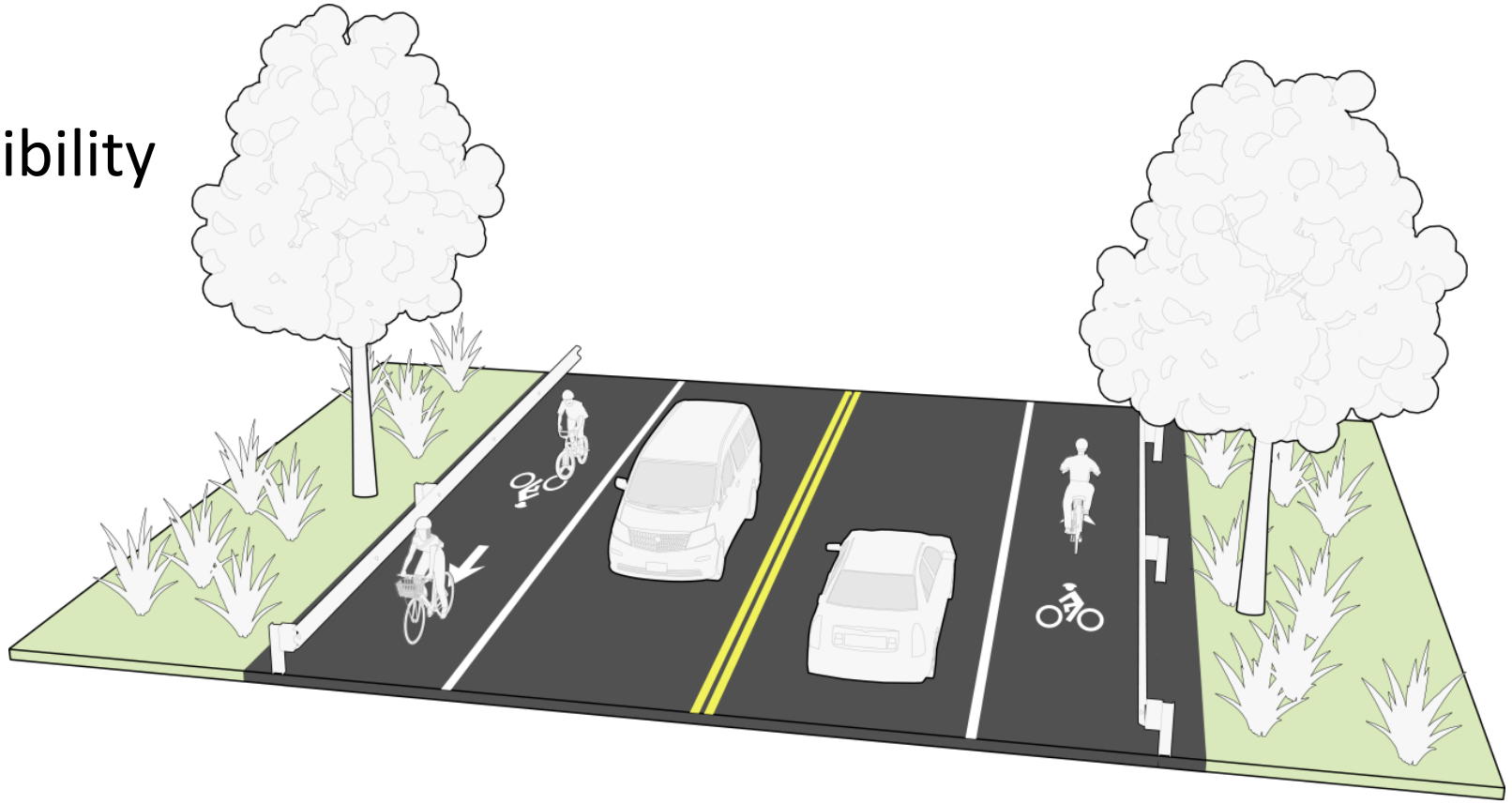
Solutions: Design Constraints

Consider main forms of design flexibility

- Lane diets, road diets, parking removal, adding paved shoulders

Consider other types of flexibility

- FHWA Guidance
- Local Design Guide
- Institutionalize within resurfacing program



Issue: Inadequate Public Participation

- Public has been given larger stake in commenting on projects
- That may have not changed for resurfacing projects process
- Adding bikeways can contribute to the complexity of a project's design and can trigger more questions, comments, explanations, modifications, etc.

Solutions: Inadequate Public Participation

- Plan on expanded public outreach timeframes when reallocating parking or travel lanes
- Extend the public involvement, if necessary
- Be prepared to explain bikeway impacts - provide brochures and that explain impacts and how different bicycle facilities work

Issue: Loss of Bikeways

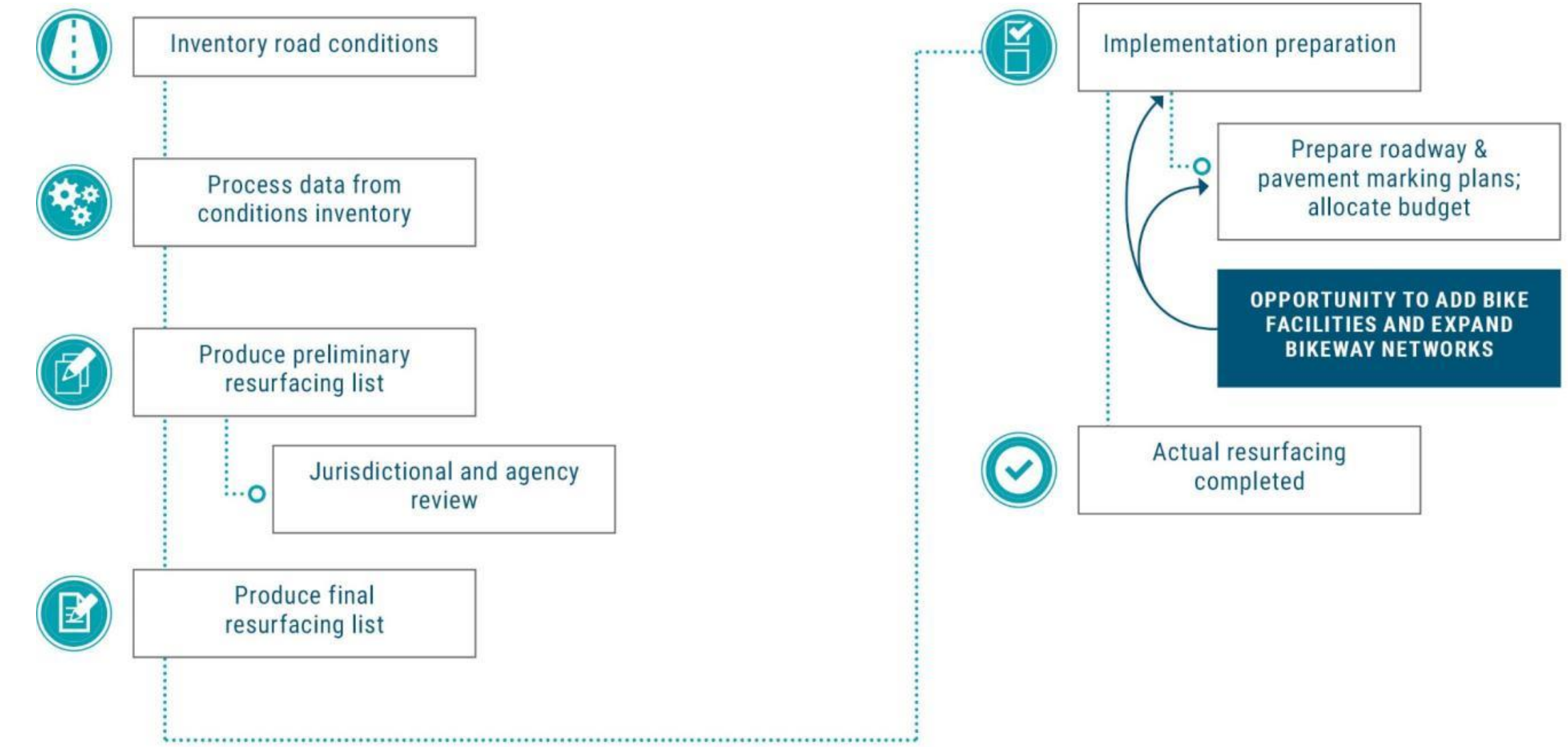
- Bikeways may already exist, but could be lost due to using old marking plans
- Marking crew may not be aware that the street had a bikeway

Solutions: Loss of Bikeways

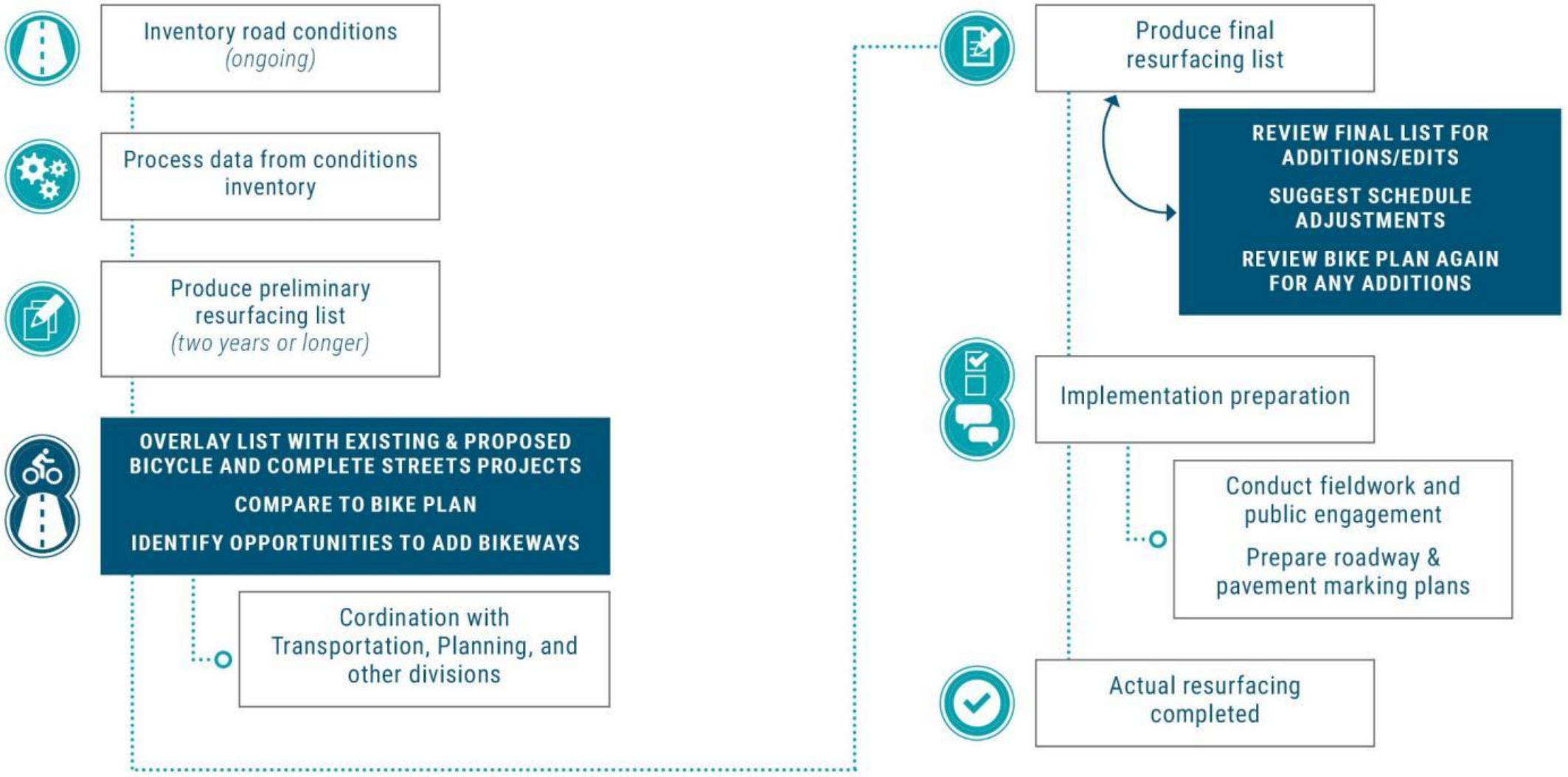
- Ensure that marking plans provided to marking crews, contractors, and agency oversight staff
- Place and field check preliminary markings on the roadway prior to final markings being installed.
- Geo-reference bike marking plans for the asset management process so existing facilities are reflected in databases and remain in future contract documents.

Photo: Jason Patten, City of Oakland

Recap: Typical Process



Recap: Recommended Process



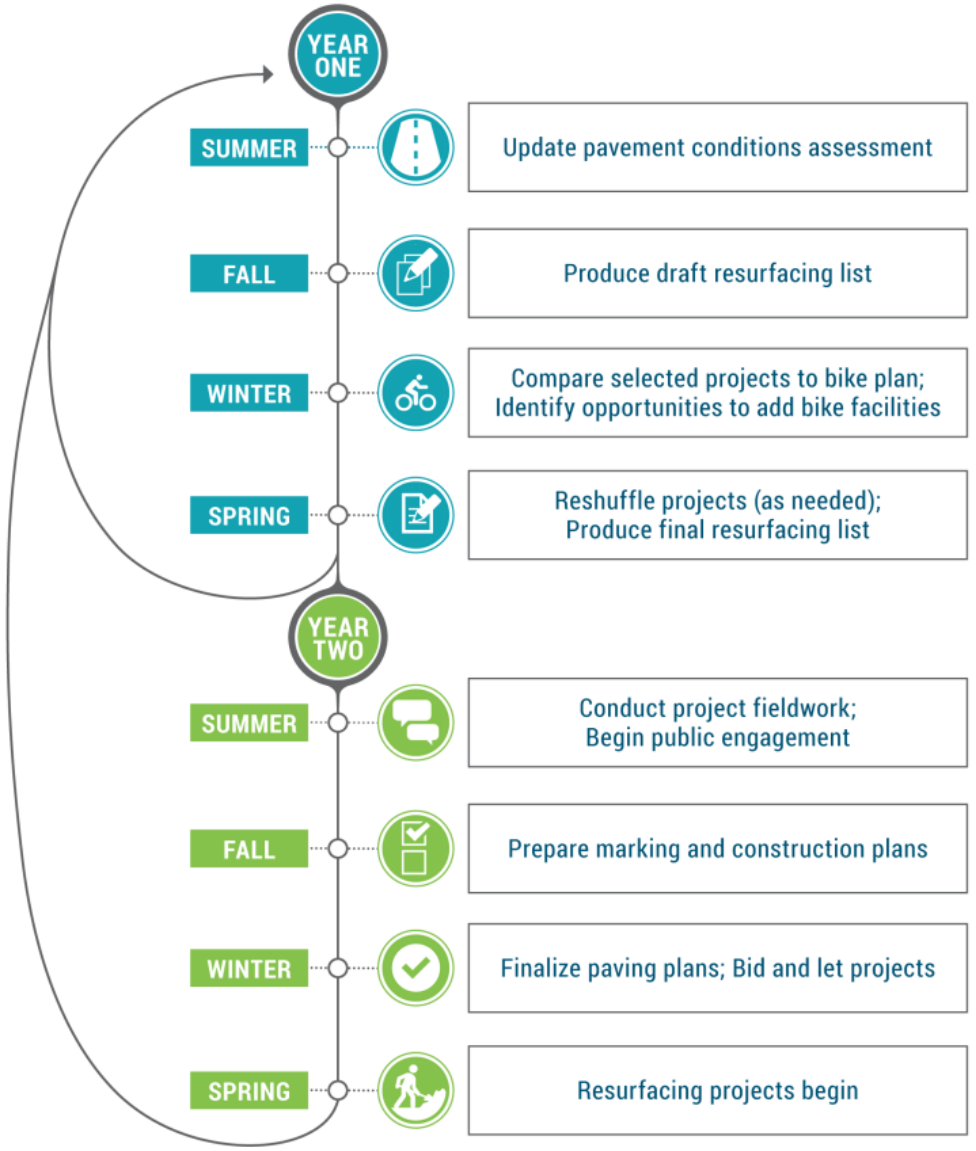
Recap: Recommended Timeline

Recommended minimum timeline is two years

- Allows time to add and reshuffle projects

Three years or more allows additional time for:

- Complicated design
- Public outreach
- Project reshuffling



Incorporating On-Road Bicycle Networks into Resurfacing Projects

Source: Randy Dittberner, VDOT

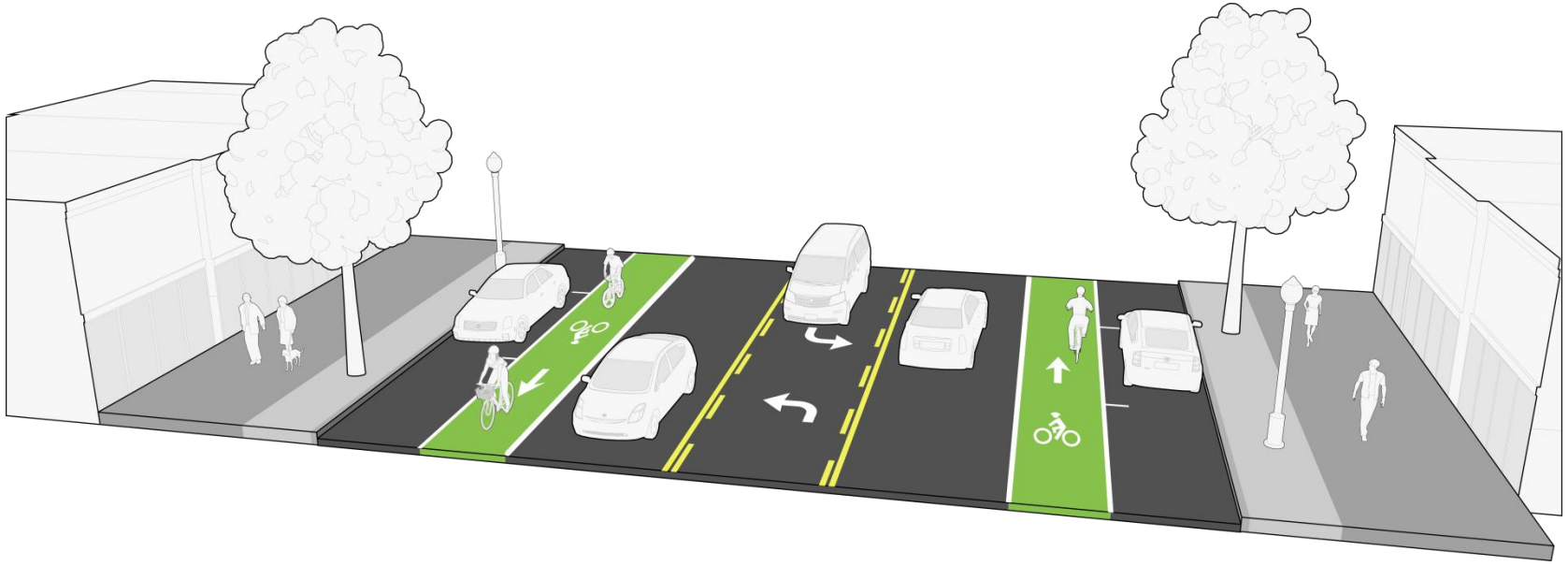
Road Diets & other Methods for Including Bikeways

Source: Randy Dittberner, VDOT

Module Overview – Road Diets & other Methods for Including Bikeways

This module will cover:

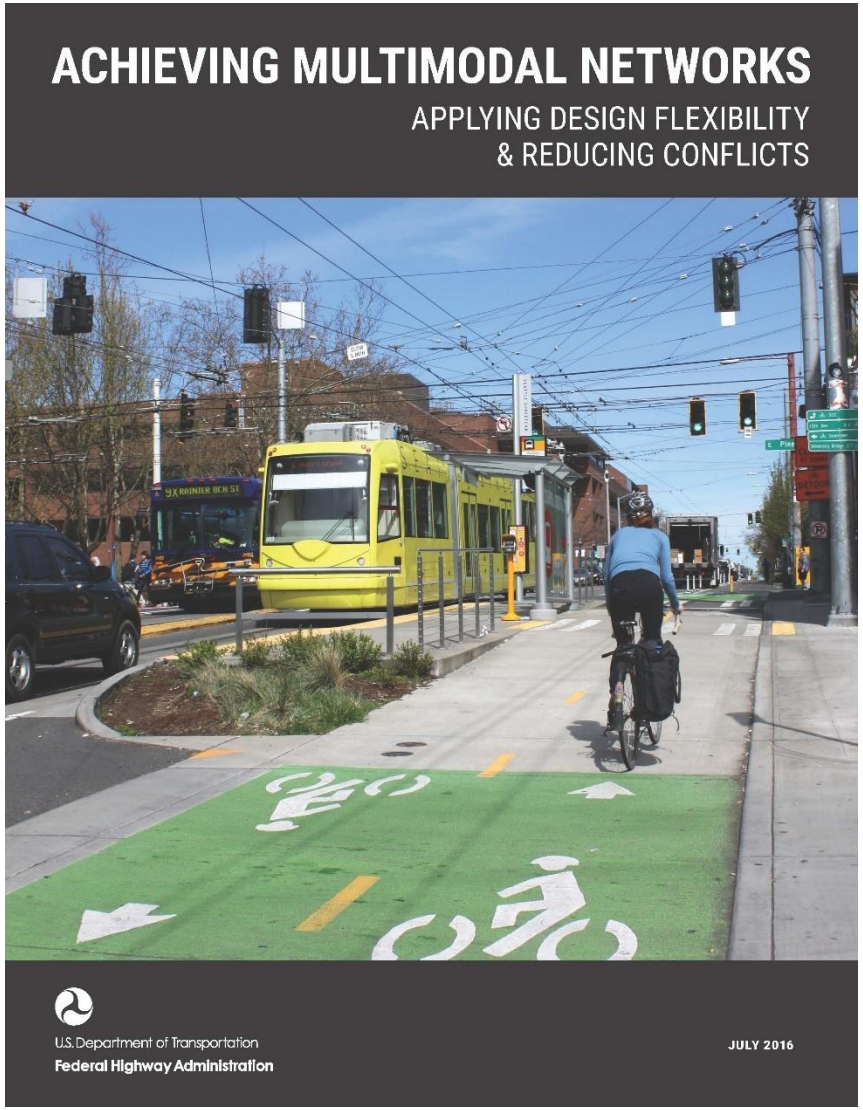
- Flexibility in Design
- Road Diets
- Other Methods for Providing Bicycle Facilities



Flexibility in Design

Need for flexibility in design to add bicycle facilities

- Existing guidance supports flexibility for setting lane widths and other issues
- Good Source: FHWA guidebook, *Achieving Multimodal Networks: Applying Design Flexibility & Reducing Conflicts*
  - Addresses common concerns
  - Perceived barriers



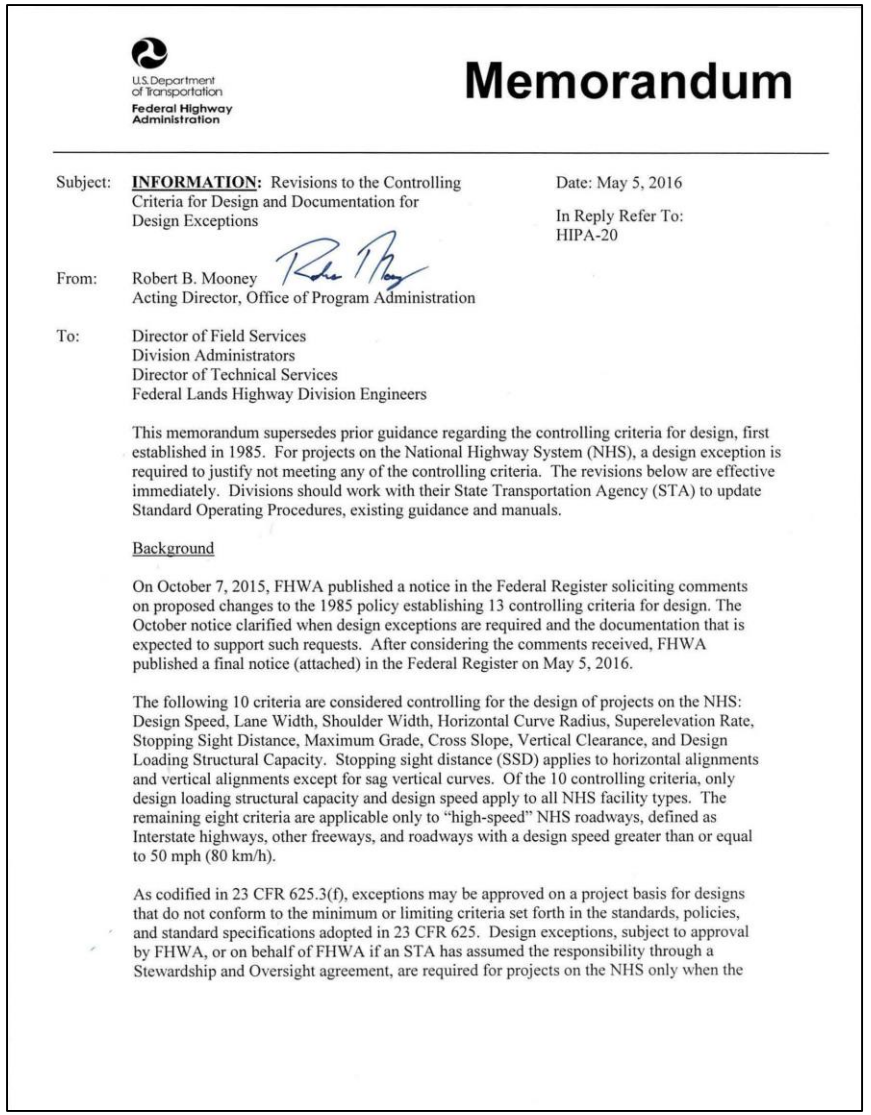
Flexibility in Design

Applying Design Flexibility

- Design Criteria and Lane Width
- Intersection Geometry
- Traffic Calming and Design Speed
- Road Diets and Traffic Analysis
- Enhanced Crossing Treatments
- Signalized Intersections
- Paved Shoulders
- Separated Bike Lanes
- Slow Streets
- Bus Stops
- Transitions to Main Streets
- Bridge Design

Changes in Design Criteria

- Historically, 13 controlling design criteria identified and followed by DOTs
- May 2016 FHWA memo:
  - 10 controlling criteria for high-speed roads (50+ mph) on National Highway System (NHS)
  - 2 controlling criteria low-speed roads (<50 mph) on the NHS:
    - Design Loading Structural Capacity
    - Design Speed



U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **INFORMATION:** Revisions to the Controlling Criteria for Design and Documentation for Design Exceptions

Date: May 5, 2016

In Reply Refer To: HIPA-20

From: Robert B. Mooney
Acting Director, Office of Program Administration

To: Director of Field Services
Division Administrators
Director of Technical Services
Federal Lands Highway Division Engineers

This memorandum supersedes prior guidance regarding the controlling criteria for design, first established in 1985. For projects on the National Highway System (NHS), a design exception is required to justify not meeting any of the controlling criteria. The revisions below are effective immediately. Divisions should work with their State Transportation Agency (STA) to update Standard Operating Procedures, existing guidance and manuals.

Background

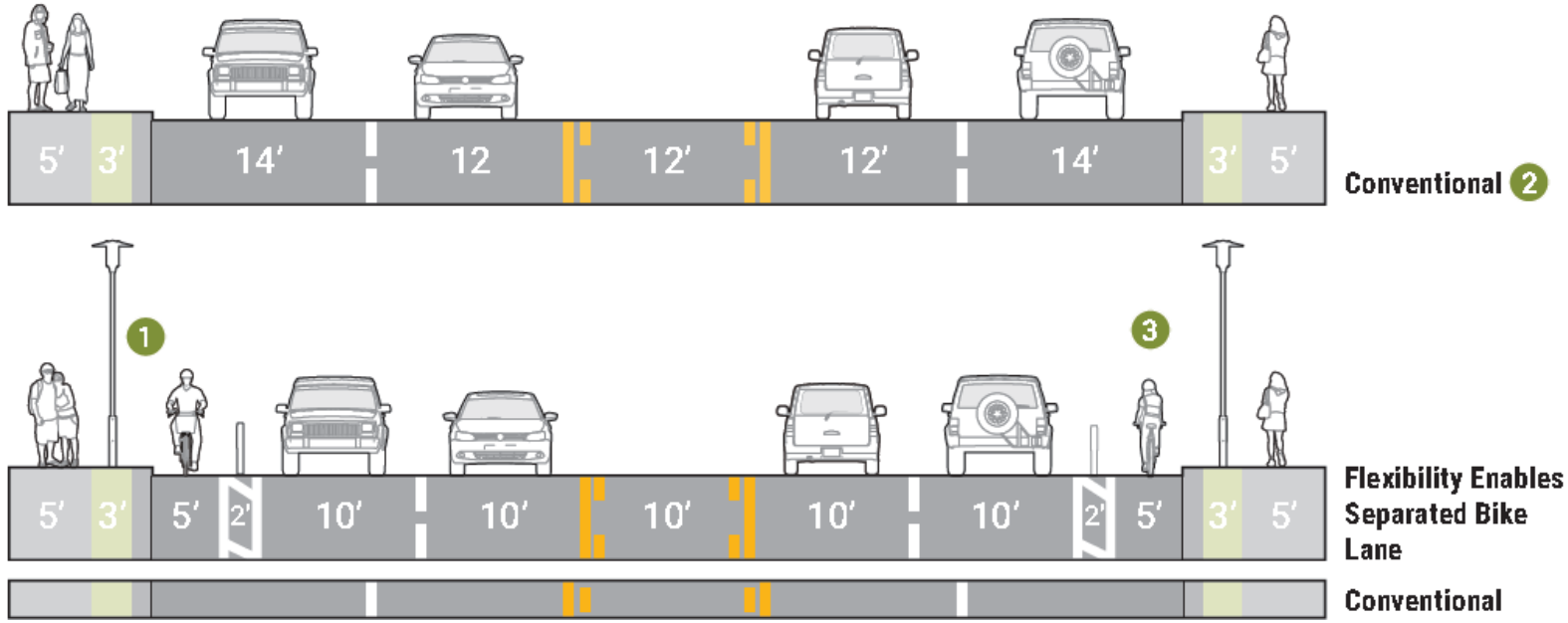
On October 7, 2015, FHWA published a notice in the Federal Register soliciting comments on proposed changes to the 1985 policy establishing 13 controlling criteria for design. The October notice clarified when design exceptions are required and the documentation that is expected to support such requests. After considering the comments received, FHWA published a final notice (attached) in the Federal Register on May 5, 2016.

The following 10 criteria are considered controlling for the design of projects on the NHS: Design Speed, Lane Width, Shoulder Width, Horizontal Curve Radius, Superelevation Rate, Stopping Sight Distance, Maximum Grade, Cross Slope, Vertical Clearance, and Design Loading Structural Capacity. Stopping sight distance (SSD) applies to horizontal alignments and vertical alignments except for sag vertical curves. Of the 10 controlling criteria, only design loading structural capacity and design speed apply to all NHS facility types. The remaining eight criteria are applicable only to "high-speed" NHS roadways, defined as Interstate highways, other freeways, and roadways with a design speed greater than or equal to 50 mph (80 km/h).

As codified in 23 CFR 625.3(f), exceptions may be approved on a project basis for designs that do not conform to the minimum or limiting criteria set forth in the standards, policies, and standard specifications adopted in 23 CFR 625. Design exceptions, subject to approval by FHWA, or on behalf of FHWA if an STA has assumed the responsibility through a Stewardship and Oversight agreement, are required for projects on the NHS only when the

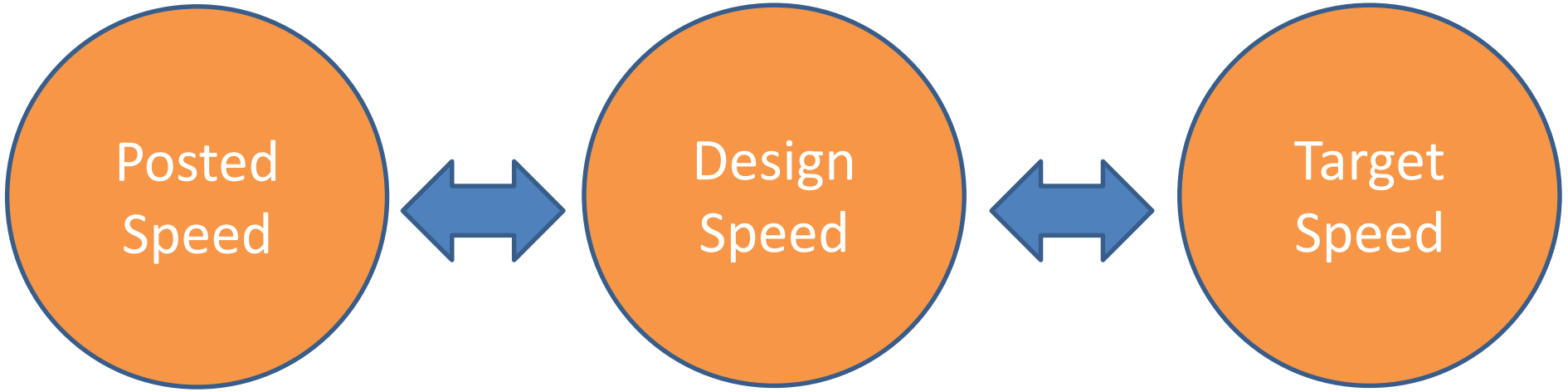
Example: Design Criteria and Lane Width

- Lane widths may range from 9 to 12 ft (AASHTO Greenbook)
- 10 ft lanes ok in low speed environments i.e., 45 mi/h or less (AASHTO)
- 10 – 11 ft lanes do not negatively impact safety, operations or vehicle capacity (Potts, et.al. 2007)



Example: Traffic Calming and Design Speed Myths

Myth: Design speed should be greater than posted speed

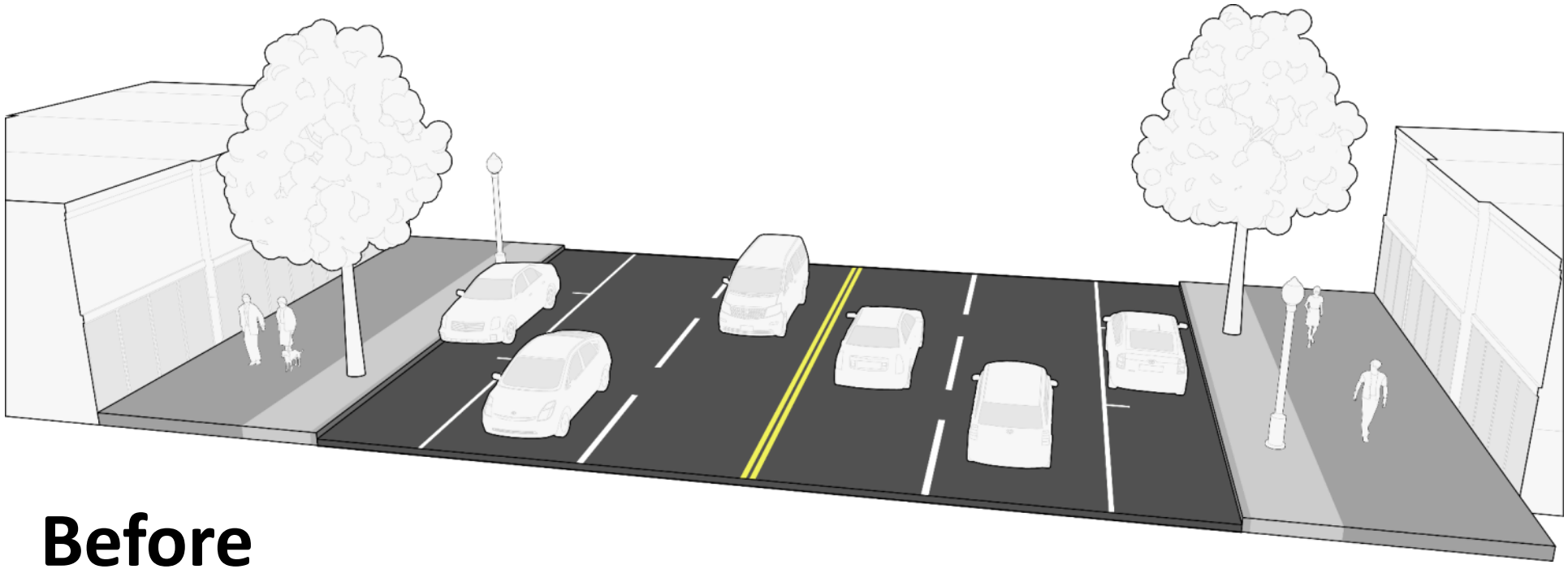


Methods for Adding Bikeways

- Methods commonly used for “creating” space
  - Road Diet
  - Lane Diet
  - Parking Removal
  - Paving Existing Shoulders
- Methods shown are generalized

Method: Road Diet

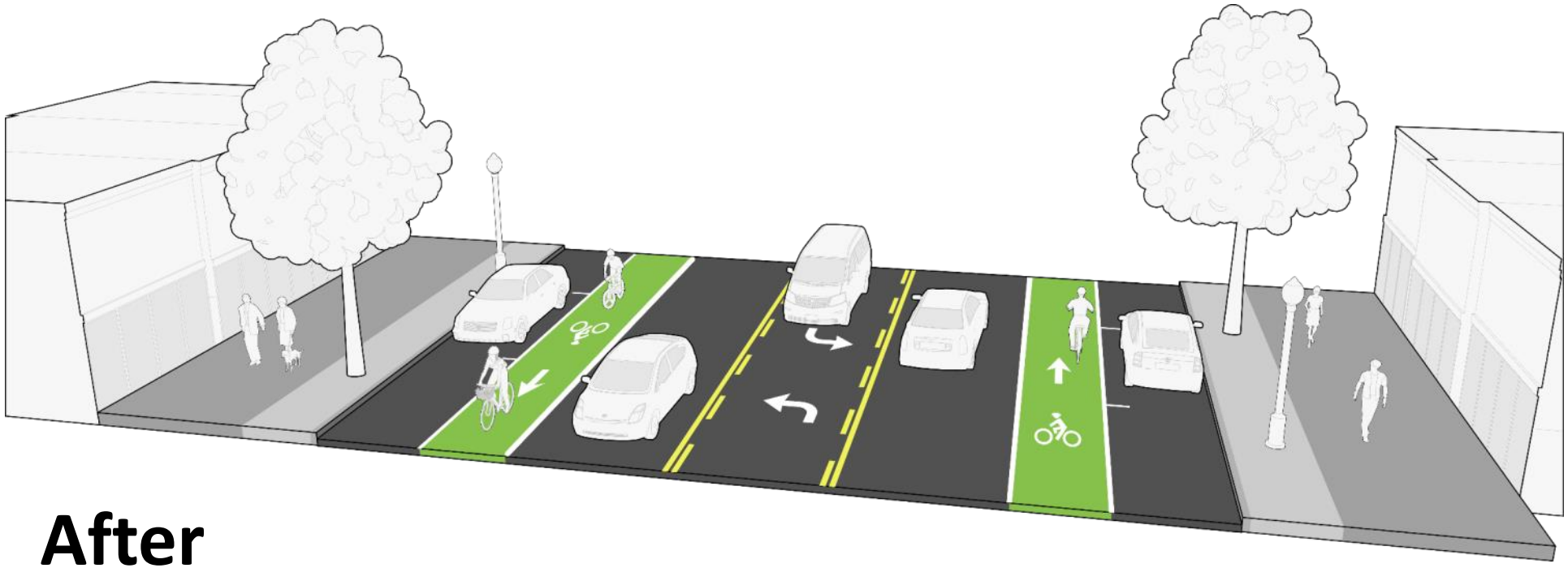
- Road Diets reconfigure travel lanes
- Excess space can be used for bicycle lanes
- Standard 4 lane depicted below before conversion



Before

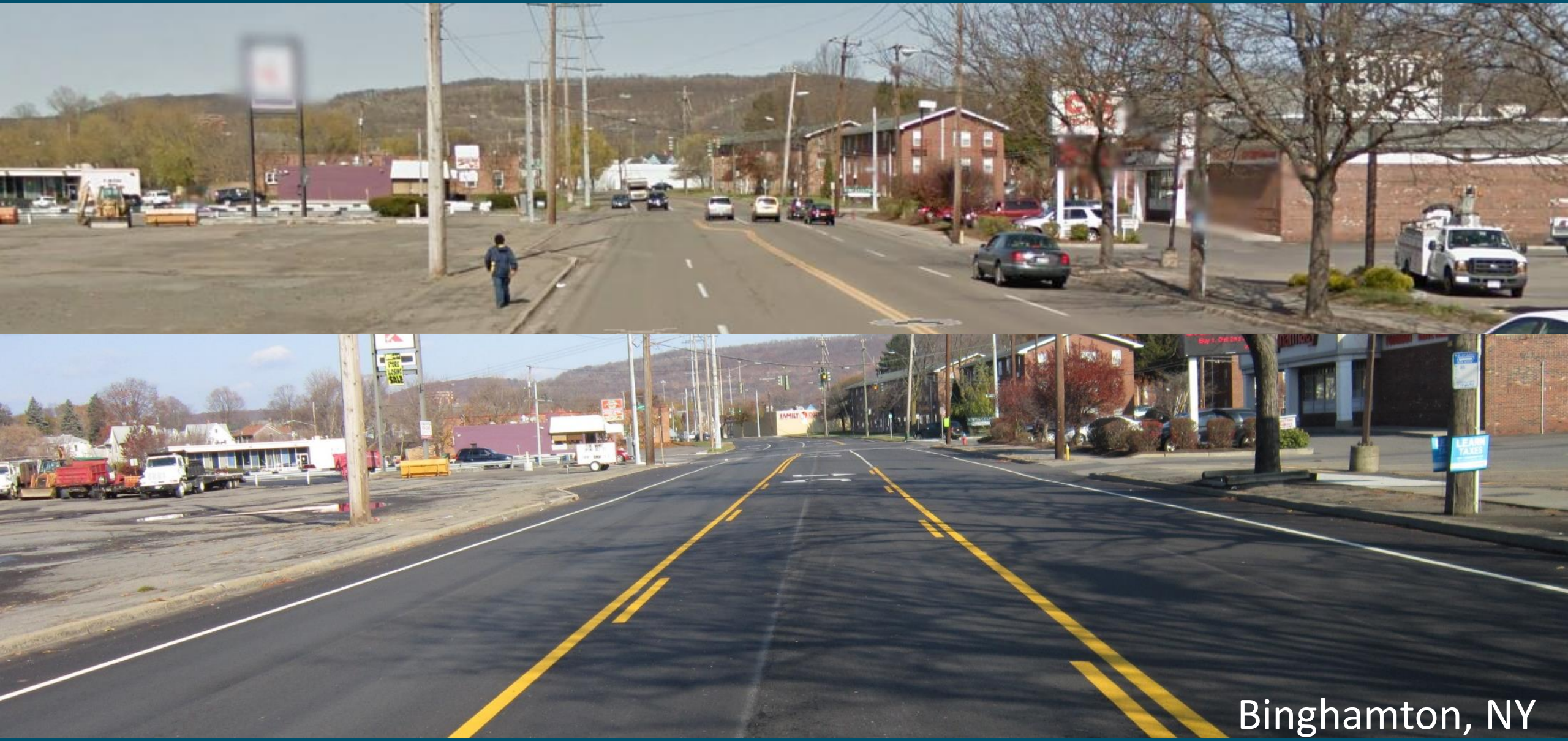
Method: Road Diet (4-3)

- Can result in smoother traffic flow & fewer crashes
- Generally done with ADT <20,000



After

Method: Road Diet (4-3) - Example



Road Diet Highlights

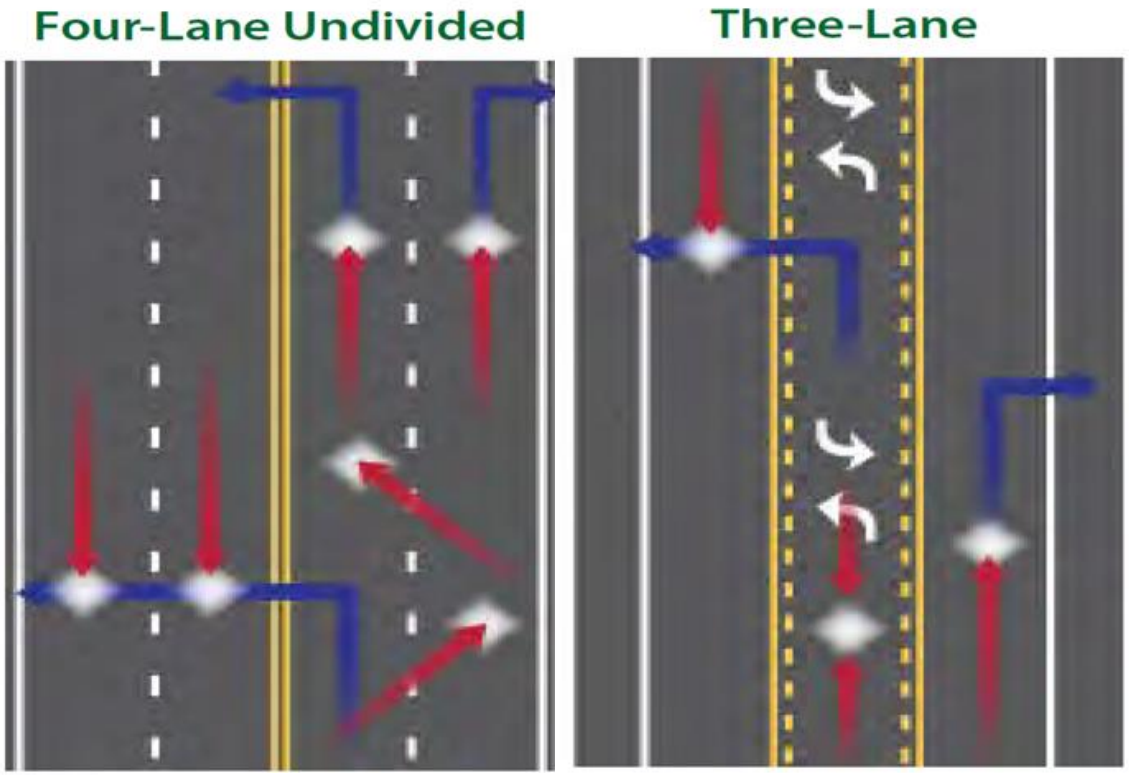
- 4- to 3-lane road diet is most popular, but also 4- to 2-lane
- Turn lane has additional benefits
- Adding a median is associated with a significant crash reduction for pedestrians crossing the street

Road Diet Design Considerations

- Four-to-three-lane conversions of two-way streets should be considered for roadways with moderate volumes (generally <20,000 ADT)
- Travel lane widths can be 10 to 12 feet, depending on the types of vehicles likely to use the road.
- Center turn lane width typically ranges from 10 to 16 feet, depending on the vehicles typically using the street.
- Intermittent raised medians and left-turn bays help eliminate the use of the center turn lane as a passing lane.

Road Diet Benefits

- Provide space for bike lanes or paved shoulders
- Center turn lanes reduce crashes by reducing conflicts with turning vehicles
- Prudent drivers who follow posted speed limits set the prevailing speed
- ADT typically not reduced if center turn lane is provided and signals are upgraded



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

Example: Before/After Studies in Seattle, WA

Street	ADT begin	ADT change	Collisions	85th %	Top end speeders	Travel time
Stone Way	13,000	-6%	- 14%	- 6%	- 80%	N/A
NE 125th St	16,200	+ 4%	N/A	- 8%	- 69%	+ 1.5 min
Nickerson St	18,600	- 1%	- 23%	- 21%	- 94%	N/A
Fauntleroy	16,500	+ 0.2%.	- 31%	- 1%	- 13%	+ 32 sec
Columbian Way	11,200	+ 20%	No change	- 6%	-50%	N/A

Road Diet Challenges

- The public involvement requirements of Road Diets may delay a resurfacing project.
- Local businesses may object to a Road Diet if they believe that it will result in less traffic along the street.
- A reduction from two lanes to one lane in each direction can result in transit or delivery vehicles occupying lanes during stops.
- A traffic study may be needed to determine the feasibility of a road diet.
- Changes will likely be needed to signs and signals on the roadway.

Resource: Economic Impacts, Policies, Costs Evaluation Metrics, Emergency Response, Candidate Locations, Public Outreach

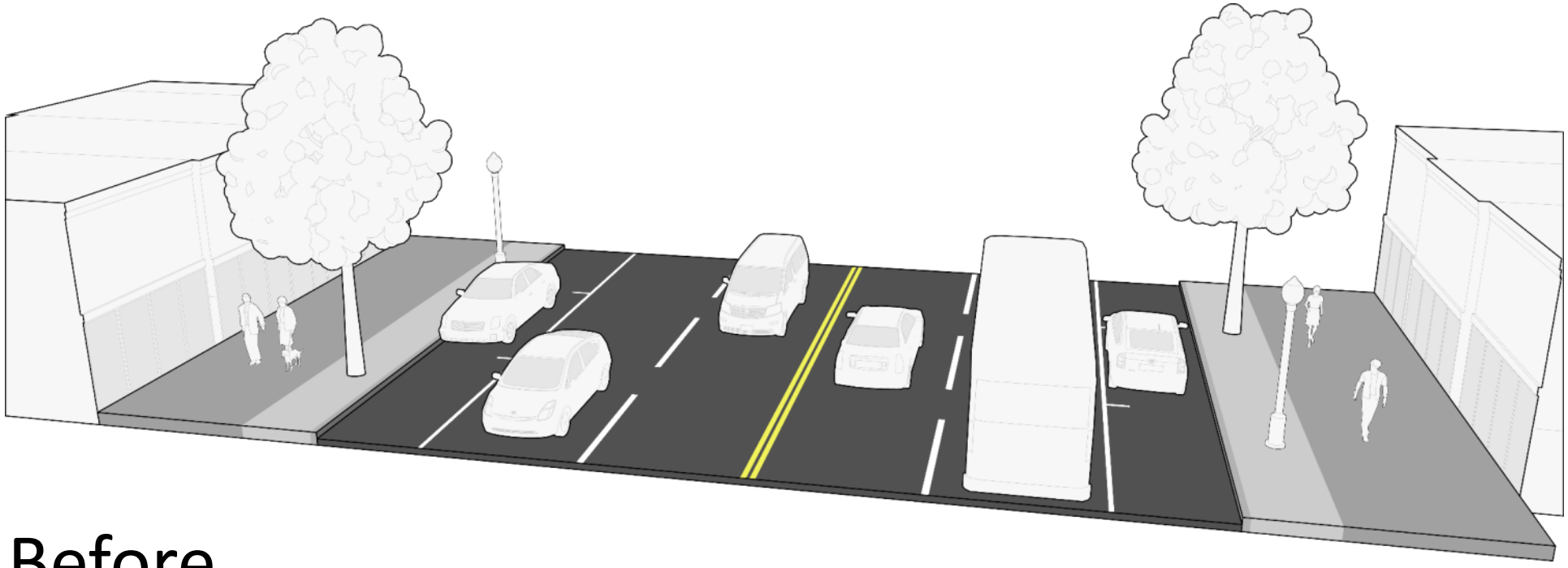
https://safety.fhwa.dot.gov/road_diets/resources/

Method: Road Diet (4-2)

- Less common than a 4 -3 lane conversion
- Will have ample space for bikeway
- Requires a careful review of left-turn movements
- In this example
  - Bus stops in-lane
  - Bike lane is on back side of bus stop

Method: Road Diet (4-2)

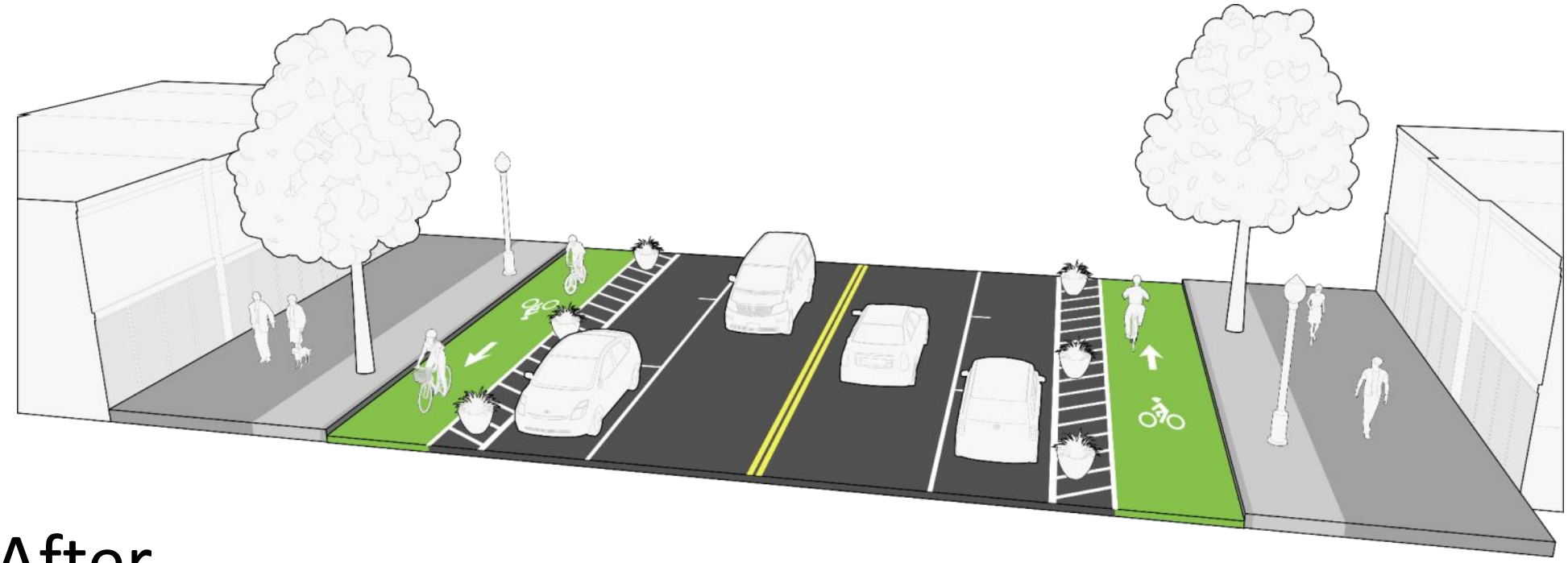
Overbuilt streets with minimal turns may be able to be reduced to two travel lanes



Before

Method: Road Diet (4-2)

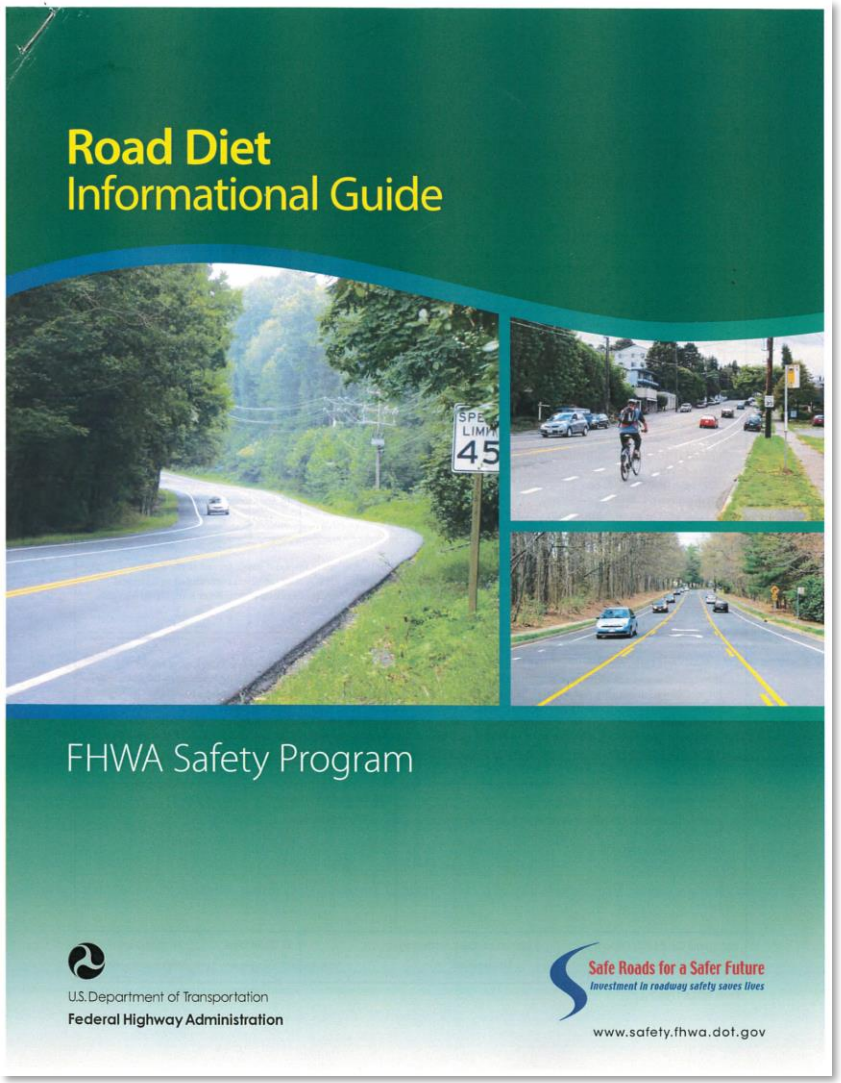
Provides space for high quality bikeway such as a separated lane



After

Road Diet Guidelines

For More Information:
https://safety.fhwa.dot.gov/road_diets/



Road Diet Guidelines – Other Sources

- Florida Department of Transportation's Statewide Lane Elimination Guidance

  http://www.dot.state.fl.us/rddesign/CSI/Files/Lane-Elimination-Guide-Part1.pdf

- Maine Department of Transportation's Guidelines to Implement a Road Diet or Other Features Involving Traffic Calming

  http://safety.fhwa.dot.gov/road_diets/guidance/docs/maineDOTroad_diet.pdf

- Michigan Department of Transportation's Road Diet Checklist

  http://safety.fhwa.dot.gov/road_diets/guidance/docs/mdot_chklist.pdf

- St. Louis County's Road Diet Policy

  https://www.stlouisco.com/Portals/8/docs/document%20library/highways/publications/Road_Diet_Policy.pdf

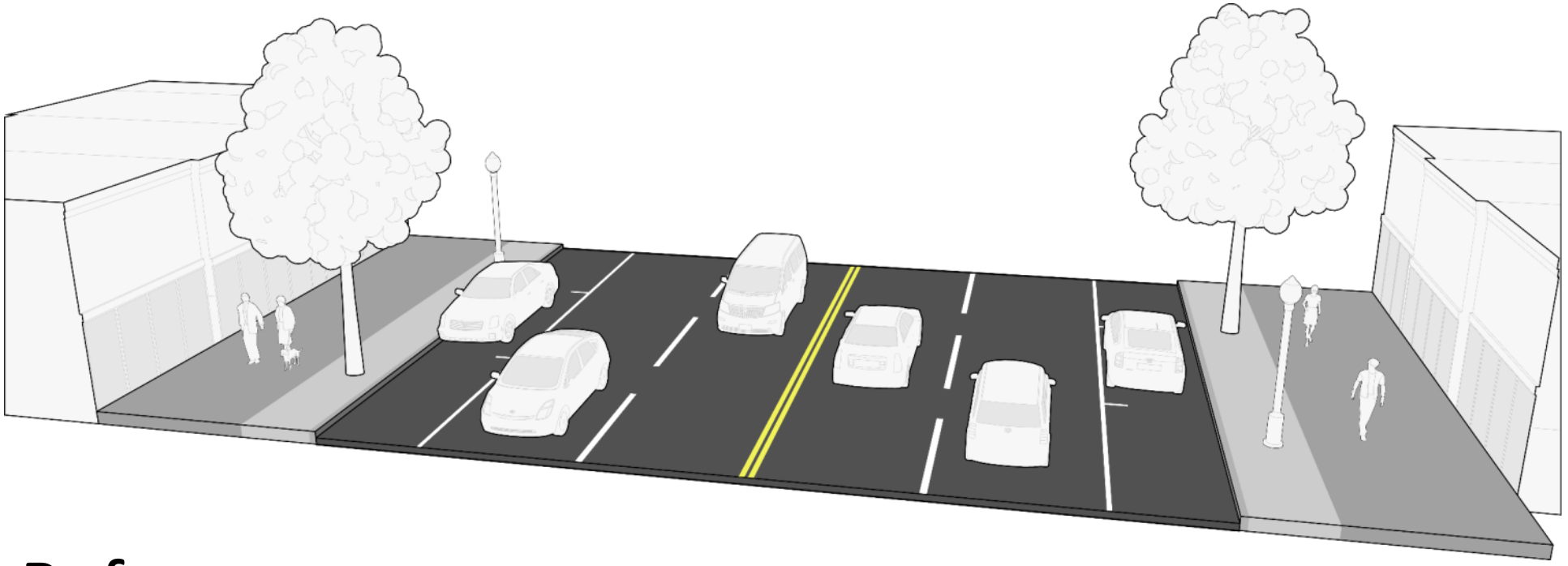
- Road Diets in SHSPs

  http://safety.fhwa.dot.gov/hsip/shsp/state_links.cfm

Road Diet Information Guide: https://safety.fhwa.dot.gov/road_diets/

Method: Lane Diet

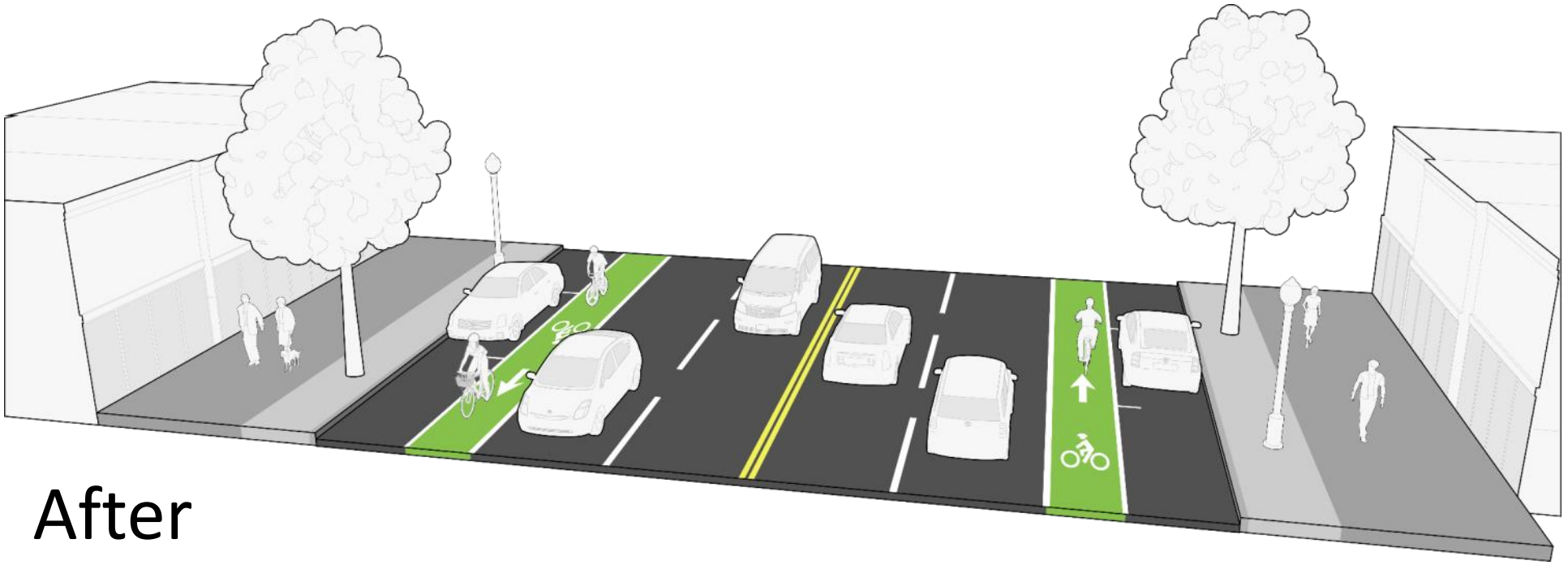
- Lane Diets narrow existing travel lanes
- Extra space can be used for bicycle lane



Before

Method: Lane Diet – Option 1

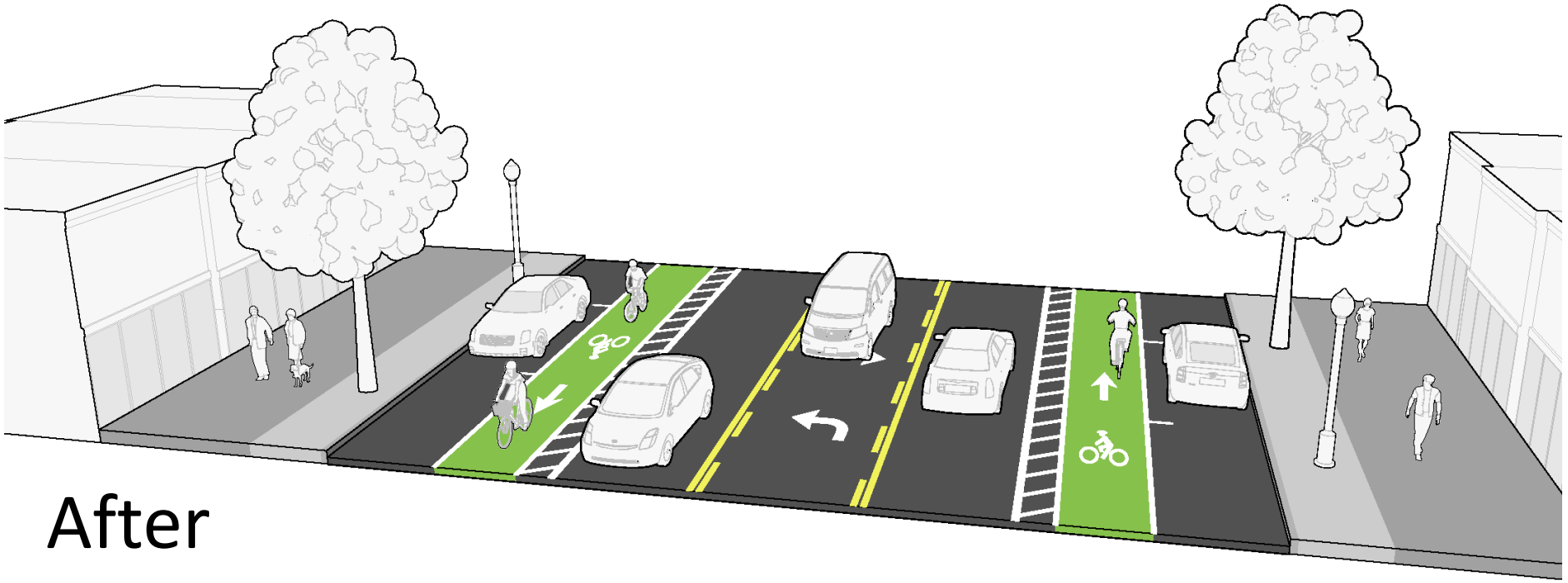
- Narrower travel lanes can slow traffic



After

Method: Lane Diet – Option 2

- A combination of road diet and lane diet provides additional space



After

Method: Lane Diet – Example

- Doesn't always need to ADD bike lanes. Could UPGRADE them too.

Philadelphia, PA

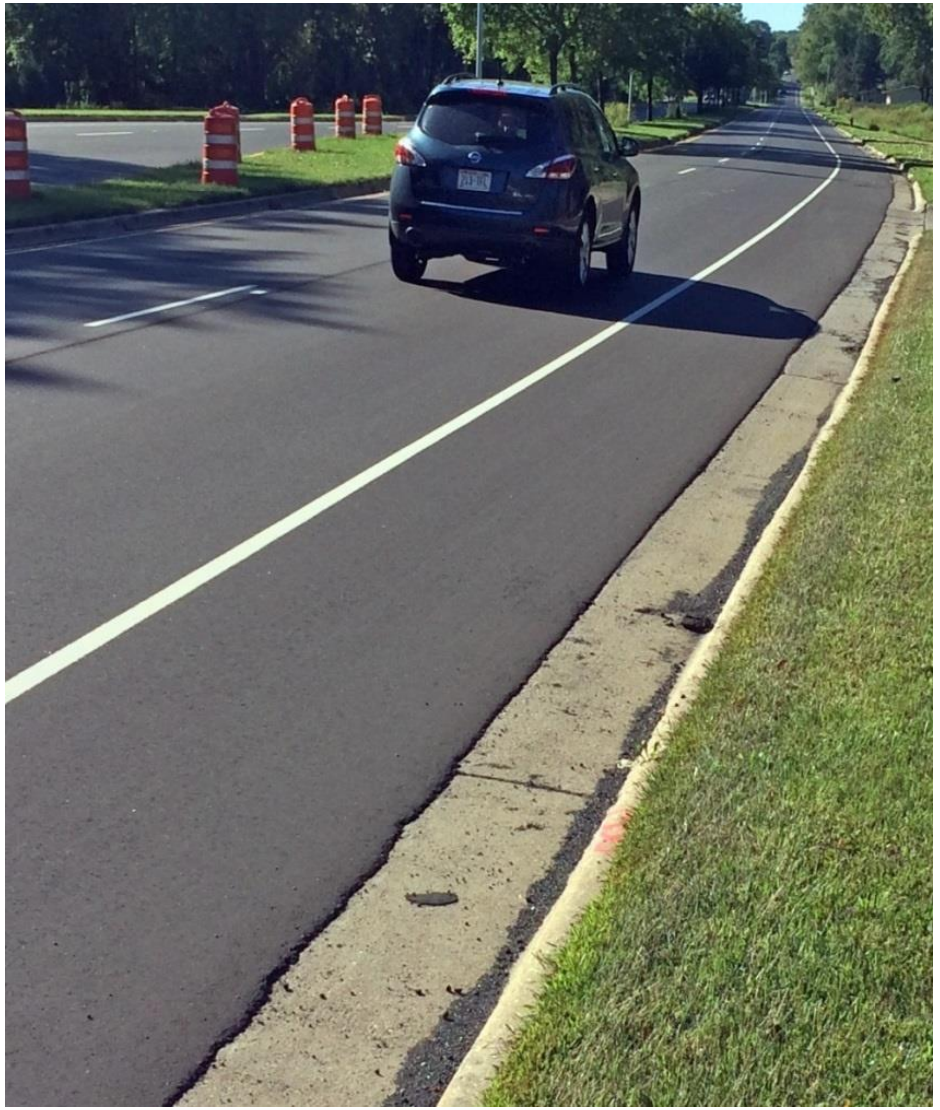
Benefits of Lane Diets

Narrower Lanes

- Provide additional roadway space for bicycle facilities.
- Make it easier to install curb extensions or median crossing islands, providing pedestrian safety benefits.
- Have no significant safety or capacity differences between 10-foot and 12-foot wide travel lanes under most urban and suburban conditions.

Lane Diet Design Considerations

- Helps to have: multiple lanes and wide travel or parking lanes to begin with
- The AASHTO Green Book recommends the following *minimum* travel lane widths:
  - 10-foot lanes for vehicular travel lanes in constrained areas where vehicle traffic is low
  - 10-foot lanes for turn lanes
  - 11-foot lanes to accommodate large volumes (8%+) of trucks, buses, or larger vehicles
- Safety is generally unaffected with narrow lanes

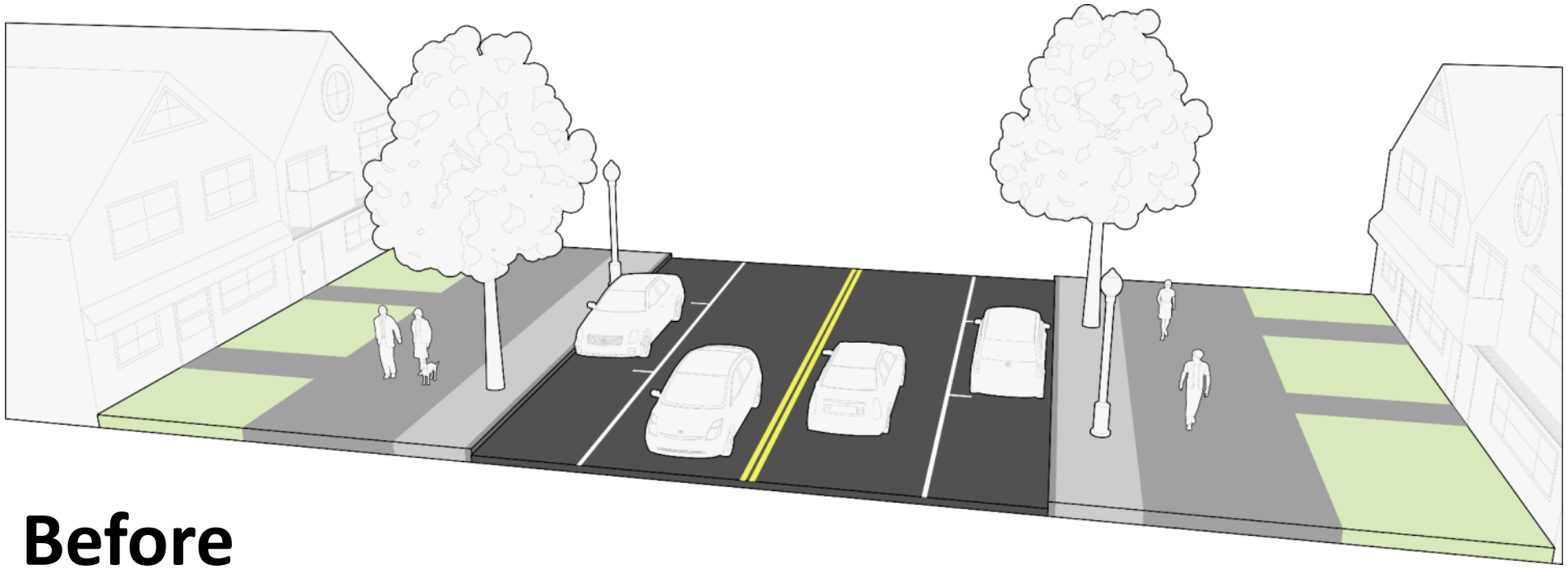


Challenges with Lane Diets

- City and State policies regarding minimum lane widths can be a barrier to Lane Diets.
- What may have potential in urban and suburban areas, will not be appropriate for higher speed, rural roadways
- Many U.S. cities already have 10-foot lanes in the downtown core and cannot narrow them further.
- The public or elected officials may oppose lane narrowing if they believe it will slow traffic or increase congestion on streets that are already congested.

Method: Parking Removal

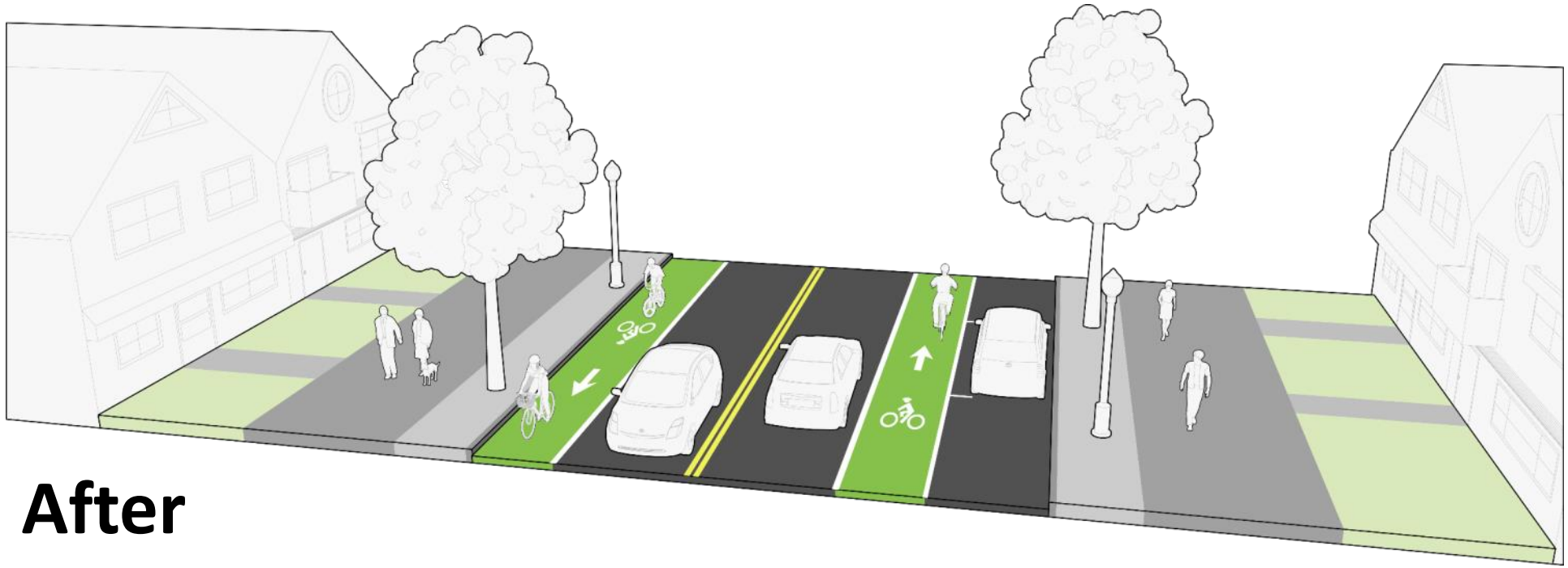
- Parking can be removed where lightly utilized or where there is ample off-street parking
- Often politically challenging



Before

Method: Parking Removal

- Parking can be retained on one side of the street or removed entirely



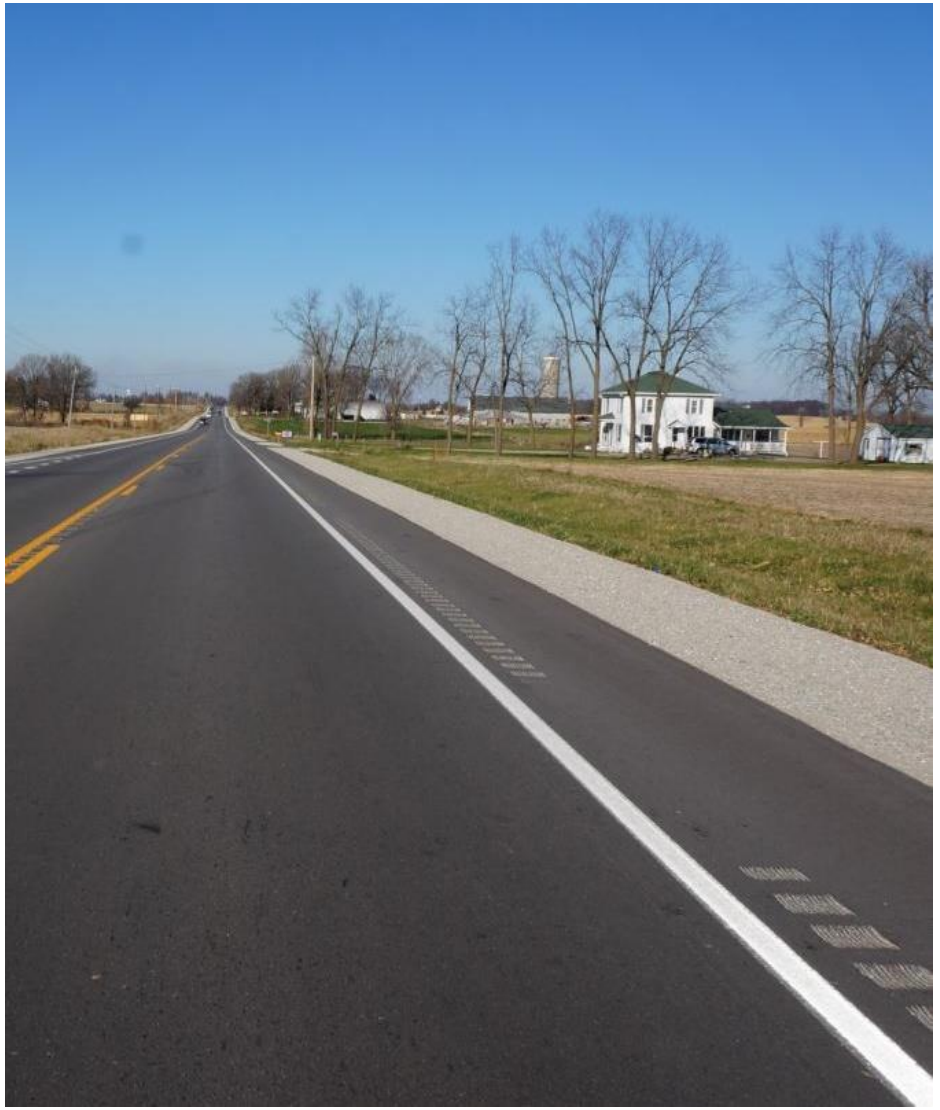
After

Challenges of Removing Parking

- Removes buffer between sidewalk and motor vehicle lane
- May increase motor vehicle speeds
- May still need to provide load/unload zones
- Resident and business support is frequently missing or at odds with removal
- Often lengthens project delivery process
- Removing parking on one side, may cause more pedestrians to cross the street to access their parked cars

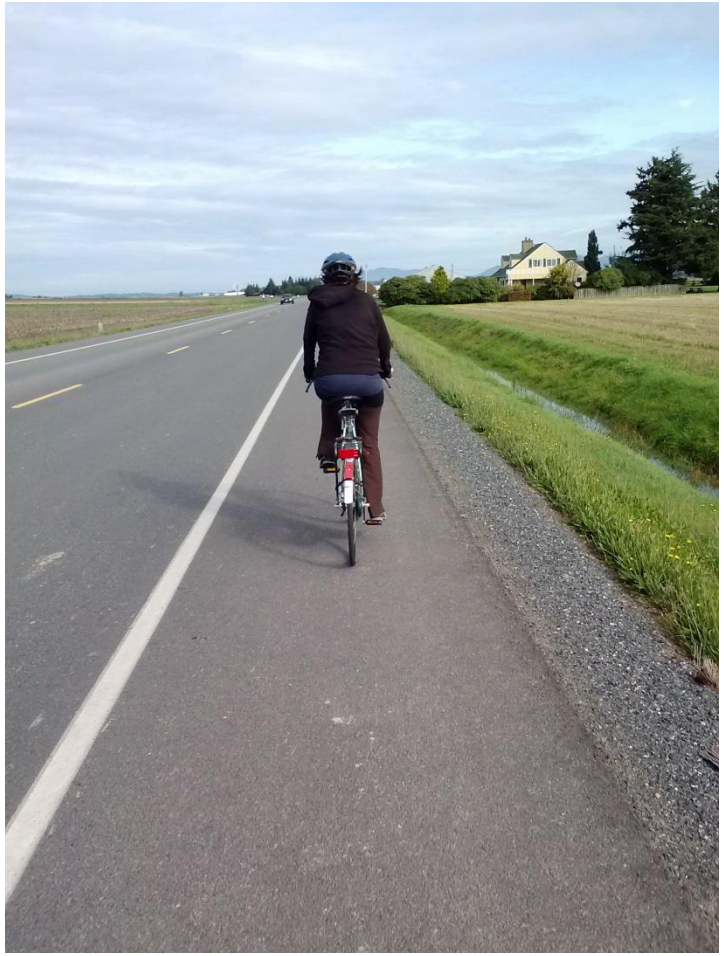
Method: Paving Shoulders

- Paving over existing gravel shoulders
- Involves projects that are beyond mill and overlay such as pavement replacement projects
- Some agencies will add paved shoulders with a major mill and overlay, but generally best to do it with a pavement replacement project
- Can be expensive where there are no existing gravel shoulders



Benefits of Paving Shoulders

- Provides a stable surface for bicyclists
- Improves comfort for bicyclists by providing space outside of the motor vehicle travel lanes.
- Improves roadway drainage
- Extends the service life of the road by reducing edge deterioration
- Reduces shoulder maintenance requirements
- Provides additional operating space for agricultural equipment and maintenance vehicles



Incorporating On-Road Bicycle Networks into Resurfacing Projects

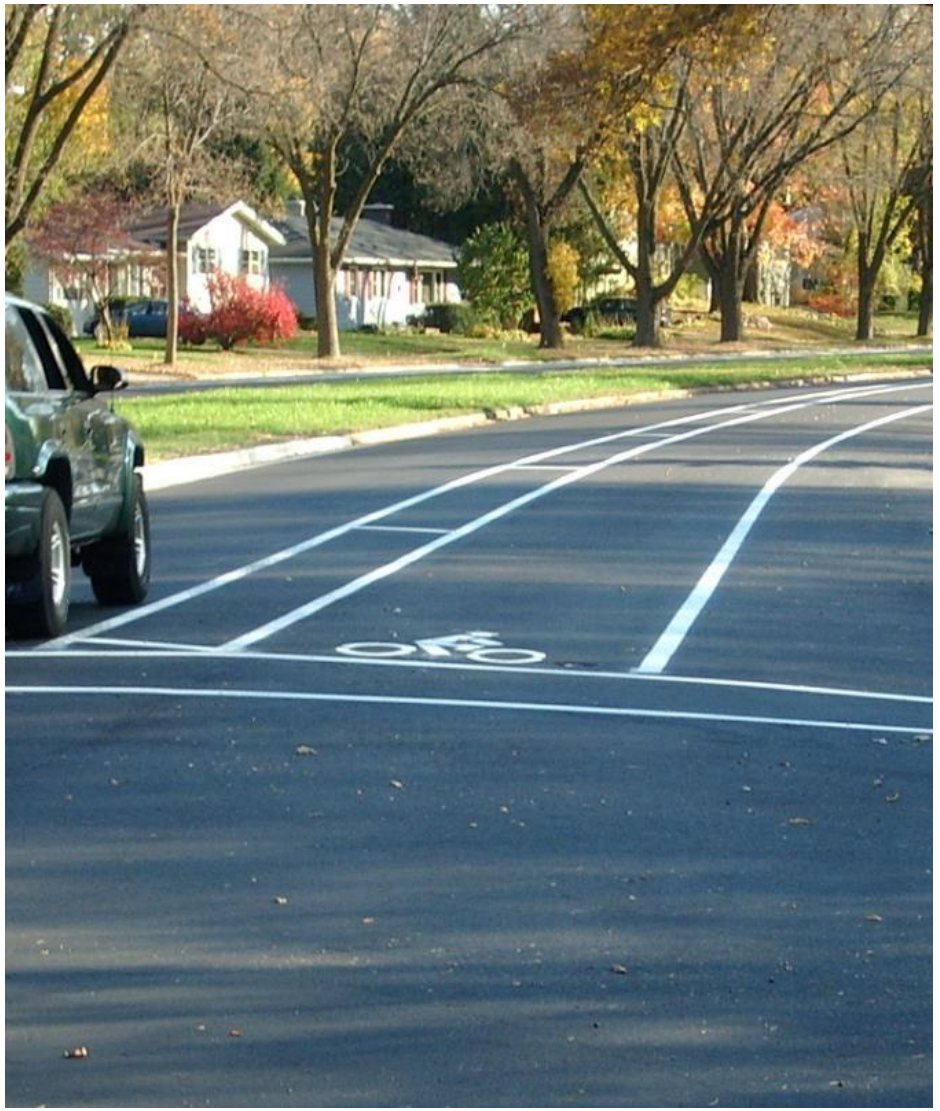
Source: Randy Dittberner, VDOT

Cost & Material Considerations

Source: Randy Dittberner, VDOT

Cost Considerations

- Considerable cost savings by providing bicycle facility with resurfacing
- Quantifiable cost savings – marking eradication, traffic control, marking costs
- Other savings more difficult to quantify
  - Not having to use a separate public involvement process
  - Cleaner markings with no grind marks
  - Not losing out on opportunities for network expansion



Material Considerations

- Cost to install and maintain
- Durability
- Retroreflectivity
- Friction coefficient (avoiding slippery surface)
- Applied using existing agency labor and equipment or contractor
- Ability to remove markings if changes occur

Resource on Cost comparisons & Life-cycle cost

- A **National Cooperative Highway Research Program (NCHRP) Synthesis 306: *Long-Term Pavement Marking Practices*** provides cost comparisons and a life-cycle cost table
- In general, thermoplastics provide a life of two to three times that of paint for long lines,
  - Costs averaged almost five times that of paint
- Epoxy markings had a life of two to three times that of paint
  - Cost four times that of paint
- For life-cycle costs, paint was half the cost of thermoplastic
  - Costs and durability ranged significantly in this study.

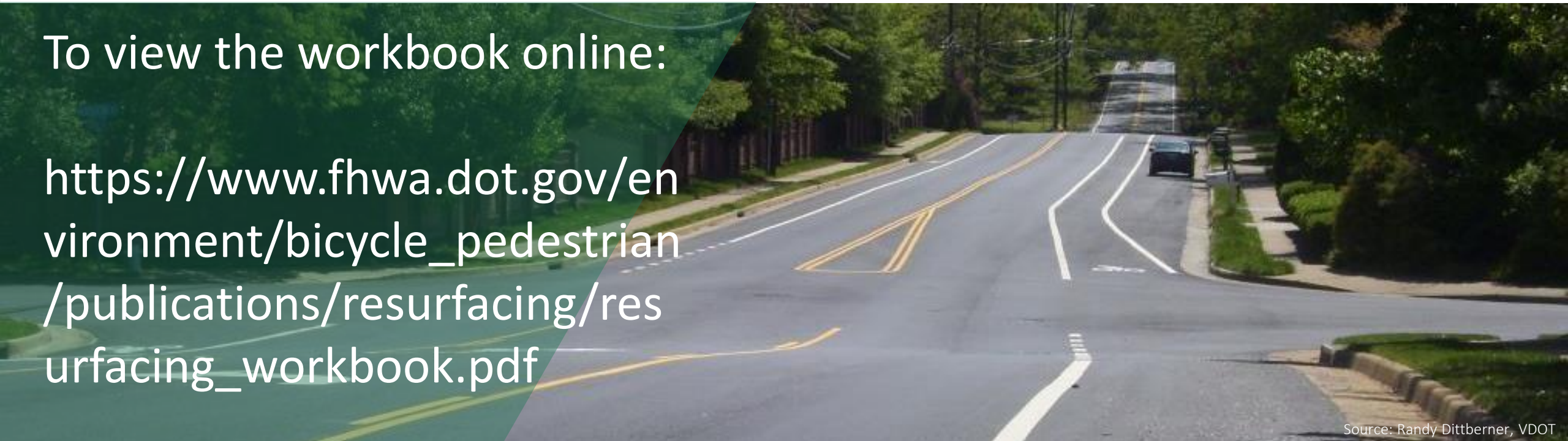
Incorporating On-Road Bicycle Networks into Resurfacing Projects:

Discussion

Source: Randy Dittberner, VDOT

To view the workbook online:

https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/resurfacing/resurfacing_workbook.pdf



Source: Randy Dittberner, VDOT