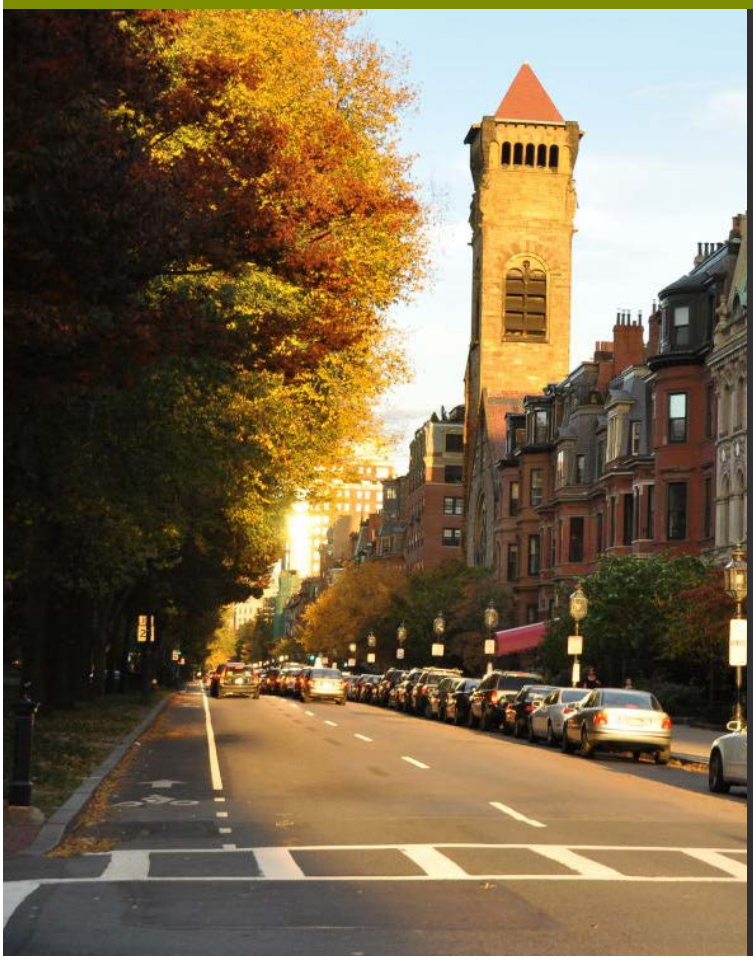
# DESIGN CRITERIA AND LANE WIDTH



Design criteria are values, such as lane widths, shoulder widths and design speeds, which vary depending on the functional classification and context of the roadway. Designers make decisions about these criteria early in project development, and these decisions should reflect the desired purpose and function of a street and prioritize the safety of all users. This design topic provides an introduction on how designers should approach selecting design criteria for multimodal roadways.

Designers sometimes adhere strictly to the most conservative values, leading to wider streets, large curves, and higher operating speeds. This may result in a design that meets all the design criteria, but has a high crash rate compared to expectations.

Designers have flexibility in selecting design criteria and are not always required to choose the most conservative values. Understanding the local context of the roadway, needs of the community, and desired function of the roadway will help the designer identify the appropriate design criteria.

## KEY DESIGN FLEXIBILITY

The **2011 AASHTO Green Book** recognizes that functional classification of highways can lead to roadway facilities that do not take into account the local context and that design has impacts beyond traffic service:

*"A highway has wide-ranging effects in addition to providing traffic service to users. It is essential that the highway be considered as an element of the total environment. The term 'environment,' as used here refers to the totality of humankind's surroundings: social, physical, natural, and synthetic."*

**AASHTO Green Book 2011, p. 2-86**

## OTHER RESOURCES

*"After a functional classification has been assigned to a roadway, however, there is still a degree of flexibility in the major controlling factor of design speed. There are no 'cookie-cutter' designs for roadways. Instead, there is a range of geometric design options available."*

**FHWA Highway Functional Classification: Concepts, Criteria and Procedures 2013, p. 42**

*"Lane widths of 10 feet are appropriate in urban areas and have a positive impact on a streets safety without impacting traffic operations."*

**NACTO Urban Streets Design Guide 2013, p. 34**

*"Conventional roadway design characteristics, including geometry and speed, are associated with each functional classification, but do not capture the nuances of a roadway's context, nor allow for the idea that a large downtown multiway boulevard might have high capacity, lower speeds, and be enjoyable to walk."*

**FHWA Livability Guide, p. 76**

# APPLYING DESIGN FLEXIBILITY

## SETTING DESIGN CRITERIA

The functional classification of a roadway directs designers to recommended values for each design criterion. Design speed is a fundamental decision because it influences other design criteria such as horizontal and vertical alignment, lane width, shoulder width, grade, and stopping sight distance. For more information, refer to design topics on **Traffic Calming and Design Speed** and **Paved Shoulders**.

The **AASHTO Green Book** allows for flexibility by providing a range of values. For example, design speeds on urban arterials range between 30 and 60 mi/h **(2011, p. 7-27)** and lane width may vary between 10 and 12 feet **(2011, p. 7-29)**. Additional national resources recommend lower design speeds: **NACTO Urban Street Design Guide** recommends a design speed of less than 35 mi/h for urban arterials **(2013, p. 141)** and **ITE's Designing Walkable Urban Thoroughfares** recommends a design speed of 25–35 mi/h for a "Boulevard," which is similar to an arterial **(2010, pp. 70–71)**.

It is essential that designers carefully consider both the context (urban, suburban, rural) and speed of the roadway as these are fundamental elements of design. Some suburban communities and rural towns have characteristics similar to areas typically considered urban. These areas are characterized by denser land use and street networks and increased pedestrian and bicycle activity. As stated in the **AASHTO Roadside Design Guide**, "there also may be whole communities that are separated from the metropolitan center by rural-like conditions but function similarly to an urban area" **(2011, p. 10-2)**. For example, in lower-speed urban environments, the **AASHTO Roadside Design Guide** recognizes that there are limitations to providing large clear zones and offsets should be a minimum of 1.5 feet from the face of curb. 1

## CONTEXT SENSITIVE SOLUTIONS, LIVABILITY, AND PERFORMANCE-BASED PRACTICAL DESIGN (PBPD)

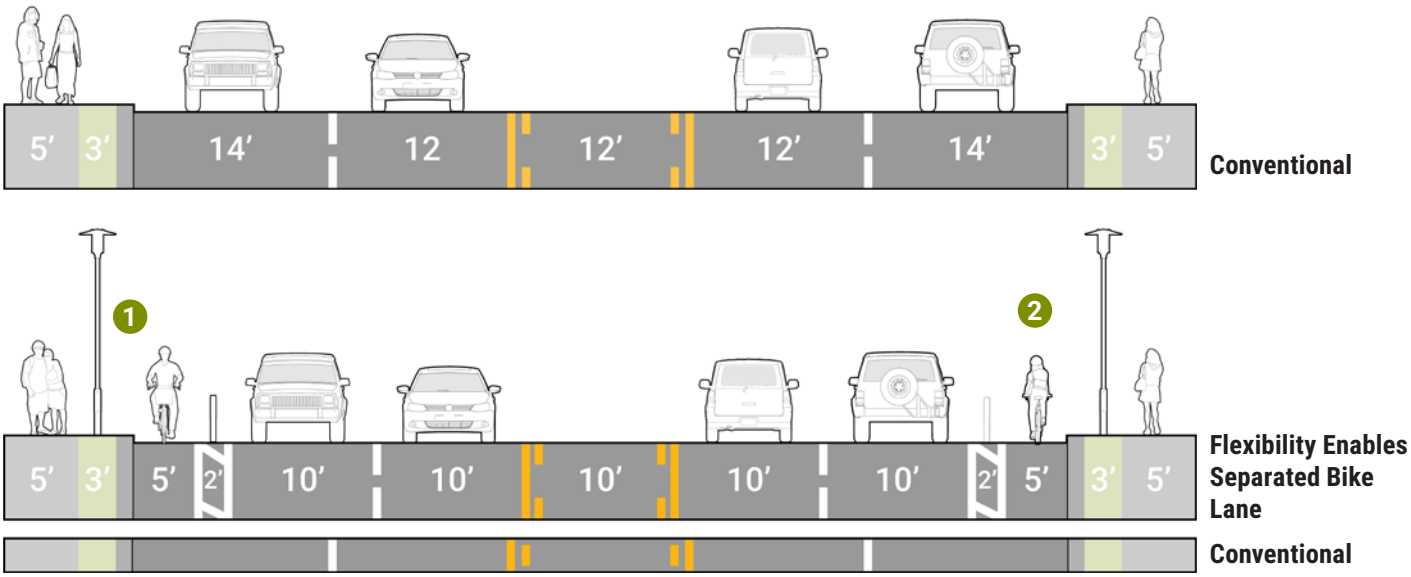
Context-sensitive solutions (CSS), livability, and performance-based practical design (PBPD) rely on flexibility to achieve results that meet a project's purposes and needs. CSS is a collaborative, interdisciplinary approach that includes the viewpoints of all stakeholders in the development of a shared vision of project goals and uses a defined decision-making process. CSS and livability seek transportation solutions that address the needs of all road users and the functions of the facility within the context of its setting, considering land use, users, the environment, and other factors. PBPD complements CSS and livability by highlighting the value of performance information that supports decision-making. For more information on PBPD, refer to **https://www.fhwa.dot.gov/design/pbpd.**

## RECOMMENDED RESOURCES

Several sources provide information on the flexibility available in design criteria selection. In addition to the **AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities** and the **AASHTO Guide for the Development of Bicycle Facilities**, the **NACTO Urban Bikeway Design Guide** and **ITE Designing Walkable Urban Thoroughfares** provide useful information on design criteria flexibility. **(FHWA, "Bicycle and Pedestrian Facility Design Flexibility," memorandum, 2013)**.

## CONTROLLING DESIGN CRITERIA AND DESIGN EXCEPTIONS

Historically, 13 controlling design criteria had been identified by FHWA as having substantial importance to the operational




*Note: One or both of the outside vehicular lanes in all of the graphics could serve as on-street parking, which would provide a traffic calming effect and a physical buffer for pedestrians and bicyclists. For more information, see design topics on **Road Diets and Traffic Analysis** and **Traffic Calming and Design Speed**.*

and safety performance of highways on the National Highway System (NHS). As of May 2016, these criteria have been revised. There are now 10 controlling criteria for high-speed roads. On non-freeways with design speeds under 50 mph on the NHS, only the following two controlling criteria apply: Design Loading Structural Capacity and Design Speed. Refer to FHWA's website for current information. **(Federal Register, Revision of Thirteen Controlling Criteria for Design and Documentation of Design Exceptions, 2016** and **National Cooperative Highway Research Program, Report 783: Evaluation of the 13 Controlling Criteria for Geometric Design, 2015)**

FHWA requires a written design exception if design criteria on the NHS are not met for any of the controlling criteria. For non-NHS roadways, States may have their own design exception processes. Some States require a design waiver to vary from State criteria and a design exception to vary from national criteria.

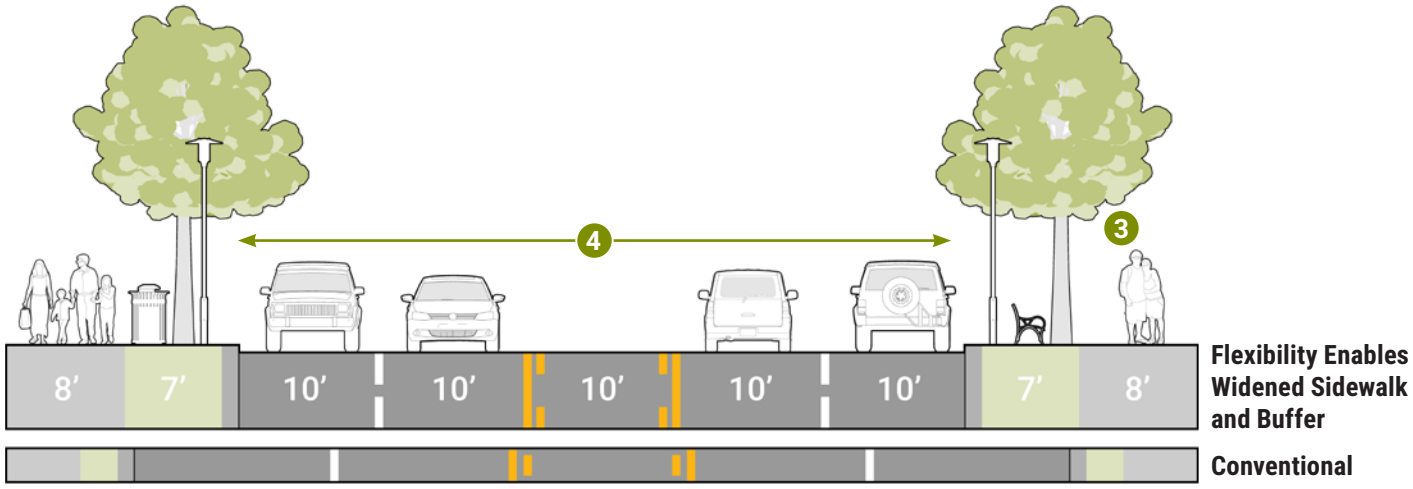
## LANE WIDTH

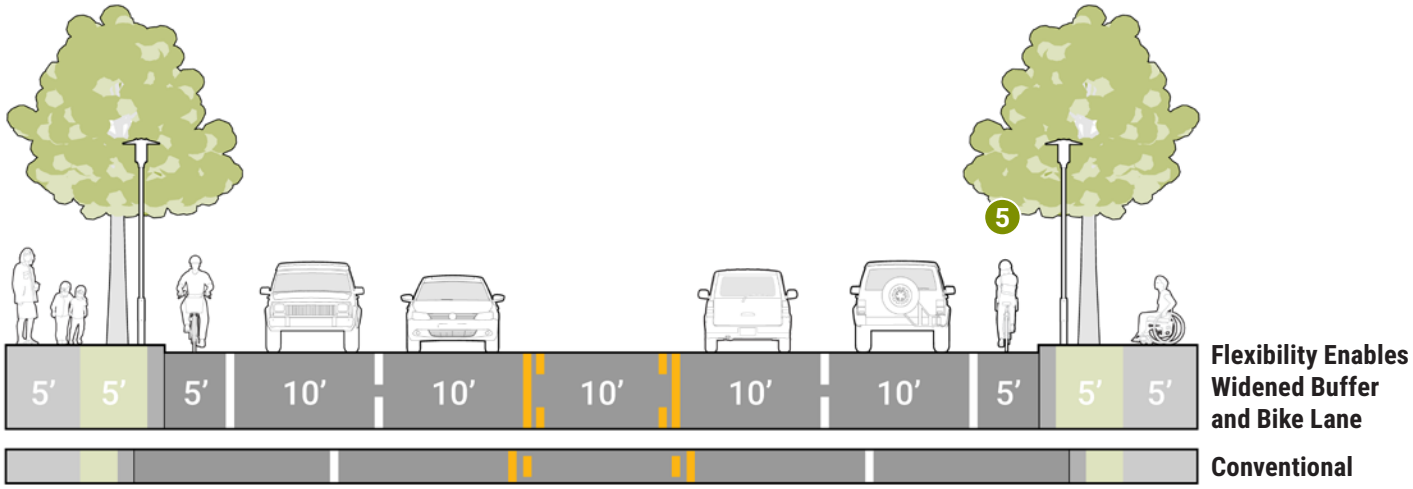
Lane width is an important design criteria. Narrower lanes can improve comfort and safety for vulnerable users. By narrowing lanes, designers can create space for a separated bike lane (2), a widened sidewalk with buffer (3) and reduced crossing distances (4), or a standard bike lane and widened buffer. (5)

Narrower lanes, as an element of an integrated urban street design, can contribute to lower operating speeds.

The **AASHTO Green Book** offers substantial flexibility regarding lane widths, allowing a range of between 9 and 12 feet depending on desired speed, capacity, and context of a roadway **(2011, p. 4-7)**. While 12-foot lanes have been used historically as motor vehicle travel lanes, the **AASHTO Green Book** allows 10-foot travel lanes in low speed environments (45 mi/h or less) **(2011, pp. 4-7–4-8)**.

Designers have avoided using narrower lane widths in the past due to concerns about safety and congestion especially on arterial roadways. However, research on suburban and urban arterials has shown that in most cases, travel lane widths between 10 feet and 11 feet as a part of a thoughtful, integrated design of arterials and collectors do not negatively impact overall motor vehicle safety or operations and have no measurable effect on vehicular capacity. The study found one exception where 10-foot wide travel lanes should be used with caution–on 4-lane, undivided arterial roadways. **(Potts, Ingrid B., Douglas W. Harwood, and Karen R. Richard. "Relationship of Lane Width to Safety on Urban and Suburban Arterials." *Transportation Research Record*, Issue 2023 (2007): 63–82. doi: 10.3141/2023-08).** For more information, refer to the design topic on **Road Diets and Traffic Analysis** and the **FHWA Crash Modification Factors Clearinghouse** website (**http://www.cmfclearinghouse.org**).

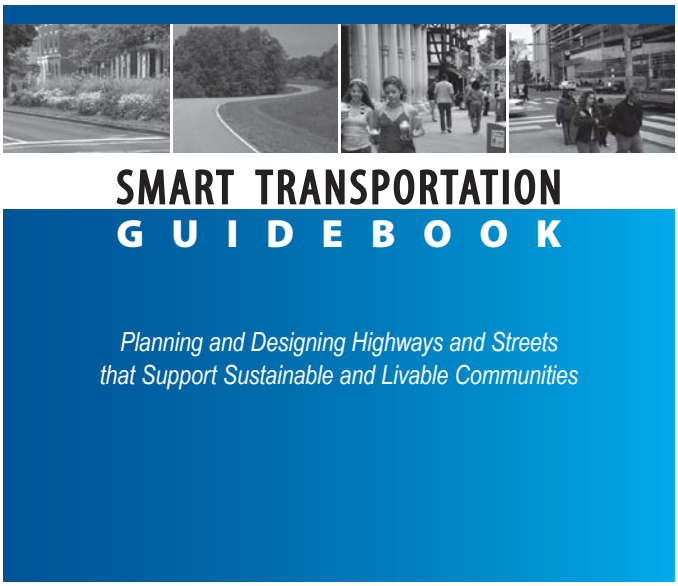


# CASE STUDIES

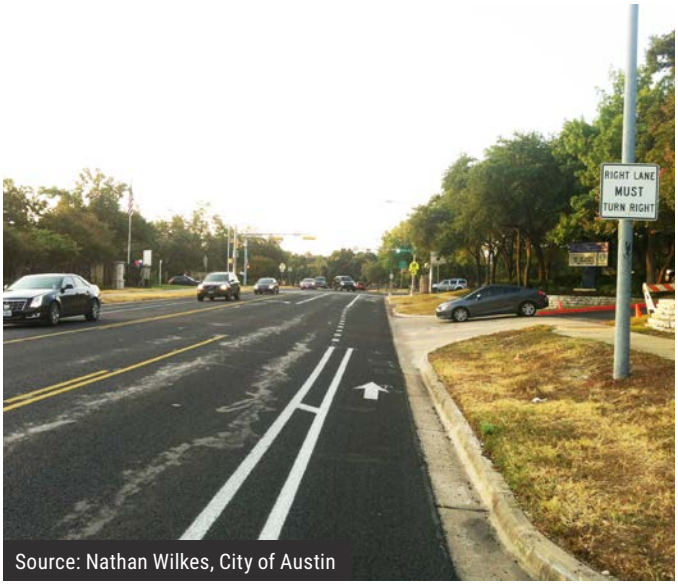
## SMART TRANSPORTATION GUIDEBOOK
## NEW JERSEY/PENNSYLVANIA

The Smart Transportation Guidebook, which received an FHWA Transportation Planning Excellence Award in 2008, defines a context-focused classification system that complements AASHTO's functional classification system. Each category in this system corresponds to a functional classification. However, it recognizes that pedestrian and bicyclist activity may be prioritized in certain land use contexts. The Guidebook tailors ranges for several design values found in the Green Book to apply to the traffic-calming needs of each context. These design values include widths for travel lanes, shoulders, parking lanes, bike lanes, sidewalks, medians, curb radii, and number of travel lanes. In doing so, it acknowledges that in some contexts, guidance should prioritize the pedestrian and bicycle experience, even if it results in decreased vehicular LOS on roadways.




## GRACY FARMS LANE ROAD DIET
## AUSTIN, TX

In 2015, the City of Austin completed a road diet on Gracy Farms Lane to include buffered bicycle lanes. Gracy Farms Lane is classified as a collector street with an average daily traffic of 10,000 vehicles per day and relatively low heavy vehicle volumes. This segment of Gracy Farms Lane provides an important east-west connection for bicyclists in a network where geographical barriers limit other options. The City decided to include a right-turn lane at one intersection due to relatively high turning volumes. To accommodate the right-turn lane while maintaining bicycle facilities through the intersection, designers narrowed travel lane widths, included a 9-foot right turn lane, and provided a continuous bike lane in one direction and sharrows in the other direction.



Source: Nathan Wilkes, City of Austin

## MASSACHUSETTS AVENUE LANE DIET
## BOSTON, MA

The City of Boston and the Massachusetts Department of Transportation worked together to develop a multimodal design solution for the reconstruction of Massachusetts Avenue in Boston. The street is a major urban arterial that, in addition to carrying 33,000 vehicles per day, is heavily traveled by pedestrians and bicyclists and has a bus route with the highest ridership in the region. With an $18 million reconstruction effort, the awarded bid package did not initially include dedicated bicycle facilities. The City of Boston utilized the design exception process to build a case to State and Federal agencies to narrow travel lanes in order to provide additional space for bike lanes. By building consensus, a change order was issued to the contractor with a new cross section consisting of 10.5-foot travel lanes and 5-foot bike lanes.