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SECTION 7 - BIKEWAYS

7.1.0 GENERAL

Bikeways are to be designed to accommodate the necessary criteria as stated in this Section.

7.2.0 TYPES AND FUNCTIONAL CHARACTERISTICS

7.2.1 Bikeways

In most circumstances, bicycles share the roadway with other vehicles. An additional three (3) to five (5) feet of pavement width should be used to accommodate cyclists on major collectors and arterials. A fifteen (15) foot outer lane should be used where motor vehicles and bicycles share the outside lane with no special lane markings for the bicycle. Bicycle lanes, however, require the addition of five (5) feet measured from outer lane line to face of curb. Bicycle lanes should be limited to roadways in which parking is prohibited.

7.2.2 Types of Bikeways

The preferred method of providing bicycle travel depends on the type of user and the primary purpose of the facility. The purpose and design criteria will be presented separately for each of the three (3) different types of bicycle facilities: (1) Bicycle Path, (2) Bicycle Lane and (3) Bicycle Street.

A. **Type I Bikeway "Off-Road Bikeway" or "Bicycle Path."**

The bicycle path is used primarily for recreational purposes. It should be located in a park-type setting as far from the roadway as practicable. Intersections with roadways should be minimized and signed to avoid bicycle-motorist conflicts. If the path must be in the roadway right-of-way, there should be a minimum distance of three (3) feet and desirable five (5) feet separating the path from the roadway. Separation from pedestrians is desirable where feasible. Figure 7-1, in Section 7.4.0 of this Manual, shows typical widths and clearances for bike paths.

B. **Type II Bikeway "Bicycle Lane."**

The bicycle lane is located within the vehicular roadway in the outside lane and is intended for the preferential or exclusive use of bicycles. The bicycle lane is usually five (5) feet wide and is delineated by means of pavement markings. Typically, bicycle lanes should not be used on roadways which allow parking unless designed to accommodate both uses. The lane should cease far enough from intersections to allow the cyclist to merge into the traffic flow in order to avoid conflict with vehicles turning right. Bicycle lanes should always be one (1) way because of the hazards associated with opposing directions of traffic. Figure 7-2, in Section 7.4.0 of this Manual, shows a typical bicycle lane design with and without parking.

C. **Type III Bikeway "Bicycle Compatible Street."**

Most cyclists use streets that have no special markings for bicycles.

Neighborhood and residential collectors are often compatible for bicycle use without additional pavement. Collectors and arterials used by commuters and experienced recreational cyclists require a minimum twelve and one half (12 ½) feet outer lane for collectors and thirteen and one half (13 ½) feet outer lane for arterials measured from outer lane line to the top of gutter for the cyclist to share the lane with a motorist. Signs may be used to define the street as a bicycle route as determined by the Director of the Transportation Services Department. Figure 7-3, in Section 7.4.0 of this Manual, shows a typical bicycle street.

7.3.0 GEOMETRIC DESIGN CRITERIA

7.3.1 Design Criteria for Type I Bikeways

A. **Design Speed.**

The speed that a cyclist travels is dependent upon the geometric features of the traveled way, type of bicycle, weather conditions and physical condition of the rider. In determining the design speed of a bikeway, the geometric features of curvature, superelevation, grade and width of traveled way are used to produce a traveling speed that is at least as high as the preferred speed of the faster travelers. Nearly all bicyclists travel within a speed range of seven (7) to twenty (20) mph with an 85th percentile speed of fifteen (15) mph. Design speeds should usually be fifteen (15) mph and on long downgrades, speeds of twenty (20) mph or more may be considered. For bike lanes and bike streets, the design speed necessary to serve motor vehicle operation will adequately serve bicycle traffic needs.

B. **Curvature.**

For a given design speed of a bikeway, consideration should be given to the minimum radius of curvature. Where bicycle lanes and bike streets follow the roadway alignment, the curvatures designed to accommodate the motor vehicles will be more than adequate for bicycles. However, care should be taken for bikeways not paralleling roadways to insure that the minimum radius of curvature is provided to permit unbraked turns at the design speed. Figure 7-4, in Section 7.4.0 of this Manual, shows a graph for determining the curvature and superelevation for various bikeway design speeds. It should be noted that the superelevation should never exceed 0.12 feet per foot.

Where the radius of curvature is less than one hundred (100) feet, it is advisable to widen the bikeway in order to increase the lateral space required by the cyclist as he leans to the inside of a turn. Figure 7-5, in Section 7.4.0 of this Manual shows the methodology used in determining the necessary widening to compensate for lean. The amount of widening should be limited to a maximum of four (4) feet.

C. **Grade.**

Whether or not a bikeway is favorable to cyclists is largely dependent upon the grade and alignment of the bikeway. The amount of energy a cyclist expends in using a bikeway will affect the usage of the bikeway. Therefore, the grades should be kept to a minimum. A bikeway grade should not exceed ten (10) percent. Figure 7-6, in Section 7.4.0 of this Manual, shows the desirable gradients for various lengths of grade. Due to topography in the City of Round Rock, however, exceptions may be warranted in some instances.

Also associated with design speed is stopping distance. Figure 7-7, in Section 7.4.0 of this Manual, gives the stopping sight distance for various speeds and related grades. The stopping sight distance for crest vertical curves can be determined from Figure 7-8, in Section 7.4.0 of this Manual.

7.3.2 Design Criteria for Type II and Type III Bikeways

A. **Clearance.**

In order to prevent encroachment conflicts, adequate vertical and horizontal clearances must be provided. The minimum vertical clearance for overhead obstructions is eight (8) feet. The minimum lateral clearance to an obstruction from the edge of the bikeway is three (3) feet. These clearances are illustrated in Figure 7-1, in Section 7.4.0 of this Manual.

B. **Drainage Grates.**

For bicycle lanes and bicycle streets, the existing street drainage inlet grates may prove to be a hazard. Drainage inlet grates with openings large enough to entrap narrow bicycle wheels should be prohibited in future construction. Suitable designs include, but are not limited to diagonal bars at a forty-five (45) degree angle, slotted grates with cross bars or slanted bars transverse to traffic. Long slotted grates with wide (one (1) inch or more) openings parallel to traffic should not be used on streets.

C. **Railroad Grade Crossings.**

The road-surface height should be within one (1) inch of the track height and the slot between road and track should be less than three (3) inches wide. The cyclist needs to cross the tracks at a perpendicular angle. It is desirable that the track angle be no more than twenty (20) degrees from the roadway to avoid the cyclist zigzagging into traffic.

D. **Bicycle Ramps.**

Figure 7-9, in Section 7.4.0 of this Manual, depicts standard bicycle ramp design.

E. **Intersections and Crossings.**

The greatest number of conflicts between motorists, bicyclists, and pedestrians occur at intersections and crossings. Elimination of conflicts where bicycle paths cross a roadway can be accomplished by providing a grade separation, but this is not always possible or economically feasible. Appropriate signs are necessary to regulate roadway users and path users at intersections between roadways and bicycle paths. Some special treatment is required at intersections to minimize conflicts between traffic lanes and bicycle lanes (see Figure 7-10, in Section 7.4.0 of this Manual, for channeling at intersections).

7.3.3 Bicycle Signs and Pavement Markings

In order to ensure the safe and efficient operation of a bikeway, there must exist adequate signs and markings to warn bicyclists of hazardous conditions or obstacles, to delineate bicycle rights-of-way, to exclude undesired vehicles from the route and to warn motorists and pedestrians of the presence of bicycle traffic. The standard signs to be used on bikeways are shown in Figure 7-11, in Section 7.4.0 of this Manual. The Texas Manual on Uniform Traffic Control Devices (TMUTCD), latest edition, should be consulted for additional signing and pavement marking options and regulations.

7.4.0 FIGURES

Figure 7-1 Off-Road Bikeways, Bicycle / Pedestrian Path

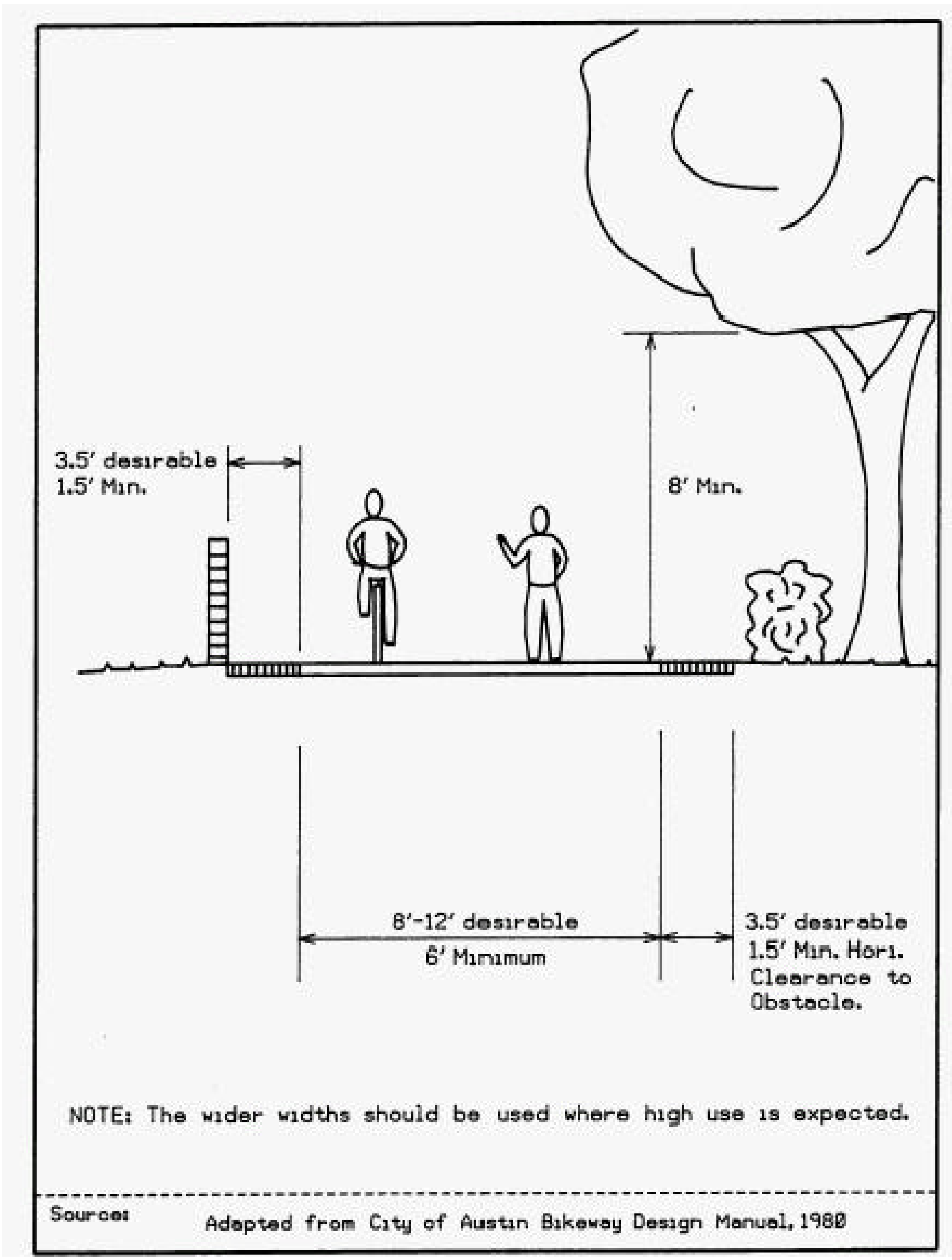
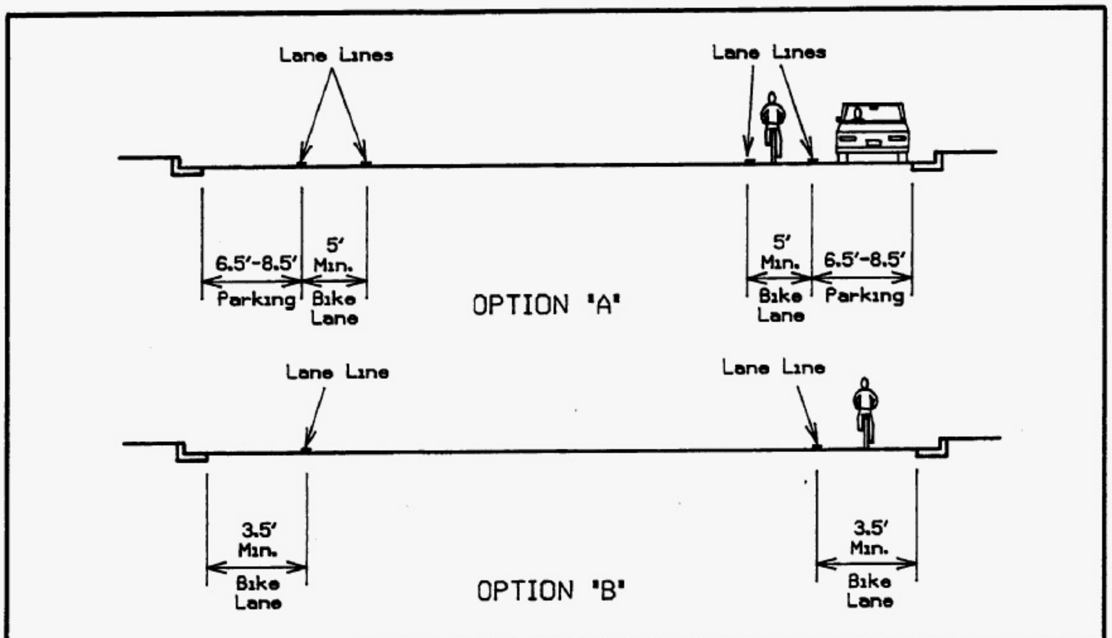
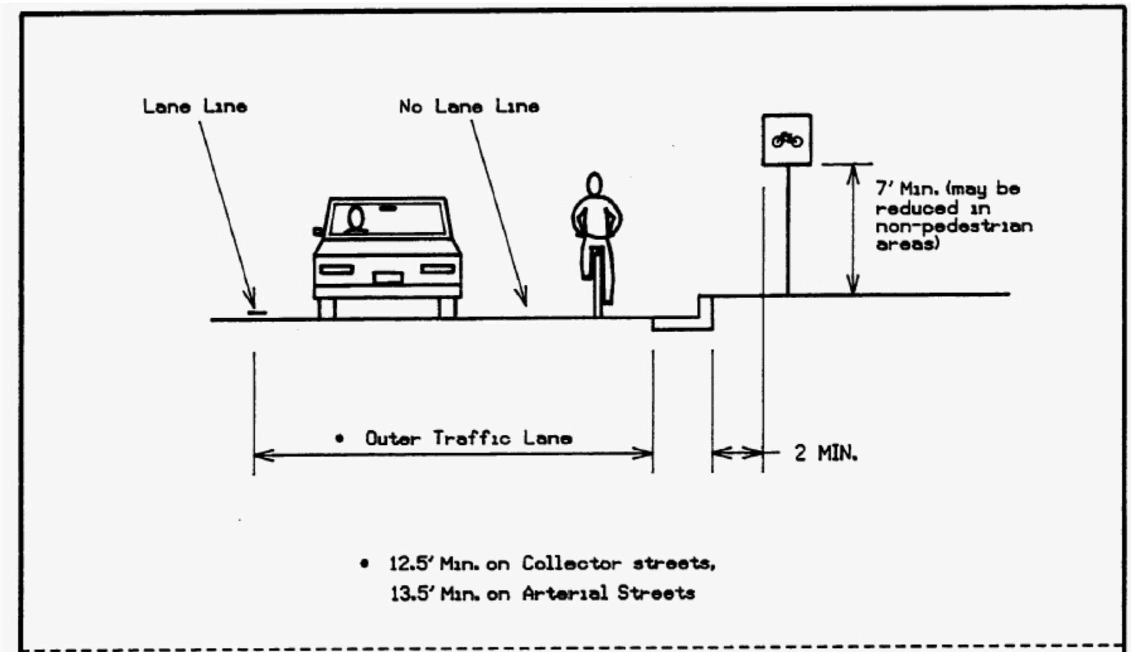


Figure 7-2 Bicycle Lane



Source: Adapted from City of Austin Bikeway Design Manual, 1980

Figure 7-3 Bicycle Compatible Street



Source: Adapted from City of Austin Bikeway Design Manual, 1980

Figure 7-4   Standard Superelevation for Bikeways

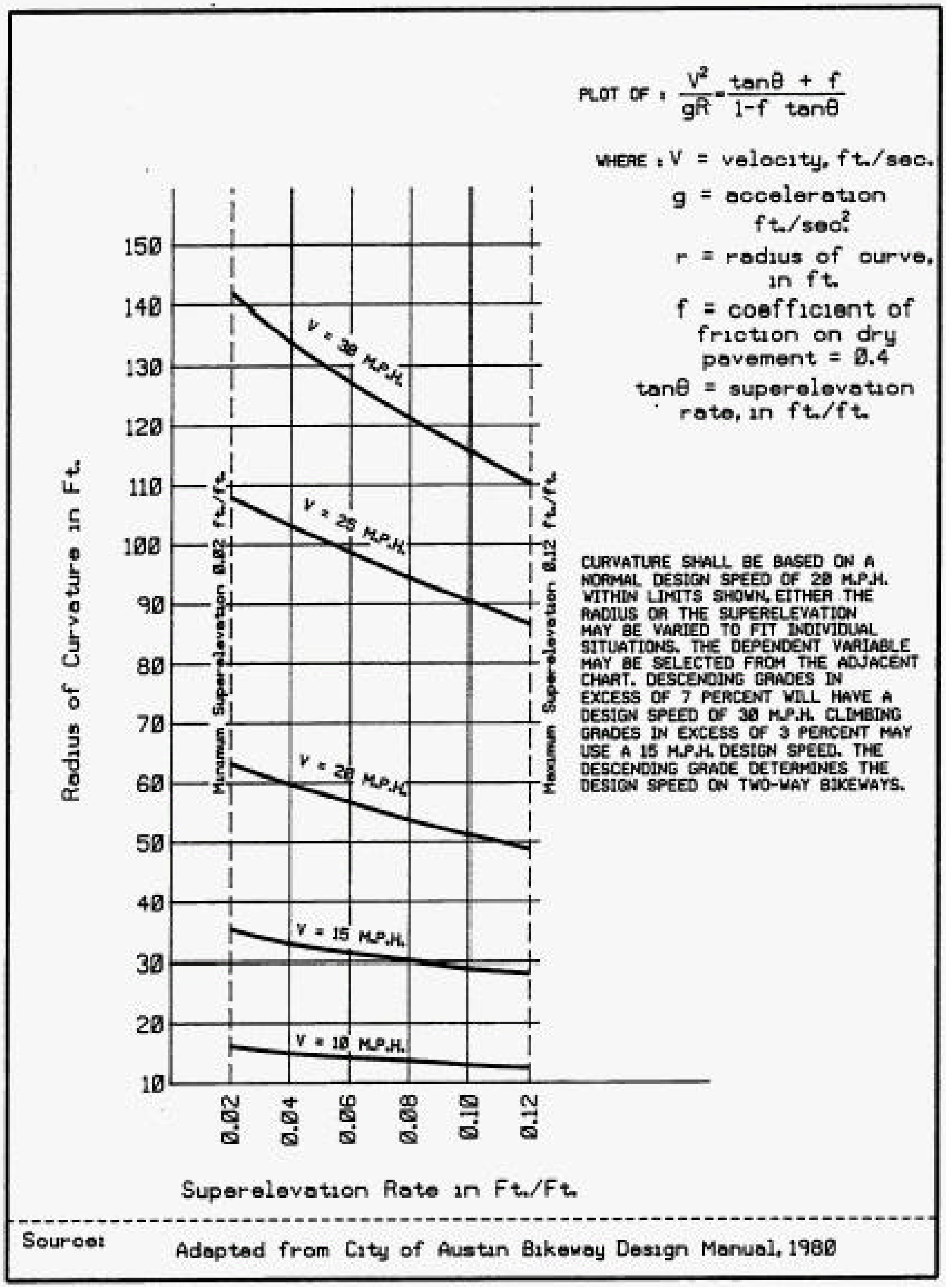
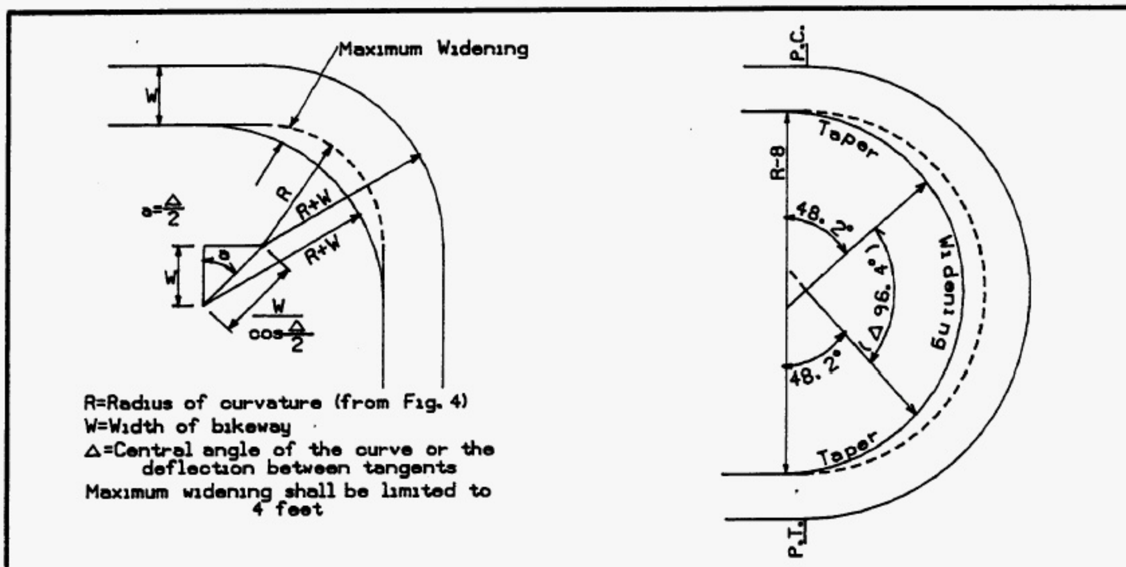


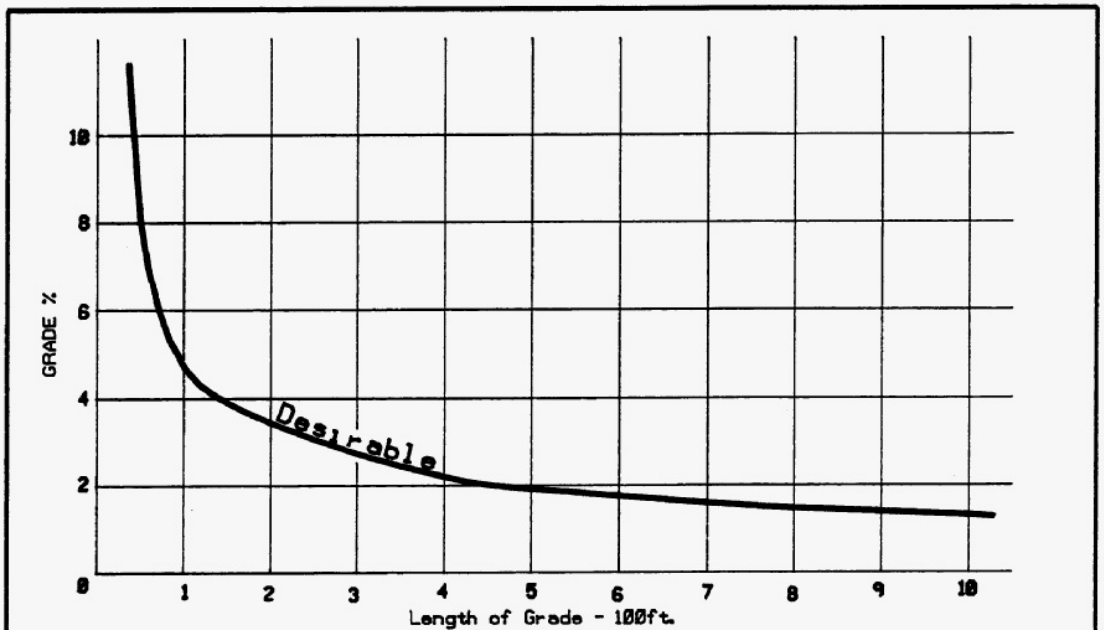
Figure 7-5   Curve Widening – Bikeways



When widening reaches 4ft. (Δ 96.4°), that width shall be carried on a radius of R-4 through the central portion of the curve (Δ-96.4°) as shown on the right.

Source: Adapted from City of Austin Bikeway Design Manual, 1980

Figure 7-6 Desirable Grades – Bikeways



Source: Adapted from City of Austin Bikeway Design Manual, 1980

Figure 7-7 Stopping Sight Distance – Bikeways

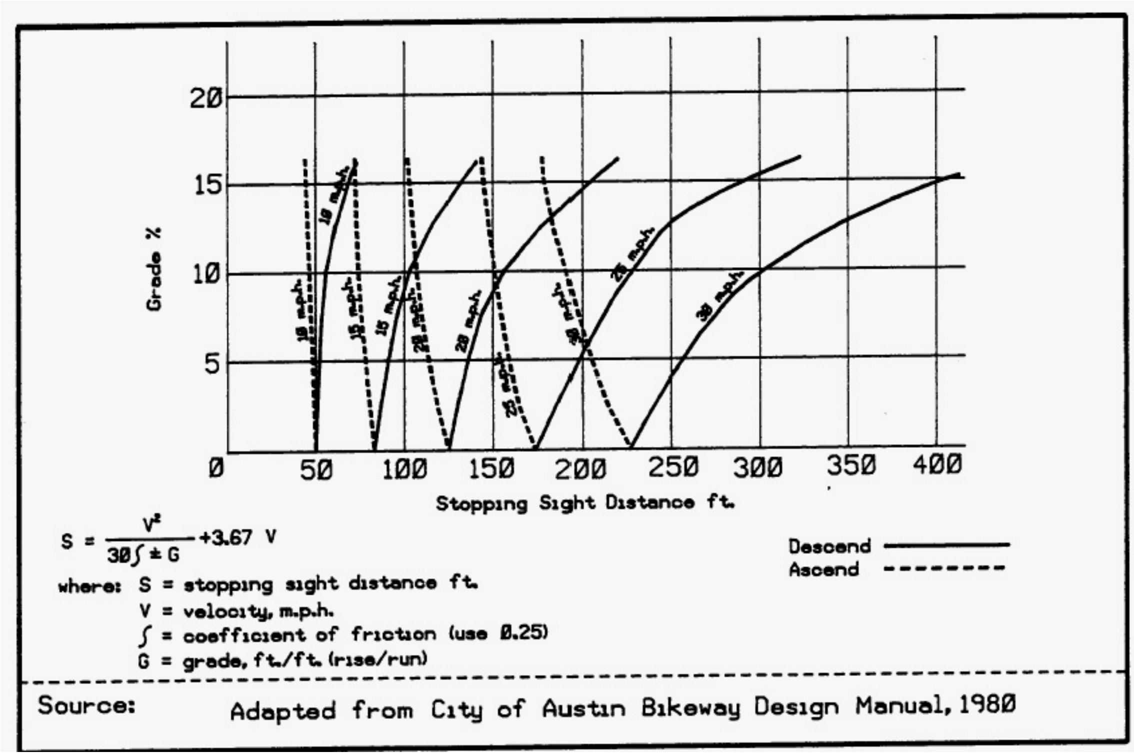
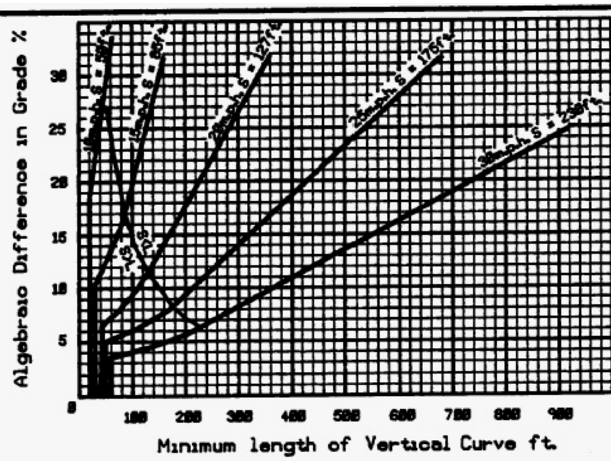


Figure 7-8 Bikeway Sight Distance for Crest Vertical Curves



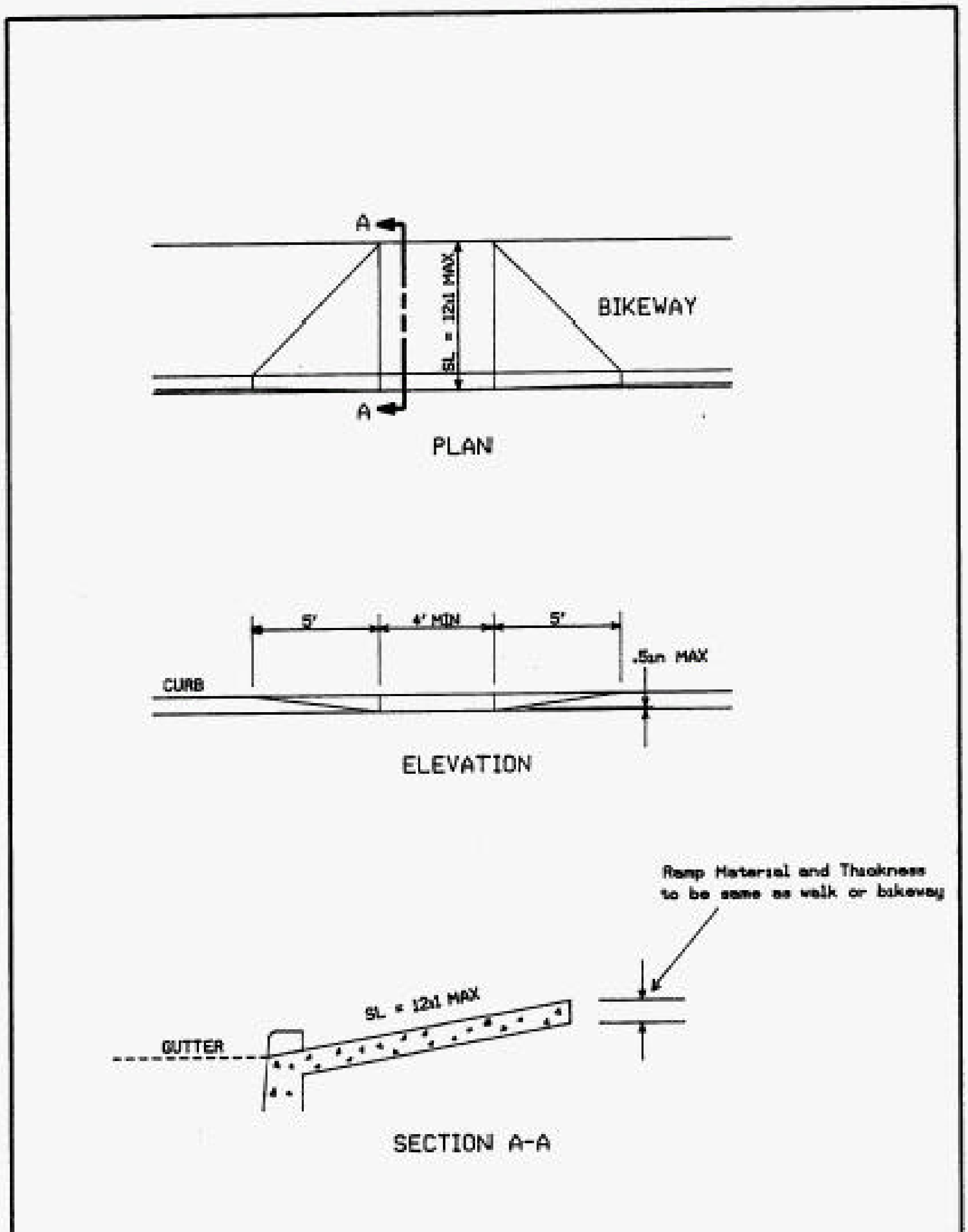
$$L = 2S - \frac{200(\sqrt{h_1} + \sqrt{h_2})^2}{A} \quad \text{when } S>L$$

$$L = \frac{AS^2}{100(\sqrt{h_1} + \sqrt{h_2})^2} \quad \text{when } S<L$$

where: S = Stopping sight distance
A = Algerbraic difference in grade
h_1 = 4 ½ ft.- eye height ofcyclist
h_2 = ⅓ ft.- height of object
L = Minimum vertical curve length

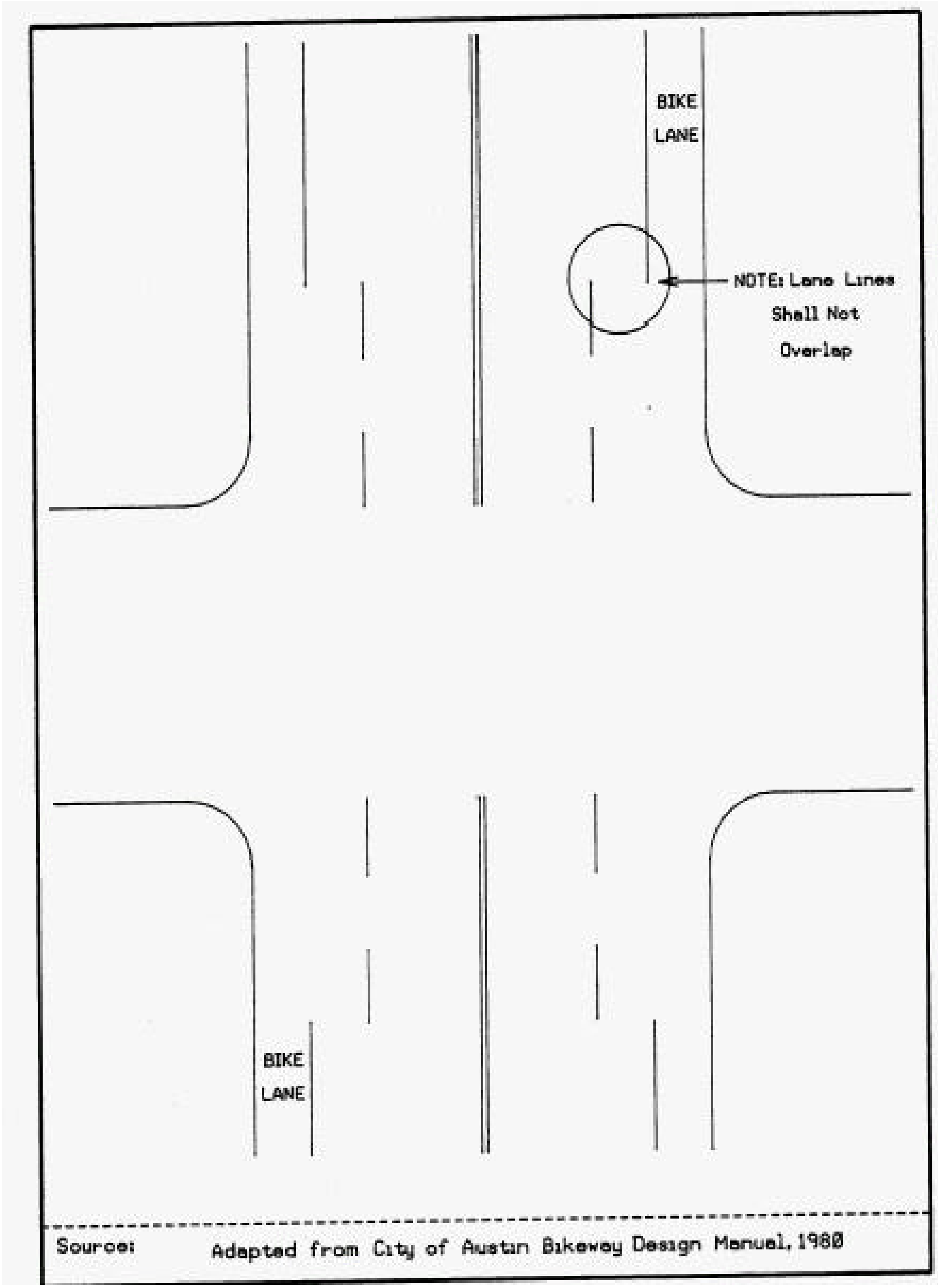
Source: Adapted from City of Austin Bikeway Design Manual, 1980

Figure 7-9   Bicycle Ramp Design



Source: Adapted from City of Austin Bikeway Design Manual, 1980

Figure 7-10 Bike Lane Treatment at Intersections



Source: Adapted from City of Austin Bikeway Design Manual, 1980

Figure 7-11 Standard Bikeway Signs