Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities

Design controls are physical and operational characteristics that guide the selection of criteria in the design of thoroughfares. Some design controls are fixed—such as terrain, climate and certain driver performance characteristics—but most controls can be influenced in some way through design and are determined by the designer. Design controls influence design by establishing a basis from which criteria, geometric design elements and dimensions are selected. Certain design controls, such as speed, have a greater influence on thoroughfare design than other controls. In CSS, one of the most important decisions the design makes is the selection of the controls that will guide the rest of the design process.

AASHTO Design Controls

AASHTO's *A Policy on Geometric Design of Highways and Streets* (Green Book) and its supplemental publication, *A Guide for Achieving Flexibility in Highway Design,* identify design controls and establish design criteria. AASHTO identifies a number of design controls that have varying degrees of influence on thoroughfare design (see sidebar). AASHTO recognizes the influence context has on driver characteristics and performance. The Green Book defines the environment as "the totality of humankind's surroundings: social, physical, natural, and synthetic" and states that full consideration of environmental factors should be used in the selection of design controls. This report focuses on design controls and critical design elements in the urban context.

AASHTO Design Controls

- Design vehicle
- Vehicle performance
- Driver performance
- Functional class
- Traffic characteristics
- Speed
- Capacity and level of service
- Access control and management
- Pedestrians and bicycle facilities
- Safety
- Environment

AASHTO's Green Book and *A Guide for Achieving Flexibility in Highway Design* identify functional classification and design speed as primary factors in determining highway design criteria. The Green Book separates its design criteria by both functional classification and context—rural and urban. The primary differences between contexts are the speed at which the facilities operate, the mix and characteristics of the users and the constraints of the surrounding context.

Design Controls in CSS

There are several design controls in the application of CSS principles that may be used differently than in the conventional design process. These controls include speed, location, design vehicle and functional classification.

Speed

Of primary importance, this report recommends the combined use of a target speed and a design speed. A lower target speed is a key characteristic of thoroughfares in walkable, mixed-use urban areas.

Target Speed – the speed at which vehicles should operate on a thoroughfare in a specific context, consistent with the level of multimodal activity generated by adjacent land uses, to provide both mobility for motor vehicles and a safe environment for pedestrians and bicyclists. The target speed is usually the posted speed limit.

Overview

The CSS publication was developed to provide planners and designers with guidance and information for using flexibility in existing American Association of State Highway and Transportation Officials (AASHTO) policy and information for context sensitive solutions (CSS) in design of major urban thoroughfares (arterials and collectors). The report was a joint effort between the Institute of Transportation Engineers and the Congress for the New Urbanism, sponsored by the Federal Highway Administration and the Environmental Protection Agency.

The publication describes:

- The importance of integrating the principles of CSS in urban roadway improvement projects,
- How CSS principles can be used in the transportation planning and project development processes, and
- Specific guidance on thoroughfare cross-section and intersection design.

The publication, published as an ITE Proposed Recommended Practice to supplement existing AASHTO policies and information, provides the user community an opportunity to use the new guidance and information, then to provide suggestions for improvements to be incorporated into the final ITE recommended practice.

Design Speed – the speed that governs certain geometric features of the thoroughfare, primarily horizontal curvature, superelevation and sight distance. Design speed is typically higher than the posted speed limit so as to result in safety conservative values for design criteria such as sight distance or alignment. This report recommends that the design speed be 5 miles per hour (mph) over the target speed.

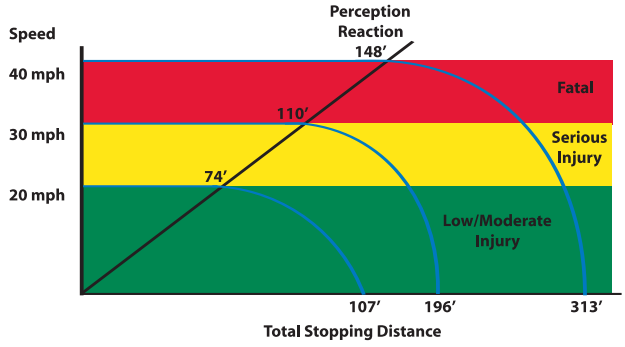

Figure 1 The speed-crash severity relationship illustrates the benefit of reduced target speeds in walkable urban places. Derived from Anderson, McLean, Farmer, Lee and Brooks, Accident Analysis & Prevention (1997).

Conventionally, design speed has been encouraged to be as high as is practical. In this report, a design speed range linked to the target speed is recommended based on the functional classification, thoroughfare type and context, including whether the area is predominantly residential or commercial. Design speed then becomes the primary control for determining the following design values:

- Minimum intersection sight distance
- Minimum sight distance on horizontal and vertical curves
- Horizontal and vertical curvature

Design speed ranges from 30 to 40 mph in this report (corresponding to target speeds of 25 to 35 mph), a range consistent with but somewhat lower than the higher end of AASHTO's recommended range for urban arterial streets.

Location
Conventional thoroughfare design is controlled by location to the extent that it is rural or urban (sometimes suburban). This report focuses on urban locations but varies in intensity from suburban to highly urban. Additionally, the variation in design elements controlled by location is expanded to include predominant land uses such as residential or commercial. Land uses govern the level of activity, which in turn influences the design of the thoroughfare. These influences include, but are not limited to, pedestrians and bicyclists, transit, economic activity of adjacent uses and right-of-way constraints. CSS may also consider planned land uses that represent a departure from existing development patterns and special design districts that seek to protect scenic, environmental, historic, cultural, or other resources.

Design Factors that Influence Target Speed

Establishing a target speed that is artificially low relative to the design of the roadway will only result in operating speeds that are higher than desirable and difficult to enforce. The design of the thoroughfare should reflect the anticipated target speed. The following design factors contribute to speed reduction and should be incorporated into thoroughfare designs as appropriate in urban areas:

- Lanes of appropriate width without excess
- Minimal or no horizontal offset between inside travel lane and median curbs
- Elimination of superelevation
- Elimination of shoulders in most urban applications (shoulders may be used strategically to provide space for breakdowns, large vehicle off-tracking at curves, or to expedite turning maneuvers)
- On-street parking
- Smaller curb return radii at intersections and elimination or reconfiguration of high-speed channelized right turns
- Spacing of signalized intersections and synchronization to the desired speed
- Paving materials with texture (e.g., crosswalks, intersection operating areas) detectable by drivers as a notification of the presence of pedestrians
- Proper use of speed limit, warning, advisory signs and other appropriate devices to gradually transition speeds when approaching and traveling through a speed zone

Design Vehicle
Design vehicle influences the selection of criteria such as lane width and curb return radii. Some practitioners will conservatively select the largest design vehicle that could use a thoroughfare, regardless of the frequency. Consistent with AASHTO, CSS emphasizes an analytical approach in the selection of a design vehicle, including evaluation of the tradeoffs involved in selecting one design vehicle over another.

In urban areas, it is not always practical or desirable to choose the largest design vehicle that might occasionally use the facility because the impacts to pedestrian crossing distances, speed of turning vehicles, etc., may be inconsistent with the community vision and goals and objectives for the thoroughfare. In contrast, selection of a small design vehicle in the design of a facility regularly used by large vehicles can invite frequent operational problems. Select the largest design vehicle that will use the facility with considerable frequency. This report recommends consideration of two types of vehicle:

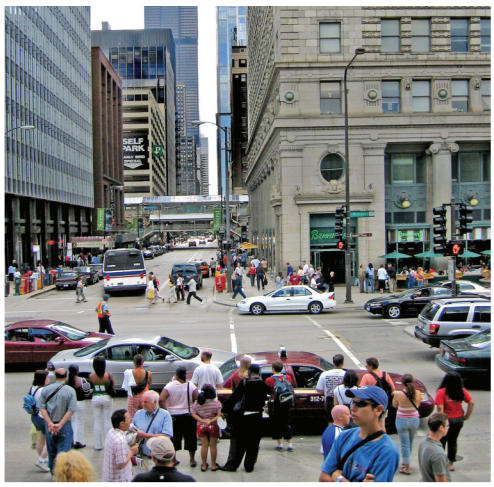

Figure 2 In urban areas, design controls need to reflect multiple modes of travel. Source: EPA.

- Design vehicle – a vehicle that must be regularly accommodated without encroachment into the opposing traffic lanes.
- Control vehicle – a vehicle that infrequently uses a facility and must be accommodated, but encroachment into the opposing traffic lanes, multiple-point turns, or minor encroachment into the roadside is acceptable.

Functional Classification
Functional classification defines a thoroughfare's function and role in the network and governs the selection of certain design controls. Functional class is used to determine aspects of the thoroughfare, such as its continuity through an area and the types of places it connects, its purpose and lengths of trips accommodated, the level of land access it serves, the type of freight service and the types of public transit served.

Pedestrian and Bicyclist Requirements as a Design Control
Pedestrian and bicyclist requirements affect the utilization of a thoroughfare's right-of-way. Thoroughfares with high levels of pedestrian and bicycle usage require appropriate roadside and bicycle lane facilities. This requirement usually affects the design elements in the traveled way. Therefore, pedestrian and bicycle requirements function as a control that influences decisions for the utilization and prioritization of the right-of-way. CSS thoroughfare designs emphasize allocating right-of-way appropriately to all modes depending on their priority and as defined by the surrounding context.

Capacity and Vehicular Level of Service in CSS
The conventional design process uses traffic projections and strives to provide the highest practical level of service. CSS takes traffic projections and level of service into account and then balances the needs of all users, or emphasizes one user over another depending on the context and circumstances. While capacity and vehicular level of service play a role in selecting design criteria, they are only two of many factors considered in the design of urban thoroughfares. In urban areas, thoroughfare capacity may be a lower priority than other factors such as economic development or historical preservation, and higher levels of congestion are considered acceptable. CSS also emphasizes network capacity as opposed to the capacity of the individual thoroughfare.

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Publication sponsored by: Federal Highway Administration, Environmental Protection Agency
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