



RAISING THE FLOOR FOR SAFETY

NCHRP Report 1036: Guide for Roadway Cross Section Reallocation

VASITE Annual Meeting
June 15, 2023

Raising the Floor For Safety – Guide for Cross Section Reallocation (aka NCHRP 1036)

- Why + Who
- What: Three key takeaways
 - Daylighting decision making
 - Raising the floor for safety
 - All day operations
- How could you use this research?

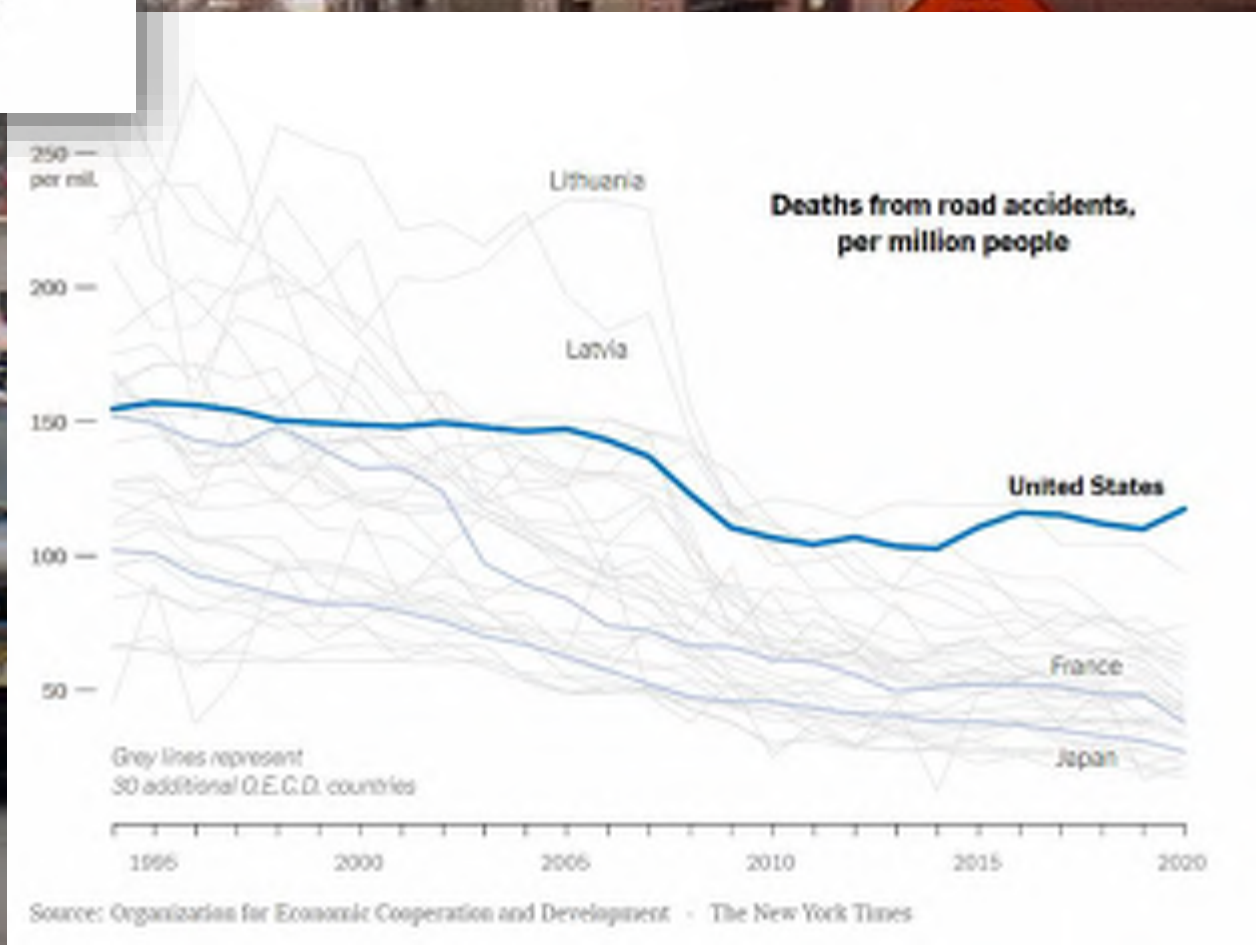


Nov. 27, 2022

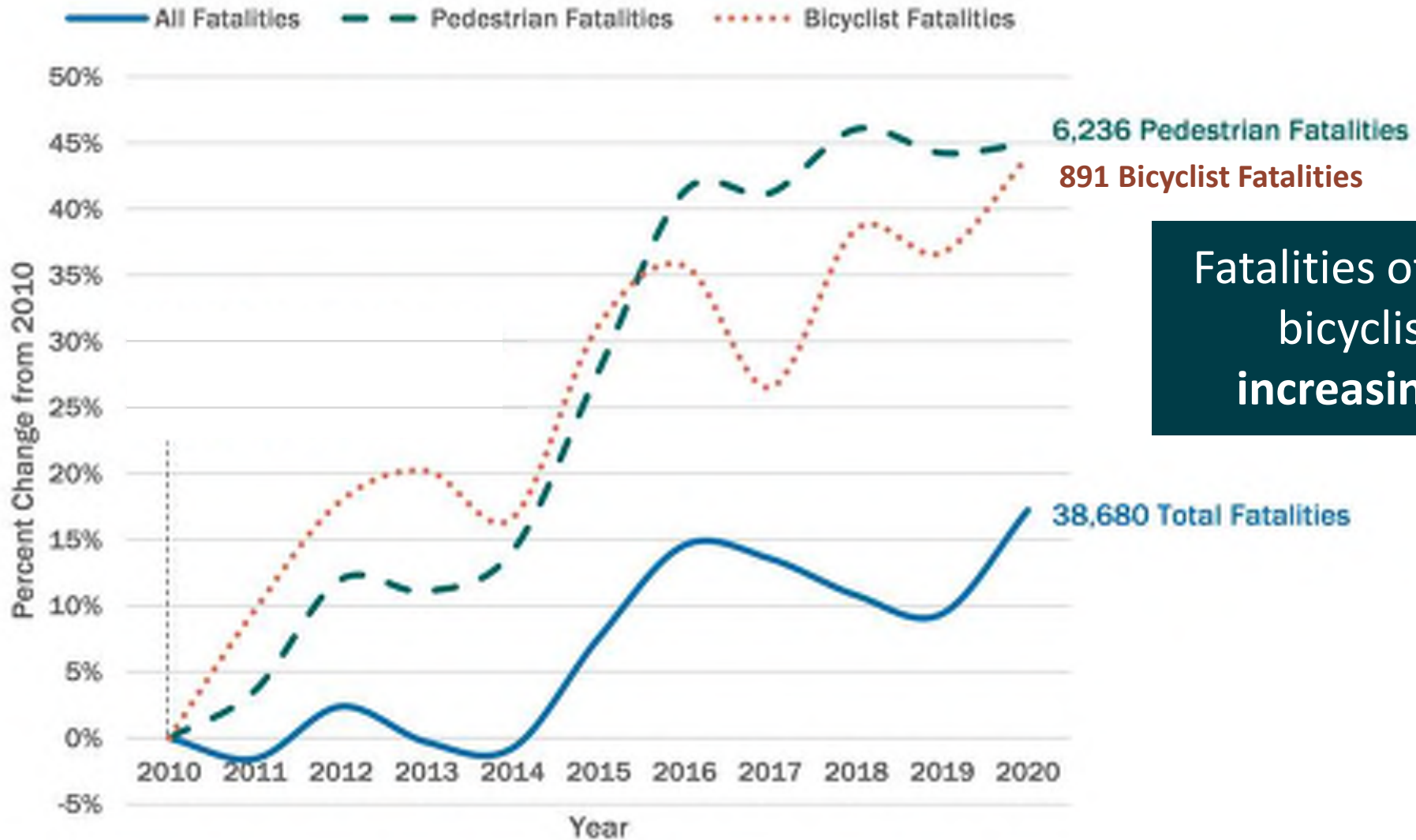
The New York Times

The Exceptionally American Problem of Rising Roadway Deaths

Why other rich nations have surpassed the U.S. in protecting pedestrians, cyclists and motorists.



WE HAVE A NATIONAL ROADWAY SAFETY PROBLEM – AND IT IS GETTING WORSE... ESPECIALLY FOR PEOPLE WALKING AND BIKING



Fatalities of pedestrians and bicyclists have been increasing even greater

FHWA IS LEADING THE SHIFT – TO THE SAFE SYSTEM APPROACH

The **Safe System Approach** aims to eliminate fatal and serious injuries for all road users by:



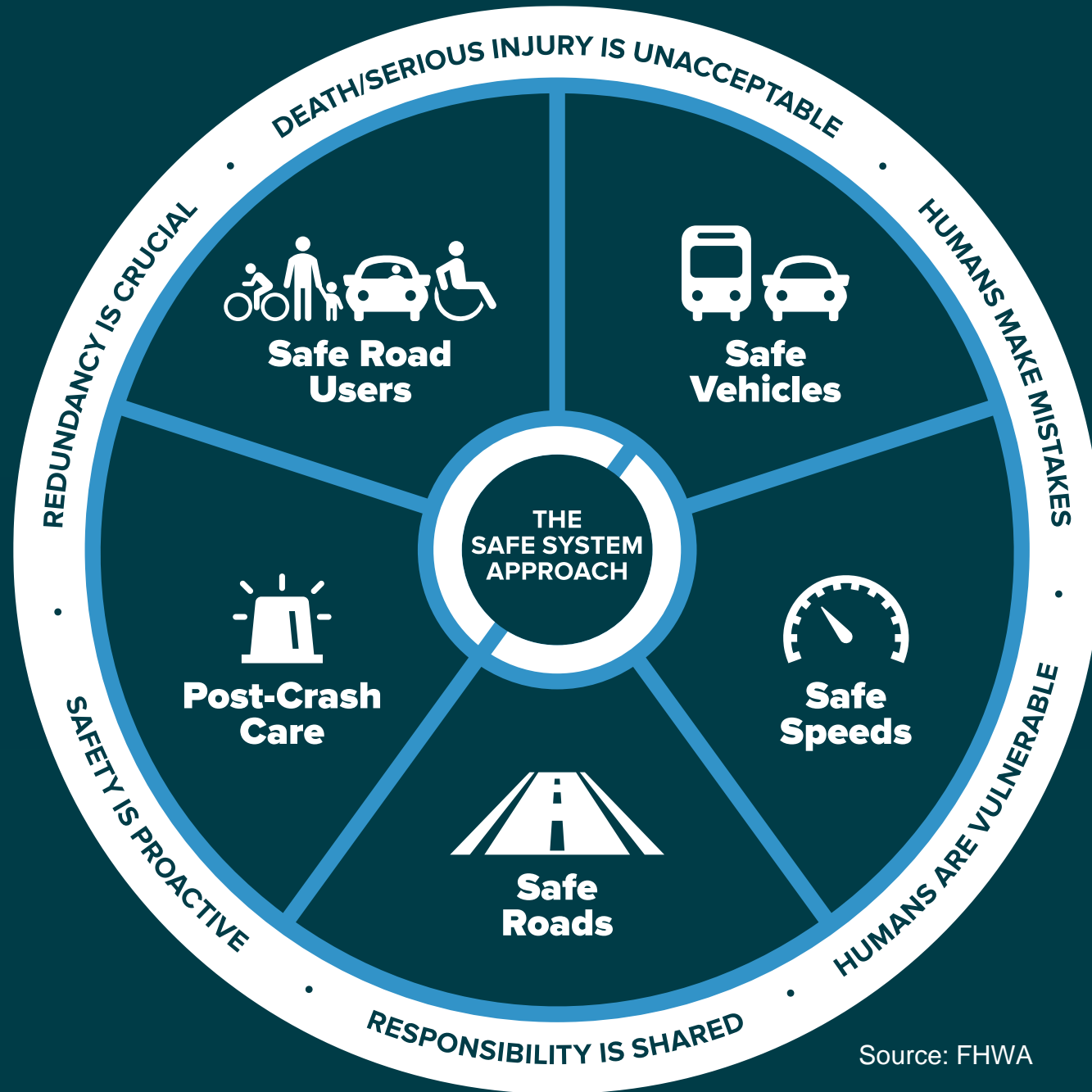
Accommodating human mistakes

PARADIGM SHIFT →



Keeping impacts on the human body at tolerable levels

THE SAFE SYSTEM APPROACH



Source: FHWA

ZERO IS POSSIBLE - OSLO, NORWAY

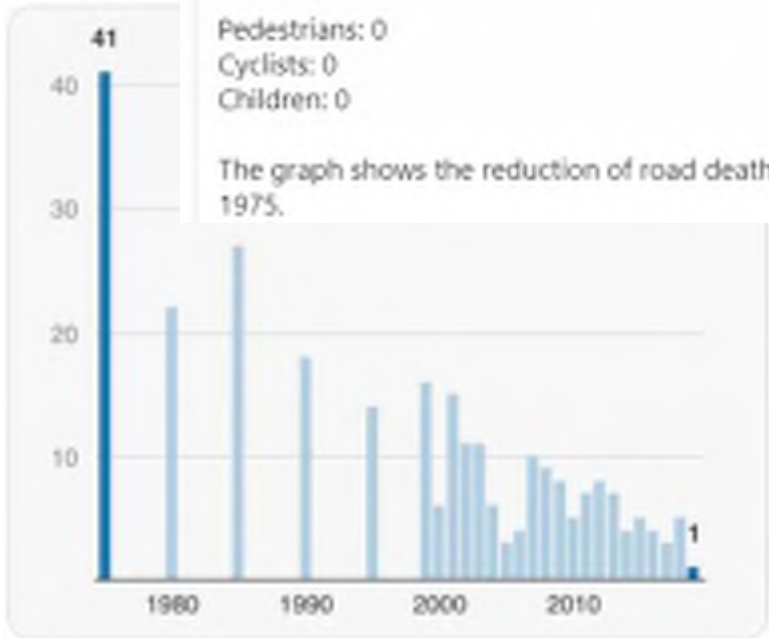
Anders Hartmann
@andershartmann

This makes me happy:

Road deaths in Oslo (pop. 673,000) in 2019:

Pedestrians: 0
Cyclists: 0
Children: 0

The graph shows the reduction of road deaths since 1975.



Oslo saw zero pedestrian and cyclist deaths in 2019. Here's how the city did it.

Reducing the number of cars reduced the number of traffic fatalities

By *Ashna Walker* | *roadsidekick.com* | Jan 3, 2020, 1:00pm EST



How Helsinki and Oslo cut pedestrian deaths to zero

After years of committed action, neither city recorded a single pedestrian fatality in 2019

Vision Zero! Norwegian Capital Completely Quashes Road Deaths

Oslo recorded zero cycling and pedestrian fatalities in 2019 and U.S. cities can learn from its example.

By *Alice Short* | Jan 3, 2020



50% increase in tolls across the city, while car parking charged increased 100%

design, removed space for cars and

HOBOKEN VISION ZERO

CURBED

GETTING AROUND | JUNE 17, 2022

Hoboken Hasn't Had a Traffic Death in Four Years. What's It Doing Right?

By Christopher Robbins



Photo: Chris Robbins

WHY DOES HOBOKEN NEED VISION ZERO?

PREVENTABLE CRASHES ARE OCCURRING ON HOBOKEN'S STREETS

There were 4,451 total crashes, 13 of which resulted in serious injury or death, between 2014 and 2018 on the streets of Hoboken. Many of these occurred at specific 'high crash frequency intersections' at major gateways to Hoboken. Most crashes involve vehicles, but people walking or biking are much more likely to be injured or killed in crashes.

VULNERABLE TRAVELERS

92% Motor Vehicle	5% Pedestrian	3% Bicycle
60% Motor Vehicle	27% Pedestrian	13% Bicycle

People walking and bicycling are involved in 8% of all crashes but 40% of those resulting in serious injury or death.

CRASHES THAT RESULT IN SERIOUS INJURY OR DEATH

People walking and bicycling are more likely to be severely injured or killed than those in a car.

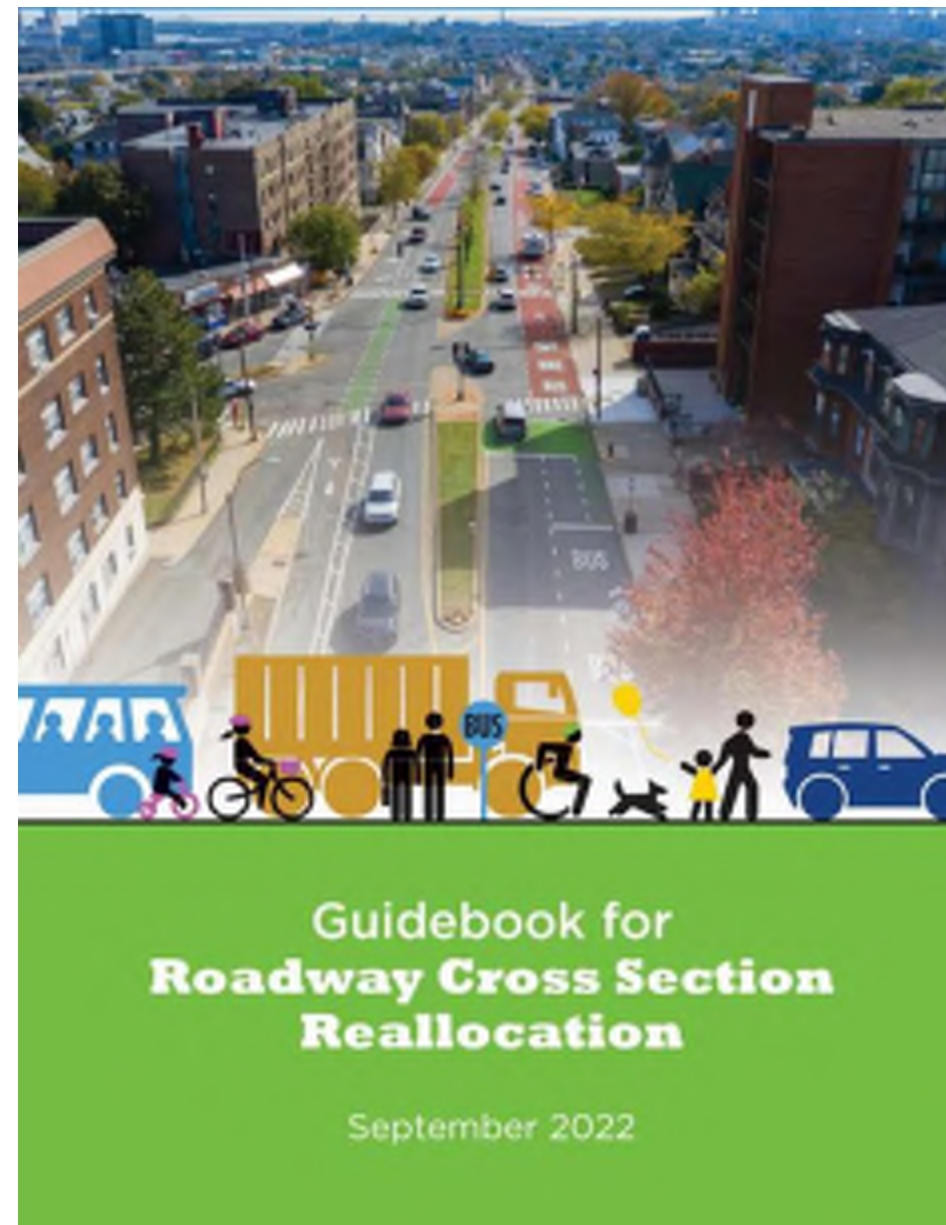
76% of pedestrian-involved crashes	67% of bicycle-involved crashes	9% of auto-involved crashes
31% of head-on auto-involved crashes	21% of right angle auto-involved crashes	

COMMON CRASH CAUSES AND LOCATIONS

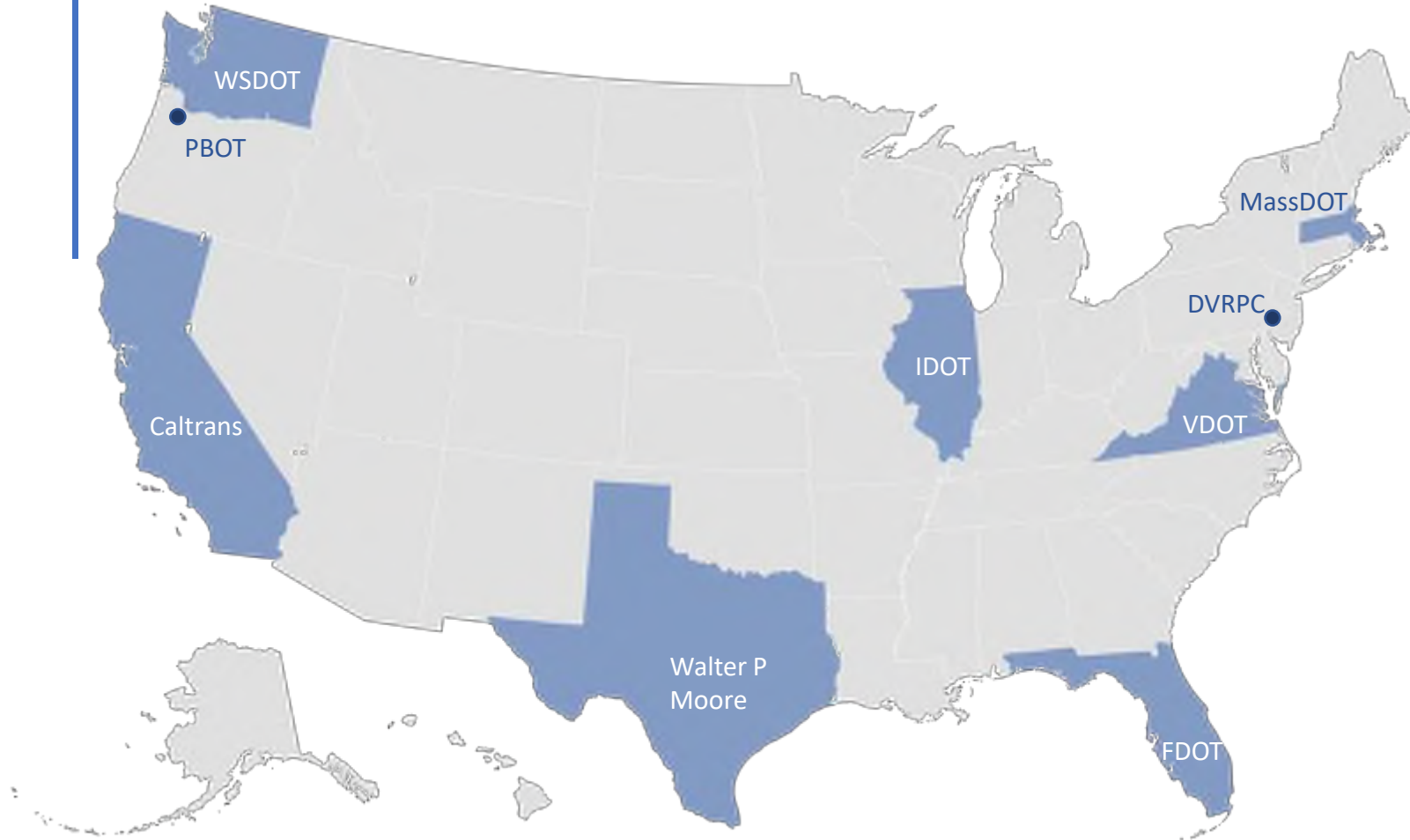
71% Driver inattention caused 71% of preventable crashes.	88% A large majority of bicycle and pedestrian crashes occurred in crosswalks at intersections.	63% Most bicycle crashes occurred on a bicycle facility.	30% Vehicles hitting parked cars accounted for 30% of all crashes.
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A NEW PARADIGM

- **NCHRP 1036:** Roadway Cross Section Reallocation – A Guide
- A new framework for allocating roadway space
- Daylighting decision-making
- Raising the floor on safety
- Connecting decisions to outcomes



WHO WAS INVOLVED?



NCHRP Research Panel

Agency (Current Role)	Panel Member
Caltrans	Antonette Clark
Delaware Valley Regional Planning Council (CALSTART)	Al Beatty
Florida DOT	Jeremy Fletcher
Illinois DOT	Jonathan McCormack
Massachusetts DOT (Toole Design)	Michelle Danila
Portland Bureau of Transportation	Karla Kingsley
VDOT/VTRC	Peter Ohlms
Walter P Moore	April Eke
Washington DOT	Celeste Gilman
FHWA	Clayton Wellman
AASHTO	Patricia Bush
NCHRP	Dianne Schwager

Project Team

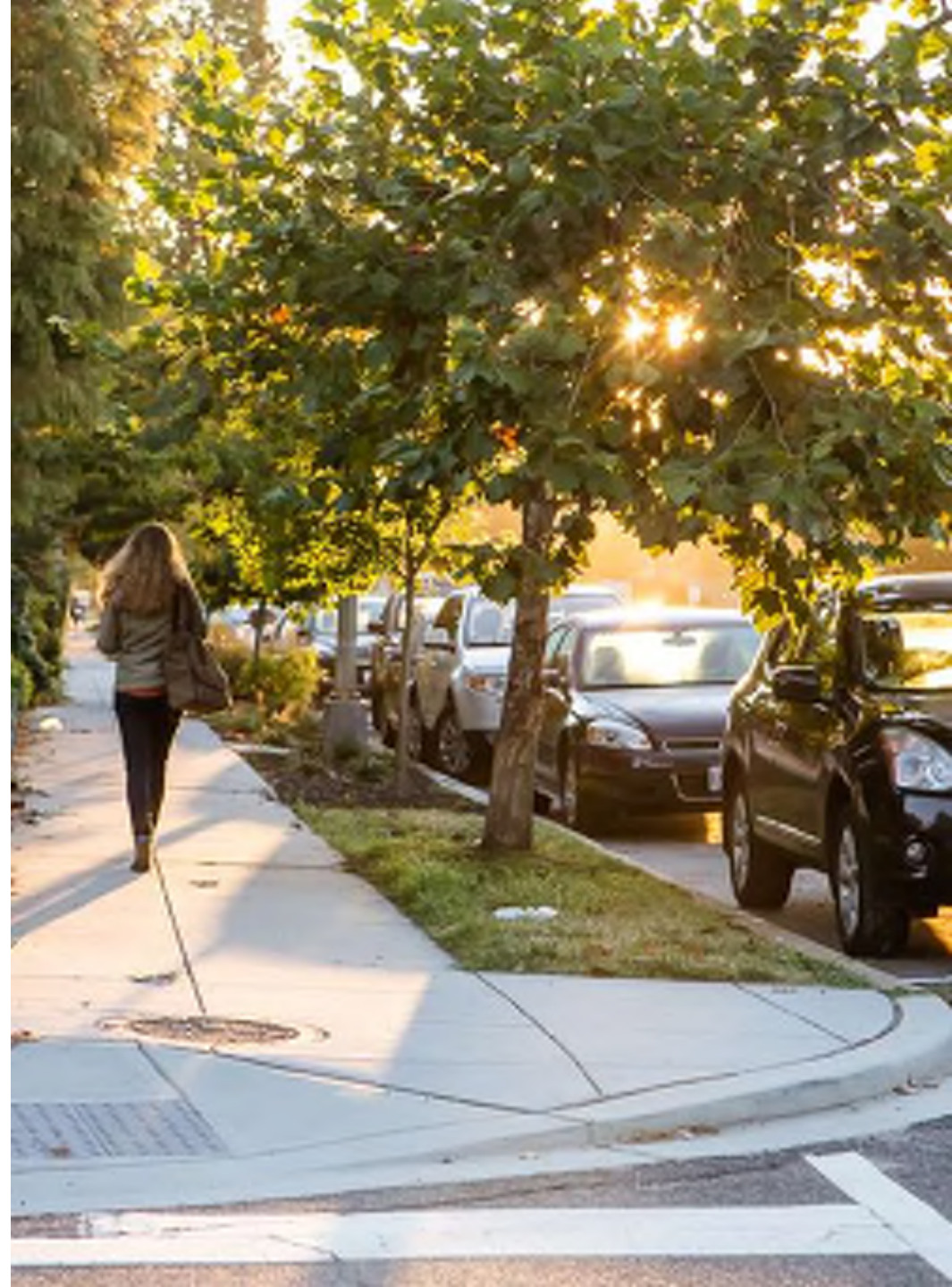
Kittelson, Mobycon, Safe Streets, ITRE



DAYLIGHT DECISION-MAKING

BARRIERS TO SAFE STREET DESIGN

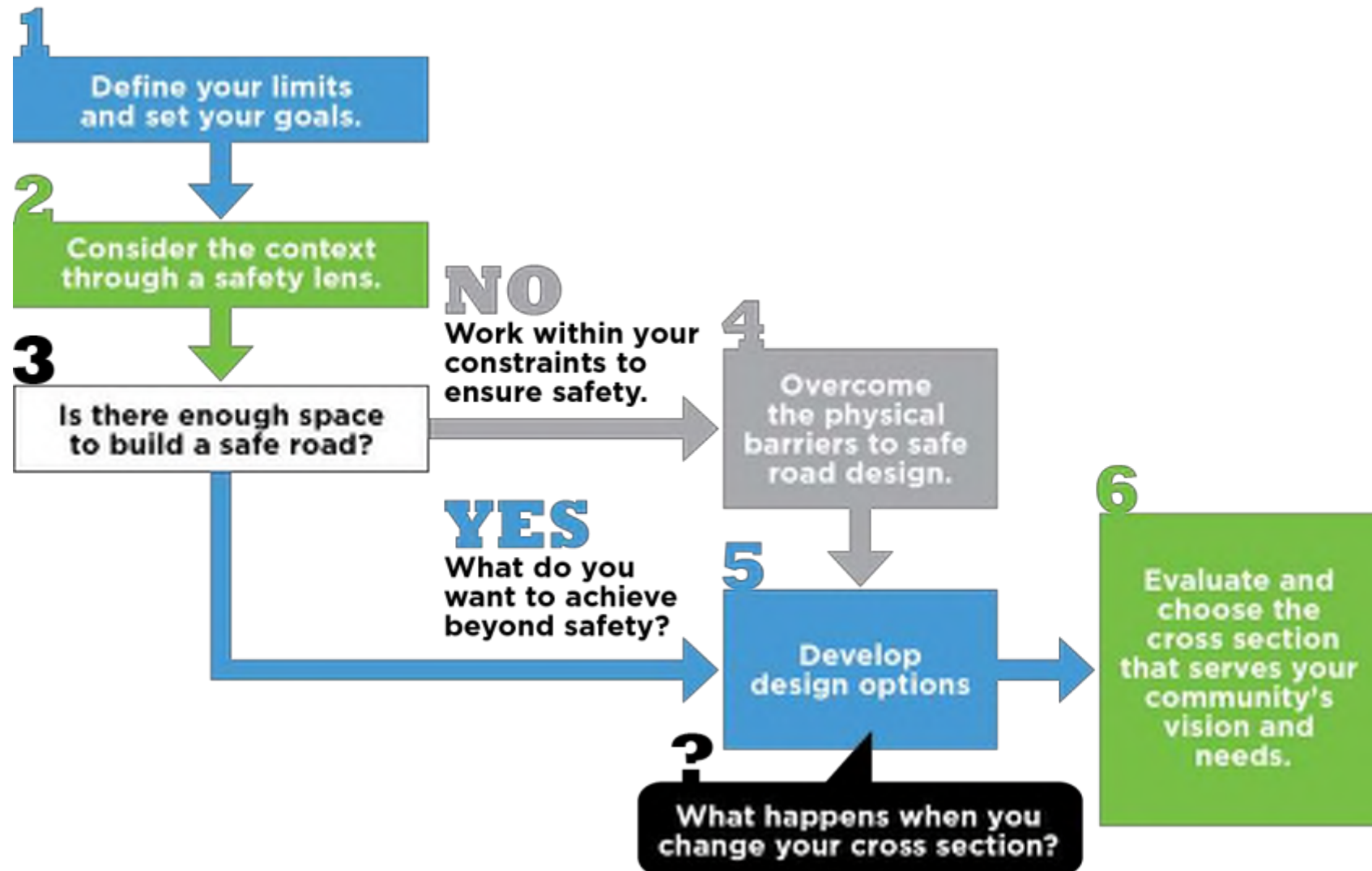
- Agencies are looking for information to support changes to the cross section
- Peak hour intersection operations limit cross section opportunities
- Lack of transparency in the decision-making process
- In practice, safety has not always been the top priority



RETHINKING HOW WE USE OUR STREETS



A NEW DECISION-MAKING FRAMEWORK



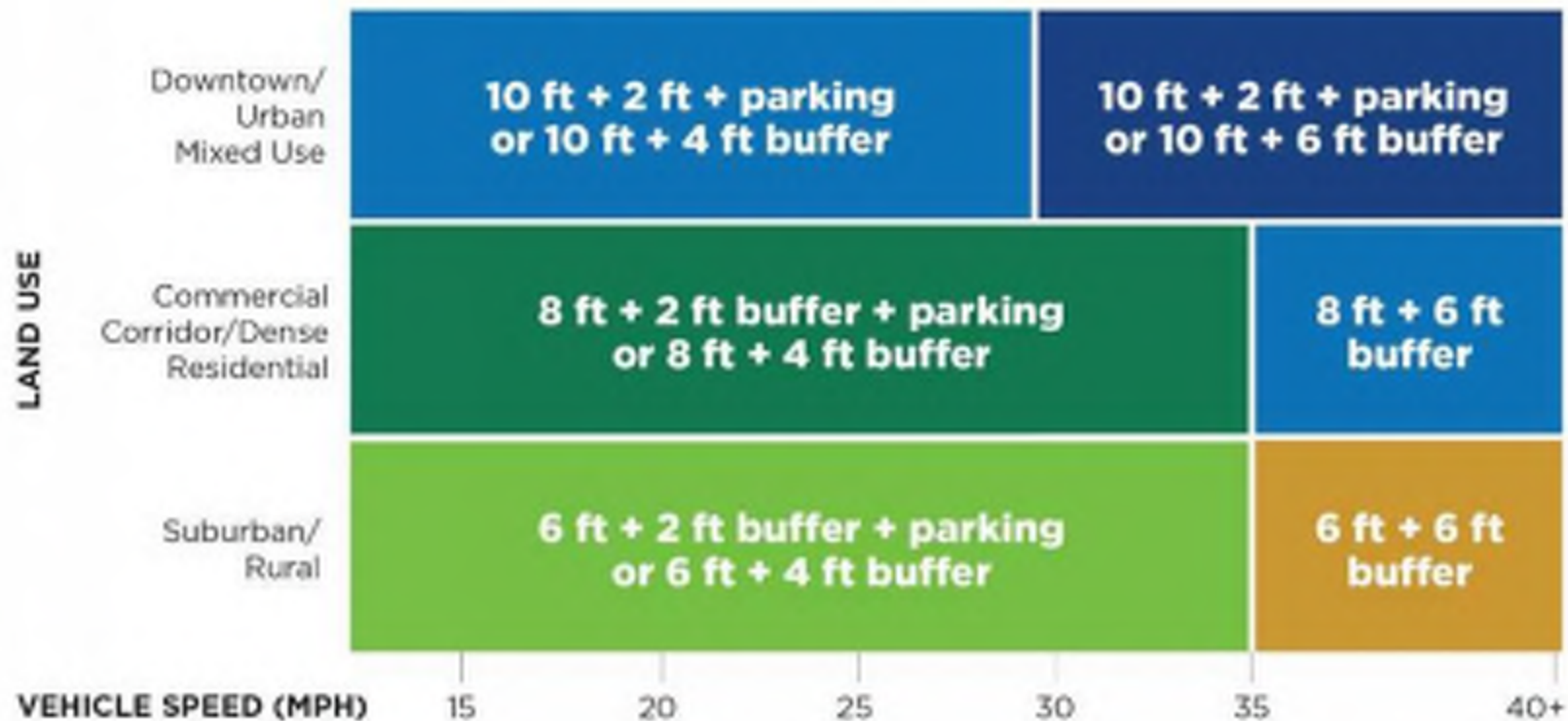
RAISING THE FLOOR ON TRANSPORTATION SAFETY



RAISING THE FLOOR ON TRANSPORTATION SAFETY

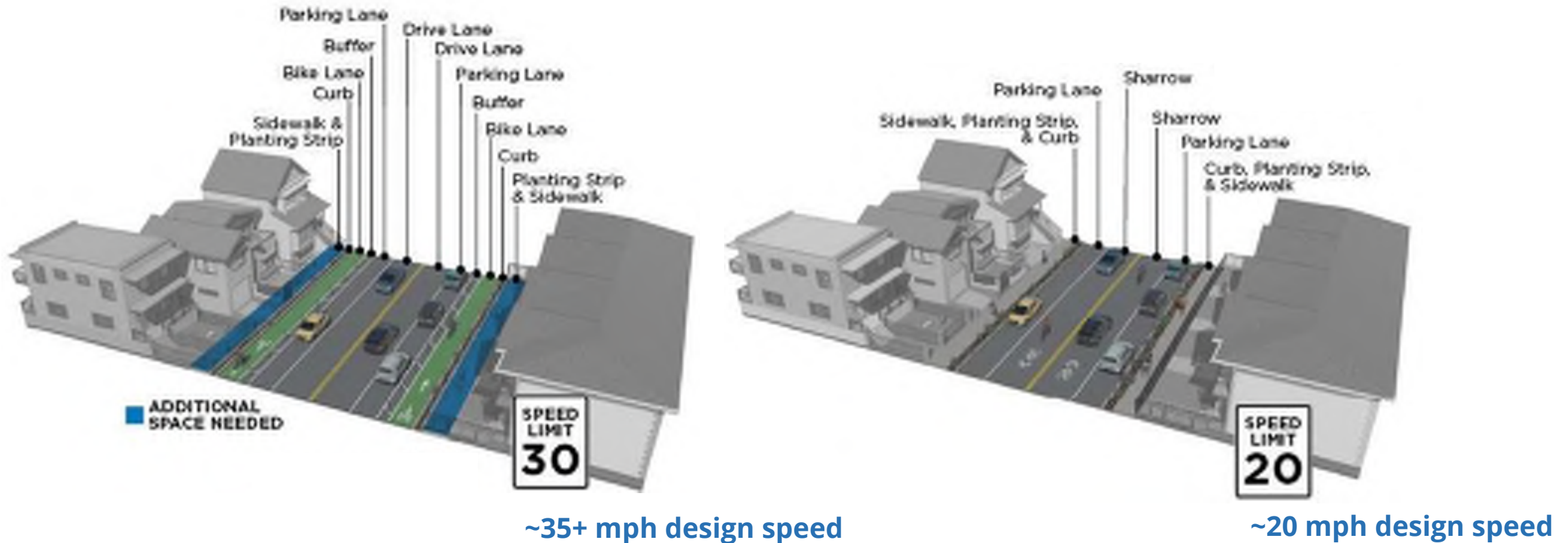


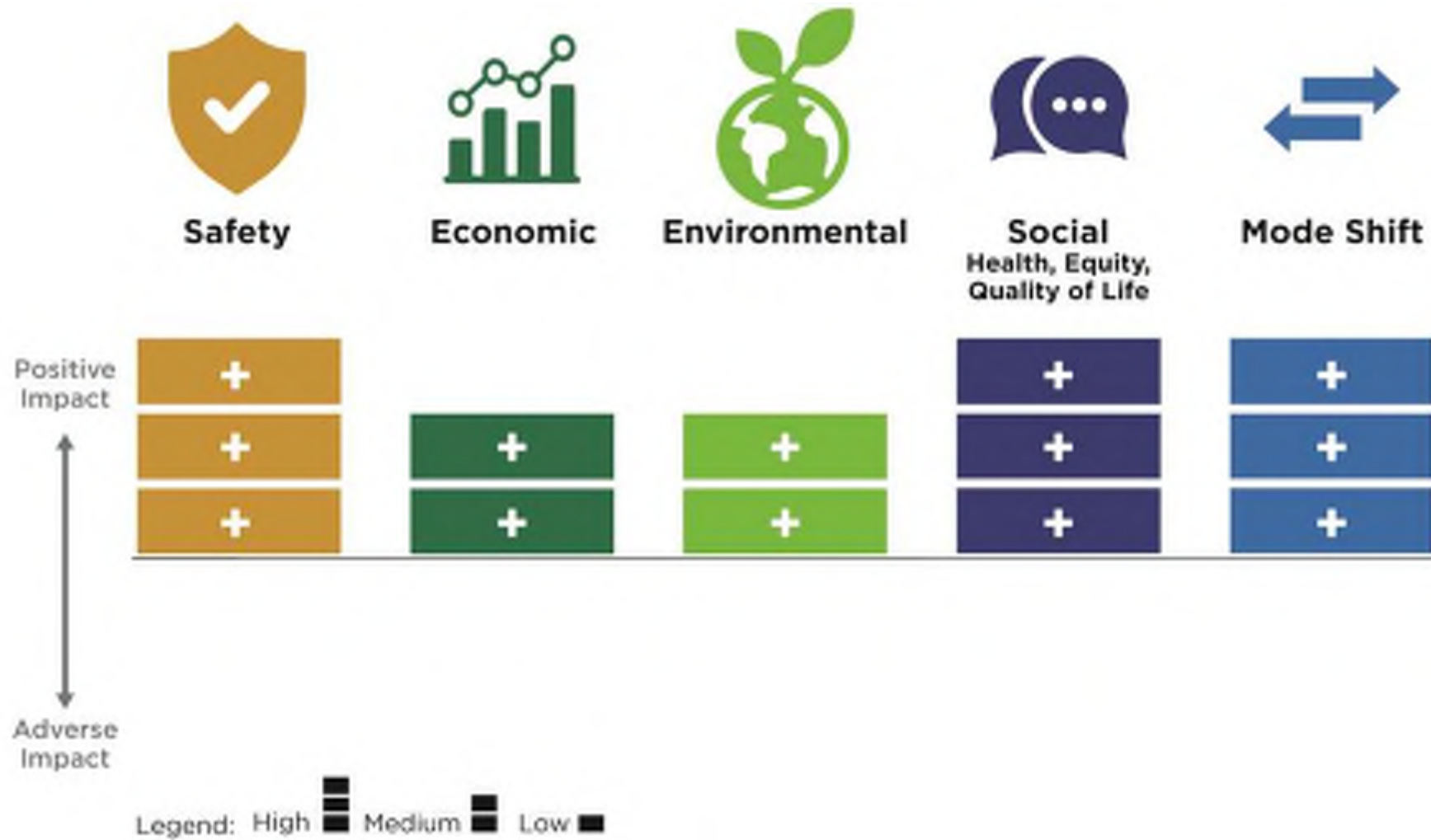
RAISING THE FLOOR ON TRANSPORTATION SAFETY



Overcome the physical barriers to safe road design.

Lower Speeds





Outcomes of adding bicycle lanes

“That won’t work.”

Traditional Guidance/Practice

“Capacity and other traffic analyses typically focus on the peak-hour traffic volume because it represents the most critical period for operations and has the highest capacity requirements.”

- Source: HCM 7th Edition Chapter 3

“Customary practice in the United States is to base rural highway design on the 30th highest hour of the year. There are few hours with higher volumes than this hour, while there are many hours with volumes not much lower. In urban areas, there is usually little difference between the 30th and the 200th highest hour of the year, because of the recurring morning and afternoon commute patterns.”

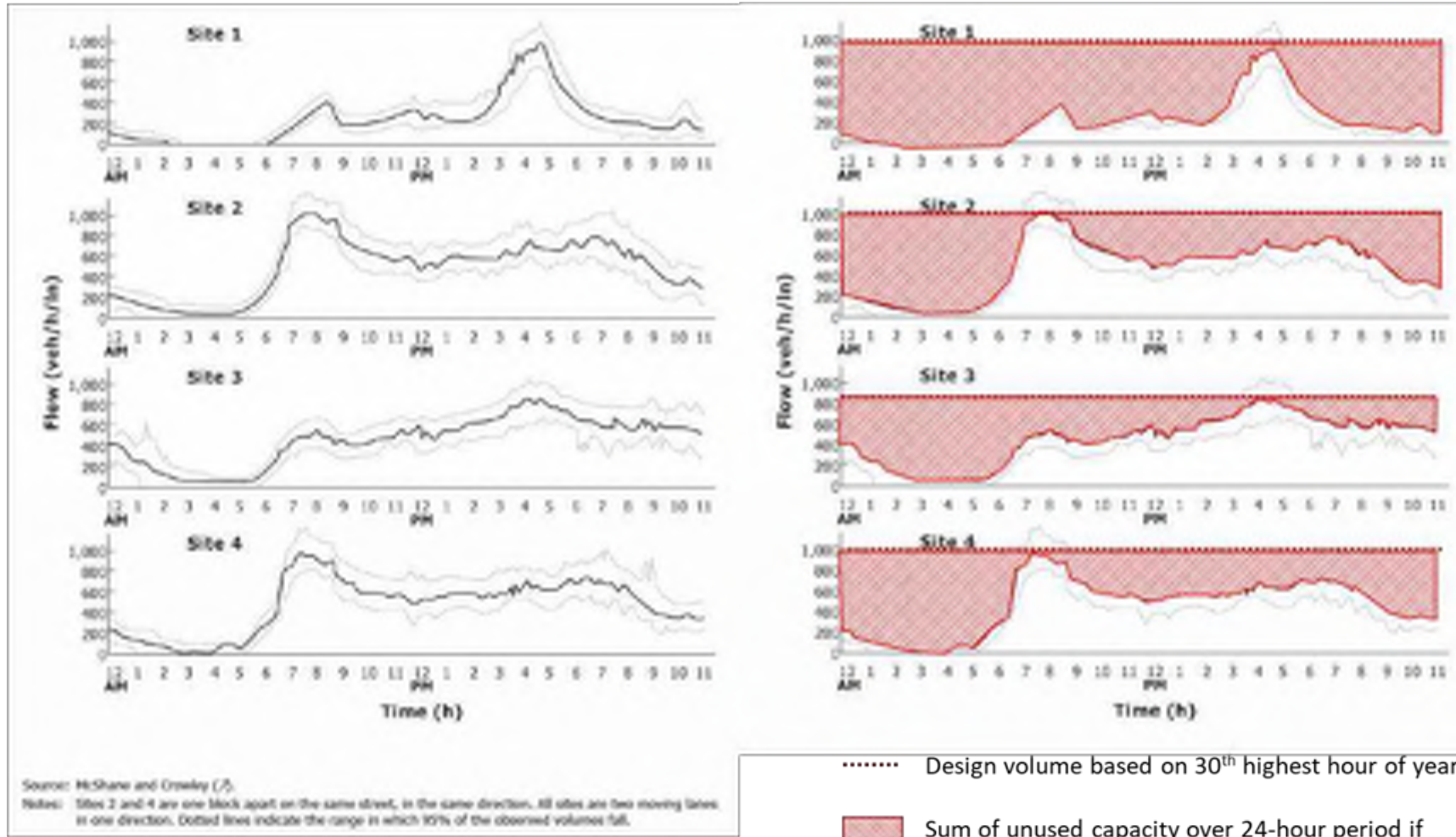
- Source: HCM 7th Edition Chapter 3

“The design hourly volume (DHV) for rural area highways, therefore, should generally be the 30 HV of the future year chosen for design.”

“Therefore, in urban area design, the 30th highest hourly volume can be a reasonable representation of daily peak hours during the year.”

- Source: AASHTO 2018 Green Book

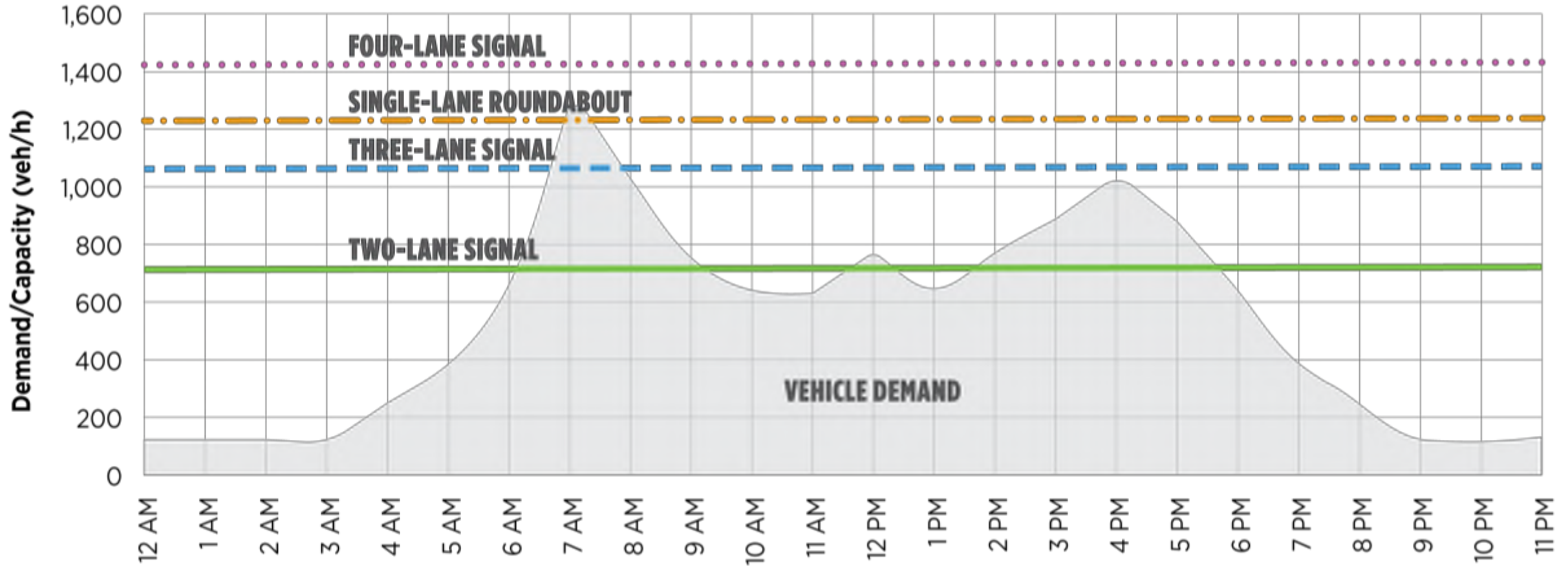
Designing for peak-hour capacity and the 30th highest hourly volume results in unused capacity for most of the day!



Source: Adapted from HCM 7th Edition Chapter 3

ALL-DAY INTERSECTION ASSESSMENT

Illustrative Example



4 LANE



7AM



NOON



7PM



WHAT'S WRONG WITH UNUSED CAPACITY?

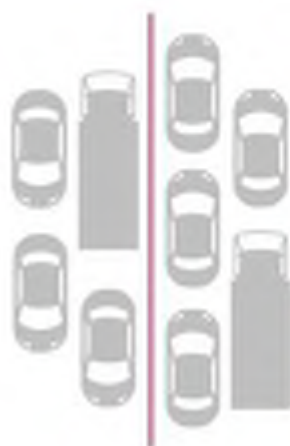
UNDER CAPACITY = HIGHER SPEEDS

WHICH ARE ASSOCIATED WITH INCREASED AND MORE SEVERE CRASHES



OVERDESIGNING FACILITIES

FOR CARS MAKES THEM LESS SAFE FOR PEOPLE WALKING AND BIKING



THE MORE TRAVEL LANES, THE

LONGER WAIT TIMES

FOR ALL MODES

STREETS MAKE UP MORE THAN



OF PUBLIC SPACES IN CITIES AND TOWNS

THE 24-HOUR CAPACITY FRAMEWORK



HOURLY DEMAND-TO-CAPACITY (D/C) RATIO

allows practitioners to assess whether demand exceeds capacity at any time during the day and, if so, for how long



The percentage of the hours between 5:00 a.m. and 9:00 p.m. the street utilizes at least 50% of its potential capacity

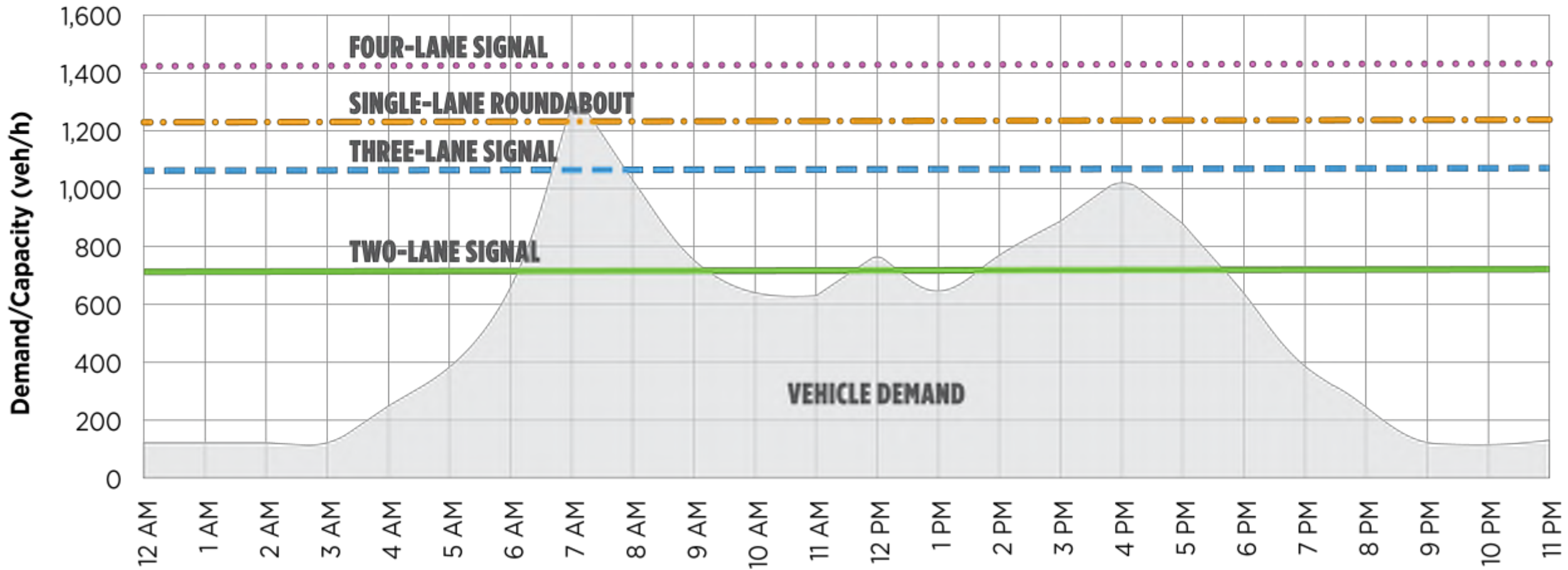
The lane-capacity provided for but unused during that 16-hour period



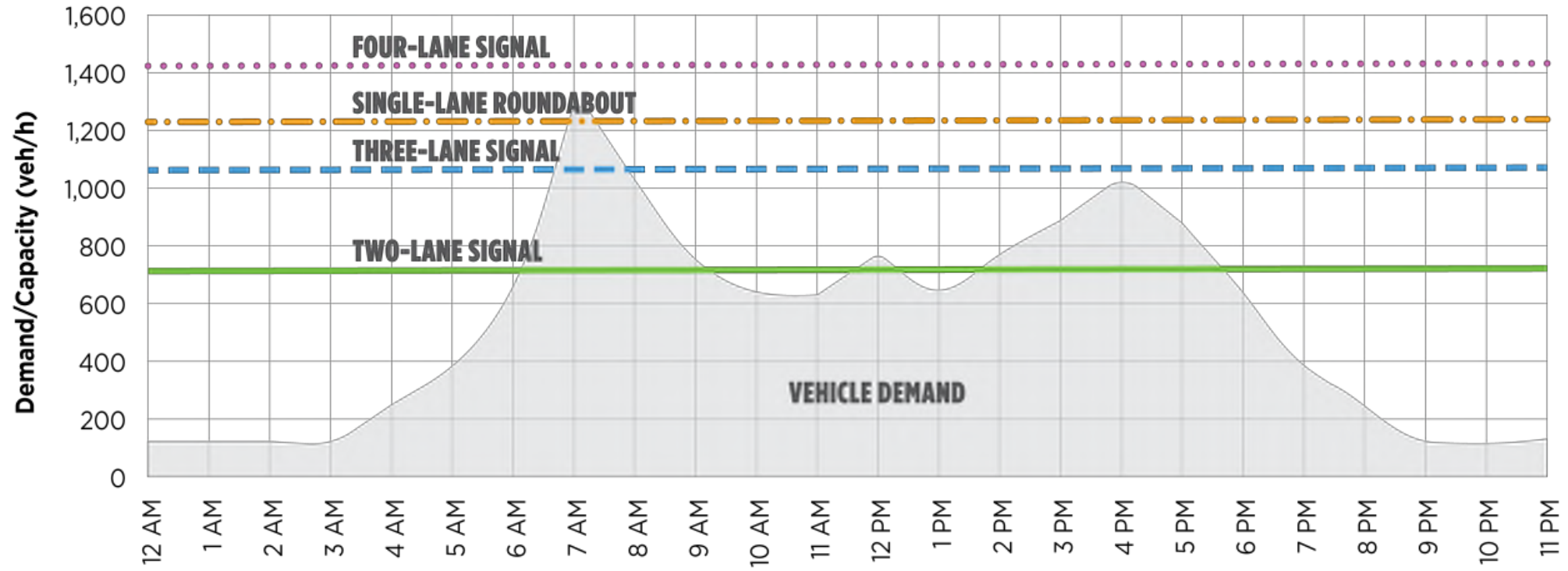
The number of hours (out of 24) during which the street is operating below capacity



ALL-DAY INTERSECTION ASSESSMENT



ALL-DAY INTERSECTION ASSESSMENT



Intersection Control	Max Demand-to-Capacity Ratio (d/c)	16-Hour Efficiency	16-Hour Excess Capacity (Lane Hours)	Total Hours Below Capacity
FOUR-LANE SIGNAL	0.89	31.3%	15.9	24
THREE-LANE SIGNAL	1.18	50.0%	8.2	23
TWO-LANE SIGNAL	1.77	81.3%	2.2	16
SINGLE-LANE ROUNDABOUT	1.02	50.0%	6.7	23



7AM



NOON



7PM

4 LANE



3 LANE



How could you use this research?

- How could you see yourself applying this approach?
- What about this approach is exciting? What about it makes you feel queasy?
- What challenges/opportunities do you expect when balancing traffic operations with other goals?





THANK YOU!

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DECISION-MAKING TOOL

- bit.ly/NCHRP1036_Guide
- bit.ly/NCHRP1036_RepavingTool
- bit.ly/NCHRP1036_ReconstructionTool

NCHRP Project 15-78
Decision-Making Framework Tool - Repaving Projects

This spreadsheet tool is provided as a decision-making support tool to accompany the NCHRP Project 15-78 Guidebook. It is strongly encouraged to use this tool alongside the referenced sections of the guidebook, as this tool is intended to help implement the framework presented in the guidebook.

The objective of this research is to develop a guidebook and decision-making framework for roadway designers, planners, and others for identifying, comparing, evaluating, and justifying non-traditional cross-sectional reallocations of existing urban and suburban roadway space for multimodal safety, access, and mobility.

This Repaving spreadsheet tool is intended for road repaving projects where it is assumed the curb lines cannot be moved. For reconstruction projects, refer to the Reconstruction spreadsheet tool.

This tool includes the following tabs:

Step 1: User Input	Start here and enter all project information. Once complete, press the "Generate minimum safe dimensions" button. You will be automatically directed to the next appropriate tab (either 2A or 2B).
Step 2A: Insufficient Space	Use this tab to explore options to fit the desired project and minimum safe facilities within the available ROW. If unavailable to fit within ROW, you can adjust your desired AADT or speed, which may relax your width requirements.
Step 2B: Sufficient Space	If available cross-section elements fit within ROW, use this tab to guide decision-making about how best to use the remaining ROW width.
Steps 3A - 3D	These pages will display your results, including the cross-section summary, impact summary, and capacity analysis. Note: This page includes the decision support matrix.

Throughout the tool, cell color is an indicator of how to interact with various fields:
Blue: a selection or type directly in blue cells.
Yellow: automatically calculated (do not edit).
Cells with red text include notes to keep in mind when designing your cross-section.

Considerations for Use:

- Separate workbooks are provided for repaving projects and for reconstruction projects. For the former, we assume it is assumed that some changes would be infeasible (e.g., widening sidewalks). For the latter, the user should consider a two-way to one-way conversion, the user should simply enter out appropriate values in user should restart with Step 1.
- Yellow buttons throughout the workbook are important and must be used in order to generate the correct results. Workbook must be reset between uses. Press the button below or in Step 1 to reset.

[Click here to reset workbook between iterations](#)

Table of Contents | Step 1 User Input | Step 2A Insufficient Space | Step 2B Sufficient



1 Define your limits and set your goals.



How much space do you have to work with?



What purpose does the road serve?



What are your community's priorities?

2 Consider the context through a safety lens.



A safe street must be safe for all users!



Determine the **minimum safe travel space** for people walking, bicycling, riding transit, and driving.

4 Overcome the physical barriers to safe road design.



Reduce dimension needed for driving



Reduce dimension needed for bicycling/walking



Lower speed



Reduce vehicle volumes



Safe parallel facility



Close street to traffic



Convert to shared street (woonerf)

5 Develop design options: what happens when you change your cross section?

Choose a few suitable alternatives to evaluate. The community priorities from Step 1 may make some options more desirable.



**Wider
Sidewalk**



Bus-Only Lanes



**On-street
parking**



Medians



**Add Traffic
Lanes**



**Wider
Bike Lanes**

6 Evaluate and choose the cross section to serve your vision and needs.

Compare the likely outcomes of the alternatives you developed in Step 5.

