

INSTRUCTIONAL MEMORANDUMS

To Local Public Agencies



To: Counties	Date: March 15, 2023
From: Local Systems Bureau	I.M. No. 3.210
Subject: Rural Design Guidelines	

Contents: This Instructional Memorandum (I.M.) provides design guidelines for new construction or reconstruction of road or bridge projects on rural collectors and rural local roads. It includes general design considerations, background on the development and application of the design guidelines, and several design tables. These guidelines are most applicable to counties; however, they may be used on projects within the corporate limits that have a rural cross section (e.g., shoulders with open ditches, no curbs). Please note the following:

1. These guidelines will be used by the Iowa Department of Transportation (Iowa DOT) to review the proposed design values of Federal-aid road or bridge projects.
2. The Iowa County Engineers Association (ICEA), by action of the Association’s Design Guide Committee and Executive Board, has adopted the AASHTO Guidelines Tables contained in this I.M. for use on County projects funded with Swap, Farm-to-Market (FM), or local funds. For such projects, the Iowa DOT will not provide any review of the proposed design values, unless specifically requested by the County.
3. These guidelines are **not** applicable for projects on arterial roadways. For Primary or Interstate roadways, refer to the Iowa DOT [Design Manual](#). For minor arterials that are not on either the Primary or Interstate systems, refer to the American Association of State Highway and Transportation Officials (AASHTO) publications: *A Policy on Geometric Design of Highways and Streets* (2018), commonly referred to as the “Green Book”.

Definitions

Agricultural Access Roads – Certain roads in rural areas serve primarily to provide access to fields and farming operations. Vehicle types that use such roads include combines, tractors, trucks that haul agricultural products, and other large and slow-moving vehicles with unique operating characteristics. The driving population generally consists of repeat users who are familiar with the roads and its characteristics. Such roads are often unpaved.

Clear Zone – Refer to [I.M. 3.240](#), Clear Zone Guidelines.

New Construction – New construction projects are those that construct roads on new alignment where no existing roadway is present.

Reconstruction – Reconstruction projects are projects that utilize an existing roadway alignment (or make only minor changes to an existing alignment) but involve a change in the basic roadway type. Changes in the basic roadway type include widening a road to provide additional through lanes or adding a raised or depressed median where none currently exists, and where these changes cannot be accomplished within the existing roadway width (including shoulders).

Roadway – The portion of a highway, including shoulders, for vehicular use. A divided highway has two or more roadways. The roadway width is the sum of the traveled way and shoulder widths.

Shoulder – The shoulder is the portion of the roadway contiguous with the traveled way that accommodates stopped vehicles, emergency use, and lateral support of subbase, base, and surface courses. In some cases, the shoulder can accommodate bicyclists.

Traveled Way – The portion of the roadway that allows for the movement of through traffic, including vehicles, transit, and freight. It does not include such facilities as curbs, shoulders, turn lanes, bicycle facilities, sidewalks, or parking lanes. Divided highways are made up of two separate roadways, each with its own traveled way.

Design Considerations

The objective of the engineering design of any public facility is to satisfy the demands for service in the safest and most economical manner while maintaining the integrity of the environment. On new construction or reconstruction projects, the selected design speed should be consistent with the proposed or existing operating speed limit. Any individual curves below this design speed may require mitigation by placement of warning signs

and/or markings such as: curve or turn signs, advisory speed plaques, chevrons, no passing lines, edgelines, or reduced speed zones.

Under 23 U.S.C. 217(e), all projects with Federal financial participation that replace or rehabilitate a highway bridge deck are required to provide safe accommodation of pedestrians or bicyclists, as applicable, on the bridge, when both of the following conditions are met:

- the bridge is located on a highway on which pedestrians or bicyclists are allowed to operate at each end of the bridge, and
- FHWA determines that safe accommodation can be provided at reasonable cost.

The standard shoulder widths shown in the Design Tables should be sufficient in most circumstances to provide the necessary bike and pedestrian accommodation for Federal-aid participation. Where the need has been identified for additional shoulder width or pedestrian accommodation, it should be provided at a reasonable cost.

Development and Application of the Design Tables

The guidelines in this I.M. are applicable to rural collectors and rural local roads, as classified on the [Federal Functional Classification Maps](#). For each of these road classifications, two design tables are provided: the Design Aids tables and the AASHTO Guidelines tables. These tables were developed using two AASHTO publications: the Green Book (2018) and the *Guidelines for Geometric Design of Low-Volume Roads* (2019). The proper application and use of each kind of table is described below.

The values in the Design Aids tables are based on design speeds adopted by the ICEA. These values equal or exceed the recommended values in the Green Book. These higher values were chosen because it was felt that higher design criteria could and should be achieved in many situations. These tables should be used in the initial stages of project development. Values approaching or exceeding the values in the Design Aids tables should be used as the basis for design wherever the conditions permit. However, values less than those in the Design Aids tables but greater than or equal to those in the AASHTO tables are acceptable. For Federal-aid projects, the County Engineer shall identify any design values that do not meet or exceed the Design Aids tables and shall explain the reasons for not meeting these values. This documentation is not a formal design exception, but it should be included with the Concept Statement submittal.

The values in the AASHTO Guidelines tables typically represent the minimum recommended values given in the Green Book. For local roads with design traffic volumes less than or equal to 400 ADT that can be classified as agricultural access roads, the values in the AASHTO Guidelines for Rural Local Roads table are based on the *Guidelines for Geometric Design of Very Low-Volume Local Roads*. The AASHTO Guidelines tables are furnished to provide alternate values for design criteria where problems with excessive costs exist or where adverse impacts to adjacent property occur when using the Design Aids values. Any proposed Federal-aid project that does not meet the values in the AASHTO Guidelines tables will require a design exception. The design exception request will need to be in the form of safety and service (crash experience, function of road, etc.) benefits versus the economics and environment (right of way and construction costs, farmsteads affected, parks, etc.), as described in [I.M. 3.260](#), Design Exception Process.

Design Aids For Rural Collectors

These “Aids” are presented to help in the design of new construction or reconstruction projects on rural collector roads. Each design element of each project should reflect the most practicable and economically justified value. For Federal-aid projects, design values below those shown in this table will be considered on a project-by-project basis, provided that an explanation is provided to the Iowa DOT Administering Team.

Design Elements	Paved Roadway						Non-Paved Roadway			
	Over 1500		1500 – 400		Under 400		400 – 50		Under 50	
Terrain (1)	Level	Rolling	Level	Rolling	Level	Rolling	Level	Rolling	Level	Rolling
Design Speed (mph)	60	50	55	50	55	45	55	45	50	40
Stopping Sight Distance (ft) (2)	570	425	495	425	495	360	495	360	425	305
Minimum K for Crest/Sag Vertical Curves	151/136	84/96	114/115	84/96	114/115	61/79	114/115	61/79	84/96	44/64
Minimum Horizontal Curve Radius (ft) (3)	1200	758	960	758	960	587	960	587	758	444
Maximum Gradient (%) (4)	5	7	6	7	6	8	6	8	6	8
Traveled Way (ft)	24	24	22	22	22	22	22	20	20	20
Shoulder Width (ft)	8	8	6	6	6	6	4	4	2	2
New Bridge Roadway Width (ft) (5)	40	40	30	30	30	30	30	24	24	24
Existing Bridge Roadway Width (ft) (6)	24	24	22	22	22	22	22	22	22	22
Foreslope	4:1	4:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1	3:1
Entrance Foreslopes	8:1	8:1	6:1	6:1	6:1	6:1	3:1	3:1	3:1	3:1
Clear Zone Distance (ft)	See note (7)									

- NOTES:
- (1) Prevailing (over 50%) slopes of natural ground are: Level-less than 3%, Rolling-3% or more.
 - (2) Stopping Sight Distance is based on level roadways for all situations shown. For downgrades and upgrades, consider using Table 3-2 in the Green Book.
 - (3) a. Based on a maximum superelevation (e) of 0.08.
b. Horizontal curves should have a minimum length of 500 feet.
 - (4) Short lengths of grade (less than 500 feet) and grades on low-volume rural collectors (<2000 vpd) may be steepened by 2%.
 - (5) a. Where the Approach Roadway Width (Traveled Way plus shoulders) is surfaced, that surface width should be carried across the structure.
b. Minimum clear roadway width for bridges is Traveled Way + 2ft (each side) for Design Volumes of under 400 ADT, Traveled Way + 4ft (each side) for Design Volumes of 400-2000 ADT, and Approach Roadway Width for Design Volumes over 2000 ADT.
c. For Design Volumes of 400 ADT or greater, for bridges over 100 feet long, the width may be the Traveled Way plus 6 feet (3ft on each side).
d. Design loading shall be at least HL-93.
e. Refer to [I.M. 3.230](#), Traffic Barriers (Guardrail and Bridge Barrier Rail), for information on when to install or upgrade guardrail and/or bridge barrier rail.
 - (6) a. Applies to bridges less than 100 feet in length. Bridges over 100 ft. will be analyzed individually.
b. If the Design Volume is over 2000 ADT, use 28 feet.
c. Design loading shall be at least HS-20. Refer to [I.M. 1.100](#), Highway Bridge Programs for Cities and Counties for requirements on bridge rehabilitation projects.
d. Existing Bridge Roadway Width should be greater than or equal to the Traveled Way width unless a design exception has been approved.
e. Refer to [I.M. 3.230](#), Traffic Barriers (Guardrail and Bridge Barrier Rail), for information on when to install or upgrade guardrail and/or bridge barrier rail.
 - (7) The recommended clear zone distance is a function of Design Speed, Design Volume, horizontal curvature, and roadside geometry. To determine the recommended clear zone distance, refer to [I.M. 3.240](#), Clear Zone Guidelines.

AASHTO Guidelines For Rural Collectors

These "Guidelines" are the recommendations from Chapter 6 of the AASHTO Green Book (2018). These guidelines are presented to help in the design of new construction or reconstruction projects on rural collectors. For Federal-aid projects, design values below those shown in this table may be used on a project-by-project basis, provided that a design exception or justification is approved by the Iowa DOT Administering Team, as per [I.M. 3.260](#), Design Exception Process.

Design Elements	Green Book reference	All Collector Roads					
		Over 2000		2000 – 400		Under 400	
Terrain (1)		Level	Rolling	Level	Rolling	Level	Rolling
Design Speed (mph)	Table 6-1	60	50	50	40	40	30
Stopping Sight Distance (ft) (2)	Tables 3-1 & 6-3	570	425	425	305	305	200
Minimum K for Crest/Sag Vertical Curves	Tables 3-35, 3-37 & 6-3	151/136	84/96	84/96	44/64	44/64	19/37
Minimum Horizontal Curve Radius (ft) (3)	Table 3-7	1200	758	758	444	444	214
Maximum Gradient (%) (4)	Table 6-2	5	7	6	8	7	9
Traveled Way (ft) (5)	Table 6-5	22	22	22	22	20	20
Shoulder Width (ft)	Table 6-5	6	6	4	4	2	2
New Bridge Roadway Width (ft) (6)	Table 6-6	34	34	30	30	24	24
Existing Bridge Roadway Width (ft) (7)	Table 6-7 (2011 Green Book)	28	28	24	24	22	22
Foreslope	Page 6-9	3:1	3:1	3:1	3:1	3:1	3:1
Clear Zone Distance (ft)		See note (8)					

- NOTES:
- (1) AASHTO "Mountainous" terrain design guides may be used on Federal-aid projects only with Iowa DOT concurrence. Note (1) in the Design Aids Table provides definitions for Level and Rolling.
 - (2) Stopping Sight Distance is based on level roadways for all situations shown. For downgrades and upgrades, consult Table 3-2 in the Green Book.
 - (3) Based on a maximum superelevation (e) of 0.08.
 - (4) Short lengths of grade (less than 500 feet) and grades on low-volume rural collectors (<2000 vpd) may be steepened by 2%.
 - (5) For Design Volumes of ≥ 2000 ADT, consider using Traveled Way width of 24ft where substantial truck volumes are present or agricultural equipment frequently uses the road.
 - (6)
 - a. Where the Approach Roadway Width (Traveled Way plus shoulders) is surfaced, that surface width should be carried across the structure.
 - b. Minimum clear roadway width for bridges is Traveled Way + 2ft (each side) for Design Volumes of under 400 ADT, Traveled Way + 4ft (each side) for Design Volumes of 400-2000 ADT, and Approach Roadway Width for Design Volumes over 2000 ADT.
 - c. For Design Volumes of 400 ADT or greater, for bridges over 100 feet long, the width may be the Traveled Way plus 6 feet (3ft on each side).
 - d. Design loading shall be at least HL-93.
 - e. Refer to [I.M. 3.230](#), Traffic Barriers (Guardrail and Bridge Barrier Rail), for information on when to install or upgrade guardrail and/or bridge barrier rail.
 - (7)
 - a. Applies to bridges less than 100 feet in length. Bridges over 100 feet will be analyzed individually.
 - b. Design Loading shall be at least HS-20. Refer to [I.M. 1.100](#), Highway Bridge Programs for Cities and Counties for requirements on bridge rehabilitation projects.
 - c. Existing Bridge Roadway Width should be greater than or equal to the Traveled Way width, unless a design exception has been approved.
 - d. Refer to [I.M. 3.230](#), Traffic Barriers (Guardrail and Bridge Barrier Rail), for information on when to install or upgrade guardrail and/or bridge barrier rail.
 - (8) The recommended clear zone distance is a function of Design Speed, Design Volume, horizontal curvature, and roadside geometry. To determine the recommended clear zone distance, refer to [I.M. 3.240](#), Clear Zone Guidelines.

Design Aids For Rural Local Roads

These "Aids" are presented to help in the design of new construction or reconstruction projects on rural local roads. Each design element of each project should reflect the most practicable and economically justified value. For Federal-aid projects, design values below those shown in this table will be considered on a project-by-project basis, provided that an explanation is provided to the Iowa DOT Administering Team.

Design Elements	All Local Roads									
	Over 1500		1500 – 400		400 – 250		250 – 50		Under 50	
Design Volume (ADT)	Level	Rolling	Level	Rolling	Level	Rolling	Level	Rolling	Level	Rolling
Terrain (1)	Level	Rolling	Level	Rolling	Level	Rolling	Level	Rolling	Level	Rolling
Design Speed (mph)	55	50	55	45	50	45	50	40	40	35
Stopping Sight Distance (ft) (2)	495	425	495	360	425	360	425	305	305	250
Minimum K for Crest/Sag Vertical Curves	114/115	84/96	114/115	61/79	84/96	61/79	84/96	44/64	44/64	29/49
Minimum Horizontal Curve Radius (ft) (3)	960	758	960	587	758	587	758	444	444	314
Maximum Gradient (%) (4)	6	8	6	9	6	9	6	10	7	10
Traveled Way (ft)	24	24	22	22	22	22	20	20	20	20
Shoulder Width (ft)	8	8	6	6	4	4	3	3	2	2
New Bridge Roadway Width (ft) (5)	40	40	30	30	30	30	24	24	24	24
Existing Bridge Roadway Width (ft) (6)	24	24	22	22	22	22	20	20	20	20
Foreslope (7)	4:1	4:1	3:1	3:1	2:1*	2:1*	2:1*	2:1*	2:1*	2:1*
Clear Zone Distance (ft)	See note (8)									

- NOTES:
- (1) Prevailing (over 50%) slopes of natural ground are: Level – less than 3%, Rolling - 3% or more.
 - (2) Stopping Sight Distance is based on level roadways for all situations shown. For downgrades and upgrades, consult Table 3-2 in the Green Book.
 - (3) a. Based on a maximum superelevation (e) of 0.08.
b. Horizontal curves should have a minimum length of 500 feet.
 - (4) Short lengths of grade (less than 500 feet) and grades on low-volume rural collectors (<2000 vpd) may be steepened by 2%.
 - (5) a. Where the Approach Roadway Width (Traveled Way plus shoulders) is surfaced, that surface width should be carried across the structure.
b. Minimum clear roadway width for bridges is Traveled way + 2ft (each side) for Design Volumes of under 400 ADT, Traveled way + 3ft (each side) for Design Volumes of 400-2000 ADT, and Approach Roadway Width for Design Volumes over 2000 ADT.
c. For Design Volumes of 2000 ADT or greater, for bridges over 100 feet long, the width may be the traveled way plus 6 feet (3ft on each side).
d. Design loading shall be at least HL-93.
e. Refer to [I.M. 3.230](#), Traffic Barriers (Guardrail and Bridge Barrier Rail), for information on when to install or upgrade guardrail and/or bridge barrier rail.
 - (6) a. Applies to bridges less than 100 feet in length. Bridges over 100 feet will be analyzed individually.
b. If the Design Volume is over 2000 ADT, use 28 feet.
c. Design loading shall be at least HS-20. Refer to [I.M. 1.100](#), Highway Bridge Programs for Cities and Counties for requirements on bridge rehabilitation projects.
d. Existing Bridge Roadway Width should be greater than or equal to the Traveled Way width, unless a design exception has been approved.
e. Refer to [I.M. 3.230](#), Traffic Barriers (Guardrail and Bridge Barrier Rail), for information on when to install or upgrade guardrail and/or bridge barrier rail.
 - (7) * If slopes steeper than 3:1 are used within the recommended clear zone distance, they should be reviewed for shielding with a traffic barrier, as per [I.M. 3.240](#), Clear Zone Guidelines.
 - (8) The recommended clear zone distance is a function of Design Speed, Design Volume, horizontal curvature, and roadside geometry. To determine the recommended clear zone distance, refer to [I.M. 3.240](#), Clear Zone Guidelines.

AASHTO Guidelines For Rural Local Roads

These "Guidelines" are a composite of the AASHTO recommendations from Chapter 5 of the Green Book (2018) and the Guidelines for Geometric Design of Low-Volume Roads (2019). The values in the first three columns are based on the Green Book. The values in the last column (Agricultural Access) are based on the Guidelines for Geometric Design of Low-Volume Roads. These guidelines are presented to help in the design of new construction or reconstruction projects on rural local roads. For Federal-aid projects, design values below those shown in this table may be used on a project-by-project basis, provided that a design exception or justification is approved by the Iowa DOT Administering Team, as per [I.M. 3.260](#), Design Exception Process.

Design Elements	Green Book reference	All Local Roads							
		Over 2000		2000 – 400		Under 400		Under 400 Agricultural Access (10)	
Terrain (1)		Level	Rolling	Level	Rolling	Level	Rolling	Level	Rolling
Design Speed (mph)	Table 5-1	50	40	50	40	40	30	30	20
Stopping Sight Distance (ft) (2)	Tables 3-1 & 5-3	425	305	425	305	305	200	165	95
Minimum K for Crest/Sag Vertical Curves	Tables 3-35, 3-37, & 5-3	84/96	44/64	84/96	44/64	44/64	19/37	13	5
Minimum Horizontal Curve Radius (ft) (3)	Table 3-7	758	444	758	444	444	214	135	75
Maximum Gradient (%) (4)	Table 5-2	6	10	6	10	7	10	--	--
Traveled Way (ft) (5)	Table 5-5	22	22	22	20	18	18	18	18
Shoulder Width (ft)	Table 5-5	6	6	3	3	2	2	2	2
New Bridge Roadway Width (ft) (6)	Table 5-6	34	34	28	26	22	22	TW+2'	TW+2'
Existing Bridge Roadway Width (ft) (7)	Table 5-7 (2011 Green Book)	28	28	24	24	22	22	UAC	UAC
Foreslope (8)	Page 5-11	2:1*	2:1*	2:1*	2:1*	2:1*	2:1*	UAC*	UAC*
Clear Zone Distance (ft)		See note (9)							

NOTES:

- (1) AASHTO "Mountainous" terrain design guides may be used on Federal-aid projects only with Iowa DOT concurrence. Note (1) in the Design Aids Table provides definitions for Level and Rolling.
- (2) Stopping Sight Distance is based on level roadways for all situations shown. For downgrades and upgrades, consult Table 3-2 in the Green Book.
- (3) Based on a maximum superelevation (e) of 0.08.
- (4) a. Short lengths of grade (less than 500 feet) and grades on low-volume rural collectors (<2000 vpd) may be steepened by 2%.
b. No values are shown in the Agricultural Access column because there are no criteria for maximum gradient in the Guidelines for Geometric Design of Low-Volume Roads.
- (5) For Design Volumes of 2000 ADT or greater, consider using Traveled Way width of 24ft where substantial truck volumes are present or agricultural equipment frequently uses the road.
- (6) a. Where the Approach Roadway Width (Traveled Way plus shoulders) is surfaced, that surface width should be carried across the structure.
b. Minimum clear roadway width for bridges is Traveled way + 2ft (each side) for Design Volumes of under 400 ADT, Traveled way + 3ft (each side) for Design Volumes of 400-2000 ADT, and Approach Roadway Width for Design Volumes over 2000 ADT.
c. For Design Volumes of 2000 ADT or greater, for bridges over 100 feet long, the width may be the Traveled Way plus 6 feet (3 feet on each side).
d. Design Loading shall be at least HL-93.
e. Refer to [I.M. 3.230](#), Traffic Barriers (Guardrail and Bridge Barrier Rail), for information on when to install or upgrade guardrail and/or bridge barrier rail.
- (7) a. Applies to bridges less than 100 feet in length. Bridges over 100 feet will be analyzed individually.
b. Design loading shall be at least HS-20. Refer to [I.M. 1.100](#), Highway Bridge Programs for Cities and Counties for requirements on bridge rehabilitation projects.
c. 20 foot minimum clear roadway width is acceptable for Design Volumes from 0 – 250 ADT.

- d. Existing Bridge Roadway Width should be greater than or equal to the Traveled Way width, unless a design exception has been approved.
 - e. Refer to [I.M. 3.230](#), Traffic Barriers (Guardrail and Bridge Barrier Rail), for information on when to install or upgrade guardrail and/or bridge barrier rail.
- (8) * If slopes steeper than 3:1 are used within the recommended clear zone distance, they should be reviewed for shielding with a traffic barrier, as per [I.M. 3.240](#), Clear Zone Guidelines.
- (9) The recommended clear zone distance is a function of Design Speed, Design Volume, horizontal curvature, and roadside geometry. To determine the recommended clear zone distance, refer to [I.M. 3.240](#), Clear Zone Guidelines.
- (10) Values in this column are taken from the Guidelines for Geometric Design of Low-Volume Roads unless specified otherwise below.
- a. Design Speed is taken from the Green Book using a Design Volume of under 50vpd.
 - b. While the Guidelines for the Geometric Design of Low-Volume Roads allow for a lesser width, for construction projects, [Iowa Code 309.39](#) states, "...and no traveled roadway shall be less than twenty-two feet from shoulder to shoulder."
 - ** The Guidelines for the Geometric Design of Low-Volume Roads specify a minimum Total Roadway Width (Traveled Way plus shoulders) of 24 feet for the Design Speeds listed.
 - c. Page 4-6 of the Guidelines for the Geometric Design of Low-Volume Roads states, "Existing bridges can remain in place without widening unless there is evidence of a site-specific crash pattern related to the width of the bridge. However, [Iowa Code 309.74](#) states, "All culverts shall have a clear width of roadway of at least twenty feet. Bridges shall have a clear width of roadway of at least sixteen feet."