

The Adobe Tower
by Jerry Hall and Loretta Hall

Initial Design Standards for the Interstate System

As the 20th century began, road design criteria in this country were exceptionally simple, involving curves and grades that slow-moving horse-drawn wagons could negotiate. A growing number of motorized vehicles were using the roads, but engineers knew little about geometric design criteria for these vehicles. In 1914, one-third of American vehicles were still horse-drawn, but a Washington state engineer wrote, “All highways are now designed for motor-driven vehicles and these are yearly increasing in efficiency.” That year, the American Association of State Highway Officials (AASHO) was created as a forum for states to discuss the sweeping changes that were occurring in vehicles and roadways.

Road designers struggled with defining what we now call a design vehicle and a design speed. A typical roadway was 16 feet wide, and vehicles usually straddled the centerline; severe crowns—as much as 20 inches—allowed quick water runoff, but they were difficult for motorized vehicles to traverse. Typical speeds were 15–20 mph for cars and 10–12 mph for trucks, while horse-drawn vehicles rarely exceeded 8 mph. A 1919 article discussed curve widening to accommodate “modern motor trucks” up to 7.5 feet wide with a 15-foot wheelbase; however, horses were still in the vehicle mix. Even in 1921, a technical article on alignment and grade commented, “An extremely sharp curve with a large central angle also reduces the hauling capacity of a six-horse team by 20 to 40 percent.”

AASHO and the Bureau of Public Roads began a systematic program to conduct research and inventory highway and traffic conditions in the 1920s and early 1930s. In 1937, AASHO created the Committee on Planning and Design Policies to develop administrative policies “looking toward the incorporation into practice of highway design features which will result in maximum safety and utility.” AASHO developed, adopted, and issued seven policies between 1938 and 1944: highway classification, geometric highway types, sight distance on highways, marking and signing of no-passing zones, intersections and grades, rotary intersections, and grade separations.

These seven policies were published as separate booklets, but they were collated in the 1950 book *Policies on Geometric Highway Design*. This book also included a chapter titled “Design Standards for the National System of Interstate Highways, Adopted August 1, 1945,” which contained brief statements on critical elements. They can be summarized as follows:

- Control of Access. Designs shall include access control “wherever economically possible,” with frontage roads being a recommended strategy.
- Railroad Crossings. Grade separations should be provided when two or more mainline tracks cross the interstate highway, or when a single rail line carries significant train traffic. “Where grades are not separated, provision shall be made for installation and operation of adequate protective devices.”
- Crossroads. “For a design traffic density (volume in today’s terminology) of 3,000 per hour or more on an interstate highway, every effort shall be made to eliminate all cross traffic at grade.” Grades shall be separated if justified by an economic analysis. “Where cross traffic at grade is not eliminated, traffic signal control installations, channelized

- intersections, or stop control on the crossroads shall be provided.”
- Design Speed. Minimum and desirable design speeds are 40 mph and 50 mph, respectively, for urban sections. Corresponding rural values range from 40 mph and 50 mph for mountainous topography to 60 mph and 70 mph for flat topography.
 - Alinement Control. “All curves sharper than 1° shall be super-elevated. All curves sharper than 2° shall be designed with approach transition curves.” Maximum and desirable degrees of curvature range from 4° and 3°, respectively, for a 70 mph design speed to 14° and 11° at 40 mph.
 - Sight Distance. Adequate stopping sight distance must be provided on all roads. Two-lane roads should have frequent sections with sufficient sight distance for safe passing; where this is not feasible, “consideration should be given to the provision of a four-lane highway instead.”
 - Gradients. “The maximum gradients preferably shall not exceed 5 percent and in any case shall not exceed 6 percent.”
 - Pavement Widths. In urban areas, lanes shall be 12 feet wide. Rural lane widths shall be 11 feet for traffic densities less than 200 per lane, or 12 feet for higher densities.
 - Divided Highways. “Where the traffic density is 800 or more, a divided highway facility shall be constructed.” The median width is 15–40 feet wide for rural sections, and 4–12 feet for urban sections.
 - Shoulders. Shoulders shall be at least 10 feet wide, although 4 feet is the minimum in mountainous terrain.
 - Slopes. Generally, side slopes shall not exceed 2:1 unless they are in rock; slopes flatter than 4:1 shall be used on fills less than 10 feet high.
 - Right-of-way. Rural right-of-way shall be 120–220 feet for two-lane highways and 150–250 feet for divided highways.
 - Culverts. The clear width “shall be sufficient to carry the pavements, median strip, and shoulders across without reduction and, as necessary, the continued slopes outside the shoulders.”

In response to the rapid evolution of highway engineering, the AASHO committee decided to combine all its policies into one document, introduce new material, eliminate duplications and obsolete material, and provide one comprehensive source for highway design. In 1954, AASHO published *A Policy on Geometric Design of Rural Highways*. Known as the “Blue Book” because of the cover’s color, it had perhaps the most profound influence of any single document on modern highway design practices in the United States. A comparison of these 60-year-old standards with current AASHTO design values highlights the evolution of these parameters.

Jerry Hall, a professor of Civil Engineering at the University of New Mexico, has served District 6 as president and international director. Loretta Hall, a member of the Construction Writers Association, is a freelance writer concentrating on engineering and construction. They can be contacted at jerome@unm.edu and lorettahall@constructionwriters.org, respectively.

This is the fourth in a series of articles tracing the development of the Interstate Highway System.