CHAPTER 6
PART 2

IMPROVEMENTS TO EXISTING ROADWAYS: DESIGN AND TECHNICAL CRITERIA

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6.16 GENERAL

This section (Chapter 6, Part 2) sets forth the minimum technical criteria for the analysis and design to be used in determining the adequacy of existing roadways and in the preparing roadway plan sets to upgrade such roadways.

6.17 CRITERIA FOR DETERMINING ADEQUACY

When new development is proposed that requires the use of existing roadways dedicated to public use and within unincorporated Teller County, the adequacy of these roadways must be determined utilizing the following criteria and procedures. When these roadways are determined inadequate the Department of Transportation will recommend denial of proposed development.

6.17.1 Adequate Infrastructure (Roadway)

Any existing roadways dedicated to public use and within unincorporated Teller County that does not meet the requirements of Chapter 6, Part 2, of these Roadway Standards is considered inadequate. The applicant shall be responsible for scheduling a meeting with the Teller County Department of Transportation to determine the adequacy of the roadway. The applicant is responsible for providing preliminary design information on the existing County roadway network to assist in the determination of the roadway adequacy.

6.17.2 Connectivity

A pedestrian travelway (i.e., sidewalk or trail) is required between a new development and an existing public facility. These public facilities include, but are not limited to, schools, post office, and dedicated open space or park with an existing trail system. When proposed public facilities are required as part of, but not necessarily adjacent to, a new development, pedestrian travelway(s) must be provided.

6.17.3 Applicability

The standards concerning the adequacy of existing roadways as set forth in this Chapter shall apply to Final Plats, Minor Plats, Preliminary Plans, Rezoning or PUD proposals, Sketch Plans and any other submittal requiring adequacy approval by Teller County's Land Use Regulations. Changes per resolution no. 05-22-03-(21), adopted 05/22/03.

6.17.4 Variances

Existing roadways must meet the minimum standards as defined in Chapter 6, Part 2 of these Roadway Standards. If the roadway can not meet all of the defined geometric conditions and standards, it is the applicant's responsibility to provide a proposed solution and request a variance. The solution and request of variance must be approved by the County Engineer or Road and Bridge Director, as appropriate.

6.17.5 Engineering Review

All variance requests and review for adequate infrastructure required by the County Engineer shall be paid for by the applicant.

6.18 ROADWAY SPECIFICATIONS

Teller County has adopted a classification of roadways (See Section 1.12 "Definitions") based on traffic volumes, land use and expected growth. This classification designates roadways as local, collector, or arterial (major and minor). Within each of these classifications, the roadway type is further subdivided into either urban or rural depending on its location. Criteria have been provided for each roadway classification.

6.18.1 Summary

Table 6.9 summarizes the minimum geometric standards and other roadway construction requirements that apply to existing roadways dedicated to public use and within unincorporated Teller County which are being improved in order to accommodate proposed development. This table also summarizes the minimum standards to determine roadway adequacy.

TABLE 6.9
ROADWAY SPECIFICATION SUMMARY TABLE

TYPE	LOCAL		COLLECTOR		ARTERIAL	
CLASSIFICATION	URBAN	RURAL	URBAN	RURAL	MINOR	MAJOR
Posted Speed[1,2] (mph)	25	25	30	30	35 (min.)	35 (min.)
Driving Lanes	2	2	2	2	2 – 4	2 – 4
Min. ROW (ft.)	Right-of-way necessary to build and maintain the roadway section as defined in Chapter 6, Part 2. See Section 6.29					
Roadway Width[3]	24'	24'	28' (2' Shoulders)	28' (2' Shoulders)	32' (4' Shoulders)	32' (4' Shoulders)
Curb, Gutter & Walk	5'Walk or 5' – 6' trail on one side[4]	-	5' Walk on one side and 5' walk or 5' – 6' trail on other side[4]	-	5' Walk on one side and 5' Walk or 6' trail on other side[4].	
Intersection Radii	See Table 6.12					
Min. Curve Radius	See Table 6.11					
Min. Tangent Length	25'	25'	50'	50'	100'	100'
Max. Grade @ Intersection	4%	4%	4%	4%	3%	3%
Cross-slope	See Table 6.20					
Roadway Grade	See Table 6.16					
Vertical Alignment	See Table 6.15					
Min. Surface/Pavement Section[5]	See Section 6.19 & Table 6.10					

1. Design speeds are normally 5-10 MPH higher than posted speeds.
2. These are the recommended posted speeds. Speed limits may be modified to achieve design standards.
3. Parking prohibited on existing roadways.
4. Sidewalk and/or trail required to meet connectivity requirement as defined in Section 6.17.1.
5. Pavement designs must be submitted for all roadways. The pavement section shall not be less than that listed. (For pavement design and alternate materials see Chapter 7.)

6.18.2 Roadway Classifications

The following design and technical criteria apply to each classification of existing roadways dedicated to public use and within unincorporated Teller County.

6.18.2.1 Urban Local

a. Speed Limit
Posted or prima facie speeds, whichever requires the most restrictive stringent design criteria, for this roadway classification shall be 5 miles per hour less than the design speed of that roadway.

b. Surface – See Section 6.19, Surface and Pavement and Table 6.10.

c. Right-of-way and Easements – As defined in Section 6.22, Right-of-way.

d. Number of Travel Lanes – Two (2).

e. Type of Curb & Gutter – 6" vertical curb and gutter. Mountable permissible with attached sidewalk.

f. Sidewalk – 5' sidewalk or 4'-6' trail on one side of the roadway when connectivity requirement must be meet.

g. Roadway Widths – Two (2) twelve foot (12') travel lanes without shoulder. Parking prohibited.

h. Minimum Horizontal Curve – See Table 6.11.

i. Minimum Vertical Curve – See Section 6.21, Vertical Alignment.

j. Roadway Grades – See Table 6.16.

k. Curb Return Radii – See Table 6.12.

6.18.2.2 Rural Local

a. Speed Limit
Posted or prima facie speeds, whichever requires the most stringent design criteria, for this roadway classification shall be 5 miles per hour less than the design speed of that roadway.

b. Surface – See Section 6.19, Surface and Pavement and Table 6.10.

c. Right-of-way and Easements – As defined in Section 6.22, Right-of-way.

d. Number of Travel Lanes – Two (2).

e. Type of Curb & Gutter – Not required.

f. Sidewalk – Not required.

g. Roadway Widths – Two (2) twelve foot (12') travel lanes without shoulder. Parking prohibited.

h. Minimum Horizontal Curve – See Table 6.11.

i. Minimum Vertical Curve – See Section 6.21, Vertical Alignment.

j. Roadway Grades – See Table 6.16.

k. Curb Return Radii – See Table 6.12.

6.18.2.3 Urban Collector

a. Speed Limit
Posted or prima facie speeds, whichever requires the most stringent design criteria, for this roadway classification shall be 5 miles per hour less than the design speed of that roadway.

b. Surface – See Section 6.19, Surface and Pavement and Table 6.10.

c. Right-of-way and Easements – As defined in Section 6.22, Right-of-way.

d. Number of Travel Lanes – Two (2).

e. Type of Curb & Gutter – 6" vertical curb and gutter. Mountable permissible with attached sidewalk.

f. Sidewalk – 5' sidewalk on one side of the roadway and a 4' sidewalk or 5'-6' trail on other side of the roadway when connectivity requirement must be meet.

g. Roadway Widths – Two (2) twelve foot (12') travel lanes with two foot (2') shoulders. Parking prohibited.

h. Minimum Horizontal Curve – See Table 6.11.

i. Minimum Vertical Curve – See Section 6.21, Vertical Alignment.

j. Roadway Grades – See Table 6.16.

k. Curb Return Radii – See Table 6.12.

6.18.2.4 Rural Collector

a. Speed Limit
Posted or prima facie speeds, whichever requires the most stringent design criteria, for this roadway classification shall be 5 miles per hour less than the design speed of that roadway.

b. Surface – See Section 6.19, Surface and Pavement and Table 6.10.

c. Right-of-way and Easements – As defined in Section 6.22, Right-of-way.

d. Number of Travel Lanes – Two (2).

e. Type of Curb & Gutter – Not required.

f. Sidewalk – Not required.

g. Roadway Widths – Two (2) twelve foot (12') travel lanes with two foot (2') shoulders. Parking prohibited.

h. Minimum Horizontal Curve – See Table 6.11.

i. Minimum Vertical Curve – See Section 6.21, Vertical Alignment.

j. Roadway Grades – See Table 6.16.

k. Curb Return Radii – See Table 6.12.

6.18.2.5 Minor Arterial

a. Speed Limit
Actual posted speed to be determined by the County Engineer prior to submittal of construction plans. Posted or prima facie speeds, whichever requires the most stringent design criteria, for this roadway classification shall be 10 miles per hour less than the design speed of that roadway.

b. Surface – See Section 6.19, Surface and Pavement and Table 6.10.

c. Right-of-way and Easements – As defined in Section 6.22, Right-of-way.

d. Number of Travel Lanes – Two (2).

e. Type of Curb & Gutter – 6" vertical curb and gutter. Mountable permissible with attached sidewalk. (Urban areas only)

f. Sidewalk – 5' sidewalk on one side of the roadway and a 5' sidewalk or 6' trail on other side of the roadway when connectivity requirement must be meet.

g. Roadway Widths – Two (2) twelve foot (12') travel lanes with four foot (4') shoulders. Parking prohibited.

h. Minimum Horizontal Curve – See Table 6.11.

i. Minimum Vertical Curve – See Section 6.21, Vertical Alignment.

j. Roadway Grades – See Table 6.16.

k. Curb Return Radii – See Table 6.12.

6.18.2.6 Major Arterial

a. Speed Limit
Actual posted speed to be determined by the County Engineer prior to submittal of construction plans. Posted or prima facie speeds, whichever requires the most stringent design criteria, for this roadway classification shall be 10 miles per hour less than the design speed of that roadway.

b. Surface – See Section 6.19, Surface and Pavement and Table 6.10.

c. Right-of-way and Easements – As defined in Section 6.22, Right-of-way.

d. Number of Travel Lanes – Two (2).

e. Type of Curb & Gutter – 6" vertical curb and gutter. Mountable permissible with attached sidewalk.

f. Sidewalk – 5' sidewalk on one side of the roadway and a 5' sidewalk or 6' trail on other side of the roadway when connectivity requirement must be meet.

g. Roadway Widths – Two (2) twelve foot (12') travel lanes with four foot (4') shoulders. Parking prohibited.

h. Minimum Horizontal Curve – See Table 6.11.

i. Minimum Vertical Curve – See Section 6.21, Vertical Alignment.

j. Roadway Grades – See Table 6.16.

k. Curb Return Radii – See Table 6.12.

6.18.2.7 Cul-de-sac

a. Cul-de-sacs are required at the end of existing roadways dedicated to public use and within unincorporated Teller County or at the end of phased construction in order to allow maintenance and emergency vehicles an adequate turnaround point.

b. A minimum forty five (45') foot flow line radius is required for all cul-de-sacs.

6.19 SURFACE AND PAVEMENT

6.19.1 Surface Requirement

The roadway surface shall be based on the average daily traffic as shown in Table 6.10 below.

Table 6.10 Minimum Roadway Surface Section

Average Daily Traffic (ADT)	Minimum Surface Requirement
0-200[2]	Gravel surface
0-999[1]	Single application ¾" chip & seal
1,000-3,499[1]	Double application ¾" chip & seal or 3" asphalt
> 3,500[1]	3" asphalt or as designed per Chapter 7 of these Roadway Standards.

[1]Subbase and base course must meet design requirements for 20-year life with 3" asphalt (min.).
[2]Gravel surface available for rural local roadways only.

6.19.2 Gravel Surface

Gravel roadways shall have a minimum six (6") inch depth of CDOT Class 5 material or as based on the subsurface investigation and pavement design, whichever is greater. If visual subgrade or surface deficiencies are noted, the surface section shall be designed in accordance with the following standards.

The procedure accepted by Teller County for selection of base and sub-base thickness for gravel roadways is based upon the AASHTO Guide for Design of Pavement Structures. Portions of this section including the tables and nomographs in Figures 6.7, 6.8, and 6.9 are taken from that publication.

6.19.2.1 Factors

The allowable values for factors used in gravel roadway design are as follows:

a. Allowable rutting, RD = 2 inches

b. Gravel loss, GL = 2 inches

c. Serviceability loss, ▲PSI = 3.0

d. Quality of roadbed soils shall be based upon HVEEM Stabilometer "R" values as follows:

R < 15	Very Poor
R = 15 –25	Poor
R = 25 –35	Fair
R = 35 – 55	Good
R > 55	Very Good

e. Season lengths, in number of months, shall be based upon U.S. climatic region VI, and are as follows:

Winter (roadbed frozen)	3.0 months
Spring thaw (roadbed saturated)	1.5 months
Summer (roadbed dry)	4.5 months
Spring/fall (roadbed wet)	3.0 months

f. Seasonal roadbed soil resilient moduli, M_R (psi), as a function of the relative quality of the road bed material shall be as follows:

Quality of roadbed soil	Season (roadbed soil moisture condition) Summer	Winter	Spring-thaw	Spring/fall
very good	20,000	2,500	8,000	20,000
good	20,000	2,000	6,000	10,000
fair	20,000	2,000	4,500	6,500
poor	20,000	1,500	3,300	4,900
very poor	20,000	1,500	2,500	4,000

6.19.3 Chip Seal

The specifications, construction requirements and procedures for chip seal application shall conform to Section 9.9.2 of these Roadway Standards.

6.19.4 Geometry Constraints

Asphalt pavement may be required when vertical curve or grade variance is granted. Any roadway upgrade project requesting a variance from Chapter 6, Part 2 of these Roadway Standards may be granted if the pavement section meets the minimum requirements in Table 7.4 or per a pavement design whichever is greater.

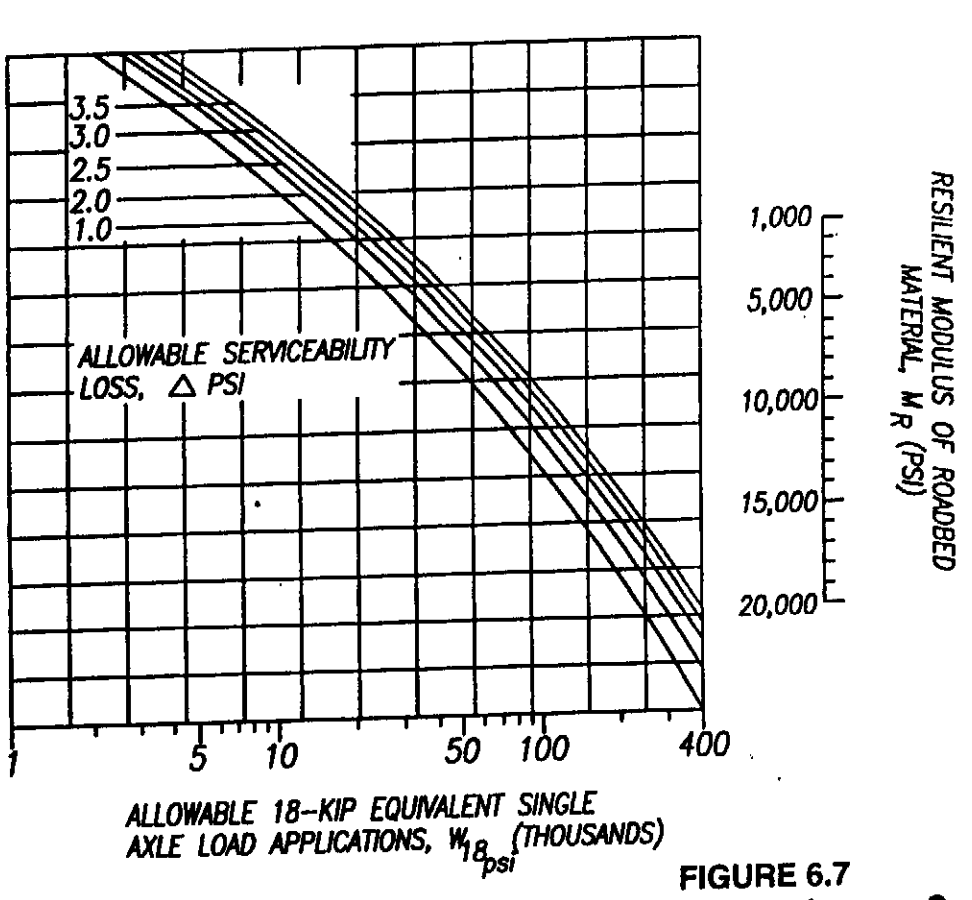

FIGURE 6.7
Design Nomograph for Gravel Roadways – Serviceability Criteria

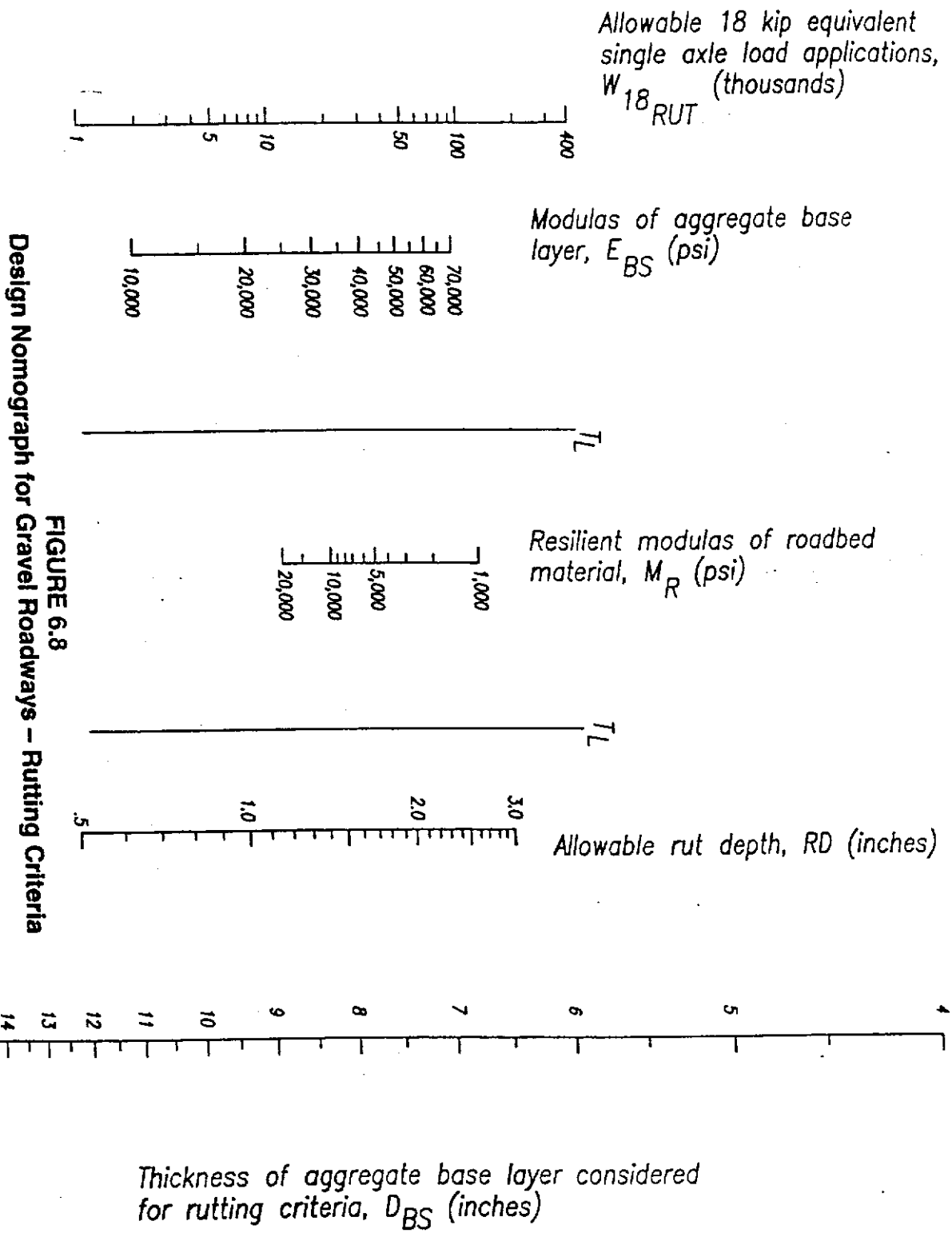

FIGURE 6.8
Design Nomograph for Gravel Roadways – Rutting Criteria

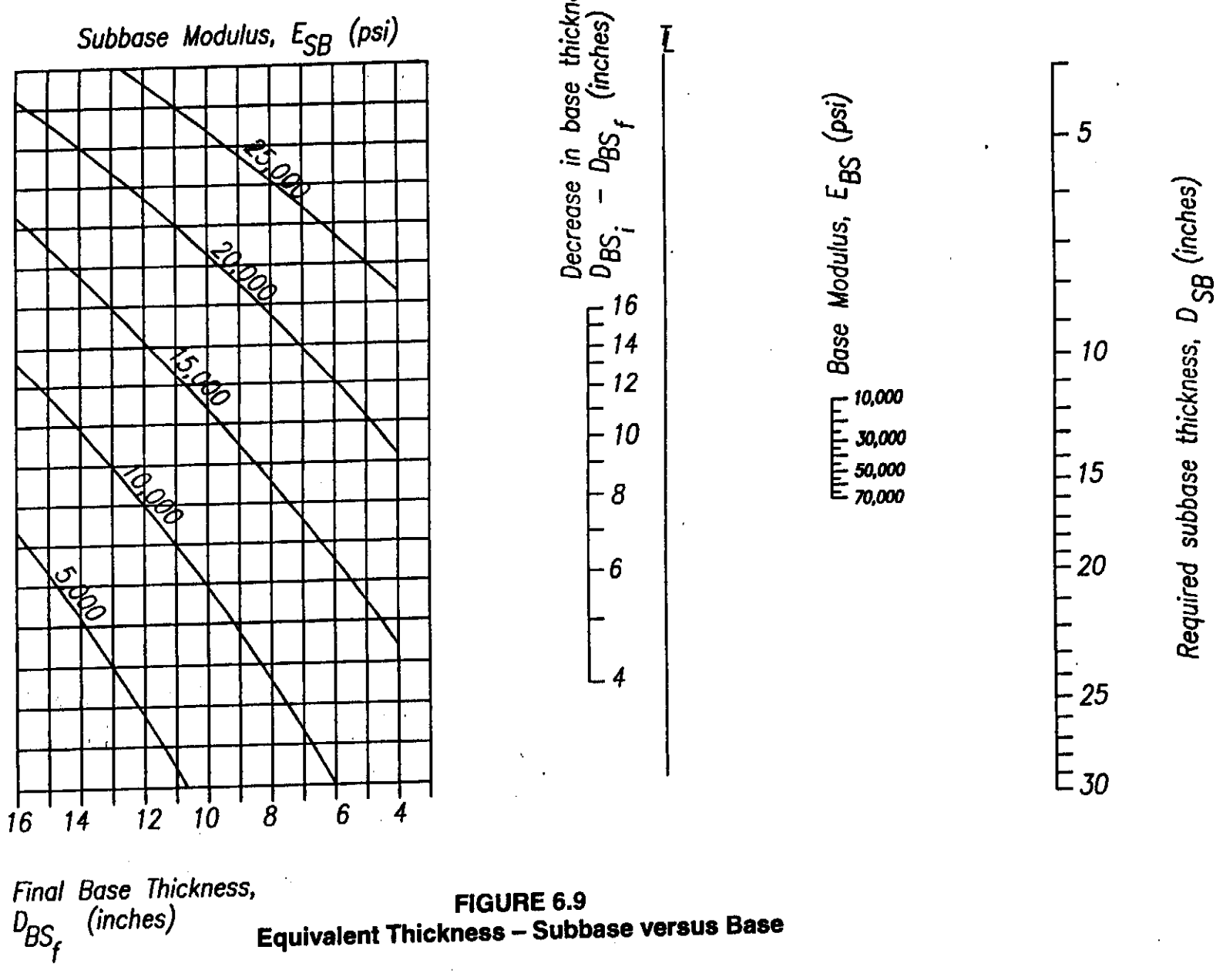

FIGURE 6.9
Equivalent Thickness – Subbase versus Base

6.20 HORIZONTAL ALIGNMENT

6.20.1 General

The major considerations in the alignment of roadways are safety, grade, profile, roadway area, design speed, sight distance, topography, drainage and performance of heavy-duty vehicles. Alignment should provide for safe and continuous operation at a uniform design speed. Roadway layouts shall bear a logical relationship to existing or platted roadways in adjacent properties.

6.20.2 Horizontal Curves

See Table 6.11 for minimum horizontal curve requirements.

TABLE 6.11
HORIZONTAL CURVES

DESIGN SPEED (MPH)	MAXIMUM CURVE (DEGREES)	MINIMUM CURVE RADIUS (FEET)
15	99.3	70
20**	55.9	110
25**	32.7	175
30**	22.9	225
35**	14.3	400
40**	10.4	600
45**	8.0	720
50**	6.7	850
55**	5.7	1000
60**	4.8	1200

** Superelevation may be allowed. (See Section 6.20.5)

6.20.3 Curb Return Radii

Minimum curb return radii shall be as shown in Table 6.12.

TABLE 6.12
CURB RETURN RADII
(Measured Along Flowline)

THROUGH ROADWAY	ARTERIAL	COLLECTOR	LOCAL SERVICE
ARTERIAL	50'	30'	25'
COLLECTOR	30'	25'	25'
LOCAL	30'	25'	20'

6.20.4 Design Speed

Horizontal alignment design speed shall be consistent with the requirement for vertical alignment design speed.

If no superelevation is required and a normal crown section exists, the horizontal curve data as shown in Table 6.11 shall be used.

6.20.5 Superelevation

Superelevation may be required for all roadway classifications. Horizontal curve radii and superelevation shall be in accordance with the recommendations of the AASHTO "Green Book" and the Division "M" Standards (CDOT). Prior to design, the County Engineer must approve the use of superelevation.

The following procedure is an outline for the correct application of superelevation on roadways within Teller County.

6.20.5.1 Definitions Regarding Superelevation

Superelevation Runoff – That length of roadway needed to accomplish the change in cross slope from a section with the adverse crown removed (flat) to the fully superelevated section, or vice versa.

Transition Points – Beginning or ending of tangent runout, superelevation runoff or full superelevation.

Tangent Runout – That length of roadway needed to accomplish the change in cross slope from a normal (2.0%) crown section to a section with the adverse crown removed (flat), or vice versa. Roadways with cross slopes greater than 2% must provide additional runout as required for a proper transition.

6.20.5.2 General

One of the most important factors to consider in highway safety is the centrifugal force generated when a vehicle traverses a curve. Centrifugal force increases as the velocity of the vehicle and the degree of curvature increases.

It is possible to balance centrifugal force by superelevation alone, because for any given curve radius a certain superelevation rate is exactly correct for only one driving speed. At all other speeds there will be a side thrust either outward or inward, relative to the curve center, which must be offset by side friction.

6.20.5.3 Standards for Superelevation

The Division "M" Standards (CDOT) on superelevation give the required rate of superelevation for the various degrees of curvature.

Maximum superelevation rates of 0.04 to 0.06 foot per foot are commonly used on major roadways. The lower value should be used where snow and ice are significant factors.

6.20.5.4 Existing Roadway Conditions

Every effort should be made to maintain standard rates of superelevation. However, in urban areas, roadway intersections, established roadway grades, curbs and drainage conditions may require a reduction in the rate of superelevation, or different rates for each half of the roadbed. In warping areas for drainage, adverse superelevation should be avoided.

6.20.5.5 Spiral Curves

Spiral curves are not recommended but may be permitted.

6.20.5.6 Railroad Crossings

Reference Section 6.5.7 for further information.

6.20.6 Sight Distances

a. **Sight Distance.** Horizontal alignment must provide at least the minimum stopping distance for the design speed at all points. This includes visibility at intersections as well as around curves and roadside encroachments.

b. **Stopping Sight Distance.** The minimum stopping sight distance is the distance required by the driver of a vehicle traveling at the design speed to bring the vehicle to a stop after an object on the roadway becomes visible. Stopping sight distance is calculated in accordance with the AASHTO

"Green Book". Object height is 6" above the roadway surface and viewer's height is 3.50 ft. above roadway surface.

Where an object off the pavement restricts sight distance, the stopping sight distance (See Figures 6.1a and 6.1b) determines the minimum radius of curvature. In no case shall the stopping sight distance be less than as specified in Table 6.13. A likely obstruction may be a bridge abutment or line of columns, wall, cut sideslope, or a side or corner of a building.

The lateral clearance, inner edge of pavement to sight obstruction, for various radii of inner edge of pavement and design speeds, is shown graphically in Figure 6.1a and Figure 6.1b. The position of the driver's eye and the object sighted are assumed to be 6 ft. from the inner edge of pavement, with the sight distance being measured along this arc.

TABLE 6.13
STOPPING AND PASSING SIGHT DISTANCE

DESIGN SPEED (MPH)	STOPPING SIGHT DISTANCE	PASSING SIGHT DISTANCE
15	100	500
20	125	800
25	150	1000
30	200	1100
35	250	1300
40	275	1500
45	325	1650
50	400	1800
55	450	1950

c. **Passing Sight Distance.** Passing sight distance is the minimum sight distance that must be available to enable the driver of one vehicle to pass another safely and comfortably without interfering with oncoming traffic traveling at the design speed. Two-lane roadways should provide adequate

passing zones. Required passing sight distance for given design speeds is given in Table 6.13.

d. **Coefficient of Friction.** The coefficient of friction (f) shall conform to the values shown in Table 6.14 for snow-packed conditions rather than as stated in the AASHTO "Green Book".

TABLE 6.14
COEFFICIENT OF FRICTION
(Design Criteria Snow-packed)

DESIGN SPEED	INCREASE (f)
15-30	.26
30-40	.24
40-50	.22
50-60	.21
60-70	.20

e. **Intersection and Driveway Sight Distance.** Reference Section 6.5.9.2.e for further information.

6.21 VERTICAL ALIGNMENT

Design controls for vertical alignment are shown in the tables below.

6.21.1 Vertical Curves

Vertical curves shall be designed as outlined in the tables below.

TABLE 6.15
VERTICAL ALIGNMENT CONTROLS[3]

DESCRIPTION	DESIGN SPEED[1]	MAX. GRADE[2]	K-VALUE RANGES CREST	K-VALUE RANGES SAG	MIN V.C.L. CREST	MIN V.C.L. SAG
URBAN LOCAL	30	8%	25-30	25-30	50	50
RURAL LOCAL	30	10%	25-30	25-30	50	50
URBAN COLL.	35	6%	35-50	40-50	50	50
RURAL COLL.	35	9%	35-50	40-50	50	50
MINOR ARTERIAL	45	6% Urban (7% Rural)	70-105	65-85	70	60
MAJOR ARTERIAL	45	6.0%	115-220	90-125	110	90

[1]The design speed is a minimum of five (5) mph over the posted or prima facie speed for each classification, except arterials. Arterials are ten (10) mph over posted or prima facie speed.
[2]The grade indicated is the maximum recommended grade. Maximum grades are allowed per Table 6.16. The designer should strive to minimize the use of steep grades for considerable lengths on north facing slopes.
[3]Requests for variation from these design criteria must receive approval from the County Engineer.

6.21.2 Permissible Roadway Grades

Minimum longitudinal (flowline) grade for gravel roadways will be 1%. Minimum longitudinal (flowline) grades will be 0.30% for local roadways and 0.50% for collector and arterial roadways. A minimum longitudinal grade of 0.50% shall be required along the centerline of all collector and arterial roadways. The maximum allowable grades for all roadway classifications are shown on Table 6.16 below.

TABLE 6.16

TABLE 6.16 MAXIMUM GRADE (%) FOR SPECIFIED DESIGN SPEED (mph)

	DESIGN SPEED (mph)									
ROADWAY CLASSIFICATION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Local, Rural	17	16	15	14	13	13	12	10	10	-
Local, Urban	14	14	13	12	12	12	11	10	10	9
Collector, Rural[1]	12	12	11	10	10	10	10	9	9	8
Collector, Urban	14	14	13	12	12	12	11	10	10	9
Minor, Arterial, Rural[2]	-	-	-	-	8	8	7	7	6	6
Minor Arterial, Urban[2]	-	-	-	11	10	10	9	9	8	8
Major Arterial[2]	-	-	-	11	10	10	9	9	8	8

Footnote:
[1]Short length of grade in rural areas, such as grades less than 500 feet in length, one-way downgrades, and grades on low volume rural collectors may be up to 2% steeper than grades shown above.
[2]5% maximum grade for design speed 65mph and higher.

6.21.3 Permissible Intersection Grades (Public Rights-of-Way)

The maximum permissible grade at intersections will be as shown in Figure 6.4. These grades are maximum instantaneous flowline grades for the stated distances (each side of the roadway) for the minor (intersecting) roadways. Desirable intersection grades should be in the range of two (2.0) to four (4.0) percent for all intersecting roadways with the limit of three (3.0) percent for arterials.

Then, intersection grade of the "through" roadway at the intersection may be dictated by design considerations for that roadway. However, if the "through" roadway intersection grade exceeds 3%, the type of access and access control will be dictated by the County Engineer.

All private commercial driveways with curb return radii shall follow the standard set forth for a local roadway. The length of the maximum grade for the commercial driveway shall be a minimum of 50 feet measured from the flowline intersection of the public roadway.

6.21.4 Sight Distances

Both the horizontal and vertical sight distance should be checked to insure that the sight distance along the major highway is sufficient to allow a vehicle to cross or turn left, whichever is required.

a. Stopping Sight Distance

Minimum stopping sight distance shall be as shown on Table 6.17 and Table 6.18 below. Criteria for measuring sight distance, both vertical and horizontal, are as follows: For stopping sight distance the height-of-eye is 3.5 feet and the height-of-object is 0.5 feet; for passing sight distance the height-of-object is 4.25 feet.

Table 6.17
Minimum Stopping Sight Distance for Crest & Sag Vertical Curves

Design Speed (mph)	Design Stopping Sight Distance (feet)	Rate of Vertical Curvature, k[a] (ft/%)	
		Crest	Sag
15	80	3	10
20	800	7	17
25	950	12	26
30	1100	19	37
35	1300	29	49
40	1500	44	64
45	1650	61	79
50	1800	84	96
55	1950	114	115
60	2100	151	136

Table 6.18
Stopping Sight Distance on Grades

Design Speed (mph)	Stopping sight distance (ft)					
	Downgrades			Upgrades		
	3%	6%	9%	3%	6%	9%
15	80	82	85	75	74	73
20	116	120	126	109	107	104
25	158	165	173	147	143	140
30	205	215	227	200	184	179
35	257	271	287	237	229	222
40	315	333	354	289	278	269
45	378	400	427	344	331	320
50	446	474	507	405	388	375
55	520	553	593	469	450	433
60	598	638	686	538	515	495
65	682	728	785	612	584	561
70	771	825	891	690	658	631
75	866	927	1003	772	736	704
80	965	1035	1121	859	817	782

b. Passing Sight Distance – Passing Sight Distance requirements shall be as shown in Table 6.19 below. The passing sight distance shall be as defined in **item a** above.

TABLE 6.19
Design Controls for Crest Vertical Curves Based on Passing Sight Distance

Design Speed (mph)	Design Passing Sight Distance (ft)	Rate of Vertical Curvature, K[a] (ft/%)
20	710	180
25	900	289
30	1090	424
35	1280	585
40	1470	772
45	1625	943
50	1835	1203
55	1985	1407
60	2135	1628

[a] Rate of vertical curvature, K, is the length of curve per percent algebraic difference in the intersecting grades (i.e., K = L/A).

6.22 RIGHT-OF-WAY

The right-of-way required for existing roadways dedicated to public use and within unincorporated Teller County shall be the minimum necessary to build and maintain the roadway section as defined in Chapter 6, Part 2 of these Roadway Standards. The roadway section shall include, but not be limited to, the travel lanes, shoulders, ditch foreslope and clear zone.

Right-of-way, temporary construction easements and drainage easements may be necessary for construction and maintenance of the upgraded roadway section.

Additional right-of-way may exist or can be provided above the minimum requirements.

6.23 CLEAR ZONE

Clear zone is defined as the unobstructed area beyond the edge of the traveled way for the recovery of errant vehicles. For the upgrade of existing roadways dedicated to public use and within unincorporated Teller County, this includes shoulders and ditches (maximum 3:1 slope).

A minimum of 10 feet should be provided. The County will consider decreasing the clear zone requirement to 6' for urban roadways with curb and gutter and no attached sidewalk, as long as the lack of clear zone does not impede maintenance, sight distance and safety.

When roadside obstacles can not be eliminated, guardrails or other barrier systems must be installed to reduce accident severity.

6.24 SIDEWALKS AND CURBS AND GUTTER

6.24.1 All sidewalks used in conjunction with vertical curb and gutter shall have a minimum width as indicated in Table 6-9.

6.24.2 Combination curb, gutter and walk is approved for use on all roadways. Vertical curb, gutter and detached walk or trail are also permitted.

6.24.3 CRS requires that handicap ramps be installed at all intersections and at certain mid-block locations for all new construction or reconstruction of curb and sidewalk (CRS 43-2-107[2]). Handicap ramps shall be constructed in accordance with standard plates. (Appendix A) Handicap ramps must be shown at all curb returns and at all "T" intersections directly opposite either curb return. Whenever referencing a handicap ramp, call out the specific Roadway Standards standard plate to be used to construct that ramp. On local roadways only, mid-block handicap ramps may be

constructed per CDOT M-Standard M-608-1 "TYPE 3A – MID-BLOCK" (6" from flowline to back-of-ramp). See STANDARD PLATE SP.9B.

6.24.4 Where curb cuts are allowed based on traffic considerations, concentrated storm water runoff must not be discharged across the sidewalk. These flows must be directed to a sidewalk chase section (See Section 6.4.5). If this is not possible due to grading restraints, radius returns and a crosspan must be used.

6.24.5 Curb cuts and driveways shall be constructed in accordance with the Teller County Standard Drawing SP.4 (Appendix A) and Chapter 13 of these Roadway Standards.

6.25 TRAILS

6.24.6 General.

Applicants are responsible for coordinating with the Teller County Division of Park authorized representative for the latest trail specifications and dimensions.

6.24.7 Surface.

Non-paved trail surfaces shall be 3/8" crusher waste/fines or as approved by the County Engineer. Paved trail surfaces shall be 3" asphalt.

6.24.8 Width.

Trail widths vary based on the designated use, but are typically 4' to 6' wide when adjoining an existing roadway. Contact the County Engineer for additional information on trail dimensions.

6.26 DRAINAGE

Storm drainage systems shall be designed in accordance with the Drainage Criteria (Appendix G). Because safe and efficient conveyance of traffic is the primary function of roadways, the storm drainage function of the roadway (such as allowable gutter capacity and road overtopping) will be designed to the limits set forth in the Drainage Criteria.

6.26.1 Roadside Ditches

Minimum roadway drainage requires ditches with a maximum 3:1 foreslope from the edge of the roadway to a minimum 2-foot depth. Ditch depth requirements may increase to accommodate ancillary structures, such as culverts, plus the minimum cover required by the manufacturer. Ditch depth may decrease based on a complete drainage design in accordance with Appendix G. Desired

maximum backslope is 3:1 or as terrain dictates. Erosion control measures are required to maintain the ditch and side slopes.

6.26.2 Crosspans

Reference section 6.4.1 for further information.

6.26.3 Inlets

Reference section 6.4.2 for further information.

6.26.4 Cross Slope

Cross-slopes are provided to allow drainage across the roadway surface. Paved roadways are normally designed with a centerline crown and cross slopes at 2%, except at intersections or where superelevation is required. Cross-slopes will be constructed as shown in Table 6.20 based on the roadway surface.

TABLE 6.20
Allowable Cross-Slope
(Minimum and Maximum)

ROADWAY SURFACE	CROSS SLOPE
Gravel	4% - 6%
Chip & Seal[1]	3% - 4%
Asphalt/Concrete	2% - 3%

[1]Any roadway with future projected ADT of 3,500 or greater shall be constructed with a 3% cross-slope to prepare for future asphalt overlay.

6.26.5 Erosion and Sediment Control Criteria

Erosion and sediment control shall be designed in accordance with CDOT "Erosion Control and Stormwater Quality Guide" (June 1995), which is incorporated by reference, and the Stormwater Management Checklist shown as Table 6.21.

Table 6.21
Stormwater Management Checklist

Erosion and Sediment Control Measure	Applicable	Not Applicable
Soil Stabilization		
Seeding		
Mulching		
Sodding		
Erosion Control Blankets		
Surface Roughening		
Structural Practices		
Erosion Bales		
Silt Fence		
Berm/Diversion		
Slope Drain		
Storm Drain Inlet Protection		
Check Dams		
Outlet Protection		
Channel Stabilization (or Lining)		
Sediment Trap		
Sediment Basin		
Dewatering Structure		
Temporary Stream Crossing		
Stabilized Construction Entrance		
Level Spreader		
Brush Barrier		
Sandbag Barrier		
Other Practices		
Spill Prevention		
Waste Disposal		
Protection of Trees		
Curb Roll/Shoulder Gutter		
Stormwater Quality		
Non-Structural Practices		
Curb Elimination		
Reduction of Direct Discharges		
Establish and Maintain Vegetation		
Structural Practices		
Grass Lined Swale		
Grass Buffer Strip		
Extended Dry Detention Basin		
Wet Detention Basin		
Constructed Wetlands		
Infiltration Basin		
Infiltration Trench		

6.27 ACCELERATION/DECELERATION LANES

The design of the arterial roadway system depends upon the proper control of access to developments. The location and design of access points must minimize traffic hazards and interference to through traffic movements. Acceleration/Deceleration lanes shall be designed using the CDOT "State Highway Access Code" (latest version). The need for acceleration or deceleration lanes shall be established by the approved traffic impact study for the final development plan.

6.28 INTERSECTIONS

Reference section 6.7 for further information.

6.29 OFF-SITE DESIGN

The design grade, and existing ground at that design grade, of all roadways that dead end due to project phasing, subdivision boundaries, etc., shall be continued, in the same plan-and-profile as the proposed design, for at least one hundred fifty (150) feet or to its intersection with an arterial roadway

6.29.1 If the off-site roadway, adjacent to the proposed development, is not fully improved, the developer is responsible for the design and construction of a transition for the safe conveyance of traffic from the improved section to the existing roadway. The following formula shall be applied to the taper of lane change necessary for this transition:

$$L = WS^2/60$$

where

L = Length of transition in feet
W = Width of offset in feet
S = Speed limit or 85th percentile speed.

6.29.2 The County Engineer should be contacted to approve unusual transition criteria. This contact is the responsibility of the Applicant.

6.30 CONSTRUCTION TRAFFIC CONTROL

Reference section 6.11 for further information.

6.31 SIGNAGE AND STRIPING CRITERIA

All traffic control devices and striping shall be fabricated and installed in accordance with the MUTCD and Section 6.13 of these Roadway Standards.