American Association of State Highway and Transportation Officials
AASHTO

# A Policy on Design Standards—Interstate System

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*Cover photo courtesy of Florida Department of Transportation. Photo depicts the I-10/I-95 Interchange "The Big I" Project. The project was the Grand Prize winner for AASHTO's 2011 America's Transportation Award Competition.*



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# GENERAL

The Dwight D. Eisenhower National System of Interstate and Defense Highways (Interstate) is the most important highway system in the United States. It carries more traffic per mile (kilometer) than any other comparable national system and includes the roads of greatest significance to the economic welfare and defense of the nation. The highways of this system are to be designed in keeping with their importance as the backbone of the nation's highway systems. To this end, they are designed to provide safety and mobility for predicted growth in traffic.

These objectives can be realized by conscientious attention to design. The following minimum standards apply to Interstate highway segments constructed on new right-of-way and segments undergoing reconstruction along existing right-of-way. The geometric design standards used for resurfacing, restoration, and rehabilitation (3R) projects may be the AASHTO Interstate standards that were in effect at the time of original construction or inclusion into the Interstate system.

Design values are presented in this document in both U.S. customary and metric units and were developed independently within each system of units. The relationship is neither exact (soft) nor a completely rationalized (hard) conversion. The values are those that would have been presented in either system. Therefore, the user is advised to work entirely in one system and not attempt to convert directly between the two. In addition, all projects, including 3R, or elements of projects that retain existing geometrics meeting the minimum standards for the selected design speed in one system of units are considered in compliance with comparable design speed standards in the other.

The current editions of AASHTO's *A Policy on Geometric Design of Highways and Streets ("The Green Book")* and the AASHTO *LRFD Bridge Design Specifications* shall be used as design guides where they do not conflict with these standards.

# DESIGN TRAFFIC

The Interstate highway system is designed to safely and efficiently accommodate the volumes of passenger vehicles, buses, trucks—including tractor-trailer and semi-trailer combinations, and corresponding military equipment—estimated for the design year. The design year for new construction and reconstruction should be at least 20 years beyond the year in which the plans, specifications, and estimate for construction of the section are approved.

The traffic volumes used for design should be the appropriate hourly volume of the design year, usually referred to as the design hourly volume (DHV) in vehicles per hour (vph). The DHV is the total traffic in both directions of travel. The directional design hourly volume (DDHV) (vph) is the directional distribution of traffic on multi-lane facilities during the design hour. Refer to AASHTO's *Green Book* for discussion on designing for future operating conditions.

# RIGHT-OF-WAY

## Right-of-Way

The width of right-of-way shall be sufficient to accommodate the roadway cross section elements and requisite appurtenances necessary for an adequate facility in the design year. Acquisition of right-of-way sufficient to accommodate anticipated future improvements should be considered.

## Access Control

Access to the Interstate system, including ramps, shall be fully controlled. The Interstate highway shall be grade separated at all railroad crossings and selected public crossroads. At-grade intersections shall not be allowed. To accomplish this, all intersecting roads are to be grade separated, terminated, rerouted, and/or intercepted by frontage roads. Access is to be achieved by interchanges at selected public roads.

Access control shall extend the full length of ramps and ramp terminals at the crossroad or frontage road. Such control shall either be acquired outright prior to construction or by the construction of frontage roads or by a combination of both. Controlling access on crossroads in the vicinity of interchanges can provide significant benefits to traffic operations and safety performance through the interchange area. Access control beyond the ramp terminals should be achieved by purchasing access rights, providing frontage roads, or prohibiting driveways. Determination of the access control limits should be based on an evaluation that considers variables such as the:

- Functional classification of the crossroad;
- Volume of through movements, turning movements, and weaving maneuvers;
- Type of access (right turn only, left turn from crossroad, left turn from access, or intersection);
- Number of lanes;
- Design of medians and turn lanes; and
- Observed and predicted safety and operational performance.

A break in access control on the crossroad or frontage road should be no closer to the ramp terminal than 100 ft (30 m) in urban areas and 300 ft (90 m) in rural areas. Extended areas of access control may be needed to provide adequate safety and operation of the intersection(s). Refer to AASHTO's *Green Book* and the Transportation Research Board's *Access Management Manual* for additional details and guidance for access spacing in interchange areas.

# GEOMETRIC CONTROLS AND CRITERIA

## Design Speed

Design speeds on the Interstate system shall meet or exceed the following values:

**Table 1. Design Speed**

| Context | Minimum Design Speed (mph) | Minimum Design Speed (km/h) |
|---|---|---|
| Rural (non-mountainous) | 70 | 110 |
| Rural (mountainous) | 50 | 80 |
| Urban | 50 | 80 |

## Sight Distance

The minimum stopping sight distance shall be established in accordance with the procedures contained in the current edition of AASHTO's *Green Book.*

## Curvature and Superelevation

Curvature and superelevation shall be designed in accordance with the current edition of AASHTO's *Green Book.*

## Gradients

Maximum grades as a function of the design speed and the type of terrain shall be in accordance with the following table:

**Table 2. Maximum Grades**

| Type of Terrain | U.S. Customary | | | | | | | Metric | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Design Speed (mph) | | | | | | | Design Speed (km/h) | | | | | |
| | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 80 | 90 | 100 | 110 | 120 | 130 |
| | Grades (%)* | | | | | | | Grades (%)* | | | | | |
| Level | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 3 | 3 |
| Rolling | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 4 | 4 |
| Mountainous | 6 | 6 | 6 | 5 | 5 | – | – | 6 | 6 | 6 | 5 | – | – |

* Grades 1% steeper than the value shown may be used in urban areas.

# CROSS SECTION ELEMENTS

## Number of Lanes

Interstate highways shall have a minimum of two through-traffic lanes for each direction of travel. For new location projects, the number of lanes provided shall be sufficient to demonstrate an acceptable operational condition associated with the anticipated DHV in the design year. Projects in existing corridors shall provide enough lanes to demonstrate that the facility will operate as well or better than the no-build condition in the design year. Refer to AASHTO's *Green Book* for guidance in designing for future operating conditions.

On ascending grades that exceed the critical design length, a climbing lane analysis should be performed and climbing lanes added where appropriate. Likewise, on extended lengths of maximum or near maximum descending grades, emergency escape ramps should be added where an analysis indicates they are appropriate.

## Width of Traffic Lanes

All traffic lanes shall be at least 12 ft (3.6 m) wide.

## Shoulders

Minimum paved shoulder widths in each direction of travel as a function of terrain and the number of through lanes shall be in accordance with the following table:

**Table 3. Minimum Paved Shoulder Widths**

| One-Directional No. Through lanes | Terrain | Left Shoulder (ft) | Right Shoulder (ft) | Left Shoulder (m) | Right Shoulder (m) |
|---|---|---|---|---|---|
| 2-lane | Level or Rolling | 4 | 10 | 1.2 | 3.0 |
| 3-lane or more | Level or Rolling | 10 | 10 | 3.0 | 3.0 |
| 2 or 3-lane | Mountainous | 4 | 8 | 1.2 | 2.4 |
| 4-lane or more | Mountainous | 8 | 8 | 2.4 | 2.4 |

Where truck traffic exceeds 250 DDHV, additional shoulder width may be beneficial. Refer to AASHTO's *Green Book* for more information. Additional guidance on shoulder widths for tunnels and long bridges [overall length over 200 ft (60 m)] is provided later in this document.

## Traveled Way and Shoulder Cross Slope

On tangent sections, the rate of cross slope applicable to the traveled way is influenced by drainage needs. The normal cross slope of the traveled way is 2.0 percent and shall not be less than 1.5 percent. When three or more lanes are inclined in the same direction, or in areas of intense rainfall, refer to AASHTO's *Green Book* for additional guidance. Paved shoulders should have a cross slope in the range of 2.0 to 6.0 percent but shall not have a cross slope less than the cross slope of the adjacent traveled way.

The cross slope break between the traveled way and the shoulder on the high side of superelevated curves should not exceed 8 percent.

## Medians

Medians in rural areas in level or rolling topography should be at least 50 ft (15 m), and preferably 60 ft (18 m), wide. Medians in urban or mountainous areas shall be wide enough to accommodate the left shoulder width plus the space needed for a barrier. Wider medians may be needed for drainage and may provide flexibility to accommodate future widening for additional travel lanes. Refer to the current edition of AASHTO's *Roadside Design Guide* for guidance on barrier installation in the median.

Median areas should not be drained across travel lanes. Refer to the AASHTO *Drainage Manual, Volume 1— Policy* for more information.

## Roadside Design

The clear zone provided should be determined through application of the procedures in the AASHTO *Roadside Design Guide.* Objects that cannot be made to be breakaway or yielding, such as walls, piers, and abutments, should be shielded by installation of crashworthy barriers or attenuators.

Depressed Interstates in urban areas have more restrictive rights-of-way which may need retaining walls or bridge piers to be placed within the clear zone. Such walls and piers should be at least 2 ft (0.6 m) beyond the outer edge of shoulder. Retaining walls and pier crash walls should incorporate an integral concrete barrier shape, or they should be offset from the shoulder a sufficient distance to permit shielding with a separate barrier.

## Sideslopes

Sideslopes within the clear zone are typically 1V:6H or flatter and should not be steeper than 1V:4H. Where slopes steeper than 1V:4H are used within the clear zone, refer to the current edition of AASHTO's *Roadside Design Guide* for guidance.

### Curbs

Caution should be exercised in the use of curbs on Interstates. Where curbs are provided, they shall not be closer to the traveled way than the outer edge of the paved shoulder, shall have a sloping face, and be limited to a height of 4 in. (100 mm). Special care should be taken when curbs are placed next to barriers. For more information, refer to the discussion on curb types and their placement in AASHTO's *Green Book*.

### Multimodal Accommodations

In urban and suburban areas, consideration should be given to providing bicycle and pedestrian accommodation along the crossroad or reserving sufficient space for such facilities to be added in the future. Refer to AASHTO's *Guide for the Development of Bicycle Facilities* and the AASHTO *Guide for the Planning, Design, and Operation of Pedestrian Facilities* for more information regarding bicycle and pedestrian accommodation. On planned or existing transit corridors, transit should also be accommodated through the interchange. Refer to AASHTO's *Guide for Geometric Design of Transit Facilities on Highways and Streets* for more information regarding transit accommodation.

## INTERCHANGES

Interchanges shall be provided between all intersecting Interstate routes, between other selected access-controlled highways, and at other selected public highways to facilitate the distribution of traffic. Each interchange shall provide for all traffic movements.

The ramp curvature, pavement widths, and related elements that constitute an interchange shall be adequate to accommodate the appropriate design vehicles. Refer to AASHTO's *Green Book* for additional discussion.

Spacing of interchanges and between ramps has a significant effect on the operation of Interstate highways. The spacing needed between interchanges will depend upon the combined effects of geometric design, traffic operations, safety performance, and signing. In areas of concentrated development, proper spacing may be difficult to obtain because of demand for frequent access. Minimum spacing should not be less than 1 mi (1.5 km) in urban areas and 3 mi (5 km) in rural areas, based on crossroad-to-crossroad spacing. In urban areas, spacing of less than 1 mi (1.5 km) may be facilitated by grade-separated ramps or by collector-distributor roads.

# BRIDGES AND OTHER STRUCTURES

## General

The following additional standards apply to Interstate highway bridges, overpasses. and underpasses. Standards for crossroad overpasses and underpasses are to be those applicable to the appropriate functional classification and terrain of the crossroads.

## Vertical Clearance

In rural areas, the vertical clearance to structures shall not be less than 16 ft (4.9 m) over the entire roadway width, including auxiliary lanes and shoulders, as well as to ramps and collector-distributor roadways. In urban areas, where multiple Interstate routes exist, the vertical clearance to structures on each Interstate routing through the urban area shall not be less than 16 ft (4.9 m) over the entire roadway width, including auxiliary lanes and shoulders, as well as to ramps and collector-distributor roadways, or each Interstate routing shall be connected by other Interstate routes to provide for through movements with 16 ft (4.9 m) minimum vertical clearance. On those Interstate urban routes that are not necessary to provide these connecting through movements, the vertical clearance shall not be less than 14 ft (4.3 m). In all cases, an allowance should be made for future resurfacing.

The vertical clearance to sign trusses and pedestrian overpasses shall not be less than 17 ft (5.1 m). On Interstate urban routes with less than the 16 ft (4.9 m) vertical clearance, the vertical clearance to sign trusses shall be at least 1 ft (0.3 m) greater than the minimum vertical clearance of other structures. The vertical clearance from the roadway to the overhead cross bracing of through truss structures shall not be less than 17.5 ft (5.3 m).

When evaluating vertical clearance for Interstate routes, it is important to remember that all Interstate highways are part of the Strategic Highway Network (STRAHNET) and are critical to the Department of Defense's domestic operations.

## Cross Section

The width of bridges less than or equal to 200 ft (60 m) in length shall not be less than the full paved width of the approach roadway, including shoulders. The bridge width is measured between the bridge railing, parapet, or barrier. Long bridges, defined as bridges having an overall length in excess of 200 ft (60 m), may have a lesser width and should be analyzed individually. On long bridges, a reduced shoulder width of 4 ft (1.2 m) may be used on both the left and the right sides.

## Design Loading Structural Capacity

All new and totally replaced bridges shall be designed in accordance with the AASHTO *LRFD Bridge Design Specifications.*

## Existing Bridges to Remain in Place

Mainline bridges on the Interstate system and bridges on routes to be incorporated into the system may remain in place if, as a minimum, they meet all of the following criteria:

- For bridges less than or equal to 200 ft (60 m) in length, the bridge cross section consists of at least 12 ft (3.6 m) lanes, 10 ft (3.0 m) shoulder on the right and 3.5 ft (1.1 m) shoulder on the left;
- For long bridges, shoulder width on both the left and right is at least 3.5 ft (1.1 m) measured from the edge of the nearest travel lane; and
- Bridge railing meets or will be upgraded to current standards.

## Tunnels

From the standpoint of service to traffic, tunnels should not differ materially from grade separation structures. Essentially the same standards apply except the minimum values are often used because of high cost and restrictive right-of-way.

The vertical clearance for tunnels shall be consistent with the vertical clearance requirements for bridges. Resurfacing and overhead features (such as lighting, signing, monitoring, and ventilation) should be considered when determining the vertical clearance to be provided. When designing horizontal curves, the limitations of the tunneling methodology used to construct the tunnel should be considered.

Cross sections for tunnels should match the full paved width of the approach roadways, including the shoulders. Additional width may be needed to accommodate roadside barrier, pedestrian railing, or other necessary features. Because of the high cost associated with tunnels, a reduced width may be provided. A minimum 4 ft (1.2 m) shoulder on each side shall be provided to maintain the operational effectiveness of the tunnel. In some cases, additional space can be provided for bicyclists and pedestrians to establish a critical link across major topographical features.

Emergency egress (including for persons with disabilities) and access for emergency responders and maintenance equipment must also be considered. A minimum emergency egress walkway width of 4 ft (1.2 m) shall be provided on one side. The emergency egress walkway should be elevated a minimum of 6 in (150 mm) or separated from the roadway with barrier. Additional guidance may be found in local building codes and from National Fire Protection Association (NFPA) 502: S*tandard for Road Tunnels, Bridges, and Other Limited Access Highways.*

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