INDIANA DEPARTMENT OF TRANSPORTATION

INTER-DEPARTMENT COMMUNICATION

Standards Section – Room N642

Writer's Direct Line
232-6775

November 28, 2005

DESIGN MEMORANDUM No. 05-37
TECHNICAL ADVISORY

TO **All Design, Operations, and District Personnel and Consultants**

FROM: ***/s/ Anthony L. Uremovich***
Anthony L. Uremovich
Design Policy Engineer
Contracts and Construction Division

SUBJECT: **Shoulder Cross Slope and Pavement Section**

REVISES: ***Indiana Design Manual*** **Sections**
43-3.06(01), 45-1.02(05), 52-9.02(06), and 56-4.04(03);
Figures 52-13A through 52-13X; Tables 53-1 through 53-9,
Table 54-2A, Tables 55-3A through 55-3H

EFFECTIVE: **September 13, 2006, Letting**

I. Shoulder Cross Slope in Tangent Section

For a paved shoulder of 1.2 m (4 ft) or narrower, the shoulder cross slope should be the same as that of the adjacent travel lane. See Figure 05-37A, Paved-Shoulder Cross Slopes and Pavement Treatments, Tangent Section, With Underdrains; or Figure 05-37B, Paved-Shoulder Cross Slopes and Pavement Treatments, Tangent Section, Without Underdrains.

Indiana Design Manual Tables 53-1 through 53-9, 54-2A, and 55-3A through 55-3H have been affected by this change. The metric-units PDF versions of such tables are attached hereto. They include *Manual* headers and footers. Please print them on two-sided pages and replace the like-numbered pages in your copy of the *Manual* with them. The english-units versions are accessible from the Department's website, at
www.in.gov/dot/div/contracts/standards/dm/english/ .

Metric Units

Paved Shld. Width, *w* (m)	Shoulder Cross Slope	Shoulder Pavement Section
$0.6 \leq w \leq 1.2$	2% *	Same as Travelway
$w > 1.2$	2% *, for 0.6 m, then 4%	Same as Travelway for 0.6 m, then that shown in *IDM* Figure 52-13A, B, C, D, E, F, G, I, or J, as required

English Units

Paved Shld. Width, *w* (ft)	Shoulder Cross Slope	Shoulder Pavement Section
$2 \leq w \leq 4$	2% *	Same as Travelway
$w > 4$	2% *, for 2 ft, then 4%	Same as Travelway for 2 ft, then that shown in *IDM* Figure 52-13A, B, C, D, E, F, G, I, or J, as required

** Where the travelway tangent cross slope differs from 2%, the shoulder cross slope should match the travelway cross slope.*

PAVED-SHOULDER CROSS SLOPES AND PAVEMENT TREATMENTS, TANGENT SECTION, WITH UNDERDRAINS

Figure 05-37A

Metric Units

Paved Shld. Width, *w* (m)	Shoulder Cross Slope	Shoulder Pavement Section
$0 \leq w \leq 0.6$	2% *	Same as Travelway
$0.6 < w \leq 1.2$	2% *	Same as Travelway, except for PCCP travelway with HMA shoulder, that shown in *Indiana Design Manual* Figure 52-13D
$w > 1.2$	4%	That shown in *IDM* Figure 52-13A, B, C, D, E, F, G, I, or J, as required

English Units

Paved Shld. Width, *w* (ft)	Shoulder Cross Slope	Shoulder Pavement Section
$0 \leq w \leq 2$	2% *	Same as Travelway
$2 < w \leq 4$	2% *	Same as Travelway, except for PCCP travelway with HMA shoulder, that shown in *Indiana Design Manual* Figure 52-13D
$w > 4$	4%	That shown in *IDM* Figure 52-13A, B, C, D, E, F, G, I, or J, as required

** Where the travelway tangent cross slope differs from 2%, the shoulder cross slope should match the travelway cross slope.*

PAVED-SHOULDER CROSS SLOPES AND PAVEMENT TREATMENTS, TANGENT SECTION, WITHOUT UNDERDRAINS

Figure 05-37B

II. Shoulder Cross Slope in Superelevated Section

Where a paved median shoulder is the high-side shoulder and is 1.2 m (4 ft) or narrower, it should be sloped in the same plane as the travelway. See Figure 05-37C, Paved-Shoulder Cross Slopes, Superelevated Section, With Underdrains; or Figure 05-37D, Paved-Shoulder Cross Slopes, Superelevated Section, Without Underdrains, for more-specific information.

Metric Units

Paved Shld. Width, *w* (m)	High-Side Shoulder Cross Slope	Low-Side Shoulder Cross Slope
$0.6 \leq w \leq 1.2$	*e*	*e*
$w > 1.2$	*e* for 0.6 m Closest to Travel Lane, then **	*e* for 0.6 m Closest to Travel Lane, then ***

English Units

Paved Shld. Width, *w* (ft)	High-Side Shoulder Cross Slope	Low-Side Shoulder Cross Slope
$2 \leq w \leq 4$	*e*	*e*
$w > 4$	*e* for 2 ft Closest to Travel Lane, then **	*e* for 2 ft Closest to Travel Lane, then ***

e = superelevation rate for travelway
** *as outlined in* Indiana Design Manual *Section 43-3.06(01)*
*** *as outlined in* Indiana Design Manual *Section 43-3.06(02)*

PAVED-SHOULDER CROSS SLOPES
SUPERELEVATED SECTION, WITH UNDERDRAINS

Figure 05-37C

Metric Units

Paved Shld. Width, *w* (m)	High-Side Shoulder Cross Sslope	Low-Side Shoulder Cross Slope
$0 \le w \le 0.6$	*e*	*e*
$0.6 < w \le 1.2$	*e*	*e*
$w > 1.2$	**	***

English Units

Paved Shld. Width, *w* (ft)	High-Side Shoulder Cross Slope	Low-Side Shoulder Cross Slope
$0 \le w \le 2$	*e*	*e*
$2 < w \le 4$	*e*	*e*
$w > 4$	**	***

e = superelevation rate for travelway
*** as outlined in* Indiana Design Manual *Section 43-3.06(01)*
**** as outlined in* Indiana Design Manual *Section 43-3.06(02)*

PAVED-SHOULDER CROSS SLOPES
SUPERELEVATED SECTION, WITHOUT UNDERDRAINS

Figure 05-37D

III. Shoulder Cross Slope, Partial 3R Project

The cross slope of a paved shoulder of 1.2 m (4 ft) or narrower should match the mainline cross slope. The cross slope of a paved shoulder wider than 1.2 m (4 ft) should match the existing shoulder slope, or should desirably be 4%. An aggregate- or earth-shoulder slope should be 4% to 8%. In a horizontal curve, shoulder slope should be determined in accordance with *Indiana Design Manual* Section 43-3.0.

IV. Shoulder Pavement Section

For a HMA paved shoulder of 1.2 m (4 ft) or narrower, the same HMA thicknesses and pay item designations as those used for the adjacent travel lane should be specified. For a HMA paved shoulder wider than 1.2 m (4 ft), the thicknesses and HMA pay item designations for the appropriate ESAL level identified in revised *Indiana Design Manual* Figures 52-13A through 52-13X should be specified. The metric-units PDF versions of such tables are attached hereto. They include *Manual* headers and footers. Please print them as two-sided pages and replace the like-numbered pages in your copy of the *Manual* with them. The english-units versions are accessible from the Department's website, at www.in.gov/dot/div/contracts/standards/dm/english/ .

For a HMA paved shoulder of 1.2 m (4 ft) or narrower consisting of 360 kg/m^2 (660 #/yd^2) over 150 mm (6 in.) of compacted aggregate, the same HMA pay item designation for the travelway surface course should be specified for the shoulder surface course.

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Attachments

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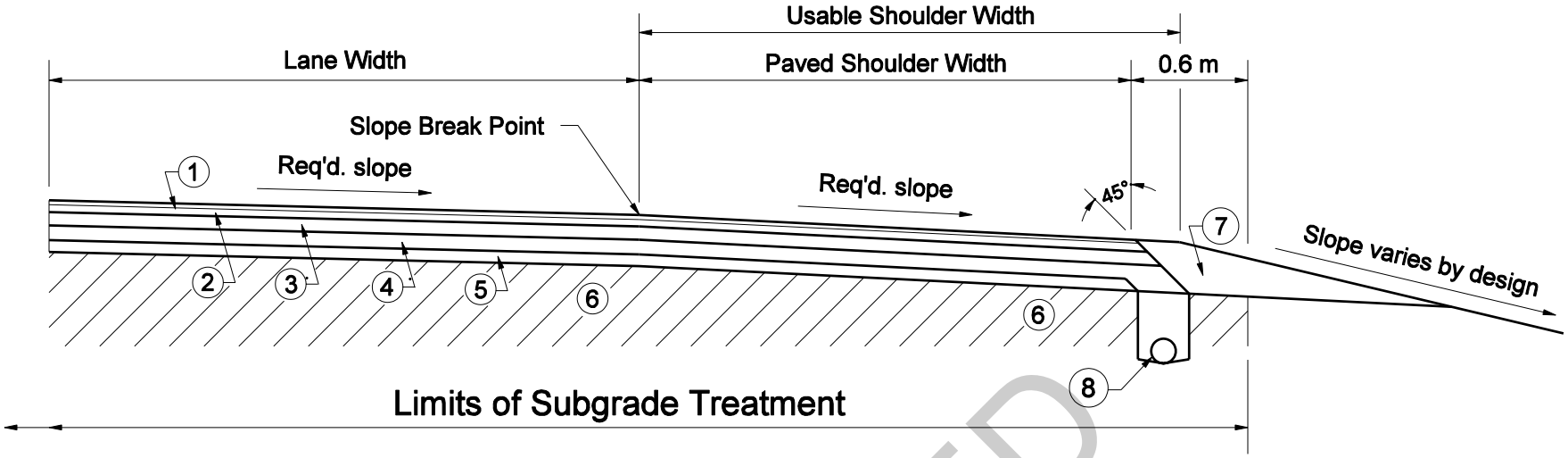
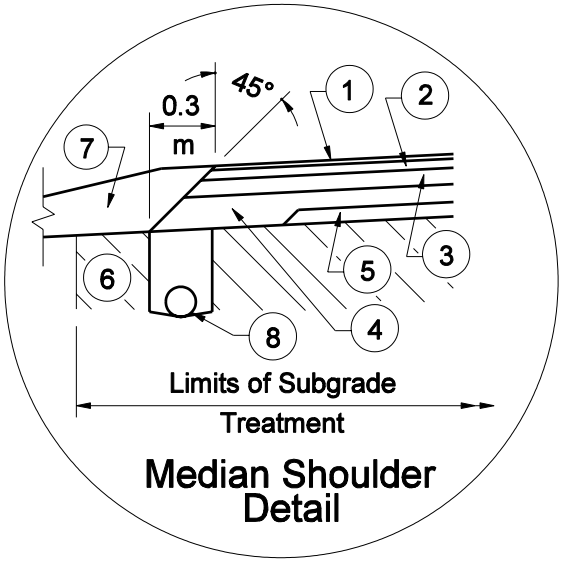


* All Pavement, Including All Shoulders

1. 90 kg/m² HMA Surface 9.5 mm
2. 150 kg/m² HMA Intermediate 19.0 mm
3. 240 kg/m² Minimum HMA Base 25.0 mm
** 4. 250 kg/m² QC/QA-HMA Intermediate OG25.0 mm
5. 240 kg/m² HMA Base 25.0 mm
6. Subgrade Treatment
7. Variable-Depth Compacted Aggregate, No. 53
8. Pipe, Type 4, Circular, 150 mm



Median Shoulder Detail

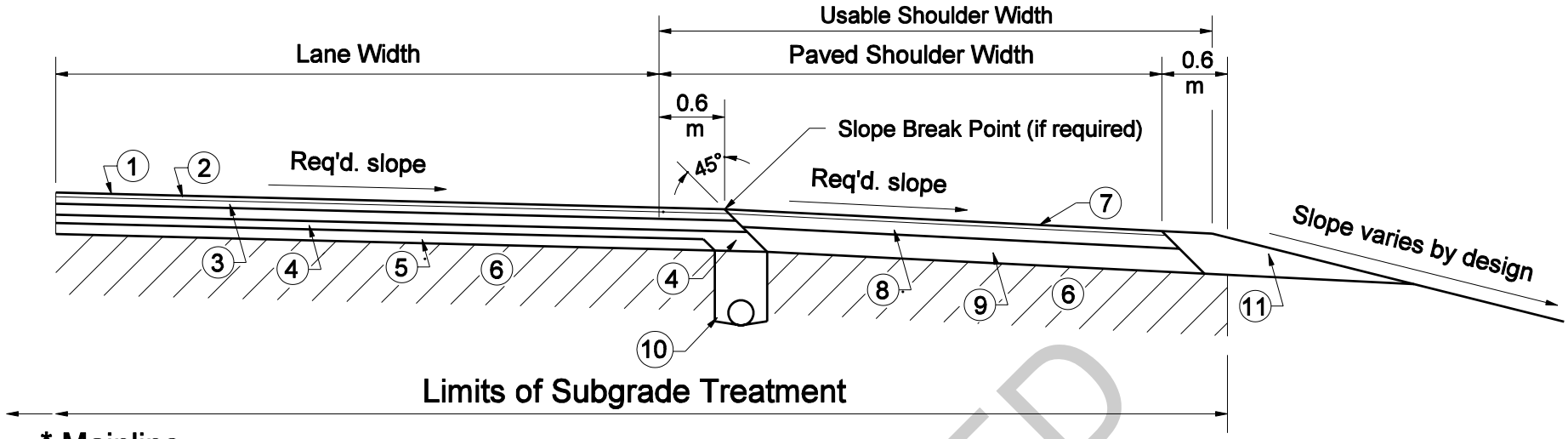
* Open graded mixtures OG19.0 mm or OG25.0 mm should be QC/QA-HMA, 5, 76. For all other mixtures, see Section 52-9.02 to determine the appropriate HMA mixture designation.

** Where underdrains are not required, Intermediate OG25.0 mm mix should be replaced with HMA Base 25.0 mm, minimum 270 kg/m².

FULL DEPTH HMA PAVEMENT,

≥ 30 MILLION ESALs

Figure 52-13A



* Mainline

1. 90 kg/m² HMA Surface 9.5 mm
2. 150 kg/m² HMA Intermediate 19.0 mm
3. 240 kg/m² Minimum HMA Base 25.0 mm
** 4. 165 kg/m² QC/QA-HMA Intermediate OG25.0 mm
5. 240 kg/m² HMA Base 25.0 mm
6. Subgrade Treatment
10. Pipe, Type 4, Circular, 150 mm

* Shoulders

7. 90 kg/m² HMA Surface 9.5 mm
8. 270 kg/m² HMA Base 25.0 mm
9. Compacted Aggregate, No. 53, Base
   (Depth equals mainline HMA thickness minus 150 mm)
11. Variable-Depth Compacted Aggregate, No. 53

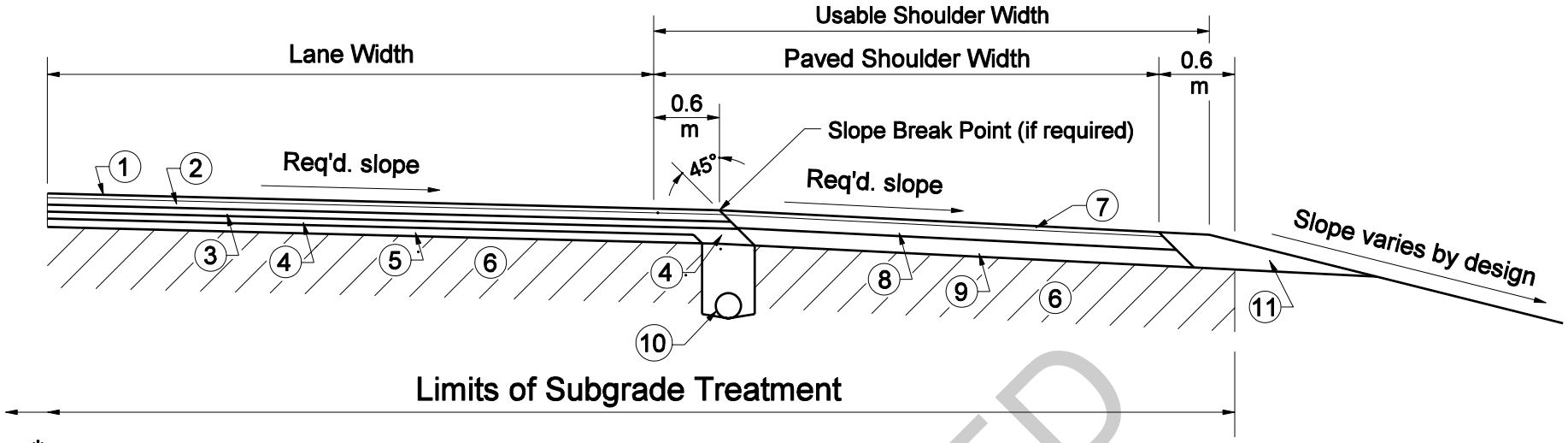
* Open graded mixtures OG19.0 mm or OG25.0 mm should be QC/QA-HMA, 5, 76. For all other mixtures, see Section 52-9.02 to determine the appropriate HMA mixture designation.

** Where underdrains are not required, QC/QA-HMA Intermediate OG25.0 mm mix should be replaced with HMA Base 25.0 mm, 180 kg/m².

FULL DEPTH HMA PAVEMENT,

10 MILLION ≤ ESALs < 30 MILLION

Figure 52-13B



* Mainline Pavement (Section With Shoulders)

1. 90 kg/m² HMA Surface 9.5 mm
2. 150 kg/m² HMA Intermediate 19.0 mm
3. 150 kg/m² Minimum HMA Base 19.0 mm
** 4. 140 kg/m² QC/QA-HMA Intermediate OG19.0 mm
5. 180 kg/m² QC/QA-HMA Base 19.0 mm
6. Subgrade Treatment
10. Pipe, Type 4, Circular, 150 mm

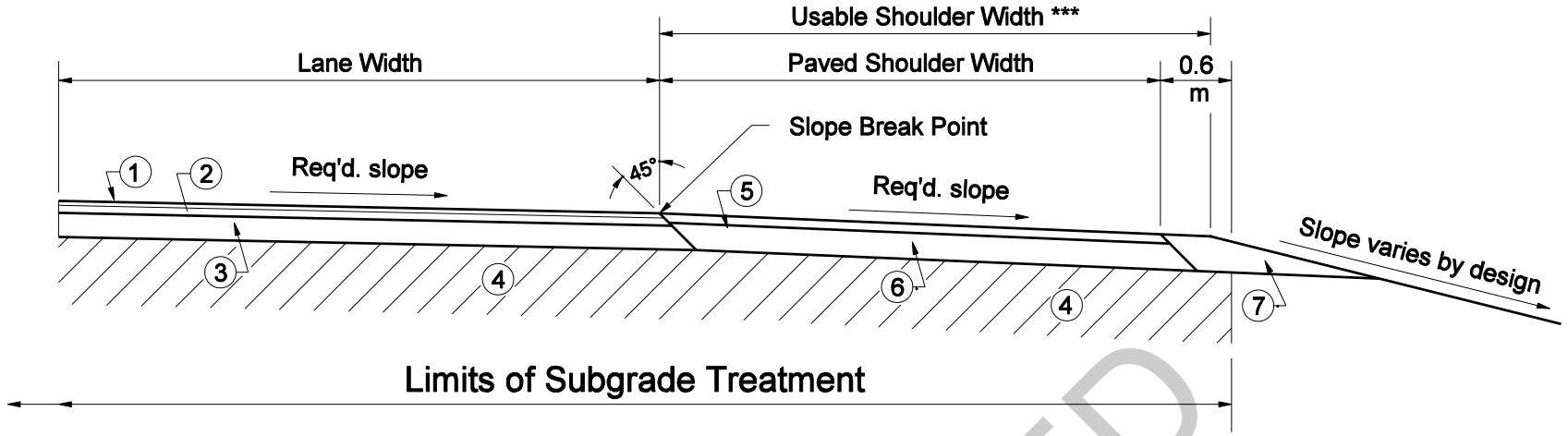
* Shoulders

7. 90 kg/m² HMA Surface 9.5 mm
8. 270 kg/m² HMA Base 25.0 mm
9. Compacted Aggregate, No.53, Base
   (Depth equals mainline HMA thickness minus 150 mm)
11. Variable-Depth Compacted Aggregate, No. 53

* Open graded mixtures OG19.0 mm or OG25.0 mm should be QC/QA-HMA, 5, 76. For all other mixtures, see Section 52-9.02 to determine the appropriate HMA mixture designation.

** Where underdrains are not required, QC/QA-HMA Intermediate OG19.0 mm mix should be replaced with HMA Base 19.0 mm, 150 kg/m².

FULL DEPTH HMA PAVEMENT,
1 MILLION ≤ ESALs <10 MILLION
Figure 52-13C



* Mainline (Section With Shoulders)

(1) 90 kg/m² HMA Surface 9.5 mm
(2) 150 kg/m² HMA Intermediate 19.0 mm
** (3) 480 kg/m² HMA Base 25.0 mm
(4) Subgrade Treatment

* Shoulders

(5) 180 kg/m² HMA Surface 9.5 mm
(6) 225 mm Compacted Aggregate, No. 53, Base
Or (5) & (6) may be replaced by
300 mm Minimum Compacted Aggregate, No. 53, Base
(7) Variable-Depth Compacted Aggregate, No. 53

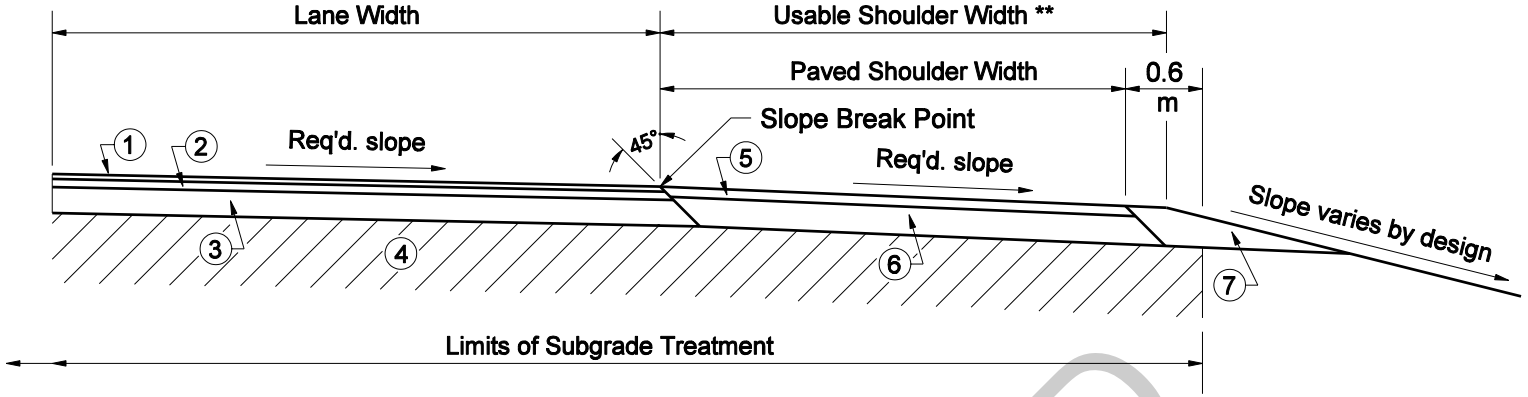
* Where underdrains are not required, see Figure 52-13C.

** See Section 52-9.02 to determine the appropriate HMA mixture designation.

*** Earth may be substituted for compacted aggregate dependent on geometric requirements for the usable shoulder width outside the paved area.

FULL DEPTH HMA PAVEMENT, < 1 MILLION ESALs

Figure 52-13D



* Mainline (Section With Shoulders)

1. 90 kg/m² HMA Surface 9.5 mm
2. 150-330 kg/m² HMA Intermediate 19.0 mm
3. 125-200 mm Compacted Aggregate Base

   (1) + (2) + (3) ≥ 300 mm
4. Subgrade Treatment

* See Section 52-9.02 to determine the appropriate HMA mixture designation.

** Earth may be substituted for compacted aggregate dependent on geometric requirements for the usable shoulder width outside the paved area.

** Shoulders

5. 180 kg/m² HMA Surface 9.5 mm
6. 225 mm Compacted Aggregate, No. 53, Base

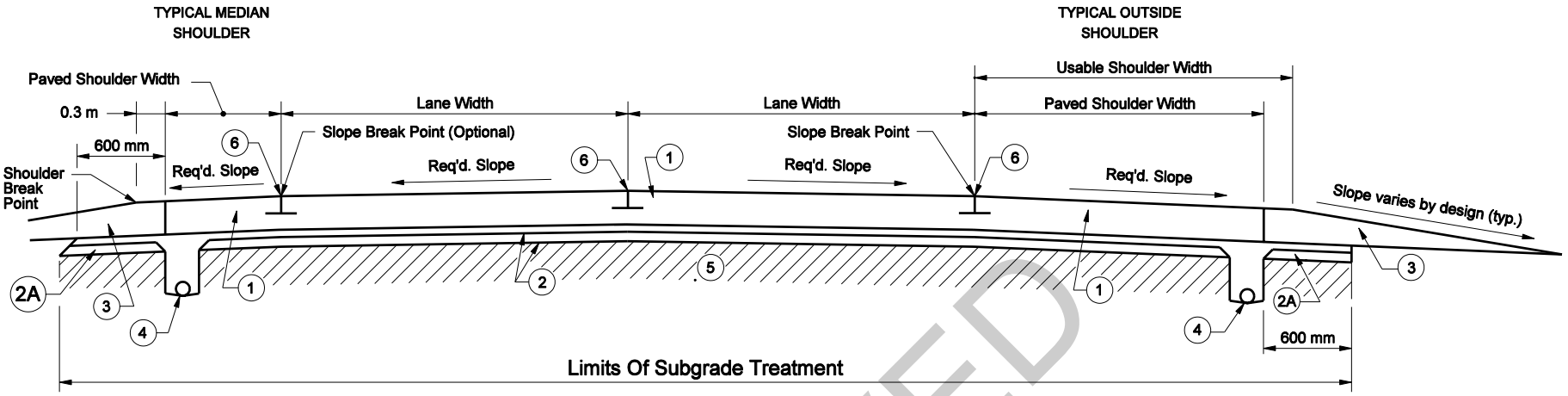
   Or (5) & (6) may be replaced by

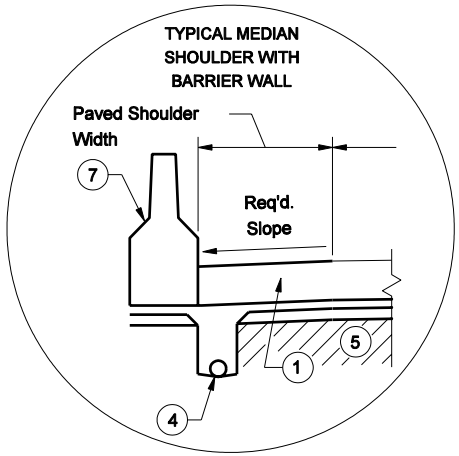
   300 mm Minimum Compacted Aggregate, No. 53, Base
7. Variable-Depth Compacted Aggregate, No. 53

COMPOSITE HMA / COMPACTED AGGREGATE PAVEMENT

< 1 MILLION ESALs

Figure 52-13E





Mainline and Shoulders

(1) PCCP

* (2) Subbase for PCCP (75 mm Coarse Aggregate No.8 On 150 mm Coarse Aggregate No.53, Base)

(2A) 150 mm Compacted Aggregate, No. 53, Base

(3) Variable-Depth Compacted Aggregate, No. 53

(4) Pipe, Type 4, Circular, 150 mm

(5) Subgrade Treatment

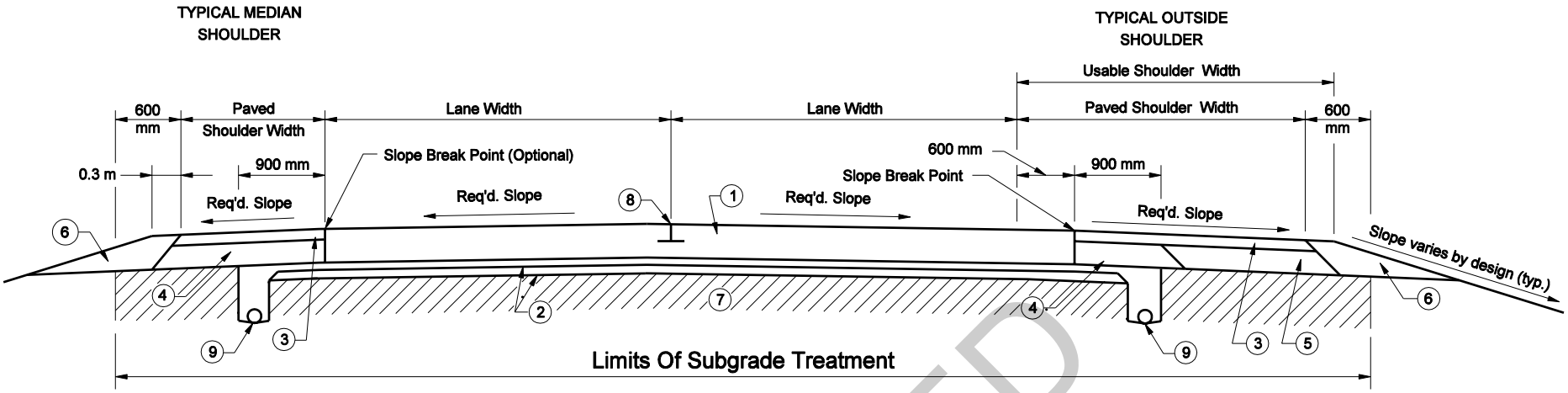
(6) Longitudinal Joint or Longitudinal Construction Joint. See Figure 52-13R for Pavement Joint Options.

(7) Concrete Median Barrier

* Where underdrains are not required, Dense Graded Subbase should be used.

PCCP SECTION WITH PCC SHOULDER, ≥ 30 MILLION ESALs

Figure 52-13F



Mainline

(1) PCCP

* (2) Subbase for PCCP (75 mm Coarse Aggregate No.8 On 150 mm Coarse Aggregate No.53, Base)

Shoulders

** (3) 90 kg/m² HMA Surface 9.5 mm
180 kg/m² HMA Intermediate 19.0 mm

** (4) HMA Base 25.0 mm

(5) Compacted Aggregate, No. 53, Base

(6) Variable-Depth Compacted Aggregate, No. 53

(7) Subgrade Treatment

(8) Longitudinal Joint or Longitudinal Construction Joint

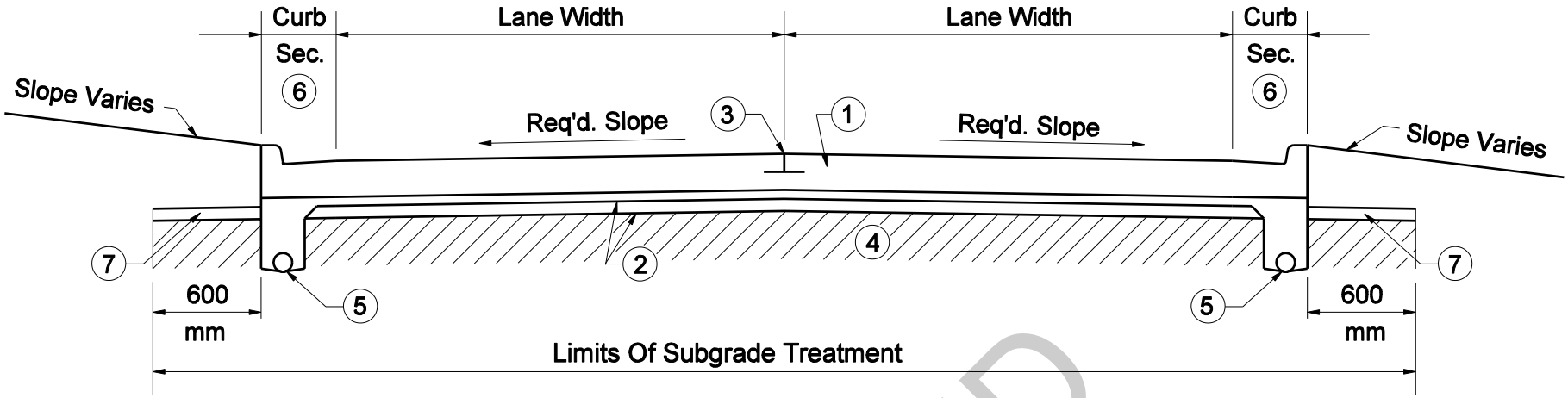
(9) Pipe, Type 4, Circular, 150 mm

* Where underdrains are not required, Dense Graded Subbase should be used.

** See Section 52-9.02 to determine the appropriate HMA mixture designation.

PCCP SECTION WITH HMA SHOULDER, < 30 MILLION ESALs

Figure 52-13G



Mainline

(1) PCCP

* (2) Subbase for PCCP (75 mm Coarse Aggregate #8 On 150 mm Coarse Aggregate #53, Base)

(3) Longitudinal Joint or Longitudinal Construction Joint

(4) Subgrade Treatment

(5) Pipe, Type 4, Circular, 150 mm

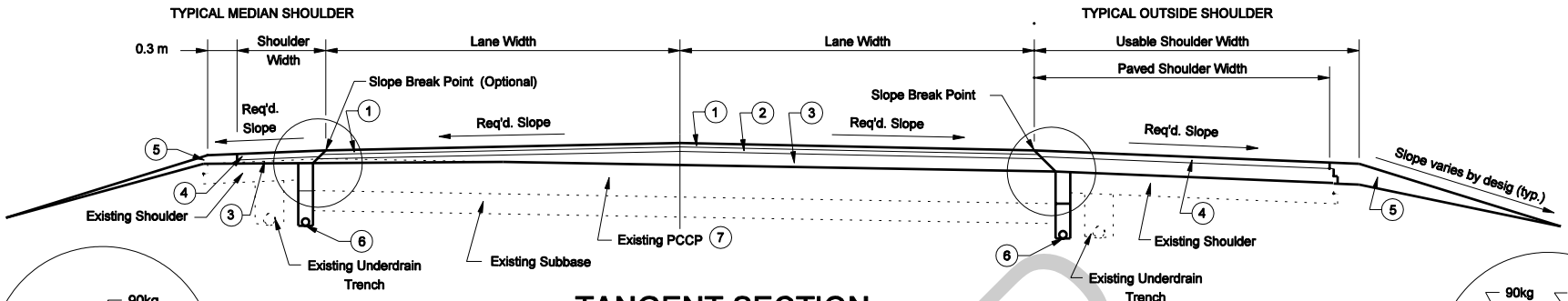
(6) See Figure 52-13Q for Geotextile Installation Requirements for Curbs (Required Only With Underdrains)

* Where underdrains are not required, Dense Graded Subbase should be used.

(7) 150 mm Compacted Aggregate, No. 53, Base

PCCP WITH CONCRETE CURB

Figure 52-13H



TANGENT SECTION

* Mainline Tangent Section

1. 90 kg/m² HMA Surface 9.5 mm
2. 120 kg/m² HMA Intermediate 12.5 mm
3. Variable (110 kg/m² Min.) QC/QA-HMA Intermediate OG19.0 mm. Mill Existing PCCP 50 mm Left Edge of Pavement to 0 mm at Center of Passing Lane, Mill Shoulder to Match Pavement

* Shoulder Tangent Section

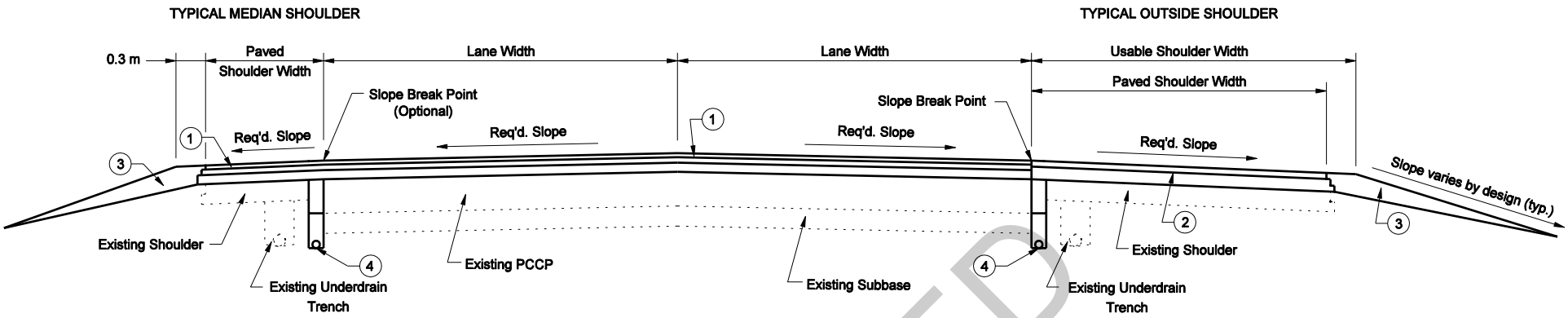
4. 90 kg/m² HMA Surface 9.5 mm on Variable HMA Intermediate 19.0 mm
5. Compacted Aggregate, No. 53
6. Pipe, Type 4, Circular, 100 mm

* Open graded mixture OG19.0 mm should be QC/QA-HMA, 5, 76. For all other mixtures, see Section 52-9.02 to determine the appropriate HMA mixture designation.

* Mainline Superelevated Section

1. 90 kg/m² HMA Surface 9.5 mm
2. 120 kg/m² HMA Intermediate 12.5 mm
3. Variable (110 kg/m² Min.) QC/QA-HMA Intermediate OG19.0 mm to attain proper superelevation
7. Do not mill Existing PCCP if superelevated

OVERLAY (TILT TO CROWN SECTION)
Figure 52-13 I



* Mainline

(1) 90 kg/m² HMA Surface 9.5 mm
120 kg/m² HMA Intermediate 12.5 mm
Variable depth QC/QA-HMA, 5, 76, Intermediate OG19.0 mm (110 kg/m² at Pavement Edge, 150 kg/m² at ℄)

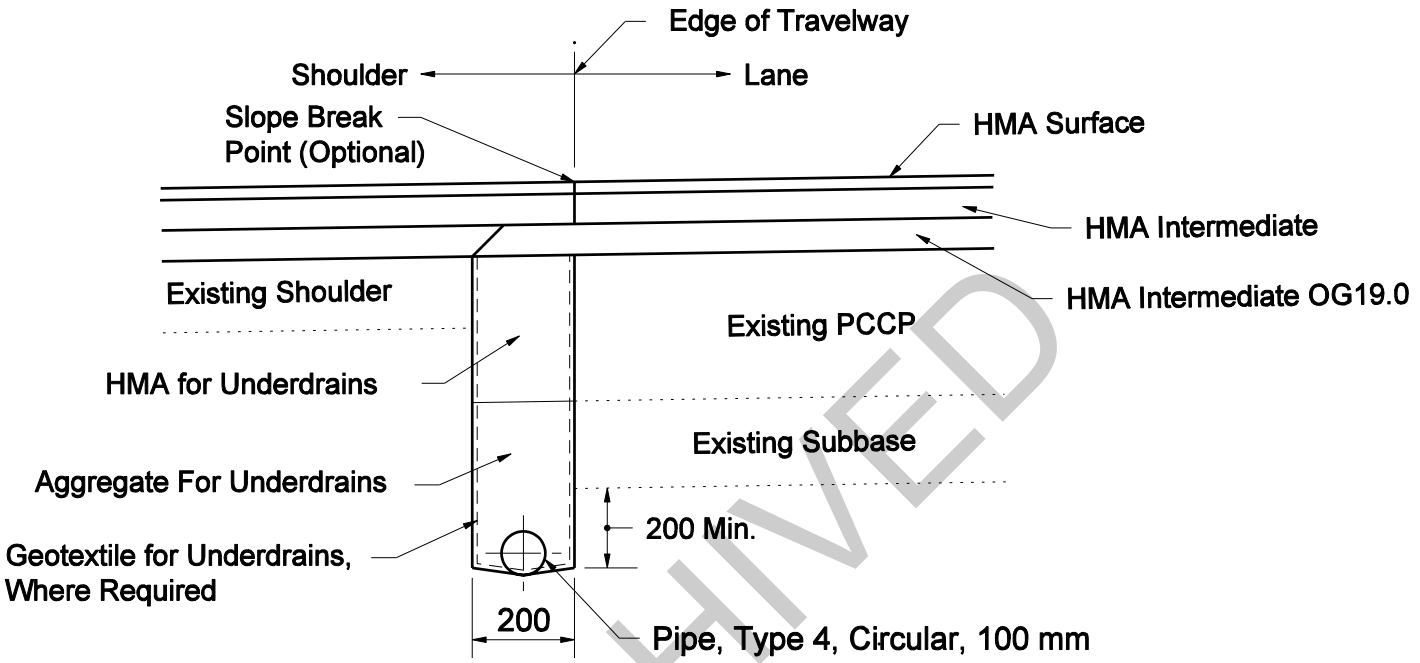
* Shoulder

(2) 90 kg/m² HMA Surface 9.5 mm on
240 kg/m² HMA Base 25.0 mm
(3) Compacted Aggregate, No. 53
(4) Pipe, Type 4, Circular, 100 mm. See Figure 52-13K for Retrofit Underdrain Detail.

* Open graded mixture OG19.0 mm should be QC/QA-HMA, 5, 76. For all other mixtures, see Section 52-9.02 to determine the appropriate HMA mixture designation.

OVERLAY (CROWN TO CROWN SECTION)

FIGURE 52-13J

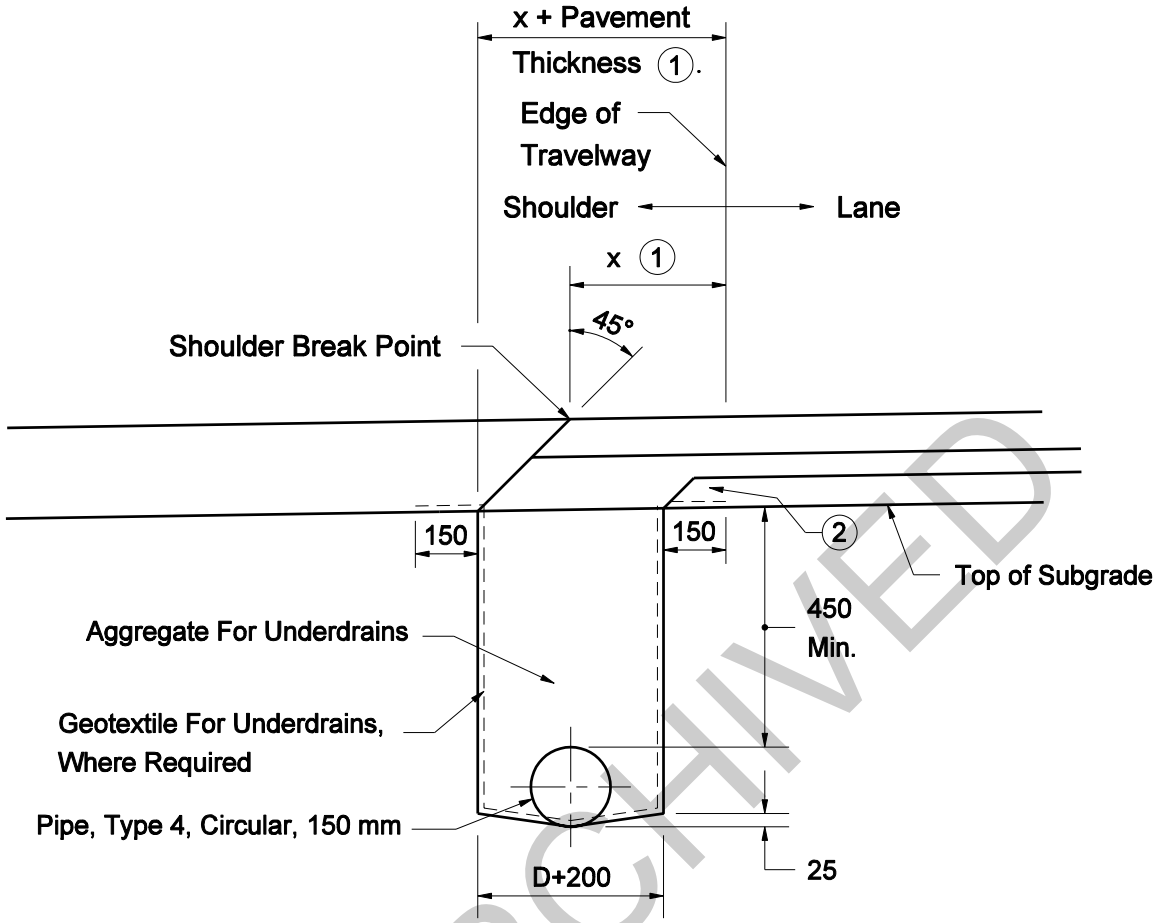


Notes:

1. Open graded mixture OG19.0 mm should be QC/QA-HMA, 5, 76. For all other mixtures, see Section 52-9.02 to determine the appropriate HMA mixture designation.
2. Median installation shown. Outside installation reversed as appropriate. However, slope break point is required.

RETROFIT UNDERDRAIN

Figure 52-13K



(1) Dimension x is 0.6 m min., 1.2 m max. See Fig. 45-1A(1).

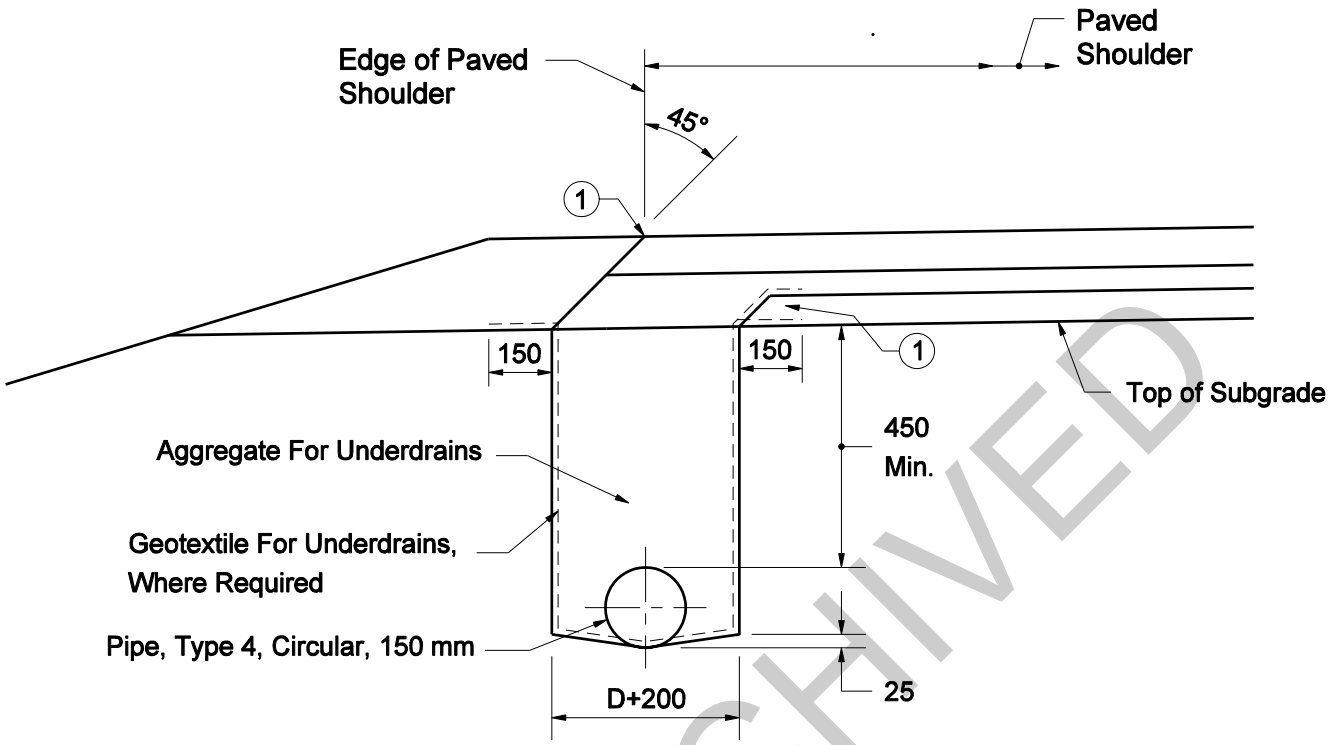
(2) Where a HMA Base 25.0 mm course is used, the geotextile fabric shall extend under the course.

3. Median Installation shown. Outside Installation Reversed as Applicable.

All dimensions are in mm unless otherwise noted

UNDERDRAIN FOR HMA PAVEMENT ≥ 30 MILLION ESALs

Figure 52-13L

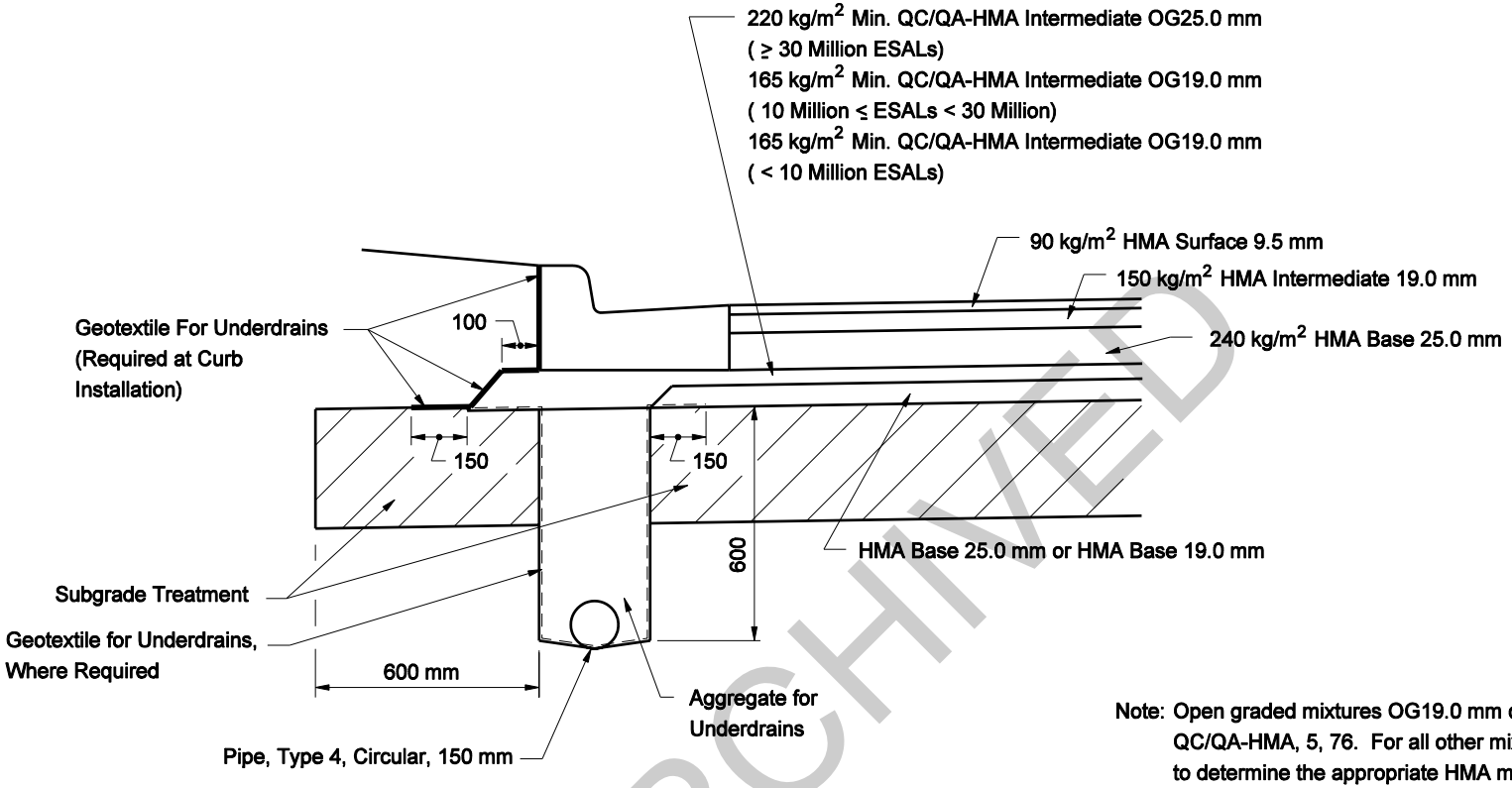


1. Where a HMA Base 25.0 mm course is used, the geotextile fabric shall extend under the course.
2. Median Installation shown. Outside Installation Reversed as Applicable.

UNDERDRAIN FOR HMA PAVEMENT ≥ 30 MILLION ESALs

Figure 52-13M

All dimensions are in mm unless otherwise noted

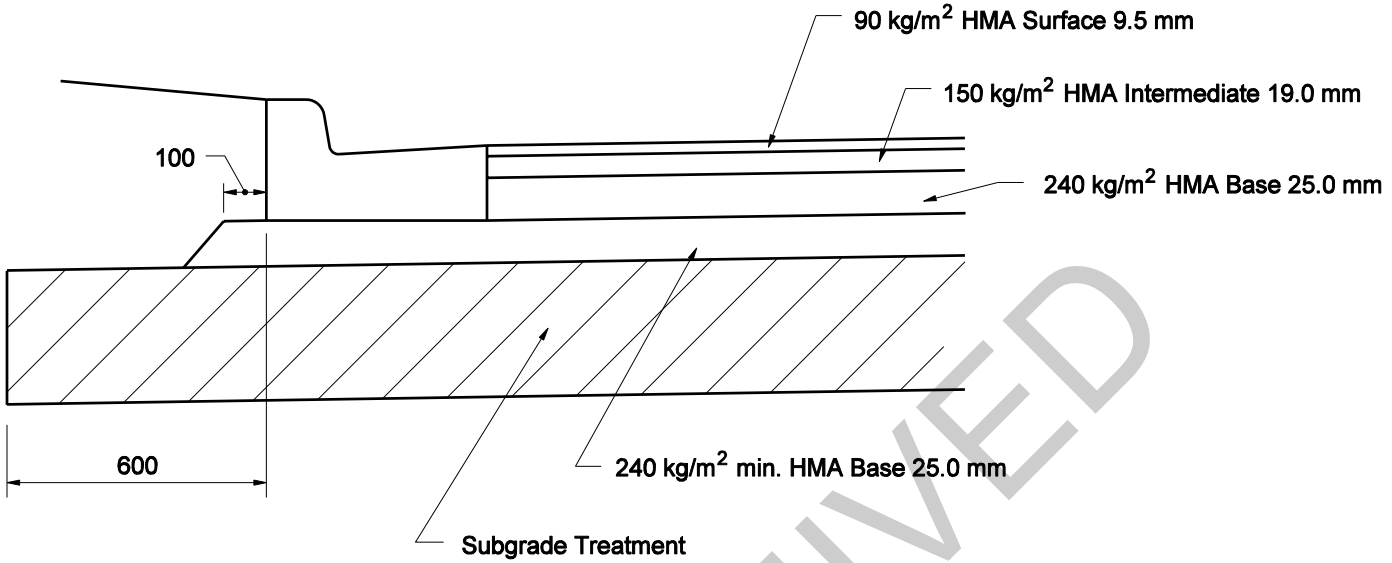


Note: Open graded mixtures OG19.0 mm or OG25.0 mm should be QC/QA-HMA, 5, 76. For all other mixtures, see Section 52-9.02 to determine the appropriate HMA mixture designation.

CONCRETE CURB AND GUTTER SECTION FOR HMA PAVEMENT WITH UNDERDRAIN

Figure 52-13N

All dimensions are in mm unless otherwise noted

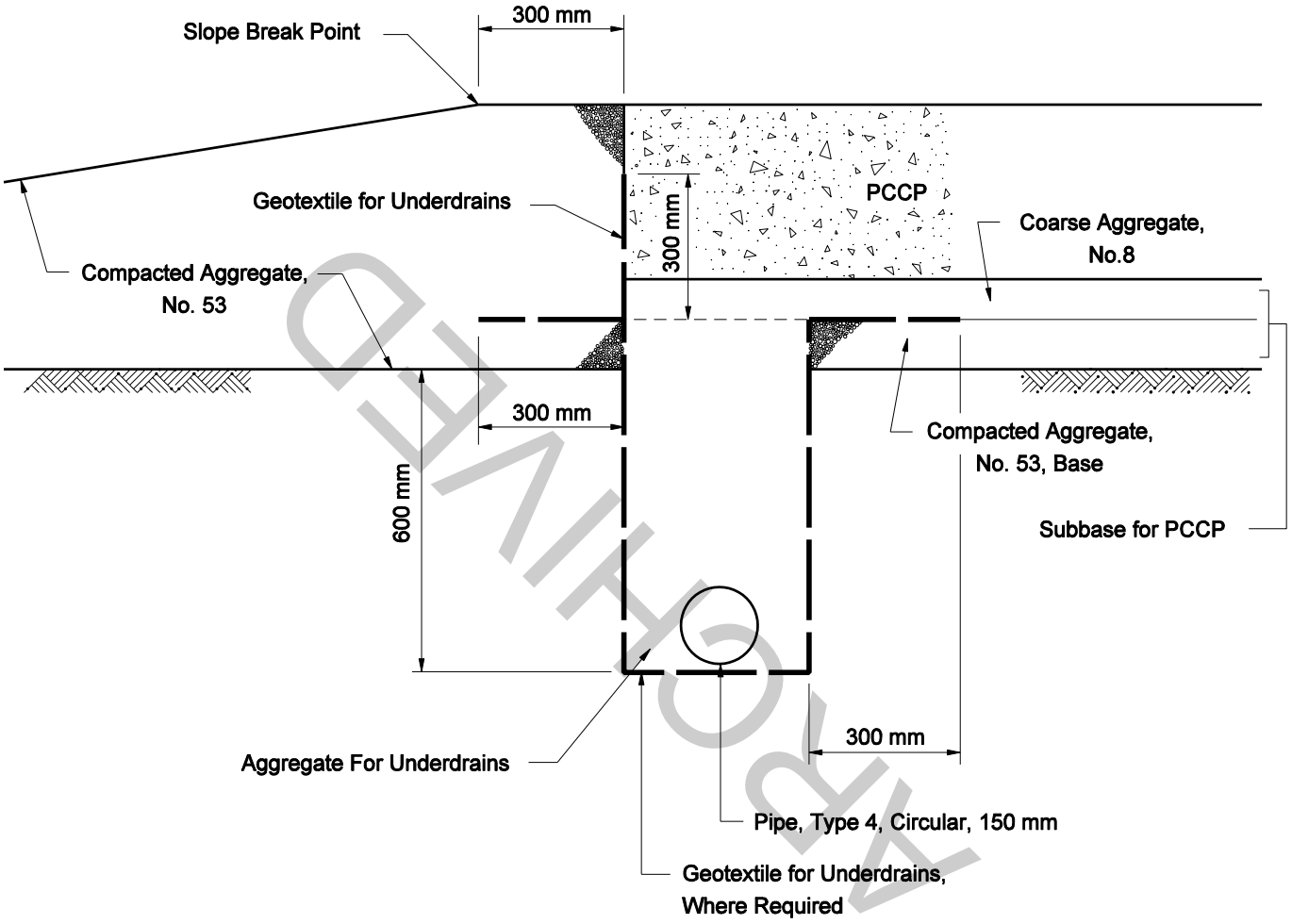


Note: See Section 52-9.02 to determine the appropriate HMA mixture designation.

CONCRETE CURB AND GUTTER SECTION FOR HMA PAVEMENT WITHOUT UNDERDRAIN

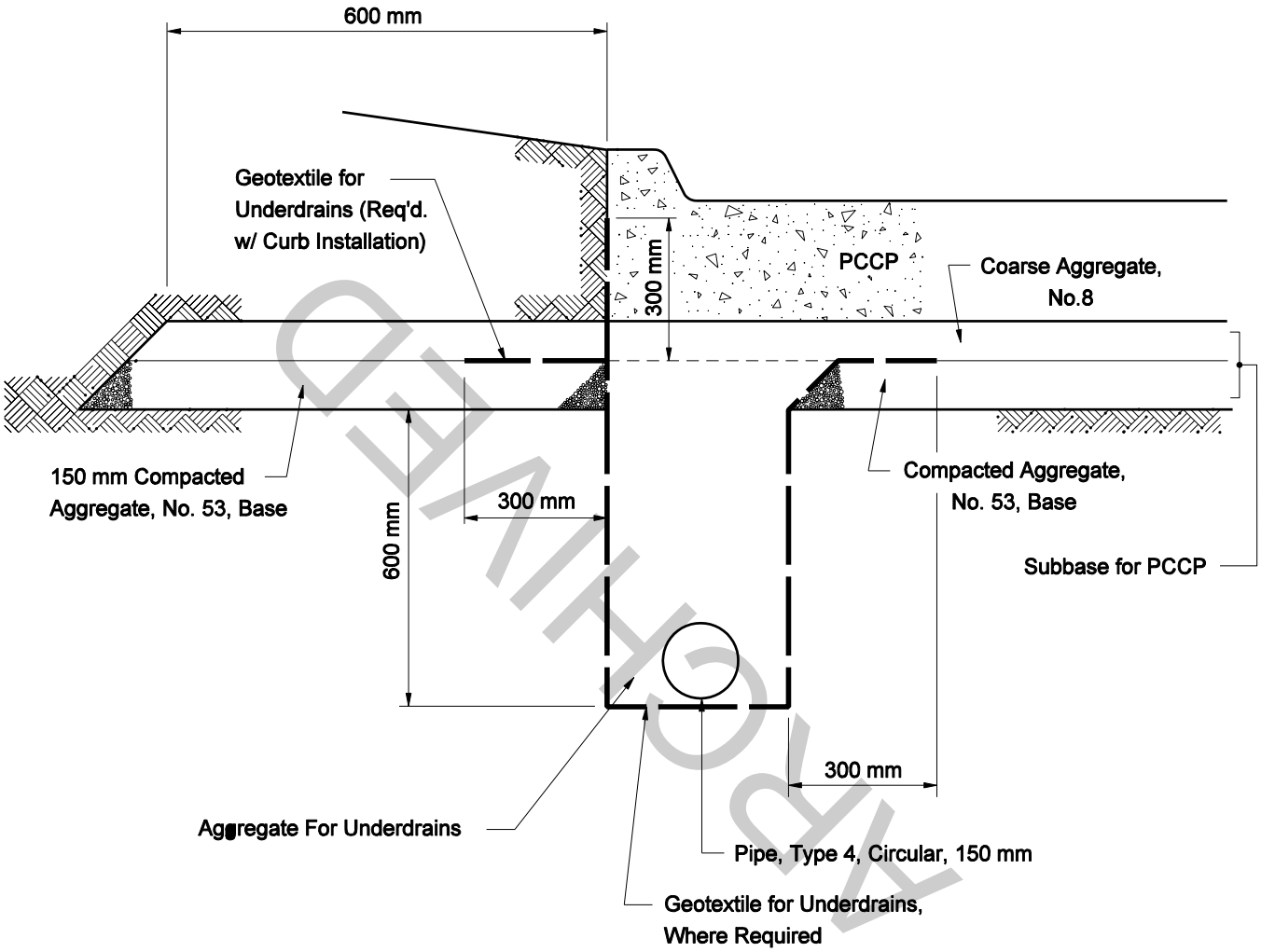
Figure 52-13 O

All dimensions are in mm unless otherwise noted



PCCP WITH UNDERDRAIN

Figure 52-13P

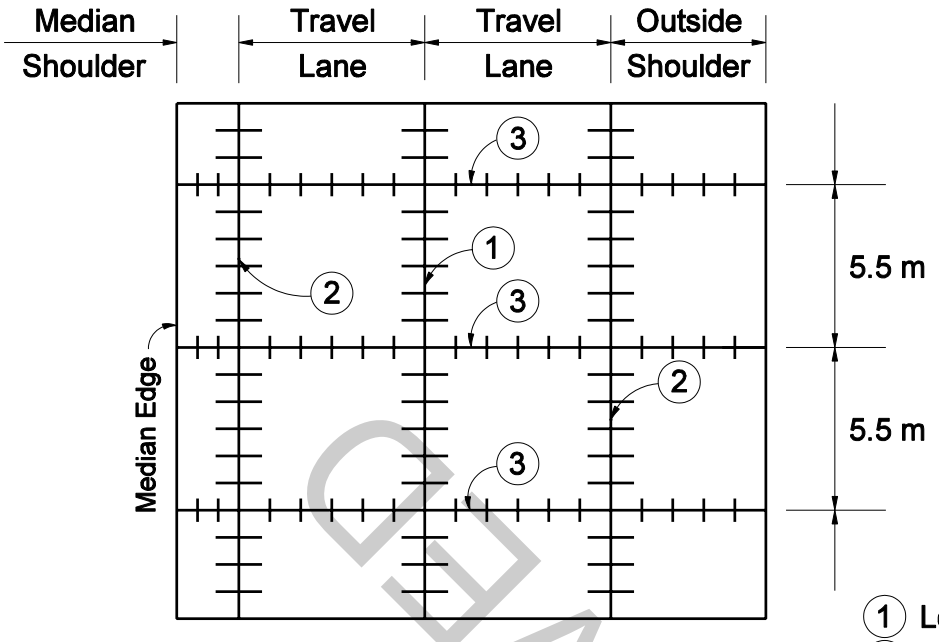


CURBED PCCP
WITH UNDERDRAIN

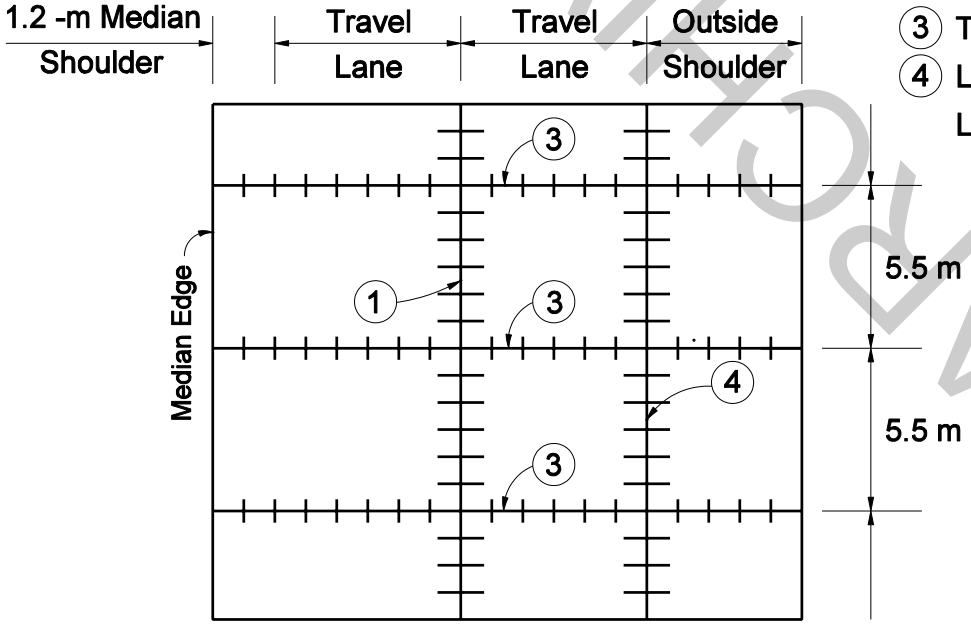
Figure 52-13Q

Note: Option to be determined by the contractor.

OPTIONS A AND B:



OPTION C:

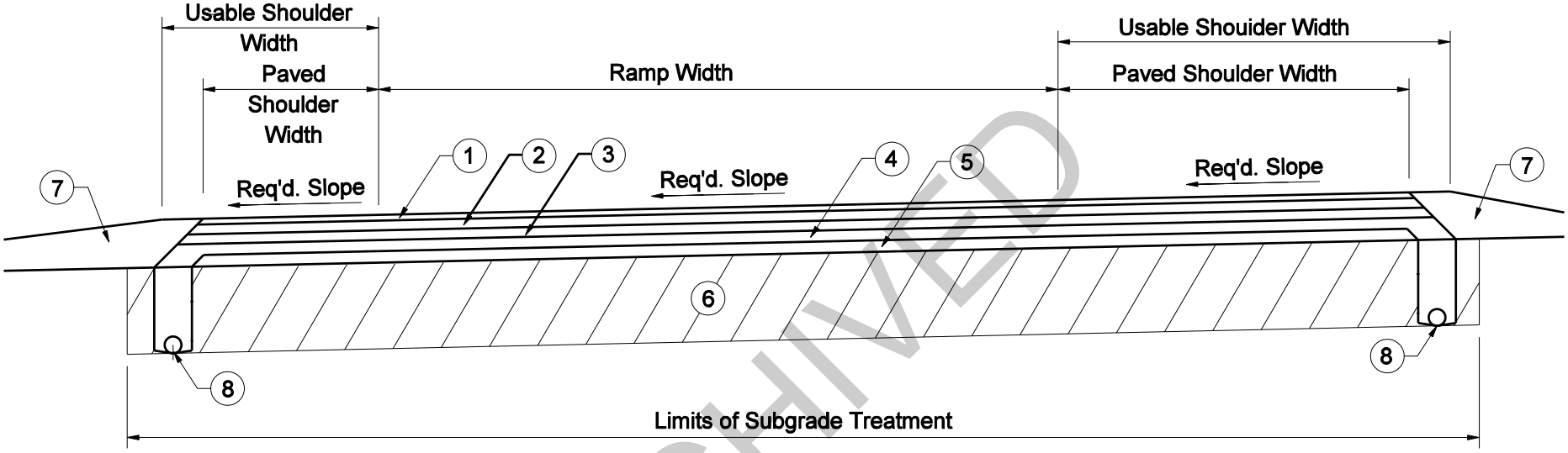


1 Longitudinal Joint
2 Option A: Longitudinal Joint
Option B: Longitudinal Constr. Joint
3 Type D-1 Contraction Joint
4 Longitudinal Joint or
Longitudinal Constr. Joint

MEDIAN EDGE OF CONCRETE PAVEMENT
LONGITUDINAL JOINT OPTIONS

Figure 52-13R

* Open graded mixtures OG19.0 mm or OG25.0 mm should be QC/QA-HMA, 5, 76. For all other mixtures, see Section 52-9.02 to determine the appropriate HMA mixture designation.

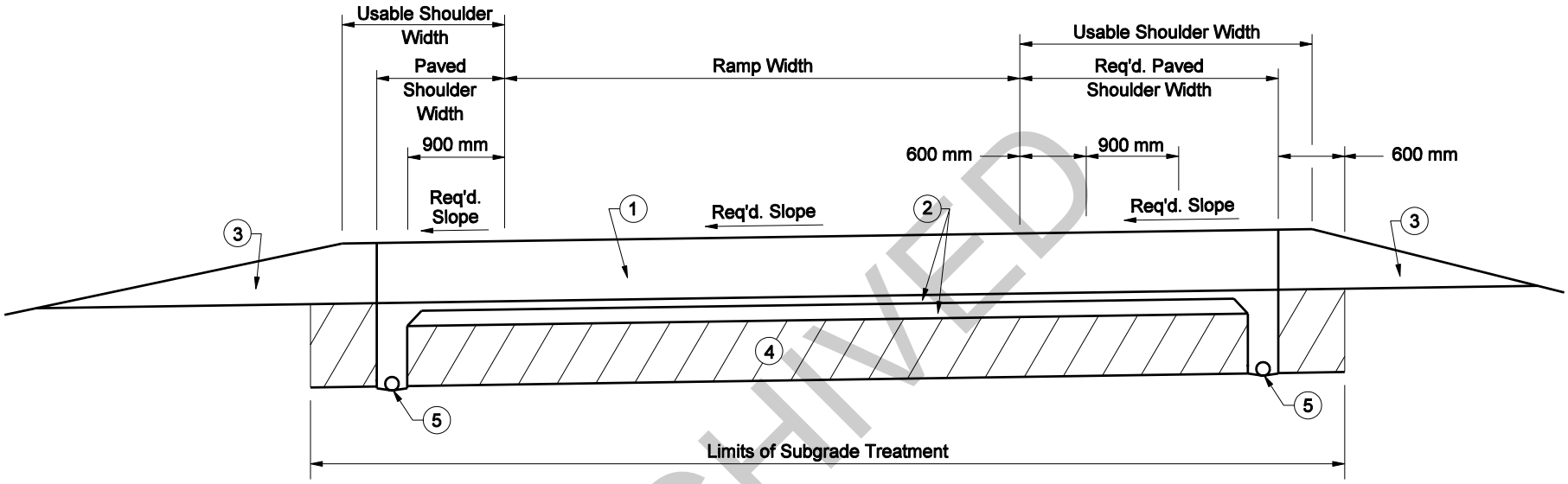


*Ramp

1. 90 kg/m² HMA Surface 9.5 mm
2. 150 kg/m² HMA Intermediate 19.0 mm
3. 180 kg/m² Minimum HMA Base 19.0 mm or HMA Intermediate 19.0 mm
4. 140 kg/m² QC/QA-HMA Inteermediate OG19.0 mm
5. 180 kg/m² QC/QA-HMA Base 19.0 mm or HMA Intermediate 19.0 mm
6. Subgrade Treatment
7. Variable-Depth Compacted Aggregate, No. 53
8. Pipe, Type 4, Circular, 150 mm

FULL-DEPTH HMA RAMP

Figure 52-13S



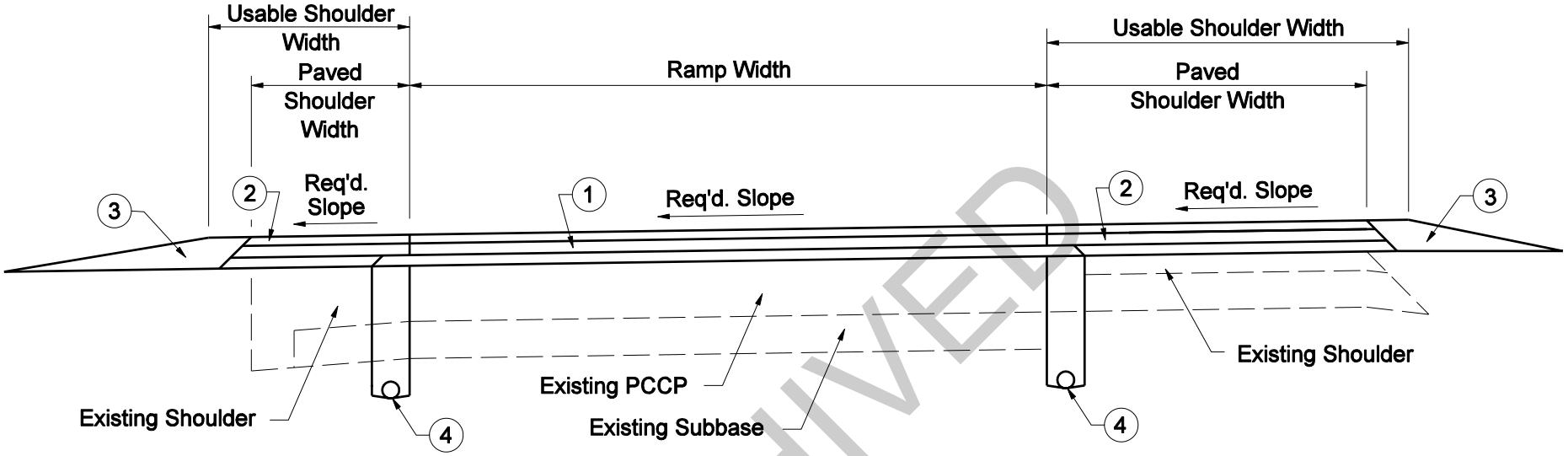
Ramp

1. PCCP
2. Subbase for PCCP (75 mm Coarse Aggregate, No. 8 on 150 mm Coarse Aggregate, No. 53, Base)
3. Variable Depth Compacted Aggregate, No. 53
4. Subgrade Treatment
5. Pipe, Type 4, Circular, 150 mm

PCCP RAMP

Figure 52-13T

Note:
Open graded mixture OG19.0 mm should be QC/QA-HMA, 5, 76. For all other mixtures, see Section 52-9.02 to determine the appropriate HMA mixture designation.



Ramp

(1) 90 kg/m² HMA Surface 9.5 mm on
120 kg/m² HMA Intermediate 12.5 mm on
120 kg/m² QC/QA-HMA, 5, 76, Intermediate OG19.0 mm

Shoulder

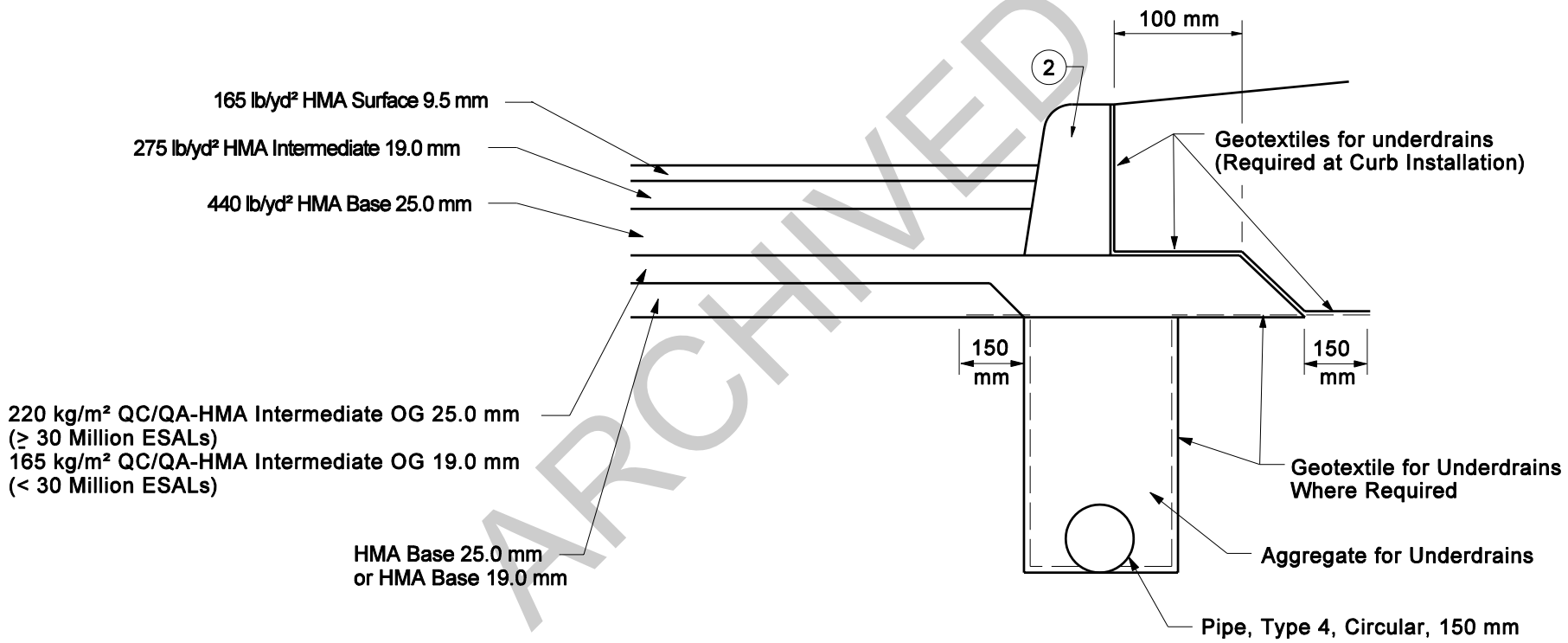
(2) 90 kg/m² HMA Surface 9.5 mm on
240 kg/m² HMA Base 25.0 mm
(3) Variable-Depth Compacted Aggregate, No. 53
(4) Pipe, Type 4, Circular, 100 mm (See Figure 52-13K for Retrofit Underdrain Detail)

RAMP WITH OVERLAY
Figure 52-13U

Notes:

1. Open graded mixtures OG 19.0 mm or OG 25.0 mm should be QC/QA-HMA, 5, 76. For all other mixtures, see Section 52-9.02 to determine the appropriate HMA mixture designation.

(2) Concrete Curb and Gutter desirable. Type B curb may be used where drainage is away from it.

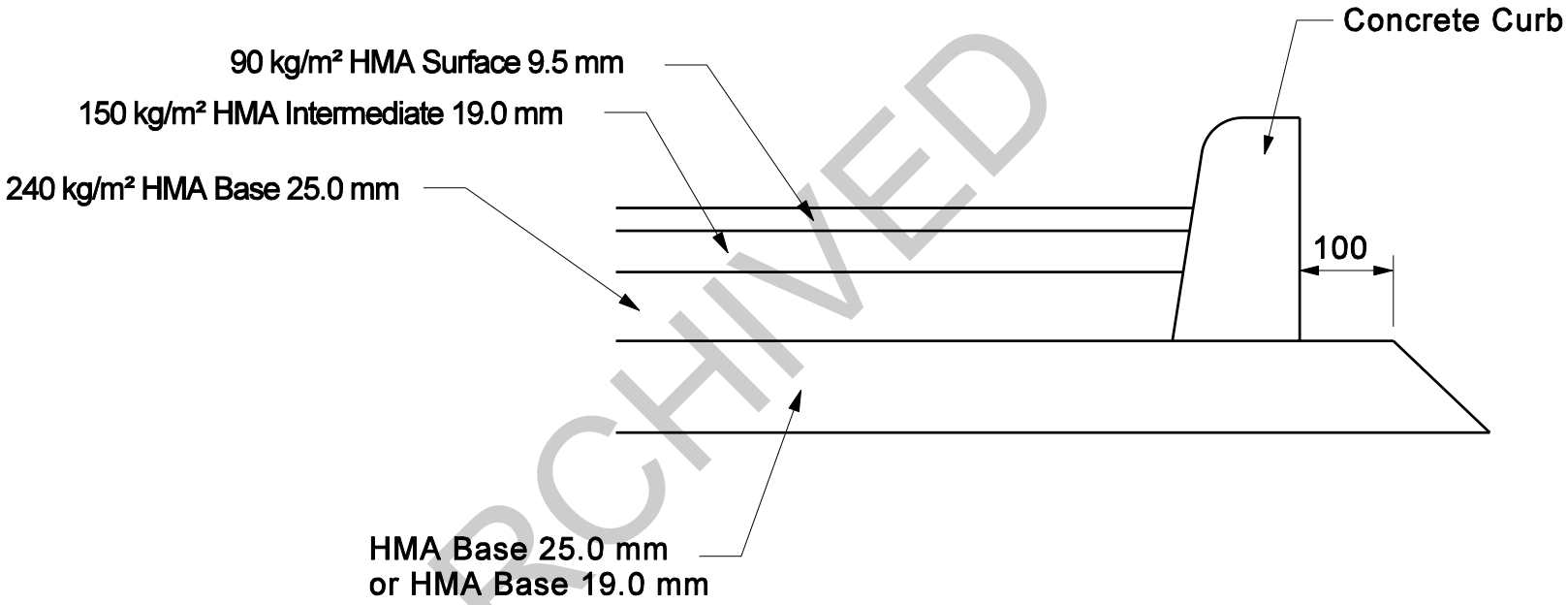


HMA PAVEMENT WITH CONCRETE CURB AND UNDERDRAIN

Figure 52-13V

Notes:

See Section 52-9.02 to determine the appropriate HMA mixture designation.



HMA PAVEMENT WITH CONCRETE CURB
AND NO UNDERDRAIN

Figure 52-13W

Light-Duty HMA / Aggregate Composite Section
(Equivalent to Class II Drive Section):

90 kg/m^2 HMA Surface Type A on
150 kg/m^2 Intermediate Type A on
200 mm Min. Compacted Aggregate Base, No. 53

Medium-Duty HMA / Aggregate Composite Section
(Equivalent to Class IV Drive Section):

90 kg/m^2 HMA Surface Type B on
150 kg/m^2 Intermediate Type B on
200 mm Min. Compacted Aggregate Base, No. 53

Heavy-Duty HMA / Aggregate Composite Section
(Equivalent to Class VI Drive Section):

90 kg/m^2 HMA Surface Type B on
330 kg/m^2 Intermediate Type B on
250 mm Min. Compacted Aggregate Base, No. 53

PCCP Section:

150 mm Min. PCCP for Approaches on
150 mm Dense Grade Subbase

PARKING LOT PAVEMENT SECTIONS

Figure 52-13X

Design Element				Manual Section	Rural	Urban
Design Controls	Design Forecast Year			40-2.02	20 Years	20 Years
	*Design Speed (km/h)			40-3.0	110	80-110 (1)
	Access Control			40-5.0	Full Control	Full Control
	Level of Service			40-2.0	Desirable: B Minimum: C	Desirable: B Minimum: C (2)
Cross Section Elements	Travel Lane	*Width		45-1.01	3.6 m	3.6 m
		Surface Type(3)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete
	Shoulder	*Right Width(4)		45-1.02	Usable: 3.3 m Paved: 3.0 m	Usable: 3.3 m Paved: 3.0 m
		*Left Width(5)			2 Ln: D 2.4, M 1.2 m Paved; 3 Ln: 3.0 m Paved	2 Lanes: 1.2 m Paved 3 Lanes: 3.0 m Paved
		Surface Type(3)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (6)		45-1.01	2%	2%
		Shoulder (6A)		45-1.02	Paved Width ≤ 1.2 m: 2% Paved Width > 1.2 m: 4%	Paved Width ≤ 1.2 m: 2% Paved Width > 1.2 m: 4%
	Auxiliary Lanes	*Lane Width		45-1.03	3.6 m	3.6 m
		*Shoulder Width			Right: 3.0 m (7) Left: 1.2 m	Right: 3.0 m (7) Left: 1.2 m
	Median Width	Depressed		45-2.0	Desirable: 25 m Minimum: 18 m	Desirable: 18 m Minimum: 7.9 m
		Flush (CMB)			Minimum: 8.0 m	Minimum: 8.0 m
	Clear Zone			49-2.0	(8)	(8)
	Side Slopes (9)	Cut	Foreslope	45-3.0	6:1 (10)	6:1 (10)
			Ditch Width		1.2 m (11)	1.2 m (11)
			Backslope		4:1 (12)	4:1 (12)
		Fill		45-3.0	6:1 to Clear Zone; 3:1 max. to Toe	6:1 to Clear Zone; 3:1 max. to Toe
	Median Slopes			45-2.02	Desirable: 8:1 Maximum: 5:1	Desirable: 8:1 Maximum: 5:1
Bridges	New or Reconstructed Bridge	*Structural Capacity		Ch. 60	HS-25 & Alternate Military Loading (13)	HS-25 & Alternate Military Loading (13)
		*Clear Roadway Width (14)		45-4.01	Full Paved Approach Width	Full Paved Approach Width
	Existing Bridge to Remain in Place	*Structural Capacity		Ch. 72	HS-20	HS-20
		*Clear Roadway Width		45-4.01	Travelway Plus 3.0 m Rt. & 1.2 m Lt. Shoulders	Travelway Plus 3.0 m Rt. & 1.2 m Lt. Shoulders
	*Vertical Clearance (Freeway Under) (15c)	New or Replaced Overpassing Bridge (15a)		44-4.0	5.05 m	5.05 m (15b)
		Existing Overpassing Bridge			4.90 m	4.90 m (15b)
		Sign Truss / Pedestrian Bridge (15a)			New: 5.35 m; Existing: 5.20 m	New: 5.35 m; Existing: 5.20 m
	Vertical Clearance (Freeway over Railroad) (16)			Ch. 69	7.00 m	7.00 m

* Controlling design criteria (see Section 40-8.0).

GEOMETRIC DESIGN CRITERIA FOR FREEWAY
(New Construction or Complete Reconstruction)

Table 53-1

Design Element			Manual Section	Rural	Urban			
Alignment Elements	Design Speed		---	110 km/h	80 km/h	90 km/h	100 km/h	110 km/h
	*Stopping Sight Distance		42-1.0	220 m	130	160 m	185 m	220 m
	Decision Sight Distance (17)		42-2.0	235 m	315	360 m	400 m	430 m
	*Minimum Radii (e=8%)		43-2.0	502 m	230	305 m	395 m	505 m
	*Superelevation Rate		43-3.0	e_{max}=8% (18)	e_{max}=8% (18)			
	*Horizontal Sight Distance		43-4.0	(19)	(19)			
	*Vertical Curvature (K-values)	Crest	44-3.0	74	26	39	52	74
		Sag		55	30	38	45	55
	*Maximum Grade (20)	Level		3%	4%	3.5%	3%	3%
		Rolling	44-1.02	4%	5%	4.5%	4%	4%
	Minimum Grade		44-1.03	Desirable: 0.5% Minimum: 0.0%	Desirable: 0.5% Minimum: 0.0%			

* Controlling design criteria (see Section 40-8.0).

These standards are for use on a freeway including that on the National Highway System. They are to be used for each project that is classified as new construction or reconstruction regardless of funding source. Deviations from controlling design criteria should be covered by an approved design exception.

Design exception requests are required for Level One design criteria for each project type as follows:

a) Non-exempt federally-funded project on the Interstate system requires FHWA approval.
b) Exempt federally-funded project on the Interstate system requires Chief, Design Division approval.
c) Non-federally-funded project on the Interstate system requires Chief, Design Division approval with an information copy sent to FHWA.
d. Project not on the Interstate system requires Chief, Design Division approval.

GEOMETRIC DESIGN CRITERIA FOR FREEWAY
(New Construction or Complete Reconstruction)

Table 53-1 (Continued)

GEOMETRIC DESIGN CRITERIA FOR FREEWAY
(New Construction or Complete Reconstruction)

Footnotes to Table 53-1

(1) Design Speed. An 80-km/h design speed may be considered in a restrictive urban area.

(2) Level of Service. A minimum Level of Service of D may be used for urban reconstruction.

(3) Surface Type. The pavement type selection will be determined by the Materials and Tests Division's pavement design engineer.

(4) Shoulder Width (Right). The following will apply:

a. The shoulder is paved to the face of guardrail. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. See Section 49-5.0 for more information.

b. Where the number of trucks exceeds 250 DDHV, a 3.6-m right shoulder should be used. If the 3.6-m shoulder is used, the usable shoulder width will be 3.9 m.

c. Usable shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.

(5) Shoulder Width (Left). The following will apply:

a. Typically, the usable shoulder width is equal to the paved shoulder width. The desirable guardrail offset is 0.6 m from the usable shoulder width. See Section 49-5.0 for more information.

b. Where there are 3 or more lanes in one direction and the volume of trucks exceed 250 DDHV, a 3.6-m left shoulder should be used.

c. For a left shoulder greater than 1.2 m, the usable shoulder width will be 0.3 m more than the paved shoulder width.

(6) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(6A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(7) Auxiliary Lane Shoulder Width (Right). On a reconstruction project, a 1.8-m right shoulder may be used.

(8) Clear Zone. The clear zone will vary according to design speed, traffic volumes, side slopes, and horizontal curvature. See Section 49-2.0.

(9) Side Slopes. Values in the tables are for new construction. See Section 45-3.0 and section 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(10) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(11) Ditch Width. A V-ditch should be used in a rock cut. See Section 45-8.0.

(12) Backslopes. For an earth cut greater than 3.0 m in height, the first horizontal 6.0 m of the backslope should be sloped at a rate of 4:1 and the remainder should be sloped at 3:1 to the natural ground line. See Section 45-3.0 and the INDOT *Standard Drawings*. The backslope for a rock cut will vary according to geotechnical factors and the height of cut. See the INDOT *Standard Drawings* for typical rock cut sections.

(13) Structural Capacity (New or Reconstructed Bridge). Other loadings will apply to the Toll Road or an Extra Heavy Duty Highway. See Chapter Sixty for more information.

(14) Width (New or Reconstructed Bridge). See Section 59-1.0 for more information on bridge width.

(15) Vertical Clearance (Freeway Under). The following will apply:

a. Table values include an additional 150 mm allowance for a future overlay.

b. A 4.3-m clearance may be used in an urban area where an alternate freeway facility with a 4.9-m clearance is available.

c. Vertical clearances apply from usable edge to usable edge of shoulders.

(16) Vertical Clearance (Freeway Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(17) Decision Sight Distance. Table values are for the avoidance maneuver (speed/path/direction change). See Section 42-2.0.

(18) Superelevation Rate. See Section 43-3.0 for values of superelevation based on design speed and radii.

(19) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance. The SSD values for trucks should sometimes be considered. See the discussion in Section 43-4.0.

(20) Maximum Grade. A grade 1% steeper that that shown in the table may be used in a restricted urban area where development precludes the use of a flatter grade. A grade 1% steeper that that shown in the table may also be used for a one-way downgrade.

(21) For a bridge longer than 60 m that is to remain in place, the minimum widths of both shoulders may be 1.2 m. This requirement does not apply to a bridge deck replacement.

Design Element				Manual Section	2-Lane			Multi-Lane	
Design Controls	Design Year Traffic		AADT	40-2.01	< 400	400 ≤ AADT < 2000	≥ 2000	**Undivided	Divided
	Design Forecast Year			40-2.02	20 Years			20 Years	
	*Design Speed (km/h) (1)			40-3.0	Level: 100-110; Rolling: 80-100			100	110
	Access Control			40-5.0	Partial Control / None			Partial Control / None	
	Level of Service			40-2.0	Desirable: B; Minimum: C			Desirable: B; Minimum: C	
Cross Section Elements**	Travel Lane	*Width		45-1.01	3.6 m			3.6 m	
		Typical Surface Type (2)		Ch. 52	Asphalt / Concrete			Asphalt / Concrete	
	Shoulder (3)	*Width Usable		45-1.02	1.8 m	2.4 m	3.3 m (3b)	3.3 m (3b)	Right: 3.3 m (3b) Left: 1.2 m (3e)
		*Width Paved		45-1.02	1.2 m	1.8 m	3.0 m (3b)	3.0 m (3b)	Right: 3.0 m (3b) Left: 1.2 m (3e)
		Typical Surface Type (2)		Ch. 52	Asphalt / Concrete			Asphalt / Concrete	
	Cross Slope	*Travel Lane (4)		45-1.01	2%			2%	
		Shoulder (4A)		45-1.02	Paved Width ≤ 1.2 m: 2% Paved Width > 1.2 m: 4%			Paved Width ≤ 1.2 m: 2% Paved Width > 1.2 m: 4%	
	Auxiliary Lanes	Lane Width (5)		45-1.03	Desirable: 3.6 m; Minimum: 3.3 m			Desirable: 3.6 m; Minimum: 3.3 m	
		Shoulder Width (6)			Same as That Next to Travel Lane			Same as That Next to Travel Lane	
	Median Width			45-2.0	N/A			0.0 m	Desirable: 25.0 m Minimum: 4.8 m (7)
	Clear Zone			49-2.0	(8)			(8)	
	Side Slopes (9)	Cut	Foreslope	45-3.0	6:1 (10)			6:1 (10)	
			Ditch Width		1.2 m (11)			1.2 m (11)	
			Backslope		4:1 for 6.0 m; 3:1 Max. to Top (12)			4:1 for 6.0 m; 3:1 Max. to Top (12)	
		Fill		45-3.0	6:1 to Clear Zone; 3:1 Max. to Toe			6:1 to Clear Zone; 3:1 Max. to Toe	
	Median Slopes			45-2.02	N/A			Desirable: 8:1; Maximum: 5:1	
Bridges***	New or Reconstructed Bridge	*Structural Capacity		Ch. 60	HS-25 (13)				
		*Clear Roadway Width(14)		45-4.01	Full Paved Approach Width				
	Existing Bridge Bridge to Remain in Place	*Structural Capacity		Ch. 72	HS-20				
		*Clear Roadway Width		45-4.01	Travelway Plus 0.6 m on Each Side				
	Vertical Clearance (Arterial Under)	New or Replaced Overpassing Bridge (15)		44-4.0	5.05 m				
		Existing Overpassing Bridge			4.30 m				
		Sign Truss / Pedestrian Bridge (15)			New: 5.35 m; Existing: 5.20 m				
	Vertical Clearance (Arterial Over Railroad) (16)			Ch. 69	7.00 m				

Controlling design criteria (see Section 40-8.0). ** A multi-lane arterial on a new locations should be designed as Divided.
*** Selection of the cross section and bridge elements is based on the design-year traffic volume irrespective of the design speed.

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIAL
(New Construction or Reconstruction)
Table 53-2

Design Element			Manual Section	Rural Arterial			
Alignment Elements	Design Speed		---	80 km/h	90 km/h	100 km/h	110 km/h
	*Stopping Sight Distance		42-1.0	130 m	160	185 m	220 m
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	230 m	270	315 m	330 m
		Stop Maneuver		140 m	170 m	200 m	235 m
	Passing Sight Distance		42-3.0	540 m	615 m	670 m	730 m
	Intersection Sight Distance, -3% to +3% (20)		46-10.0	P: 190 m; SU: 235 m	P: 230 m; SU: 280 m	P: 265 m; SU: 320 m	P: 310 m; SU: 370 m
	*Minimum Radii (e=8%)		43-2.0	230 m	305 m	395 m	505 m
	*Superelevation Rate		43-3.0	e_{max} = 8% (17)			
	*Horizontal Sight Distance		43-4.0	(18)			
	*Vertical Curvature (K-values)	Crest	44-3.0	26	39	52	74
		Sag		30	38	45	55
	*Maximum Grade (19)	Level	44-1.02	4%	3.5%	3%	3%
		Rolling		5%	4.5%	4%	4%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.0%			

* Controlling design criteria (see Section 40-8.0).

These standards are for use on a Rural Arterial including that on the National Highway System. They are to be used for each project that is classified as new construction or reconstruction regardless of funding source. Deviations from controlling design criteria should be covered by an approved design exception.

Design exception requests are required for Level One design criteria for each project type as follows:

a) Non-exempt federally-funded project on the Interstate system requires FHWA approval.
b) Exempt federally-funded project on the Interstate system requires Chief, Design Division approval.
c) Non-federally-funded project on the Interstate system requires Chief, Design Division approval with an information copy sent to FHWA.
d. Project not on the Interstate system requires Chief, Design Division approval.

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIAL
(New Construction or Reconstruction)

Table 53-2 (Continued)

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIAL
(New Construction or Reconstruction)

Footnotes to Table 53-2

(1) Design Speed. The minimum design speed should equal the minimum value from the table or the anticipated posted speed limit after construction, whichever is greater. The state legal limit is 60 mph on a non-posted highway.

(2) Surface Type. The pavement type selection will be determined by the Materials and Tests Division's pavement design engineer.

(3) Shoulder. The following will apply:

a. If there are 3 or more lanes in each direction and there is a median barrier, a 3.0 m paved shoulder and a 0.6 m offset is required.
b. On a reconstruction project, the usable shoulder width may be 3.0 m, and the paved width may be 2.4 m.
c. The shoulder is paved to the face of guardrail. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. See Section 49-5.0 for more information.
d. Usable shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.
e. If there are three or more lanes in each direction, a full-width shoulder, 3.3 m usable and 3.0 m paved, is desirable.

(4) Cross Slope (Travel Lanes). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place. Where three or more lanes are sloped in the same direction, each successive pair of lanes may have an increased sideslope.

(4A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(5) Auxiliary Lane (Lane Widths). The width of a truck climbing lane should be 3.6 m.

(6) Auxiliary Lane (Shoulder Width). At a minimum, a 0.6-m shoulder may be used adjacent to an auxiliary lane. At a minimum, a shoulder adjacent to a truck climbing lane should be 1.2 m.

(7) Median Width (Flush). Values in the table are for new construction. A median of less than 7.5 m should be avoided at an intersection. A median width of greater than 18 m is undesirable at a signalized intersection or an intersection that may become signalized in the foreseeable future. On a reconstruction project, the minimum flush median width is 4.2 m for a roadway with a left-turn lane and 6.6 m for a roadway with a median barrier.

(8) Clear Zone. The clear zone will vary according to design speed, traffic volumes, side slopes, and horizontal curvature. See Section 49-2.0.

(9) Side Slopes. Values in the tables are for new construction. See Section 45-3.0 and Section 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(10) Foreslope. See the Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(11) Ditch Widths. A V-ditch should be used in a rock cut. See Section 45-8.0.

(12) Backslopes. The backslope for a rock cut will vary according to geotechnical factors and the height of the cut. See Section 45-8.0 for typical rock cut sections.

(13) Structural Capacity (New or Reconstructed Bridge). The following will apply:

a. Each bridge on a facility with greater than 600 trucks per day should be checked using the Alternate Military loading.
b. Each State highway bridge within 25 km of a Toll Road gate must be designed for Toll Road Loading.
c. Each bridge on an Extra Heavy Duty Highway must be designed for the Michigan Train truck loading configuration.
d. See Chapter Sixty for additional information on the loading configurations.

(14) Width (New or Reconstructed Bridge). See Section 59-1.0 for more information on bridge width.

(15) Vertical Clearance (Arterial Under). Table values include an additional 150 mm allowance for a future pavement overlay. Vertical clearances apply from usable edge to usable edge of shoulders.

(16) Vertical Clearance (Arterial Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(17) Superelevation Rate. See Section 43-3.0 for values of superelevation based on design speed and radii.

(18) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. The SSD values for trucks should sometimes be considered. See the discussion in Section 43-4.0.

(19) Maximum Grades. A grade 1% steeper that that shown in the table may also be used for a one-way downgrade.

(20) Intersection Sight Distance. For left turn onto a 2-lane road. P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element				Manual Section	2-Lane			
Design Controls	Design Year Traffic	AADT		40-2.01	< 400	400 ≤ AADT < 1500	1500 ≤ AADT < 2000	> 2000
	Design Forecast Year			40-2.02	20 Years			
	*Design Speed (km/h) (2)	Level		40-3.0	60 - 90	80 - 90	80 - 90	100
		Rolling			60 - 90	60 - 90	60 - 90	80 - 90
	Access Control			40-5.0	None			
	Level of Service			40-2.0	Desirable.: B; Minimum: C			
Cross Section Elements**	Travel Lane	*Width		45-1.01	D: 3.6 m; M: 3.3 m	D: 3.6 m; M: 3.3 m	D: 3.6 m; M: 3.3 m (20)	3.6 m
		Typical Surface Type (3)		Ch. 52	Asphalt / Concrete			
	Shoulder (4)	*Width Usable		45-1.02	1.2 m	1.8 m	2.4 m	3.0 m
		*Width Paved		45-1.02	0.6 m	1.2 m	1.8 m	2.4 m
		Typical Surface Type (3)		Ch. 52	Asphalt / Concrete			
	Cross Slope	*Travel Lane (5)		45-1.01	2%			
		Shoulder (5A)		45-1.02	Paved Width ≤ 1.2 m: 2%; Paved Width > 1.2 m: 4%			
	Auxiliary Lane	Lane Width		45-1.03	Des: Same as Through Lanes; Min: 3.3 m			Desirable: 3.6 m Minimum: 3.3 m
		Shoulder Width (6)			Same as Next to Travel Lane			
	Clear Zone			49-2.0	(7)			
	Side Slopes (8)	Cut	Foreslope	45-3.0	Des: 6:1; Max: 4:1 (9)			
			Ditch Width		1.2 m (10)			
			Backslope		4:1 for 6.0 m; 3:1 Max. to Top (11)			
		Fill		45-3.0	Des: 6:1 to Clear Zone; Max: 3:1 to Toe			
Bridges**	New or Reconstructed Bridge	*Structural Capacity		Ch. 60	HS-25 (12)			
		*Clear Roadway Width (13)		45-4.01	Full Paved Approach Width			
	Existing Bridge to Remain in Place	*Structural Capacity		Ch. 72	HS-15			
		*Clear Roadway Width (14)		45-4.01	6.6 m	6.6 m	7.2 m	8.4 m
	*Vertical Clearance (Collector Under)	New or Replaced Overpassing Bridge (15)		44-4.0	4.45 m			
		Existing Overpassing Bridge			4.30 m			
	Vertical Clearance (Collector Over Railroad) (16)			Ch. 69	7.00 m			

* Controlling design criteria (see Section 40-8.0). D or Des: Desirable; M or Min: Minimum
** Selection of the cross section and bridge elements is based on the design-year traffic volumes irrespective of the design speed.

GEOMETRIC DESIGN CRITERIA FOR STATE RURAL COLLECTOR
(New Construction or Reconstruction)

Table 53-3

n Element			Manual Section	2-Lane				
Alignment Elements	Design Speed			60 km/h	70 km/h	80 km/h	90 km/h	100 km/h
	*Stopping Sight Distance		42-1.0	85 m	105 m	130 m	160 m	185 m
	Decision Sight Distance	Speed / path / direction change	42-2.0	170 m	200 m	230 m	270 m	315 m
		Stop Maneuver		95 m	115 m	140 m	170 m	200 m
	Passing Sight Distance		42-3.0	410 m	485 m	540 m	615 m	670 m
	Intersection Sight Distance, -3% to +3% (21)		46-10.0	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 190 m SU: 235 m	P: 230 m SU: 280 m	P: 265 m SU: 320 m
	*Minimum Radii (e=8%)		43-2.0	125 m	180 m	230 m	305 m	395 m
	*Superelevation Rate		43-3.0	e_{max} = 8% (17)				
	*Horizontal Sight Distance		43-4.0	(18)				
	*Vertical Curvature (K-values)	Crest	44-3.0	11	17	26	39	52
		Sag		18	23	30	38	45
	*Maximum Grade (19)	Level	44-1.02	7%	6.5%	6%	5.5%	5%
		Rolling		8%	7.5%	7%	6.5%	6%
	Minimum Grade		44-1.03	Desirable: 0.5% Minimum: 0.0%				

* Controlling design criteria (see Section 40-8.0).

These standards are to be used for each project on a state rural collector that is classified as new construction or reconstruction regardless of funding source. Deviations from controlling Level One design criteria should be covered by a design exception approved by the Chief, Design Division.

GEOMETRIC DESIGN CRITERIA FOR STATE RURAL COLLECTOR
(New Construction or Reconstruction)

Table 53-3 (Continued)

GEOMETRIC DESIGN CRITERIA FOR STATE RURAL COLLECTOR
(New Construction or Reconstruction)

Footnotes to Table 53-3

(1) (Note deleted.)

(2) Design Speed. The minimum design speed should equal the minimum value from the table or the anticipated posted speed limit after construction, whichever is greater. The state legal limit is 55 mph on a non-posted highway.

(3) Surface Type. The pavement type selection will be determined by the Materials and Tests Division's pavement design engineer.

(4) Shoulder Width. The following will apply:

a. The shoulder is paved to the face of guardrail. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. See Section 49-5.0 for more information.

b. Usable shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.

(5) Cross Slope (Travel Lanes). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(5A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(6) Auxiliary Lane (Shoulder Width). At a minimum, a 0.6-m shoulder may be used adjacent to an auxiliary lane.

(7) Clear Zone. The clear zone will vary according to design speed, traffic volumes, side slopes, and horizontal curvature. See Section 49-2.0.

(8) Side Slopes. Values in the tables are for new construction. See Section 45-3.0 and Section 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(9) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(10) Ditch Widths. A V-ditch should be used in a rock cut. See Section 45-8.0.

(11) Backslopes. The backslope for a rock cut will vary according to geotechnical factors and the height of the cut. See Section 45-8.0 for typical rock cut sections.

(12) Structural Capacity (New or Reconstructed Bridge). The following will apply:

a. Each bridge on a facility with greater than 600 trucks per day should be checked using the Alternate Military loading.
b. Each State highway bridge within 25 km of a Toll Road gate must be designed for Toll Road Loading.
c. Each bridge on an Extra Heavy Duty Highway must be designed for the Michigan Train truck loading configuration.
d. See Chapter Sixty for additional information on the loading configurations.

(13) Width (New or Reconstructed Bridge). Minimum clear roadway width will be 9.4 m. See Section 59-1.0 for more information on bridge width.

(14) Width (Existing Bridge to Remain in Place). Clear width will be at least equal to the approach traveled way width or the table values, whichever is greater.

(15) Vertical Clearance (Collector Under). Table values include an additional 150 mm allowance for a future pavement overlay. Vertical clearances apply from usable edge to usable edge of shoulders.

(16) Vertical Clearance (Collector Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(17) Superelevation Rate. See Section 43-3.0 for values of superelevation based on design speed and radii.

(18) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. See Section 43-4.0.

(19) Maximum Grades. For a grade of less than 150 m in length (PVT to PVC), a one-way downgrade, or a grade on a road with AADT < 400, the maximum grade may be up to 2% steeper than the table value.

(20) Use 3.6 m if V = 90 km/h.

(21) Intersection Sight Distance. For left turn onto a 2-lane road. P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element				Manual Section	2-Lane			
Design Controls	Design Year Traffic	AADT		40-2.01	< 400	400 ≤ AADT < 1500	1500 ≤ AADT < 2000	≥ 2000
	Design Forecast Year			40-2.02	20 Years			
	*Design Speed (km/h) (3)	Level		40-3.0	60 - 90	80 – 90	80 - 90	100
		Rolling			50 - 90	60 - 90	60 - 90	80 - 90
	Access Control			40-5.0	None			
	Level of Service			40-2.0	Desirable: B; Minimum: C			
Cross Section Elements**	Travel Lane	*Width (4)		45-1.01	3.0 m (4a)	3.3 m	3.3 m (4b)	3.6 m
		Typical Surface Type		Ch. 52	Asphalt / Concrete			
	Shoulder	*Width Usable		45-1.02	Des: 1.2 m Min: 0.6 m (5)	Des: 1.8 m Min: 1.2 m	Des: 2.4 m Min: 1.8 m	Des: 3.0 m Min: 2.4 m
		*Width Paved (optional)		45-1.02	0.6 m	1.2 m	1.8 m	2.4 m
		Typical Surface Type		Ch. 52	Asphalt / Aggregate / Earth			
	Cross Slope	*Travel Lane (6)		45-1.01	2%			
		Shoulder (6A)		45-1.02	Paved Width ≤ 1.2 m: 2%; Paved Width > 1.2 m: 4% - 6% Asphalt; 6%-8% Aggregate; 8% Earth			
	Auxiliary Lanes	Lane Width		45-1.03	3.0 m		Desirable: 3.3 m Minimum: 3.0 m	Desirable: 3.6 m Minimum: 3.0 m
		Shoulder Width			Desirable: Same as Next to Travel Lane; Minimum: 0.6 m			
	Clear Zone			49-2.0	(7)			
	Side Slopes (8)	Cut	Foreslope	45-3.0	Des: 6:1; Max: 4:1 (9)			
			Ditch Width		1.2 m (10)			
			Backslope		4:1 for 6.0 m; 3:1 Max. to Top (11)			
		Fill		45-3.0	Des: 6:1 to Clear Zone; Max: 3:1 to Toe			
Bridges**	New or Reconstructed Bridge	*Structural Capacity		Ch. 60	HS-25 (11a)			
		*Clear Roadway Width (12)		45-4.01	Travelway + 1.2 m	Travelway + 1.8 m	Travelway + 2.4 m	Full Paved Approach Width
	Existing Bridge to Remain in Place	*Structural Capacity		Ch.72	HS-15			
		*Clear Roadway Width (13)		45-4.01	6.6 m	6.6 m	7.2 m	8.4 m
	*Vertical Clearance (Collector Under)	New or Replaced Overpassing Bridge (14)		44-4.0	4.45 m			
		Existing Overpassing Bridge			4.30 m			
	Vertical Clearance (Collector Over Railroad) (15)			Ch. 69	7.00 m			

* Controlling design criteria (see Section 40-8.0). Des: Desirable; Min: Minimum.
** Selection of the cross section and bridge elements is based on the design-year traffic volumes irrespective of the design speed.

GEOMETRIC DESIGN CRITERIA FOR LOCAL AGENCY RURAL COLLECTOR (1)
(New Construction or Reconstruction)

Table 53-4

Design Element			Manual Section	2-Lane					
Alignment Elements	Design Speed		---	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h	100 km/h
	*Stopping Sight Distance		42-1.0	65 m	85 m	105 m	130 m	160 m	185 m
	Decision Sight Distance	Speed / path / direction change	42-2.0	145 m	170 m	200 m	230 m	270 m	315 m
		Stop Maneuver		70 m	95 m	115 m	140 m	170 m	200 m
	Passing Sight Distance		42-3.0	345 m	410 m	485 m	540 m	615 m	670 m
	Intersection Sight Distance, -3% to +3% (19)		46-10.0	P: 105 m SU: 135 m	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 170 m SU: 235 m	P: 230 m SU: 280 m	P: 265 m SU: 320 m
	*Minimum Radii (e=8%)		43-2.0	85 m	125 m	180 m	230 m	305 m	395 m
	*Superelevation Rate		43-3.0	emax = 8% (16)					
	*Horizontal Sight Distance		43-4.0	(17)					
	*Vertical Curvature (K-values)	Crest	44-3.0	7	11	17	26	39	52
		Sag		13	18	23	30	38	45
	*Maximum Grade (18)	Level	44-1.02	7%	7%	6%	6%	5.5%	5%
		Rolling		9%	8%	7%	7%	6.5%	6%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.0%					

* Controlling design criteria (see Section 40-8.0).

These standards are to be used for each federal-aid funded project on a local agency rural collector that is classified as new construction or reconstruction. Deviations from controlling Level One design criteria should be covered by a design exception approved by the Chief, Design Division.

GEOMETRIC DESIGN CRITERIA FOR LOCAL AGENCY RURAL COLLECTOR (1)
(New Construction or Reconstruction)

Table 53-4 (Continued)

GEOMETRIC DESIGN CRITERIA FOR LOCAL AGENCY RURAL COLLECTOR
(New Construction or Reconstruction)

Footnotes to Table 53-4

(1) Applicability. This table is only applicable to a federal-aid funded project.

(2) (Blank.)

(3) Design Speed. The minimum design speed should equal the minimum value from the table or the anticipated posted speed limit after construction, whichever is greater. The state legal limit is 55 mph on a non-posted highway.

(4) Travel Lane Width. The following will apply:

a. Use a 3.3-m width if the design speed is 90 km/h.
b. Use a 3.6-m width if the design speed is 90 km/h.

(5) Shoulder Width. The following will apply:

a. If guardrail is present, the minimum shoulder width is 1.2 m.
b. Usable shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.

(6) Cross Slope (Travel Lanes). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(6A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(7) Clear Zone. The clear zone will vary according to design speed, traffic volumes, side slopes, and horizontal curvature. See Section 49-2.0.

(8) Side Slopes. Values in the tables are for new construction. See Section 45-3.0 and Section 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(9) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(10) Ditch Widths. A V-ditch should be used in a rock cut. See Section 45-8.0

(11) Backslopes. Backslopes for a rock cut will vary according to geotechnical factors and the height of the cut. See Section 45-8.0 for typical rock cut sections.

(11a) Structural Capacity (New or Reconstructed Bridge). A bridge with design year average daily truck traffic (ADTT) greater than 1,000 should be designed for HS 25 live loads. A bridge with an ADTT less than or equal to 1,000 may be designed for HS 25 or HS 20, whichever the LPA elects.

(12) Width (New or Reconstructed Bridge). The following will apply:

a. Where the approach roadway width (travelway plus shoulders) is surfaced, that surfaced width will be carried across the structure.

b. The width each bridge of more than 30 m in length will be analyzed individually. At a minimum, the roadway width of such a bridge will be the width of travel lanes plus a 0.9-m right shoulder and 0.9-m left shoulder for a highway with AADT > 400.

c. See Section 59-1.0 for more information on bridge width.

(13) Width (Existing Bridge to Remain in Place). Clear width will be at least equal to the approach traveled way width or the table values, whichever is greater. For a bridge of more than 30 m in length, the values in the table do not apply. The acceptability of such a bridge will be assessed individually.

(14) Vertical Clearance (Collector Under). Table values include an additional 150 mm allowance for a future pavement overlay. Vertical clearances apply from usable edge to usable edge of shoulders.

(15) Vertical Clearance (Collector Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(16) Superelevation Rate. See Section 43-3.0 for values of superelevation based on design speed and radii.

(17) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. See Section 43-4.0.

(18) Maximum Grades. For a grade less than 150 m in length (PVT to PVC), a one-way downgrade, or a grade on a road with AADT < 400, the maximum grade may be up to 2% steeper than the table value.

(19) Intersection Sight Distance. For left turn onto a 2-lane road. P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element				Manual Section	2-Lane					
Design Controls	Design Year Traffic	AADT		40-2.01	< 50	50 ≤ AADT < 250	250 ≤ AADT < 400	400 ≤ AADT < 1500	1500 ≤ AADT < 2000	≥ 2000
	Design Forecast Year			40-2.02	20 years					
	*Design Speed (km/h) (3)	Level		40-3.0	50 - 90	50 - 90	60 - 90	80 - 90	80 - 90	80 - 90
		Rolling			50 - 90	50 - 90	50 - 90	60 - 90	60 - 90	60 - 90
	Access Control			40-5.0	None					
	Level of Service			40-2.0	Desirable: B; Minimum: D					
Cross Section Elements**	Travel Lane	*Width		45-1.01	3.0 m	3.0 m	3.0 m (4a)	3.3 m	3.3 m(4b)	3.6 m
		Typical Surface Type		Ch. 52	Asphalt / Concrete / Aggregate					
	Shoulder	*Width Usable		45-1.02	0.6 m	0.6 m	0.6 m	1.8 m (5)	1.8 m	2.4 m
		Typical Surface Type		Ch. 52	Asphalt / Aggregate / Earth					
	Cross Slope	*Travel Lane (6)		45-1.01	2%-3% Asphalt / Concrete; 6% Aggregate					
		Shoulder (6A)		45-1.02	Paved Width ≤ 1.2 m: 2% - 3%; Paved Width > 1.2 m: 4% - 6% Asphalt/Concrete; 6%-8% Aggregate; 8% Earth					
	Auxiliary Lanes	Lane Width		45-1.03	Same as Travel Lane			Des: Same as Travel Lane; Min: 3.0 m		
		Shoulder Width			Desirable: 1.2 m; Minimum: 0.6 m					
	Clear Zone			49-2.0	(7)					
	Side Slopes	Cut	Foreslope	45-3.0	4:1 (V > 60) (8); 3:1 (V # 60) (8)					
			Ditch Width		Des: 1.2 m; Min: 0.0 m					
			Backslope		4:1 (V > 60); 3:1 (V # 60) (9)					
		Fill	0-9 m Height	45-3.0	Desirable: 4:1; Maximum: 3:1					
			> 9 m Height		3:1					
Bridges**	New or Reconstructed Bridge	*Structural Capacity		Ch. 60	HS-25 (9a)					
		*Clear Roadway Width (10)		45-4.01	Travelway + 1.2 m			Travelway + 1.8 m		Full Paved Approach Width
	Existing Bridge to Remain in Place	*Structural Capacity		Ch. 72	HS-10	HS-15				
		*Clear Roadway Width (11)		45-4.01	6.0 m		6.6 m		7.2 m	8.4 m
	*Vertical Clearance (Local Road Under)	New or Replaced Overpassing Bridge (12)		44-4.0	4.45 m					
		Existing Overpassing Bridge			4.30 m					
	Vertical Clearance (Local Road Over Railroad) (13)			Ch. 69	7.00 m					

*Controlling design criteria (see Section 40-8.0). ** Selection of the cross section and bridge elements is based on the design-year traffic volumes irrespective of the design speed.
Des: Desirable. Min: Minimum.

GEOMETRIC DESIGN CRITERIA FOR LOCAL RURAL ROAD [1]
(New Construction or Reconstruction)

Table 53-5

Design Element			Manual Section	2-Lane						
Alignment Elements	Design Speed		---	30 km/h	40 km/h	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h
	*Stopping Sight Distance		42-1.0	35 m	50 m	65 m	85 m	105 m	130 m	160 m
	Decision Sight Distance	Speed / Path / Direction Chg.	42-2.0	90 m	120 m	145 m	170 m	200 m	230 m	270 m
		Stop Maneuver		40 m	50 m	70 m	95 m	115 m	140 m	170 m
	Passing Sight Distance		42-3.0	200 m	270 m	345 m	410 m	485 m	540 m	615 m
	Intersection Sight Distance		46-10.0	65 m	85 m	105 m	150 m	150 m	170 m	190 m
	*Minimum Radii (e=8%)		43-2.0	30 m	55 m	85 m	125 m	180 m	230 m	305 m
	*Superelevation Rate		43-3.0	emax=8% (14)						
	*Horizontal Sight Distance		43-4.0	(15)						
	*Vertical Curvature (K-values)	Crest	44-3.0	2	4	7	11	17	26	39
		Sag		6	9	13	18	23	30	38
	*Maximum Grade	Level	44-1.02	8%	7%	7%	7%	7%	6%	5.5%
		Rolling		11%	11%	10%	9%	9%	8%	7%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.0%						

* Controlling design criteria (see Section 40-8.0).

These standards are to be used for each federal-aid funded project agency rural local road classified as new construction or reconstruction. Deviations from controlling Level One design criteria should be covered by a design exception approved by the Chief, Design Division.

GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROAD(1)
(New Construction or Reconstruction)

Table 53-5 (Continued)

GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROAD
(New Construction or Reconstruction)

Footnotes to Table 53-5

(1) Applicability. This table is only applicable to a federal-aid project.

(2) (Blank).

(3) Design Speed. The minimum design speed should equal the minimum value from the table or the anticipated posted speed limit after construction, whichever is greater. The state legal limit is 55 mph on a non-posted highway.

(4) Travel Lane Width. The following will apply:

a. Use 3.3 m lanes where V ≥ 90 km/h.
b. Use 3.6 m lanes where V ≥ 90 km/h.

(5) Shoulder Width. The following will apply:

a. For 400 ≤ AADT < 1500, the shoulder width may be 1.2 m.
b. Usable shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.

(6) Cross Slope (Travel Lanes). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(6A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(7) Clear Zone. The clear zone will vary according to design speed, traffic volumes, side slopes, and horizontal curvature. See Section 49-2.0. For a design speed lower than 80 km/h, a 3.0 m clear zone may be used.

(8) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(9) Backslopes. Backslopes for a rock cut will vary according to geotechnical factors and the height of the cut.

(9a) Structural Capacity (New or Reconstructed Bridge). A bridge with design year average daily truck traffic (ADTT) greater than 1,000 should be designed for HS 25 live loads. A bridge with an ADTT less than or equal to 1,000 may be designed for HS 25 or HS 20, whichever the LPA elects.

(10) Width (New or Reconstructed Bridge). The width of each bridge of more than 30 m in length will be analyzed individually. At a minimum, the roadway width of such a bridge will be the width of travel lanes plus a 0.9-m right shoulder and 0.9-m left shoulder for a highway with AADT > 2000. Where shoulders are paved, it is desirable to provide the full approach roadway width. See Section 59-1.0 for more information on bridge width.

(11) Width (Existing Bridge to Remain in Place). A minimum clear width that is 0.6 m narrower may be used on a road with few trucks. The clear roadway width should be at least the same width as the approach travelway. For a one-lane bridge, the width may be 5.4 m. For a bridge of more than 30 m in length, the values in the table do not apply. The acceptability of such a bridge will be assessed individually.

(12) Vertical Clearance (Local Road Under). Table values include an additional 150 mm allowance for a future pavement overlay. Vertical clearances apply from usable edge to usable edge of shoulders.

(13) Vertical Clearance (Local Road Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(14) Superelevation Rate. See Section 43-3.0 for values of superelevation based on design speed and radii.

(15) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. See Section 43-4.0.

Design Element			Manual Section	Design Values (By Type of Area)		
				Suburban	Intermediate	Built-Up
Design Controls	Design Forecast Year		40-2.02	20 Years	20 Years	20 Years
	*Design Speed (km/h) (1)		40-3.0	Curbed: 70-90 Uncurbed: 80-100	Curbed: 60-80 Uncurbed: 80-90	Curbed: 50-60
	Access Control		40-5.0	Partial Control / None	None	None
	Level of Service		40-2.0	Des: B; Min: C	Des: C; Min: D	Des: C; Min: D
	On-Street Parking		45-1.04	None	Optional (2)	Optional (2)
Cross Section Elements	Travel Lane	*Width (3)	45-1.01	Curbed: 3.6 m Uncurbed: 3.6 m	Curbed: Des.: 3.6 m; Min.: 3.3 m Uncurbed: Des.: 3.6 m; Min.: 3.3 m	Curbed: Des.: 3.6 m; Min.: 3.0 m
		Typical Surface Type (4)	Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (5)		45-1.02	0.6 m	0.6 m	0.6 m
	Shoulder	*Paved Width (6)	45-1.02	Curbed, Rt. Des: 3.0 m; Min 0.6 m Curbed, Lt. Des: 1.2 m; Min 0.6 m Uncurbed, Rt.: 3.0 m; Lt.: 1.2 m	Curbed, Rt. Des: 2.4 m; Min 0.6 m Curbed, Lt. Des: 1.2 m; Min 0.6 m Uncurbed, Rt.: 2.4 m; Lt.: 1.2 m	Right: 1.8 m; Left: 1.2 m
		Typical Surface Type (4)	Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (7)	45-1.01	2%	2%	2%
		Shoulder (7A)	45-1.02	Paved Width ≤ 1.2 m: 2%; Paved Width > 1.2 m: 4%	Paved Width ≤ 1.2 m: 2%; Paved Width > 1.2 m: 4%	Paved Width ≤ 1.2 m: 2%; Paved Width > 1.2 m: 4%
	Auxiliary Lanes	Lane Width	45-1.03	Des: 3.6 m; Min: 3.3 m	Des: 3.6 m; Min: 3.3 m	Des: 3.6 m; Min: 3.0 m
		Curb Offset (8)		0.3 m	0.3 m	0.3 m
		Shoulder Width		Des: 3.0 m; Min: 0.6 m	Des: 2.4 m; Min: 0.6 m	Des: 1.8 m; Min: 0.6 m
		Typical Surface Type (4)	Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	TWLTL Lane Width		46-5.0	Des: 4.8 m; Min. 4.2 m	Des: 4.8 m; Min: 4.2 m	Des: 4.2 m; Min: 3.6 m
	Parking Lane Width		45-1.04	N/A	Des: 3.6 m; Min: 3.0 m (9)	Des: 3.6 m; Min: 3.0 m (9)
	Median Width	Depressed	45-2.0	8.0 m - 15.0 m	N/A	N/A
		Raised Island		Des: 5.4 m; Min: 3.9 m (10)	Des: 5.4 m; Min: 1.2 m (10)	Des: 5.4 m; Min: 1.2 m (10)
		Flush / Corrugated		Des: 4.8 m; Min: 3.9 m (10)	Des: 4.8 m; Min: 1.2 m (10)	Des: 4.8 m; Min: 1.2 m (10)
	Sidewalk Width (11)		45-1.06	1.5 m with 1.5 m Buffer (Des)	1.5 m with 1.5 m Buffer (Des)	Varies; 1.8 m Min
	Bicycle Lane Width (12)		51-7.0	Curbed: 1.5 m Uncurbed: Shld Width +1.2 m	Curbed: 1.5 m Uncurbed: Shld Width +1.2 m	Curbed: 1.5 m
	Clear Zones		49-2.0	(13)	(13)	(13)
	Typical Curbing Type (where used) (14)		45-1.05	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes (Uncurbed) (15)	Cut – Foreslope	45-3.0	6:1 (16)	6:1 (16)	N/A
		Cut – Ditch Width		1.2 m (17)	1.2 m (17)	N/A
		Cut – Backslope		4:1 for 6.0 m; 3:1 Max. to Top (18)	4:1 for 6.0 m; 3:1 Max. to Top (18)	N/A
		Fill		6:1 to Clear Zone; 3:1 Max. to Toe	6:1 to Clear Zone; 3:1 Max. to Toe	N/A
	Side Slopes (Curbed)	Cut (Backslope)	45-3.0	(19)	(19)	(19)
		Fill		12:1 for 3.6 m; 3:1 Max. to Toe	12:1 for 3.6 m; 3:1 Max. to Toe	12:1 for 3.6 m; 3:1 Max. to Toe
	Median Slopes (Depressed)		45-2.0	Des: 8:1; Max: 5:1	N/A	N/A

*Controlling design criteria (see Section 40-8.0). Des: Desirable. Min: Minimum.

GEOMETRIC DESIGN CRITERIA FOR MULTI-LANE URBAN ARTERIAL
(New Construction or Reconstruction)

Table 53-6

Design Element			Manual Section	Design Values (By Type of Area)				
				Suburban	Intermediate		Built-Up	
Bridges	New or Reconstructed Bridge	*Structural Capacity (20)	Ch. 60	HS-25	HS-25		HS-25	
		*Clear Roadway Width(21)	45-4.01	Uncurbed: Full Paved Approach Width Curbed: Full Approach Curb-to-Curb Width				
	Existing Bridge to Re-main in Place	*Structural Capacity	Ch.72	HS-20	HS-20		HS-20	
		*Clear Roadway Width	45-4.01	Uncurbed: Travelway Plus 0.6 m on Each Side; Curbed: Full Approach Curb-to-Curb Width				
	*Vertical Clearance (Arterial Under) (22)	New or Replaced Overpassing Bridge (22a)	44-4.0	5.05 m	5.05 m (22b)		5.05 m (22b)	
		Existing Overpassing Bridge		4.30 m	4.30 m		4.30 m	
		Sign Truss / Pedestrian Bridge (22a)		New: 5.35 m; Existing: 5.20 m	New: 5.35 m; Existing: 5.20 m		New: 5.35 m; Existing: 5.20 m	
	Vertical Clearance (Arterial over Railroad) (23)		Ch. 69	7.00 m				
Alignment Elements	Design Speed			50 km/h	60 km/h	70 km/h	80 km/h	90 km/h
	*Stopping Sight Distance		42-1.0	65 m	85 m	105 m	130 m	160 m
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 195 m SU: 170 m	U: 235 m SU: 205 m	U: 275 m SU: 235 m	U: 315 m SU: 270 m	U: 360 m SU: 315 m
		Stop Maneuver		155 m	195 m	235 m	280 m	325 m
	Intersection Sight Distance, -3% to +3% (28)		46-10.0	P: 105 m SU: 135 m	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 190 m SU: 235 m	P: 230 m SU: 280 m
	*Minimum Radii for e_{max} =4% / 6%		43-2.0	80 m / 75 m (24a)	130 m/120 m (24a)	185 m/170 m (24a)	230 m (24b)	305 m (24b)
	*Superelevation Rate (25)		43-3.0	Up to e_{max} = 6%			e_{max}=8%	
	*Horizontal Sight Distance		43-4.0	(26)				
	*Vertical Curvature (K-values)	Crest	44-3.0	7	11	17	26	39
		Sag		13	18	23	30	38
	*Maximum Grade (27)	Level	44-1.02	8%	7%	6.5%	6%	5.5%
		Rolling		9%	8%	7.5%	7%	6.5%
	Minimum Grade		44-1.03	Desirable: 0.5% Minimum: 0.3% (Curbed); 0.0% (Uncurbed)				

* Controlling design criteria (see Section 40-8.0). U: Urban; SU: Suburban
Refer to note at bottom of Table 53-2 for approval authority for Level One design exceptions.

GEOMETRIC DESIGN CRITERIA FOR MULTI-LANE URBAN ARTERIAL
(New Construction or Reconstruction)

Table 53-6 (Continued)

GEOMETRIC DESIGN CRITERIA FOR MULTI-LANE URBAN ARTERIAL
(New Construction or Reconstruction)
Footnotes to Table 53-6

(1) Design Speed. The minimum design speed should equal a) the minimum value from the table, b) the anticipated posted speed limit after construction, or c) the state legal limit on a non-posted highway. The legal limit in an urban district is 50 km/h. Based on an engineering study, these speeds may be raised to an absolute max. of 90 km/h.

(2) On-Street Parking. In general, on-street parking is discouraged.

(3) Travel Lane Width. For an arterial on the National Truck Network, the right lane must be 3.6 m in width.

(4) Surface Type. The pavement type selection will be determined by the INDOT Pavement Design Engineer.

(5) Curb Offset. The curb offset (for both left and right) should be 0.6 m. Vertical curbs introduced intermittently should be offset 0.6 m

(6) Shoulder Width. The table values apply to paved shoulder widths. The following will also apply:

a. For an uncurbed section, the shoulder is paved to the face of guardrail. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. See Section 49-5.0 for more information.
b. For an uncurbed section, a desirable additional 0.3 m of compacted aggregate will be provided.
c. For a curbed section, the curb offset is included in the paved shoulder width.

(7) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable for an existing bridge to remain in place.

(7A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(8) Curb Offset for Auxiliary Lane. In a curbed section, the offset may be zero.

(9) Parking Lane. Where the parking lane will be used as a travel lane during peak hours or may be converted to a travel lane in the future, the width should be equal to the travel lane width plus a 0.3 m offset to the curb (if present). The cross slope for a parking lane is typically 1% steeper than the adjacent travel lane.

(10) Minimum Median Width. The criteria in the table assume the presence of a mountable curb with a 0.0-m curb offset.

(11) Sidewalk Width. A buffer of less than 0.6 m wide is not permitted. If no buffer is provided, the sidewalk width should be 1.8 m.

(12) Bicycle Lane Width. The widths in the table are in addition to the width of a parking lane, if present. See Section 51-7.0 for additional details.

(13) Clear Zones. The following will apply:

a. Facility with Vertical Curbs. The clear zone will be measured from the edge of travel lane or will be to the right-of-way line, whichever is less. No clear zone is required where there is 24-hour parking.

b. Facility with Sloping Curbs or without Curbs. The clear zone will vary according to design speed, traffic volumes, side slopes and horizontal curvature.

c. Curbed Facility. There should be an appurtenance-free area as measured from the gutter line of any curb.

d. Values. See Section 49-2.0 for specific clear zone values.

Footnotes to Table 53-6 continued

(14) Curbing Type. Vertical curbs may only be used with design speed lower than 80 km/h.

(15) Side Slopes (Uncurbed). Values in the table are for new construction. See Section 45-3.0 and Section 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(16) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(17) Ditch Widths. In rock cuts, a V ditch should be used. See Section 45-8.0.

(18) Backslopes. Backslopes for rock cuts will vary according to the height of the cut and geotechnical factors. See Section 45-8.0 for typical rock cut sections.

(19) Side Slopes (Curbed) Cut. Typically, a shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf will be 1.8 m. Where a sidewalk is present, the toe of the backslope will typically be 0.3 m beyond the edge of sidewalk. See Section 45-3.0 for more information.

(20) Structural Capacity (New or Reconstructed Bridge). The following will apply:

a. Each bridge on a facility with greater than 600 trucks per day should be checked using the Alternate Military loading.
b Each State highway bridge within 25 km of a Toll Road gate must be designed for Toll Road Loading.
c. Each bridge on an Extra Heavy Duty Highway must be designed for the Michigan Train truck loading configuration.
d. See Chapter Sixty for additional information on the loading configurations.

(21) Width (New or Reconstructed Bridge). See Section 59-1.0 for more information on bridge widths.

(22) Vertical Clearance (Arterial Under Railroad). The following will apply:

a. Table values include an additional 150-mm allowance for future pavement overlays.
b. In a highly urbanized area, a minimum clearance of 4.30 m may be provided if there is at least one route with a 4.90-m clearance.
c. Vertical clearances apply from usable edge to usable edge of shoulder.

(23) Vertical Clearance (Arterial Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(24) Minimum Radii. The following will apply:
a. Based on e_{max} = 4% or 6% and low-speed urban street conditions.
b. Based on e_{max} = 8% and open-road conditions.

(25) Superelevation Rate. See Section 43-3.0 for values of superelevation based on design speed and radii. See Section 43-3.0 and the INDOT *Standard Drawings* for information on superelevation requirements.

(26) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. Sometimes the SSD values for trucks will apply. See the discussion in Section 43-4.0.

(27) Where adjacent sidewalks are present, the maximum desirable grade is 5%.

(28) Intersection Sight Distance. For left turn onto a 2-lane road. P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element				Manual Section	Design Values (By Type of Area)		
					Suburban	Intermediate	Built-up
Design Controls	Design Forecast Year			40-2.02	20 Years	20 Years	20 Years
	*Design Speed (km/h) (1)			40-3.0	Curbed: 60-90 Uncurbed: 70-90	Curbed: 60-80 Uncurbed: 70-80	Curbed: 50-60
	Access Control			40-5.0	Partial Control / None	None	None
	Level of Service			40-2.0	Des: B; Min: C	Des: C; Min: D	Des: C; Min: D
	On-Street Parking			45-1.04	None	Optional (2)	Optional (2)
Cross Section Elements	Travel Lane	*Width (3)		45-1.01	Curbed: 3.6 m Uncurbed: 3.6 m	Curbed: Des.: 3.6 m; Min.: 3.3 m Uncurbed: 3.6 m	Curbed: Des.: 3.6 m; Min.: 3.3 m
		Typical Surface Type (4)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (5)			45-1.02	0.6 m	0.6 m	0.6 m
	Shoulder	*Paved Width (6)		45-1.02	Curbed Des: 3.0 m; Min. 0.6 m Uncurbed: 3.0 m	Curbed: Des: 2.4 m; Min: 0.6 m Uncurbed: 2.4 m;	1.8 m
		Typical Surface Type (4)		Ch 52.	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (7)		45-1.01	2%	2%	2%
		Shoulder (7A)		45-1.02	4%	4%	4%
	Auxiliary Lanes	Lane Width		45-1.03	Des: 3.6 m; Min: 3.3 m	Des: 3.6 m; Min: 3.3 m	Des: 3.3 m; Min: 3.0 m
		Curb Offset (8)			0.3 m	0.3 m	0.3 m
		Shoulder Width			Des: 3.0 m; Min: 0.6 m	Des: 2.4 m; Min: 0.6 m	Des: 1.8 m; Min: 0.6 m
		Typical Surface Type (4)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	TWLTL Lane Width			46-5.0	Des: 4.8 m; Min. 4.2 m	Des: 4.8 m; Min: 4.2 m	Des: 4.2 m; Min: 3.6 m
	Parking Lane Width			45-1.04	N/A	Des: 3.6 m; Min: 3.0 m (9)	Des: 3.6 m; Min: 3.0 m (9)
	Sidewalk Width (10)			45-1.06	1.5 m with 1.5 m Buffer (Des)	1.5 m with 1.5 m Buffer (Des)	Varies; 1.8 m Min
	Bicycle Lane Width (11)			51.7.0	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m
	Clear Zones			49-2.0	(12)	(12)	(12)
	Typical Curbing Type (where used) (13)			45-1.05	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes (Uncurbed) (14)	Cut	Foreslope	45-3.0	6:1 (15)	6:1 (15)	N/A
			Ditch Width		1.2 m (16)	1.2 m (16)	N/A
			Backslope		4:1 for 6.0 m; 3:1 Max. to Top (17)	4:1 for 6.0 m; 3:1 Max. to Top (17)	N/A
		Fill			6:1 to Clear Zone; 3:1 Max. to Toe	6:1 to Clear Zone; 3:1 Max. to Toe	N/A
	Side Slopes (Curbed)	Cut (Backslope)		45-3.0	(18)	(18)	(18)
		Fill			12:1 for 3.6 m; 3:1 Max. to Toe	12:1 for 3.6 m; 3:1 Max. to Toe	12:1 for 3.6 m; 3:1 Max. to Toe

*Controlling design criteria (see Section 40-8.0). Des: Desirable; Min. Minimum.

GEOMETRIC DESIGN CRITERIA FOR TWO-LANE URBAN ARTERIAL
(New Construction or Reconstruction)

Table 53-7

Design Element			Manual Section	Design Values (By Type of Area)				
				Suburban	Intermediate	Built-Up		
Bridges	New or Reconstructed Bridge	*Structural Capacity (19)	Ch. 60	HS-25	HS-25	HS-25		
		*Clear Roadway Width(20)	45-4.01	Uncurbed: Full Paved Approach Width Curbed: Full Approach Curb-to-Curb Width				
	Existing Bridge to Re-main in Place	*Structural Capacity	Ch. 72	HS-20	HS-20	HS-20		
		*Clear Roadway Width	45-4.0	Uncurbed: Travelway Plus 0.6 m on Each Side; Curbed: Full Approach Curb-to-Curb Width				
	*Vertical Clearance (Arterial Under) (21)	New or Replaced Overpassing Bridge (21a)	44-4.0	5.05 m	5.05 m (21b)	5.05 m (21b)		
		Existing Overpassing Bridge		4.30 m	4.30 m	4.30 m		
		Sign Truss / Pedestrian Bridge (21a)		New: 5.35 m; Existing: 5.20 m	New: 5.35 m; Existing: 5.20 m	New: 5.35 m; Existing: 5.20 m		
	Vertical Clearance (Arterial over Railroad) (22)		Ch. 69	7.00 m				
Alignment Elemets	Design Speed			50 km/h	60 km/h	70 km/h	80 km/h	90 km/h
	*Stopping Sight Distance		42-1.0	65 m	85 m	105 m	130 m	160 m
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 195 m SU: 170 m	U: 235 m SU: 205 m	U: 275 m SU: 235 m	U: 315 m SU: 270 m	U: 360 m SU: 315 m
		Stop Maneuver		155 m	195 m	235 m	280 m	325 m
	Intersection Sight Distance, -3% to +3% (27)		46-10.0	P: 105 m SU: 135 m	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 190 m SU: 235 m	P: 230 m SU: 280 m
	*Minimum Radii for e_{max} = 4% / 6%		43-2.0	80 m / 75 m (23a)	130 m / 120 m (23a)	185 m /170 m (23a)	230 m (23b)	305 m (23b)
	*Superelevation Rate (24)		43-3.0	Up to e_{max}=6%			e_{max}=8%	
	*Horizontal Sight Distance		43-4.0	(25)				
	*Vertical Curvature (K-values)	Crest	44-3.0	7	11	17	26	39
		Sag		13	18	23	30	38
	*Maximum Grade	Level	44-1.02	8%	7%	6.5%	6%	5.5%
		Rolling		9%	8%	7.5%	7%	6.5%
	Minimum Grade (26)		44-1.03	Desirable: 0.5% Minimum: 0.3% (Curbed); 0.0% (Uncurbed)				

* Controlling design criteria (see Section 40-8.0). U: Urban; SU: Suburban.
See notes at bottom of Table 53-2 for approval authority for Level One design exception requests.

GEOMETRIC DESIGN CRITERIA FOR TWO-LANE URBAN ARTERIAL (New Construction or Reconstruction)

Table 53-7 (Continued)

GEOMETRIC DESIGN CRITERIA FOR TWO-LANE URBAN ARTERIAL
(New Construction or Reconstruction)
Footnotes to Table 53-7

(1) Design Speed. The minimum design speed should equal a) the minimum value from the table, b) the anticipated posted speed limit after construction or c) the state legal limit on a non-posted highway. The legal limit in an urban district is 50 km/h. Based upon an engineering study, these speeds may be raised to an absolute maximum of 90 km/h.

(2) On-Street Parking. In general, on-street parking is discouraged.

(3) Travel Lane Width. For an arterial on the National Truck Network, lane widths must be 3.6 m.

(4) Surface Type. The pavement type selection will be determined by the INDOT Pavement Design Engineer.

(5) Curb Offset. The curb offset should be 0.6 m. Vertical curbs introduced intermittently should be offset 0.6 m.

(6) Shoulder Width. The table values apply to paved shoulder widths. The following will also apply:

a. For an uncurbed section, the shoulder is paved to the face of guardrail. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. See Section 49-5.0 for more information.
b. For an uncurbed section, a desirable additional 0.3 m of compacted aggregate will be provided.
c. For a curbed section, the curb offset is included in the paved shoulder width.

(7) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(7A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(8) Curb Offset for Auxiliary Lane. In a curbed section, the offset may be zero.

(9) Parking Lane. Where the parking lane will be used as a travel lane during peak hours or may be converted to a travel lane in the future, the width should be equal to the travel lane width plus a 0.3 m offset to the curb (if present). The cross slope for a parking lane is typically 1% steeper than the adjacent travel lane.

(10) Sidewalk Width. A buffer of less than 0.6 m wide is not permitted. If no buffer is provided, the sidewalk width should be 1.8 m.

(11) Bicycle Lane Width. The widths in the table are in addition to the width of a parking lane, if present. See Section 51-7.0 for additional details.

(12) Clear Zones. The following will apply:

a. Facility with Vertical Curbs. The clear zone will be measured from the edge of travel lane or will be to the right-of-way line, whichever is less. No clear zone is required where there is 24-hour parking.
b. Facility with Sloping Curbs or without Curbs. The clear zone will vary according to design speed, traffic volumes, side slopes and horizontal curvature.
c. Curbed Facility. There should be an appurtenance-free area as measured from the gutter line of any curb.
d. Values. See Section 49-2.0 for specific clear zone values.

(13) Curbing Type. Vertical curbs may only be used with design speed lower than 80 km/h.

(14) Side Slope (Uncurbed). Values in the table are for new construction. See Section 45-3.0 and Section 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(15) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(16) Ditch Width. In a rock cut, a V ditch should be used. See Section 45-8.0.

(17) Backslope. The backslope for a rock cut will vary according to the height of the cut and geotechnical factors. See Section 45-8.0 for typical rock cut sections.

(18) Side Slope (Curbed) Cut. Typically, a shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf will be 1.8 m. Where a sidewalk is present, the toe of the backslope will typically be 0.6 m beyond the edge of sidewalk. See Section 45-3.0 for more information.

(19) Structural Capacity (New or Reconstructed Bridge). The following will apply:

a. Each bridge on a facility with greater than 600 trucks per day should be checked using the Alternate Military loading.
b. Each State highway bridge within 25 km of a Toll Road gate must be designed for Toll Road Loading.
c. Each bridge on an Extra Heavy Duty Highway must be designed for the Michigan Train truck loading configuration.
d. See Chapter Sixty for additional information on the loading configurations.

(20) Width (New or Reconstructed Bridge). See Section 59-1.0 for more information on bridge width.

(21) Vertical Clearance (Arterial Under Railroad). The following will apply:

a. Table values include an additional 150 mm allowance for future pavement overlays.
b. In a highly urbanized area, a minimum clearance of 4.30 m may be provided if there is at least one route with a 4.90-m clearance.
c. Vertical clearances apply from usable edge to usable edge of shoulder.

(22) Vertical Clearance (Arterial Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(23) Minimum Radii. The following will apply:

a. Based on e_{max} = 4% or 6% and low-speed urban street conditions.
b. Based on e_{max} = 8% and open-road conditions.

(24) Superelevation Rate. See Section 43-3.0 for values of superelevation based on design speed and radius. See Section 43-3.0 and the INDOT *Standard Drawings* for information on superelevation requirements.

(25) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. Sometimes the SSD values for trucks will apply. See the discussion in Section 43-4.0.

(26) Where adjacent sidewalks are present, the maximum desirable grade is 5%.

(27) Intersection Sight Distance. For left turn onto a 2-lane road. P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element				Manual Section	Design Values (By Type of Area)		
					Suburban	Intermediate	Built-Up
Design Controls	Design Forecast Year			40-2.02	20 Years	20 Years	20 Years
	*Design Speed (km/h) (2)			40-3.0	Curbed: 50-80 Uncurbed: 50-80	Curbed: 50-70 Uncurbed: 50-70	Curbed: 50-60
	Access Control			40-5.0	None	None	None
	Level of Service			40-2.0	Desirable: C; Minimum: D	Desirable: C; Minimum: D	Desirable: C; Minimum: D
	On-Street Parking			45-1.04	Optional (3)	Optional (3)	Optional (3)
Alignment Elements	Travel Lane	*Width (4)		45-1.01	Curbed: Des: 3.6 m; Min: 3.3 m Uncurbed: Des: 3.6 m; Min: 3.3 m	Curbed: Des: 3.6 m; Min: 3.3 m Uncurbed: Des: 3.6 m; Min: 3.3 m	Curbed: Des: 3.6 m; Min: 3.0 m
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (6)			45-1.02	0.6 m	0.6 m	0.6 m
	Shoulder	*Paved Width (7)		45-1.02	Curbed Des: 2.4 m; Min. 0.6 m Uncurbed: 2.4 m	Curbed: Des: 1.8 m; Min: 0.6 m Uncurbed: 1.8 m	1.2 m
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (8)		45-1.01	2%	2%	2%
		Shoulder (8A)		45-1.02	4%	4%	2%
	Auxiliary Lanes	Lane Width		45-1.03	Des: 3.6 m; Min: 3.3 m	Des: 3.6 m; Min: 3.0 m	Des: 3.6 m; Min: 3.0 m
		Curb Offset			Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m
		Shoulder Width			Des: 2.4 m; Min: 0.6 m	Des: 1.8 m; Min: 0.6 m	Des: 1.2 m; Min: 0.6 m
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	TWLTL Lane Width			46-5.0	Des: 4.8 m; Min: 3.6 m	Des: 4.2 m; Min: 3.6 m	Des: 4.2 m; Min: 3.6 m
	Parking Lane Width (1)			45-1.04	Des: 3.0 m; Min: 2.4 m	Des: 3.0 m; Min: 2.4 m	Des: 3.0 m; Min: 2.4 m
	Median Width	Raised Island		45-2.0	Des: 5.4 m; Min: 1.2 m (9)	Des: 5.4 m; Min: 1.2 m (9)	Des: 5.4 m; Min: 1.2 m (9)
		Flush / Corrugated			Des: 4.8 m; Min: 1.2 m (9)	Des: 4.8 m; Min: 1.2 m (9)	Des: 4.8 m; Min: 1.2 m (9)
	Sidewalk Width (10)			45-1.06	1.5 m with 1.5 m Buffer (Des)	1.5 m with 1.5 m Buffer (Des)	Varies, 1.8 m Min
	Bicycle Lane Width (11)			51-7.0	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m
	Clear Zones			49-2.0	(12)	(12)	(12)
	Typical Curbing Type (where used) (13)			45-1.05	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes (Uncurbed) (14)	Cut	Foreslope	45-3.0	Des: 6:1; Max: 4:1 (15)	Des: 6:1; Max: 4:1 (15)	N/A
			Ditch Width		1.2 m (16)	1.2 m (16)	N/A
			Backslope		4:1 for 1.2 m; 3:1 Max. to Top (17)	4:1 for 1.2 m; 3:1 Max. to Top (17)	N/A
		Fill			Des: 6:1 to Clr Zone; 3:1 Max to Toe Max: 4:1 to Clr Zone; 3:1 Max to Toe	Des: 6:1 to Clr Zone; 3:1 Max to Toe Max: 4:1 to Clr Zone; 3:1 Max to Toe	N/A
	Side Slopes (Curbed)	Cut(Backslope)		45-3.0	(18)	(18)	(18)
		Fill (19)			12:1 for 3.6 m; 3:1 Max to Toe	12:1 for 3.6 m; 3:1 Max to Toe	12:1 for 3.6 m; 3:1 Max to Toe

* Controlling design criteria (see Section 40-8.0). Des: Desirable; Min: Minimum.

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR
(New Construction or Reconstruction)

Table 53-8

Design Element			Manual Section	Design Values (By Type of Area)			
				Suburban	Intermediate		Built-Up
Bridges	New or Reconstructed Bridge	*Structural Capacity (20)	Ch. 60	HS-25	HS-25		HS-25
		*Clear Roadway Width(21)	45-4.01	Uncurbed: Full Paved Approach Width Curbed: Full Approach Curb-to-Curb Width			
	Existing Bridge to Remain in Place	*Structural Capacity	Ch. 72	HS-20	HS-20		HS-20
		*Clear Roadway Width	45-4.01	Uncurbed: Travelway Plus 0.6 m on Each Side Curbed: Full Approach Curb-to-Curb Width			
	*Vertical Clearance (Collector) (22)	New or Replaced Overpassing Bridge (22)	44-4.0	4.45 m	4.45 m		4.45 m
		Existing Overpassing Bridge		4.30 m	4.30 m		4.30 m
	Vertical Clearance (Collector over Railroad) (23)		Ch. 69	7.00 m			
Alignment Element	Design Speed			50 km/h	60 km/h	70 km/h	80 km/h
	*Stopping Sight Distance		42-1.0	65 m	85 m	105 m	130 m
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 195 m SU: 170 m	U: 235 m SU: 205 m	U: 275 m SU: 235 m	U: 315 m SU: 270 m
		Stop Maneuver		155 m	195 m	235 m	280 m
	Intersection Sight Distance, -3% to +3% (28)		46-10.0	P: 105 m SU: 135 m	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 190 m SU: 235 m
	*Minimum Radii for e_{max} = 4% / 6%		43-2.0	80 m/75 m (24a)	130 m/120 m (24a)	185 m/170 m (24a)	230 m (24b)
	*Superelevation Rate (25)		43-3.0	Up to emax = 6%			emax = 8%
	*Horizontal Sight Distance		43-4.0	(26)			
	*Vertical Curvature (K-values)	Crest	44-3.0	7	11	17	26
		Sag		13	18	23	30
	*Maximum Grade (27)	Level	44-1.02	9%	9%	8%	7%
		Rolling		11%	10%	9%	8%
	Minimum Grade		44-1.03	Desirable: 0.5% Minimum: 0.3% (Curbed); 0.0% (Uncurbed)			

* Controlling design criteria (see Section 40-8.0). U: Urban; SU: Suburban.
See note at bottom of Table 53-3 for Level One design criteria exception approval authority for a state urban collector.
See note at bottom of Table 53-4 for Level One design criteria exception approval authority for a federally-funded local agency urban collector.

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR
(New Construction or Reconstruction)

Table 53-8 (Continued)

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR
(New Construction or Reconstruction)
Footnotes to Table 53-8

(1) Parking Lane. In a residential area, a parallel parking lane from 2.1 to 2.4 m in width should be provided on one or both sides of the street. In a commercial or industrial area, parking lane widths should range from 2.4 to 3.3 m, and should usually be provided on both sides of the street. Where a curb-and-gutter section is used, the gutter pan width may be considered as part of the parking lane width. Where practical, the parking lane width should be in addition to the gutter pan width.

(2) Design Speed. The minimum design speed should equal a) the minimum value from the table, b) the anticipated posted speed limit after construction, or c) the state legal limit on a non-posted highway. The legal limit in an urban district is 50 km/h. Based upon an engineering study, these speeds may be raised to an absolute maximum of 90 km/h.

(3) On-Street Parking. In general, on-street parking is discouraged.

(4) Travel Lane Width. In an industrial area, a 3.6-m travel lane should be used. Where right-of-way is restricted, 3.0-m lanes can be used in a residential area, and 3.3-m lanes can be used in an industrial area. On a multi-lane facility in a built-up area, the minimum width is 3.0 m.

(5) Surface Type. The pavement type selection will be determined by the INDOT Pavement Design Engineer for a State highway.

(6) Curb Offset. The curb offset should be 0.6 m. Vertical curbs introduced intermittently should be offset 0.6 m.

(7) Shoulder Width. The table values apply to paved shoulder widths. The following will also apply:

a. For an uncurbed section, the shoulder is paved to the face of guardrail. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. See Section 49-5.0 for more information.
b. For an uncurbed section, a desirable additional 0.3 m of compacted aggregate will be provided.
c. For a curbed section, the curb offset is included in the paved shoulder width.

(8) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(8A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(9) Minimum Median Width. The criteria in the table assume the presence of mountable curbs with a 0.0-m curb offset.

(10) Sidewalk Width. A buffer of less than 0.6 m wide is not permitted. If no buffer is provided, the sidewalk width should be 1.8 m.

(11) Bicycle Lane Width. The widths in the table are in addition to the width of a parking lane, if present. See Section 51-7.0 for additional details.

(12) Clear Zones. The following will apply:

a. Facility with Vertical Curbs. The clear zone will be measured from the edge of travel lane or will be to the right-of-way line, whichever is less. No clear zone is required where there is 24-hour parking.

b. Facility with Sloping Curbs or without Curbs. The clear zone will vary according to design speed, traffic volumes, side slopes and horizontal curvature.

c. Curbed Facility. There should be an appurtenance-free area as measured from the gutter line of any curb.

d. Values. See Section 49-2.0 for specific clear zone values

(13) Curbing Type. Vertical curbs may only be used with a design speed lower than 80 km/h.

(14) Side Slopes (Uncurbed). Values in the table are for new construction. See Section 45-3.0 and Section 45-8.0 for more information. For a reconstruction project, see Section 49-3.0.

(15) Foreslope. See Sections 49-2.0 and 49-3.0 for the lateral extent of the foreslope in a ditch section.

(16) Ditch Width. In a rock cut, a V ditch should be used. See Section 45-8.0.

(17) Backslope. The backslope for a rock cut will vary according to the height of the cut and geotechnical factors. See Section 45-8.0 for typical rock cut sections.

(18) Side Slope (Curbed) Cut. Typically, a shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf will be 1.8 m. Where a sidewalk is present, the toe of the backslope will typically be 0.3 m beyond the edge of sidewalk. See Section 45-3.0 for more information.

(19) Side Slope (Curbed) Fill. If no sidewalks are present or planned, the lateral extent of the 12:1 slope may be reduced to 1.2 m.

(20) Structural Capacity (New or Reconstructed Bridge). The following will apply:

a. Each bridge on a facility with greater than 600 trucks per day should be checked using the Alternate Military loading.
b. Each State highway bridge within 25 km of a Toll Road gate must be designed for Toll Road Loading.
c. Each bridge on an Extra Heavy Duty Highway must be designed for the Michigan Train truck loading configuration.
d. See Chapter Sixty for additional information on the loading configurations.

(21) Width (New or Reconstructed Bridge). See Section 59-1.0 for more information on bridge width.

(22) Vertical Clearance (Collector Under Railroad). Table values include an additional 150-mm allowance for future pavement overlays. Vertical clearances apply from usable edge to usable edge of shoulder.

(23) Vertical Clearance (Collector Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(24) Minimum Radii. The following will apply:

a. Based on e_{max} = 4% or 6% and low-speed urban street conditions.
b. Based on e_{max} = 8% and open-road conditions.

(25) Superelevation Rate. See Section 43-3.0 for values of superelevation based on design speed and radii. See Section 43-3.0 and the INDOT *Standard Drawings* for information on superelevation requirements.

(26) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. See the discussion in Section 43-4.0.

(27) Maximum Grades. For a grade less than 150 m in length (PVT to PVC), a one-way downgrade, or a street with AADT < 400, the maximum grade may be 2% steeper than table value. Where adjacent sidewalks are present, the maximum desirable grade is 5%.

(28) Intersection Sight Distance. For left turn onto a 2-lane road. P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element			Manual Section	Design Values (By Type of Area)		
				Suburban	Intermediate	Built-Up
Design Controls	Design Forecast Year		40-2.02	20 Years	20 Years	20 Years
	*Design Speed (km/h) (2)		40-3.0	Curbed: 50-60 Uncurbed: 50-70	Curbed: 50-60 Uncurbed: 50-60	Curbed: 40-60
	Access Control		40-5.0	None	None	None
	Level of Service		40-2.0	Desirable: C; Minimum: D	Desirable: C; Minimum: D	D
	On-Street Parking		45-1.04	Optional (3)	Optional (3)	Optional (3)
Cross Section Elements	Travel Lane	*Width (4)	45-1.01	Curbed: 3.3 m Uncurbed: 3.3 m	Curbed: 3.0 m Uncurbed: 3.3 m	Curbed: 3.0 m
		Typical Surface Type	Chp. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (5)		45-1.02	0.6 m	0.6 m	0.6 m
	Shoulder	*Usable Width	45-1.02	Curbed Des: 1.2 m; Min. 0.6 m Uncurbed: Des: 1.2 m; Min. 0.6 m	Curbed Des: 1.2 m; Min. 0.6 m Uncurbed: Des: 1.2 m; Min. 0.6 m	Des: 1.2 m; Min: 0.6 m
		Typical Surface Type	Chp. 52	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth
	Cross Slope	*Travel Lane (6)	45-1.01	2%	2%	2%
		Shoulder	45-1.02	2%-6% Asph. / Conc.; 6%-8% Aggr.; 8% Earth	2%-6% Asph. / Conc.; 6%-8% Aggr.; 8% Earth	2%-6% Asph. / Conc.; 6%-8% Aggr.; 8% Earth
	Auxiliary Lanes	Lane Width	45-1.03	Des: 3.3 m; Min: 3.0 m	Des: 3.3 m; Min: 3.0 m	3.0 m
		Curb Offset		Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m
		Shoulder Width		Des: 1.2 m; Min: 0.6 m	Des: 1.2 m; Min: 0.6 m	Des: 1.2 m; Min: 0.6 m
		Typical Surface Type	Chp. 52	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth
	Parking Lane Width (1)		45-1.04	Des: 2.7 m; Min: 2.4 m	Des: 2.7 m; Min: 2.4 m	Des: 2.7 m; Min: 2.4 m
	Sidewalk Width (7)		45-1.06	1.5 m with 1.5 m Buffer (Des)	1.5 m with 1.5 m Buffer (Des)	Varies, 1.8 m Min
	Bicycle Lane Width (8)		51-7.0	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m
	Clear Zones		49-2.0	(9)	(9)	(9)
	Typical Curbing Type (where used) (9c)		45-1.05	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes (Uncurbed)	Cut – Foreslope	45-3.0	3:1 Max	3:1 Max	N/A
		Cut – Ditch Width		Des: 1.2 m; Min: 0.0 m	Des: 1.2 m; Min: 0.0 m	N/A
		Cut – Backslope		3:1 Max (10)	3:1 Max. (10)	N/A
		Fill		3:1 Max	3:1 Max.	N/A
	Side Slopes (Curbed)	Cut (Backslope)	45-3.0	(11)	(11)	(11)
		Fill (12)		12:1 for 3.6 m; 3:1 Max to Toe	12:1 for 3.6 m; 3:1 Max to Toe	12:1 for 3.6 m; 3:1 Max to Toe

* Controlling design criteria (see Section 40-8.0).
** Table applies only to projects with Federal-aid funds.
Des: Desirable; Min: Minimum.

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL STREET **
(New Construction or Reconstruction)

Table 53-9

Design Element			Manual Section	Design Values (By Type of Area)				
				Suburban	Intermediate	Built-Up		
Bridges	New or Reconstructed Bridge	*Structural Capacity	Ch. 60	HS-25(12a)	HS-25(12a)	HS-25(12a)		
		*Clear Roadway Width	45-4.01	Curbed: Full Approach Curb-to-Curb Width Uncurbed: (13)				
	Existing Bridge to Re-main in Place	*Structural Capacity	Ch. 72	HS-20	HS-20	HS-20		
		*Clear Roadway Width	45-4.01	Existing Width (14)				
	*Vertical Clearance (Local Under) (15)	New or Replaced Overpassing Bridge (15)	44-4.0	4.45 m	4.45 m	4.45 m		
		Existing Overpassing Bridge		4.30 m	4.30 m	4.30 m		
	Vertical Clearance (Local over Railroad) (16)		Ch. 69	7.00 m				
Alignment Elements	Design Speed			30 km/h	40 km/h	50 km/h	60 km/h	70 km/h
	*Stopping Sight Distance	Desirable	42-1.0	35	50 m	65 m	85 m	105 m
	Decision Sight Distance	Speed / Path / DirectionChange	42-2.0	U: 120 m SU: 100 m	U: 160 m SU: 130 m	U: 195 m SU: 170 m	U: 235 m SU: 205 m	U: 275 m SU: 235 m
		Stop Maneuver		90 m	130 m	155 m	195 m	235 m
	Intersection Sight Distance, -3% to +3% (22)		46-10.0	P: 65 m SU: 80 m	P: 85 m SU: 110 m	P: 105 m SU: 135 m	P: 125 m SU: 160 m	P: 150 m SU: 185 m
	*Minimum Radii		43-2.0	20 m (17)	45 m (17)	80 m (17)	130 m (17)	185 m (17)
	*Superelevation Rate (18)		43-3.0	e_{max} = 4%				
	*Horizontal Sight Distance		43-4.0	(19)				
	*Vertical Curvature (K-values)	Crest	44-3.0	2	4	7	11	17
		Sag		6	9	13	18	23
	*Maximum Grade (20)	Level	44-1.02	10%	10%	10%	9%	8%
		Rolling		15%	11%	11%	10.5%	10%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.3% (Curbed) (21) 0.0% (Uncurbed)				

* Controlling design criteria (see Section 40-8.0). U: Urban; SU: Suburban.
** Table applies only to a project with federal-aid funds.

See note at bottom of Table 53-4 for Level One design criteria exception approval authority for a federally-funded urban local street.

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL STREET **
(New Construction or Reconstruction)

Table 53-9 (Continued)

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL STREET
(New Construction or Reconstruction)
Footnotes to Table 53-9

(1) Parking Lanes. In a residential area, the minimum width is 2.1 m. In a commercial or industrial area the minimum is 2.4 m. Where curb and gutter sections are used, the gutter width should be considered part of the parking lane width.

(2) Design Speed. The minimum design speed should equal a) the minimum value from the table, b) the anticipated posted speed limit after construction, or c) the state legal limit on non-posted highways. The legal limit in an urban district is 50 km/h. Based upon an engineering study, these speeds may be raised to an absolute maximum of 90 km/h.

(3) On-Street Parking. In general, on-street parking is discouraged.

(4) Travel Lane Width. In a restricted area and where there are few trucks, travel lanes 0.3 m narrower may be used but may not be less than 3.0 m. In an industrial area, a 3.6-m travel lane should be used. In many residential areas, an 8.0-m roadway (curb face to curb face) consisting of one 3.6-m lane and two 2.2-m parking lanes is used. In an industrial area, 3.6-m lanes are desirable and 3.3-m lanes are minimum.

(5) Curb Offset. The curb offset should be 0.6 m. For a curbed section, the curb offset is included in the paved shoulder width.

(6) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(7) Sidewalk Width. A buffer of less than 0.6 m wide is not permitted. If no buffer is provided, the sidewalk width should be 1.8 m.

(8) Bicycle Lane Width. The widths in the table are in addition to the width of a parking lane, if present. See Section 51-7.0 for additional details.

(9) Clear Zones. The following will apply:

a. Facility with Vertical Curbs. The clear zone will be measured from the edge of travel lane or will be to the right-of-way line, whichever is less. No clear zone is required where there is 24-hour parking.

b. Facility with Sloping Curbs or without Curbs. The clear zone will vary according to design speed, traffic volumes, side slopes, and horizontal curvature.

c. Curbed Facility. There should be an appurtenance-free area as measured from the gutter line of any curb. Vertical curbs may only be used with design speed lower than 80 km/h.

d. Values. See Section 49-2.0 for specific clear zone values.

(10) Backslope. The backslope for a rock cut will vary according to the height of the cut and geotechnical factors. See INDOT *Standard Drawings* for typical rock cut sections.

(11) Side Slope (Curbed) Cut. Typically, a shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf will be 1.8 m. Where a sidewalk is present, the toe of the backslope will typically be 0.3 m beyond the edge of sidewalk. See Section 45-3.0 for more information.

(12) Side Slope (Curbed) Fill. If no sidewalks are present or planned, the lateral extent of the 12:1 slope may be reduced to 1.2 m.

(12a) Structural Capacity (New or Reconstructed Bridge). A bridge with design year average daily truck traffic (ADTT) greater than 1,000 should be designed for HS 25 live loads. A bridge with an ADTT less than or equal to 1,000 may be designed for HS 25 or HS 20, whichever the LPA elects.

(13) Width (New or Reconstructed Bridge) Uncurbed. The following will apply:

Volume	Minimum Clear Width
$0 < AADT < 400$	Travelway +0.6 m each side
$400 \leq AADT < 2000$	Travelway +0.9 m each side
$AADT \geq 2000$	Approach Roadway Width (Travelway Plus Shoulders)

(14) Width (Existing Bridge to Remain in Place). If the width of an existing bridge is less than the approach travelway width, consideration should be given to widening the bridge. For such a bridge of length greater than 60 m, the minimum shoulder width on the right and the left may be 1.1 m.

(15) Vertical Clearance (Local Street Under Railroad). Table values include an additional 150-mm allowance for future pavement overlays. Vertical clearances apply from usable edge to usable edge of shoulder.

(16) Vertical Clearance (Local Street Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(17) Minimum Radii. This is based on e_{max}=4% and low-speed urban street conditions.

(18) Superelevation Rate. See Section 43-3.0 for values of superelevation based on design speed and radii. See Section 43-3.0 for information on superelevation requirements.

(19) Horizontal Sight Distance. For a given design speed, the necessary middle ordinate will be determined by the radius and the sight distance which applies at the site. See the discussion in Section 43-4.0.

(20) Maximum Grades. In a residential area, the maximum grade should not exceed 15%. In an industrial or commercial area, the maximum grade should not exceed 8%.

(21) Flat Terrain. In very flat terrain and where no drainage outlet is available, gutter grades as low as 0.2% may be used.

(22) Intersection Sight Distance. For left turn onto a 2-lane road. P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

54-2.0 TABLE OF 3R/PARTIAL 4R FREEWAY GEOMETRIC DESIGN VALUES

Figure 54-2A, Geometric Design Criteria for Freeways (3R / Partial 4R Projects) presents the Department's criteria for the design of 3R/partial 4R freeway projects for both rural and urban areas. The designer should consider the following in the use of the table.

1. Manual Section References. These tables are intended to provide a concise listing of design values for easy use. However, the designer should review the appropriate section references for greater insight into the design elements.

2. Footnotes. The tables include many footnotes, which are identified by a number in parentheses (e.g., (6)). The information in the footnotes is critical to the proper use of the design tables.

3. Controlling Design Criteria. The 3R/partial 4R table of geometric design criteria provides an asterisk to indicate controlling design criteria. The designer will evaluate the proposed design against the criteria presented in Table 54-2A and elsewhere in this Chapter.

4. Design Exceptions. These standards are for use on existing freeways including those on the National Highway System. They are to be used for all projects that are classified as 3R or partial reconstruction regardless of funding source. In other words, any 3R or partial reconstruction work, whether Federal-aid funded or not, must meet these standards. Deviation from controlling design criteria should be covered by an approved design exception. Also, any operational or maintenance changes, permanent or temporary, exclusive of work zone traffic control that in fact create substandard conditions such as by re-striping to obtain added lane(s) by reducing existing lane widths and/or shoulders, must be covered by design exceptions whether or not actual construction or reconstruction is involved.

   Design exception requests for Level One design criteria on the following:

   a) Non-Exempt FHWA Funded Projects on the NHS require FHWA Approval.
   b) Exempt FHWA funded Projects on the NHS require Chief, Division of Design approval.
   c) Non-FHWA Federally Funded Projects on the NHS require Chief, Division of Design approval with an information copy sent to FHWA.
   d) Projects not on the NHS require Chief, Division of Design approval

Design Element				Manual Section	Rural	Urban
Design Controls	Design Forecast Year			54-3.01	20 Years (1)	20 Years (1)
	*Design Speed (km/h)			54-3.01	Min: Original Design Speed	Min: Original Design Speed (2)
	Access Control			40-5.0	Full Control	Full Control
	Level of Service			40-2.04	Desirable: B; Minimum: C	Desirable: B; Minimum: D
Cross Section Elements	Travel Lane	*Width		54-3.03	3.6 m	3.6 m
		Surface Type(3)		Chp. 52	Asphalt / Concrete	Asphalt / Concrete
	Shoulder	*Right Width(4)		54-3.03	Usable: 3.3 m; Paved: 3.0 m	Usable: 3.3 m; Paved: 3.0 m
		*Left Width(5)			2 Lanes: 1.2 m Paved. 3 Lanes: 3.0 m Paved	2 Lanes: 1.2 m Paved. 3 Lanes: 3.0 m Paved
		Surface Type(3)		Chp. 52	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (6)		45-1.01	2%	2%
		Shoulder (6A)		45-1.02	Paved Width ≤ 1.2m: 2%; Paved Width > 1.2 m: 4%	Paved Width ≤ 1.2m: 2%; Paved Width > 1.2 m: 4%
	Auxiliary Lanes	*Lane Width		45-1.03	3.6 m	3.6 m
		*Shoulder Width			Left or Right: Des: 3.6 m; Min: 1.8 m	Left or Right: Des: 3.6 m; Min: 1.8 m
	Median Width	Depressed		54-3.03	Existing	Existing
		Flush (CMB)			Existing	Existing
	Clear Zone			49-2.0	(8)	(8)
	Side Slopes (9)	Cut	Foreslope	54-3.03	2:1 or Flatter	2:1 or Flatter
			Ditch Width		Existing	Existing
			Back Slope		2:1 or Flatter	2:1 or Flatter
		Fill		45-3.0	2:1 or Flatter	2:1 or Flatter
	Median Slopes			45-3.03	Desirable: 8:1; Maximum: 4:1	Desirable: 8:1; Maximum: 4:1
Bridges	New and Reconstructed Bridges	*Structural Capacity		Chp. 60	HS-25 & Alt. Military Loading (10)	HS-25 & Alt. Military Loading (10)
		*Clear Roadway Width(11)		54-5.0	Full Paved Approach Width	Full Paved Approach Width
	Existing Bridges to Remain in Place	*Structural Capacity		Chp. 72	HS-20	HS-20
		*Clear Roadway Width		54-5.0	Travelway Plus 3.0 m Rt. & 1.2 m Lt. Shoulders (7)	Travelway Plus 3.0 m Rt. & 1.2 m Lt. Shoulders (7)
	*Vertical Clearance (Freeway Under) (12a)	New and Replaced Overpassing Bridges (12b)		54-5.0	5.05 m	5.05 m (12c)
		Existing Overpassing Bridges			4.90 m	4.90 m (12c)
		Sign Truss / Pedestrian Bridges			New: 5:35 m; Existing: 5.20 m	New: 5.35 m; Existing: 5.20 m
	Vertical Clearance (Freeway over Railroad) (13)			Chp. 69	7.00 m	7.00 m

* Controlling design criteria (see Section 40-8.0).

GEOMETRIC DESIGN CRITERIA FOR FREEWAY
(3R or Partial 4R Project)

Table 54-2A

Design Element			Manual Section	Rural	Urban		
Alignment Elements	Design Speed			110 km/h	90 km/h	100 km/h	110 km/h
	*Stopping Sight Distance		42-1.0	220 m	160 m	185 m	220 m
	*Minimum Radii		43-2.0	Existing (14)	Existing (14)		
	*Superelevation Rate (15)		43-3.0	e_{max} = 8%	e_{max} = 8%		
	*Horizontal Sight Distance		43-4.0	See Section 43-4.0	See Section 43-4.0		
	*Vertical Curvature (K-values)	Crest	44-3.0	Existing (14)	Existing (14)		
		Sag		Existing (14)	Existing (14)		
	*Maximum Grade	Level	54-3.02	Existing (14)	Existing (14)		
		Rolling		Existing (14)	Existing (14)		
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.0%	Desirable: 0.5% Minimum: 0.0%		
Interchange Elements	Traveled Way	Width	48-5.02	4.9 m	4.9 m		
		Surface Type (3)	Chp. 52	Asphalt / Concrete	Asphalt / Concrete		
	Shoulder	Right Width	48-5.02	Usable: 3.3 m. Paved: Des: 2.4 m; Min: 2.3 m	Usable: 3.3 m. Paved: Des: 2.4 m; Min: 2.3 m		
		Left Width		Usable: 2.1 m. Paved: Des: 1.2 m; Min: 0.8 m	Usable: 2.1 m. Paved: Des: 1.2 m; Min: 0.8 m		
		Surface Type (16)	Chp. 52	Asphalt / Concrete	Asphalt / Concrete		
	Cross Slope	Traveled Way	48-5.02	2%	2%		
		Shoulder (17)		Right: 4%; Left: 2%	Right: 4%; Left: 2%		
	Superelevation		48-5.03	e_{max} = 8%	e_{max} = 4%, 6%, or 8% (18)		
	Maximum Grade	Upgrades	48-5.04	3% - 5%	3% - 5%		
		Downgrades		4% - 6%	4% - 6%		

* Controlling design criteria (see Section 40-8.0).

GEOMETRIC DESIGN CRITERIA FOR FREEWAY
(3R or Partial 4R Project)

Table 54-2A (Continued)

GEOMETRIC DESIGN CRITERIA FOR FREEWAY
(3R or Partial 4R Project)

Footnotes to Table 54-2A

(1) Design Forecast Year. Resurfaced pavements may have a 10-year design life.

(2) Design Speed. The existing posted speed limit may be used in restricted urban conditions, but not less than 80 km/h on Interstate highways.

(3) Surface Type. The pavement type selection will be determined by the Pavement Design Engineer.

(4) Shoulder Width (Right). The following will apply:

a. The shoulder is paved to the face of guardrail. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. See Section 49-5.0 for more information.

b. When the number of trucks exceeds 250 DDHV, a 3.6-m right shoulder should be considered. If the 3.6-m shoulder is used, the usable shoulder width will be 3.9 m.

c. Usable shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.

(5) Shoulder Width (Left). The following will apply:

a. Typically, the effective usable shoulder width is equal to the paved shoulder width. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. See Section 49-5.0 for more information.

b. When there are 3 or more lanes in one direction, a 3.6-m left shoulder should be provided if practical.

c. Usable shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point. Usable width is typically 0.3 m wider than the paved shoulder width.

(6) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on existing bridges to remain in place.

(6A) Cross Slope (Shoulder). See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information.

(7) Shoulders for Bridge to Remain in Place. For such a bridge of length > 60 m, the minimum width for both shoulders may be 1.2 m. This requirement does not apply to a bridge deck replacement.

(8) Clear Zone. The clear zone will vary according to design speed, traffic volumes, side slopes and horizontal curvature. See Section 49-2.0.

GEOMETRIC DESIGN CRITERIA FOR FREEWAY
(3R or Partial 4R Project)

Footnotes to Table 54-2A (Continued)

(9) Side Slopes. Retention of the existing side slope shape of 2:1 or flatter will most often be acceptable. However, an existing fill slope of steeper than 4:1 should be evaluated for flattening. Section 54-3.03 provides additional information for side slope criteria for a project with freeway widening (i.e., lane and/or shoulder widening).

(10) Structural Capacity (New or Reconstructed Bridge). Other loadings will apply to the Toll Road or an Extra Heavy Duty Highway. See Chapter Sixty for more information.

(11) Width (New or Reconstructed Bridge). See Sections 49-5.0 and 59-1.0 for more information on bridge width.

(12) Vertical Clearance (Freeway Under). The following will apply:

a. Vertical clearance applies from usable edge to usable edge of shoulders.
b. Table values include an additional 150-mm allowance for future overlays.
c. A 4.3-m clearance may be used in an urban area where an alternative freeway facility with a 4.9-m clearance is available; see Section 54-3.02.

(13) Vertical Clearance (Freeway Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(14) Existing Conditions. For these design elements, the existing conditions are generally satisfactory unless accident history dictates that a modification is necessary.

(15) Superelevation Rate. The designer should review Sections 43-2.0 and 43-3.0 to determine if any improvements are necessary.

(16) Shoulders (Surface Type). The pavement type selection will be determined by the Pavement Design Engineer. For a ramp with curve radii less than or equal to 100 m, the shoulders will have the same pavement design as the travelway.

(17) Cross Slope (Shoulders). For a ramp with curve radii less than or equal to 100 m, the shoulder cross slope will be the same as the travelway.

(18) Superelevation. The maximum superelevation rate will depend on site conditions. The highest rate practical should be used, especially for a descending ramp.

4. Rural Tables. The rural tables do not provide design criteria for sub-categories. However, there are many "rural" facilities in Indiana which pass through relatively built-up, but unincorporated, areas. In these cases, it may be inappropriate to use the criteria for rural roads and highways. The designer may, as an option, use the "suburban" criteria for that functional classification (e.g., arterials) in relatively built-up rural areas. Therefore, if the area is "urban" in character (e.g., a densely populated area with a grid-like street system), it may be appropriate to use the urban design criteria even though the facility is rural. This decision will be documented in the Preliminary Engineering Report (see Chapter Seven).

5. Cross Section Elements. The designer should realize that some of the cross section elements included in a table (e.g., sidewalk width) are not automatically warranted in the project design. The values in the tables will only apply after the decision has been made to include the element in the highway cross section.

   General Department policy is that a 3R project will not be designed with a narrower roadway width than the existing facility. See Section 55-4.05.

6. Manual Section References. These tables are intended to provide a concise listing of design values for easy use. However, the designer should review the *Manual* section references for greater insight into the design elements.

7. Footnotes. The tables include many footnotes, which are identified by a number in parentheses, e.g., (6). The information in the footnotes is critical to the proper use of the design tables.

8. Controlling Design Criteria. The 3R tables of geometric design criteria provide an asterisk to indicate controlling design criteria which, if not met, require a Level One design exception. The discussion in Section 40-8.0 on design exceptions applies equally to the geometric design of 3R projects. However, the designer will evaluate the proposed design against the criteria presented in this Chapter.

Design Element				Manual Section	2-Lane				Multi-Lane	
Design Controls	Design Year Traffic (AADT)			40-2.01	< 400	400 ≤ AADT < 3000	3000 ≤ AADT < 5000	≥ 5000	Undivided	Divided
	Design Forecast Year			55-4.01	20 Years (1)				20 Years (1)	
	*Design Speed (km/h) (2)			55-4.01	Posted Speed Limit				Posted Speed Limit	
	Access Control			40-5.0	Partial Control / None				Partial Control / None	
	Level of Service			40-2.0	Desirable: B; Minimum: D				Desirable: B; Minimum: D	
Cross Section Elements	Travel Lane	*Width		55-4.05	3.6 m	3.6 m	3.6 m	3.6 m	3.6 m	
		Typical Surface Type (3)		Ch. 52	Asphalt / Concrete				Asphalt / Concrete	
	Shoulder (4)	*Width Usable		55-4.05	D: 1.8 m M: 0.6 m	D: 2.4 m M: 0.9 m	D: 2.4 m M: 1.8 m	D: 3.3 m M: 2.4 m	Desirable: 3.3 m Minimum: 2.4 m	Rt: D: 3.3 m; M: 2.7 m Lt: D: 1.2 m; M: 1.2 m
		*Width Paved		55-4.05	D: 1.2 m M: 0.0 m	D: 1.8 m M: 0.6 m	D: 1.8 m M: 0.6 m	D: 3.0 m M: 0.6 m	Desirable: 3.0 m Minimum: 2.4 m	Rt: D: 3.0 m; M: 2.4 m Lt: D: 1.2 m; M: 0.9 m
		Typical Surface Type (3)		Ch. 52	Asphalt / Concrete / Sealed Aggregate				Asphalt / Concrete / Sealed Aggregate	
	Cross Slopes	*Travel Lane (5)		55-4.05	2%				2%	
		Shoulder (6)		55-4.05	Paved Width ≤ 1.2 m: 2%; Paved Width > 1.2 m: 4% Asphalt / Concrete; 6% Sealed Aggregate				Paved Width ≤ 1.2 m: 2%; Paved Width > 1.2 m: 4% Asphalt / Concrete; 6% Sealed Aggregate	
	Auxillary Lanes	Lane Width		55-4.05	Desirable: 3.6 m; Minimum: 3.3 m				Desirable: 3.6 m; Minimum: 3.3 m	
		Shoulder Width			Des: Same as Next to Travel Lane; Min: 0.6 m				Des: Same as Next to Travel Lane; Min: 0.6 m	
	Median Width			55-4.05	N/A				0.0 m	Existing
	Obstruction Free Zone			55-5.02	See Section 55-5.02				See Section 55-5.02	
	Side Slopes	Cut	Foreslope	55-4.05	2:1 or Flatter (7)				2:1 or Flatter (7)	
			Ditch Width		(7)				(7)	
			Backslope		2:1 or Flatter (7)				2:1 or Flatter (7)	
		Fill			2:1 or Flatter (7)				2:1 or Flatter (7)	
	Median Slopes			55-4.05	N/A				Desirable: 8:1; Maximum: 4:1	
Bridges**	New or Reconstructed Bridge	*Structural Capacity		Ch. 60	HS-25 (8)					
		*Clear Roadway Width (9)		55-6.03	Full Paved Approach Width					
	Existing Bridge to Remain in Place	*Structural Capacity		Ch. 72	HS-20					
		*Clear Roadway Width		55-6.02	Travelway Plus 0.6 m on Each Side					
	*Vertical Clearance (Arterial Under) (10)	New or Replaced Overpassing Bridge		55-6.0	5.05 m					
		Existing Overpassing Bridge (11)			4.30 m					
		Sign Truss / Pedestrian Bridge			New: 5.35 m; Existing: 5.20 m					
	Vertical Clearance (Arterial Over Railroad) (12)			Ch. 69	7.00 m					

D or Des: Desirable; M or Min: Minimum.

* Controlling design criteria (see Section 40-8.0). ** Selection of the cross section and bridge elements is based on the design year traffic volumes irrespective of the design speed.

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIAL (3R Project)

Table 55-3A

Design Element			Manual Section			
Alignment Elements	Design Speed		---	80 km/h	90 km/h	100 km/h
	*Stopping Sight Distance		55-4.02	130 m	160 m	185 m
	DecisionSight Distance	Speed / Path / Direction Change	42-2.0	230 m	270 m	315 m
		Stop Maneuver		140 m	170 m	200 m
	Passing Sight Distance		42-3.0	Existing	Existing	Existing
	Intersection Sight Distance, -3% to +3% (14)		55-4.06	P: 190 m; SU: 235 m	P: 230 m; SU: 280 m	P: 265 m; SU: 320 m
	*Minimum Radii		55-4.03	See Section 55-4.03		
	*Superelevation Rate		55-4.03	See Section 55-4.03		
	*Horizontal Sight Distance		55-4.03	See Section 55-4.03		
	*Vertical Curvature (K-values)	Crest	55-4.04	See Section 55-4.04		
		Sag		See Section 55-4.04		
	*Maximum Grade (13)	Level	55-4.04	5%	4.5%	4%
		Rolling		6%	5.5%	5%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum 0.0%		

* Controlling design criteria (see Section 40-8.0)

Deviations from controlling design criteria should be addressed in an approved design exception. Also, any operational or maintenance changes, permanent or temporary, exclusive of work-zone traffic control that in fact create substandard conditions such as by re-striping to obtain added lane(s) by reducing existing land widths or shoulders, must be addressed in design exceptions whether or not actual construction or reconstruction is involved.

Design exception requests are required for Level One design criteria for each project type as follows:

a) Non-exempt federally-funded project on the Interstate system requires FHWA approval.
b) Exempt federally-funded project on the Interstate system requires Chief, Design Division approval.
c) Non-federally-funded project on the Interstate system requires Chief, Design Division approval with an information copy sent to FHWA.
d. Project not on the Interstate system requires Chief, Design Division approval.

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIAL (3R Project)

Table 55-3A (Continued)

GEOMETRIC DESIGN CRITERIA FOR RURAL ARTERIAL
(3R Project)

Footnotes to Table 55-3A

(1) Design Forecast Year. For a partial 3R project, the pavement should be designed for at least a 10-year design life.

(2) Design Speed. The minimum design speed should equal a) the anticipated posted speed limit after construction or b) the state legal limit of 60 mph on a non-posted multilane divided highway or 55mph on a non-posted two-lane highway.

(3) Surface Type. The pavement type selection will be determined by the Materials and Tests Division's pavement design engineer or by the local jurisdiction.

(4) Shoulder. The following will apply:

a. On an INDOT facility, the shoulder should be paved to the front face of guardrail. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. In a restrictive situation, the guardrail offset may be 0.3 m from the effective usable shoulder width. See Section 49-5.0 for more information.

b. If guardrail is present, the minimum offset from E.T.L. to the front face of guardrail should desirably be equal to the shy line distance, but should not be less than 1.2 m. See Section 49-5.0 for shy line offsets.

c. Usable shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.

(5) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(6) Cross Slopes (Shoulder). Table values are for tangent sections. See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information. See Figure 43-3M or Figure 43-3N for shoulder cross slope on a horizontal curve.

(7) Side Slopes. Section 55-4.05 provides additional information for side slope criteria.

(8) Structural Capacity (New or Reconstructed Bridge). The following will apply:

a. Each bridge on a facility with greater than 600 trucks per day should be checked using the Alternate Military loading.
b. Each State highway bridge within 25 km of a Toll Road gate must be designed for Toll Road Loading.
c. Each bridge on an Extra Heavy Duty Highway must be designed for the Michigan Train truck loading configuration.
d. See Chapter Sixty for additional information on the loading configurations.

(9) Width (New or Reconstructed Bridge). Width is the minimum for a 3R project. See Section 59-1.0 for additional information on bridge width. On a State highway, the minimum clear roadway width should be 9.4 m.

(10) Vertical Clearance (Arterial Under). Table values include an additional 150 mm allowance for a future pavement overlay. Vertical clearances apply from usable edge to usable edge of shoulders.

(11) Vertical Clearance (Existing Bridge). See Section 55-6.02 for additional information on minimum allowable vertical clearance.

(12) Vertical Clearance (Arterial Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(13) Maximum Grade. A grade that is 1% steeper may be used for a one-way downgrade.

(14) Intersection Sight Distance. For left turn onto a 2-lane road. P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element				Manual Section	2-Lane				
Design Controls	Design Year Traffic (AADT)			40-2.01	< 400	400 ≤ AADT < 1000	1000 ≤ AADT < 3000	3000 ≤ AADT < 5000	≥ 5000
	Design Forecast Year			55-4.01	20 Years (1)				
	*Design Speed (km/h) (2)			55-4.01	Posted Speed Limit				
	Access Control			40-5.0	None				
	Level of Service			40-2.0	Desirable: B; Minimum: D				
Cross Section Elemnts	Travel Lane	*Width		55-4.05	Des: 3.6 m Min: 3.0 m	Des: 3.6 m Min: 3.3 m	Des: 3.6 m Min: 3.3 m	3.6 m (3)	3.6 m (3)
		Typical Surface Type (4)		Ch. 52	Asphalt / Concrete				
	Shoulder (5)	*Width Usable		55-4.05	Des: 1.2 m Min: 0.6 m	Des: 1.8 m Min: 0.6 m	Des: 2.4 m Min: 0.9 m	Des: 2.4 m Min: 1.8 m	Des: 3.0 m Min: 1.8 m
		*Width Paved		55-4.05	Des: 0.6 m Min: 0.0 m	Des: 1.2 m Min: 0.0 m	Des: 1.2 m Min: 0.6 m	Des: 1.8 m Min: 0.6 m	Des: 2.4 m Min: 0.6 m
		Typical Surface Type (4)		Ch. 52	Asphalt / Concrete / Sealed Aggregate				
	Cross Slope	*Travel Lane (6)		55-4.05	2% Typical; 3% Maximum				
		Shoulder (7)		55-4.05	Paved Width ≤ 1.2 m: 2%-3%; Paved Width > 1.2 m: 4%-6% Asphalt / Concrete; 6% Sealed Aggregate				
	Auxiliary Lanes	Lane Width		55-4.05	Des: Same as Travel Lane Min: 3.0 m		Des: Same as Travel Lane Min: 3.3 m		
		Shoulder Width			Des: Same as Next to Travel Lane; Min: 0.6 m				
	Obstruction Free Zone			55-5.02	See Section 55-5.02				
	Side Slopes	Cut	Foreslope	55-4.05	2:1 or Flatter (8)				
			Ditch Width		(8)				
			Backslope		2:1 or Flatter (8)				
		Fill		55-4.05	2:1 or Flatter (8)				
Bridges**	New or Reconstructed Bridge	*Structural Capacity		Ch. 60	HS-25 (9)				
		*Clear Roadway Width (10)		55-6.03	Full Paved Approach Width				
	Existing Bridge to Remain in Place	*Structural Capacity		Ch. 72	HS-15				
		*Clear Roadway Width (11)		55-6.02	6.6 m	6.6 m	7.2 m	8.4 m	8.4 m
	*Vertical Clearance (Collector Under)	New or Replaced Overpassing Bridge (12)		55-6.0	4.45 m				
		Existing Overpassing Bridge (13)			4.30 m				
	Vertical Clearance (Collector Over Railroad) (14)			Ch. 69	7.00 m				

Des: Desirable; Min: Minimum.

* Controlling design criteria (see Section 40-8.0). ** Selection of the cross section and bridge elements is based on the design year traffic volumes irrespective of the design speed.

GEOMETRIC DESIGN CRITERIA FOR STATE RURAL COLLECTOR ROAD (3R Project)
Table 55-3B

Design Element			Manual Section	2-Lane				
Alignment Elements	Design Speed		---	60 km/h	70 km/h	80 km/h	90 km/h	100 km/h
	*Stopping Sight Distance	Desirable	55-4.02	85 m	105 m	130 m	160 m	185 m
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	170 m	200 m	230 m	270 m	315 m
		Stop Maneuver		95 m	115 m	140 m	170 m	200 m
	Passing Sight Distance		42-3.0	Existing	Existing	Existing	Existing	Existing
	Intersection Sight Distance, -3% to +3% (16)		55-4.06	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 190 m SU: 235 m	P: 230 m SU: 280 m	P: 265 m SU: 320 m
	*Minimum Radii		55-4.03	See Section 55-4.03				
	*Superelevation Rate		55-4.03	See Section 55-4.03				
	*Horizontal Sight Distance		55-4.03	See Section 55-4.03				
	*Vertical Curvature (K-values)	Crest	55-4.04	See Section 55-4.04				
		Sag		See Section 55-4.04				
	*Maximum Grade (15)	Level	55-4.04	9%	8%	8%	7.5%	7%
		Rolling		10%	9%	9%	8.5%	8%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.0%				

* Controlling design criteria (see Section 40-8.0).

Deviations from controlling design criteria should be addressed in an approved design exception. Also, any operational or maintenance changes, permanent or temporary, exclusive of work-zone traffic control that in fact create substandard conditions such as by re-striping to obtain added lane(s) by reducing existing lane widths or shoulders, must be addressed in design exceptions whether or not actual construction or reconstruction involved.

Design exception requests for Level One design criteria require Chief, Design Division approval.

GEOMETRIC DESIGN CRITERIA FOR STATE RURAL COLLECTOR ROAD (3R Project)

Table 55-3B (Continued)

GEOMETRIC DESIGN CRITERIA FOR STATE RURAL COLLECTOR ROAD
(3R Project)

Footnotes to Table 55-3B

(1) Design Forecast Year. For a partial 3R project, the pavement should be designed for at least a 10-year design life.

(2) Design Speed. The minimum design speed should equal a) the anticipated posted speed limit after construction or b) the state legal limit (55 mph) on a non-posted highway.

(3) Travel Lane (Widths). A minimum 3.3-m travel lane may be used where truck volumes are less than 200 trucks per day.

(4) Surface Type. The pavement type selection will be determined by the Materials and Tests Division's pavement design engineer or by the local jurisdiction.

(5) Shoulder. The following will apply:

a. On an INDOT facility, the shoulder should be paved to the front face of guardrail. The desirable guardrail offset is 0.3 m from the effective usable shoulder width. In a restrictive situation, the guardrail offset may be 0.3 m from the effective usable shoulder width. See Section 49-5.0 for more information.

b. If guardrail is present, the minimum offset from E.T.L. to the front face of guardrail should desirably be equal to the shy line distance, but not less than 1.2 m. See Section 49-5.0 for shy line offsets.

c. Usable shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.

(6) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(7) Cross Slopes (Shoulder). Table values are for tangent sections. See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information. See Figure 43-3M or Figure 43-3N for shoulder cross slope on a horizontal curve.

(8) Side Slopes. Section 55-4.05 provides additional information for side slope criteria.

(9) Structural Capacity (New or Reconstructed Bridge). The following will apply:

a. Each bridge on a facility with greater than 600 trucks per day should be checked using the Alternate Military loading.
b. Each State highway bridge within 25 km of a Toll Road gate must be designed for Toll Road Loading.
c. Each bridge on an Extra Heavy Duty Highway must be designed for the Michigan Train truck loading configuration.
d. See Chapter Sixty for additional information on the loading configurations.

(10) Width (New or Reconstructed Bridge). Width is the minimum for a 3R project. See Section 59-1.0 for additional information on bridge width. On a State highway, the minimum clear roadway width should be 9.4 m.

(11) Width (Existing Bridge to Remain in Place). Clear width will be at least equal to the approach traveled way width or the table values, whichever is greater.

(12) Vertical Clearance (Collector Under). Table values include an additional 150 mm allowance for a future pavement overlay. Vertical clearances apply from usable edge to usable edge of shoulders.

(13) Vertical Clearance (Existing Bridge). See Section 55-6.02 for additional information on minimum allowable vertical clearance.

(14) Vertical Clearance (Collector Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(15) Maximum Grades. For a grade less than 150 m in length (PVT to PVC), the maximum grade may be up to 2% steeper than table value. For a road with AADT < 400, the maximum grade may also be 2% steeper.

(16) Intersection Sight Distance. For left turn onto a 2-lane road, P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element				Manual Section	2-Lane				
Design Controls	Design Year Traffic (AADT)			40-2.01	< 400	400 ≤ AADT < 1000	1000 ≤ AADT < 3000	3000 ≤ AADT < 5000	≥ 5000
	Design Forecast Year			55-4.01	20 Years (2)				
	*Design Speed (km/h)			55-4.01	See Section 55-4.01 (3)				
	Access Control			40-5.0	None				
	Level of Service			40-2.0	Desirable: B; Minimum: D				
Cross Section Elements	Travel Lane	*Width (4)		55-4.05	Des: 3.0 m Min: 2.7 m (4a)	Des: 3.3 m Min: 3.0 m (4b)	Des: 3.3 m Min: 3.0 m (4b)	Des: 3.6 m Min: 3.3 m	Des: 3.6 m Min: 3.3 m (4c)
		Typical Surface Type		Ch. 52	Asphalt / Concrete				
	Shoulder (5)	*Width Usable		55-4.05	Des: 1.2 m Min: 0.6 m	Des: 1.8 m Min: 0.6 m	Des: 1.8 m Min: 0.9 m	Des: 2.4 m Min: 1.8 m	Des: 3.0 m Min: 2.4 m
		*Width Paved		55-4.05	Des: 0.6 m Min: 0.0 m	Des: 0.6 m Min: 0.0 m	Des: 1.2 m Min: 0.6 m	Des: 1.8 m Min: 0.6 m	Des: 2.4 m Min: 0.6 m
		Typical Surface Type		Ch. 52	Asphalt / Aggregate / Earth				
	Cross Slope	*Travel Lane (6)		55-4.05	2%-3%				
		Shoulder (7)		55-4.05	Paved Width ≤ 1.2 m: 2%-3%; Paved Width > 1.2 m: 4%-6% Asphalt; 6%-8% Aggregate; 8% Earth				
	Auxiliary Lanes	Lane Width		55-4.06	Des: 3.0 m; Min: 2.7 m		Des: 3.3 m; Min: 3.0 m		Des: 3.6 m Min: 3.0 m
		Shoulder Width			Des: Same as Next to Travel Lane; Min: 0.6 m				
	Obstruction-Free Zone			55-5.02	See Section 55-5.02				
	Side Slopes	Cut	Foreslope	55-4.05	2:1 or Flatter (8)				
			Ditch Width		(8)				
			Backslope		2:1 or Flatter (8)				
		Fill		55-4.05	2:1 or Flatter (8)				
Bridges**	New or Reconstructed Bridge	*Structural Capacity		Ch. 60	HS-25(8a)				
		*Clear Roadway Width (9)		55-6.03	Travelway +1.2 m	Travelway +1.8 m	Travelway +1.8 m	Travelway +2.4 m	Full Paved Appr. Width
	Existing Bridge to Remain in Place	*Structural Capacity		Ch. 72	HS-15 (10)				
		*Clear Roadway Width (11)		55-6.02	6.6 m	6.6 m	7.2 m	8.4 m	8.4 m
	*Vertical Clearance (Collector Under)	New or Replaced Overpassing Bridge (12)		55-6.0	4.45 m				
		Existing Overpassing Bridge			4.30 m				
	Vertical Clearance (Collector Over Railroad) (13)			Ch. 69	7.00 m				

Des: Desirable; Min: Minimum.

* Controlling design criteria (see Section 40-8.0). ** Selection of the cross section and bridge elements is based on the design year traffic volumes irrespective of the design speed.

GEOMETRIC DESIGN CRITERIA FOR LOCAL AGENCY RURAL COLLECTOR ROAD [(1)] (3R Project)

Table 55-3C

Design Element			Manual Section	2-Lane				
Alignment Elements	Design Speed		---	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h
	*Stopping Sight Distance		55-4.02	65 m	85 m	105 m	130 m	160 m
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	145 m	170 m	200 m	230 m	270 m
		Stop Maneuver		70 m	95 m	115 m	140 m	170 m
	Passing Sight Distance		42-3.0	Existing	Existing	Existing	Existing	Existing
	Intersection Sight Distance, -3% to +3% (15)		55-4.06	P: 105 m SU: 135 m	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 190 m SU: 235 m	P: 230 m SU: 280 m
	*Minimum Radii		55-4.03	See Section 55-4.03				
	*Superelevation Rate		55-4.03	See Section 55-4.03				
	*Horizontal Sight Distance		55-4.03	See Section 55-4.03				
	*Vertical Curvature (K-values)	Crest	55-4.04	See Section 55-4.04				
		Sag		See Section 55-4.04				
	*Maximum Grade (14)	Level	55-4.04	9%	9%	8%	8%	7%
		Rolling		11%	10%	9%	9%	8%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.0%				

* Controlling design criteria (see Section 40-8.0).

Deviations from controlling design criteria should be addressed in an approved design exception. Also, any operational or maintenance changes, permanent or temporary exclusive of work-zone traffic control that in fact create substandard conditions such as by re-striping to obtain added lane(s) by reducing existing lane widths or shoulders, must be addressed in design exceptions whether or not actual construction or reconstruction is involved.

Design exception requests for Level One design criteria require Chief, Design Division approval.

GEOMETRIC DESIGN CRITERIA FOR LOCAL AGENCY RURAL COLLECTOR ROAD[(1)]
(3R Project)

Table 55-3C (Continued)

GEOMETRIC DESIGN CRITERIA FOR LOCAL AGENCY RURAL COLLECTOR ROAD[1]
(3R Project)

Footnotes to Table 55-3C

(1) Applicability. This table is only applicable to a federal-aid funded project.

(2) Design Forecast Year. For a partial 3R project, the pavement should be designed for at least a 10-year design life.

(3) Design Speed. The minimum design speed should equal a) the anticipated posted speed limit after construction or b) the state legal limit (55 mph) on a non-posted highway.

(4) Travel Lane (Width). A 3.3-m travel lane width should be used where truck volumes exceed 200 trucks per day. In addition, the following will apply:

a. Where V ≥ 80 km/h, the minimum width is 3.0 m.
b. Where V ≥ 80 km/h, the minimum width is 3.3 m.
c. Where V ≥ 80 km/h, the minimum width is 3.6 m.

(5) Shoulder Width. The following will apply:

a. The desirable guardrail offset is 0.3 m from the effective usable shoulder width. See Section 49-5.0 for more information.

b. If guardrail is present, the minimum offset from the E.T.L. to face of guardrail should desirably be equal to the shy line offset distance, but not less than 1.2 m (see Section 49-5.0 for shy line offsets).

c. Usable shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.

(6) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(7) Cross Slope (Shoulder). Table values are for tangent sections. See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information. See Figure 43-3M or Figure 43-3N for shoulder cross slope on a horizontal curve.

(8) Side Slopes. Section 55-4.05 provides additional information for side slope criteria.

(8a) Structural Capacity (New or Reconstructed Bridge). A bridge with design year average daily truck traffic (ADTT) greater than 1,000 should be designed for HS 25 live loads. A bridge with an ADTT less than or equal to 1,000 may be designed for HS 25 or HS 20, whichever the LPA elects.

(9) Width (New or Reconstructed Bridge). The following will apply:

a. Where the approach roadway width (travelway plus shoulders) is surfaced, such surfaced width should be carried across all structures.

b. The width of each bridge of more than 30 m in length will be analyzed individually. At a minimum, the roadway width of such a bridge should be the width of travel lanes plus a 0.9-m right shoulder and 0.9-m left shoulder.

c. See Section 59-1.0 for more information on bridge width.

(10) Structural Capacity (Existing Bridge to Remain in Place). If the AADT ≤ 50, a HS-10 loading is acceptable.

(11) Width (Existing Bridge to Remain in Place). Clear width should be at least equal to the approach traveled way width or the table value, whichever is greater. For a bridge of more than 30 m in length, the value in the table does not apply. The acceptability of such a bridge will be assessed individually.

(12) Vertical Clearance (Collector Under). Table value includes an additional 150 mm allowance for a future pavement overlay. Vertical clearances apply from usable edge to usable edge of shoulders.

(13) Vertical Clearance (Collector Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(14) Maximum Grades. For a grades of less than 150 m in length (PVT to PVC), the maximum grade may be 2% steeper than table value. For a road with AADT < 400, the maximum grade may also be 2% steeper.

(15) Intersection Sight Distance. For left turn onto a 2-lane road, P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element				Manual Section	2-Lane				
Design Controls	Design Year Traffic (AADT)			40-2.01	< 400	400-≤ AADT < 1000	1000-≤ AADT < 3000	3000-≤ AADT < 5000	≥ 5000
	Design Forecast Year			55-4.01	20 Years (2)				
	*Design Speed (km/h)			55-4.01	See Section 55-4.01 (3)				
	Access Control			40-5.0	None				
	Level of Service			40-2.0	Desirable: B; Minimum: D				
Cross Section Elements**	Travel Lane	*Width (4)		55-4.05	Des: 3.0 m; Min: 2.7 m (4a)		Des: 3.3 m Min: 3.0 m (4b)	Des: 3.6 m Min: 3.3 m (4c)	Des: 3.6 m Min: 3.3 m (4c)
		Typical Surface Type		Ch. 52	Asphalt / Concrete / Aggregate				
	Shoulder (5)	*Width Usable		55-4.05	Min: 0.6 m	Des: 1.2 m Min: 0.6 m	Des: 1.8 m Min: 0.9 m	Des: 1.8 m Min: 1.2 m	Des: 2.4 m Min: 1.8 m
		Typical Surface Type		Ch. 52	Asphalt / Aggregate / Earth				
	Cross Slope	*Travel Lane (6)		55-4.05	2%-3% Asphalt / Concrete; 6%-8% Aggregate				
		Shoulder (7)		55-4.05	Paved Width ≤ 1.2 m: 2%-3%; Paved Width > 1.2 m: 4%-6% Asphalt; 6%-8% Aggregate; 8% Earth				
	Auxiliary Lanes	Lane Width		55-4.06	Des: Same As Travel Lane Min: 2.7 m		Des: Same as Travel Lane Min: 3.0 m		
		Shoulder Width			Des: 1.2 m; Min: 0.6 m				
	Obstruction Free Zone			55-5.02	See Section 55-5.02				
	Side Slopes	Cut	Foreslope	55-4.05	2:1 or Flatter (8)				
			Ditch Width		(8)				
			Backslope		2:1 or Flatter (8)				
		Fill		55-4.05	2:1 or Flatter (8)				
Bridges**	New or Reconstructed Bridge	*Structural Capacity		Ch. 60	HS-25(8a)				
		*Clear Roadway Width (9)		55-6.03	Travelway +1.2 m	Travelway +1.8 m			Full Paved Appr. Width
	Existing Bridge to Remain in Place	*Structural Capacity		Ch. 72	HS-15 (10)				
		*Clear Roadway Width (11)		55-6.02	6.0 m	6.6 m	7.2 m	8.4 m	8.4 m
	*Vertical Clearance (Collector Under)	New or Replaced Overpassing Bridge (12)		55-6.0	4.45 m				
		Existing Overpassing Bridge			4.30 m				
	Vertical Clearance (Collector Over Railroad) (13)			Ch. 69	7.00 m				

Des: Desirable; Min: Minimum.

* Controlling design criteria (see Section 40-8.0). ** Selection of the cross section and bridge elements is based on the design year traffic volumes irrespective of the design speed.

GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROAD [1] (3R Project)

Table 55-3D

Design Element			Manual Section	2-Lane				
Alignment Elements	Design Speed		---	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h
	*Stopping Sight Distance		55-4.02	65 m	85 m	105 m	130 m	160 m
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	145 m	170 m	200 m	230 m	270 m
		Stop Maneuver		70 m	95 m	115 m	140 m	170 m
	Passing Sight Distance		42-3.0	Existing	Existing	Existing	Existing	Existing
	Intersection Sight Distance , -3% to +3% (14)		55-4.06	P: 105 m SU: 135 m	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 170 m SU: 235 m	P: 190 m SU: 280 m
	*Minimum Radii		55-4.03	See Section 55-4.03				
	*Superelevation Rate		55-4.03	See Section 55-4.03				
	*Horizontal Sight Distance		55-4.03	See Section 55-4.03				
	*Vertical Curvature (K-values)	Crest	55-4.04	See Section 55-4.04				
		Sag		See Section 55-4.04				
	*Maximum Grade	Level	55-4.04	10%	9%	8.5%	8%	7%
		Rolling		12%	11%	10.5%	10%	9%
	Minimum Grade		44-1.03	Desirable: 0.5%; Minimum: 0.0%				

* Controlling design criteria (see Section 40-8.0).

Deviations from controlling design criteria should be addressed in an approved design exception. Also, any operational or maintenance changes, permanent or temporary, exclusive of work-zone traffic control that in fact create substandard conditions such as by re-striping to obtain added lane(s) by reducing existing lane widths or shoulders, must be addressed in design exceptions whether or not actual construction or reconstruction is involved.

Design exception requests for Level One design criteria require Chief, Design Division approval.

GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROAD[(1)]
(3R Project)

Table 55-3D (Continued)

GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROAD[(1)]
(3R Project)

Footnotes to Table 55-3D

(1) Applicability. This table is only applicable to a federal-aid funded project.

(2) Design Forecast Year. For a partial 3R project, the pavement should be designed for at least a 10-year design life.

(3) Design Speed. The minimum design speed should equal a) the anticipated posted speed limit after construction or b) the state legal limit (55 mph) on a non-posted highway.

(4) Travel Lane (Width). A 3.3-m travel lane should be used where truck volumes exceed 200 trucks per day. In addition, the following will apply:

a. Where V ≥ 80 km/h, the minimum width is 3.0 m.
b. Where V ≥ 80 km/h, the minimum width is 3.3 m.
c. Where V ≥ 80 km/h, the minimum width is 3.6 m.

(5) Shoulder Width. The following will apply:

a. The desirable guardrail offset is 0.3 m from the effective usable shoulder width. In a restrictive situation, the guardrail offset may be 0.3 m from the effective usable shoulder width. See Section 49-5.0 for more information.

b. If guardrail is present, the minimum offset from E.T.L. to face of guardrail should desirably be equal to the shy line offset distance, but not less than 1.2 m (see Section 49-5.0 for shy line offsets).

c. Usable shoulder width is defined as the distance from the edge of the travel lane to the shoulder break point.

(6) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(7) Cross Slope (Shoulder). Table values are for tangent sections. See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information. See Figure 43-3M or Figure 43-3N for shoulder cross slope on a horizontal curve.

(8) Side Slopes. Section 55-4.05 provides additional information for side slope criteria.

(8a) Structural Capacity (New or Reconstructed Bridge). A bridge with design year average daily truck traffic (ADTT) greater than 1,000 should be designed for HS 25 live loads. A bridge with an ADTT less than or equal to 1,000 may be designed for HS 25 or HS 20, whichever the LPA elects.

(9) Width (New or Reconstructed Bridge). The width of a bridge of more than 30 m in length should be analyzed individually. At a minimum, the roadway width of such a bridge will be the width of travel lanes plus a 0.6-m right shoulder and 0.6-m left shoulder. Where shoulders are paved, it is desirable to provide the full roadway width across the bridge. See Section 59-1.0 for more information on bridge width.

(10) Structural Capacity (Existing Bridge to Remain in Place). If the AADT ≤ 50, an HS-10 loading is acceptable.

(11) Width (Existing Bridge to Remain in Place). A minimum clear width that is 0.6 m narrower than that shown in the table may be used on a road with few trucks. The clear roadway width should be at least the same width as the approach travelway. For a one-lane bridge, the width may be 5.4 m. For a bridge of more than 30 m in length, the value in the table do not apply. The acceptability of such a bridge will be assessed individually.

(12) Vertical Clearance (Local Under). Table values include an additional 150 mm allowance for a future pavement overlay. Vertical clearances apply from usable edge to usable edge of shoulders.

(13) Vertical Clearance (Local Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(14) Intersection Sight Distance. For left turn onto a 2-lane road, P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element				Manual Section	Design Values (By Type of Area)		
					Suburban	Intermediate	Built-Up
Design Controls	Design Forecast Year			55-4.01	20 Years (1)	20 Years (1)	20 Years (1)
	*Design Speed (km/h) (2)			55-4.01	Posted Speed Limit	Posted Speed Limit	Posted Speed Limit
	Access Control			40-5.0	Partial Control / None	None	None
	Level of Service			40-2.0	Des: B; Min: D	Des: C; Min: D	Des: C; Min: D
	On-Street Parking			45-1.0	None	Optional (3)	Optional (3)
Cross Section Elements	Travel Lane	*Width (4)		55-4.05	Curbed: Des: 3.6 m; Min: 3.3 m Uncurbed: Des: 3.6 m; Min: 3.3 m	Curbed: Des: 3.6 m; Min: 3.3 m Uncurbed: Des: 3.6 m; Min: 3.3 m	Curbed: Des: 3.6 m; Min: 3.0 m
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (6)			55-4.05	Des: 0.6 m; Min: 0.3 m	Des: 0.6 m; Min: 0.3 m	Des: 0.6 m; Min: 0.3 m
	Shoulder	*Paved Width (7)		55-4.05	Curbed, Rt. Des: 3.0 m; Min 0.3 m Curbed, Lt. Des: 1.2 m; Min 0.3 m Uncurbed, Rt.: 3.0 m; Lt.: 1.2 m	Curbed, Rt. Des: 2.4 m; Min 0.3 m Curbed, Lt. Des: 0.9 m; Min 0.6 m Uncurbed, Rt.: 2.4 m; Lt.: 0.9 m	Right: 1.8 m; Left: 0.9 m
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (8)		55-4.05	2% - 3%	2% - 3%	2% - 3%
		Shoulder (9)		55-4.05	Rt.: 4% - 6%; Lt.: 2% - 3%	Paved Width ≤ 1.2 m: 2%-3%; Paved Width > 1.2m: 4%-6%	Paved Width ≤ 1.2 m: 2%-3%; Paved Width > 1.2m: 4%-6%
	Auxiliary Lanes	Lane Width		55-4.05	Des: 3.6 m; Min: 3.3 m	Des: 3.6 m; Min: 3.0 m	Des: 3.6 m; Min: 3.0 m
		Curb Offset			Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m
		Shoulder Width			Des: 3.0 m; Min: 0.6 m	Des: 2.4 m; Min: 0.6 m	Des: 1.8 m; Min: 0.6 m
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	TWLTL Lane Width			46-5.0	Des: 4.8 m; Min. 4.2 m	Des: 4.8 m; Min: 3.6 m	Des: 4.2 m; Min: 3.3 m
	Parking Lane Width			45-1.04	N/A	Des: 3.0 m; Min: 2.4 (10)	Des: 3.0 m; Min: 2.4 m (10)
	Median Width	Depressed		55-4.05	Existing	Existing	N/A
		Raised Island			Des: 4.8 m; Min: 0.6 m	Des: 4.8 m; Min: 0.6 m	Des: 4.8 m; Min: 0.6 m
		Flush / Corrugated			Des: 4.8 m; Min: 0.6 m	Des: 4.8 m; Min: 0.6 m	Des: 4.8 m; Min: 0.6 m
	Sidewalk Width (11)			55-4.05	1.2 m with 1.5-m Buffer (Des)	Des: 1.8 m; Min: 1.2 m	Des: 1.8 m; Min: 1.2 m
	Bicycle Lane Width (12)			51-7.0	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m
	Obstruction Free Zone			55-5.02	See Section 55-5.02	See Section 55-5.02	See Section 55-5.02
	Typical Curbing Type (where used) (13)			55-4.05	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes (Uncurbed)	Cut	Foreslope	55-4.05	2:1 or Flatter	2:1 or Flatter (14)	N/A
			Ditch Width		(14)	(14)	N/A
			Backslope		2:1 or Flatter (14)	2:1 or Flatter (14)	N/A
		Fill			2:1 or Flatter (14)	2:1 or Flatter (14)	N/A
	Side Slopes (Curbed)	Cut (Backslope)		55-4.05	(15)	(15)	(15)
		Fill			2:1 or Flatter (14)	2:1 or Flatter (14)	2:1 or Flatter (14)
	Median Slopes (Depressed)			55-4.05	Desirable: 8:1; Maximum: 4:1	Desirable: 8:1; Maximum: 4:1	Desirable: 8:1; Maximum: 4:1

Des: Desirable; Min: Minimum

* Controlling design criteria (see Section 40-8.0).

GEOMETRIC DESIGN CRITERIA FOR MULTI-LANE URBAN ARTERIAL
(3R Project)

Table 55-3E

Design Element			Manual Section	Design Values (By Type of Area)				
				Suburban	Intermediate	Built-Up		
Bridges	New or Reconstructed Bridge	*Structural Capacity (16)	Ch. 60	HS-25	HS-25	HS-25		
		*Clear Roadway Width(17)	55-6.03	Curbed: Full Approach Curb-to-Curb Width Uncurbed: Full Approach Width				
	Existing Bridge to Re-main in Place	*Structural Capacity	Ch. 72	HS-20	HS-20	HS-20		
		*Clear Roadway Width	55-6.02	Curbed: Full Approach Curb-to-Curb Width; Uncurbed: Travelway Plus 0.6 m on Each Side				
	*Vertical Clearance (Arterial Under)	New or Replaced Overpassing Bridge (18a & 18c)	55-6.0	5.05 m	5.05 m (18b)	5.05 m (18b)		
		Existing Overpassing Bridge (19)		4.30 m	4.30 m	4.30 m		
		Sign Truss / Pedestrian Bridge (18a & 18c)		New: 5.35 m; Existing: 5.20 m	New: 5.35 m; Existing: 5.20 m	New: 5.35 m; Existing: 5.20 m		
	Vertical Clearance (Arterial over Railroad) (20)		Ch. 69	7.00 m				
Alignment Elements	Design Speed		---	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h
	*Stopping Sight Distance		55-4.02	65 m	85 m	105 m	130 m	160 m
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 195 m SU: 170 m	U: 235 m SU: 205 m	U: 275 m SU: 235 m	U: 315 m SU: 270 m	U: 360 m SU: 315 m
		Stop Maneuver		155 m	195 m	235 m	280 m	325 m
	Intersection Sight Distance, -3% to +3% (21)		55-4.06	P: 105 m SU: 135 m	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 190 m SU: 235 m	P: 230 m SU: 280 m
	*Minimum Radii		55-4.03	See Section 55-4.03				
	*Superelevation Rate		55-4.03	See Section 55-4.03				
	*Horizontal Sight Distance		55-4.03	See Section 55-4.03				
	*Vertical Curvature (K-values)	Crest	55-4.04	See Section 55-4.04				
		Sag		See Section 55-4.04				
	*Maximum Grade	Level	55-4.04	10%	9%	8.5%	8%	7%
		Rolling		11%	10%	9.5%	9%	8%
	Minimum Grade		44-1.03	Curbed Des: 0.5%; Curbed Min: 0.3% Uncurbed: 0.0%				

* Controlling design criteria (see Section 40-8.0). SU: Suburban U: Urban
See note at bottom of Table 55-3A for approval authority for Level One design exceptions.

GEOMETRIC DESIGN CRITERIA FOR MULTI-LANE URBAN ARTERIAL (3R Project)

Table 55-3E (Continued)

GEOMETRIC DESIGN CRITERIA FOR MULTI-LANE URBAN ARTERIAL (3R Project)

Footnotes to Table 55-3E

(1) Design Forecast Year. For a partial 3R project, the pavement should be designed for at least a 10-year design life.

(2) Design Speed. The minimum design speed should equal a) the anticipated posted speed limit after construction, or b) the state legal limit on a non-posted highway. The legal limit is 30 mph, but with an engineering study may be raised to a maximum of 55 mph.

(3) On-Street Parking. In general, on-street parking is discouraged.

(4) Travel Lane (Width). For an arterial on the National Truck Network, the right lane must be 3.6m in width. For a non-National Truck Network route, a minimum 3.3-m travel lane should be used where truck volumes exceed 200 trucks a day. See Section 55-4.05.

(5) Surface Type. The pavement type selection will be determined by the Materials and Tests Division's pavement design engineer or by the local jurisdiction.

(6) Curb Offset. Vertical curbs which are either continuous or introduced intermittently may be offset 0.3 m.

(7) Shoulder Width. The table values apply to paved shoulder width. The following will also apply:

a. For an uncurbed section, the shoulder is paved to the face of guardrail. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. See Section 49-5.0 for more information.

b. For an uncurbed section, a desirable additional 0.3 m of compacted aggregate will be provided.

c. If guardrail is present, the minimum offset from E.T.L. to face of guardrail should desirably be equal to the shy line offset distance, but not less than 1.2 m (see Section 49-5.0 for shy line offsets). In a restrictive situation, the guardrail offset may be 0.3 m from the effective usable shoulder width.

d. For a curbed section, the curb offset is included in the paved shoulder width.

(8) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(9) Cross Slope (Shoulder). Table values are for tangent sections. See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information. See Figure 43-3M or Figure 43-3N for shoulder cross slope on a horizontal curve.

(10) Parking Lane Width. The following will apply:

a. Where the parking lane will be used as a travel lane during peak hours or may be converted to a travel lane in the future, the width should be equal to the travel lane width plus the curb offset width (if present).

b. A parking lane for residential usage may be 0.3 m narrower.

c. The cross slope for a parking lane is typically 1% steeper than that of the adjacent travel lane.

(11) Sidewalk Width. Table values are for the installation of new sidewalks. An existing sidewalk width of 0.9 m or greater (with or without a buffer) may be retained. A buffer strip of 1.2 m or more is desirable.

(12) Bicycle Lane Width. The widths in the table are in addition to the width of a parking lane, if present. See Section 51-7.0 for additional details.

(13) Curbing Type. Vertical curbs may only be used with design speed lower than 80 km/h.

(14) Side Slopes. Section 55-4.05 provides additional information for side slope criteria.

(15) Side Slope (Curbed) Cut. Typically, a shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf desirably should be 1.8 m. Where a sidewalk is present, the toe of the backslope will typically be 0.3 m beyond the edge of sidewalk. See Section 45-3.0 for more information.

(16) Structural Capacity (New or Reconstructed Bridge). The following will apply:

a. Each bridge on a facility with greater than 600 trucks per day should be checked using the Alternate Military Loading.
b. Each State highway bridge within 25 km of a Toll Road gate must be designed for Toll Road Loading.
c. Each bridge on an Extra Heavy Duty Highway must be designed for the Michigan Train truck loading configuration.
d. See Chapter Sixty for additional information on the loading criteria.

(17) Width (New or Reconstructed Bridge). Widths are minimums for a 3R project. See Section 59-1.0 for additional information on bridge width.

(18) Vertical Clearance (Arterial Under Railroad). The following will apply:

a. Table values include an additional 150-mm allowance for a future pavement overlay.
b. In a highly urbanized area, a minimum clearance of 4.30 m may be provided if there is at least one route with a 4.90-m clearance.
c. Vertical clearances apply from usable edge to usable edge of shoulder.

(19) Vertical Clearance (Existing Bridge). See Section 55-6.02 for additional information on minimum allowable vertical clearances.

(20) Vertical Clearance (Arterial Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(21) Intersection Sight Distance. For left turn onto a 2-lane road, P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element				Manual Section	Design Values (By Type of Area)		
					Suburban	Intermediate	Built-up
Design Controls	Design Forecast Year			55-4.01	20 Years (1)	20 Years (1)	20 Years (1)
	*Design Speed (km/h) (2)			55-4.01	Posted Speed Limit	Posted Speed Limit	Posted Speed Limit
	Access Control			40-5.01	Partial Control / None	None	None
	Level of Service			40-2.0	Des: B; Min: D	Des: C; Min: D	Des: C; Min: D
	On-Street Parking			45-1.0	None	Optional (3)	Optional (3)
Cross Section Elements	Travel Lane	*Width (4)		55-4.05	Curbed: Des: 3.6 m; Min: 3.3 m Uncurbed: Des: 3.6 m; Min: 3.3 m	Curbed: Des: 3.6 m; Min: 3.3 m Uncurbed: Des: 3.6 m; Min: 3.3 m	Curbed Des: 3.6m Curbed Min: 3.0 m
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (6)			55-4.05	Des: 0.6 m; Min: 0.3 m	Des: 0.6 m; Min: 0.3 m	Des: 0.6 m; Min: 0.3 m
	Shoulder	*Paved Width (7)		55-4.05	Curbed Des: 3.0 m; Min. 0.3 m Uncurbed: Des: 3.0 m; Min. 1.8 m	Curbed: Des: 2.4 m; Min: 0.3 m Uncurbed: Des: 2.4 m; Min. 1.2 m	Des: 1.8 m; Min: 0.6 m
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (8)		55-4.05	2%-3%	2%-3%	2%-3%
		Shoulder (9)		55-4.05	4%-6%	Paved Width ≤ 1.2 m: 2%-3%; Paved Width > 1.2m: 4%-6%	Paved Width ≤ 1.2 m: 2%-3%; Paved Width > 1.2m: 4%-6%
	Auxiliary Lanes	Lane Width		55-4.05	Des: 3.6 m; Min: 3.3 m	Des: 3.6 m; Min: 3.3 m	Des: 3.6 m; Min: 3.0 m
		Curb Offset			Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m
		Shoulder Width			Des: 3.0 m; Min: 0.6 m	Des: 2.4 m; Min: 0.6 m	Des: 1.8 m; Min: 0.6 m
		Typical Surface Type (5)		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	TWLTL Lane Width			46-5.0	Des: 4.8 m; Min. 4.2 m	Des: 4.8 m; Min: 3.6 m	Des: 4.8 m; Min: 3.3 m
	Parking Lane Width			45-1.04	N/A	Des: 3.0 m; Min: 2.4 m (10)	Des: 3.0 m; Min: 2.4 m (10)
	Sidewalk Width (11)			45-1.06	1.2 m with 1.5-m Buffer (Des)	Des: 1.8 m; Min: 1.2 m	Des: 1.8 m; Min: 1.2 m
	Bicycle Lane Width (12)			51-7.0	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m
	Obstruction Free Zone			55-5.02	See Section 55-5.02	See Section 55-5.02	See Section 55-5.02
	Typical Curbing Type (where used) (13)			55-5.0	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes (Uncurbed)	Cut	Foreslope	55-5.0	2:1 or Flatter (14)	2:1 or Flatter (14)	N/A
			Ditch Width		(14)	(14)	N/A
			Backslope		2:1 or Flatter (14)	2:1 or Flatter (14)	N/A
		Fill			2:1 or Flatter (14)	2:1 or Flatter (14)	N/A
	Side Slopes (Curbed)	Cut (Backslope)		55-4.05	(15)	(15)	(15)
		Fill			2:1 or Flatter (14)	2:1 or Flatter (14)	2:1 or Flatter (14)

Des: Desirable; Min: Minimum.
* Controlling design criteria (see Section 40-8.0).

GEOMETRIC DESIGN CRITERIA FOR TWO-LANE URBAN ARTERIAL
(3R Project)

Table 55-3F

Design Element			Manual Section	Design Values (By Type of Area)					
				Suburban	Intermediate	Built-up			
Bridges	New or Reconstructed Bridge	*Structural Capacity (16)	Ch. 60	HS-25	HS-25	HS-25			
		*Clear Roadway Width(17)	55-6.03	Curbed: Full Approach Curb-to-Curb Width Uncurbed: Full Approach Paved Width					
	Existing Bridge to Re-main in Place	*Structural Capacity	Ch. 72	HS-20	HS-20	HS-20			
		*Clear Roadway Width	55-6.02	Curbed: Full Approach Curb-to-Curb Width; Uncurbed: Travelway Plus 0.6 m on Each Side					
	*Vertical Clearance (Arterial Under)	New or Replaced Overpassing Bridge (18a & 18c)	44-4.0	5.05 m	5.05 m (18b)	5.05 m (18b)			
		Existing Overpassing Bridge (19)		4.30 m	4.30 m	4.30 m			
		Sign Truss / Pedestrian Bridge (18a & 18c)		New: 5.35 m; Existing: 5.20 m	New: 5.35 m; Existing: 5.20 m	New: 5.35 m; Existing: 5.20 m			
	Vertical Clearance (Arterial over Railroad) (20)		Ch. 69	7.00 m					
Alignment Elements	Design Speed			40 km/h	50 km/h	60 km/h	70 k/h	80 km/h	90 km/h
	*Stopping Sight Distance		55-4.02	50 m	65 m	85 m	105 m	130 m	160 m
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 160 m SU: 130 m	U: 195 m SU: 170 m	U: 235 m SU: 205 m	U: 275 m SU: 235 m	U: 315 m SU: 270 m	U: 360 m SU: 315 m
		Stop Maneuver		130 m	155 m	195 m	250 m	270 m	325 m
	Intersection Sight Distance		55-4.06	P: 85 m SU: 110 m	P: 105 m SU: 135 m	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 180 m SU: 235 m	P: 230 m SU: 280 m
	*Minimum Radii		55-4.03	See Section 55-4.03					
	*Superelevation Rate		55-4.03	See Section 55-4.03					
	*Horizontal Sight Distance		55-4.03	See Section 55-4.03					
	*Vertical Curvature (K-values)	Crest	55-4.04	See Section 55-4.04					
		Sag		See Section 55-4.04					
	*Maximum Grade	Level	55-4.04	11%	10%	9%	8.5%	8%	7%
		Rolling		12%	11%	10%	9.5%	9%	8%
	Minimum Grade		44-1.03	Curbed Des: 0.5%; Curbed Min: 0.3% Uncurbed: 0.0%					

* Controlling design criteria (see Section 40-8.0). U: Urban; SU: Suburban. Des: Desirable; Min: Minimum.
See note at bottom of Table 55-3A for approval authority for Level One design exceptions.

GEOMETRIC DESIGN CRITERIA FOR TWO-LANE URBAN ARTERIAL (3R Project)

Table 55-3F (Continued)

GEOMETRIC DESIGN CRITERIA FOR TWO-LANE URBAN ARTERIAL (3R Project)

Footnotes to Table 55-3F

(1) Design Forecast Year. For a partial 3R project, the pavement should be designed for at least a 10-year design life.

(2) Design Speed. The minimum design speed should equal a) the anticipated posted speed limit after construction, or b) the state legal limit on a non-posted highway. The legal limit is 30 mph, but with an engineering study may be raised to a maximum of 55 mph.

(3) On-Street Parking. In general, on-street parking is discouraged.

(4) Travel Lane (Width). For an arterial on the National Truck Network, the right lane must be 3.6-m in width. For a non-National Truck Network route, a minimum 3.3-m travel lane should be used where truck volumes exceed 200 trucks a day. See Section 55-4.05.

(5) Surface Type. The pavement type selection will be determined by the Materials and Tests Division's pavement design engineer or by the local jurisdiction.

(6) Curb Offset. The curb offset should be 0.6 m. Vertical curbs which are either continuous or introduced intermittently may be offset 0.3 m.

(7) Shoulder Width. The table values apply to paved shoulder widths. The following will also apply:

a. For an uncurbed section, the shoulder is paved to the face of guardrail. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. See Section 49-5.0 for more information.

b. For an uncurbed section, a desirable additional 0.3 m of compacted aggregate will be provided.

c. If guardrail is present, the minimum offset from E.T.L. to face of guardrail should desirably be equal to the shy line offset distance, but not less than 1.2 m (see Section 49-5.0 for shy line offsets). In a restrictive situation, the guardrail offset may be 0.3 m from the effective usable shoulder width.

d. For a curbed section, the curb offset is included in the paved shoulder width.

(8) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(9) Cross Slope (Shoulder). Table values are for tangent sections. See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information. See Figure 43-3M or Figure 43-3N for shoulder cross slope on a horizontal curve.

(10) Parking Lane Width. The following will apply:

a. Where the parking lane will be used as a travel lane during peak hours or may be converted to a travel lane in the future, the width should be equal to the travel lane width plus the curb offset width (if present).

b. A parking lane for residential usage may be 0.3 m narrower.

c. The cross slope for a parking lane is typically 1% steeper than that for the adjacent travel lane. Buffered strips of 1.2 m or more are desirable.

(11) Sidewalk Width. Table values are for the installation of new sidewalks. An existing sidewalk width of 0.9 m or greater (with or without a buffer) may be retained. A buffer strip of 1.2 m or wider is desirable.

(12) Bicycle Lane Width. The widths in the table are in addition to the width of parking lane, if present. See Section 51-7.0 for additional details.

(13) Curbing Types. Vertical curbs may only be used with design speed lower than 80 km/h.

(14) Side Slopes. Section 55-4.05 provides additional information for side slope criteria.

(15) Side Slopes (Curbed) Cut. Typically, a shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf desirably should be 1.8 m. Where a sidewalk is present, the toe of the backslope will typically be 0.3 m beyond the edge of sidewalk. See Section 45-3.0 for more information.

(16) Structural Capacity (New or Reconstructed Bridge). The following will apply:

a. Each bridge on a facility with greater than 600 trucks per day should be checked using the Alternate Military Loading.
b. Each State highway bridge within 25 km of a Toll Road gate must be designed for Toll Road Loading.
c. Each bridge on an Extra Heavy Duty Highway must be designed for the Michigan Train truck loading configuration.
d. See Chapter Sixty for additional information on the loading criteria.

(17) Width (New or Reconstructed Bridge). Widths are minimums for a 3R project. See Section 59-1.0 for additional information on bridge width.

(18) Vertical Clearance (Arterial Under Railroad). The following will apply:

a. Table value includes an additional 150 mm allowance for a future pavement overlay.
b. In a highly urbanized area, a minimum clearance of 4.30 m may be provided if there is at least one route with a 4.90-m clearance.
c. Vertical clearances apply from usable edge to usable edge of shoulder.

(19) Vertical Clearance (Existing Bridge). See Section 55-6.02 for additional information on minimum allowable vertical clearance.

(20) Vertical Clearance (Arterial Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(21) Intersection Sight Distance. For left turn onto a 2-lane road. P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element			Manual Section	Design Values (By Type of Area)		
				Suburban	Intermediate	Built-Up
Design Controls	Design Forecast Year		55-4.01	20 Years (1)	20 Years (1)	20 Years (1)
	*Design Speed (km/h) (2)		55-4.01	Posted Speed Limit	Posted Speed Limit	Posted Speed Limit
	Access Control		40-5.0	None	None	None
	Level of Service		40-2.0	Desirable: C; Minimum: D	Desirable: C; Minimum: D	Desirable: C; Minimum: D
	On-Street Parking		45-1.0	Optional (3)	Optional (3)	Optional (3)
Cross Section Elements	Travel Lane	*Width (4)	55-4.05	Curbed: Des: 3.6 m; Min: 3.0 m Uncurbed: Des: 3.6 m; Min: 3.0 m	Curbed: Des: 3.6 m; Min: 3.0 m Uncurbed: Des: 3.6 m; Min: 3.0 m	Curbed Des: 3.6 m Curbed Min: 3.0 m
		Typical Surface Type (5)	Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	Curb Offset (6)		55-4.05	Des: 0.6 m; Min: 0.3 m	Des: 0.6 m; Min: 0.3 m	Des: 0.6 m; Min: 0.3 m
	Shoulder	*Paved Width (7)	55-4.05	Curbed Des: 2.4 m; Min. 0.3 m Uncurbed: Des: 2.4 m; Min. 1.2 m	Curbed Des: 1.8 m; Min. 0.3 m Uncurbed: Des: 1.8 m; Min. 0.9 m	Des: 1.2 m; Min: 0.6 m
		Typical Surface Type (5)	Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	Cross Slope	*Travel Lane (8)	55-4.05	2%-3%	2%-3%	2%-3%
		Shoulder (9)	55-4.05	Paved Width ≤ 1.2 m: 2%-3%; Paved Width > 1.2m: 4%-6%	Paved Width ≤ 1.2 m: 2%-3%; Paved Width > 1.2m: 4%-6%	Paved Width ≤ 1.2 m: 2%-3%; Paved Width > 1.2m: 4%-6%
	Auxiliary Lanes	Lane Width	55-4.05	Des: 3.6 m; Min: 3.0 m	Des: 3.6 m; Min: 3.0 m	Des: 3.6 m; Min: 2.7 m
		Curb Offset		Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m
		Shoulder Width		Des: 2.4 m; Min: 0.6 m	Des: 1.8 m; Min: 0.6 m	Des: 1.2 m; Min: 0.6 m
		Typical Surface Type (5)	Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	TWLTL Lane Width		46-5.0	Des: 4.8 m; Min: 3.6 m	Des: 4.2 m; Min: 3.3 m	Des: 4.2 m; Min: 3.0 m
	Parking Lane Width		45-1.04	Des: 3.0 m; Min: 2.4 m	Des: 3.0 m; Min: 2.4 m (10)	Des: 3.0 m; Min: 2.4 m (10)
	Median Width	Raised Island	55-4.05	Des: 4.8 m; Min: 0.6 m	Des: 4.8 m; Min: 0.6 m	Des: 4.8 m; Min: 0.6 m
		Flush / Corrugated		Des: 4.8 m; Min: 0.6 m	Des: 4.8 m; Min: 0.6 m	Des: 4.8 m; Min: 0.6 m
	Sidewalk Width (11)		55-4.05	1.2 m with 1.5-m Buffer (Des)	Des: 1.8 m; Min: 1.2 m	Des: 1.8 m; Min: 1.2 m
	Bicycle Lane Width (12)		51-7.0	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m
	Obstruction Free Zone		55-5.02	See Section 55-5.02	See Section 55-5.02	See Section 55-5.02
	Typical Curbing Type (where used) (13)		55-4.05	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes (Uncurbed)	Cut: Foreslope	55-4.05	2:1 or Flatter (14)	2:1 or Flatter (14)	N/A
		Cut: Ditch Width		(14)	(14)	N/A
		Cut: Backslope		2:1 or Flatter (14)	2:1 or Flatter (14)	N/A
		Fill		2:1 or Flatter (14)	2:1 or Flatter (14)	N/A
	Side Slopes (Curbed)	Cut (Backslope)	55-4.05	(15)	(15)	(15)
		Fill		2:1 or Flatter (14)	2:1 or Flatter (14)	2:1 or Flatter (14)

Des: Desirable; Min: Minimum.
* Controlling design criteria (see Section 40-8.0).

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR
(3R Project)

Table 55-3G

Design Element			Manual Section	Design Values (By Type of Area)					
				Suburban		Intermediate		Built-Up	
Bridges	New or Reconstructed Bridge	*Structural Capacity (16)	Ch. 60	HS-25		HS-25		HS-25	
		*Clear Roadway Width(17)	55-6.03	Curbed: Full Approach Curb-to-Curb Width Uncurbed: Full Approach Paved Width					
	Existing Bridge to Re-main in Place	*Structural Capacity	Ch. 72	HS-15		HS-15		HS-15	
		*Clear Roadway Width	55-6.02	Curbed: Full Approach Curb-to-Curb Width Uncurbed: Travelway Plus 0.6 m on Each Side				Curbed: Full Approach Curb-to-Curb Width Uncurbed: Travelway + 0.3 m on Each Side	
	*Vertical Clearance (Collector)	New or Replaced Overpassing Bridge (18)	55-6.0	4.45 m		4.45 m		4.45 m	
		Existing Overpassing Bridge (19)		4.30 m		4.30 m		4.30 m	
	Vertical Clearance (Collector over Railroad) (20)		Ch. 69	7.00 m					
Alignment Elements	Design Speed		---	40 km/h	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h
	*Stopping Sight Distance		55-4.02	50 m	65 m	85 m	105 m	130 m	160 m
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 160 m SU: 130 m	U: 195 m SU: 170 m	U: 235 m SU: 205 m	U: 275 m SU: 235 m	U: 315 m SU: 270 m	U: 360 m SU: 315 m
		Stop Maneuver		130 m	155 m	195 m	235 m	280 m	325 m
	Intersection Sight Distance, -3% to +3% (22)		55-4.06	P: 85 m SU: 110 m	P: 105 m SU: 135 m	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 190 m SU: 235 m	P: 230 m SU: 280 m
	*Minimum Radii		55-4.03	See Section 55-4.05					
	*Superelevation Rate (24)		55-4.03	See Section 55-4.05					
	*Horizontal Sight Distance		55-4.03	See Section 55-4.05					
	*Vertical Curvature (K-values)	Crest	55-4.04	See Section 55-4.04					
		Sag		See Section 55-4.04					
	*Maximum Grade (21)	Level	55-4.04	11%	11%	11%	10%	9%	8%
		Rolling		14%	13%	12%	11%	10%	9%
	Minimum Grade		44-1.03	Curbed Des: 0.5%; Curbed Min: 0.3% Uncurbed: 0.0%					

* Controlling design criteria (see Section 40-8.0). SU: Suburban; U: Urban. Des: Desirable; Min: Minimum.
For a state-route project, see note at bottom of Table 55-3B for approval authority for Level One design exceptions.
For a federally-funded local project, see note at bottom of Table 55-3C for approval authority for Level One design exceptions.

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR
(3R Project)

Table 55-3G (Continued)

GEOMETRIC DESIGN CRITERIA FOR URBAN COLLECTOR
(3R Project)

Footnotes to Table 55-3G

(1) Design Forecast Year. For a partial 3R project, the pavement should be designed for at least a 10-year design life.

(2) Design Speed. The minimum design speed should equal a) the anticipated posted speed limit after construction, or b) the state legal limit on a non-posted highway. The legal limit is 30 mph, but with an engineering study may be raised to a maximum of 55 mph.

(3) On-Street Parking. In general, on-street parking is discouraged.

(4) Travel Lane (Width). A minimum 3.3-m travel lane should be used where truck volumes exceed 200 trucks per day. See Section 55-4.05.

(5) Surface Type. The pavement type selection will be determined by the Materials and Tests Division's pavement design engineer or by the local jurisdiction.

(6) Curb Offset. The curb offset should be 0.6 m. Vertical curbs which are either continuous or introduced intermittently should be offset 0.3 m.

(7) Shoulder Width. The table values apply to paved shoulder widths. The following will also apply:

a. For an uncurbed section, the shoulder is paved to the face of guardrail. The desirable guardrail offset is 0.6 m from the effective usable shoulder width. See Section 49-5.0 for more information.

b. For an uncurbed section, a desirable additional 0.3 m of compacted aggregate will be provided.

c. If guardrail is present, the minimum offset from the E.T.L. to face of guardrail should desirably be equal to the shy line offset distance, but not less than 1.2 m (see Section 49-5.0 for shy line offsets). In a restrictive situation, the guardrail offset may be 0.3 m from the effective usable shoulder width.

d. For a curbed section, the curb offset is included in the paved shoulder width.

(8) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(9) Cross Slope (Shoulder). Table values are for tangent sections. See Figure 45-1A(1) or Figure 45-1A(2) for more-specific information. See Figure 43-3M or Figure 43-3N for shoulder cross slope on a horizontal curve.

(10) Parking Lane Width. A parking lane for residential usage may be 0.3 m less. The cross slope for a parking lane is typically 1% steeper than that for the adjacent travel lane. In a residential area, a parallel parking lane from 2.1 to 2.4 m in width should be provided on one or both sides of the street. In a commercial or industrial area, the parking lane width should range from 2.4 to 3.3 m, and should usually be provided on both sides of the street. Where curb-and-gutter sections are used, the gutter pan width may be considered as part of the parking lane width. Where practical, the parking lane width should be in addition to the gutter pan width.

(11) Sidewalk Width. Table values are for the installation of new sidewalks. An existing sidewalk width of 0.9 m or greater (with or without a buffer) may be retained. A buffer strip of 1.2 m or wider is more desirable.

(12) Bicycle Lane Width. The widths in the table are in addition to the width of parking lane, if present. See Section 51-7.0 for additional details.

(13) Curbing Type. Vertical curbs may only be used with design speed lower than 80 km/h.

(14) Side Slopes. Section 55-4.05 provides additional information for side slope criteria.

(15) Side Slope (Curbed) Cut. Typically, a shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf desirably should be 1.8 m. Where a sidewalk is present, the toe of the backslope will typically be 0.3 m beyond the edge of sidewalk. See Section 45-3.0 for more information.

(16) Structural Capacity (New or Reconstructed Bridge). The following will apply:

a. Each bridge on a facility with greater than 600 trucks per day should be checked using the Alternate Military Loading.
b. Each State highway bridge within 25 km of a Toll Road gate must be designed for Toll Road Loading.
c. Each bridge on an Extra Heavy Duty Highway must be designed for the Michigan Train truck loading configuration.
d. See Chapter Sixty for additional information on the loading criteria.

(17) Width (New or Reconstructed Bridge). Widths are minimums for a 3R project. See Section 59-1.0 for additional information on bridge width.

(18) Vertical Clearance (Collector Under Railroad). Table value includes an additional 150 mm allowance for a future pavement overlay. Vertical clearances apply from usable edge to usable edge of shoulder.

(19) Vertical Clearance (Existing Bridge). See Section 55-6.02 for additional information on minimum allowable vertical clearance.

(20) Vertical Clearance (Arterial Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(21) Maximum Grades. For a grade of less than 150 m in length (PVT to PVC), a one-way downgrade, or a street with AADT < 400, the maximum grade may be 2% steeper than table value. Where adjacent sidewalks are present, the maximum desirable grade is 5%.

(22) Intersection Sight Distance. For left turn onto a 2-lane road, P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.

Design Element				Manual Section	Design Values (By Type of Area)		
					Suburban	Intermediate	Built-Up
Design Controls	Design Forecast Year			55-4.01	20 Years (1)	20 Years (1)	20 Years (1)
	*Design Speed (km/h) (2)			55-4.01	See Section 55-4.01	See Section 55-4.01	See Section 55-4.01
	Access Control			40-5.0	None	None	None
	Level of Service			40-2.0	Desirable: C; Minimum: D	Desirable: C; Minimum: D	Desirable: C; Minimum: D
	On-Street Parking			45-1.0	Optional (3)	Optional	Optional
Cross Section Elements	Travel Lane	*Width (4)		55-4.05	Curbed: Des: 3.3 m; Min: 3.0 m Uncurbed: Des: 3.3 m; Min: 3.0 m	Curbed: Des: 3.0 m; Min: 2.7 m Uncurbed: Des: 3.3 m; Min: 3.0 m	Curbed Des: 3.0 m Curbed Min: 2.7 m
		Typical Surface Type		Ch. 52	Asphalt / Concrete	Asphalt / Concrete	Asphalt / Concrete
	*Curb Offset (5)			55-4.05	Des: 0.6 m; Min: 0.3 m	Des: 0.6 m; Min: 0.3 m	Des: 0.6 m; Min: 0.3 m
	Shoulder	*Usable Width		55-4.05	Curbed Des: 1.2 m; Min. 0.3 m Uncurbed: Des: 1.2 m; Min. 0.6 m	Curbed Des: 1.2 m; Min. 0.3 m Uncurbed: Des: 1.2 m; Min. 0.6 m	Des: 1.2 m; Min: 0.6 m
		Typical Surface Type		Ch. 52	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth
	Cross Slope	*Travel Lane (6)		55-4.05	2%-3%	2%-3%	2%-3%
		Shoulder (7)		55-4.05	2%-3% Asphalt / Concrete; 6%-8% Aggregate; 8% Earth	2%-3% Asphalt / Concrete; 6%-8% Aggregate; 8% Earth	2%-3% asphalt / Concrete; 6%-8% Aggregate; 8% Earth
	Auxiliary Lanes	Lane Width		55-4.05	Des: 3.3 m; Min: 3.0 m	Des: 3.3 m; Min: 2.7 m	Des: 3.0 m; Min: 2.7 m
		Curb Offset			Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m	Des: 0.3 m; Min: 0.0 m
		Shoulder Width			Des: 1.2 m; Min: 0.3 m	Des: 1.2 m; Min: 0.3 m	Des: 1.2 m; Min: 0.3 m
		Typical Surface Type		Ch. 52	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth	Asphalt / Concrete / Aggregate / Earth
	Parking Lane Width (3)			45-1.04	Des: 2.7 m; Min: 2.1 m	Des: 2.7 m; Min: 2.1 m	Des: 2.7 m; Min: 2.1 m
	Sidewalk Width (8)			55-4.05	1.2 m with 1.5-m Buffer (Des)	Des: 1.8 m; Min: 1.2 m	Des: 1.8 m; Min: 1.2 m
	Bicycle Lane Width (9)			51-7.0	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m Uncurbed: Shld. Width +1.2 m	Curbed: 1.5 m
	Obstruction Free Zone			55-5.02	See Section 55-5.02	See Section 55-5.02	See Section 55-5.02
	Typical Curbing Type (where used) (5)			55-4.05	Sloping / Vertical	Sloping / Vertical	Sloping / Vertical
	Side Slopes (Uncurbed)	Cut	Foreslope	55-4.05	2:1 or Flatter (10)	2:1 or Flatter (10)	N/A
			Ditch Width		(10)	(10)	N/A
			Backslope		2:1 or Flatter (10)	2:1 or Flatter (10)	N/A
		Fill			2:1 or Flatter (10)	2:1 or Flatter (10)	N/A
	Side Slopes (Curbed)	Cut (Backslope)		55-4.05	(11)	(11)	(11)
		Fill			2:1 or Flatter (10)	2:1 of Flatter (10)	2:1 or Flatter (10)

Des: Desirable; Min: Minimum.

* Controlling design criteria (see Section 40-8.0).

** Table applies only to a project with federal-aid funds.

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL STREET (3R Project)

Table 55-3H

Design Element			Manual Section	Design Values (By Type of Area)					
				Suburban		Intermediate		Built-Up	
Bridges	New or Reconstructed Bridge	*Structural Capacity	Ch. 60	HS-25(11a)		HS-25(11a)		HS-25(11a)	
		*Clear Roadway Width	55-6.03	Curbed: Full Approach Curb-to-Curb Width Uncurbed: (12)					
	Existing Bridge to Remain in Place	*Structural Capacity (13)	Ch. 72	HS-15		HS-15		HS-15	
		*Clear Roadway Width	55-6.02	Existing Width (14)					
	*Vertical Clearance (Local Under)	New or Replaced Overpassing Bridge (15)	44-4.0	4.45 m		4.45 m		4.45 m	
		Existing Overpassing Bridge (16)		4.30 m		4.30 m		4.30 m	
	Vertical Clearance (Local over Railroad) (17)		Ch. 69	7.00 m					
Alignment Elements	Design Speed			40 km/h	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h
	*Stopping Sight Distance		55-4.02	50 m	65 m	85 m	105 m	130 m	160 m
	Decision Sight Distance	Speed / Path / Direction Change	42-2.0	U: 160 m SU: 130 m	U: 195 m SU: 170 m	U: 235 m SU: 205 m	U: 275 m SU: 235 m	U: 315 m SU: 270 m	U: 360 m SU: 315 m
		Stop Maneuver		130 m	155 m	195 m	235 m	280 m	325 m
	Intersection Sight Distance, -3% to +3% (18)		55-4.06	P: 85 m SU: 110 m	P: 105 m SU: 135 m	P: 125 m SU: 160 m	P: 150 m SU: 185 m	P: 170 m SU: 235 m	P: 190 m SU: 280 m
	*Minimum Radii		55-4.03	See Section 55-4.03					
	*Superelevation Rate		55-4.03	See Section 55-4.03					
	*Horizontal Sight Distance		55-4.03	See Section 55-4.03					
	*Vertical Curvature (K-values)	Crest	55-4.04	See Section 55-4.04					
		Sag		See Section 55-4.04					
	*Maximum Grade	Level	55-4.04	In a residential area, the maximum grade should not exceed 15%. In an industrial or commercial area, the maximum grade should not exceed 8%.					
		Rolling							
	Minimum Grade		55-4.04	Curbed Des: 0.5%; Curbed Min: 0.3% Uncurbed: 0.0%					

U: Urban; SU: Suburban. Des: Desirable; Min: Minimum.
* Controlling design criteria (see Section 40-8.0).
** Table applies only to a project with federal-aid funds.

See note at bottom of Table 55-3D for approval authority for Level One design exceptions.

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL STREET **
(3R Project)

Table 55-3H (Continued)

GEOMETRIC DESIGN CRITERIA FOR URBAN LOCAL STREET (3R Project)

Footnotes to Table 55-3H

(1) Design Forecast Year. For a partial 3R project, the pavement should be designed for at least a 10-year design life.

(2) Design Speed. The minimum design speed should equal a) the anticipated posted speed limit after construction, or b) the state legal limit on a non-posted highway. The legal limit is 30 mph, but with an engineering study may be raised to a maximum of 55 mph.

(3) On-Street Parking. In general, on-street parking is discouraged. However, if parking lanes are used, cross slopes are typically 1% steeper than that of the adjacent travel lane. In a residential area, a parallel parking lane from 2.1 to 2.4 m in width should be provided on one or both sides of the street. In a commercial or industrial area, parking lane width should range from 2.4 to 3.3 m, and should usually be provided on both sides of the street. Where curb-and-gutter sections are used, the gutter pan width may be considered as part of the parking lane width. Where practical, the parking lane width should be in addition to the gutter pan width.

(4) Travel Lane (Width). A minimum 3.3-m travel lane should be used where truck volumes exceed 200 trucks per day. See Section 55-4.05.

(5) Curb Offset. A vertical-curb offset should be 0.6 m. Vertical curbs which are either continuous or introduced intermittently may be offset 0.3 m. A sloping-curb offset may be zero. For a curbed section, the curb offset is included in the paved shoulder width. Vertical curbs may only be used with design speed lower than 80 km/h.

(6) Cross Slope (Travel Lane). Cross slopes of 1.5% are acceptable on an existing bridge to remain in place.

(7) Cross Slope (Shoulder). Table values are for tangent sections; see Section 43-3.06 for shoulder cross slopes on a horizontal curve.

(8) Sidewalk Width. Table values are for the installation of new sidewalks. An existing sidewalk width of 0.9 m or greater (with or without a buffer) may be retained. A buffer strip of 1.2 m or wider is desirable.

(9) Bicycle Lane Width. The widths in the table are in addition to the width of parking lane, if present. See Section 51-7.0 for additional details.

(10) Side Slopes. Section 55-4.05 provides additional information for side slope criteria.

(11) Side Slope (Curbed) Cut. Typically, a shelf or sidewalk will be present immediately behind the curb before the toe of the backslope. The minimum width of a shelf desirably should be 1.8 m. Where a sidewalk is present, the toe of the backslope will typically be 0.3 m beyond the edge of sidewalk. See Section 45-3.0 for more information.

(11a) Structural Capacity (New or Reconstructed Bridge). A bridge with design year average daily truck traffic (ADTT) greater than 1,000 should be designed for HS 25 live loads. A bridge with an ADTT less than or equal to 1,000 may be designed for HS 25 or HS 20, whichever the LPA elects.

(12) Width (New or Reconstructed Bridge) Uncurbed. The following will apply:

Volume	Minimum Clear Width
0 < AADT < 400	Travelway + 0.6 m each side
400 ≤ AADT < 5000	Travelway + 0.9 m each side
AADT ≥ 5000	Approach Roadway Width (Travelway Plus Shoulders)

See Section 59-1.0 for more information on bridge width.

(13) Structural Capacity (Existing Bridge to Remain in Place). For a street with AADT ≤50, an HS-10 loading is acceptable.

(14) Width (Existing Bridge to Remain in Place). If the width of the existing bridge is less than the approach travelway width, strong consideration should be given to widening the bridge to at least the travelway width.

(15) Vertical Clearance (Local Under Railroad). Table values include an additional 150 mm allowance for a future pavement overlay. Vertical clearances apply from usable edge to usable edge of shoulder.

(16) Vertical Clearance (Existing Bridge). See Section 55-6.02 for additional information on minimum allowable vertical clearance.

(17) Vertical Clearance (Local Over Railroad). See Chapter Sixty-nine for additional information on railroad clearance under a highway.

(18) Intersection Sight Distance. For left turn onto a 2-lane road, P = Passenger car; SU = single unit truck. See Figure 46-10G for values for combination trucks.