CHAPTER 1

GENERAL DESIGN

1.0 INTRODUCTION

The purpose of this Manual is to provide its users with the current, uniform procedures and guidelines for the application and design of safe, convenient, efficient and attractive highways that are compatible with their service characteristics and that optimally satisfy the needs of highway users while maintaining the integrity of the environment.

This Manual does not attempt to encompass the total scope of important, published information and literature relative to the formulation of highway design criteria, policies and procedures. Sources of additional publications and related material which may complement the concepts contained herein include the following:

- Publication 408, *Specifications*, and associated changes, Pennsylvania Department of Transportation (PENNDOT).
- *A Policy on Geometric Design of Highways and Streets*, 2004 AASHTO Publication.*
- *Roadside Design Guide*, 2006 AASHTO Publication.**
- *Highway Capacity Manual*, Transportation Research Board, 2000 or newer edition.***
- *Manual on Uniform Traffic Control Devices*, Federal Highway Administration, 2003 or newer edition.****
- *A Policy on Design Standards---Interstate System*, 2005 AASHTO Publication.

Initiative should be exercised to utilize the most appropriate design values within the given ranges based upon the project context and roadway typology wherever practicable and within reasonable economic limitations and sound engineering judgment. When design criteria presented in this Manual differs from criteria presented in other sources, this Manual shall take precedence. However, for Federal-aid projects on the National Highway System (NHS), this Manual only takes precedence when criteria in this Manual exceed the criteria in the 2004 AASHTO Green Book and the 2005 AASHTO publication, *A Policy on Design Standards---Interstate System* (for Interstate Federal-aid projects). The design criteria and text presented herein provide guidance to the designer by referencing a range of values for critical dimensions.

Since the concepts, practices and procedures described in this Manual are subject to future change, the contents shall be updated accordingly to reflect those changes in order to retain its usefulness. The Highway Quality Assurance Division, Bureau of Design shall be responsible for keeping the Manual current by incorporating revisions, additions or deletions when required.

Whenever a District Executive determines that modifications or additions are required to improve the current design criteria in this Manual, the following procedures shall be followed:

1. The recommended modifications or additions shall be transmitted to the Director, Bureau of Design with the following information:

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* Hereinafter referred to as the 2004 AASHTO Green Book.

** Hereinafter referred to as the AASHTO Roadside Design Guide.

*** Hereinafter referred to as the *HCM*.

**** Hereinafter referred to as the *MUTCD*.

a. The title and page number of the existing practice, if applicable.

b. The recommended modifications or additions and the Chapter(s) and the appropriate page number(s) into which they should be incorporated.

c. The reasons for recommending the modifications or additions.

2. The Director, Bureau of Design shall review the recommended modifications or additions and transmit copies to the various Bureau Directors and District Executives involved for their comments. FHWA comments shall also be solicited.

3. All comments shall be submitted to the Director, Bureau of Design and, upon review, appropriate action shall be taken.

4. If modifications or additions are required to the current criteria, they shall be made through standard procedures for incorporation into this Manual.

The numerical measurements presented in this Manual are generally stated in metric values followed by English values in parentheses. Also, refer to the current AASHTO and ASTM Material Standards, AASHTO Designation R1 (ASTM E 380), which uses the International System of Units (SI) as required by Federal Law.

The inclusion of specified design criteria in this Manual does not imply that existing roadways, which were designed and constructed using different criteria, are either substandard or must be reconstructed to meet the criteria contained herein. Many existing facilities which met the design criteria at the time of their construction are adequate to safely and efficiently accommodate current traffic demands.

Since it is not feasible to provide a highway system that is continuously in total compliance with the most current design criteria, it is imperative that both new construction and reconstruction projects are selected from a carefully planned program which identifies those locations in need of improvement and then treats them in priority order. Once a new construction or reconstruction project is selected in this manner, this Manual shall be used in determining the appropriate design criteria.

When design criteria presented in this Manual cannot be achieved for new, reconstruction, or Resurfacing, Restoration and Rehabilitation (3R) projects, a design exception request shall be prepared with full justification provided for the retention of these features. Variations from the design criteria may be required for special or unusual conditions where deviations from a particular criteria may be desirable due to structural restrictions, especially bridge, roadway and shoulder widths. Exceptions for bridges may be justified based on bridge type, bridge length, safety, traffic volumes, remaining life of the structure, design speed and other pertinent factors.

Exceptions to the design criteria should be considered on a highway system basis. Higher level systems such as interstates and other designated routes on the National Highway System warrant closer adherence to criteria in keeping with their higher importance; whereas improvements on lower level systems may not warrant such close adherence to design criteria. The determination to approve a project design not conforming to the minimum criteria should be made only after due consideration is given to all project conditions such as maximum service and safety benefits for the dollar invested, compatibility with adjacent sections of unimproved roadways and the probable time before reconstruction of the section due to increased traffic demand or changed conditions.

For all Federal Oversight (FO), Federal-aid highway projects, all exceptions to design criteria require formal written approval from the Federal Highway Administration (FHWA). For any designs on NHS projects that do not meet the criteria in this Manual, but conform to the minimum criteria in the 2004 AASHTO Green Book, a design exception is not required to be approved by FHWA, but requires Bureau of Design (BOD) approval. For all PENNDOT Oversight (PO) highway projects, all exceptions to design criteria require formal written approval from the Director, Bureau of Design or the District Executive, depending on delegation authority. Design exceptions for both PO and FO projects are submitted in letter format to the approval authority. For more information regarding Design Exceptions, refer to Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures*, Appendix F.

Highway design practice provides a broad range of measures that can be used alone or in combination with others that are highly cost effective when used in place of full construction. Achievement of these incremental geometric improvements can mitigate the effects of substandard features and provide for safer operations through relatively low-cost safety improvement measures for existing highway facilities. Table 1.1 provides examples of geometric features and associated safety measures that can be considered for adoption and incorporation into a design exception request justification when full construction to current design criteria is not practical.

The policies contained in this Manual, as well as the 2004 AASHTO Green Book, place emphasis on the joint use of transportation corridors by pedestrians, cyclists, and public transit vehicles. Designers should recognize the implications of this sharing of the transportation corridors and are encouraged to consider not only vehicular movement, but also movement of people, distribution of goods, and provision of essential services. A more comprehensive transportation program is thereby emphasized. Refer to Chapter 19, Considerations for Alternative Transportation Modes, for more information about considering the needs of bicyclists, pedestrians, and transit users in designing all roadway projects.

An important concept in highway design is that every project is unique. The setting and character of the area, the values of the community, the needs of the highway users, and the challenges and opportunities are unique factors that designers must consider with each highway project. Whether the design to be developed is for a safety improvement or several kilometers (miles) of rural freeway on new location, there are no patented solutions. For each potential project, designers are faced with the task of balancing the need for the highway improvement with the need to safely integrate the design into the surrounding natural and human environments.

Another important concept in highway design is the development of context sensitive design. Context sensitive design is a collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic, and environmental resources, while maintaining safety and mobility. Context sensitive design is an approach that considers the total context within which a transportation improvement project will exist.

For more information regarding these two important concepts, refer to the material described for context sensitive design in Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures*, Chapter 6, Section 6.3.F.

1.1 STANDARDS FOR ROADWAY CONSTRUCTION

The Department has prepared standard roadway drawings (Publication 72M, *Roadway Construction Standards*) to provide engineering personnel, designers and contractors with a catalog of specific design conditions for use as a guide in the development of the design of highways. The standard drawings shall be used in conjunction with the specifications, special provisions and construction plans to provide a more uniform design and construction practice for all projects.

1.2 DESIGN CRITERIA

The design criteria contained in this section shall be used in the design of new highway construction projects and in the improvement of the existing highway system.

Each project's scope shall be based on the well-defined needs that must be addressed. The needs are based upon the most pressing transportation problems in the project area. The scope of work shall be used to determine the appropriate design criteria for all projects. In addition to the design criteria for the design of new highway construction projects and the improvement of the existing highway system, all other design criteria, including Resurfacing, Restoration and Rehabilitation (3R) Criteria, Minimum Width Criteria for Bridges, Local, Collector, and Arterial Bridge Width Criteria (3R Bridge Width), Pavement Preservation Guidelines, and Non-Expressway Pavement Preservation Guidelines shall be applied, accordingly.

When designing 3R projects, improvements shall be designed using the 3R Design Criteria as presented in Section 1.2. The designer should also refer to the Transportation Research Board's Special Report 214, "Designing Safer Roads, Practices for Resurfacing, Restoration and Rehabilitation" and related publications for guidance.

A determination of the roadway's typology should be identified early in project design during the scoping field view process based on a project's context, as well as the functional classification of the roadway. Roadway typology captures the role of the roadway within its context, focusing on characteristics of access, mobility, and speed. The Roadway Typologies are illustrated in Table 1.2. The roadway classes shown in Table 1.2 correspond to the classifications of arterial, collector, and local, as described in the 2004 AASHTO Green Book.

Once the roadway typology is determined at the scoping field view, the appropriate design criteria can be selected from the Matrices of Design Values for the following roadways:

- Regional Arterial (Table 1.3)
- Community Arterial (Table 1.4)
- Community Collector (Table 1.5)
- Neighborhood Collector (Table 1.6)
- Local Road (Table 1.7)

The Roadside design values included in Tables 1.3 through 1.7 should be considered and implemented as feasible and reasonable; however, Chapter 6, Pedestrian Facilities, should still be evaluated for applicable design criteria.

The appropriate design criteria for Limited Access Freeways can be selected from the Matrix of Design Values in Table 1.8. Design values for Urban and Rural Interstates are in accordance with AASHTO's "A Policy on Design Standards – Interstate System".

For NHS roadways, the 2004 AASHTO Green Book governs. The design criteria in this Manual only take precedence for NHS roadways when it exceeds the criteria in the 2004 AASHTO Green Book.

As stated in Section 1.0 above, initiative should be exercised to utilize the most appropriate design values within the given ranges based upon the project context and roadway typology wherever practicable and within reasonable economic limitations and sound engineering judgment.

Criteria for Local Roads is not applicable to Federal-aid systems and only applies to Federal-aid off system projects.

The roadways that comprise the functional classification systems differ for urban and rural areas. The hierarchy of the functional classification systems consists of Interstate and Other Limited Access Freeways, Principal and Minor Arterials, Major and Minor Collectors and Local Roads. These systems for both urban and rural areas and their associated service characteristics are presented in Figure 1.1.

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TABLE 1.1
LOW COST SAFETY IMPROVEMENT MEASURES

GEOMETRIC FEATURES	SAFETY MEASURES
NARROW LANES AND SHOULDERS	Pavement edge lines. Raised pavement markers. Post delineators.
STEEP SIDESLOPES AND ROADSIDE OBSTRUCTIONS	Object markings. Slope flattening. Ditch rounding. Obstruction removal. Breakaway safety hardware. Guide rail.
NARROW BRIDGES *	Traffic control devices. Approach guide rail. Object markers. Pavement markings. Structure delineation. Warning signs. Speed control. Direction control.
LIMITED SIGHT DISTANCE AT CREST OR SAG VERTICAL CURVES	Traffic control devices. Fixed object removal. Driveway relocation.
SHARP HORIZONTAL CURVES	Traffic control devices. Shoulder widening. Appropriate superelevation. Slope flattening. Pavement antiskid treatment. Obstruction removal or relocation. Obstruction shielding. Warning signs.
INTERSECTIONS WITH POINTS OF CONFLICT	Traffic control devices. Traffic signalization. Fixed lighting. Pavement antiskid treatment. Speed controls.

* NARROW BRIDGES MAY BE APPROPRIATE FOR RETENTION WITH A DESIGN EXCEPTION REQUEST PROVIDED THE APPROACH TRAVELED WAY WIDTH IS NO WIDER THAN THE BRIDGE AND NO ACCIDENT PROBLEM EXISTS AND THE APPROACH IN ADVANCE OF THE BRIDGE IS NARROWED TO MEET THE BRIDGE. AS A GUIDE, USE THE RATIO OF TWICE THE DESIGN SPEED AS THE LONGITUDINAL TAPER. THE DESIGN LOAD STRUCTURAL CAPACITY SHALL MEET THE LOADS INDICATED IN THE MINIMUM WIDTH CRITERIA FOR BRIDGES. ALL NARROW BRIDGES SHALL BE PROPERLY SIGNED AS INDICATED IN THE MUTCD.

FIGURE 1.1
FUNCTIONAL CLASSIFICATION SYSTEM
SERVICE CHARACTERISTICS

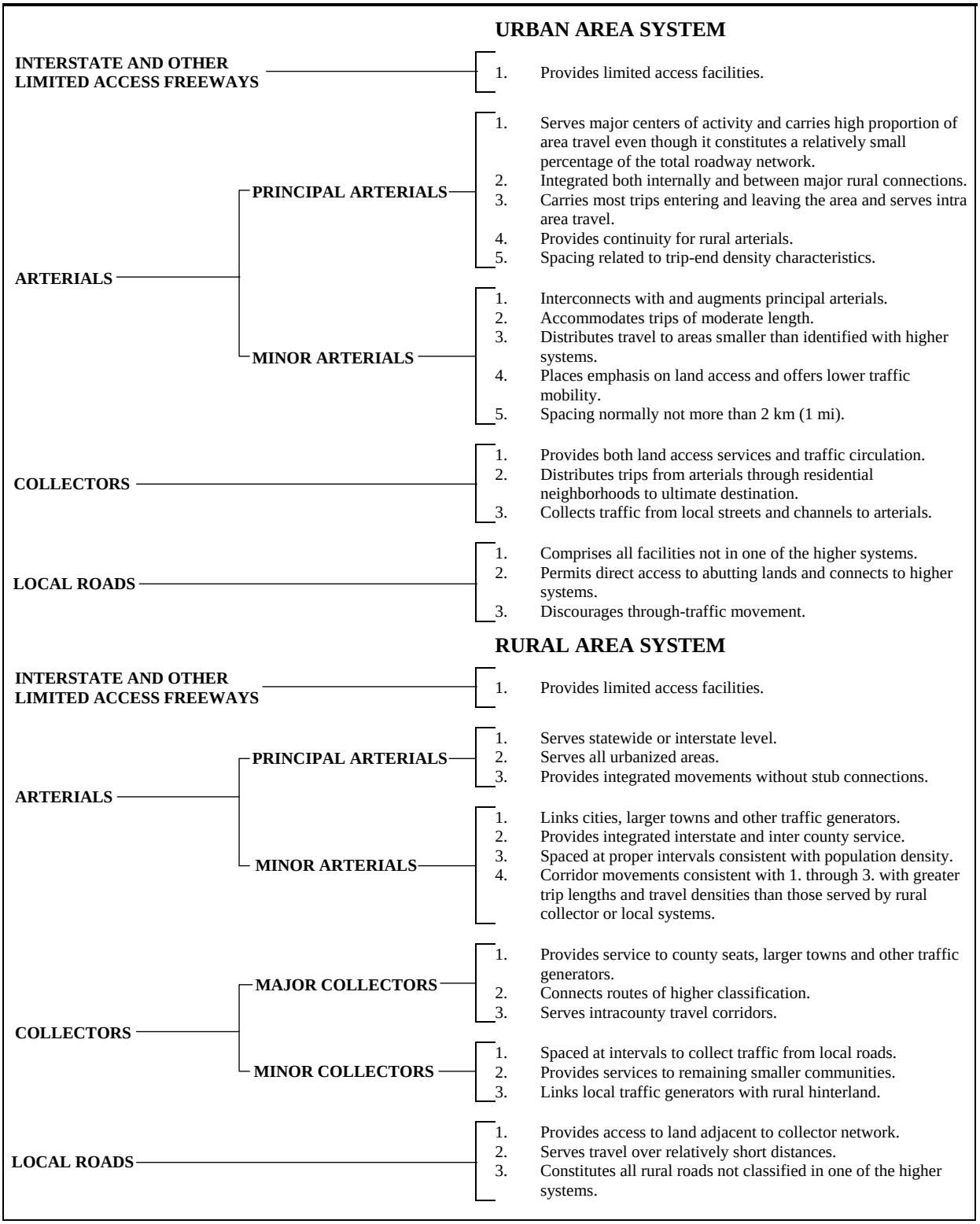

TABLE 1.2
ROADWAY TYPOLOGIES

ROADWAY CLASS	ROADWAY TYPE	DESIRED OPERATING SPEED	AVERAGE TRIP LENGTH	VOLUME	INTERSECTION SPACING	COMMENTS
Arterial	Regional	50-90 km/h (30-55 mph)	24-56 km (15-35 mi)	10,000-40,000 veh/day	200-400 m (660-1,320 ft)	Roadways in this category would be considered "Principal Arterial" in traditional functional classification.
Arterial	Community	40-90 km/h (25-55 mph)	11-40 km (7-25 mi)	5,000-25,000 veh/day	90-400 m (300-1,320 ft)	Often classified as "Minor Arterial" in traditional classification but may include road segments classified as "Principal Arterial".
Collector	Community	40-90 km/h (25-55 mph)	8-16 km (5-10 mi)	5,000-15,000 veh/day	90-200 m (300-660 ft)	Often similar in appearance to a community arterial. Typically classified as "Major Collector".
Collector	Neighborhood	40-60 km/h (25-35 mph)	< 11 km (< 7 mi)	< 6,000 veh/day	90-200 m (300-660 ft)	Similar in appearance to local roadways. Typically classified as "Minor Collector".
Local	Local	30-50 km/h (20-30 mph)	< 8 km (< 5 mi)	< 3,000 veh/day	60-200 m (200-660 ft)	

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FIGURE 1.2
ILLUSTRATED ROADWAY TYPOLOGIES

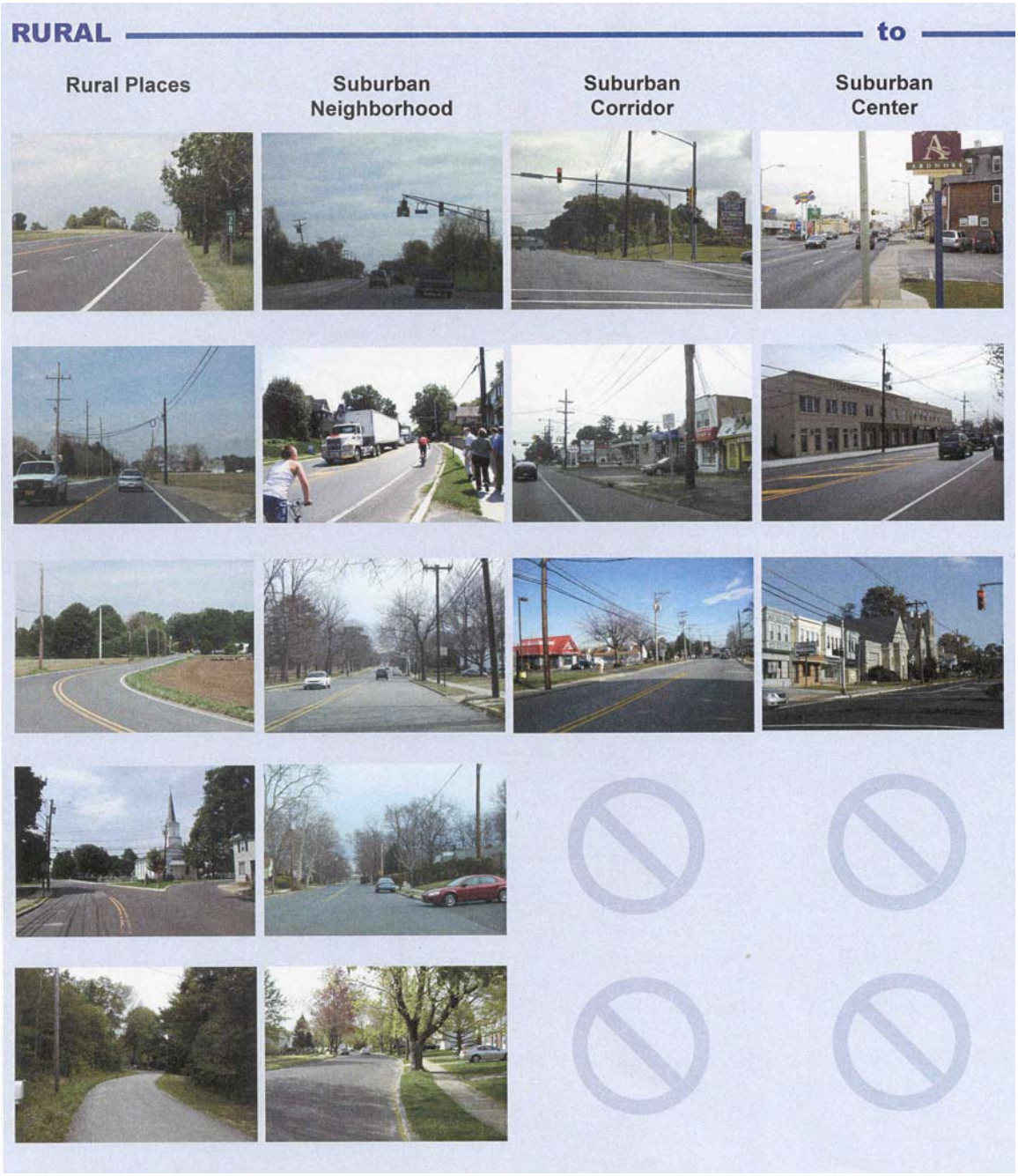


FIGURE 1.2 (CONTINUED)
ILLUSTRATED ROADWAY TYPOLOGIES

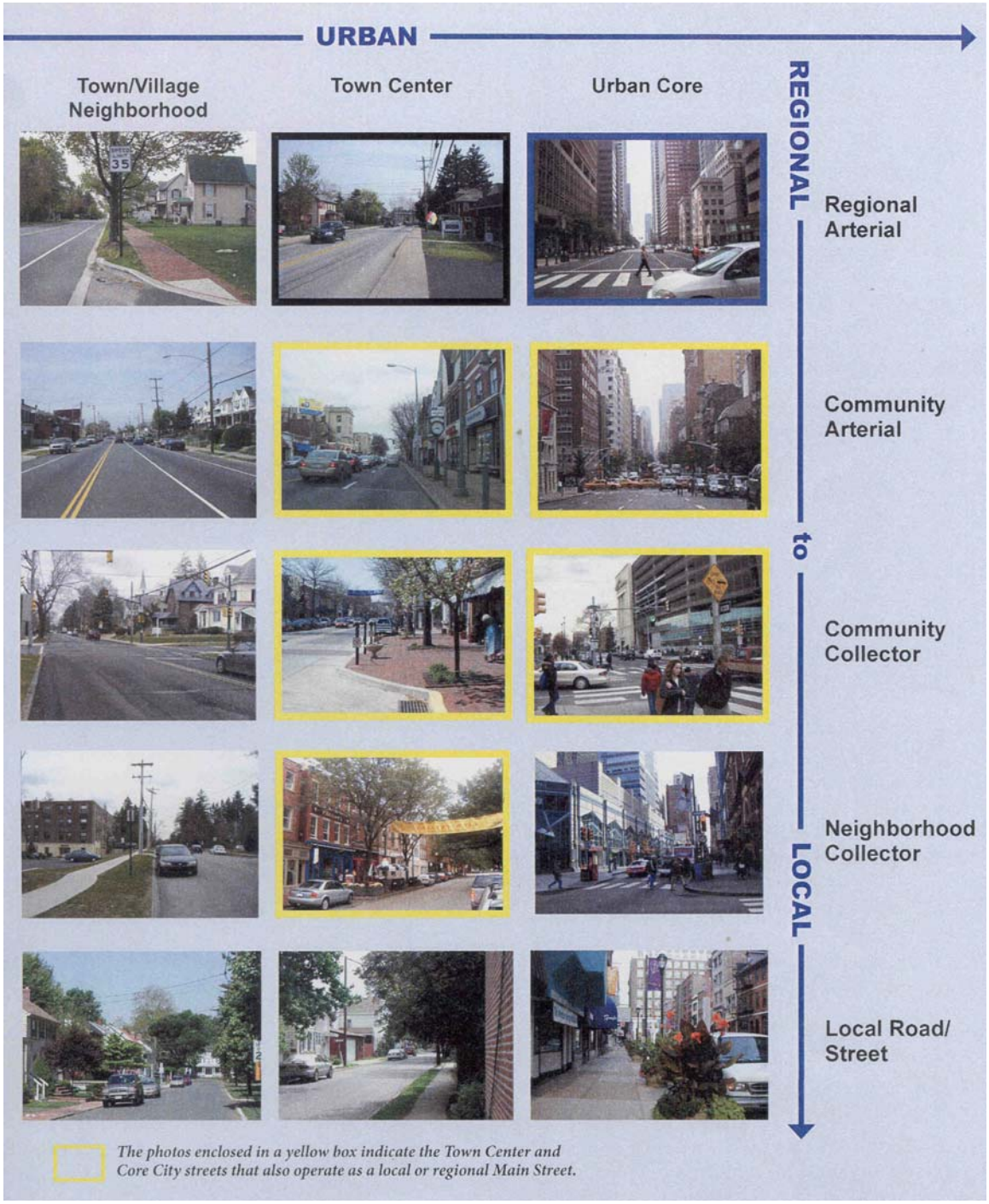


TABLE 1.3 (METRIC)
MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

	Regional Arterial	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town/Village Center	Urban Core
Roadway	Lane Width [1]	3.3 m to 3.6 m	3.3 m to 3.6 m	3.3 m to 3.6 m	3.3 m to 3.6 m	3.0 m to 3.6 m	3.0 m to 3.6 m	3.0 m to 3.6 m
	Shoulder Width [2, 3]	2.4 m to 3.0 m	2.4 m to 3.0 m	2.4 m to 3.6 m	1.2 m to 1.8 m (if No Parking or Bike Lane)	1.2 m to 1.8 m (if No Parking or Bike Lane)	1.2 m to 1.8 m (if No Parking or Bike Lane)	1.2 m to 1.8 m (if No Parking or Bike Lane)
	Parking Lane	NA	NA	NA	2.4 m Parallel	2.4 m Parallel	2.4 m Parallel	2.4 m Parallel
	Bike Lane [4]	NA	1.5 m to 1.8 m (if No Shoulder)	1.8 m (if No Shoulder)	1.5 m to 1.8 m	1.5 m to 1.8 m	1.5 m to 1.8 m	1.5 m to 1.8 m
	Median (if needed)	1.2 m to 1.8 m	4.8 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians Only	4.8 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians Only	4.8 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians Only	4.8 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians Only	4.8 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians Only	4.8 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians Only
	Curb Return [5]	9.0 m to 15.0 m	7.5 m to 10.5 m	9.0 m to 15.0 m	7.5 m to 15.0 m	4.5 m to 12.0 m	4.5 m to 12.0 m	4.5 m to 12.0 m
	Travel Lanes	2 to 6	2 to 6	4 to 6	4 to 6	2 to 4	2 to 4	2 to 6
	Cross Slopes (Minimum) [6, 7]	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
	Cross Slopes (Maximum) [8]	8.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
	Bridge Widths (Two-Lane Facilities) [9, 10, 16]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Bridge Widths (Four-Lane or More Facilities) [9, 10, 16]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Vertical Grades (Minimum) [11]	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
	Vertical Clearance (Minimum)	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2
Roadside [12]	Clear Sidewalk Width	NA	1.5 m	1.5 m to 1.8 m	1.5 m to 1.8 m	1.8 m to 2.4 m	1.8 m to 3.0 m	1.8 m to 3.6 m
	Buffer [13]	NA	1.8 m+	1.8 m to 3.0 m	1.2 m to 1.8 m	1.2 m to 1.8 m	1.2 m to 1.8 m	1.2 m to 1.8 m
	Shy Distance	NA	NA	NA	0 m to 0.6 m	0 m to 0.6 m	0.6 m	0.6 m
	Total Sidewalk Width	NA	1.5 m	1.5 m to 1.8 m	2.7 m to 4.2 m	3.0 m to 4.8 m	3.6 m to 5.4 m	3.6 m to 6.0 m
	Clear Zone Widths [14]	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12
	Right-of-Way Widths [15]	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Speed	Desired Operating Speed (Design Speed)	70-90 km/h	60-70 km/h	60-90 km/h	50-60 km/h	50-60 km/h	50-60 km/h	50-60 km/h
	Stopping and Passing Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1
	Vertical Grades (Maximum)	2004 AASHTO Green Book, Exhibit 7-2	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10

TABLE 1.3 (METRIC) (CONTINUED)
MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

Matrix of Design Values - Notes (Regional Arterial)
[1] 3.6 m preferred for regular transit routes, and heavy truck volumes > 5%, particularly for design speeds of 60 km/h or greater. A 0.3 m to 0.6 m offset to the curb is desirable. 4.2 m for an outside lane with no shoulder or bike lane, if optimal accommodation for bicyclists is desired.
[2] Shoulders should only be installed in urban contexts as a retrofit of wide travel lanes to accommodate bicyclists. For rural divided arterials with three or more lanes in each direction, a 3.0 m wide left shoulder within the median is desirable.
[3] Paving for railroad grade crossings shall extend 0.6 m beyond the extreme rails for the full graded width of the highway.
[4] Design of bike lanes should be considered when identified as part of the Engineering & Environmental (E&E) Scoping process. For additional guidance, refer to Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures,* Appendix J, Bicycle and Pedestrian Checklist.
[5] Curb return radius should be as small as possible. Number of lanes, on street parking, bike lanes, and shoulders should be utilized to determine effective radius.
[6] Cross slopes of 3.0% are recommended for design speeds less than 60 km/h.
[7] In curbed areas with longitudinal slopes of 1% or less, 3.0% cross slopes may be used on tangents.
[8] For additional guidance, refer to Chapter 2, Sections 2.13.B, Rates of Superelevation and 2.13.C, Maximum Superelevation.
[9] On curbed approaches, the minimum bridge width may equal the curb-to-curb width. Where pedestrian traffic is anticipated, provisions for a sidewalk, preferably on the outside of the parapet, should be considered and shall meet the Department's Standards and requirements (see Chapter 6). Where paved or curbed parking lanes exist or have been approved for construction on approaches, the clear roadway width of the proposed bridge in each case shall be determined by the Central Office, Bureau of Design upon receipt of the District Executive's recommendation.
[10] For appropriate bridge widths, refer to the Minimum Width Criteria for Bridges.
[11] Recommended minimum grade of 0.75% on curbed sections.
[12] The Roadside design values should be considered and implemented as feasible and reasonable; however, Chapter 6, Pedestrian Facilities, should still be used for minimum design criteria. ADA accommodations must be addressed in accordance with ADA policy.
[13] Buffer is assumed to be planted area (grass, shrubs and/or trees) for suburban neighborhood and corridor contexts; street furniture/car door zone for other land use contexts. Minimum of 1.8 m for transit zones.
[14] Center piers are not desirable. Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures* .
[15] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[16] For long bridges over 60 m in length, the shoulder width may be 1.2 m on each side.

TABLE 1.3 (ENGLISH)
MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

	Regional Arterial	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town/Village Center	Urban Core
Roadway	Lane Width [1]	11' to 12'	11' to 12'	11' to 12'	11' to 12'	10' to 12'	10' to 12'	10' to 12'
	Shoulder Width [2, 3]	8' to 10'	8' to 10'	8' to 12'	4' to 6' (if No Parking or Bike Lane)	4' to 6' (if No Parking or Bike Lane)	4' to 6' (if No Parking or Bike Lane)	4' to 6' (if No Parking or Bike Lane)
	Parking Lane	NA	NA	NA	8' Parallel	8' Parallel	8' Parallel	8' Parallel
	Bike Lane [4]	NA	5' to 6' (if No Shoulder)	6' (if No Shoulder)	5' to 6'	5' to 6'	5' to 6'	5' to 6'
	Median (if needed)	4' to 6'	16' to 18' for Left Turn; 6' to 8' for Pedestrians Only	16' to 18' for Left Turn; 6' to 8' for Pedestrians Only	16' to 18' for Left Turn; 6' to 8' for Pedestrians Only	16' to 18' for Left Turn; 6' to 8' for Pedestrians Only	16' to 18' for Left Turn; 6' to 8' for Pedestrians Only	16' to 18' for Left Turn; 6' to 8' for Pedestrians Only
	Curb Return [5]	30' to 50'	25' to 35'	30' to 50'	25' to 50'	15' to 40'	15' to 40'	15' to 40'
	Travel Lanes	2 to 6	2 to 6	4 to 6	4 to 6	2 to 4	2 to 4	2 to 6
	Cross Slopes (Minimum) [6, 7]	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
	Cross Slopes (Maximum) [8]	8.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
	Bridge Widths (Two-Lane Facilities) [9, 10, 16]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Bridge Widths (Four-Lane or More Facilities) [9, 10, 16]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Vertical Grades (Minimum) [11]	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
	Vertical Clearance (Minimum)	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2
Roadside [12]	Clear Sidewalk Width	NA	5'	5' to 6'	5' to 6'	6' to 8'	6' to 10'	6' to 12'
	Buffer [13]	NA	6'+	6' to 10'	4' to 6'	4' to 6'	4' to 6'	4' to 6'
	Shy Distance	NA	NA	NA	0' to 2'	0' to 2'	2'	2'
	Total Sidewalk Width	NA	5'	5' to 6'	9' to 14'	10' to 16'	12' to 18'	12' to 20'
	Clear Zone Widths [14]	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12
	Right-of-Way Widths [15]	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Speed	Desired Operating Speed (Design Speed)	45-55 mph	35-40 mph	35-55 mph	30-35 mph	30-35 mph	30-35 mph	30-35 mph
	Stopping and Passing Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1
	Vertical Grades (Maximum)	2004 AASHTO Green Book, Exhibit 7-2	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10

TABLE 1.3 (ENGLISH) (CONTINUED)
MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

Matrix of Design Values - Notes (Regional Arterial)
[1] 12' preferred for regular transit routes, and heavy truck volumes > 5%, particularly for design speeds of 35 mph or greater. A 1' to 2' offset to the curb is desirable. 14' for an outside lane with no shoulder or bike lane, if optimal accommodation for bicyclists is desired.
[2] Shoulders should only be installed in urban contexts as a retrofit of wide travel lanes to accommodate bicyclists. For rural divided arterials with three or more lanes in each direction, a 10' wide left shoulder within the median is desirable.
[3] Paving for railroad grade crossings shall extend 2' beyond the extreme rails for the full graded width of the highway.
[4] Design of bike lanes should be considered when identified as part of the Engineering & Environmental (E&E) Scoping process. For additional guidance, refer to Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures,* Appendix J, Bicycle and Pedestrian Checklist.
[5] Curb return radius should be as small as possible. Number of lanes, on street parking, bike lanes, and shoulders should be utilized to determine effective radius.
[6] Cross slopes of 3.0% are recommended for design speeds less than 40 mph.
[7] In curbed areas with longitudinal slopes of 1% or less, 3.0% cross slopes may be used on tangents.
[8] For additional guidance, refer to Chapter 2, Sections 2.13.B, Rates of Superelevation and 2.13.C, Maximum Superelevation.
[9] On curbed approaches, the minimum bridge width may equal the curb-to-curb width. Where pedestrian traffic is anticipated, provisions for a sidewalk, preferably on the outside of the parapet, should be considered and shall meet the Department's Standards and requirements (see Chapter 6). Where paved or curbed parking lanes exist or have been approved for construction on approaches, the clear roadway width of the proposed bridge in each case shall be determined by the Central Office, Bureau of Design upon receipt of the District Executive's recommendation.
[10] For appropriate bridge widths, refer to the Minimum Width Criteria for Bridges.
[11] Recommended minimum grade of 0.75% on curbed sections.
[12] The Roadside design values should be considered and implemented as feasible and reasonable; however, Chapter 6, Pedestrian Facilities, should still be used for minimum design criteria. ADA accommodations must be addressed in accordance with ADA policy.
[13] Buffer is assumed to be planted area (grass, shrubs and/or trees) for suburban neighborhood and corridor contexts; street furniture/car door zone for other land use contexts. Minimum of 6' for transit zones.
[14] Center piers are not desirable. Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures* .
[15] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[16] For long bridges over 200' in length, the shoulder width may be 4' on each side.

TABLE 1.4 (METRIC)
MATRIX OF DESIGN VALUES – COMMUNITY ARTERIAL

	Community Arterial	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town/Village Center	Urban Core
Roadway	Lane Width [1]	3.3 m to 3.6 m	3.0 m to 3.6 m	3.3 m to 3.6 m	3.0 m to 3.6 m	3.0 m to 3.6 m	3.0 m to 3.6 m	3.0 m to 3.6 m
Roadway	Shoulder Width [2, 3]	2.4 m to 3.0 m	1.2 m to 2.4 m (if No Parking or Bike Lane)	2.4 m to 3.0 m	1.2 m to 1.8 m (if No Parking or Bike Lane)	1.2 m to 1.8 m (if No Parking or Bike Lane)	1.2 m to 1.8 m (if No Parking or Bike Lane)	1.2 m to 1.8 m (if No Parking or Bike Lane)
Roadway	Parking Lane [16]	NA	2.1 m to 2.4 m Parallel	NA	2.4 m Parallel	2.1 m to 2.4 m Parallel	2.1 m to 2.4 m Parallel	2.1 m to 2.4 m Parallel
Roadway	Bike Lane [4]	NA	1.5 m to 1.8 m (if No Shoulder)	1.5 m to 1.8 m (if No Shoulder)	1.5 m to 1.8 m	1.5 m to 1.8 m	1.5 m to 1.8 m	1.5 m to 1.8 m
Roadway	Median (if needed)	1.2 m to 1.8 m	4.8 m to 5.4 m for Left Turn 3.6 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians	4.8 m to 5.4 m for Left Turn 3.6 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians	4.8 m to 5.4 m for Left Turn 3.6 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians	4.8 m to 5.4 m for Left Turn 3.6 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians	4.8 m to 5.4 m for Left Turn 3.6 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians	4.8 m to 5.4 m for Left Turn 3.6 m to 5.4 m for Left Turn; 1.8 m to 2.4 m for Pedestrians
Roadway	Curb Return [5]	7.5 m to 15.0 m	7.5 m to 10.5 m	7.5 m to 15.0 m	6.0 m to 12.0 m	4.5 m to 9.0 m	4.5 m to 10.5 m	4.5 m to 12.0 m
Roadway	Travel Lanes	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4
Roadway	Cross Slopes (Minimum) [6, 7]	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Roadway	Cross Slopes (Maximum) [8]	8.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
Roadway	Bridge Widths (Two-Lane Facilities) [9, 10, 17]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
Roadway	Bridge Widths (Four-Lane Facilities) [9, 10, 17]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
Roadway	Vertical Grades (Minimum) [11]	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Roadway	Vertical Clearance (Minimum)	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2
Roadside [12]	Clear Sidewalk Width	NA	1.5 m	1.5 m to 1.8 m	1.8 m	1.8 m to 2.4 m	1.8 m to 3.0 m	2.4 m to 4.2 m
Roadside [12]	Buffer [13]	NA	1.8 m+	1.5 m to 3.0 m	1.2 m to 1.8 m	1.2 m to 1.8 m	1.2 m to 1.8 m	1.2 m to 1.8 m
Roadside [12]	Shy Distance	NA	NA	NA	0 m to 0.6 m	0 m to 0.6 m	0.6 m	0.6 m
Roadside [12]	Total Sidewalk Width	NA	1.5 m	1.5 m to 1.8 m	3.0 m to 4.2 m	3.0 m to 4.8 m	3.6 m to 5.4 m	4.2 m to 6.6 m
Roadside [12]	Clear Zone Widths [14]	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12
Roadside [12]	Right-of-Way Widths [15]	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Speed	Desired Operating Speed (Design Speed)	60-90 km/h	50-60 km/h	60-80 km/h	50 km/h	40-50 km/h	40-50 km/h	40-50 km/h
Speed	Stopping and Passing Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1
Speed	Vertical Grades (Maximum)	2004 AASHTO Green Book, Exhibit 7-2	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10

TABLE 1.4 (METRIC) (CONTINUED)
MATRIX OF DESIGN VALUES – COMMUNITY ARTERIAL

Matrix of Design Values - Notes (Community Arterial)
[1] 3.6 m preferred for regular transit routes, and heavy truck volumes > 5%, particularly for design speeds of 60 km/h or greater. A 0.3 m to 0.6 m offset to the curb is desirable. 4.2 m for an outside lane with no shoulder or bike lane, if optimal accommodation for bicyclists is desired.
[2] Shoulders should be installed in urban contexts only as part of a retrofit of wide travel lanes to accommodate bicyclists.
[3] Paving for railroad grade crossings shall extend 0.6 m beyond the extreme rails for the full graded width of the highway.
[4] Design of bike lanes should be considered when identified as part of the Engineering & Environmental (E&E) Scoping process. For additional guidance, refer to Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures,* Appendix J, Bicycle and Pedestrian Checklist.
[5] Curb Return radius should be as small as possible. Number of lanes, on street parking, bike lanes, and shoulders should be utilized to determine effective radius.
[6] Cross slopes of 3.0% are recommended for design speeds less than 60 km/h.
[7] In curbed areas with longitudinal slopes of 1% or less, 3.0% cross slopes may be used on tangents.
[8] For additional guidance, refer to Chapter 2, Sections 2.13.B, Rates of Superelevation and 2.13.C, Maximum Superelevation.
[9] On curbed approaches, the minimum bridge width may equal the curb-to-curb width. Where pedestrian traffic is anticipated, provisions for a sidewalk, preferably on the outside of the parapet, should be considered and shall meet the Department's Standards and requirements (see Chapter 6). Where paved or curbed parking lanes exist or have been approved for construction on approaches, the clear roadway width of the proposed bridge in each case shall be determined by the Central Office, Bureau of Design upon receipt of the District Executive's recommendation.
[10] For appropriate bridge widths, refer to the Minimum Width Criteria for Bridges.
[11] Recommended minimum grade of 0.75% on curbed sections.
[12] The Roadside design values should be considered and implemented as feasible and reasonable; however, Chapter 6, Pedestrian Facilities, should still be used for minimum design criteria. ADA accommodations must be addressed in accordance with ADA policy.
[13] Buffer is assumed to be planted area (grass, shrubs and/or trees) for suburban neighborhood and corridor contexts; street furniture/car door zone for other land use contexts. Minimum of 1.8 m for transit zones.
[14] Center piers are not desirable. Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures* .
[15] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[16] 2.1 m parking lanes on this roadway type to be considered in appropriate conditions.
[17] For long bridges over 60 m in length, the shoulder width may be 1.2 m on each side.

TABLE 1.4 (ENGLISH)
MATRIX OF DESIGN VALUES – COMMUNITY ARTERIAL

	Community Arterial	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town/Village Center	Urban Core
Roadway	Lane Width [1]	11' to 12'	10' to 12'	11' to 12'	10' to 12'	10' to 12'	10' to 12'	10' to 12'
	Shoulder Width [2, 3]	8' to 10'	4' to 8' (if No Parking or Bike Lane)	8' to 10'	4' to 6' (if No Parking or Bike Lane)	4' to 6' (if No Parking or Bike Lane)	4' to 6' (if No Parking or Bike Lane)	4' to 6' (if No Parking or Bike Lane)
	Parking Lane [16]	NA	7' to 8' Parallel	NA	8' Parallel	7' to 8' Parallel	7' to 8' Parallel	7' to 8' Parallel
	Bike Lane [4]	NA	5' to 6' (if No Shoulder)	5' to 6' (if No Shoulder)	5' to 6'	5' to 6'	5' to 6'	5' to 6'
	Median (if needed)	4' to 6'	16' to 18' for Left Turn 12' to 18' for Left Turn; 6' to 8' for Pedestrians	16' to 18' for Left Turn 12' to 18' for Left Turn; 6' to 8' for Pedestrians	16' to 18' for Left Turn 12' to 18' for Left Turn; 6' to 8' for Pedestrians	16' to 18' for Left Turn 12' to 18' for Left Turn; 6' to 8' for Pedestrians	16' to 18' for Left Turn 12' to 18' for Left Turn; 6' to 8' for Pedestrians	16' to 18' for Left Turn 12' to 18' for Left Turn; 6' to 8' for Pedestrians
	Curb Return [5]	25' to 50'	25' to 35'	25' to 50'	20' to 40'	15' to 30'	15' to 35'	15' to 40'
	Travel Lanes	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4
	Cross Slopes (Minimum) [6, 7]	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
	Cross Slopes (Maximum) [8]	8.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
	Bridge Widths (Two-Lane Facilities) [9, 10, 17]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Bridge Widths (Four-Lane Facilities) [9, 10, 17]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Vertical Grades (Minimum) [11]	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
	Vertical Clearance (Minimum)	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2
Roadside [12]	Clear Sidewalk Width	NA	5'	5' to 6'	6'	6' to 8'	6' to 10'	8' to 14'
	Buffer [13]	NA	6'+	5' to 10'	4' to 6'	4' to 6'	4' to 6'	4' to 6'
	Shy Distance	NA	NA	NA	0' to 2'	0' to 2'	2'	2'
	Total Sidewalk Width	NA	5'	5' to 6'	10' to 14'	10' to 16'	12' to 18'	14' to 22'
	Clear Zone Widths [14]	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12
	Right-of-Way Widths [15]	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Speed	Desired Operating Speed (Design Speed)	35-55 mph	30-35 mph	35-50 mph	30 mph	25-30 mph	25-30 mph	25-30 mph
	Stopping and Passing Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1	2004 AASHTO Green Book, Exhibit 7-1
	Vertical Grades (Maximum)	2004 AASHTO Green Book, Exhibit 7-2	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10	2004 AASHTO Green Book, Exhibit 7-10

TABLE 1.4 (ENGLISH) (CONTINUED)
MATRIX OF DESIGN VALUES – COMMUNITY ARTERIAL

Matrix of Design Values - Notes (Community Arterial)
[1] 12' preferred for regular transit routes, and heavy truck volumes > 5%, particularly for design speeds of 35 mph or greater. A 1' to 2' offset to the curb is desirable. 14' for an outside lane with no shoulder or bike lane, if optimal accommodation for bicyclists is desired.
[2] Shoulders should be installed in urban contexts only as part of a retrofit of wide travel lanes to accommodate bicyclists.
[3] Paving for railroad grade crossings shall extend 2' beyond the extreme rails for the full graded width of the highway.
[4] Design of bike lanes should be considered when identified as part of the Engineering & Environmental (E&E) Scoping process. For additional guidance, refer to Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures,* Appendix J, Bicycle and Pedestrian Checklist.
[5] Curb Return radius should be as small as possible. Number of lanes, on street parking, bike lanes, and shoulders should be utilized to determine effective radius.
[6] Cross slopes of 3.0% are recommended for design speeds less than 40 mph.
[7] In curbed areas with longitudinal slopes of 1% or less, 3.0% cross slopes may be used on tangents.
[8] For additional guidance, refer to Chapter 2, Sections 2.13.B, Rates of Superelevation and 2.13.C, Maximum Superelevation.
[9] On curbed approaches, the minimum bridge width may equal the curb-to-curb width. Where pedestrian traffic is anticipated, provisions for a sidewalk, preferably on the outside of the parapet, should be considered and shall meet the Department's Standards and requirements (see Chapter 6). Where paved or curbed parking lanes exist or have been approved for construction on approaches, the clear roadway width of the proposed bridge in each case shall be determined by the Central Office, Bureau of Design upon receipt of the District Executive's recommendation.
[10] For appropriate bridge widths, refer to the Minimum Width Criteria for Bridges.
[11] Recommended minimum grade of 0.75% on curbed sections.
[12] The Roadside design values should be considered and implemented as feasible and reasonable; however, Chapter 6, Pedestrian Facilities, should still be used for minimum design criteria. ADA accommodations must be addressed in accordance with ADA policy.
[13] Buffer is assumed to be planted area (grass, shrubs and/or trees) for suburban neighborhood and corridor contexts; street furniture/car door zone for other land use contexts. Minimum of 6' for transit zones.
[14] Center piers are not desirable. Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures* .
[15] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[16] 7' parking lanes on this roadway type to be considered in appropriate conditions.
[17] For long bridges over 200' in length, the shoulder width may be 4' on each side.

TABLE 1.5 (METRIC)
MATRIX OF DESIGN VALUES – COMMUNITY COLLECTOR

	Community Collector	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town/Village Center	Urban Core
Roadway	Lane Width [1]	3.3 m to 3.6 m	3.0 m to 3.6 m	3.3 m to 3.6 m	3.0 m to 3.3 m	3.0 m to 3.3 m	3.0 m to 3.3 m	3.0 m to 3.3 m
	Shoulder Width [2, 3]	1.2 m to 2.4 m	1.2 m to 2.4 m (if No Parking or Bike Lane)	2.4 m to 3.0 m	1.2 m to 1.8 m (if No Parking or Bike Lane)	1.2 m (if No Parking or Bike Lane)	1.2 m (if No Parking or Bike Lane)	1.2 m (if No Parking or Bike Lane)
	Parking Lane	NA	2.1 m	NA	2.1 m to 2.4 m Parallel	2.1 m to 2.4 m Parallel	2.1 m to 2.4 m Parallel	2.1 m to 2.4 m Parallel
	Bike Lane [4]	NA	1.5 m	1.5 m to 1.8 m	1.5 m to 1.8 m	1.5 m to 1.8 m	1.5 m to 1.8 m	1.5 m to 1.8 m
	Median (if needed)	NA	3.6 m to 4.8 m for Left Turn; 1.8 m for Pedestrians Only	3.6 m to 4.8 m for Left Turn; 1.8 m for Pedestrians Only	3.6 m to 4.8 m for Left Turn; 1.8 m for Pedestrians Only	3.6 m to 4.8 m for Left Turn; 1.8 m for Pedestrians Only	3.6 m to 4.8 m for Left Turn; 1.8 m for Pedestrians Only	3.6 m to 4.8 m for Left Turn; 1.8 m for Pedestrians Only
	Curb Return [5]	6.0 m to 12.0 m	4.5 m to 10.5 m	6.0 m to 12.0 m	6.0 m to 10.5 m	3.0 m to 7.5 m	3.0 m to 7.5 m	3.0 m to 9.0 m
	Travel Lanes	2	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4
	Cross Slopes (Minimum) [6, 7]	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
	Cross Slopes (Maximum) [8]	8.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
	Bridge Widths (Two-Lane Facilities) [9, 10, 17]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Bridge Widths (Four-Lane Facilities) [9, 10, 17]	NA	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Vertical Grades (Minimum) [11]	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
	Vertical Clearance (Minimum)	4.3 m, See Chapter 2	4.3 m, See Chapter 2	4.3 m, See Chapter 2	4.3 m, See Chapter 2	4.3 m, See Chapter 2	4.3 m, See Chapter 2	4.3 m, See Chapter 2
Roadside [12]	Clear Sidewalk Width	NA	1.2 m to 1.5 m	1.5 m to 1.8 m	1.8 m to 2.4 m	1.5 m to 1.8 m	1.8 m to 2.4 m	1.8 m to 3.0 m
	Buffer [13]	NA	1.5 m+	1.5 m to 3.0 m	1.2 m to 1.5 m	1.2 m to 1.5 m	1.2 m to 1.5 m	1.2 m to 1.8 m
	Shy Distance	NA	NA	NA	0 m to 0.6 m	0 m to 0.6 m	0.6 m	0.6 m
	Total Sidewalk Width	NA	1.2 m to 1.5 m	1.5 m to 1.8 m	3.0 m to 4.5 m	2.7 m to 3.9 m	3.6 m to 4.5 m	3.6 m to 5.4 m
	Clear Zone Widths [14]	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12
	Right-of-Way Widths [15]	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Speed	Desired Operating Speed (Design Speed)	60-90 km/h	40-50 km/h	50-60 km/h	40-50 km/h	40-50 km/h	40-50 km/h	40-50 km/h
	Stopping and Passing Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3
	Vertical Grades (Maximum) [16]	2004 AASHTO Green Book, Exhibit 6-4	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8

TABLE 1.5 (METRIC) (CONTINUED)
MATRIX OF DESIGN VALUES – COMMUNITY COLLECTOR

Matrix of Design Values - Notes (Community Collector)
[1] 3.3 m to 3.6 m preferred for heavy truck volumes > 5% and regular transit routes. A 0.3 m to 0.6 m offset to the curb is desirable. 4.2 m for an outside lane with no shoulder or bike lane, if optimal accommodation for bicyclists is desired.
[2] Shoulders should be installed in urban contexts only as part of a retrofit of wide travel lanes to accommodate bicyclists.
[3] Paving for railroad grade crossings shall extend 0.6 m beyond the extreme rails for the full graded width of the highway.
[4] Design of bike lanes should be considered when identified as part of the Engineering & Environmental (E&E) Scoping process. For additional guidance, refer to Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures,* Appendix J, Bicycle and Pedestrian Checklist.
[5] Curb Return radius should be as small as possible. Number of lanes, on street parking, bike lanes, and shoulders should be utilized to determine effective radius.
[6] Cross slopes of 3.0% are recommended for design speeds less than 60 km/h.
[7] In curbed areas with longitudinal slopes of 1% or less, 3.0% cross slopes may be used on tangents.
[8] For additional guidance, refer to Chapter 2, Sections 2.13.B, Rates of Superelevation and 2.13.C, Maximum Superelevation.
[9] On curbed approaches, the minimum bridge width may equal the curb-to-curb width. Where pedestrian traffic is anticipated, provisions for a sidewalk, preferably on the outside of the parapet, should be considered and shall meet the Department's Standards and requirements (see Chapter 6). Where paved or curbed parking lanes exist or have been approved for construction on approaches, the clear roadway width of the proposed bridge in each case shall be determined by the Central Office, Bureau of Design upon receipt of the District Executive's recommendation.
[10] For appropriate bridge widths, refer to the Minimum Width Criteria for Bridges.
[11] Recommended minimum grade of 0.75% on curbed sections.
[12] The Roadside design values should be considered and implemented as feasible and reasonable; however, Chapter 6, Pedestrian Facilities, should still be used for minimum design criteria. ADA accommodations must be addressed in accordance with ADA policy.
[13] Buffer is assumed to be planted area (grass, shrubs, and/or trees) for suburban neighborhood and corridor contexts.
[14] Center piers are not desirable. Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures* .
[15] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[16] For short grades less than 150 m, one-way downgrades, and grades on low-volume rural or urban collectors, maximum grades may be up to 2% steeper.
[17] For long bridges over 30 m in length, the shoulder width may be 1 m on each side.

TABLE 1.5 (ENGLISH)
MATRIX OF DESIGN VALUES – COMMUNITY COLLECTOR

	Community Collector	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town/Village Center	Urban Core
Roadway	Lane Width [1]	11' to 12'	10' to 12'	11' to 12'	10' to 11'	10' to 11'	10' to 11'	10' to 11'
	Shoulder Width [2, 3]	4' to 8'	4' to 8' (if No Parking or Bike Lane)	8' to 10'	4' to 6' (if No Parking or Bike Lane)	4' (if No Parking or Bike Lane)	4' (if No Parking or Bike Lane)	4' (if No Parking or Bike Lane)
	Parking Lane	NA	7'	NA	7' to 8' Parallel	7' to 8' Parallel	7' to 8' Parallel	7' to 8' Parallel
	Bike Lane [4]	NA	5'	5' to 6'	5' to 6'	5' to 6'	5' to 6'	5' to 6'
	Median (if needed)	NA	12' to 16' for Left Turn; 6' for Pedestrians Only	12' to 16' for Left Turn; 6' for Pedestrians Only	12' to 16' for Left Turn; 6' for Pedestrians Only	12' to 16' for Left Turn; 6' for Pedestrians Only	12' to 16' for Left Turn; 6' for Pedestrians Only	12' to 16' for Left Turn; 6' for Pedestrians Only
	Curb Return [5]	20' to 40'	15' to 35'	20' to 40'	20' to 35'	10' to 25'	10' to 25'	10' to 30'
	Travel Lanes	2	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4	2 to 4
	Cross Slopes (Minimum) [6, 7]	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
	Cross Slopes (Maximum) [8]	8.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
	Bridge Widths (Two-Lane Facilities) [9, 10, 17]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Bridge Widths (Four-Lane Facilities) [9, 10, 17]	NA	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Vertical Grades (Minimum) [11]	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
	Vertical Clearance (Minimum)	14'-0", See Chapter 2	14'-0", See Chapter 2	14'-0", See Chapter 2	14'-0", See Chapter 2	14'-0", See Chapter 2	14'-0", See Chapter 2	14'-0", See Chapter 2
Roadside [12]	Clear Sidewalk Width	NA	4' to 5'	5' to 6'	6' to 8'	5' to 6'	6' to 8'	6' to 10'
	Buffer [13]	NA	5'+	5' to 10'	4' to 5'	4' to 5'	4' to 5'	4' to 6'
	Shy Distance	NA	NA	NA	0' to 2'	0' to 2'	2'	2'
	Total Sidewalk Width	NA	4' to 5'	5' to 6'	10' to 15'	9' to 13'	12' to 15'	12' to 18'
	Clear Zone Widths [14]	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12
	Right-of-Way Widths [15]	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Speed	Desired Operating Speed (Design Speed)	35-55 mph	25-30 mph	30-35 mph	25-30 mph	25-30 mph	25-30 mph	25-30 mph
	Stopping and Passing Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3
	Vertical Grades (Maximum) [16]	2004 AASHTO Green Book, Exhibit 6-4	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8

TABLE 1.5 (ENGLISH) (CONTINUED)
MATRIX OF DESIGN VALUES – COMMUNITY COLLECTOR

Matrix of Design Values - Notes (Community Collector)
[1] 11' to 12' preferred for heavy truck volumes > 5% and regular transit routes. A 1' to 2' offset to the curb is desirable. 14' for an outside lane with no shoulder or bike lane, if optimal accommodation for bicyclists is desired.
[2] Shoulders should be installed in urban contexts only as part of a retrofit of wide travel lanes to accommodate bicyclists.
[3] Paving for railroad grade crossings shall extend 2' beyond the extreme rails for the full graded width of the highway.
[4] Design of bike lanes should be considered when identified as part of the Engineering & Environmental (E&E) Scoping process. For additional guidance, refer to Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures,* Appendix J, Bicycle and Pedestrian Checklist.
[5] Curb Return radius should be as small as possible. Number of lanes, on street parking, bike lanes, and shoulders should be utilized to determine effective radius.
[6] Cross slopes of 3.0% are recommended for design speeds less than 40 mph.
[7] In curbed areas with longitudinal slopes of 1% or less, 3.0% cross slopes may be used on tangents.
[8] For additional guidance, refer to Chapter 2, Sections 2.13.B, Rates of Superelevation and 2.13.C, Maximum Superelevation.
[9] On curbed approaches, the minimum bridge width may equal the curb-to-curb width. Where pedestrian traffic is anticipated, provisions for a sidewalk, preferably on the outside of the parapet, should be considered and shall meet the Department's Standards and requirements (see Chapter 6). Where paved or curbed parking lanes exist or have been approved for construction on approaches, the clear roadway width of the proposed bridge in each case shall be determined by the Central Office, Bureau of Design upon receipt of the District Executive's recommendation.
[10] For appropriate bridge widths, refer to the Minimum Width Criteria for Bridges.
[11] Recommended minimum grade of 0.75% on curbed sections.
[12] The Roadside design values should be considered and implemented as feasible and reasonable; however, Chapter 6, Pedestrian Facilities, should still be used for minimum design criteria. ADA accommodations must be addressed in accordance with ADA policy.
[13] Buffer is assumed to be planted area (grass, shrubs, and/or trees) for suburban neighborhood and corridor contexts.
[14] Center piers are not desirable. Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures* .
[15] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[16] For short grades less than 500', one-way downgrades, and grades on low-volume rural or urban collectors, maximum grades may be up to 2% steeper.
[17] For long bridges over 100' in length, the shoulder width may be 3' on each side.

TABLE 1.6 (METRIC)
MATRIX OF DESIGN VALUES – NEIGHBORHOOD COLLECTOR

	Neighborhood Collector	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town/Village Center	Urban Core
Roadway	Lane Width [1]	3.0 m to 3.3 m	3.0 m to 3.3 m	NA	NA	2.7 m to 3.3 m	2.7 m to 3.3 m	2.7 m to 3.3 m
	Shoulder Width [2, 3]	1.2 m to 2.4 m	1.2 m to 2.4 m (if No Parking or Bike Lane)	NA	NA	NA	NA	NA
	Parking Lane	NA	2.1 m Parallel	NA	NA	2.1 m to 2.4 m Parallel	2.1 m to 2.4 m Parallel	2.1 m to 2.4 m Parallel
	Bike Lane [4]	NA	1.5 m	NA	NA	1.5 m	1.5 m	1.5 m
	Median (if needed)	NA	2.4 m to 3.0 m Landscaping; 1.8 m to 2.4 m for Peds	NA	NA	2.4 m to 3.0 m Landscaping; 1.8 m to 2.4 m for Peds	2.4 m to 3.0 m Landscaping; 1.8 m to 2.4 m for Peds	2.4 m to 3.0 m Landscaping; 1.8 m to 2.4 m for Peds
	Curb Return [5]	4.5 m to 10.5 m	4.5 m to 10.5 m	NA	NA	3.0 m to 7.5 m	3.0 m to 7.5 m	3.0 m to 7.5 m
	Travel Lanes	2	2	NA	NA	2	2	2
	Cross Slopes (Minimum) [6, 7]	2.0%	2.0%	NA	NA	2.0%	2.0%	2.0%
	Cross Slopes (Maximum) [8]	8.0%	6.0%	NA	NA	6.0%	6.0%	6.0%
	Bridge Widths [9, 10, 17]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	NA	NA	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Vertical Grades (Minimum) [11]	0.5%	0.5%	NA	NA	0.5%	0.5%	0.5%
	Vertical Clearance (Minimum)	4.3 m, See Chapter 2	4.3 m, See Chapter 2	NA	NA	4.3 m, See Chapter 2	4.3 m, See Chapter 2	4.3 m, See Chapter 2
Roadside [12]	Clear Sidewalk Width	NA	1.2 m to 1.5 m	NA	NA	1.5 m to 1.8 m	1.8 m	1.8 m to 2.4 m
	Buffer [13]	NA	1.2 m+	NA	NA	0.9 m to 1.5 m	0.9 m to 1.5 m	1.2 m to 1.8 m
	Shy Distance	NA	NA	NA	NA	0 m to 0.6 m	0.6 m	0.6 m
	Total Sidewalk Width	NA	1.2 m to 1.5 m	NA	NA	2.4 m to 3.9 m	3.3 m to 3.9 m	3.6 m to 4.8 m
	Clear Zone Widths [14]	See Chapter 12	See Chapter 12	NA	NA	See Chapter 12	See Chapter 12	See Chapter 12
	Right-of-Way Widths [15]	Varies	Varies	NA	NA	Varies	Varies	Varies
Speed	Desired Operating Speed (Design Speed)	30-60 km/h	40-50 km/h	NA	NA	40-50 km/h	40-50 km/h	40-50 km/h
	Stopping and Passing Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	NA	NA	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3
	Vertical Grades (Maximum) [16]	2004 AASHTO Green Book, Exhibit 6-4	2004 AASHTO Green Book, Exhibit 6-8	NA	NA	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8

TABLE 1.6 (METRIC) (CONTINUED)
MATRIX OF DESIGN VALUES – NEIGHBORHOOD COLLECTOR

Matrix of Design Values - Notes (Neighborhood Collector)
[1] 3.3 m to 3.6 m preferred for heavy truck volumes > 5% and regular transit routes. A 0.3 m to 0.6 m offset to the curb is desirable. 4.2 m for an outside lane with no shoulder or bike lane, if optimal accommodation for bicyclists is desired.
[2] Shoulders should be installed in urban contexts only as part of a retrofit of wide travel lanes to accommodate bicyclists.
[3] Paving for railroad grade crossings shall extend 0.6 m beyond the extreme rails for the full graded width of the highway.
[4] Design of bike lanes should be considered when identified as part of the Engineering & Environmental (E&E) Scoping process. For additional guidance, refer to Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures,* Appendix J, Bicycle and Pedestrian Checklist.
[5] Curb Return radius should be as small as possible. Number of lanes, on street parking, bike lanes, and shoulders should be utilized to determine effective radius.
[6] Cross slopes of 3.0% are recommended for design speeds less than 60 km/h.
[7] In curbed areas with longitudinal slopes of 1% or less, 3.0% cross slopes may be used on tangents.
[8] For additional guidance, refer to Chapter 2, Sections 2.13.B, Rates of Superelevation and 2.13.C, Maximum Superelevation.
[9] On curbed approaches, the minimum bridge width may equal the curb-to-curb width. Where pedestrian traffic is anticipated, provisions for a sidewalk, preferably on the outside of the parapet, should be considered and shall meet the Department's Standards and requirements (see Chapter 6). Where paved or curbed parking lanes exist or have been approved for construction on approaches, the clear roadway width of the proposed bridge in each case shall be determined by the Central Office, Bureau of Design upon receipt of the District Executive's recommendation.
[10] For appropriate bridge widths, refer to the Minimum Width Criteria for Bridges.
[11] Recommended minimum grade of 0.75% on curbed sections.
[12] The Roadside design values should be considered and implemented as feasible and reasonable; however, Chapter 6, Pedestrian Facilities, should still be used for minimum design criteria. ADA accommodations must be addressed in accordance with ADA policy.
[13] Buffer is assumed to be planted area (grass, shrubs and/or trees) for suburban neighborhood and corridor contexts.
[14] Center piers are not desirable. Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures* .
[15] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[16] For short grades less than 150 m, one-way downgrades, and grades on low-volume rural or urban collectors, maximum grades may be up to 2% steeper.
[17] For long bridges over 30 m in length, the shoulder width may be 1 m on each side.

TABLE 1.6 (ENGLISH)
MATRIX OF DESIGN VALUES – NEIGHBORHOOD COLLECTOR

	Neighborhood Collector	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town/Village Center	Urban Core
Roadway	Lane Width [1]	10' to 11'	10' to 11'	NA	NA	9' to 11'	9' to 11'	9' to 11'
	Shoulder Width [2, 3]	4' to 8'	4' to 8' (if No Parking or Bike Lane)	NA	NA	NA	NA	NA
	Parking Lane	NA	7' Parallel	NA	NA	7' to 8' Parallel	7' to 8' Parallel	7' to 8' Parallel
	Bike Lane [4]	NA	5'	NA	NA	5'	5'	5'
	Median (if needed)	NA	8' to 10' Landscaping; 6' to 8' for Peds	NA	NA	8' to 10' Landscaping; 6' to 8' for Peds	8' to 10' Landscaping; 6' to 8' for Peds	8' to 10' Landscaping; 6' to 8' for Peds
	Curb Return [5]	15' to 35'	15' to 35'	NA	NA	10' to 25'	10' to 25'	10' to 25'
	Travel Lanes	2	2	NA	NA	2	2	2
	Cross Slopes (Minimum) [6, 7]	2.0%	2.0%	NA	NA	2.0%	2.0%	2.0%
	Cross Slopes (Maximum) [8]	8.0%	6.0%	NA	NA	6.0%	6.0%	6.0%
	Bridge Widths [9, 10, 17]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	NA	NA	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Vertical Grades (Minimum) [11]	0.5%	0.5%	NA	NA	0.5%	0.5%	0.5%
	Vertical Clearance (Minimum)	14'-0", See Chapter 2	14'-0", See Chapter 2	NA	NA	14'-0", See Chapter 2	14'-0", See Chapter 2	14'-0", See Chapter 2
Roadside [12]	Clear Sidewalk Width	NA	4' to 5'	NA	NA	5' to 6'	6'	6' to 8'
	Buffer [13]	NA	4'+	NA	NA	3' to 5'	3' to 5'	4' to 6'
	Shy Distance	NA	NA	NA	NA	0' to 2'	2'	2'
	Total Sidewalk Width	NA	4' to 5'	NA	NA	8' to 13'	11' to 13'	12' to 16'
	Clear Zone Widths [14]	See Chapter 12	See Chapter 12	NA	NA	See Chapter 12	See Chapter 12	See Chapter 12
	Right-of-Way Widths [15]	Varies	Varies	NA	NA	Varies	Varies	Varies
Speed	Desired Operating Speed (Design Speed)	20-35 mph	25-30 mph	NA	NA	25-30 mph	25-30 mph	25-30 mph
	Stopping and Passing Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	NA	NA	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3	2004 AASHTO Green Book, Exhibits 6-2 & 6-3
	Vertical Grades (Maximum) [16]	2004 AASHTO Green Book, Exhibit 6-4	2004 AASHTO Green Book, Exhibit 6-8	NA	NA	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8	2004 AASHTO Green Book, Exhibit 6-8

TABLE 1.6 (ENGLISH) (CONTINUED)
MATRIX OF DESIGN VALUES – NEIGHBORHOOD COLLECTOR

Matrix of Design Values - Notes (Neighborhood Collector)
[1] 11' to 12' preferred for heavy truck volumes > 5% and regular transit routes. A 1' to 2' offset to the curb is desirable. 14' for an outside lane with no shoulder or bike lane, if optimal accommodation for bicyclists is desired.
[2] Shoulders should be installed in urban contexts only as part of a retrofit of wide travel lanes to accommodate bicyclists.
[3] Paving for railroad grade crossings shall extend 2' beyond the extreme rails for the full graded width of the highway.
[4] Design of bike lanes should be considered when identified as part of the Engineering & Environmental (E&E) Scoping process. For additional guidance, refer to Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures,* Appendix J, Bicycle and Pedestrian Checklist.
[5] Curb Return radius should be as small as possible. Number of lanes, on street parking, bike lanes, and shoulders should be utilized to determine effective radius.
[6] Cross slopes of 3.0% are recommended for design speeds less than 40 mph.
[7] In curbed areas with longitudinal slopes of 1% or less, 3.0% cross slopes may be used on tangents.
[8] For additional guidance, refer to Chapter 2, Sections 2.13.B, Rates of Superelevation and 2.13.C, Maximum Superelevation.
[9] On curbed approaches, the minimum bridge width may equal the curb-to-curb width. Where pedestrian traffic is anticipated, provisions for a sidewalk, preferably on the outside of the parapet, should be considered and shall meet the Department's Standards and requirements (see Chapter 6). Where paved or curbed parking lanes exist or have been approved for construction on approaches, the clear roadway width of the proposed bridge in each case shall be determined by the Central Office, Bureau of Design upon receipt of the District Executive's recommendation.
[10] For appropriate bridge widths, refer to the Minimum Width Criteria for Bridges.
[11] Recommended minimum grade of 0.75% on curbed sections.
[12] The Roadside design values should be considered and implemented as feasible and reasonable; however, Chapter 6, Pedestrian Facilities, should still be used for minimum design criteria. ADA accommodations must be addressed in accordance with ADA policy.
[13] Buffer is assumed to be planted area (grass, shrubs and/or trees) for suburban neighborhood and corridor contexts.
[14] Center piers are not desirable. Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures.*
[15] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[16] For short grades less than 500', one-way downgrades, and grades on low-volume rural or urban collectors, maximum grades may be up to 2% steeper.
[17] For long bridges over 100' in length, the shoulder width may be 3' on each side.

TABLE 1.7 (METRIC)
MATRIX OF DESIGN VALUES – LOCAL ROAD

	Local Road	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town/Village Center	Urban Core
Roadway	Lane Width [1]	2.7 m to 3.3 m	See Roadway Width	NA	NA	See Roadway Width	2.7 m to 3.3 m	2.7 m to 3.3 m
	Roadway Width [2]	See Lane and Shoulder Width	Wide: 10.2 m to 10.8 m Medium: 9.0 m Narrow: 7.8 m Very Narrow: 6.0 m	NA	NA	Wide: 10.2 m to 10.8 m Medium: 9.0 m Narrow: 7.8 m Very Narrow: 6.0 m	See Lane and Parking Width	See Lane and Parking Width
	Shoulder Width [3]	0.6 m to 2.4 m	NA	NA	NA	NA	NA	NA
	Parking Lane	NA	See Roadway Width	NA	NA	See Roadway Width	2.1 m to 2.4 m Parallel	2.1 m to 2.4 m Parallel
	Bike Lane [4]	NA	NA	NA	NA	NA	NA	NA
	Median	NA	NA	NA	NA	NA	NA	NA
	Curb Return [5]	3.0 m to 7.5 m	3.0 m to 7.5 m	NA	NA	1.5 m to 7.5 m	1.5 m to 7.5 m	1.5 m to 7.5 m
	Travel Lanes	2	2	NA	NA	2	2	2
	Cross Slopes (Minimum) [6, 7]	2.0%	2.0%	NA	NA	2.0%	2.0%	2.0%
	Cross Slopes (Maximum) [8]	8.0%	6.0%	NA	NA	6.0%	6.0%	6.0%
	Bridge Widths [9, 10, 17]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	NA	NA	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Vertical Grades (Minimum) [11]	0.5%	0.5%	NA	NA	0.5%	0.5%	0.5%
	Vertical Clearance (Minimum)	4.3 m, See Chapter 2	4.3 m, See Chapter 2	NA	NA	4.3 m, See Chapter 2	4.3 m, See Chapter 2	4.3 m, See Chapter 2
Roadside [12]	Clear Sidewalk Width	NA	1.2 m to 1.5 m	NA	NA	1.5 m	1.5 m to 1.8 m	1.8 m to 2.4 m
	Buffer [13]	NA	1.2 m+	NA	NA	0.9 m to 1.5 m	0.9 m to 1.5 m	0.9 m to 1.5 m
	Shy Distance	NA	NA	NA	NA	0 m to 0.6 m	0.6 m	0.6 m
	Total Sidewalk Width	NA	1.2 m to 1.5 m	NA	NA	2.4 m to 3.6 m	3.0 m to 3.9 m	3.3 m to 4.5 m
	Clear Zone Widths [14]	See Chapter 12	See Chapter 12	NA	NA	See Chapter 12	See Chapter 12	See Chapter 12
	Right-of-Way Widths [15]	Varies	Varies	NA	NA	Varies	Varies	Varies
Speed	Desired Operating Speed (Design Speed)	30-50 km/h	30-40 km/h	NA	NA	30-40 km/h	30-40 km/h	30-40 km/h
	Stopping and Passing Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibits 5-2 & 5-3	2004 AASHTO Green Book, Exhibits 5-2 & 5-3	NA	NA	2004 AASHTO Green Book, Exhibits 5-2 & 5-3	2004 AASHTO Green Book, Exhibits 5-2 & 5-3	2004 AASHTO Green Book, Exhibits 5-2 & 5-3
	Vertical Grades (Maximum)	2004 AASHTO Green Book, Exhibit 5-4	8% to 15% [16]	NA	NA	8% to 15% [16]	8% to 15% [16]	8% to 15% [16]

TABLE 1.7 (METRIC) (CONTINUED)
MATRIX OF DESIGN VALUES – LOCAL ROAD

Matrix of Design Values - Notes (Local Road)
[1] 3.3 m to 3.6 m recommended for industrial districts. A 0.3 m to 0.6 m offset to the curb is desirable. 4.2 m for an outside lane with no shoulder or bike lane, if optimal accommodation for bicyclists is desired.
[2] Index to residential streets: **Wide:** High-density neighborhoods, two-way, parking both sides **Medium:** Can be used in all neighborhoods - two-way, parking both sides **Narrow:** Low-density and medium density - two-way, parking both sides; all neighborhoods - one-way street, parking both sides, or two-way, parking one side **Very Narrow:** All neighborhoods - one-way, parking one side; two-way, no parking
[3] Paving for railroad grade crossings shall extend 0.6 m beyond the extreme rails for the full graded width of the highway.
[4] Design of bike lanes should be considered when identified as part of the Engineering & Environmental (E&E) Scoping process. For additional guidance, refer to Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures* , Appendix J, Bicycle and Pedestrian Checklist.
[5] Curb Return radius should be as small as possible. Number of lanes, on street parking, bike lanes, and shoulders should be utilized to determine effective radius.
[6] Cross slopes of 3.0% are recommended for design speeds less than 60 km/h.
[7] In curbed areas with longitudinal slopes of 1% or less, 3.0% cross slopes may be used on tangents.
[8] For additional guidance, refer to Chapter 2, Sections 2.13.B, Rates of Superelevation and 2.13.C, Maximum Superelevation.
[9] On curbed approaches, the minimum bridge width may equal the curb-to-curb width. Where pedestrian traffic is anticipated, provisions for a sidewalk, preferably on the outside of the parapet, should be considered and shall meet the Department's Standards and requirements (see Chapter 6). Where paved or curbed parking lanes exist or have been approved for construction on approaches, the clear roadway width of the proposed bridge in each case shall be determined by the Central Office, Bureau of Design upon receipt of the District Executive's recommendation.
[10] For appropriate bridge widths, refer to the Minimum Width Criteria for Bridges.
[11] Recommended minimum grade of 0.75% on curbed sections.
[12] The Roadside design values should be considered and implemented as feasible and reasonable; however, Chapter 6, Pedestrian Facilities, should still be used for minimum design criteria. ADA accommodations must be addressed in accordance with ADA policy.
[13] Buffer is assumed to be planted area (grass, shrubs and/or trees) for suburban neighborhood and corridor contexts; street furniture/car door zone for other land use contexts.
[14] Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures* .
[15] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[16] The gradient for local suburban and urban residential streets should be less than 15%. For streets in commerical and industrial areas, gradient design should be less than 8%.
[17] One-lane bridges may be provided on single-lane roads and two-lane roads not on the National Highway System that have an ADT less than 100 where the designer finds that a one-lane bridge can operate effectively and no existing or anticipated significant land use conflicts exist. The minimum width of a one-lane bridge should be 4.5 m unless the designer concludes that a narrower bridge can function effectively and the Bureau of Design, Highway Quality Assurance Division concurs. Caution should be exercised in design of one-lane bridges wider than 4.8 m to assure that drivers will not use them as two-lane structures. Simultaneous arrival of two or more opposing vehicles at a one-lane bridge should be rare, given the low traffic volumes, but one-lane bridges should have intervisible pull-offs at each end where drivers can wait for traffic on the bridge to clear. Alignment and sight distance should be carefully studied so that they are not compromised. Appropriate safety mitigation measures should be provided. Reference Table 1.1, Low Cost Safety Improvement Measures.

TABLE 1.7 (ENGLISH)
MATRIX OF DESIGN VALUES – LOCAL ROAD

	Local Road	Rural	Suburban Neighborhood	Suburban Corridor	Suburban Center	Town/Village Neighborhood	Town/Village Center	Urban Core
Roadway	Lane Width [1]	9' to 11'	See Roadway Width	NA	NA	See Roadway Width	9' to 11'	9' to 11'
	Roadway Width [2]	See Lane and Shoulder Width	Wide: 34' to 36' Medium: 30' Narrow: 26' Very Narrow: 20'	NA	NA	Wide: 34' to 36' Medium: 30' Narrow: 26' Very Narrow: 20'	See Lane and Parking Width	See Lane and Parking Width
	Shoulder Width [3]	2' to 8'	NA	NA	NA	NA	NA	NA
	Parking Lane	NA	See Roadway Width	NA	NA	See Roadway Width	7' to 8' Parallel	7' to 8' Parallel
	Bike Lane [4]	NA	NA	NA	NA	NA	NA	NA
	Median	NA	NA	NA	NA	NA	NA	NA
	Curb Return [5]	10' to 25'	10' to 25'	NA	NA	5' to 25'	5' to 25'	5' to 25'
	Travel Lanes	2	2	NA	NA	2	2	2
	Cross Slopes (Minimum) [6, 7]	2.0%	2.0%	NA	NA	2.0%	2.0%	2.0%
	Cross Slopes (Maximum) [8]	8.0%	6.0%	NA	NA	6.0%	6.0%	6.0%
	Bridge Widths [9, 10, 17]	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	NA	NA	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side	Lane Widths Plus Shoulders Each Side
	Vertical Grades (Minimum) [11]	0.5%	0.5%	NA	NA	0.5%	0.5%	0.5%
	Vertical Clearance (Minimum)	14'-0", See Chapter 2	14'-0", See Chapter 2	NA	NA	14'-0", See Chapter 2	14'-0", See Chapter 2	14'-0", See Chapter 2
Roadside [12]	Clear Sidewalk Width	NA	4' to 5'	NA	NA	5'	5' to 6'	6' to 8'
	Buffer [13]	NA	4'+	NA	NA	3' to 5'	3' to 5'	3' to 5'
	Shy Distance	NA	NA	NA	NA	0' to 2'	2'	2'
	Total Sidewalk Width	NA	4' to 5'	NA	NA	8' to 12'	10' to 13'	11' to 15'
	Clear Zone Widths [14]	See Chapter 12	See Chapter 12	NA	NA	See Chapter 12	See Chapter 12	See Chapter 12
	Right-of-Way Widths [15]	Varies	Varies	NA	NA	Varies	Varies	Varies
Speed	Desired Operating Speed (Design Speed)	20-30 mph	20-25 mph	NA	NA	20-25 mph	20-25 mph	20-25 mph
	Stopping and Passing Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibits 5-2 & 5-3	2004 AASHTO Green Book, Exhibits 5-2 & 5-3	NA	NA	2004 AASHTO Green Book, Exhibits 5-2 & 5-3	2004 AASHTO Green Book, Exhibits 5-2 & 5-3	2004 AASHTO Green Book, Exhibits 5-2 & 5-3
	Vertical Grades (Maximum)	2004 AASHTO Green Book, Exhibit 5-4	8% to 15% [16]	NA	NA	8% to 15% [16]	8% to 15% [16]	8% to 15% [16]

TABLE 1.7 (ENGLISH) (CONTINUED)
MATRIX OF DESIGN VALUES – LOCAL ROAD

Matrix of Design Values - Notes (Local Road)
[1] 11' to 12' recommended for industrial districts. A 1' to 2' offset to the curb is desirable. 14' for an outside lane with no shoulder or bike lane, if optimal accommodation for bicyclists is desired.
[2] Index to residential streets: **Wide:** High-density neighborhoods, two-way, parking both sides **Medium:** Can be used in all neighborhoods - two-way, parking both sides **Narrow:** Low-density and medium density - two-way, parking both sides; all neighborhoods - one-way street, parking both sides, or two-way, parking one side **Very Narrow:** All neighborhoods - one-way, parking one side; two-way, no parking
[3] Paving for railroad grade crossings shall extend 2' beyond the extreme rails for the full graded width of the highway.
[4] Design of bike lanes should be considered when identified as part of the Engineering & Environmental (E&E) Scoping process. For additional guidance, refer to Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures,* Appendix J, Bicycle and Pedestrian Checklist.
[5] Curb Return radius should be as small as possible. Number of lanes, on street parking, bike lanes, and shoulders should be utilized to determine effective radius.
[6] Cross slopes of 3.0% are desirable for design speeds less than 40 mph.
[7] In curbed areas with longitudinal slopes of 1% or less, 3.0% cross slopes may be used on tangents.
[8] For additional guidance, refer to Chapter 2, Sections 2.13.B, Rates of Superelevation and 2.13.C, Maximum Superelevation.
[9] On curbed approaches, the minimum bridge width may equal the curb-to-curb width. Where pedestrian traffic is anticipated, provisions for a sidewalk, preferably on the outside of the parapet, should be considered and shall meet the Department's Standards and requirements (see Chapter 6). Where paved or curbed parking lanes exist or have been approved for construction on approaches, the clear roadway width of the proposed bridge in each case shall be determined by the Central Office, Bureau of Design upon receipt of the District Executive's recommendation.
[10] For appropriate bridge widths, refer to the Minimum Width Criteria for Bridges.
[11] Recommended minimum grade of 0.75% on curbed sections.
[12] The Roadside design values should be considered and implemented as feasible and reasonable; however, Chapter 6, Pedestrian Facilities, should still be used for minimum design criteria. ADA accommodations must be addressed in accordance with ADA policy.
[13] Buffer is assumed to be planted area (grass, shrubs and/or trees) for suburban neighborhood and corridor contexts; street furniture/car door zone for other land use contexts.
[14] Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures.*
[15] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[16] The gradient for local suburban and urban residential streets should be less than 15%. For streets in commerical and industrial areas, gradient design should be less than 8%.
[17] One-lane bridges may be provided on single-lane roads and two-lane roads not on the National Highway System that have an ADT less than 100 where the designer finds that a one-lane bridge can operate effectively and no existing or anticipated significant land use conflicts exist. The minimum width of a one-lane bridge should be 15' unless the designer concludes that a narrower bridge can function effectively and the Bureau of Design, Highway Quality Assurance Division concurs. Caution should be exercised in design of one-lane bridges wider than 16' to assure that drivers will not use them as two-lane structures. Simultaneous arrival of two or more opposing vehicles at a one-lane bridge should be rare, given the low traffic volumes, but one-lane bridges should have intervisible pull-offs at each end where drivers can wait for traffic on the bridge to clear. Alignment and sight distance should be carefully studied so that they are not compromised. Appropriate safety mitigation measures should be provided. Reference Table 1.1, Low Cost Safety Improvement Measures.

TABLE 1.8 (METRIC)
MATRIX OF DESIGN VALUES – LIMITED ACCESS FREEWAY

Limited Access Freeway		Rural Interstate	Rural Non-Interstate	Urban Interstate	Urban Non-Interstate
Roadway	Lane Widths [1]	4 or More 3.6 m Lanes	4 or More 3.6 m Lanes [2]	4 or More 3.6 m Lanes	4 or More 3.6 m Lanes [2]
	Shoulder Widths [3, 4, 5]	3.0 m Right Shoulder 2.4 m Graded, 1.2 m Paved Left Shoulder (Medians Only)	3.0 m Right Shoulder 2.4 m Graded, 1.2 m Paved Left Shoulder (Medians Only)	3.0 m Right Shoulder 2.4 m Graded, 1.2 m Paved Left Shoulder (Medians Only)	3.0 m Right Shoulder 2.4 m Graded, 1.2 m Paved Left Shoulder (Medians Only)
	Median Widths	3.0 m to 15.0 m [6, 7] (Mountainous) 10.8 m to 30.0 m [8] (Level or Rolling)	3.0 m to 30.0 m [6, 7, 8]	3.0 m [6]	3.0 m [6]
	Cross Slopes (Minimum)	2.0%	2.0%	2.0%	2.0%
	Cross Slopes (Maximum)	8.0%	8.0%	6.0%	6.0%
	Bridge Widths [9, 10]	Lane Widths Plus Right Shoulder Plus 1.8 m Left Shoulder	Lane Widths Plus Right Shoulder Plus 1.8 m Left Shoulder	Lane Widths Plus Right Shoulder Plus 1.8 m Left Shoulder	Lane Widths Plus Right Shoulder Plus 1.8 m Left Shoulder
	Vertical Grades (Minimum)	0.5%	0.5%	0.5%	0.5%
	Vertical Clearance (Minimum)	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2	4.9 m, See Chapter 2
Roadside	Clear Zone Widths [11]	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12
	Right-of-Way Widths [12]	Varies	Varies	Varies	Varies
Speed	Design Speed [13]	110 km/h	110 km/h	80-110 km/h	80-110 km/h
	Stopping Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibit 3-72	2004 AASHTO Green Book, Exhibit 3-72	2004 AASHTO Green Book, Exhibit 3-72	2004 AASHTO Green Book, Exhibit 3-72
	Vertical Grades (Maximum) [14, 15]	2004 AASHTO Green Book, Exhibit 8-1	2004 AASHTO Green Book, Exhibit 8-1	2004 AASHTO Green Book, Exhibit 8-1	2004 AASHTO Green Book, Exhibit 8-1

TABLE 1.8 (METRIC) (CONTINUED)
MATRIX OF DESIGN VALUES – LIMITED ACCESS FREEWAY

Matrix of Design Values - Notes (Limited Access Freeway)
[1] Number of lanes determined by lane capacity design for selected Level of Service.
[2] Paving for railroad grade crossings shall extend 0.6 m beyond the extreme rails for the full graded width of the highway.
[3] Where truck traffic exceeds 250 DDHV, a paved width of 3.6 m for the right shoulder should be considered.
[4] On sections with six or more lanes, a paved width of 3.0 m for the left shoulder should be provided. Where truck traffic exceeds 250 DDHV, a paved width of 3.6 m for the left shoulder should be considered.
[5] In mountainous terrain, a reduced paved shoulder width together with a minimal median width may be used to reduce the high costs associated with providing a full width roadway cross section. In these instances, a 2.4 m minimum paved right shoulder and a 1.2 m minimum paved left shoulder may be used on a traveled way consisting of four or six lanes. Where eight or more lanes are provided, a 2.4 m minimum paved shoulder width should be used on both sides.
[6] Use a minimum width of 3.0 m for a two-lane directional facility which provides for two 1.2 m shoulders and a 0.6 m median barrier. For three or more lane directional facilities, the minimum width is 6.6 m and preferably 7.8 m where DDHV is greater than 250 Trucks.
[7] All median widths 6.0 m or less should be paved. When Type 1 shoulders are specified for the 1.2 m median shoulders, Type 3 shoulders may be used for the remainder if the remaining width is 2.4 m or greater.
[8] The 30 m dimension shown in the 2004 AASHTO Green Book, Exhibit 8-3B permits the designer to use independent profiles in rolling terrain to blend the freeway more appropriately with the environment while maintaining flat slopes for vehicle recovery.
[9] Selection of single or dual structures shall be made based on an economic analysis. Such items as structure length and width, horizontal and vertical curvature and ramp geometry shall be considered.
[10] Provide 3.6 m left shoulder for bridges carrying three or more through lanes. Auxiliary lanes shall not be counted as through lanes.
[11] Center piers are not desirable. Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures* .
[12] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[13] Where terrain is mountainous, a design speed from 80 to 100 km/h may be used. In urban areas, the design speed shall be at least 80 km/h.
[14] For short grades less than 150 m and for one-way downgrades, maximum grades may be up to 1% steeper.
[15] Grades up to 1% steeper than the value shown in Exhibit 8-1 may be provided in urban areas with crucial right-of-way constraints or where needed in mountainous terrain.

TABLE 1.8 (ENGLISH)
MATRIX OF DESIGN VALUES – LIMITED ACCESS FREEWAY

Limited Access Freeway		Rural Interstate	Rural Non-Interstate	Urban Interstate	Urban Non-Interstate
Roadway	Lane Widths [1]	4 or More 12'-0" Lanes	4 or More 12'-0" Lanes [2]	4 or More 12'-0" Lanes	4 or More 12'-0" Lanes [2]
	Shoulder Widths [3, 4, 5]	10'-0" Right Shoulder 8'-0" Graded, 4'-0" Paved Left Shoulder (Medians Only)	10'-0" Right Shoulder 8'-0" Graded, 4'-0" Paved Left Shoulder (Medians Only)	10'-0" Right Shoulder 8'-0" Graded, 4'-0" Paved Left Shoulder (Medians Only)	10'-0" Right Shoulder 8'-0" Graded, 4'-0" Paved Left Shoulder (Medians Only)
	Median Widths	10'-0" to 50'-0" [6, 7] (Mountainous) 36'-0" to 100'-0" [8] (Level or Rolling)	10'-0" to 100'-0" [6, 7, 8]	10'-0" [6]	10'-0" [6]
	Cross Slopes (Minimum)	2.0%	2.0%	2.0%	2.0%
	Cross Slopes (Maximum)	8.0%	8.0%	6.0%	6.0%
	Bridge Widths [9, 10]	Lane Widths Plus Right Shoulder Plus 6'-0" Left Shoulder	Lane Widths Plus Right Shoulder Plus 6'-0" Left Shoulder	Lane Widths Plus Right Shoulder Plus 6'-0" Left Shoulder	Lane Widths Plus Right Shoulder Plus 6'-0" Left Shoulder
	Vertical Grades (Minimum)	0.5%	0.5%	0.5%	0.5%
	Vertical Clearance (Minimum)	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2	16'-0", See Chapter 2
Roadside	Clear Zone Widths [11]	See Chapter 12	See Chapter 12	See Chapter 12	See Chapter 12
	Right-of-Way Widths [12]	Varies	Varies	Varies	Varies
Speed	Design Speed [13]	70 mph	70 mph	50-70 mph	50-70 mph
	Stopping Sight Distances (Minimum)	2004 AASHTO Green Book, Exhibit 3-72	2004 AASHTO Green Book, Exhibit 3-72	2004 AASHTO Green Book, Exhibit 3-72	2004 AASHTO Green Book, Exhibit 3-72
	Vertical Grades (Maximum) [14, 15]	2004 AASHTO Green Book, Exhibit 8-1	2004 AASHTO Green Book, Exhibit 8-1	2004 AASHTO Green Book, Exhibit 8-1	2004 AASHTO Green Book, Exhibit 8-1

TABLE 1.8 (ENGLISH) (CONTINUED)
MATRIX OF DESIGN VALUES – LIMITED ACCESS FREEWAY

Matrix of Design Values - Notes (Limited Access Freeway)
[1] Number of lanes determined by lane capacity design for selected Level of Service.
[2] Paving for railroad grade crossings shall extend 2' beyond the extreme rails for the full graded width of the highway.
[3] Where truck traffic exceeds 250 DDHV, a paved width of 12' for the right shoulder should be considered.
[4] On sections with six or more lanes, a paved width of 10' for the left shoulder should be provided. Where truck traffic exceeds 250 DDHV, a paved width of 12' for the left shoulder should be considered.
[5] In mountainous terrain, a reduced paved shoulder width together with a minimal median width may be used to reduce the high costs associated with providing a full width roadway cross section. In these instances, a 8' minimum paved right shoulder and a 4' minimum paved left shoulder may be used on a traveled way consisting of four or six lanes. Where eight or more lanes are provided, a 8' minimum paved shoulder width should be used on both sides.
[6] Use a minimum width of 10' for a two-lane directional facility which provides for two 4' shoulders and a 2' median barrier. For three or more lane directional facilities, the minimum width is 22' and preferably 26' where DDHV is greater than 250 Trucks.
[7] All median widths 20' or less should be paved. When Type 1 shoulders are specified for the 4' median shoulders, Type 3 shoulders may be used for the remainder if the remaining width is 8' or greater.
[8] The 100' dimension shown in the 2004 AASHTO Green Book, Exhibit 8-3B permits the designer to use independent profiles in rolling terrain to blend the freeway more appropriately with the environment while maintaining flat slopes for vehicle recovery.
[9] Selection of single or dual structures shall be made based on an economic analysis. Such items as structure length and width, horizontal and vertical curvature and ramp geometry shall be considered.
[10] Provide 12' left shoulder for bridges carrying three or more through lanes. Auxiliary lanes shall not be counted as through lanes.
[11] Center piers are not desirable. Increase bridge span where necessary to provide for required horizontal stopping sight distance. Provide clearance for guide rail in front of substructures if protection is required. For offset distances to substructure units, see Publication 15M, Design Manual, Part 4, *Structures* .
[12] No minimum right-of-way width is suggested. The procurement of sufficient right-of-way width should be based on the preferable dimensions for all the elements of the composite highway cross section and should be adequate to accommodate the construction and proper maintenance of the highway throughout the project. Future widening should be considered and, where needed for safety, additional right-of-way may be required for adequate sight distance. For additional information on right-of-way widths, refer to the 2004 AASHTO Green Book.
[13] Where terrain is mountainous, a design speed from 50 to 60 mph may be used. In urban areas, the design speed shall be at least 50 mph.
[14] For short grades less than 500' and for one-way downgrades, maximum grades may be up to 1% steeper.
[15] Grades up to 1% steeper than the value shown in Exhibit 8-1 may be provided in urban areas with crucial right-of-way constraints or where needed in mountainous terrain.

MINIMUM WIDTH CRITERIA FOR BRIDGES

I. MINIMUM WIDTH CRITERIA FOR NEW BRIDGES ON NEW FACILITIES (ALL FUNCTIONAL CLASSIFICATIONS)

Where a new highway is to be constructed on a new location, bridges shall be designed for a PHL-93 design load structural capacity with the minimum bridge width equal to the pavement and shoulder widths for the applicable functional classification systems indicated in Chapter 1, Table 1.3 through Table 1.8.

II. MINIMUM WIDTH CRITERIA FOR BRIDGES ON LIMITED ACCESS FREEWAY (INTERSTATE) FACILITIES

A. BRIDGES TO REMAIN IN PLACE (Deck repair or deck overlay, parapet modifications or no bridge work).

Where an existing highway is to be rehabilitated or reconstructed and no bridge work is to be performed, or an existing bridge deck is to be repaired or overlaid, the bridge may remain in place when: the design load structural capacity meets MS-18 (HS-20); and the bridge parapet meets current standards (F shape); and the bridge width shall provide 3.6 m (12 ft) lanes and a minimum of a 3.0 m (10 ft) right shoulder and a 1.05 m (3.5 ft) left shoulder. For major long-span bridges, generally over 60 m (200 ft) in length, offsets to the face of the parapet or bridge rail shall be a minimum of 1.05 m (3.5 ft) from the travel lane both left and right.

B. DECK REPLACEMENT OR PARTIAL SUPERSTRUCTURE REPLACEMENT.

Where a bridge deck is to be replaced, or a portion of the superstructure is to be replaced, the bridge or superstructure shall meet the MS-18 (HS-20) minimum (PHL-93 desirable) design load structural capacity and shall meet the applicable bridge widths indicated in Chapter 1, Table 1.8. For major long-span bridges, generally over 60 m (200 ft) in length, offsets to the face of the parapet or bridge rail shall be a minimum of 1.2 m (4 ft), but not less than the existing widths, from the travel lane both left and right.

C. RECONSTRUCTED BRIDGES (Superstructure replacement or bridge replacement).

Where the entire superstructure is to be replaced, or the bridge is to be replaced, the superstructure or bridge shall meet the applicable bridge widths indicated in Chapter 1, Table 1.8. For major long-span bridges, generally over 60 m (200 ft) in length, offsets to the face of the parapet or bridge rail shall be a minimum of 1.2 m (4 ft), but not less than the existing width, from the travel lane both left and right. Design load structural capacity shall equal PHL-93.

III. MINIMUM WIDTH CRITERIA FOR BRIDGES ON LIMITED ACCESS FREEWAY (NON-INTERSTATE) FACILITIES

A. BRIDGES TO REMAIN IN PLACE (Deck repair or deck overlay, parapet modifications or no bridge work).

Where an existing highway is to be rehabilitated or reconstructed and no bridge work is to be performed, or an existing bridge deck is to be repaired or overlaid, the bridge may remain in place when: the design load structural capacity meets MS-18 (HS-20); and the bridge parapet meets current standards (F shape); and the bridge width shall provide 3.3 m (11 ft) lanes and a minimum of a 2.4 m (8 ft) right shoulder and a 1.05 m (3.5 ft) left shoulder. For major long-span bridges, generally over 60 m (200 ft) in length, offsets to the face of parapet or bridge rail shall be a minimum of 1.05 m (3.5 ft) from the travel lane both left and right.

B. DECK REPLACEMENT OR PARTIAL SUPERSTRUCTURE REPLACEMENT.

Where a bridge deck is to be replaced, or a portion of the superstructure is to be replaced, the bridge or superstructure shall meet the MS-18 (HS-20) minimum (PHL-93 desirable) design load structural capacity and shall meet the applicable bridge widths indicated in Chapter 1, Table 1.8. For major long-span bridges, generally over 60 m (200 ft) in length, offsets to the face of the parapet or bridge rail shall be a minimum of 1.2 m (4 ft), but not less than the existing widths, from the travel lane both left and right.

C. RECONSTRUCTED BRIDGES (Superstructure replacement or bridge replacement).

Where the entire superstructure is to be replaced, or the bridge is to be replaced, the superstructure or bridge shall meet the applicable bridge widths indicated in Chapter 1, Table 1.8. For major long-span bridges, generally over 60 m (200 ft) in length, offsets to the face of the parapet or bridge rail shall be a minimum of 1.2 m (4 ft), but not less than the existing width, from the travel lane both left and right. Design load structural capacity shall equal PHL-93.

IV. MINIMUM WIDTH CRITERIA FOR BRIDGES ON ARTERIAL FACILITIES

A. BRIDGES TO REMAIN IN PLACE (Deck repair or deck overlay, parapet modifications or no bridge work).

Where an existing highway is to be rehabilitated or reconstructed and no bridge work is to be performed, or an existing bridge deck is to be repaired or overlaid, an existing bridge that fits the proposed alignment and profile may remain in place when the design load structural capacity meets MS-18 (HS-20) and the bridge width is equal to or greater than the applicable widths indicated in Table 1 on Pages 1 - 35 and 1 - 36. The approach lane widths plus the approach shoulder widths indicated in Table 1.3 and Table 1.4 may be considered for bridge widths if they are less than the bridge widths on Pages 1 - 35 and 1 - 36.

B. DECK REPLACEMENT OR PARTIAL SUPERSTRUCTURE REPLACEMENT.

Where a bridge deck is to be replaced, or a portion of the superstructure is to be replaced, the bridge or superstructure shall meet the MS-18 (HS-20) minimum (PHL-93 desirable) design load structural capacity and the minimum bridge width shall equal or exceed the applicable widths indicated in Table 2 on Pages 1 - 35 and 1 - 36. The approach lane widths plus the approach shoulder widths indicated in Table 1.3 and Table 1.4 may be considered for bridge widths if they are less than the bridge widths on Pages 1 - 35 and 1 - 36.

If the bridge is not on the National Highway System and the conditions listed on the form in Chapter1, Appendix A, 3R Bridge Width Criteria Documentation are met, the minimum bridge width is equal to the corresponding value listed in Minimum Width Criteria for Rural 3R Projects table in Chapter 1, Section 1.2. If the conditions are not met, this criterion does not apply. Forward a copy of the signed documentation to the Bureau of Design, Highway Quality Assurance Division.

C. RECONSTRUCTED BRIDGES (Superstructure replacement or bridge replacement).

Where the entire superstructure is to be replaced, or the bridge is to be replaced, the superstructure or bridge shall meet the applicable bridge widths indicated in Chapter 1, Tables 1.3 and 1.4. Design load structural capacity shall equal PHL-93.

If the bridge is not on the National Highway System and the conditions listed on the form in Chapter 1, Appendix A, 3R Bridge Width Criteria Documentation are met, the minimum bridge width is equal to the corresponding value listed in Minimum Width Criteria for Rural 3R Projects table in Chapter 1, Section 1.2. If the conditions are not met, this criterion does not apply. Forward a copy of the signed documentation to the Bureau of Design, Highway Quality Assurance Division.

MINIMUM WIDTH CRITERIA FOR BRIDGES (CONTINUED)

V. MINIMUM WIDTH CRITERIA FOR BRIDGES ON COLLECTOR AND LOCAL ROAD FACILITIES

A. BRIDGES TO REMAIN IN PLACE (Deck repair or deck overlay, parapet modifications or no bridge work).

Where an existing highway is to be rehabilitated or reconstructed and no bridge work is to be performed, or an existing bridge deck is to be repaired or overlaid, an existing bridge that fits the proposed alignment and profile may remain in place when the design load structural capacity meets MS-13.5 (HS-15) and the bridge width is equal to or greater than the applicable widths indicated in Table 3 on Pages 1 - 35 and 1 - 36. The approach lane widths plus the approach shoulder widths indicated in Table 1.5 through Table 1.7 may be considered for bridge widths if they are less than the bridge widths on Pages 1 - 35 and 1 - 36.

B. DECK REPLACEMENT OR PARTIAL SUPERSTRUCTURE REPLACEMENT.

Where a bridge deck is to be replaced, or a portion of the superstructure is to be replaced, the bridge or superstructure shall meet the MS-13.5 (HS-15) minimum (MS-18 (HS-20) desirable) design load structural capacity and the minimum bridge width shall equal or exceed the applicable widths indicated in Table 4 on Pages 1 - 35 and 1 - 36. The approach lane widths plus the approach shoulder widths indicated in Table 1.5 through Table 1.7 may be considered for bridge widths if they are less than the bridge widths on Pages 1 - 35 and 1 - 36.

If the bridge is not on the National Highway System and the conditions listed on the form in Chapter 1, Appendix A, 3R Bridge Width Criteria Documentation are met, the minimum bridge width is equal to the corresponding value listed in Minimum Width Criteria for Rural 3R Projects table in Chapter 1, Section 1.2. If the conditions are not met, this criterion does not apply. Forward a copy of the signed documentation to the Bureau of Design, Highway Quality Assurance Division.

C. RECONSTRUCTED BRIDGES (Superstructure replacement or bridge replacement).

Where the entire superstructure is to be replaced, or the bridge is to be replaced, the superstructure or bridge shall meet the applicable bridge widths indicated in Table 5 on Pages 1 - 35 and 1 - 36. Design load structural capacity shall equal PHL-93. The approach lane widths plus the approach shoulder widths indicated in Table 1.5 through Table 1.7 may be considered for bridge widths if they are less than the bridge widths on Pages 1 - 35 and 1 - 36.

If the bridge is not on the National Highway System and the conditions listed on the form in Chapter 1, Appendix A, 3R Bridge Width Criteria Documentation are met, the minimum bridge width is equal to the corresponding value listed in Minimum Width Criteria for Rural 3R Projects table in Chapter 1, Section 1.2. If the conditions are not met, this criterion does not apply. Forward a copy of the signed documentation to the Bureau of Design, Highway Quality Assurance Division.

MINIMUM WIDTH CRITERIA FOR BRIDGES ON ARTERIAL FACILITIES (Metric)

	TABLE 1 BRIDGES TO REMAIN IN PLACE (Deck Repair or Deck Overlay, Parapet Modifications or No Bridge Work)		TABLE 2 DECK REPLACEMENT OR PARTIAL SUPERSTRUCTURE REPLACEMENT	
TRAFFIC VOLUMES CURRENT (a) TRAFFIC ADT	MINIMUM BRIDGE WIDTHS (b)	DESIGN LOAD STRUCTURAL CAPACITY	MINIMUM BRIDGE WIDTHS (b) (c) (n)	DESIGN LOAD STRUCTURAL CAPACITY
400 and Under	8.4 m	MS-18	9.0 m	MS-18 Min*
401 to 1500	9.0 m	MS-18	9.6 m	MS-18 Min*
1501 to 2000	9.0 m	MS-18	10.2 m	MS-18 Min*
Over 2000	9.0 m	MS-18	10.2 m	MS-18 Min*

* PHL-93 Desirable

MINIMUM WIDTH CRITERIA FOR BRIDGES ON COLLECTOR AND LOCAL ROAD FACILITIES (Metric)

	TABLE 3 BRIDGES TO REMAIN IN PLACE (Deck Repair or Deck Overlay, Parapet Modifications or No Bridge Work)		TABLE 4 DECK REPLACEMENT OR PARTIAL SUPERSTRUCTURE REPLACEMENT		TABLE 5 RECONSTRUCTED BRIDGES (Superstructure Replacement or Bridge Replacement)	
TRAFFIC VOLUMES CURRENT (a) TRAFFIC ADT	MINIMUM BRIDGE WIDTHS (b)	DESIGN LOAD STRUCTURAL CAPACITY (e)	MINIMUM BRIDGE WIDTHS (b) (c) (n)	DESIGN LOAD STRUCTURAL CAPACITY (e)	MINIMUM BRIDGE WIDTHS (b) (g) (h) (k) (n)	DESIGN LOAD STRUCTURAL CAPACITY
400 and Under	6.6 m (d) (l)	MS-13.5	7.2 m (d) (l)	MS-13.5 Min*	7.2 m (i) (m)	PHL-93
401 to 1500	6.6 m	MS-13.5	8.4 m	MS-13.5 Min*	8.4 m	PHL-93
1501 to 2000	7.2 m	MS-13.5	9.0 m (f)	MS-13.5 Min*	9.6 m	PHL-93
Over 2000	8.4 m	MS-13.5	10.2 m (f)	MS-13.5 Min*	12.0 m (j)	PHL-93

* MS-18 Desirable

See General Bridge Width Table Notes on Page 1 - 37.

MINIMUM WIDTH CRITERIA FOR BRIDGES (CONTINUED)

MINIMUM WIDTH CRITERIA FOR BRIDGES ON ARTERIAL FACILITIES (English)

	TABLE 1 BRIDGES TO REMAIN IN PLACE (Deck Repair or Deck Overlay, Parapet Modifications or No Bridge Work)		TABLE 2 DECK REPLACEMENT OR PARTIAL SUPERSTRUCTURE REPLACEMENT	
TRAFFIC VOLUMES CURRENT (a) TRAFFIC ADT	MINIMUM BRIDGE WIDTHS (b)	DESIGN LOAD STRUCTURAL CAPACITY	MINIMUM BRIDGE WIDTHS (b) (c) (n)	DESIGN LOAD STRUCTURAL CAPACITY
400 and Under	28'-0"	HS-20	30'-0"	HS-20 Min*
401 to 1500	30'-0"	HS-20	32'-0"	HS-20 Min*
1501 to 2000	30'-0"	HS-20	34'-0"	HS-20 Min*
Over 2000	30'-0"	HS-20	34'-0"	HS-20 Min*

* PHL-93 Desirable

MINIMUM WIDTH CRITERIA FOR BRIDGES ON COLLECTOR AND LOCAL ROAD FACILITIES (English)

	TABLE 3 BRIDGES TO REMAIN IN PLACE (Deck Repair or Deck Overlay, Parapet Modifications or No Bridge Work)		TABLE 4 DECK REPLACEMENT OR PARTIAL SUPERSTRUCTURE REPLACEMENT		TABLE 5 RECONSTRUCTED BRIDGES (Superstructure Replacement or Bridge Replacement)	
TRAFFIC VOLUMES CURRENT (a) TRAFFIC ADT	MINIMUM BRIDGE WIDTHS (b)	DESIGN LOAD STRUCTURAL CAPACITY (e)	MINIMUM BRIDGE WIDTHS (b) (c) (n)	DESIGN LOAD STRUCTURAL CAPACITY (e)	MINIMUM BRIDGE WIDTHS (b) (g) (h) (k) (n)	DESIGN LOAD STRUCTURAL CAPACITY
400 and Under	22'-0" (d) (l)	HS-15	24'-0" (d) (l)	HS-15 Min*	24'-0" (i) (m)	PHL-93
401 to 1500	22'-0"	HS-15	28'-0"	HS-15 Min*	28'-0"	PHL-93
1501 to 2000	24'-0"	HS-15	30'-0" (f)	HS-15 Min*	32'-0"	PHL-93
Over 2000	28'-0"	HS-15	34'-0" (f)	HS-15 Min*	40'-0" (j)	PHL-93

* HS-20 Desirable

See General Bridge Width Table Notes on Page 1 - 37.

GENERAL BRIDGE WIDTH TABLE NOTES

(a) For roads in new locations, a projected 20 year average daily traffic (ADT) shall be used. For rehabilitation of existing facilities, the ADT for the current year may be used.

(b) Bridge width between curbs or rails, whichever is less, is to be at least the same as the approach lane widths plus the approach shoulder widths. The approach lane widths plus the approach shoulder widths indicated in Table 1.3 through Table 1.7 may be considered for bridge widths if they are less than the bridge widths on Pages 1 - 35 and 1 - 36.

(c) When existing widths are greater than the values indicated, the existing width shall be equaled as a minimum. Widths greater than the minimum values indicated shall be provided whenever increased widening will not require adding a line of girders. When special conditions warrant, such as two-way traffic operations for future rehabilitation (repair or overlay), consideration should be given to increased widths which do require additional girders.

(d) For Local Road facilities not on any Federal-aid system with a current average daily traffic (ADT) of 250 and less, the minimum bridge widths may be 0.6 m (2 ft) less than the values indicated. In no case shall the bridge width be less than the approach traveled way width.

(e) For design Average Daily Truck Traffic (ADTT) of 500 or more, use MS-18 (HS-20).

(f) For design speeds less than 80 km/h (50 mph), the minimum bridge widths may be 0.6 m (2 ft) less than the values indicated.

(g) For replaced bridges on new alignment, the minimum bridge width shall equal the approach traveled way width plus the approach shoulder width.

(h) For bridges over 30 m (100 ft) in length, the minimum bridge width may equal the existing or proposed approach traveled way width, whichever is greater, plus 1 m (3 ft) shoulders each side when traffic ADT is greater than 1500.

(i) For Local Road facilities not on any Federal aid system with a current average daily traffic (ADT) of 250 and less and a design speed less than 60 km/h (40 mph), the minimum bridge width may be 0.6 m (2 ft) less than the value indicated. In no case shall the bridge width be less than the approach traveled way width.

(j) For Urban Collector facilities, the minimum bridge width shall equal 10.8 m (36 ft) and for Urban Local Road facilities, it shall equal 9.6 m (32 ft). In no case shall the bridge width be less than the approach traveled way width plus the approach shoulder width.

(k) On curbed approaches, the minimum bridge width may equal the curb-to-curb width. Where pedestrian traffic is anticipated, provisions for a sidewalk, preferably on the outside of the parapet, should be considered and shall meet the Department's Standards and requirements (see Chapter 6).

(l) On facilities functionally classified as a local road not on the National Highway System (NHS), existing bridges can remain in place without widening unless there is evidence of a site-specific safety problem related to the width of the bridge. This applies to deck replacements and partial superstructure replacement projects also. Appropriate safety mitigation measures should be provided. Reference Chapter 1, Table 1.1, Low Cost Safety Improvement Measures.

(m) For bridges on new roadways where there is no existing roadway or bridge in place, one-lane bridges may be provided on single-lane roads and on two-lane roads with ADT less than 100 vehicles per day where the designer finds that a one-lane bridge can operate effectively. The minimum width of a one-lane bridge should be 4.5 m (15 ft) unless the designer concludes that a narrower bridge can function effectively and the Bureau of Design, Highway Quality Assurance Division concurs.

When an existing bridge meets all of the following conditions:

- on a facility functionally classified as a local road off the National Highway System,
- has an ADT less than or equal to 400,
- needs reconstructed for structural reasons but there is no evidence of a site-specific safety problem, and
- no existing or anticipated significant land use conflicts exist,

the replacement bridge can be constructed with the same width as the existing bridge. The minimum width of a one-lane bridge should be 4.5 m (15 ft) unless the designer concludes that a narrower bridge can function effectively and the Bureau of Design, Highway Quality Assurance Division concurs. This criterion applies to bridges that are reconstructed on the same alignment and bridges that are reconstructed on a more favorable alignment.

For bridges on new roadways and for existing bridges, alignment and sight distance should be carefully studied so that they are not compromised. Appropriate safety mitigation measures should be provided. Reference Chapter 1, Table 1.1, Low Cost Safety Improvement Measures.

(n) If the conditions listed on the form in Chapter 1, Appendix A, 3R Bridge Width Criteria Documentation are met, the minimum bridge width is equal to the corresponding value listed in Minimum Width Criteria for Rural 3R Projects table in Chapter 1, Section 1.2. If the conditions are not met, then this note does not apply.

SHOULDER CRITERIA FOR NEW CONSTRUCTION AND RECONSTRUCTION PROJECTS

I. General: Any new construction or reconstruction project having a rigid pavement structure shall have Portland Cement Concrete shoulders provided. On any new construction or reconstruction project having a flexible pavement, the pavement shall be constructed 0.6 m (2 ft) wider into the shoulder area. The remainder of the shoulder shall be constructed with the type of shoulder designated below. The shoulder area is defined as the appropriate shoulder width indicated on the design criteria charts. The 0.6 m (2 ft) widening does not apply to the inside shoulders on Interstate and Other Limited Access Freeways. See Publication 72M, *Roadway Construction Standards*, RC-25M. Types 1-F, 1-S, 1-SP, 6-F, 6-S and 6-SP Shoulders have been developed primarily to provide smooth surfaces for bicyclists and pedestrians where it is anticipated such activities would take place. At the discretion of the District Executive, these types of shoulders may be provided elsewhere.

II. Provide Concrete Shoulders adjacent to rigid pavements. Concrete Shoulders, Type 1 shall be provided on Interstate and Other Limited Access Freeways. Concrete Shoulders, Type 2 shall be provided on Arterials, Collectors and Local Roads.

III. Provide Type 1, 1-F, 1-S or 1-SP Shoulders adjacent to flexible pavements in the following cases:
   A. On all Interstate and Other Limited Access Freeways and Arterials.
   B. On other type roadways where serious drainage problems are anticipated.
   C. On two-lane roadways where truck traffic exceeds a Design Hourly Volume (DHV) of 150.
   D. On two-lane roadways where it is anticipated that traffic shall utilize the shoulder:
      (1) At intersections with ramps having tight radii and roadways with curves having radii less than 140 m (curves sharper than 12°-30').
      (2) At intersection approaches adjacent to the through movement where it is anticipated that left turn vehicles shall be causing vehicles wishing to proceed straight through to use the right side shoulder. In such cases, either the roadway pavement structure may be extended through the shoulder area or Type 1, 1-F or 1-S Shoulder may be used, starting 75 m (250 ft) before the intersection and stopping 45 m (150 ft) downstream from the intersection.
      (3) For approaches to an intersection, where it is anticipated that right turning vehicles shall utilize the shoulder area as a turning lane, the shoulder area shall be paved with a Type 1, 1-F, 1-S or 1-SP Shoulder or the roadway pavement structure may be extended through the shoulder area. The length of higher type paving approaching the intersection shall be in accordance with the following chart:

RIGHT TURNING VEHICLES/h	<100	100 TO 200	>200
MIN LENGTH	30 m (100 ft)	55 m (175 ft)	75 m (250 ft)

      (4) At other locations at the discretion of the Engineer.

IV. Provide Type 3 Shoulders adjacent to flexible pavements on Collectors and Local Roads of the same surface material as the pavement structure or provide Type 1, 1-F, 1-S or 1-SP Shoulders.

V. Do not use rumble strips (see RC-25M) or similar physically depressed or modified feature on shoulders for routes designated as bikeways.

RESURFACING, RESTORATION AND REHABILITATION (3R) DESIGN CRITERIA		
	RURAL AREA SYSTEM	**URBAN AREA SYSTEM**
DESIGN SPEED (km/h or mph)	SEE NOTE (1)	SEE NOTE (2)
PAVEMENT WIDTHS (3) (4)	SEE TABLE 1 ON PAGE 1 - 40	3.6 m (12 ft) LANES (DESIRABLE) (5) 3.0 m (10 ft) LANES (MINIMUM) (6)
SHOULDER WIDTHS (3) (7)	SEE TABLE 1 ON PAGE 1 - 40	EXISTING (8)
MEDIAN WIDTHS	EXISTING	EXISTING
CROSS SLOPES (9)	TANGENT: 2.0% (DESIRABLE) 1.0% (MINIMUM) WHERE GRADES ARE ≥ 1% SUPERELEVATION: SEE NOTE (10)	EXISTING (11)
VERTICAL CURVATURE AND GRADES	EXISTING (12)	EXISTING (12)
HORIZONTAL CURVATURE	EXISTING (12)	EXISTING (12)
SIGHT DISTANCES	EXISTING (12)	EXISTING (12)
GUIDE RAIL AND MEDIAN BARRIER	SEE NOTE (13)	SEE NOTE (13)
CLEAR ZONE WIDTHS	SEE CHAPTER 12	0.5 m (1.5 ft) FROM OUTSIDE EDGE OF SHOULDER (5) (6) OR FROM FRONT FACE OF CURB, ALSO SEE CHAPTER 12
BRIDGE WIDTHS	SEE PAGES 1 - 34 THROUGH 1 - 37	SEE PAGES 1 - 34 THROUGH 1 - 37
PARKING LANES	NONE	SEE CHAPTER 1, TABLE 1.3 THROUGH TABLE 1.7

◯ SEE 3R DESIGN CRITERIA NOTES ON PAGES 1 - 42 AND 1 - 43.

RESURFACING, RESTORATION AND REHABILITATION (3R) DESIGN CRITERIA

TABLE 1 (METRIC)
MINIMUM WIDTH CRITERIA FOR
RURAL 3R PROJECTS [a]

CURRENT TRAFFIC ADT	NUMBER [b] OF HEAVY VEHICLES	DESIGN SPEED (km/h)	MINIMUM WIDTHS [c]
≤ 400	40 OR LESS	< 80	5.4 m PAVEMENT PLUS 0.6 m SHOULDERS EACH SIDE
		≥ 80	6.0 m PAVEMENT PLUS 0.6 m SHOULDERS EACH SIDE
401 TO 1000	100 OR LESS	< 80	6.0 m PAVEMENT PLUS 0.6 m SHOULDERS EACH SIDE
		≥ 80	6.6 m PAVEMENT PLUS 0.6 m SHOULDERS EACH SIDE
1001 TO 2000	200 OR LESS	< 80	6.6 m PAVEMENT PLUS 0.6 m SHOULDERS EACH SIDE
		≥ 80	6.6 m PAVEMENT PLUS 0.9 m SHOULDERS EACH SIDE
2001 TO 4000	400 OR LESS	< 80	6.6 m PAVEMENT PLUS 0.9 m SHOULDERS EACH SIDE
		≥ 80	6.6 m PAVEMENT PLUS 1.2 m SHOULDERS EACH SIDE
4001 TO 10 000	1000 OR LESS	< 80	6.6 m PAVEMENT PLUS 1.2 m SHOULDERS EACH SIDE
		≥ 80	6.6 m PAVEMENT PLUS 1.5 m SHOULDERS EACH SIDE
10 001 TO 20 000	2000 OR LESS	< 80	6.6 m PAVEMENT PLUS 1.5 m SHOULDERS EACH SIDE
		≥ 80	7.2 m PAVEMENT PLUS [d] 1.5 m SHOULDERS EACH SIDE
> 20 000	[e] 2000 OR LESS	ALL	7.2 m PAVEMENT PLUS [d] 1.5 m SHOULDERS EACH SIDE

SEE NOTES ON PAGE 1-41.

TABLE 1 (ENGLISH)
MINIMUM WIDTH CRITERIA FOR
RURAL 3R PROJECTS [a]

CURRENT TRAFFIC ADT	NUMBER [b] OF HEAVY VEHICLES	DESIGN SPEED (mph)	MINIMUM WIDTHS [c]
≤ 400	40 OR LESS	< 50	18'-0" PAVEMENT PLUS 2'-0" SHOULDERS EACH SIDE
		≥ 50	20'-0" PAVEMENT PLUS 2'-0" SHOULDERS EACH SIDE
401 TO 1000	100 OR LESS	< 50	20'-0" PAVEMENT PLUS 2'-0" SHOULDERS EACH SIDE
		≥ 50	22'-0" PAVEMENT PLUS 2'-0" SHOULDERS EACH SIDE
1001 TO 2000	200 OR LESS	< 50	22'-0" PAVEMENT PLUS 2'-0" SHOULDERS EACH SIDE
		≥ 50	22'-0" PAVEMENT PLUS 3'-0" SHOULDERS EACH SIDE
2001 TO 4000	400 OR LESS	< 50	22'-0" PAVEMENT PLUS 3'-0" SHOULDERS EACH SIDE
		≥ 50	22'-0" PAVEMENT PLUS 4'-0" SHOULDERS EACH SIDE
4001 TO 10000	1000 OR LESS	< 50	22'-0" PAVEMENT PLUS 4'-0" SHOULDERS EACH SIDE
		≥ 50	22'-0" PAVEMENT PLUS 5'-0" SHOULDERS EACH SIDE
10001 TO 20000	2000 OR LESS	< 50	22'-0" PAVEMENT PLUS 5'-0" SHOULDERS EACH SIDE
		≥ 50	24'-0" PAVEMENT PLUS [d] 5'-0" SHOULDERS EACH SIDE
> 20000	[e] 2000 OR LESS	ALL	24'-0" PAVEMENT PLUS [d] 5'-0" SHOULDERS EACH SIDE

RESURFACING, RESTORATION AND REHABILITATION (3R) DESIGN CRITERIA NOTES

NOTES

(a) FOR CURRENT TRAFFIC ADT, WHERE THE NUMBER OF HEAVY VEHICLES FALLS WITHIN THE RANGE INDICATED, USE THE CORRESPONDING MINIMUM WIDTHS. WHERE THE NUMBER OF HEAVY VEHICLES EXCEEDS THE RANGE INDICATED FOR THE CORRESPONDING ADT, USE THE MINIMUM WIDTH VALUES FOR THE APPROPRIATE RANGE OF HEAVY VEHICLES (SEE EXAMPLES PRESENTED ON THIS PAGE).

(b) NUMBER OF HEAVY VEHICLES = CURRENT TRAFFIC ADT x % OF TRUCKS, BUSES AND RECREATIONAL VEHICLES.

(c) CURVE WIDENING SHALL BE APPLIED TO PAVEMENT WIDTHS AS PRESENTED IN CHAPTER 2. CONSIDERATION SHOULD BE GIVEN TO MAINTAINING CURVE WIDENED PAVEMENTS OVER THE ENTIRE PROJECT LIMITS WHEN A SIGNIFICANT PROPORTION OF THE PROJECT REQUIRES CURVE WIDENING DUE TO MULTIPLE CURVES.

(d) UNDER RESTRICTIVE OR SPECIAL CONDITIONS, SUCH AS RIGHT-OF-WAY OR LATERAL CLEARANCE LIMITATIONS, REDUCTION OF PAVEMENT WIDTH FROM 7.2 m TO 6.6 m (24'-0" TO 22'-0") IS ACCEPTABLE.

(e) OVER 10% HEAVY VEHICLES, INCREASE SHOULDER WIDTH TO 1.8 m (6'-0") EACH SIDE.

EXAMPLE 1

GIVEN: 4000 ADT
9% HEAVY VEHICLES
DESIGN SPEED = 80 km/h (50 mph)

FIND: MINIMUM WIDTH REQUIRED.

SOLUTION: 4000 ADT x 9% HEAVY VEHICLES = 360 HEAVY VEHICLES. SINCE THE 4000 ADT FALLS BETWEEN 2001 TO 4000 AND THE NUMBER OF HEAVY VEHICLES IS 400 OR LESS, THE MINIMUM WIDTH PROVIDED SHOULD BE A 6.6 m (22'-0") PAVEMENT PLUS 1.2 m (4'-0") SHOULDERS EACH SIDE.

EXAMPLE 2

GIVEN: 5850 ADT
18% HEAVY VEHICLES
DESIGN SPEED < 80 km/h (50 mph)

FIND: MINIMUM WIDTH REQUIRED.

SOLUTION: 5850 ADT x 18% HEAVY VEHICLES = 1053 HEAVY VEHICLES. ALTHOUGH THE 5850 ADT FALLS BETWEEN 4001 TO 10 000, THE NUMBER OF HEAVY VEHICLES (1053) EXCEEDS THE 1000 OR LESS CRITERIA. THEREFORE, THE APPROPRIATE RANGE OF HEAVY VEHICLES WOULD BE 2000 OR LESS AND THE MINIMUM WIDTH PROVIDED SHOULD BE 6.6 m (22'-0") PAVEMENT PLUS 1.5 m (5'-0") SHOULDERS EACH SIDE.

RESURFACING, RESTORATION AND REHABILITATION (3R) DESIGN CRITERIA NOTES

① When the project scope does not include an overlay or a roadway geometry improvement (e.g., drainage, guide rail, shoulder structural upgrading, etc.), a design speed is not applicable to the project. If an overlay or a roadway geometry improvement (e.g., pavement or shoulder widening, increase in superelevation, etc.) is included in the project scope, a design speed shall be used. The minimum design speed selected shall be equal to the average running speed plus any anticipated increase in the average running speed due to the overlay or roadway geometry improvement, rounded upward to the nearest 10 km/h (5 mph) increment (the average running speed, which represents the length of the highway segment divided by the average running time, i.e., the time the vehicle is in motion along the segment, shall be determined as set forth in Publication 212, *Official Traffic Control Devices*. The maximum design speed selected shall be based on the applicable functional classification systems indicated in Chapter 1, Table 1.3 through Table 1.8. The design speed selected may be a range of speeds based upon the governing speed in each subsection of the project.

② Major urban arterial streets and highways with some access control and fairly long distances between intersections should have a design speed determined according to Note ①. However, those major arterials that have obvious "street-like" characteristics, operationally and physically, and most urban, local and collector streets do not require a design speed determination.

③ Where the existing widths are greater than those indicated in the criteria, maintain the existing widths.

④ Railroad grade crossing paving shall extend 0.6 m (2 ft) beyond the extreme rails for the full graded width of the highway.

⑤ Lanes 2.7 m (9 ft) wide may be used on one-way streets or for divided roadways if at least a 0.3 m (1 ft) curb offset is used or if trucks and buses are prohibited.

⑥ Curb Offset:
60 km/h (40 mph) and Less - None
Greater Than 60 km/h (40 mph) - 0.3 m (1 ft) desirable

⑦ In cut sections, on widening or reconstruction projects, where the width available from the edge of pavement to the toe of the cut slope is 2.4 m (8 ft) or less, the shoulder paving should be extended to the toe of the cut slope. Where this width is variable, the shoulder paving may also be variable. If erosion is a problem in this area, consideration should be given to extending the paving 250 mm to 300 mm (10 in to 12 in) up the slope.

⑧ Use Rural 3R Design Criteria if uncurbed section is used in urban areas.

⑨ In order to increase the amount of drainage capacity or to include reconstruction of the shoulder, the shoulder cross slopes may be increased as indicated in Note ⑬.

⑩ When the actual rate of superelevation is within 3.0% of the design superelevation rate, it is not necessary to increase the superelevation rate. When the actual rate of superelevation differs by more than 3.0% from the design superelevation rate, the highest achievable rate should be provided. When the curve superelevation provided does not equal the design superelevation rate, warning signs with advisory speed plates shall be provided. A reduction of the required superelevation rate is acceptable when short tangents between reverse curves do not afford sufficient runout length after consideration to partial runout within the curves. Rates of superelevation and the design speed shall be considered jointly. See Note ⑫ for additional information relative to design speed.

⑪ Since superelevation is not always possible, more attention should be paid to other items such as friction overlays and signing and pavement marking. For additional information, see Notes ⑩ and ⑫.

RESURFACING, RESTORATION AND REHABILITATION (3R) DESIGN CRITERIA NOTES

⑫ GENERAL: Existing horizontal curvature, vertical curvature and grades and sight distance shall be evaluated against minimum criteria for the design speed. For sites with accident experience, an economic analysis shall be made to determine feasibility for reconstruction. If reconstruction is not feasible, or reconstruction is less than new construction standards, a design exception request shall be prepared. In addition, appropriate safety and other mitigation measures shall be applied to enhance and upgrade these geometric features for extended service life and safer operations. See Chapter 1, Table 1.1 for a list of low cost safety improvement measures as alternates to reconstruction.

HORIZONTAL CURVATURE: When the design speed of a horizontal curve is 25 km/h (15 mph) or less below the design speed of the proposed project and no accident problem is prevalent, warning signs with advisory speed plates shall be provided. Also, the list of low cost safety improvement measures in Chapter 1, Table 1.1 shall be considered. When the difference is greater than 25 km/h (15 mph) and the current average daily traffic (ADT) is 750 or greater, or an accident problem exists, or the design speed of the horizontal curve is less than 30 km/h (20 mph), achievement of the design speed curvature criteria shall be considered through an economic analysis to determine feasibility for reconstruction. If reconstruction to current standards is not feasible, a design exception request shall be prepared. The design speed and rates of superelevation shall be considered jointly. See Note ⑩ for additional information relative to superelevation rates.

VERTICAL CURVATURE AND GRADES: When the design speed of a vertical curve is 30 km/h (20 mph) or less below the design speed of the proposed project, and no accident problem is prevalent, consider the list of low cost safety improvement measures in Chapter 1, Table 1.1. When the difference is greater than 30 km/h (20 mph) and the current average daily traffic (ADT) is 1500 or greater, or an accident problem exists, or the design speed of the vertical curve is less than 30 km/h (20 mph), consider achievement of the design speed curvature criteria and grades through an economic analysis to determine feasibility for reconstruction. Prepare a request for a design exception if reconstruction to current standards is not feasible.

SIGHT DISTANCE: When evaluating sight distance parameters, consider the preceding criteria on horizontal and vertical curvature together.

⑬ Remove existing guide rail and median barrier where not required especially if it does not comply with NCHRP Report 350. Consider slope flattening to eliminate need. Provide upgraded guide rail at bridge approaches and at identifiable accident locations. Replace existing metal guide rail and metal median barrier where the height of the existing barrier after resurfacing is reduced by more than 75 mm (3 in) from the standard height and cannot be raised. Raising the guide rail with modified offset brackets is not permitted. In order to avoid the requirement to replace or adjust guide rail or median barrier, the shoulder slope may be increased to a maximum algebraic difference in pavement and shoulder slopes of 8.0% for shoulders greater than 1.8 m (6 ft) wide, 10.0% for shoulders 1.2 m to 1.8 m (4 ft to 6 ft) wide, 12.0% for shoulders 0.9 m to 1.2 m (3 ft to 4 ft) wide or 14.0% for shoulders 0.6 m to 0.9 m (2 ft to 3 ft) wide.

SHOULDER CRITERIA FOR RESURFACING, RESTORATION AND REHABILITATION (3R) PROJECTS

I. WITHOUT PAVEMENT WIDENING

A. On projects involving the rehabilitation of rigid pavement, concrete shoulders may be provided, if desired, to strengthen the existing pavement or provide a relatively maintenance-free shoulder. Special drawings would be required in such cases. At no time shall the joint spacing of the concrete shoulders exceed 6.0 m (20 ft).

B. Provide Type 6, 6-F, 6-S or 6-SP Shoulders on Interstate and Other Limited Access Freeways and Arterials where excavation or scarifying of the existing shoulder is necessary. If the existing shoulder is currently high-type paved (stabilized excluded), and only the first couple of meters (first few feet) adjacent to the pavement is distressed, a 0.9 m (3 ft) minimum width of Type 6, 6-F, 6-S or 6-SP Shoulder may be provided. The remaining existing shoulder should be resurfaced with the same surfacing used on the new shoulder.

C. Provide Type 7 Shoulders on Interstate and Other Limited Access Freeways and Arterials where only cleaning and patching of the existing paved shoulder is necessary.

D. Provide shoulders adjacent to flexible pavements on Collectors and Local Roads of the same surface material as the pavement structure, or provide Type 1, 1-F, 1-S or 1-SP Shoulders.

II. WITH PAVEMENT WIDENING

A. On projects where the pavement is being widened and the current traffic ADT is greater than 5000 and/or the number of heavy vehicles (Current Traffic ADT × % of trucks, buses and recreational vehicles) is greater than 500, the widening structure shall be extended into the shoulder area 0.6 m (2 ft), similar to that required for new construction. When the current traffic ADT is 5000 or less and/or the number of heavy vehicles is 500 or less, the widening structure shall be extended 0.3 m (1 ft) into the shoulder area. The entire shoulder may be paved with the same material and design as the pavement widening at the discretion of the District Executive. In areas of heavy turning movement, such as driveway entrances or exits, intersections, etc., paving out-to-out is strongly recommended. Otherwise, the type of shoulder discussed in I.A, B, C and D above should be specified.

B. The widening portion of the pavement should be constructed at the same slope as the pavement. The shoulder slope should begin at the edge of the widened pavement. When the pavement structure is being extended for the full width of the shoulder, the shoulder slope should begin at the design width of pavement. Typical sections should indicate the shoulder area in these cases even though the materials used may be paid for separately.

C. The 0.3 m (1 ft) or 0.6 m (2 ft) widening in II.A above may be eliminated on Arterials with less than 5000 ADT and on Collectors and Local Roads if the optional shoulder described in I.D above is used or if a Type 6, 6-F, 6-S, 6-SP or 7 Shoulder or a recycled shoulder is provided for the entire width of shoulder.

III. RECYCLED SHOULDERS ON 3R PROJECTS

A. The use of reclaimed bituminous concrete material, which is generally obtained from milling operations, for shoulder base courses, is acceptable on 3R projects. Refer to current Department directive titled "Guidelines for Recycling Bituminous Pavements".

B. Reclaimed material may be used in a hot-mixed recycled base course for Type 6, 6-F, or 6-S Shoulders or hot-mixed surface course for Type 7 shoulders on any roadway.

C. Reclaimed material may be used in a cold-mixed recycled base course in the shoulders of Arterials, Collectors and Local Roads. A minimum depth of 130 mm (5 in) shall be used on Arterials and 100 mm (4 in) on Collectors and Local Roads.

1.3 INTERSTATE PROGRAMMING GUIDELINES

The Intermodal Surface Transportation Efficiency Act (ISTEA) eliminated the I-4R funded program and replaced it with the National Highway System (NHS) and the Interstate Maintenance (IM) program. NHS program funds may be used for reconstruction, new construction and needed capacity expansions. The IM program provides for both Preventive Maintenance (PM) and 3R work programs. The NHS, IM, Surface Transportation Program (STP) or Federal Critical Bridge (FCB) programs are the sources of funding for all interstate projects based on the scope of the project.

1.4 PAVEMENT PRESERVATION GUIDELINES

The Pavement Preservation Guidelines (PPG) are to be used for all Federal-aid and 100% state funded pavement preservation projects on Interstates and Expressways. The Non-Expressway Pavement Preservation (NEPP) Guidelines are to be used for all Federal-aid funded pavement preservation projects on non-expressways.

The pavement preservation activities were shown to be cost-effective based upon data from the Department's Roadway Management System and thus do not require a pavement design. Exceptions to these guidelines that involve geometric and bridge issues should be addressed to the Bureau of Design. Pavement design related exceptions should be directed to the Bureau of Maintenance and Operations, Pavement Design and Analysis Section. Both the Pavement Preservation Guidelines (PPG) and the Non-Expressway Pavement Preservation (NEPP) Guidelines can be found in Publication 242, *Pavement Policy Manual*.

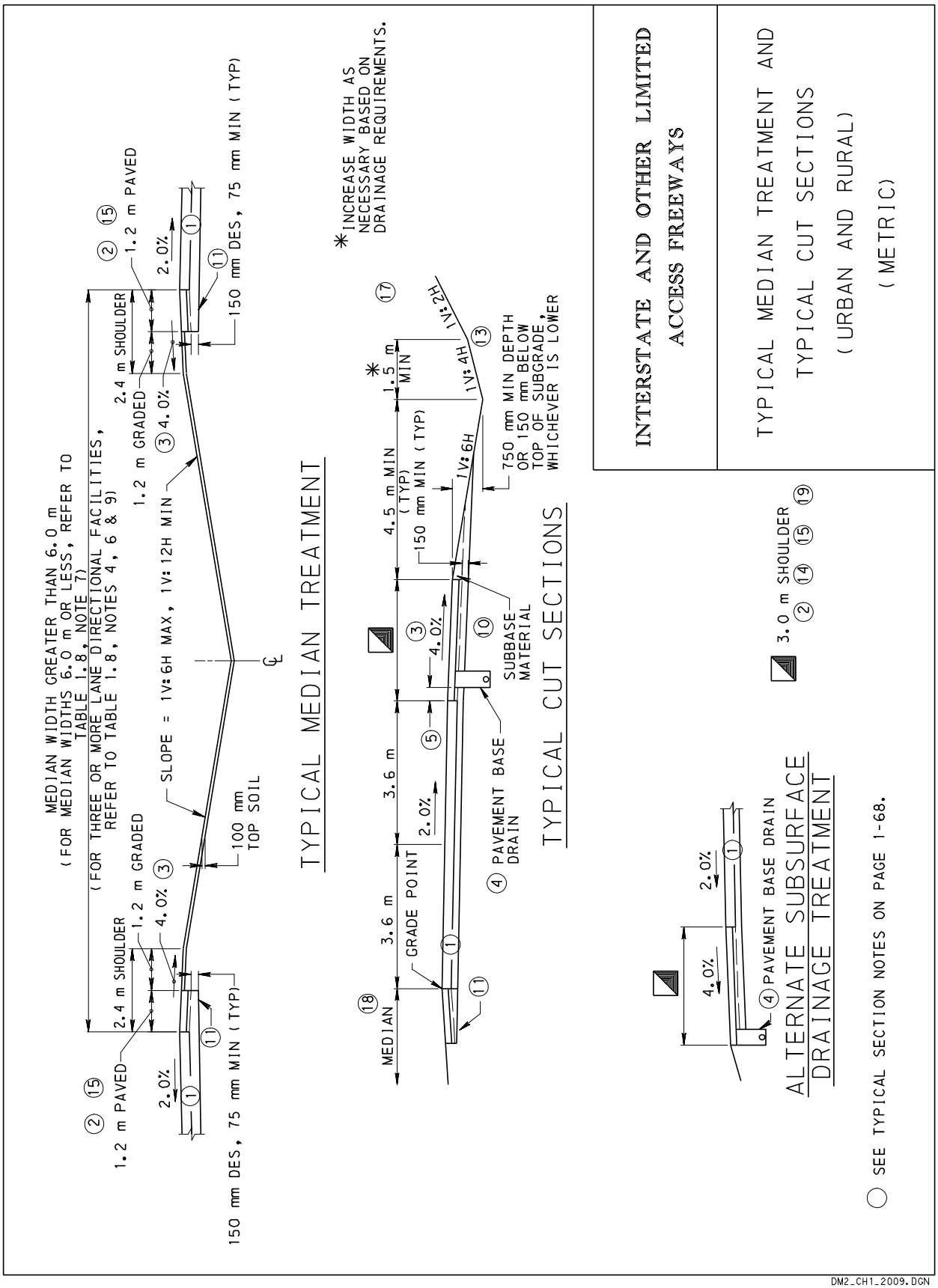
1.5 TYPICAL ROADWAY CROSS SECTIONS

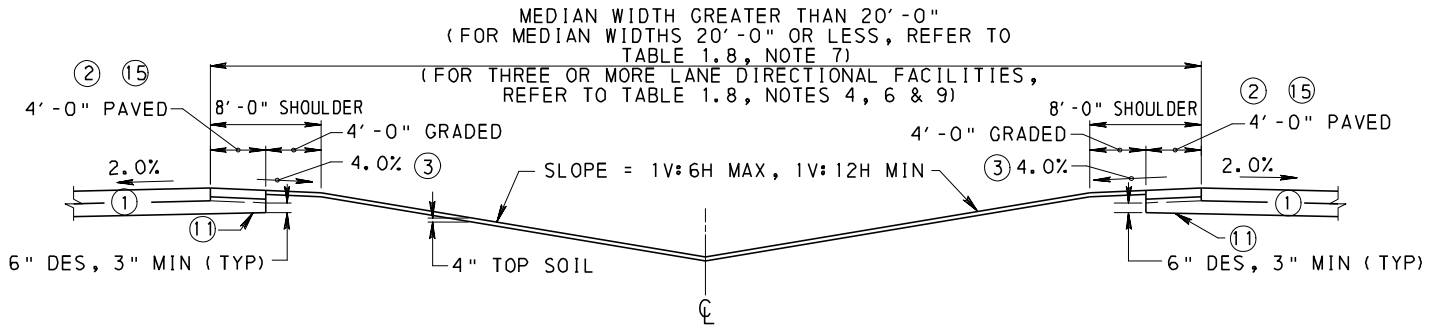
The Typical Roadway Cross Section details contained in this section shall be used in the design of typical sections for new highway construction projects on new alignment.

For Limited Access Freeways (Interstate and Non-Interstate), the design values for cross sectional elements, as presented in Table 1.8, are intended primarily for reconstruction projects.

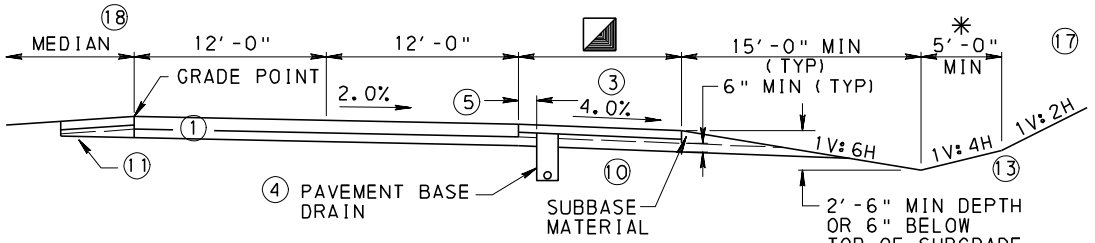
For Arterials, Collectors, and Local Roads, the design values for cross sectional elements, as presented in Table 1.3 through Table 1.7, are intended primarily for reconstruction projects.

For Arterials, Collectors, and Local Roads, when designing 3R projects, cross sectional elements shall be designed using the 3R Design Criteria as presented in Section 1.2.


INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS
TYPICAL MEDIAN TREATMENT AND TYPICAL CUT SECTIONS
(URBAN AND RURAL)
(METRIC)
TYPICAL MEDIAN TREATMENT
MEDIAN WIDTH GREATER THAN 6.0 m
(FOR MEDIAN WIDTHS 6.0 m OR LESS, REFER TO TABLE 1.8, NOTE 7)
(FOR THREE OR MORE LANE DIRECTIONAL FACILITIES, REFER TO TABLE 1.8, NOTES 4, 6 & 9)
1.2 m PAVED
2.4 m SHOULDER
1.2 m GRADED
4.0%
2.0%
SLOPE = 1V:6H MAX, 1V:12H MIN
100 mm TOP SOIL
150 mm DES, 75 mm MIN (TYP)
*INCREASE WIDTH AS NECESSARY BASED ON DRAINAGE REQUIREMENTS.
TYPICAL CUT SECTIONS
MEDIAN
3.6 m
GRADE POINT
4.5 m MIN (TYP)
150 mm MIN (TYP)
1.5 m MIN
1V:6H
1V:4H
1V:2H
750 mm MIN DEPTH OR 150 mm BELOW TOP OF SUBGRADE, WHICHEVER IS LOWER
SUBBASE MATERIAL
PAVEMENT BASE DRAIN
3.0 m SHOULDER
ALTERNATE SUBSURFACE DRAINAGE TREATMENT
SEE TYPICAL SECTION NOTES ON PAGE 1-68.
DM2_CH1_2009.DGN

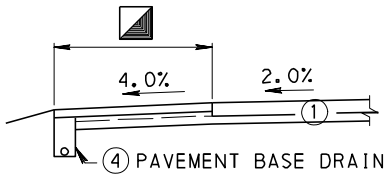


TYPICAL MEDIAN TREATMENT



*INCREASE WIDTH AS NECESSARY BASED ON DRAINAGE REQUIREMENTS.

TYPICAL CUT SECTIONS



ALTERNATE SUBSURFACE DRAINAGE TREATMENT

10'-0" SHOULDER (2) (14) (15) (19)

○ SEE TYPICAL SECTION NOTES ON PAGE 1-68.

INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS

TYPICAL MEDIAN TREATMENT AND TYPICAL CUT SECTIONS (URBAN AND RURAL) (ENGLISH)

DM2_CH1_2009.DGN

TYPICAL FILL SECTION--4.5 m AND UNDER

TYPICAL TANGENT SECTION

AN ALTERNATE 1V:3H SLOPE WITHOUT GUIDE RAIL MAY BE USED BASED ON ECONOMIC ANALYSIS. SEE "ALTERNATE TANGENT SECTION" DETAIL ON THIS PAGE.

3.0 m SHOULDER (2) (14) (15) (19)

ALTERNATE TANGENT SECTION

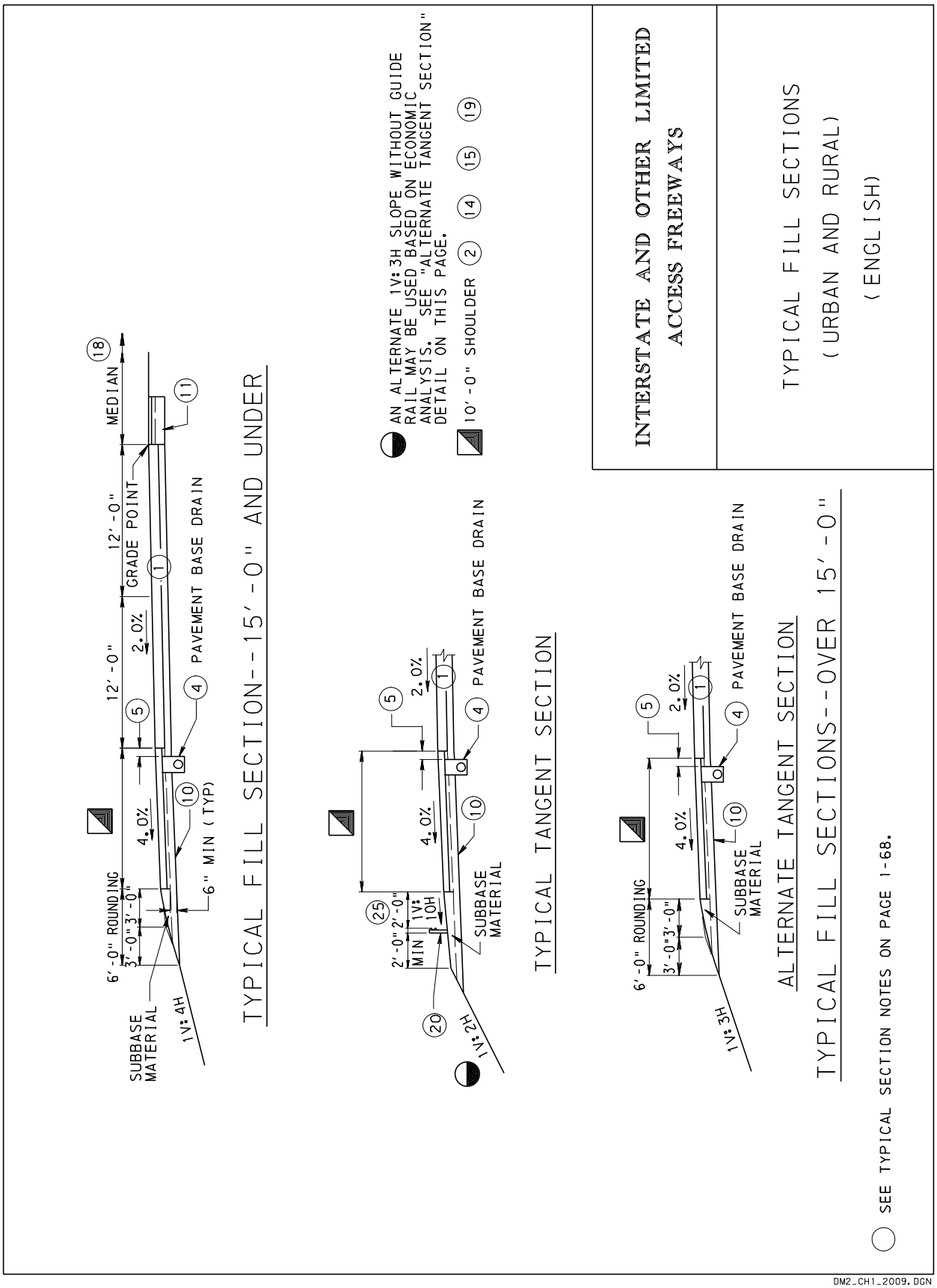
TYPICAL FILL SECTIONS--OVER 4.5 m

(○) SEE TYPICAL SECTION NOTES ON PAGE 1-68.

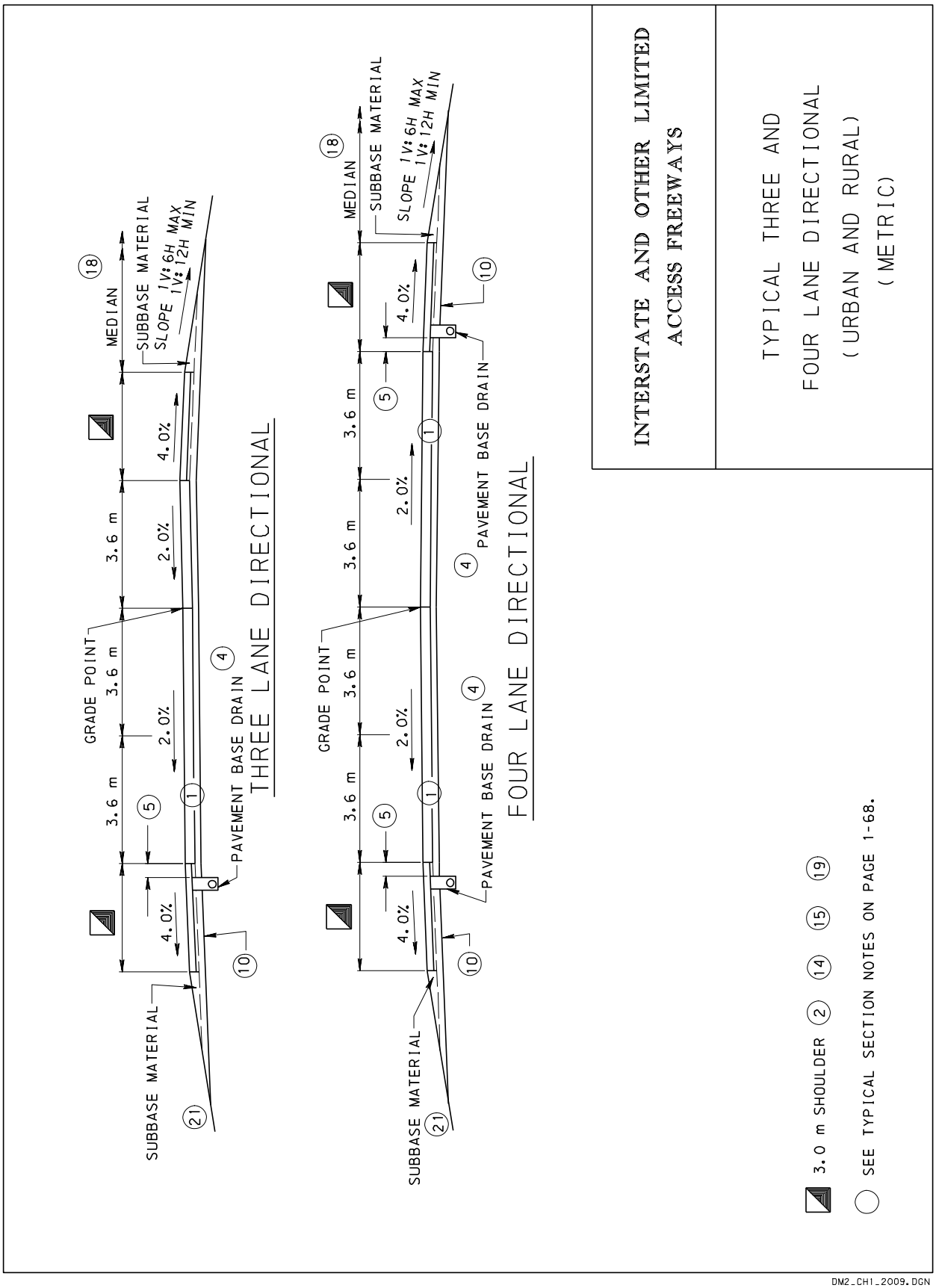
INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS

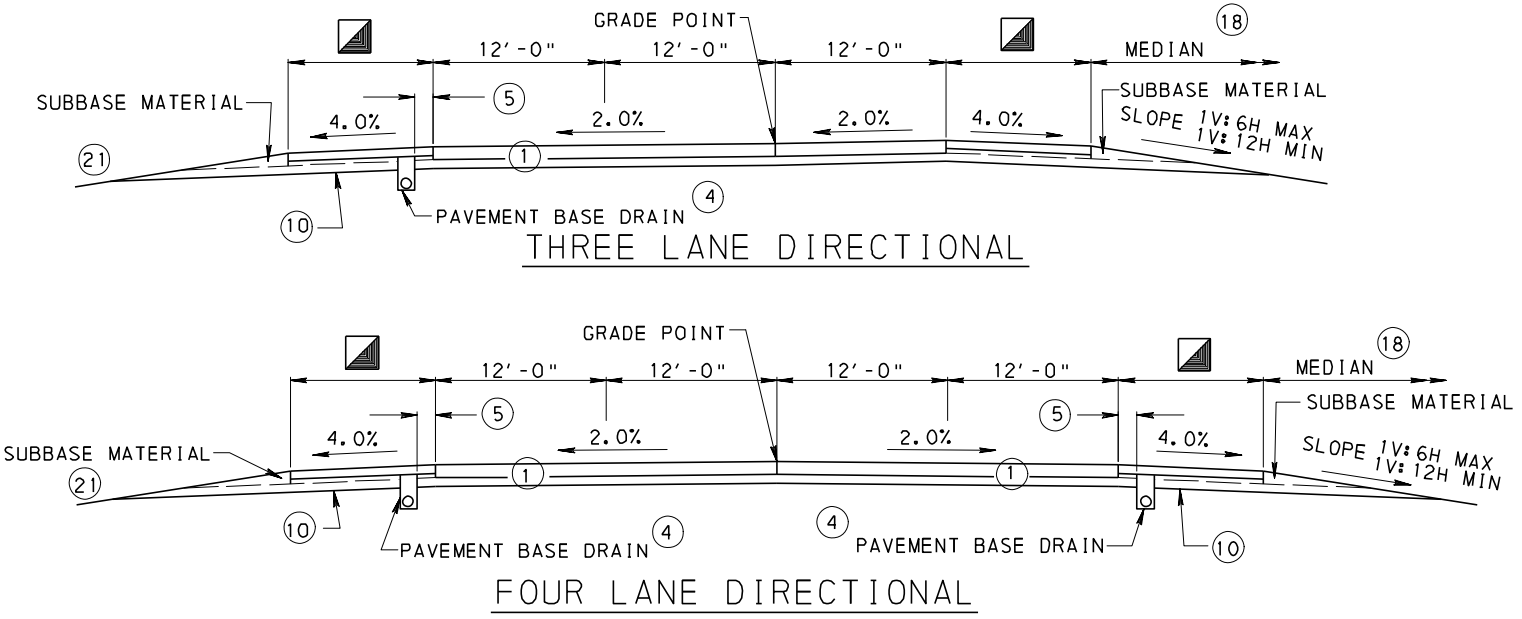
TYPICAL FILL SECTIONS
(URBAN AND RURAL)
(METRIC)

DM2_CH1_2009.DGN



DM2_CH1_2009.DGN


INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS
TYPICAL THREE AND FOUR LANE DIRECTIONAL (URBAN AND RURAL) (METRIC)
THREE LANE DIRECTIONAL
FOUR LANE DIRECTIONAL
GRADE POINT
MEDIAN
SUBBASE MATERIAL
SLOPE 1V:6H MAX 1V:12H MIN
PAVEMENT BASE DRAIN
3.6 m
2.0%
4.0%
3.0 m SHOULDER (2) (14) (15) (19)
SEE TYPICAL SECTION NOTES ON PAGE 1-68.
DM2_CH1_2009.DGN



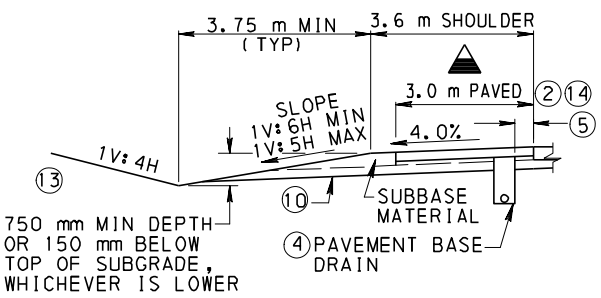
10′-0" SHOULDER (2) (14) (15) (19)

SEE TYPICAL SECTION NOTES ON PAGE 1-68.

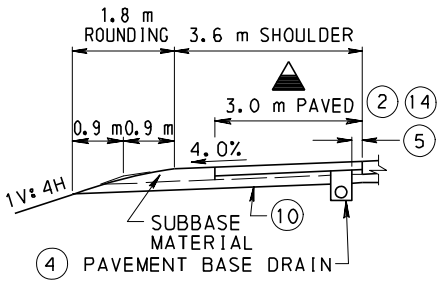
INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS

TYPICAL THREE AND FOUR LANE DIRECTIONAL (URBAN AND RURAL) (ENGLISH)

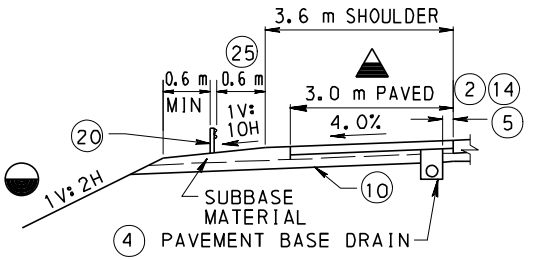
DM2_CH1_2009.DGN



CUT SECTION

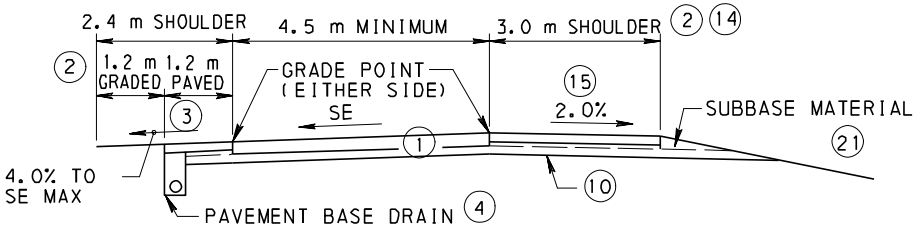


FILL SECTION--FILLS ≤ 4.5 m

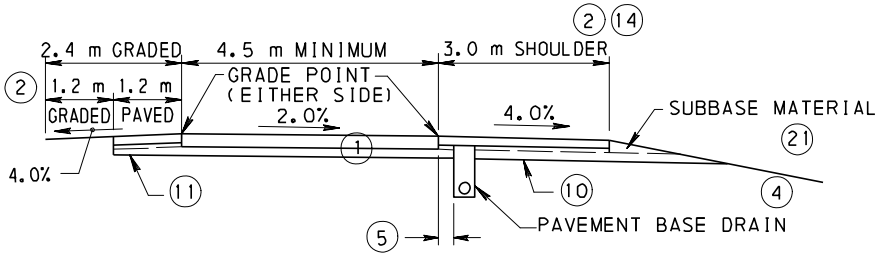


FILL SECTION--FILLS > 4.5 m

TYPICAL SHOULDER TREATMENT WHEN DDHV ≥ 250 TRUCKS



TYPICAL SUPERELEVATED SECTION



TYPICAL TANGENT SECTION

TYPICAL SINGLE LANE RAMPS

▲ WHERE TRUCK TRAFFIC EXCEEDS 250 DDHV, A PAVED WIDTH OF 3.6 m SHOULD BE CONSIDERED.

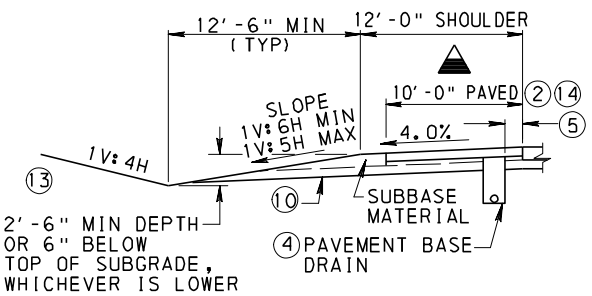
◒ AN ALTERNATE 1V:3H SLOPE WITHOUT GUIDE RAIL MAY BE USED BASED ON ECONOMIC ANALYSIS. SEE "ALTERNATE TANGENT SECTION" DETAIL ON PAGE 1-48.

○ SEE TYPICAL SECTION NOTES ON PAGE 1-68.

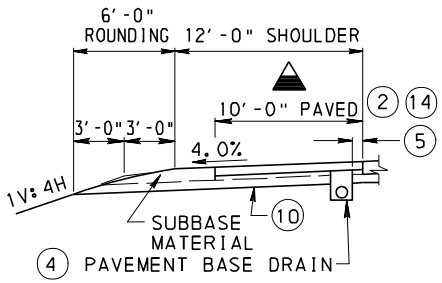
INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS

TYPICAL SHOULDER TREATMENT WHEN DDHV ≥ 250 TRUCKS AND TYPICAL SINGLE LANE RAMPS (URBAN AND RURAL) (METRIC)

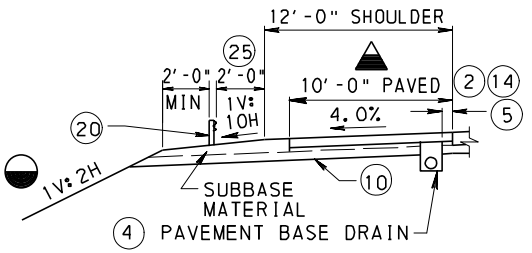
DM2_CH1_2009.DGN



CUT SECTION

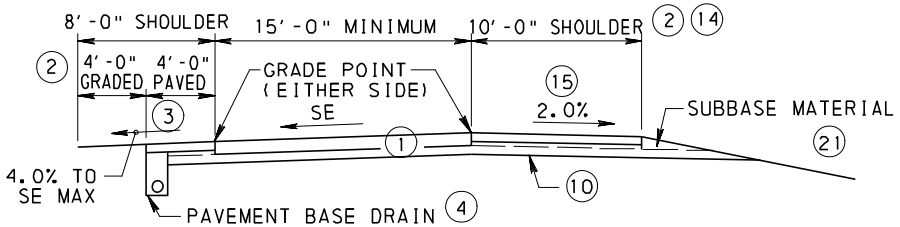


FILL SECTION--FILLS ≤ 15'-0"

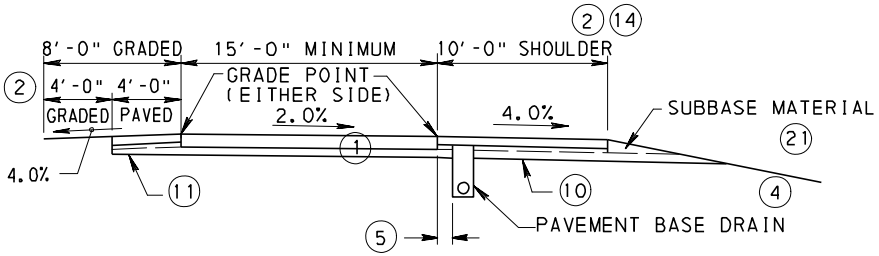


FILL SECTION--FILLS > 15'-0"

TYPICAL SHOULDER TREATMENT WHEN DDHV ≥ 250 TRUCKS



TYPICAL SUPERELEVATED SECTION



TYPICAL TANGENT SECTION

TYPICAL SINGLE LANE RAMPS

▲ WHERE TRUCK TRAFFIC EXCEEDS 250 DDHV, A PAVED WIDTH OF 12'-0" SHOULD BE CONSIDERED.

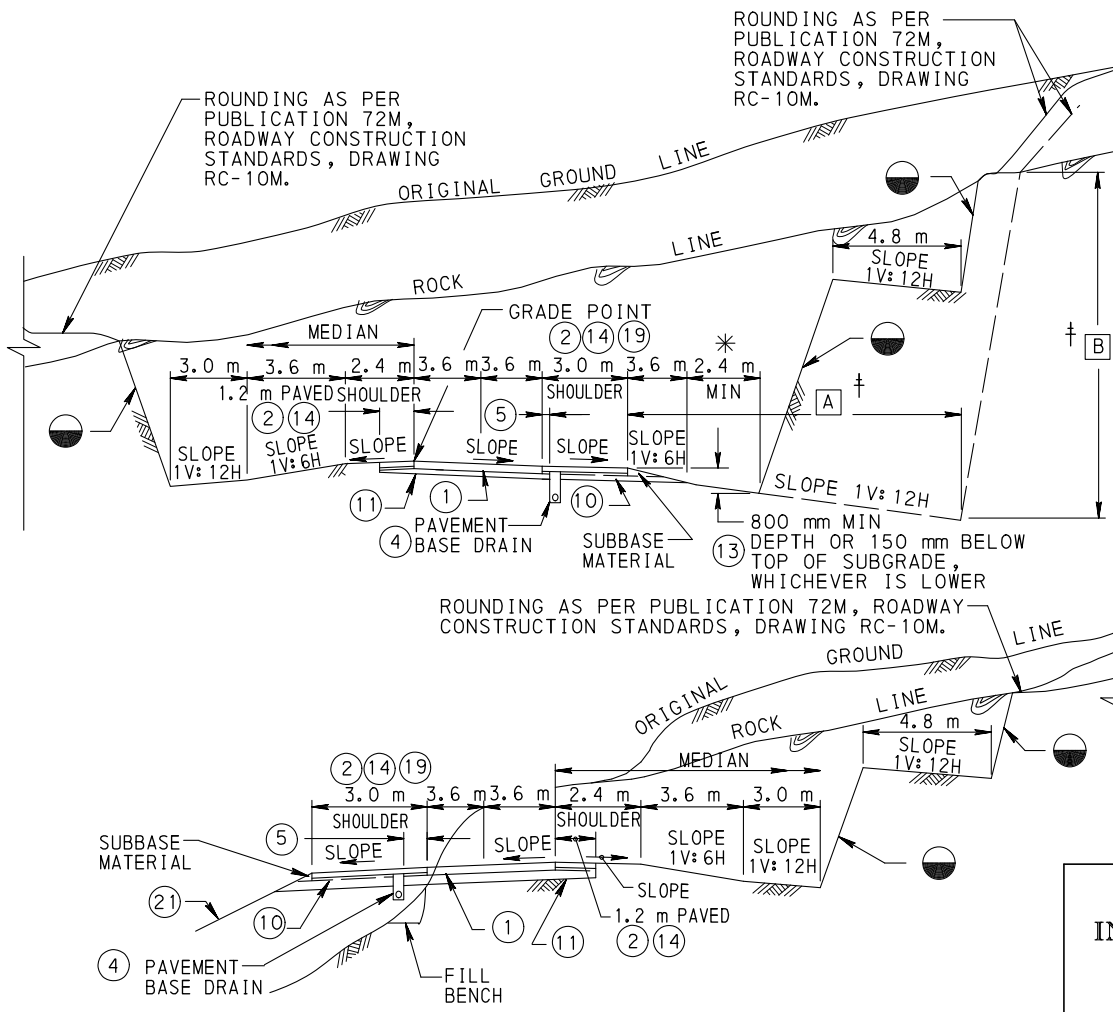
◒ AN ALTERNATE 1V:3H SLOPE WITHOUT GUIDE RAIL MAY BE USED BASED ON ECONOMIC ANALYSIS. SEE "ALTERNATE TANGENT SECTION" DETAIL ON PAGE 1-49.

◯ SEE TYPICAL SECTION NOTES ON PAGE 1-68.

INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS

TYPICAL SHOULDER TREATMENT WHEN DDHV ≥ 250 TRUCKS AND TYPICAL SINGLE LANE RAMPS (URBAN AND RURAL) (ENGLISH)

DM2_CH1_2009.DGN



NOTES

1. FILL BENCH DETAILS AND BENCH HEIGHT SHALL BE DEPENDENT UPON RECOMMENDATION OF THE SOIL SURVEY REPORT.
2. INSIDE OF SUPERELEVATED CURVES TO BE DAY-LIGHTED AS REQUIRED FOR NECESSARY SIGHT DISTANCE.

‡ WHEN BENCHES ARE ELIMINATED, THE DIMENSIONS [A] AND [B] SHALL BE DEPENDENT UPON RECOMMENDATION OF THE SOIL SURVEY REPORT.

◒ SLOPE 2V:1H OR VARIABLE AS PER RECOMMENDATION OF THE SOIL SURVEY REPORT.

✳ INCREASE WIDTH AS NECESSARY BASED ON DRAINAGE REQUIREMENTS.

TYPICAL ROADWAY SECTION FOR SPLIT LEVEL AND SEPARATED ROADWAYS WHERE BENCHING IS REQUIRED

◯ SEE TYPICAL SECTION NOTES ON PAGE 1-68.

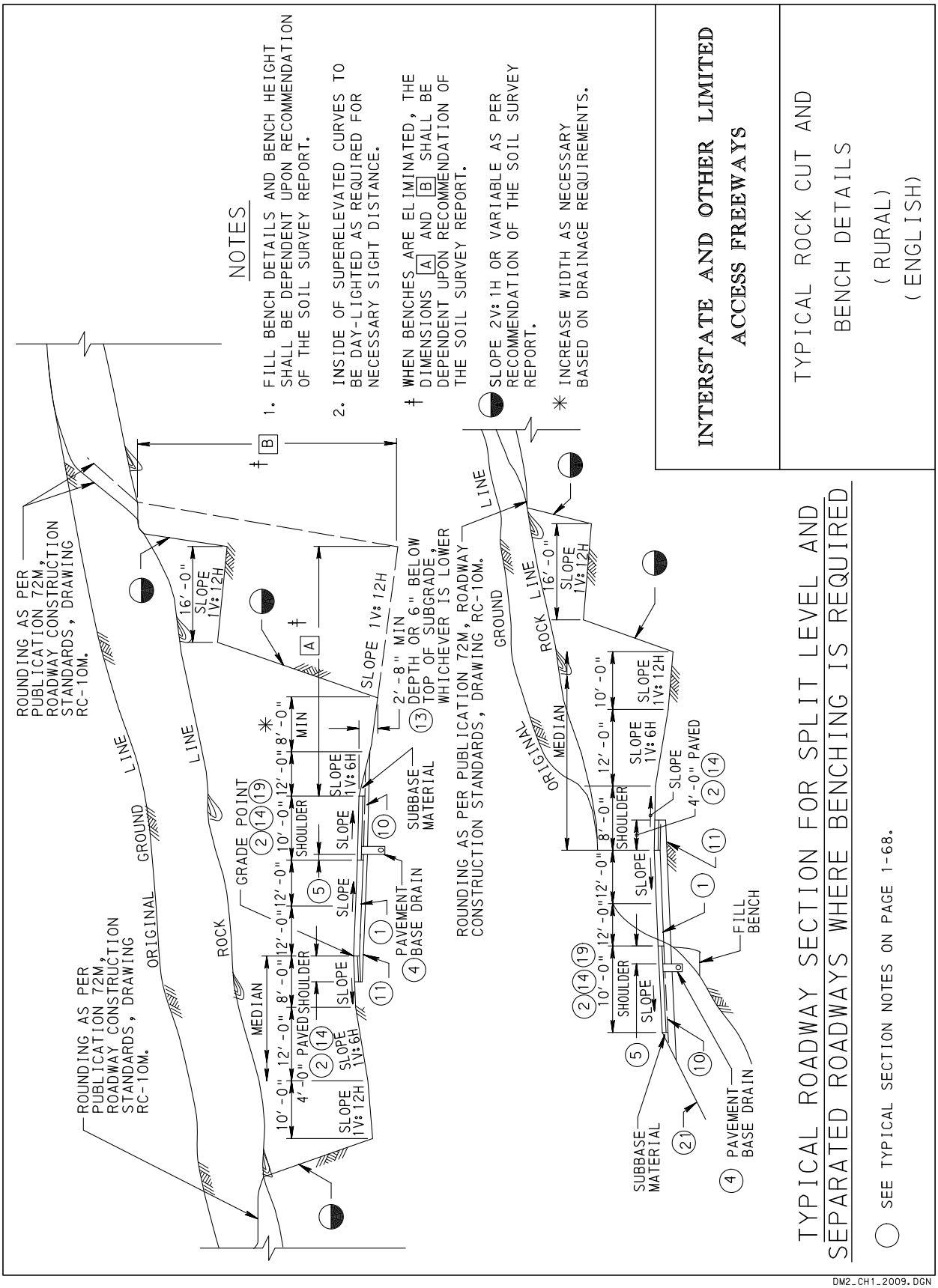
INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS

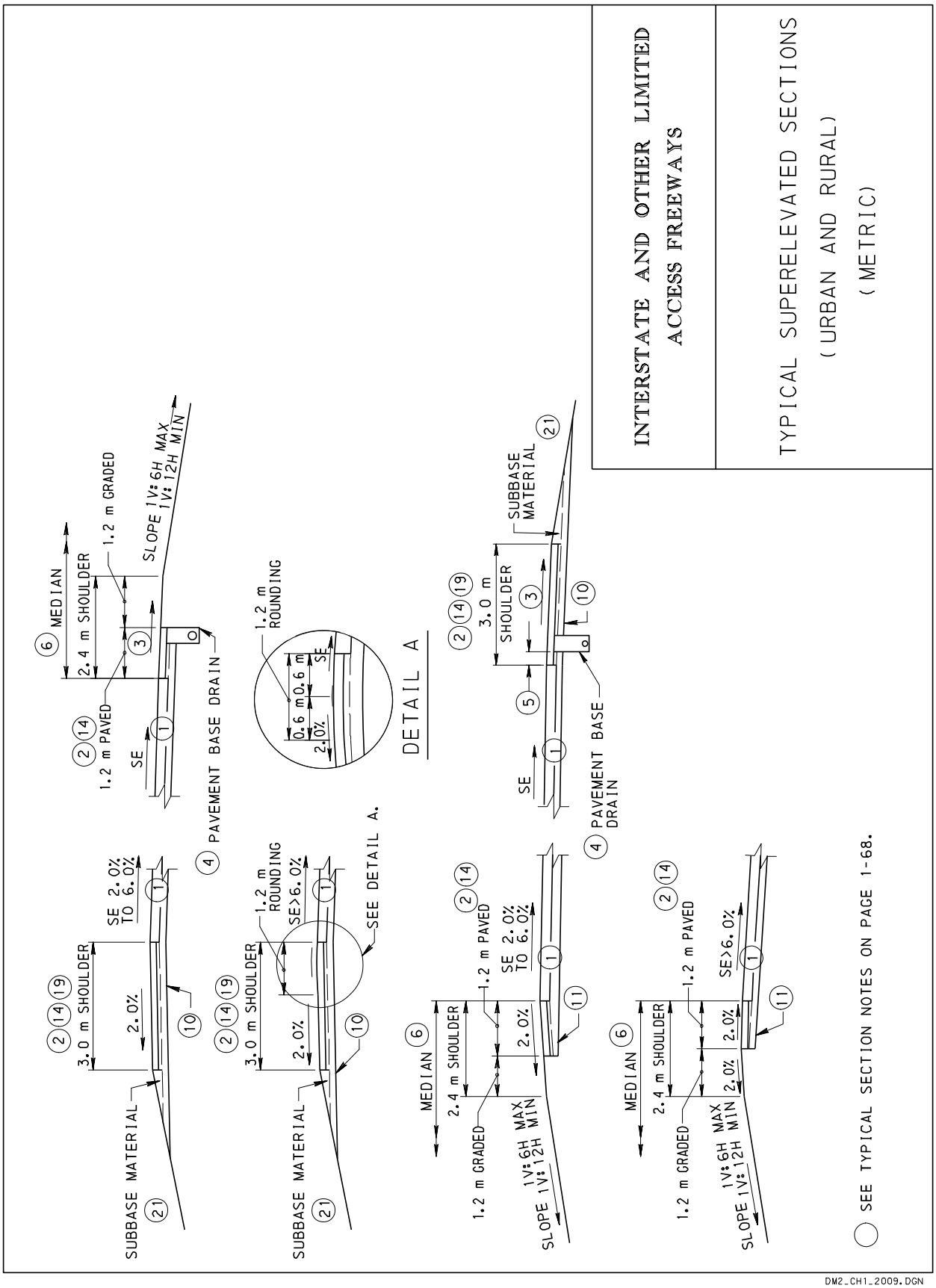
TYPICAL ROCK CUT AND BENCH DETAILS

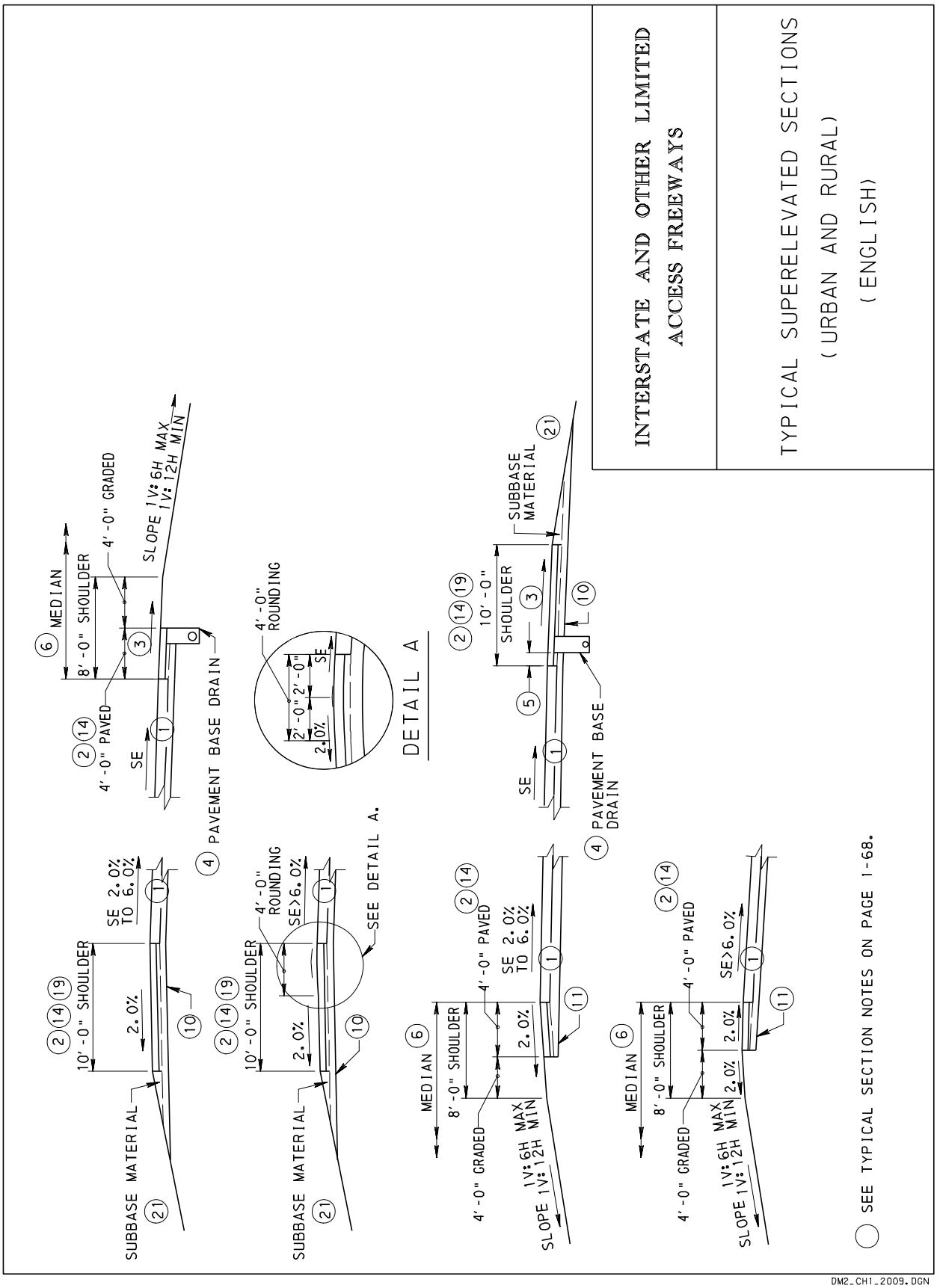
(RURAL)

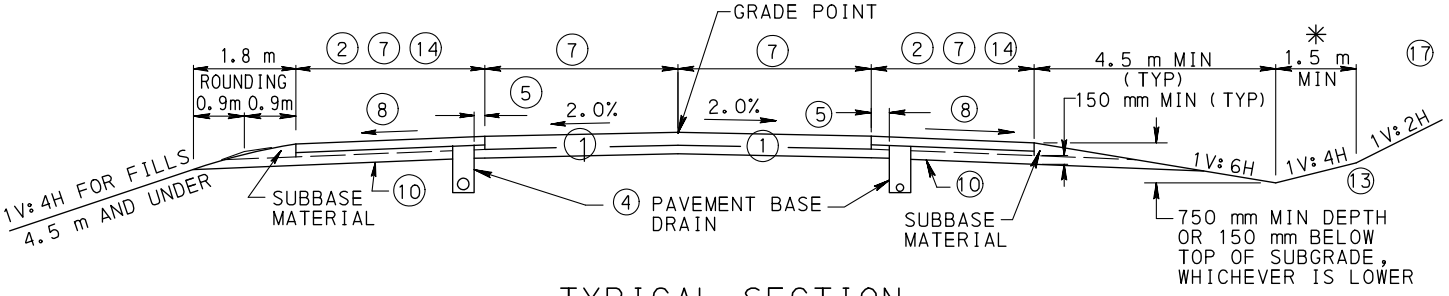
(METRIC)

DM2_CH1_2009.DGN

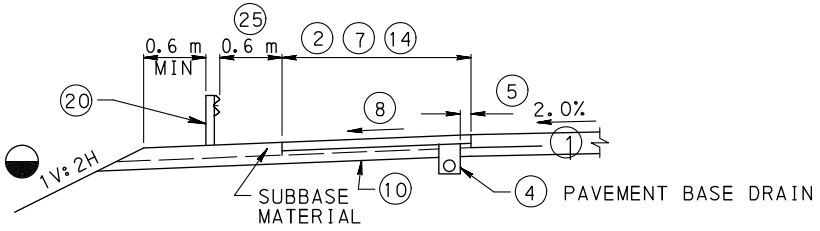

NOTES
1. FILL BENCH DETAILS AND BENCH HEIGHT SHALL BE DEPENDENT UPON RECOMMENDATION OF THE SOIL SURVEY REPORT.
2. INSIDE OF SUPERELEVATED CURVES TO BE DAY-LIGHTED AS REQUIRED FOR NECESSARY SIGHT DISTANCE.
‡ WHEN BENCHES ARE ELIMINATED, THE DIMENSIONS A AND B SHALL BE DEPENDENT UPON RECOMMENDATION OF THE SOIL SURVEY REPORT.
SLOPE 2V:1H OR VARIABLE AS PER RECOMMENDATION OF THE SOIL SURVEY REPORT.
✳ INCREASE WIDTH AS NECESSARY BASED ON DRAINAGE REQUIREMENTS.
INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS
TYPICAL ROCK CUT AND BENCH DETAILS
(RURAL)
(ENGLISH)
ROUNDING AS PER PUBLICATION 72M, ROADWAY CONSTRUCTION STANDARDS, DRAWING RC-10M.
ORIGINAL GROUND LINE
ROCK
GRADE POINT
MEDIAN
4'-0" PAVED SHOULDER
10'-0" 12'-0" 8'-0" 12'-0" 10'-0"
SLOPE 1V:12H
SLOPE 1V:6H
16'-0" SLOPE 1V:12H
2'-8" MIN DEPTH OR 6" BELOW TOP OF SUBGRADE, WHICHEVER IS LOWER
SUBBASE MATERIAL
PAVEMENT
BASE DRAIN
FILL BENCH
TYPICAL ROADWAY SECTION FOR SPLIT LEVEL AND SEPARATED ROADWAYS WHERE BENCHING IS REQUIRED
SEE TYPICAL SECTION NOTES ON PAGE 1-68.
DM2_CH1_2009.DGN


INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS
TYPICAL SUPERELEVATED SECTIONS
(URBAN AND RURAL)
(METRIC)
SEE TYPICAL SECTION NOTES ON PAGE 1-68.
DETAIL A
SEE DETAIL A.
SUBBASE MATERIAL
PAVEMENT BASE DRAIN
MEDIAN
SHOULDER
PAVED
GRADED
SLOPE
MAX
MIN
ROUNDING
SE
DM2_CH1_2009.DGN


INTERSTATE AND OTHER LIMITED ACCESS FREEWAYS
TYPICAL SUPERELEVATED SECTIONS (URBAN AND RURAL) (ENGLISH)
6 MEDIAN
8'-0" SHOULDER
4'-0" GRADED
2 14 4'-0" PAVED
SLOPE 1V:6H MAX 1V:12H MIN
SE
1
3
4 PAVEMENT BASE DRAIN
4'-0" ROUNDING
2'-0" 2'-0"
2.0%
DETAIL A
2 14 19 10'-0" SHOULDER
2.0%
SE 2.0% TO 6.0%
10
SUBBASE MATERIAL
21
SEE DETAIL A.
SE>6.0%
5
11
SEE TYPICAL SECTION NOTES ON PAGE 1-68.
DM2_CH1_2009.DGN

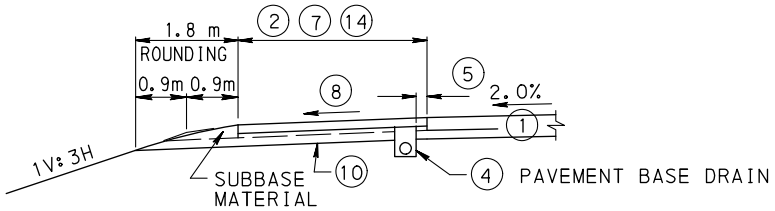


TYPICAL SECTION



TYPICAL TANGENT SECTION--FILLS OVER 4.5 m

AN ALTERNATE 1V:3H SLOPE WITHOUT GUIDE RAIL MAY BE USED BASED ON ECONOMIC ANALYSIS. SEE "ALTERNATE TANGENT SECTION" DETAIL ON THIS PAGE.



ALTERNATE TANGENT SECTION--FILLS OVER 4.5 m

SEE TYPICAL SECTION NOTES ON PAGE 1-68.

ARTERIALS

TYPICAL CUT AND FILL SECTIONS

(RURAL)

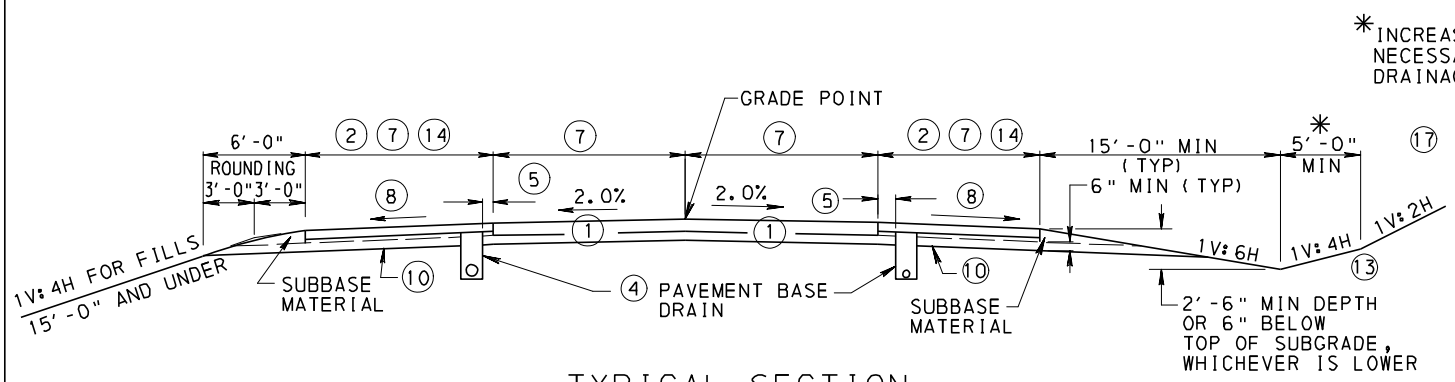
TYPICAL SECTIONS WITHOUT CURBS

FOR SPEEDS > 60 km/h

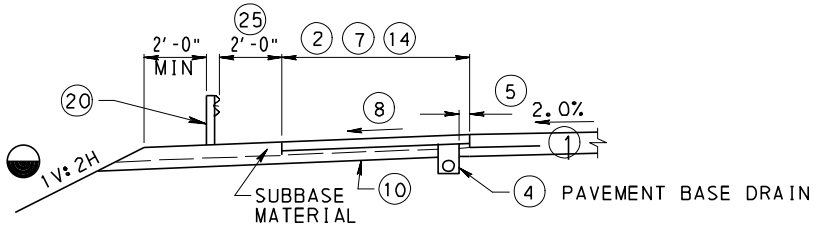
(URBAN)

(METRIC)

DM2_CH1_2009.DGN

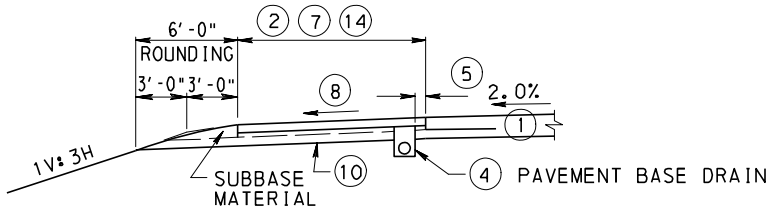


TYPICAL SECTION



TYPICAL TANGENT SECTION--FILLS OVER 15'-0"

AN ALTERNATE 1V:3H SLOPE WITHOUT GUIDE RAIL MAY BE USED BASED ON ECONOMIC ANALYSIS. SEE "ALTERNATE TANGENT SECTION" DETAIL ON THIS PAGE.



ALTERNATE TANGENT SECTION--FILLS OVER 15'-0"

SEE TYPICAL SECTION NOTES ON PAGE 1-68.

ARTERIALS

TYPICAL CUT AND FILL SECTIONS

(RURAL)

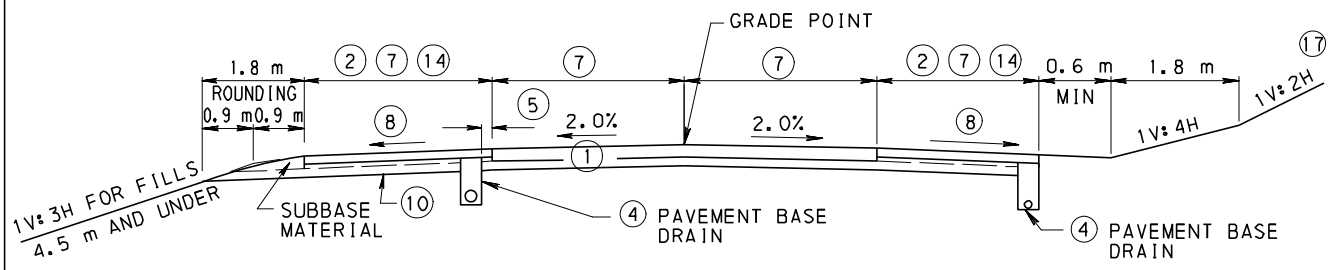
TYPICAL SECTIONS WITHOUT CURBS

FOR SPEEDS > 40 mph

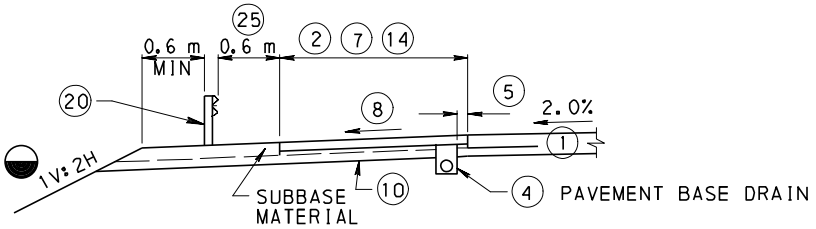
(URBAN)

(ENGLISH)

DM2-CH1-2009.DGN

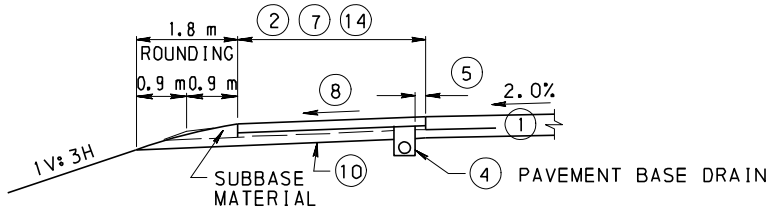


TYPICAL SECTION



TYPICAL TANGENT SECTION--FILLS OVER 4.5 m

AN ALTERNATE 1V:3H SLOPE WITHOUT GUIDE RAIL MAY BE USED BASED ON ECONOMIC ANALYSIS. SEE "ALTERNATE TANGENT SECTION" DETAIL ON THIS PAGE.



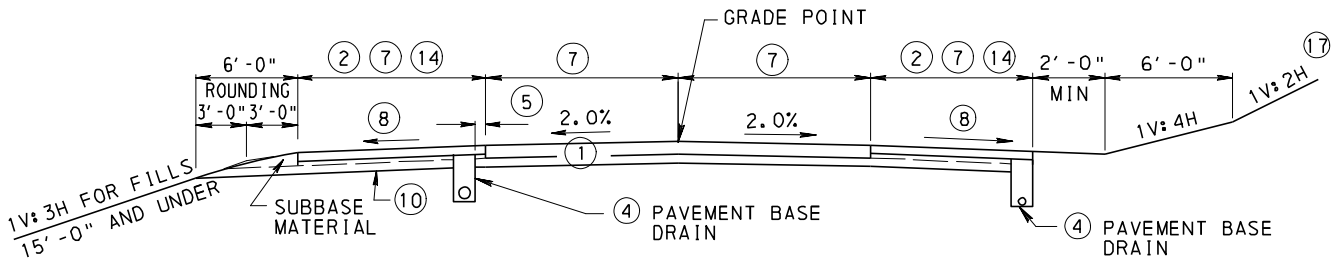
ALTERNATE TANGENT SECTION--FILLS OVER 4.5 m

SEE TYPICAL SECTION NOTES ON PAGE 1-68.

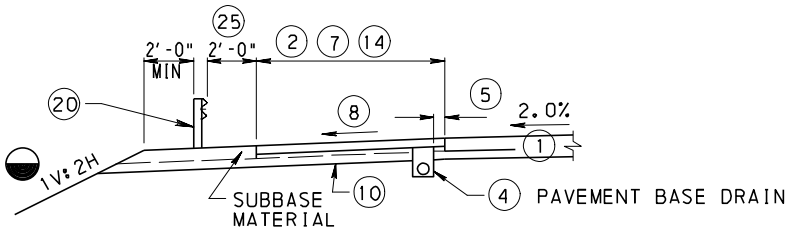
ARTERIALS

TYPICAL SECTIONS WITHOUT CURBS
FOR SPEEDS ≤ 60 km/h
(URBAN)
(METRIC)

DM2_CH1_2009.DGN

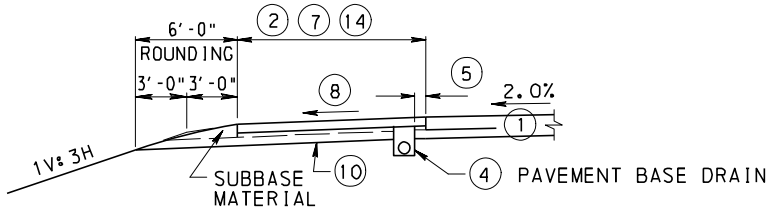


TYPICAL SECTION



TYPICAL TANGENT SECTION--FILLS OVER 15'-0"

◒ AN ALTERNATE 1V:3H SLOPE WITHOUT GUIDE RAIL MAY BE USED BASED ON ECONOMIC ANALYSIS. SEE "ALTERNATE TANGENT SECTION" DETAIL ON THIS PAGE.

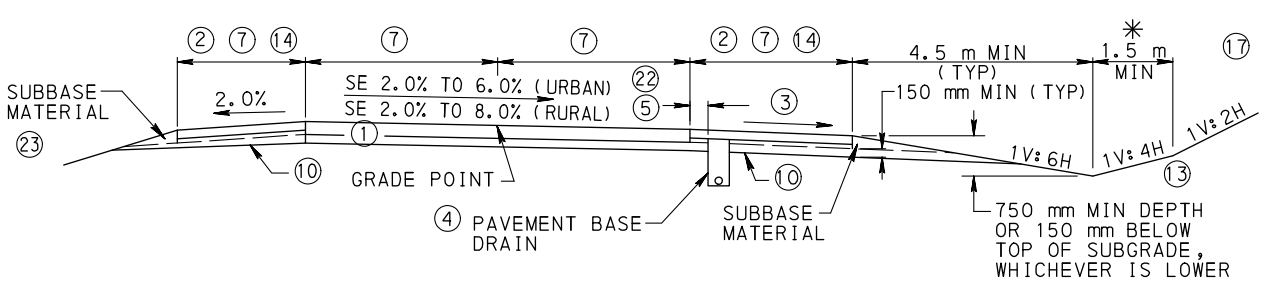


ALTERNATE TANGENT SECTION--FILLS OVER 15'-0"

◯ SEE TYPICAL SECTION NOTES ON PAGE 1-68.

ARTERIALS

TYPICAL SECTIONS WITHOUT CURBS
FOR SPEEDS ≤ 40 mph
(URBAN)
(ENGLISH)

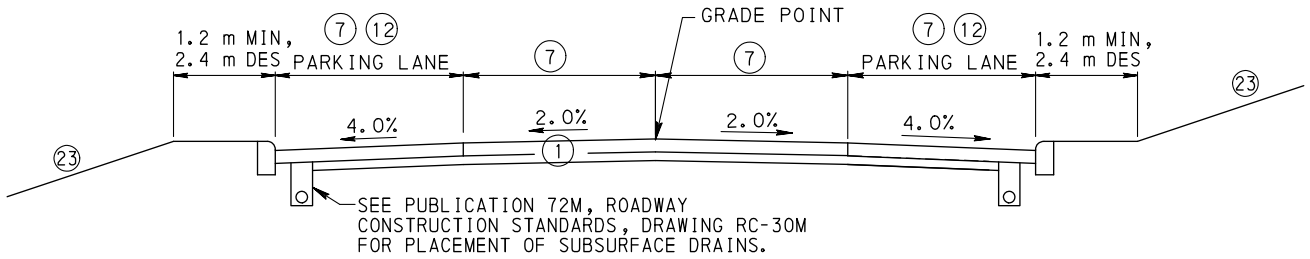


TYPICAL SUPERELEVATED SECTION

ARTERIALS

TYPICAL SUPERELEVATED SECTION
(URBAN AND RURAL)
(METRIC)

SEE TYPICAL SECTION NOTES ON PAGE 1-68.



TYPICAL SECTION WITH CURBS

ARTERIALS, COLLECTORS AND LOCAL ROADS

TYPICAL SECTION WITH CURBS
(URBAN)
(METRIC)

SEE TYPICAL SECTION NOTES ON PAGE 1-68.

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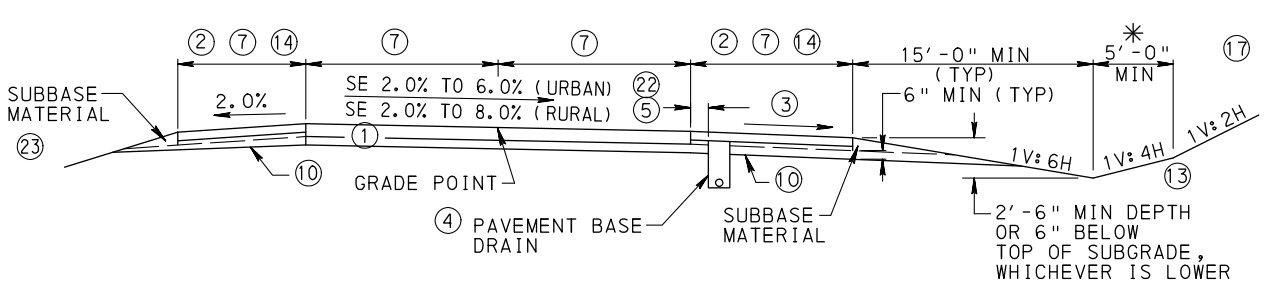
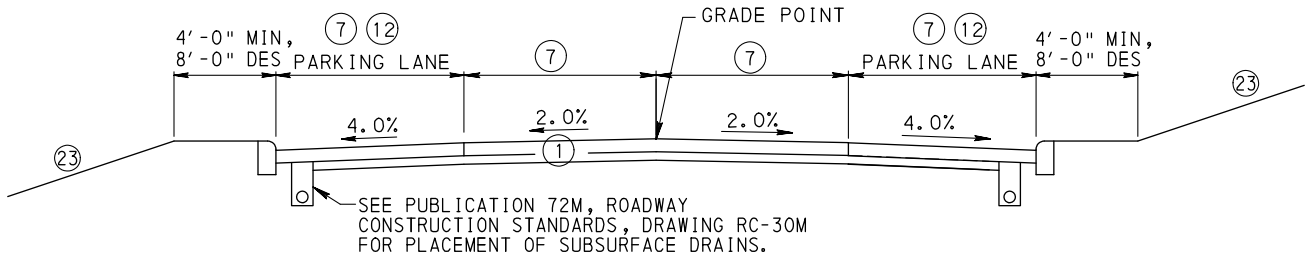


TYPICAL SUPERELEVATED SECTION

ARTERIALS

TYPICAL SUPERELEVATED SECTION
(URBAN AND RURAL)
(ENGLISH)

SEE TYPICAL SECTION NOTES ON PAGE 1-68.



TYPICAL SECTION WITH CURBS

ARTERIALS, COLLECTORS AND LOCAL ROADS

TYPICAL SECTION WITH CURBS
(URBAN)
(ENGLISH)

SEE TYPICAL SECTION NOTES ON PAGE 1-68.

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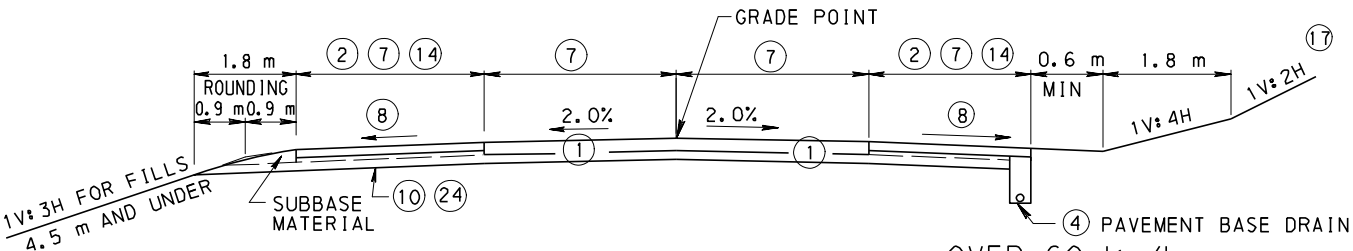
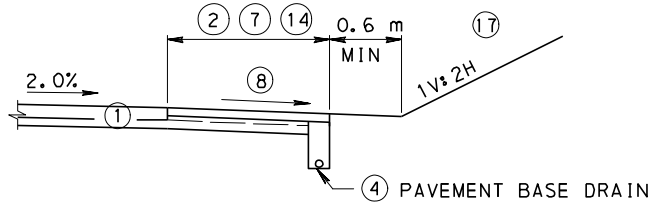


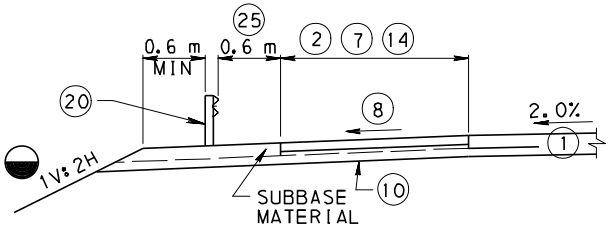
OVER 60 km/h

TYPICAL SECTION



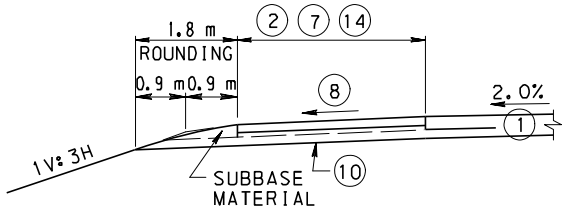
UP TO 60 km/h

SHOULDER SWALE



TYPICAL TANGENT SECTION--FILLS OVER 4.5 m

AN ALTERNATE 1V:3H SLOPE WITHOUT GUIDE RAIL MAY BE USED BASED ON ECONOMIC ANALYSIS. SEE "ALTERNATE TANGENT SECTION" DETAIL ON THIS PAGE.



ALTERNATE TANGENT SECTION--FILLS OVER 4.5 m

SEE TYPICAL SECTION NOTES ON PAGE 1-68.

COLLECTORS AND LOCAL ROADS

TYPICAL SECTIONS WITHOUT CURBS

(URBAN AND RURAL)

(METRIC)

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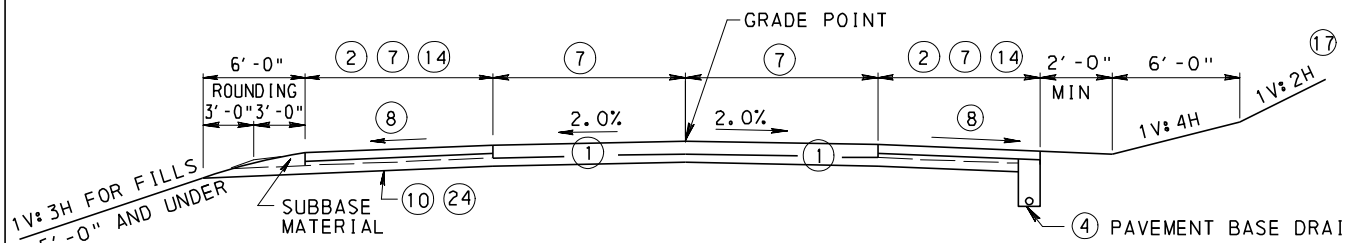
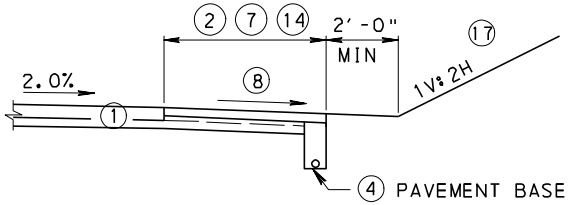


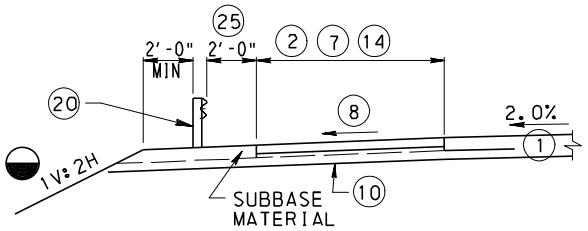
OVER 40 mph

TYPICAL SECTION



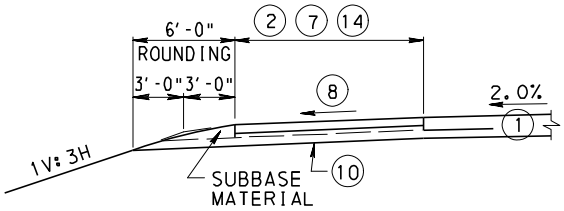
UP TO 40 mph

SHOULDER SWALE



TYPICAL TANGENT SECTION--FILLS OVER 15'-0"

◒ AN ALTERNATE 1V:3H SLOPE WITHOUT GUIDE RAIL MAY BE USED BASED ON ECONOMIC ANALYSIS. SEE "ALTERNATE TANGENT SECTION" DETAIL ON THIS PAGE.



ALTERNATE TANGENT SECTION--FILLS OVER 15'-0"

◯ SEE TYPICAL SECTION NOTES ON PAGE 1-68.

COLLECTORS AND LOCAL ROADS

TYPICAL SECTIONS WITHOUT CURBS

(URBAN AND RURAL)

(ENGLISH)

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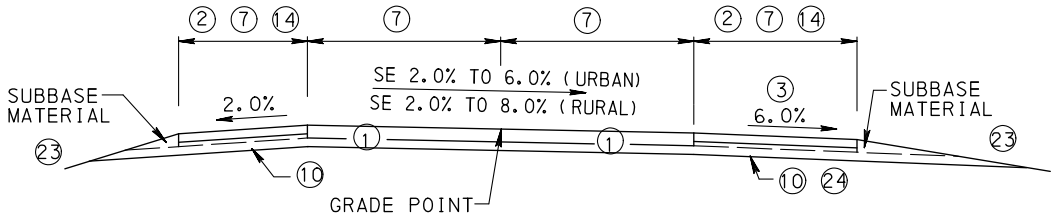
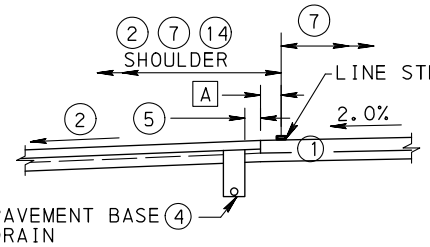


TYPICAL SUPERELEVATED SECTION

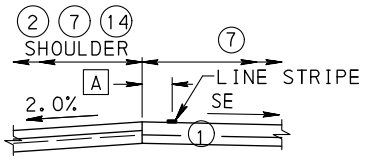
COLLECTORS AND LOCAL ROADS

TYPICAL SUPERELEVATED SECTION
(URBAN AND RURAL)
(METRIC)

◯ SEE TYPICAL SECTION NOTES ON PAGE 1-68.

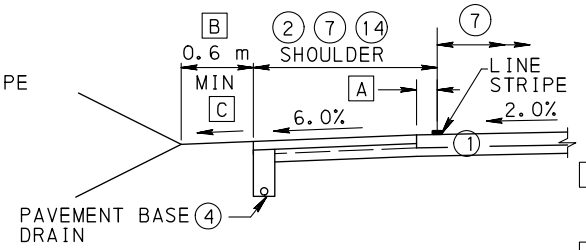


TYPICAL TANGENT SECTION

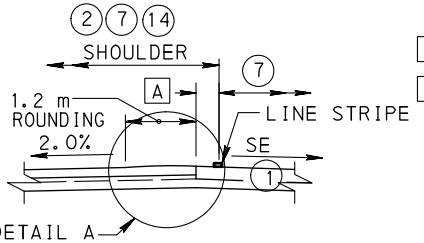


TYPICAL SUPERELEVATION SECTION
SE 2.0% TO 6.0%

◯ SEE TYPICAL SECTION NOTES ON PAGE 1-68.



TYPICAL SECTION--SHOULDERS ≤ 1.8 m



D SEE DETAIL A PAGE 1-56.

TYPICAL SUPERELEVATION SECTION
SE > 6.0%

NOTES

PAVEMENT WIDENING ON THE LOW SIDE OF SUPER-ELEVATIONS SHALL BE CONSTRUCTED AS SHOWN ON THE "TYPICAL TANGENT SECTION" DETAIL ON THIS PAGE WITH THE RATE OF PAVEMENT WIDENING THE SAME AS SUPER-ELEVATION RATE.

A SEE SHOULDER CRITERIA ON PAGES 1-38 AND 1-44 FOR EXTENSION OF WIDENING STRUCTURE INTO THE SHOULDER AREA.

B PROVIDE SUFFICIENT WIDTH TO MAINTAIN 0.6 m MINIMUM CLEARANCE BEHIND GUIDE RAIL AND TO PREVENT GUIDE RAIL ENCROACHMENT ON THE USEABLE SHOULDER AREA.

C PROVIDE 1V:6H MAXIMUM TO SHOULDER SLOPE MINIMUM.

D 1.2 m ROUNDING TREATMENT NOT REQUIRED ON 3R PROJECTS.

INTERSTATE, LIMITED ACCESS FREEWAYS, ARTERIALS, COLLECTORS AND LOCAL ROADS

TYPICAL PAVEMENT WIDENING
(URBAN AND RURAL)
(METRIC)

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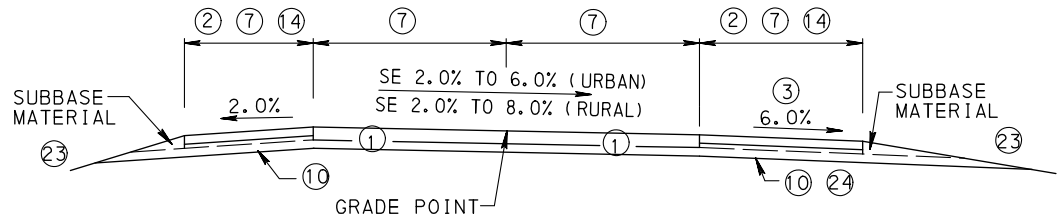
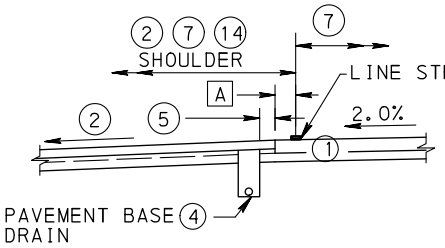


TYPICAL SUPERELEVATED SECTION

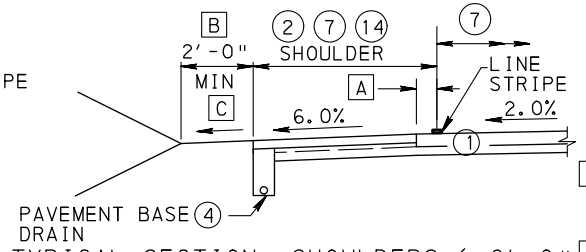
COLLECTORS AND LOCAL ROADS

TYPICAL SUPERELEVATED SECTION
(URBAN AND RURAL)
(ENGLISH)

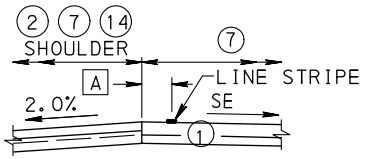
◯ SEE TYPICAL SECTION NOTES ON PAGE 1-68.



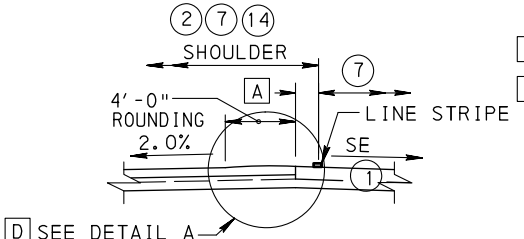
TYPICAL TANGENT SECTION



TYPICAL SECTION--SHOULDERS ≤ 6'-0"



TYPICAL SUPERELEVATION SECTION
SE 2.0% TO 6.0%



TYPICAL SUPERELEVATION SECTION
SE > 6.0%

◯ SEE TYPICAL SECTION NOTES ON PAGE 1-68.

NOTES

PAVEMENT WIDENING ON THE LOW SIDE OF SUPER-ELEVATIONS SHALL BE CONSTRUCTED AS SHOWN ON THE "TYPICAL TANGENT SECTION" DETAIL ON THIS PAGE WITH THE RATE OF PAVEMENT WIDENING THE SAME AS SUPER-ELEVATION RATE.

A SEE SHOULDER CRITERIA ON PAGES 1-38 AND 1-44 FOR EXTENSION OF WIDENING STRUCTURE INTO THE SHOULDER AREA.

B PROVIDE SUFFICIENT WIDTH TO MAINTAIN 2'-0" MINIMUM CLEARANCE BEHIND GUIDE RAIL AND TO PREVENT GUIDE RAIL ENCROACHMENT ON THE USEABLE SHOULDER AREA.

C PROVIDE 1V:6H MAXIMUM TO SHOULDER SLOPE MINIMUM.

D 4'-0" ROUNDING TREATMENT NOT REQUIRED ON 3R PROJECTS.

INTERSTATE, LIMITED ACCESS FREEWAYS, ARTERIALS, COLLECTORS AND LOCAL ROADS

TYPICAL PAVEMENT WIDENING
(URBAN AND RURAL)
(ENGLISH)

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TYPICAL ROADWAY CROSS SECTION NOTES

① See Publication 242, *Pavement Policy Manual*, for pavement design.

② See Design Criteria Notes for type of shoulder. For all new construction or reconstruction projects, refer to Publication 72M, *Roadway Construction Standards*, RC-25M, for shoulder cross sections.

③ The shoulder on the low side of a superelevated section shall be sloped at the same rate as the pavement when the rate of pavement slope exceeds the required shoulder slope of 4.0% or 6.0%.

④ Provide Pavement Base Drain in cuts and fills on all Interstate and Other Limited Access Freeways and Arterials. On Collectors and Local Roads, Pavement Base Drains shall be used only where subbase cannot be outletted. Where subsurface water is a potential problem, Underdrain or Combination Storm Sewer shall be used. Where the subbase cannot be outletted, the subgrade slope shall be in the direction of, and at the same rate as, the shoulder slope and the "ALTERNATE SUBSURFACE DRAINAGE TREATMENT" on Pages 1 - 46 and 1 - 47 shall be used.

⑤ The distance from the edge of the pavement shall be equal to the subbase depth.

⑥ Special consideration shall be given to the median treatment on the approach to structures to insure the elevation of the edges of the structure division are the same. This shall apply to medians up to 9.0 m (30 ft) on superelevated sections. Adequate length for shoulder slope transition between the roadway cross section and structure cross section should be provided.

⑦ See Design Criteria for widths of travel lanes and shoulders.

⑧ Slope shoulder at 6.0% for shoulder widths less than or equal to 2.4 m (8 ft). Slope shoulder at 4.0% for shoulder widths greater than 2.4 m (8 ft). When the roadway shoulder cross slope is different than the bridge shoulder slope, transition the roadway shoulder slope (7.5 m (25 ft) minimum) approaching the structure, to meet the slope of the bridge water table.

⑨ A 1V:12H slope may be adjusted to a 1V:6H slope to provide 150 mm (6 in) minimum clearance from bottom of swale to subgrade.

⑩ Subgrade slope shall be 1.0% minimum to shoulder slope maximum. For ease of construction, the subgrade slope under the shoulder area shall generally be the same as the pavement slope. A minimum subbase depth of 150 mm (6 in) shall be maintained under the outside of the shoulder, as shown on the "TYPICAL CUT SECTION" detail on Pages 1 - 46 and 1 - 47, or as shown on the "TYPICAL FILL SECTION - 4.5 m (15'-0") AND UNDER" detail on Pages 1 - 48 and 1 - 49.

⑪ Subgrade slope shall be in the direction of, and at the same rate as, the pavement slope. The depth of the subbase under the outside edge of the shoulder shall be as shown on the "TYPICAL MEDIAN TREATMENT" detail on Pages 1 - 46 and 1 - 47.

⑫ A curb or a combination curb and gutter section may be installed at the outside edge of a parking lane, although an offset of 0.3 m to 0.6 m (1 ft to 2 ft) is preferable. If a curb is to be installed where no parking lane is specified, provide a curb offset of 0.6 m (2 ft) desirable, 0.3 m (1 ft) minimum.

TYPICAL ROADWAY CROSS SECTION NOTES (Continued)

⑬ Maintain a minimum depth of 0.75 m (2 ft, 6 in) below the outside edge of shoulder or 150 mm (6 in) below top of subgrade, whichever is lower. Where it is not practical to construct a sufficiently deep swale, a Combination Storm Sewer and Underdrain should be constructed along the ditch line. The minimum depth of the Combination Storm Sewer and Underdrain will be either 300 mm (12 in) below the ditch line invert measured to the top of the pipe's bell or 150 mm (6 in) below the grade of the immediately adjacent subgrade, also measured to the top of the pipe's bell, whichever is lower. Provide a minimum of 150 mm (6 in) of tamped soil with appropriate Seeding and Soil Supplements placed over the Combination Storm Sewer and Underdrain.

Where subbase cannot be outletted, the pavement base drain shall be installed as indicated on the "ALTERNATE SUBSURFACE DRAINAGE TREATMENT" detail on Pages 1 - 46 and 1 - 47.

⑭ For new construction or reconstruction projects having a flexible pavement, see Pages 1 - 66 and 1 - 67 for typical pavement widening into the shoulder area.

⑮ For shoulder treatment in superelevated sections, see TYPICAL SUPERELEVATED SECTIONS detail on Pages 1 - 56 and 1 - 57.

⑯ Pavement widening on the low side of superelevations shall be constructed as shown on the "TYPICAL TANGENT SECTION" detail on Pages 1 - 66 and 1 - 67 with the rate of pavement widening the same as the superelevation rate.

⑰ Cut slope shall be 1V:2H unless otherwise indicated in the soil survey report.

⑱ For median treatment, see "TYPICAL MEDIAN TREATMENT" detail on Pages 1 - 46 and 1 - 47.

⑲ For shoulder treatment when the DDHV is equal to or greater than 250 Trucks, see Pages 1 - 52 and 1 - 53.

⑳ For guide rail type and clear zone criteria, refer to Chapter 12.

㉑ For slope treatment in cut and fill sections, see Pages 1 - 46, 1 - 47, 1 - 48 and 1 - 49.

㉒ For shoulder rounding details when superelevation is greater than 6.0%, see Pages 1 - 56 and 1 - 57.

㉓ For slope treatment, see Pages 1 - 62 and 1 - 63 for ARTERIALS and Pages 1 - 66 and 1 - 67 for COLLECTORS AND LOCAL ROADS.

㉔ Where subbase cannot be outletted, the pavement base drain shall be installed as indicated on the "ALTERNATE SUBSURFACE DRAINAGE TREATMENT" detail on Pages 1 - 46 and 1 - 47.

㉕ When there are roadside barriers, walls, or other vertical elements, it is desirable to provide a graded shoulder wide enough that the vertical elements will be offset a minimum of 0.6 m (2 ft) from the edge of the usable shoulder.

1.6 ACCELERATION AND DECELERATION (SPEED-CHANGE) LANES

The term speed-change lane, acceleration lane or deceleration lane, as used herein, applies broadly to the added pavement joining the traveled way of the highway with that of the turning roadway and does not necessarily imply a definite lane of uniform width.

The warrants for the use of speed-change lanes cannot be stated definitely. However, based on observations and past experience, the following general conclusions have been made:

1. Speed-change lanes are warranted on high-speed and on high-volume highways where a change in speed is necessary for vehicles entering or leaving the through-traffic lanes.

2. All drivers do not use speed-change lanes in the same manner.

3. Use of speed-change lanes varies with volume, the majority of drivers using them at high volumes.

4. The directional type of speed-change lane consisting of a long taper fits the behavior of most drivers and does not require maneuvering on a reverse-curve path.

5. Deceleration lanes on the approaches to intersections that also function as storage lanes for turning traffic are particularly advantageous and experience with them generally has been favorable.

For additional information on speed-change lanes as applicable to intersections and interchanges, refer to Chapter 3 and Chapter 4 and to the 2004 AASHTO Green Book, Chapter 9 and Chapter 10.

1.7 CONTROL OF ACCESS

Regulating access is called access control and is achieved through full control of access, partial control of access, access management, and driveway/entrance regulations of public access rights to and from properties abutting the highway facilities. The principal advantages of controlling access are the preservation or improvement of service and safety.

The functional advantage providing access control on a street or highway is the management of the interference with through traffic by vehicles or pedestrians entering, leaving and crossing the highway. Where access to a highway is managed, entrances and exits are located at points best suited to fit traffic and land-use needs and are designed to enable vehicles to enter and leave safely with minimum interference from through traffic. On streets or highways where there is no access management and roadside businesses are allowed to develop haphazardly, interference from the roadside can become a major factor in reducing the capacity, increasing the crash potential and eroding the mobility function of the facility. Full control of access is the most important single safety factor that may be designed into new highways. The extent and degree of access control that is feasible or ultimately possible are significant factors in defining the type of street or highway.

The following principles define access management techniques:

1. Classify the road system by the primary function of each roadway. Freeways emphasize movement and provide complete control of access. Local streets emphasize property access rather than traffic movement. Arterial and collector roads must serve a combination of both property access and traffic movement.

2. Limit direct access to roads with higher functional classifications. Direct property access should be denied or limited along higher class roadways, whenever reasonable access can be provided to a lower class roadway.

3. Locate traffic signals to emphasize through traffic movements. Signalized access points should fit into the overall signal coordination plan for traffic progression.

4. Locate driveways and major entrances to minimize interference with traffic operations. Driveways and entrances should be located away from other intersections to minimize crashes, to reduce traffic interference, and to provide for adequate storage lengths for vehicles turning into entrances.

5. Use curbed medians and locate median openings to manage access movements and minimize conflicts.

The extent of access management depends upon the location, type and density of development, and the nature of the highway system. Access management actions involve both the planning and design of new roads and the retrofitting of existing roads and driveways.

Access control on collector roads and streets should allow access to abutting properties consistent with the Level of Service desired. The control of access on urban collectors should be used primarily to ensure that access points conform to the adopted criteria for safety, location, design, construction and maintenance.

An important consideration in arterial development is the amount of access control, full or partial, that can be acquired. Although adequate access can normally be provided without interference to traffic operations, unique problems may be encountered in the form of slow-moving pieces of machinery. Therefore, access points should be situated to minimize their detrimental effects while the appropriate degree of access control or access management depends on the type and importance of an arterial. Provision of access management is vital to the concept of an arterial route if it is to provide the service life for which it is designed. Adequate and uniform spacing between access points should be considered in relationship to intersection sight distance restrictions and other intersections. This may help eliminate many conditions where a large vehicle at an intersection hides another vehicle on a nearby approach. High-volume access points can lead to particular operational problems if not properly situated.

Access control and access management on urban arterials should be carefully regulated to limit the number of points and their locations. Access control may be exercised (1) by statutory control which limits access to the cross streets or to other major traffic generators, (2) by zoning regulations which effectively control the type of property development along an arterial and influence the type and volume of traffic generated, (3) by driveway regulations to effectively preserve the functional character of the arterial and (4) by geometric highway design through the use of frontage roads; grade separations; limiting, prohibiting, or relocating left turns in and out of adjacent properties; and right-turn-in and right-turn-out arrangements. These geometric highway design measures effectively control access to the through lanes on the arterial street, provide access to adjoining property, separate local from through traffic and permit circulation of traffic along each side of the arterial.

For Interstate and Other Limited Access Freeways, with full control access, preference is given to through traffic by providing access connections with selected public roads only and by prohibiting crossings at-grade and direct private driveway connections. The principal advantages of access control include preservation of highway capacity, higher speeds, and improved safety for highway users.

Access to the interstate system 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, the 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.

On all sections of the Interstate System, access shall be controlled by acquiring access rights outright prior to construction or by the construction of frontage roads or both. Control of access is required for all sections of the Interstate System, including the full length of ramps and terminals on the crossroad. Control for connections to the crossroad should be affected beyond the ramp terminals by purchasing of access rights, providing frontage roads to control access, controlling added corner right-of-way areas or denying driveway permits. Such control should extend along the crossroads beyond the ramp terminal at least 30 m (100 ft) or more in urban areas and at least 90 m (300 ft) or more in rural areas. These distances usually should satisfy any congestion concerns. However, in areas where the potential for development exists which would create operational or safety problems, longer lengths of access control should be provided. New or revised access points on completed sections of Interstate and Other Limited Access highway facilities shall be achieved as indicated in Publication 10A, Design Manual, Part 1A, *Transportation Engineering Procedures*, Appendix G.

The Interstate highway is to be grade separated at all railroad crossings and selected public crossroads. At-grade intersections are not allowed. To accomplish this, the connecting roads are to be terminated, rerouted or intercepted by frontage roads.

1.8 STAGE CONSTRUCTION

Stage construction may be implemented on highway projects in order to maximize total benefits from highway monies. It may be possible to maintain an acceptable Level of Service on a facility by constructing additional lanes or climbing lanes at a later date. The additional stages of construction would be required when the initial stage of construction falls into a lower, below desirable standard, Level of Service. For information concerning the Levels of Service concept, refer to the *HCM*.

Various factors should be taken into consideration when stage construction is considered. These include investment rates, long term inflationary construction rates, accuracy of the traffic growth rate projections, higher construction costs to perform stages of construction separately, lower maintenance costs for the initial stage, additional engineering expenditures for stage construction, additional safety on the ultimate facility versus the initial facility (particularly two lanes on four-lane right-of-way), etc. Many of the above items are highly intangible or sensitive to wide fluctuation which would make a detailed, analytical analysis (assuming quantifiable figures for the above factors are available) useless and in many cases erroneous.

For two-lane facilities which shall be ultimately four-lane divided, adequate provisions should include the following:

1. Right-of-way acquisition for the ultimate facility.

2. Possible grading of future lanes initially to obtain an earthwork balance. This could include all earthwork required for the ultimate or be limited to selected grading areas.

3. Grading of entire roadway width in massive rock cut areas requiring extensive blasting.

4. In areas of structures, where rock is encountered, the necessary blasting for structure footers should be performed.

5. Overpassing structures should be designed and constructed for the ultimate facility.

6. Medians in cut should be graded to provide for ultimate median drainage facilities. This may require slope flattening beyond the inlet to retain an inlet not requiring a backwall.

7. The initial shoulders shall be full width on both the left and the right side.

8. In the ultimate development of a four-lane divided facility, the initial two-lane surfacing should be constructed to form one of the two-lane one-way surfaces.

In designing ultimate six or eight lane facilities, provisions should be made to include the additional lanes in the median area with a 9.0 m (30 ft) desirable recovery area provided for the ultimate construction. The vertical clearances and span length requirements of overpass structures should be determined based on the ultimate facility.

The demand volume breakpoint, when an initial stage falls below the required Level of Service, may be determined from linearly interpolating between present day traffic and design year traffic.