

CHAPTER IV
DETAIL DESIGN

FUNCTIONAL CLASSIFICATION		PRINCIPAL ARTERIALS				MINOR ARTERIALS		COLLECTORS			LOCALS		
		INTERSTATE	OTHERS										
AVERAGE DAILY TRAFFIC (DESIGN)		ALL	<1700	>1700 (2 LN.)	>1700 (4 LN.)	<1700	>1700	<400	400-1700	>1700	<400	400-1700	>1700
DESIGN SPEED (mph) (MINIMUM)	FLAT	70	60	70	70	50	60	40	50	60	40 (17)	50	50
	ROLLING	70	50	60	60	50	50	30	40	50	30	40	40
	MOUNTAINOUS	NA	40	50	50	40	50	20	30	40	20	30	30
TYPICAL SECTION	DRAWING NUMBER	D-61	D-60	D-63	D-61	D-64	D-62	D-66	D-67	D-65	D-66	D-67	D-69
	LANE WIDTH (ft) MIN	12	12	12	12	12	12	11	12	12	11	12	12
	ROADBED WIDTH (ft) 2 LN. (2) MIN.	114-128	44	44	114-128	36	40	26(19)	32(19)	40	26(19)	32(19)	40
	RIGHT OF WAY (ft) 2 LN. (3)	250 DUAL	150	150	250 DUAL	120	150	80	80	120	50	80	80
SLOPES (H:V)	BACKSLOPE	SEE PRELIMINARY GEOTECHNICAL REPORT (CHAPTER VI, PROJECT DEVELOPMENT MANUAL)											
	FILLSLOPE	SEE PRELIMINARY GEOTECHNICAL REPORT (CHAPTER VI, PROJECT DEVELOPMENT MANUAL)											
	FORESLOPE	6:1	6:1	6:1	6:1	4:1	6:1	3:1	4:1	6:1	3:1	3:1	4:1
DITCH DEPTH (ft) (MINIMUM)	(4)	4	4	4	4	2	2	2	2	2	2	2	2
CURVATURE (DEGREE) (MAXIMUM)	FLAT	3	4 3/4	3	3	7 1/2	4 3/4	12 1/4	7 1/2	4 3/4	12 1/4	7 1/2	7 1/2
	ROLLING	3	7 1/2	4 3/4	4 3/4	7 1/2	7 1/2	22 3/4	12 1/4	7 1/2	22 3/4	12 1/4	12 1/4
	MOUNTAINOUS	NA	12 1/4	7 1/2	7 1/2	12 1/4	7 1/2	53 1/2	22 3/4	12 1/4	53 1/2	22 3/4	22 3/4
SPIRAL CURVES	(18)	(18)	(18)	(18)	NA	(18)	NA	NA	(18)	NA	NA	NA	
GRADE (PERCENT) (MAXIMUM)	FLAT	3	3	3	3	4	3	7	6	5	7	6	6
	ROLLING	4	5	4	4	5	5	9	8	7	10	10	10
	MOUNTAINOUS	NA	8	7	7	8	7	12	10	10	16	14	14
STOPPING SIGHT DISTANCE (ft) (MINIMUM-DESIRABLE) (3.5 ft TO 0.5 ft)	FLAT	625-850	525-650	625-850	625-850	400-475	525-650	275-325	400-475	525-650	275-325	400-475	400-475
	ROLLING	625-850	400-475	525-650	525-650	400-475	400-475	200-200	275-325	400-475	200-200	275-325	275-325
	MOUNTAINOUS	NA	275-325	400-475	400-475	275-325	400-475	125-125	200-200	275-325	125-125	200-200	200-200
SAG VERTICAL CURVE (K VALUE)	FLAT	150-220	120-160	150-220	150-220	90-110	120-160	60-70	90-110	120-160	40-40	90-110	90-110
	ROLLING	150-220	90-110	120-160	120-160	90-110	90-110	40-40	60-70	90-110	40-40	60-70	60-70
	MOUNTAINOUS	NA	60-70	90-110	90-110	60-70	90-110	40-40	40-40	60-70	20-20	40-40	40-40
PASSING SIGHT DISTANCE (ft) (MINIMUM) (3.5 ft TO 4.25 ft)	FLAT		2100	2500		1800	2100	1500	1800	2100	1300	1800	1800
	ROLLING	NA	1800	2100	NA	1800	1800	1100	1500	1800	1100	1500	1500
	MOUNTAINOUS		1500	1800		1500	1800	1100	1100	1500	800	1100	1100
MINIMUM PERCENT OF TOTAL PROJECT LENGTH WITH PASSING SIGHT DISTANCE (DIR. WITH LOWEST PSD.)	(9) (10)	NA	25	60	NA	25	60	10	25	60	10	25	60
BRIDGES (NEW)	WIDTH	(12)										(13)	(12)
	LOADING	(14)											
BRIDGES (DECK REPLACEMENT)	WIDTH	(12)										(13)	(12)
	LOADING	(14)											
BRIDGES (USE IN PLACE)	WIDTH	(15)											
	LOADING	(15)											
BOX CULVERTS	LOADING AND STD. PLAN NUMBERS	(14) & (16)											

General Design Data Notes

Figure 4-04.1

ENGLISH

CHAPTER IV DETAIL DESIGN

NOTES:

- (1) A. Design speed may be changed within a single project if the terrain varies to the extent that such a change will result in economy of construction without affecting the safety of the project.
B. Design elements NOT conforming to the design speed should be approved as a design exception (see [Subsection 4-04.1 \(2\)](#)).
- (2) A. When the ADT for the construction year exceeds 3000 vehicles, consider acquisition for future four lane construction. Construction of the additional lanes will be considered when design year traffic exceeds 7500 vehicles.
B. On four lanes divided use 4 ft shoulders inside and 10 ft shoulders outside. For six or more lanes divided use 10 ft shoulders inside and outside. For six or more lanes on urban freeways use 12 ft. shoulders inside and outside (see [Figure 4-07.4](#)).
- (3) A. Right of way may be reduced in towns and built-up areas where it is necessary to avoid excessive property damage.
B. Fully limited access will be required for interstate and other freeways.
C. Where the terrain and grades throughout a major portion of a project are such that a right of way width can be used which is less than that shown but will satisfy the construction and maintenance requirements, the lesser width may be used, except in the case of an interstate highway, which is a minimum of 250 ft. The right of way will be increased if necessary to construct the project.
D. Limited access will be required for arterial expressways with a design traffic > 7500 ADT.
- (4) See standard plan drawings for additional details. If clear zone limit falls on backslope, use backslope based on the Roadside Design Guide.
For typical sections D-61 and D-63 a 4 ft. ditch depth required.
- (5) A. For urban non-freeway conditions, the superelevation rate, if used, should be limited to 0.04 ft/ft.
B. Angles without curves may be used in towns and built-up areas where it is necessary to follow existing streets or avoid excessive property damage.
- (6) Grades less than 500 ft. long and one-way down grades may be one percent steeper. For extreme cases in urban areas, at underpasses and bridge approaches, steeper grade for relatively short lengths may be considered.
- (7) The "Desirable Stopping Sight Distance" can be exceeded.
- (8) The "Sag Vertical Curve K Value" is based on the stopping sight distance. The values shown can be exceeded.
- (9) Designing for passing sight distance is seldom applicable for urban arterials, collectors and local streets.
- (10) A. Percentages are not applicable to divided lanes.
B. Consider additional upgrade lanes in steep terrain.
- (11) A divided highway will be considered as having two roadbeds.
- (12) Width same as roadbed width.
- (13) Width may be reduced to 24 ft. for local roads with < 400 ADT.
- (14) Use loading HS-25 (or also called HS-20 Modified) for all NHS routes, major river crossings and all routes within the COMMERCIAL ZONE LIMITS as designated on the MISSOURI VEHICLE ROUTE MAP 1999-2000. Use loading HS-20 for all other routes.
- (15) To be determined by Bridge Division.
- (16) Standard plan numbers: 703.10 thru 703.85.
- (17) Refer to 2001 AASHTO Green Book Exhibit 5-1 for design speeds for ADT < 250.
- (18) Spiral curves required on all curves meeting these conditions: ADT > 400, design speed > 50 mph and degree of curve > 2 degrees.
- (19) In rural areas (ADT < 1700) where it is necessary to accommodate pedestrian access along the roadway shoulder the typical shoulder width should be increased to at least 6 ft.

General Design Data Notes

METRIC

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DETAIL DESIGN**

FUNCTIONAL CLASSIFICATION		PRINCIPAL ARTERIALS				MINOR ARTERIALS		COLLECTORS			LOCALS			
		INTERSTATE	OTHERS											
AVERAGE DAILY TRAFFIC (DESIGN)		ALL	<1700	>1700 (2 LN.)	>1700 (4 LN.)	<1700	>1700	<400	400-1700	>1700	<400	400-1700	>1700	
DESIGN SPEED (km/h) (MINIMUM)	(1)	FLAT	110	100	110	110	80	100	60	80	100	60 (17)	80	80
		ROLLING	110	80	100	100	80	80	50	60	80	50	60	60
		MOUNTAINOUS	NA	60	80	80	60	80	30	50	60	30	50	50
TYPICAL SECTION		DRAWING NUMBER	M-D-61	M-D-60	M-D-63	M-D-61	M-D-64	M-D-62	M-D-66	M-D-67	M-D-65	M-D-66	M-D-67	M-D-69
		LANE WIDTH (m) MIN	3.6	3.6	3.6	3.6	3.6	3.6	3.3	3.6	3.6	3.3	3.6	3.6
		ROADBED WIDTH (m) 2 LN. (2) MIN.	38.4	13.2	13.2	38.4	10.8	12.0	7.8(19)	9.6(19)	12.0	7.8(19)	9.6(19)	12.0
		RIGHT OF WAY (m) 2 LN. (3)	76 DUAL	46	46	76 DUAL	36	46	24	24	36	16	24	24
SLOPES (V:H)	(4)	BACKSLOPE	SEE PRELIMINARY GEOTECHNICAL REPORT (CHAPTER VI, PROJECT DEVELOPMENT MANUAL)											
		FILLSLOPE	SEE PRELIMINARY GEOTECHNICAL REPORT (CHAPTER VI, PROJECT DEVELOPMENT MANUAL)											
		FORESLOPE	1:6	1:6	1:6	1:6	1:4	1:6	1:3	1:4	1:6	1:3	1:3	1:4
DITCH DEPTH (m) (MINIMUM)	(4)		1.2	1.2	1.2	1.2	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
CURVATURE (RADIUS) (m) (MINIMUM)	(5)	FLAT	500	395	500	500	230	395	125	230	395	125	230	230
		ROLLING	500	230	395	385	230	230	80	125	230	80	125	125
		MOUNTAINOUS	NA	145	230	230	175	230	30	80	125	30	80	80
SPIRAL CURVES		(18)	(18)	(18)	(18)	NA	(18)	NA	NA	(18)	NA	NA	NA	
GRADE (PERCENT) (MAXIMUM)	(6)	FLAT	3	3	3	3	4	3	7	6	5	7	6	6
		ROLLING	4	5	4	4	5	5	9	8	7	10	10	10
		MOUNTAINOUS	NA	8	7	7	8	7	12	10	10	16	14	14
STOPPING SIGHT DISTANCE (m) (MINIMUM-DESIRABLE) (1070 mm TO 150 mm)	(7)	FLAT	180-250	160-210	180-250	180-250	120-140	160-210	80-90	120-140	160-210	80-90	120-140	120-140
		ROLLING	180-250	120-140	160-210	160-210	120-140	120-140	60-70	80-90	120-140	60-70	80-90	80-90
		MOUNTAINOUS	NA	80-90	120-140	120-140	80-90	120-140	30-30	60-70	80-90	30-30	60-70	60-70
SAG VERTICAL CURVE (K VALUE)	(8)	FLAT	43-62	37-51	43-62	43-62	25-32	37-51	15-18	25-32	37-51	15-18	25-32	25-32
		ROLLING	43-62	25-32	37-51	37-51	25-32	25-32	11-12	15-18	25-32	11-12	15-18	15-18
		MOUNTAINOUS	NA	20-25	25-32	25-32	20-25	25-32	4-4	11-12	15-18	4-4	11-12	11-12
PASSING SIGHT DISTANCE (m) (MINIMUM) (1070 mm TO 1300 mm)		FLAT		670	728		541	670	407	541	670	407	541	541
		ROLLING	NA	541	670	NA	541	541	345	407	541	345	407	407
		MOUNTAINOUS		407	541		407	541	345	345	407	217	345	345
MINIMUM PERCENT OF TOTAL PROJECT LENGTH WITH PASSING SIGHT DISTANCE (DIR. WITH LOWEST PSD.) (9) (10)			NA	25	60	NA	25	60	10	25	60	10	25	60
BRIDGES (NEW)	(11)	WIDTH	(12)									(13)	(12)	
		LOADING	(14)											
BRIDGES (DECK REPLACEMENT)		WIDTH	(12)									(13)	(12)	
		LOADING	(14)											
BRIDGES (USE IN PLACE)		WIDTH	(15)											
		LOADING	(15)											
BOX CULVERTS	LOADING AND STD. PLAN NUMBERS	(14) & (16)												

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NOTES:

- (1) A. Design speed may be changed within a single project if the terrain varies to the extent that such a change will result in economy of construction without affecting the safety of the project.
B. Design elements NOT conforming to the design speed should be approved as a design exception (see [Subsection 4-04.1 \(2\)](#)).
- (2) A. When the ADT for the construction year exceeds 3000 vehicles, consider acquisition for future four lane construction. Construction of the additional lanes will be considered when design year traffic exceeds 7500 vehicles.
B. On four lanes divided use 1.2 m shoulders inside and 3 m shoulders outside. For six or more lanes divided use 3 m shoulders inside and outside. For six or more lanes on urban freeways use 3.6 m shoulders inside and outside (see [Figure 4-07.4](#)).
- (3) A. Right of way may be reduced in towns and built-up areas where it is necessary to avoid excessive property damage.
B. Fully limited access will be required for interstate and other freeways.
C. Where the terrain and grades throughout a major portion of a project are such that a right of way width can be used which is less than that shown but will satisfy the construction and maintenance requirements, the lesser width may be used, except in the case of an interstate highway, which is a minimum of 75 m. The right of way will be increased if necessary to construct the project.
D. Limited access will be required for arterial expressways with a design traffic > 7500 ADT.
- (4) See standard plan drawings for additional details. If clear zone limit falls on backslope, use backslope based on the Roadside Design Guide. For typical sections M-D-61 and M-D-63 a 1.2 m ditch depth required.
- (5) A. For urban non-freeway conditions, the superelevation rate, if used, should be limited to 0.04 m/m.
B. Angles without curves may be used in towns and built-up areas where it is necessary to follow existing streets or avoid excessive property damage.
- (6) Grades less than 150 m long and one-way down grades may be one percent steeper. For extreme cases in urban areas, at underpasses and bridge approaches, steeper grade for relatively short lengths may be considered.
- (7) The "Desirable Stopping Sight Distance" can be exceeded.
- (8) The "Sag Vertical Curve K Value" is based on the stopping sight distance. The values shown can be exceeded.
- (9) Designing for passing sight distance is seldom applicable for urban arterials, collectors and local streets.
- (10) A. Percentages are not applicable to divided lanes.
B. Consider additional upgrade lanes in steep terrain.
- (11) A divided highway will be considered as having two roadbeds.
- (12) Width same as roadbed width.
- (13) Width may be reduced to 7.2 m for local roads with < 400 ADT.
- (14) Use loading MS-18 Modified for all NHS routes, major river crossings and all routes within the COMMERCIAL ZONE LIMITS as designated on the MISSOURI VEHICLE ROUTE MAP 1999-2000. Use loading MS-18 for all other routes.
- (15) To be determined by Bridge Division.
- (16) Standard plan numbers: M703.10 thru M703.85.
- (17) Refer to 2001 AASHTO Green Book Exhibit 5-1 for design speeds for ADT < 250.
- (18) Spiral curves required on all curves meeting these conditions: ADT > 400, design speed > 80 km/h and curve radius < 875 meters.
- (19) In rural areas (ADT < 1700) where it is necessary to accommodate pedestrian access along the roadway shoulder the typical shoulder width should be increased to at least 1.8 meters.