5.0 DESIGN CRITERIA

To accurately examine and plan viable rail alignments, it is necessary to first develop a set of basic design criteria for each type of work. For the new construction of the proposed rail corridors, two main design criteria will be utilized: rail and roadway design criteria. The roadway design criteria is used for the design of grade separations.

The design criteria are based on design parameters outlined in *A Policy on Geometric Design of highway and Streets* (AASHTO, 2004), *Roadway Design Manual* (MDOT, 2001), and applicable Burlington Northern Santa Fe (BNSF) Railway Design Criteria supplied by BNSF. The more restrictive criteria will control the design parameters. Basic rail design criteria are summarized in **Table 5-1** and the basic roadway design criteria are summarized in **Table 5-2**. It should be noted that **Tables 5-1** and **5-2** do not represent all design criteria for the representative elements. However, they contain the basic elements used for the preparation of viable rail corridors for evaluation. **Table 5-1** represents desired new corridor criteria, and does not apply to existing rail corridors in place.

Table 5-1
Rail Design Criteria

Design Element	Current Standard	Comments	Resources
Design Speed	60 mph	Where practical Will vary based on existing rail corridor limitations and potential ordinances	Per discussions with BNSF
Track Centers	15 feet	25 feet through designated corridors	BNSF Typical Sections
R/W Width (Desired)	200 feet	Minimum where practical for new corridor to allow future double-track	Per discussions with BNSF
R/W Width (Minimum)	100 feet		Per discussions with BNSF
Main Line Turnouts	No. 20 No. 24		Per discussions with BNSF
Siding Length	10,500 feet minimum clear		Per discussions with BNSF
Track Structure Crosstie Material Rail	Concrete or Wood 112#, 115#, 132# or 136#		Per discussions with BNSF
Roadbed Sections Roadbed Width Subballast Depth Depth of Ditches Depth of ballast Access Road Width	 14 feet from centerline of track, 28 feet total 12 inches 2.4 feet minimum 8 inches w/ wood ties 12 inches w/ concrete 13 feet	See typical section	BNSF Typical Sections

Table 5-1 (Continued)

Design Element	Current Standard	Comments	Resources
Vertical Curves: Rate of Change Between Track Gradients Sag Crest	 0.05 feet per 100 feet 0.10 feet per 100 feet		Per discussions with BNSF
Vertical Grades Maximum	 1.0%		Per discussions with BNSF
Horizontal Curves Maximum Degree of Curve Minimum Length of Spiral per ½ inch of Superelevation	 2° 30' for 60 MPH 4º for 45 MPH 6º for 30 MPH 39 feet		Per discussions with BNSF
Actual Superelevation Maximum Desired Maximum Unbalanced Superelevation	 4 inches 3-3/8 inches 2 inches	Based on maximum 2° 30' curve for 60 mph .	Per discussions with BNSF
Clearances for Overhead Bridges	23.5 feet minimum		Per discussions with BNSF
Lateral Clearance	20 feet	Without crash wall	Per discussions with BNSF

Table 5-2
Roadway Design Criteria

Design Element	Current Standard	Comments	Resources
Design Vehicle	WB-65		AASHTO, Page 18
Design Speed Freeways Rural Freeways Urban Arterials Rural Arterials Urban Collectors Rural Collectors Urban	 70 mph 60-70 mph 65 mph 40-60 mph 55-65 mph 30-50 mph		 RDM Table 2-7B RDM Table 2-7B RDM Table 2-7C RDM Table 14-2G RDM Table 2-7D RDM Table 14-2H
Lane Width Freeway, Arterial and Collectors	12 feet	11feet for Urban streets where constraints prohibit 12 foot lanes	RDM Tables 14-2G and 2-7B
Cross Slope	0.02 minimum		RDM Tables 2-7B and 14-2G
Maximum Grades Freeways (All) Arterials (Urban) Arterials (Rural) Collectors (Urban) Collectors (Rural)	 3% to 4% Max. 5% to 8 % Max 3% to 4% Max 7% to 11% Max 4.5% to 6.5% Max	Based upon terrain and design speed. 1% increase in grade allowed for one-way downgrades 0.4% Minimum for Curb and gutter roadways	 RDM Table 2-7B RDM Table 14-2G RDM Table 2-7C RDM Table 14-2H RDM Table 2-7D
Minimum Stopping Sight Distance Freeways (All) Arterials (Urban) Arterials (Rural) Collectors (Urban) Collectors (Rural)	 Varies 505 to 615 feet Varies 275 to 505 feet 550 feet Varies 185 to 380 feet Varies 435 to 550 feet	Based upon design speed	 RDM Table 2-7B RDM Table 14-2G RDM Table 2-7C RDM Table 14-2H RDM Table 2-7D
Horizontal Alignment Maximum Degree of Curvature Freeways (All) Arterials (Urban) Arterials (Rural) Collectors (Urban) Collectors (Rural)	 3º 30’ to 5º 15’ 5º 15’ to 12º 45’ 4º 15’ 6º 45’ to 26º 45’ 4º 15’ to 6º 30’	Based upon design speed	 RDM Table 2-7B RDM Table 14-2G RDM Table 2-7C RDM Table 14-2H RDM Table 2-7D

Table 5-2 (Continued)

Design Element	Current Standard	Comments	Resources
Horizontal Curve Length Freeways Others	 30V 500 feet	V = design speed	RDM Section 3-2.0
Vertical Curve - Minimum 'K' Value Freeways (All) Arterials (Urban) Arterials (Rural) Collectors (Urban) Collectors (Rural)	Varies from Crest Sag 192 – 285 118 – 149 57 – 192 56 – 118 228 131 26 – 109 33 – 84 143 – 228 99 – 131	Based upon design speed	 RDM Table 2-7B RDM Table 14-2G RDM Table 2-7C RDM Table 14-2H RDM Table 2-7D
Vertical Curve Length Minimum	4V (Crest) L=KA (All)		RDM Section 4-4.02
Superelevation All Rural highways and Urban highways with V ≥55 MPH Urban with V < 55 MPH	10% Maximum 6% Maximum	Roadways with superelevation > 5% require spiral curves for superelevation transition	RDM Sections 3-3.01.02 and 3-4.01
Vertical Clearance for Bridge	23 feet Over Railroad		RDM Table 2-7B RDM Table 14-2G RDM Table 2-7C RDM Table 14-2H RDM Table 2-7D