



TOWN OF CAVE CREEK



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TECHNICAL DESIGN GUIDELINE NUMBER 2 - TRANSPORTATION

EFFECTIVE DATE: SEPTEMBER 22, 2009



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SECTION 11 - LIST OF ABBREVIATIONS

- AASHTO American Association of State Highway and Transportation Officials
- ADOT Arizona Department of Transportation
- ADT Average Daily Traffic
- ASTM..... American Society of Testing and Materials
- C/L Center Line (roadway)
- FAA..... Federal Aviation Administration
- FHWA Federal Highway Administration
- HSO Horizontal Sight Line Offset
- MAG Maricopa Association of Governments
- MCDOT..... Maricopa County Department of Transportation
- MUTCD..... Manual on Uniform Traffic Control Devices



SSD Stopping Sight Distance

TIS Traffic Impact Study

SECTION 12 - LIST OF REFERENCES

(All references are quoted in the text of these Guidelines with the square brackets: [1], [2], etc.)

1. AASHTO *Policy on Geometric Design of Highways and Streets*. Washington DC: 2004;
2. AASHTO *Guide for Design of Pavement Structures*. Washington DC: 1993;
3. AASHTO *Roadside Design Guide*. Washington DC: 2002;
4. ADOT *Materials Testing Manual*. Phoenix AZ: latest edition;
5. ASTM International *Annual Book of Standards*. West Conshohocken;
6. City of Scottsdale *Design Policies Manual*. Scottsdale AZ: 2006;
7. City of Chandler *Street Design and Access Control*. Chandler AZ: 2002;
8. FAA *Airport Pavement Design and Evaluation Manual*. Washington DC: 1995;
9. MAG *Uniform Standard Specifications for Public Works Construction*. Phoenix AZ: 2007;
10. MAG *Uniform Standard Details for Public Works Construction*. Phoenix AZ: 2007;
11. MCDOT *Roadway Design Manual*. Phoenix AZ: 2004;
12. MCDOT *Supplement to MAG Standard Specifications and Drawings*. Phoenix AZ: 2007;
13. FHWA *Manual on Traffic Control Devices including Rev. 1*. Washington DC: 2004;
14. Town of Cave Creek *Policy on Granting Access in The Vicinity of Intersections*.

**Town of Cave Creek
Technical Design Guidelines - Transportation**





SECTION 1 - INTRODUCTION

1.1 PURPOSE OF DESIGN GUIDELINE:

1.1.1 Purpose:

The purpose of this Technical Design Guideline is to establish a minimum set of guidelines for design of roadways in the jurisdiction of the Town of Cave Creek (TOCC). The intent is to assist the designer/user of these guidelines, but not to substitute for professional judgment and competency.

1.1.2 Latest Version:

The TOCC reserves the right to update, modify and delete sections of these guidelines at any time in the interest of safety, convenience of maintenance, appearance of facility, economic sensitivity, etc. It is the responsibility of the designer to check for the latest version of this document available at the Town of Cave Creek website.

1.2 GENERAL CONSIDERATIONS:

These guidelines provide the minimum design guidelines, which the designer should strive to exceed at all times. These guidelines do not substitute for any Federal, State, County, or Town regulation or standard. If these guidelines conflict with any other national or local published manual, the user of these guidelines should bring the discrepancies to the attention of the TOCC Town Engineer.

1.3 DISCLAIMER:

Transportation reports and construction plans for development and/or improvement of properties within the (TOCC) are reviewed and approved by the TOCC for general conformance with the TOCC's ordinances, policies and standards. The TOCC does not, however, assume responsibility or liability for insufficient design and/or improper construction. Review and approval by the TOCC does not absolve the owner, developer, design engineer, or contractor of liability for inadequate design or poor construction. The design engineer has the responsibility to design transportation improvements that meet the standards of practice for the industry and promote public safety. Compliance with the regulatory elements, policies, and design standards documented herein, does not imply a guarantee that properties will be free from flood, geologic, and geotechnical related damage and failures. The TOCC and its officials, employees, and contract reviewers, assume no liability for information, data, or conclusions prepared by private engineers and makes no warranty expressed or implied in its review/approval of transportation projects.

The data and information provided herein are offered as guidelines to development regarding transportation design. With the exception of requirements mandated by TOCC codes and ordinances, all guidelines provided are subject to change or variation at the discretion of the TOCC Town Engineer and/or Town Manager.



1.4 STANDARD SPECIFICATIONS AND DETAILS:

The Town of Cave Creek has adopted the Maricopa Association of Governments (MAG) *Uniform Standard Specifications and Standard Details* [9], [10], as well as Maricopa County Department of Transportation (MCDOT) *Supplement to the MAG Specifications and Details* [12]. These documents supplement these guidelines and provide additional guidance.



SECTION 2 - TRANSPORTATION PLANNING & TRAFFIC IMPACT STUDIES

2.1 GENERAL:

The Traffic Impact Study (TIS) is a useful tool which is used to better plan the roadway system thus ensuring the quality of life and safety of the TOCC's residents. In order to adequately assess impacts of new developments on the Town's roadway network and to address possible traffic issues as early as possible, a Traffic Impact Study needs to be prepared.

The TIS identifies existing traffic volumes, surrounding street conditions, proposed traffic volumes generated by the development, as well as the future street network, and assesses their combined impacts on the existing and future roadway system. When insufficient attention is given to the assessment of traffic impacts, the following problems may result:

- On-site congestion and/or congestion on adjacent roadways.
- Inadequate and/or unsafe ingress and egress.
- Poor site plans from a circulation standpoint.
- Delays in approval of site plans.

These problems can negatively affect the success of a development, can damage its marketability, and may trigger future litigation involving residents, the Town, and the Developer. The TIS provides an opportunity for the TOCC and the Developer to share information and jointly address traffic and safety related problems. It provides a means of balancing development needs with the functional integrity of the roadways that serve both the development and the TOCC.

The TIS may be prepared by an engineering firm selected by the developer or, if requested, by an on-call consultant under contract to the Town of Cave Creek. If the TIS is prepared by an on-call consultant under contract to the Town of Cave Creek, the Town Consulting Engineer will be requested to provide a cost estimate for conducting the TIS. This estimate will be presented to the developer for review. The funds for the study shall be provided by the developer to The Town of Cave Creek prior to commencement of the study. A Draft TIS will be submitted to both the developer and the Town for review. Review comments are to be provided within two weeks of submittal.

2.2 NEED FOR STUDY DEFINED:

The need for a Traffic Impact Study (TIS) should be assessed as early as possible in the development process when there is maximum flexibility for eliminating traffic-related problems. Typically, a TIS must be approved by the Town before approval of a final plat. A TIS will be typically required of all developments or additions to existing developments generating 100 or more trips during the morning or afternoon peak hour.

A TIS may also be required for any of the following reasons: (1) developments generating lower peak hour volumes for reasons such as current traffic problems or concerns that exist; (2) the public perceives an adverse traffic impact on the adjacent neighborhoods; (3) the proximity of site access to other driveways or intersections could create traffic concerns; or (4) when other specific traffic



problems or concerns may be aggravated by the proposed development. Should such conditions arise the Town Engineer will evaluate the need for the study.

Figure 2.2-1 shows the various planning and zoning cases which require a TIS. A TIS will not be required for issuing of subdivision or building permits if it was already approved during Master Plan Development, Comprehensive Plan Development, or a Rezoning Case. However, a TIS will be required if:

- The level of development changes significantly to warrant a new study.
- The adjacent roadway system changes significantly to warrant a new study.
- Detailed information for access analysis was not available during the initial development process.
- A TIS on file with the Town is more than two years old.

NEED FOR THE TRAFFIC IMPACT STUDY DEFINED

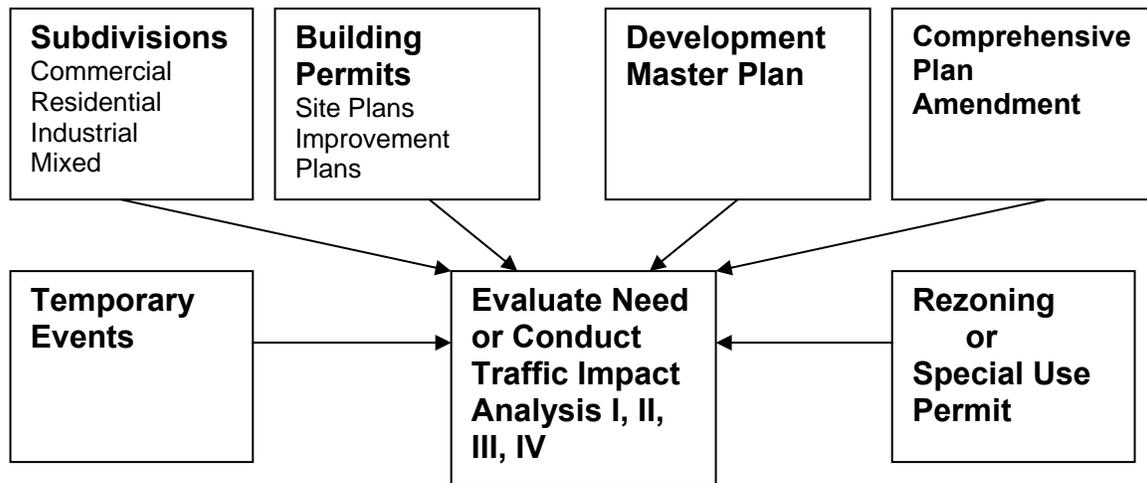


Figure 2.2-1



2.3 GUIDELINES FOR STUDY (MINIMUM REQUIREMENTS):

Minimum requirements for an initial TIS or a revised TIS will be determined by the Town Engineer in accordance with Table 2.3-1.

MINIMUM REQUIREMENTS FOR TRAFFIC IMPACT STUDIES

Analysis Category	Development Characteristic	Study Horizons^a	Minimum Study Area^b
I	Small Development 100 - 499 peak trips	1. Opening year	1. Site access driveways 2. Adjacent signal controlled intersections and/or major street intersections without signal control within ¼ mile and driveways within 500 feet.
II	Moderate Development 500 – 999 peak hour trips	1. Opening year 2. Five years after opening	1. Site access driveways 2. All signal controlled intersections and/or major street intersections without signal control within ½ mile and major driveways within ½ mile.
III	Large Development 1000 – 1500 peak hour trips	1. Opening year 2. Ten years after opening	1. Site access driveways 2. All signal controlled intersections and/or major street intersections without signal control within 1 mile and major driveways within 1 mile.
IV	Regional Development >1500 peak hour trips	1. Opening year 2. Each built-out phase of the project 3. Horizon year adopted by the MAG Transportation Plan	1. Site access driveways 2. Key signal controlled intersections and major street intersections without signal control within 3 miles.

Table 2.3-1

- a. Assume full occupancy and build-out for single-phase developments. Multi-phase developments may require assessment of up to three horizon years corresponding to key phases as directed by the Town Engineer, or his/her representative.
- b. An enlarged study area may be required when the minimum study areas identified above do not provide sufficient information to meet the intent of the Traffic Impact Study guidelines.



SECTION 3 - STREET DESIGN STANDARDS

3.1 ROADWAY CLASSIFICATION:

The Town of Cave Creek uses the following roadway classifications:

- **Arterial Road** – A major street that is intended to carry the greater portion of through traffic from one area of the TOCC to another and is generally positioned at one mile intervals. Major and minor arterials are designated in the current Town General Plan.
- **Collector Road** – A minor street that provides both access service and traffic circulation within residential neighborhoods and commercial and industrial areas. Collector roads are specifically designed to accommodate shorter trips and to feed the arterials.
- **Local Road** – A minor street that permits direct access to abutting lands and connections to the collector and arterial roads. It offers the lowest level of mobility and contains no bus routes. Service to through traffic movements is deliberately discouraged.
- **Private Street** - A street not owned or maintained by the TOCC.
- **Public Street** – A street owned and maintained by the TOCC.
- **Pedestrian Way** - A public walkway dedicated entirely through a block from street to street and/or providing access to a school, park, recreation area or shopping center.
- **Shared Use Primary Community Trail** – A public trail with natural tread composed on compacted rock or native base intended for use by hikers, equestrians and bicycles. All uses are accommodated by a single trail.
- **Cul-De-Sac** - Cul-de-sac streets shall terminate in a circular right-of-way forty-five (45) feet in radius. The Town Engineer may recommend an equally convenient form of turning and backing areas where conditions justify.



3.2 DESIGN VEHICLE:

In the design of any roadway facility, the designer should consider the largest design vehicle likely to use that facility with considerable frequency. The design vehicle dictates critical features such as radii at intersections, width of receiving lanes, driveway width, maximum grades, and pavement structural section. Special consideration should be given for school buses (S-BUS-40) and single unit trucks (SU) on collector and local roads.

At all intersections where turning movements are allowed, an appropriate template must be used to ensure the width of receiving lane is sufficient to accommodate the design vehicle. For Arterial/Arterial and Arterial/Collector Intersections, WB-40 template shall be used. For Collector/Local and Local/Local Intersections, the Single-Unit truck template shall be used. For roads along school bus routes, the turn template for school bus S-BUS-40 shall be used.

Design vehicles and respective minimum turning paths shall be determined based on AASHTO *Policy on Geometric Design* [1].

Minimum turning radii of curb returns and edge of pavement at road intersections shall be determined from the following table:

ROADWAY MINIMUM TURNING RADII AT INTERSECTIONS

Type of Intersection	Turn radius with curb and gutter, ft	Turn radius without curb and gutter, ft
Arterial with Arterial	35	45
Arterial with Collector	35	45
Arterial with Local	30	35
Collector with Collector	30	35
Collector with Local	25	30
Local with Local	25	30

Table 3.2-1

3.3 ROADWAY CHARACTERISTICS:

Tables 3.3-1 and 3.3-2 summarize design criteria for various roadway facilities in Town. These characteristics are typically used at the planning level such as during preparation of a Traffic Impact Study, Transportation Master Plans, etc.



ROADWAY CHARACTERISTICS FOR URBAN SETTINGS

Urban Classification					
Roadway Characteristic	Major Arterial	Minor Arterial	Major Collector	Minor Collector	Local
Specifications	1) Average length: over 1 mile 2) Carry large volumes of primarily through traffic. 3) Provide high mobility with limited access to local development. Access management must be provided in order to preserve desired level of service.		1) Average length: under 1 mile 2) Predominantly carry traffic to arterials 3) Substantial land access. Provide mobility and access.		1) Average length: less than ½ mile 2) Traffic movements between collectors or other roads of higher classification. 3) Provide access to adjacent parcels.
Number of Lanes	6, Divided	5	3	2	2
Number of controlled intersections per mile (new designs)	2 – 4 Always aligned with existing or planned median openings	2 – 4	≤ 8	≤ 8	Intersection spacing at 250 ft. minimum
Number of Access Points per mile (new designs)	4 on each side, co-located, full access. 8 on each side, maximum, co-located with the use of right-in-right out driveways	6 on each side, co-located, full access. 8 on each side maximum, co-located with the use of right-in-right-out driveways	>10 Uncontrolled on one side	Frequent driveway access	Frequent driveway access

Table 3.3-1a

Urban Classification					
Roadway Characteristic	Major Arterial	Minor Arterial	Major Collector	Minor Collector	Local
Median breaks (new designs)	Preferred at every ¼ mile Every 660 feet maximum	Two-way left-turn lane	Two-way left-turn lane	N/A	N/A
Posted Speeds	≤ 45 mph	≤ 45 mph	25-35 mph	25-35 mph	15-30 mph
Planning Volumes	30,000 – 60,000 ADT	5,000 – 35,000 ADT	600 – 8,500 ADT	500 – 5,000 ADT	50 – 1,500 ADT
Desired LOS	C	C	C	B	A

Table 3.3-1b



ROADWAY CHARACTERISTICS FOR RURAL SETTINGS

Rural Classification					
Roadway Characteristic	Major Arterial	Minor Arterial	Major Collector	Minor Collector	Local
Specifications	1) Average length: over 1 mile 2) Carry large volumes of traffic between major traffic generators. 3) Provide high mobility with limited access to local development. Access management must be provided in order to preserve desired level of service.	1) Average length: under 1 mile 2) Predominantly carry traffic to arterials. 3) Substantial land access. Provide mobility and access.	1) Average length: less than 2 miles 2) Traffic movements between collectors or other roads of higher classification. 3) Provide access to adjacent parcels.		
Number of Lanes	4, Divided	5	3	2	2
Number of controlled intersections per mile (new designs)	≤ 1	1 – 2	Controlled intersection spacing at 2 miles or greater	1	2
Number of Access Points per mile (new designs)	Infrequent controlled access	Infrequent controlled access	Minimum interference from driveways appropriate to rural setting	Frequent driveway access	Frequent driveway access

Table 3.3-2a

Rural Classification					
Roadway Characteristic	Major Arterial	Minor Arterial	Major Collector	Minor Collector	Local
Median breaks (new designs)	Allowed at every ½ mile	Two-way left-turn lane	Two-way left-turn lane	N/A	N/A
Posted Speeds	50-55 mph	45 -50 mph	40 mph	35 mph	15-30 mph
Planning Volumes	10,000 – 40,000 ADT	5,000 – 35,000	1,000 – 8,500 ADT	800 – 5,000 ADT	50 – 1,500 ADT
Desired LOS	C	C	C	B	A

Table 3.3-2b



3.4 GEOMETRIC DESIGN PARAMETERS:

3.4.1 Design Speed:

The main design parameter that affects most of the roadway design elements is the design speed. The design speed is the maximum recommended speed at which reasonable safe operation of a vehicle can be maintained over a specific section of a road when conditions are so favorable that the design features of the road govern. Design speeds shall be determined by the roadway classification as contained herein. Posted speeds, in general, shall be 5 to 10 miles lower than the design speeds. The use of design speeds other than those shown for each classification shall be approved by the Town Engineer.

3.4.2 Stopping Sight Distance:

Stopping sight distance is the length of the roadway ahead that is visible to the driver. The sum of the distance traveled during the brake reaction time and the distance to brake the vehicle to a stop is called the stopping sight distance. The available sight distance on a roadway should be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path. Per AASHTO *Policy on Geometric Design of Highways and Streets* [1], assumed values of the height of driver's eye of 3.5 ft and the obstacle height of 2 ft shall be used for measurement of required stopping sight distance on all roadway plans submitted to the Town.

The sight distance at every point along a roadway should be at least that as specified in Table 3.4-1. In the case where vertical grades are present, Stopping Sight Distance shall be adjusted for vertical grades as shown in the same table. Values of stopping sight distance for grades other than those shown shall be calculated per equations 3-2 and 3-3 of the AASHTO *Policy on Geometric Design* [1].

3.4.3 Passing Sight Distance:

Passing sight distance is the length of open roadway ahead necessary to pass without meeting an oncoming vehicle. Passing sight distance is applicable only to two-lane, two-way highways. Values of passing sight distance shall be per Table 3.4-2.



STOPPING SIGHT DISTANCE

Design Speed, mph	Stopping Sight Distance, ft	Stopping Sight Distance, ft			Stopping Sight Distance, ft		
		-3%	-6%	-9%	+3%	+6%	+9%
15	80	80	82	85	75	74	73
20	115	116	120	126	109	107	104
25	155	158	165	173	147	143	140
30	200	205	215	227	200	184	179
35	250	257	271	287	237	229	222
40	305	315	333	354	289	278	269
45	360	378	400	427	344	331	320
50	425	446	474		405	388	
55	495	520	553		469	450	
60	570	598	638		538	515	
65	645	682	728		612	584	
70	730	771	825		690	658	

Table 3.4-1

Source: AASHTO Policy on Geometric Design of Highways and Streets, Exhibits 3-1, 3-2.

PASSING SIGHT DISTANCE

Design Speed, mph	Passing Sight Distance, ft
20	710
25	900
30	1090
35	1280
40	1470
45	1625
50	1835
55	1985
60	2135
65	2285
70	2480

Table 3.4-2

Source: AASHTO Policy on Geometric Design of Highways and Streets, Exhibit 3-7.



3.4.4 Minimum Radius of Horizontal Curves:

The minimum curve radii shall be determined by the roadway classification as contained herein. Maximum allowable values of superelevation e_{max} shall be 4% for urban streets and 6% for rural roadways. Higher values of superelevation may be considered in the case of severe right-of-way restrictions and shall be approved by the Town Engineer.

For low-speed urban roads, the use of superelevation is discouraged due to difficulties associated with placement of superelevation on wide pavement areas, the need to meet the grade of adjacent property, surface drainage considerations, the desire to maintain low speed operation, and grade breaks at intersections with cross streets, alleys and driveways.

The required rates of superelevation for radii flatter than the minimums shown in roadway classification tables contained herein, shall be determined per AASHTO [1] Exhibits 3-25 and 3-26.

3.4.5 Horizontal Sight Line Offset:

Sight obstructions such as walls, cut slopes, buildings, and longitudinal barriers located on the inside of curves, or on the inside of the median lane on divided highways may require relocation or adjustments in the horizontal alignment or roadway cross section, if continuous sight line along the cord of the curve cannot be provided to the driver as shown in Figure 3.4-1.

For general use in design of a horizontal curve, the horizontal sight line is a chord of the curve, and the stopping sight distance is measured along the centerline of the inside lane around the curve. Values of the horizontal sight line offset are calculated according to the following formula:

$$HSO = R \left(1 - \cos \frac{28.65 * S}{R} \right)$$

Where;

- HSO** = Horizontal Sight Line Offset, ft. (measured from the center of the inside travel lane)
- R** = Curve Radius, ft
- S** = Design Speed, mph

Assumptions:

Driver's Eye Height of 3.5 ft & Object Height of 2 ft within the roadway shall be assumed for design of the Horizontal Sight Line Offset area.



HORIZONTAL SIGHT LINE OFFSET

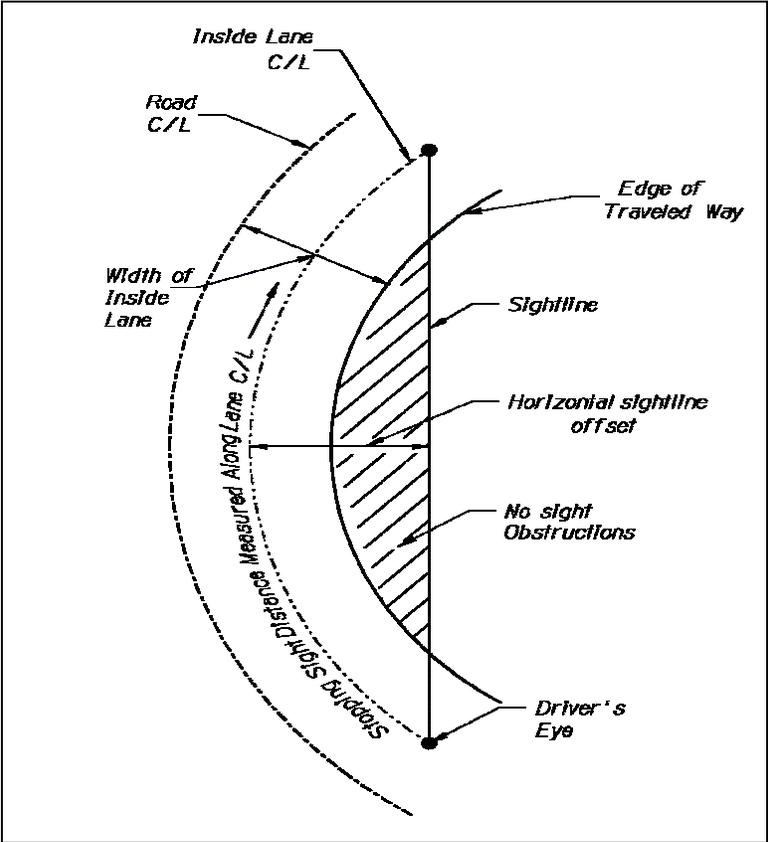


Figure 3.4-1



3.4.6 Length of Vertical Curves:

Design of vertical curves must incorporate the provision of sufficient stopping sight distances for the design speed, and, wherever practical, additional sight distance for passing maneuvers.

The K-value method shall be used for determining the length of vertical curves according to the following formula:

$$L = K * A$$

Where;

L = Length of Vertical Curve

K = Value taken from **Tables 3.6 – 3.15;**

A = Algebraic difference in grades in percent.

3.4.7 Vertical Grade:

The value of vertical grade and length of a roadway section on grade directly affect level of service of a road, especially those with high volumes of heavy vehicles. On level terrain minimum grades from 0.3% to 0.5% are desirable in order to provide adequate drainage. Maximum grades shall not exceed the values shown in the roadway classification tables contained herein for the respective roadway classifications. Maximum grades for short lengths (less than 500 ft) and one-way down grades may be 1% steeper on urban collectors, and 2% steeper on rural collectors.

3.4.8 Maximum Difference in Grades without a Vertical Curve:

Vertical grades shall be designed to provide adequate level of service, sight distance, safety, comfortable driving and good drainage. Algebraic difference in grades without a vertical curve on continuous roadways shall be equal to or less than the values specified in the roadway classification tables contained herein for the respective roadway classifications.

3.4.9 Transition Tapers:

The transition tapers shall be designed whenever modifications to through lanes are necessary in order to widen an existing road or narrow a new road to match existing cross-section. Lengths of tapers for typical design speeds are based on the following formulas:

1. Road narrows or lane drop is designed:

For design speeds $S \geq 45$ mph, $L = S * W$

For design speeds $S < 45$ mph, $L = \frac{W * S^2}{60}$



2. Road widens or through travel lanes are added¹, $L = \frac{S * W}{3}$

Where;

L = Taper distance in feet;

S = Speed limit in miles per hour;

W = Offset distance in feet.

The transitions should be made on a tangent section whenever possible. Locations with horizontal and vertical sight distance restrictions should be avoided. The entire transition must be visible to the driver of a vehicle approaching the narrower section. Transitions shall not occur through intersections.

3.4.10 Minimum Tangent Length between Two Curves:

Reverse horizontal curves must be separated by a tangent. The length of the tangent must be sufficient to fully accommodate transition in the pavement cross slope. In order to drain pavement surface at all times, care should be exercised so that flat sections are not introduced in the superelevation transition area. Values of minimum lengths for superelevation runout from the *AASHTO Policy on Geometric Design* [1] will be followed for all curve-to-tangent transitions.

The use of compound and spiral curves should be avoided.

¹ For design of turn bays and auxiliary lanes, refer to Section 4.2



URBAN PRINCIPAL ARTERIAL

Terrain	Design Speed, mph	Stopping Sight Distance ¹ , ft	Horizontal Alignment		Vertical Alignment				Curbs: Type and Height, in.
			Minimum Radius, ft		Minimum Length of Crest Vertical Curves ² , ft	Minimum Length of Sag Vertical Curves, ft	Maximum Vertical Grade ³ , %	Maximum difference in vertical grades that does not require a vertical curve, %	
			e = -2% (NC)	e _{max} = 4%	L = K * A (A = algebraic difference in grades, %)	L = K * A (A = algebraic difference in grades, %)			
Level	55	495	1850	1200	114*A	115*A	5	0.3	MAG 220 Type A (6")
Rolling	50	425	1400	925	84*A	96*A	7	0.5	MAG 220 Type A (6")
Mountainous	45	360	1050	725	61*A	79*A	9	0.5	MAG 220 Type A (6")
Pavement Section									
Structural Number, SN	≥ 2.88								

Table 3.4-3

URBAN PRINCIPAL ARTERIAL - PAVEMENT SECTION

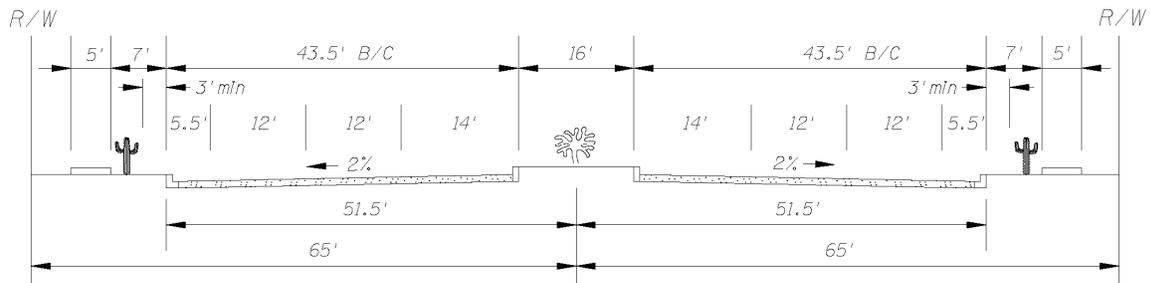


Figure 3.4-2



URBAN MINOR ARTERIAL

Terrain	Design Speed, mph	Stopping Sight Distance ¹ , ft	Horizontal Alignment		Vertical Alignment				Curbs: Type and Height, in.
			Minimum Radius, ft		Minimum Radius of Crest Vertical Curves ² , ft	Minimum Radius of Sag Vertical Curves, ft	Maximum Vertical Grade ³ , %	Maximum difference in vertical grades that does not require a vertical curve, %	
			e = -2% (NC)	e _{max} = 4%	L = K * A (A = algebraic difference in grades, %)	L = K * A (A = algebraic difference in grades, %)			
Level	55	495	1850	1200	114*A	115*A	5	0.3	MAG 220 Type A (6")
Rolling	50	425	1400	925	84*A	96*A	7	0.5	MAG 220 Type A (6")
Mountainous	45	360	1050	725	61*A	79*A	9	0.5	MAG 220 Type A (6")
Pavement Section									
Structural Number, SN	≥ 2.88								

Table 3.4-4

URBAN MINOR ARTERIAL - PAVEMENT SECTION

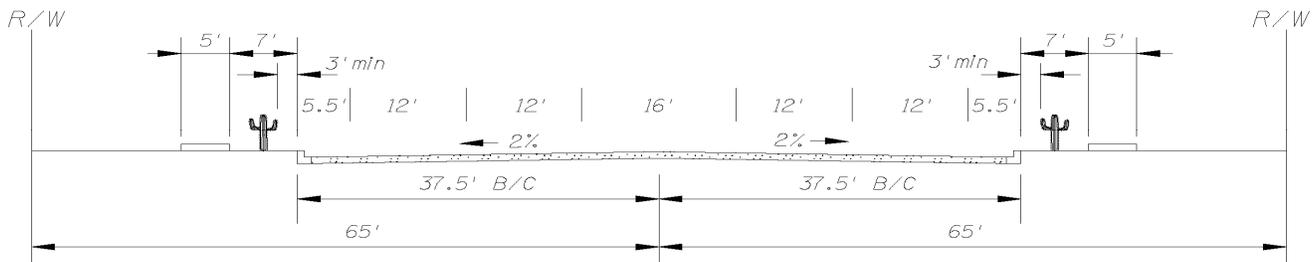


Figure 3.4-3



URBAN MAJOR COLLECTOR

Terrain	Design Speed, mph	Stopping Sight Distance ¹ , ft	Horizontal Alignment		Vertical Alignment				Curbs: Type and Height, in.
			Minimum Radius, ft		Minimum Radius of Crest Vertical Curves ² , ft	Minimum Radius of Sag Vertical Curves, ft	Maximum Vertical Grade ³ , %	Maximum difference in vertical grades that does not require a vertical curve, %	
			$e = -2\%$ (NC)	$e_{max} = 4\%$	$L = K * A$ (A = algebraic difference in grades, %)	$L = K * A$ (A = algebraic difference in grades, %)			
Level	40	305	775	550	$44 * A$	$64 * A$	9	0.5	MAG 220 Type A (6")
Rolling	30	200	350	250	$19 * A$	$37 * A$	11	1.0	MAG 220 Type A (6")
Mountainous	25	155	200	155	$12 * A$	$26 * A$	13	1.0	MAG 220 Type A (6")
Pavement Section									
Structural Number, SN	≥ 2.13								

Table 3.4-5

URBAN MAJOR COLLECTOR - PAVEMENT SECTION

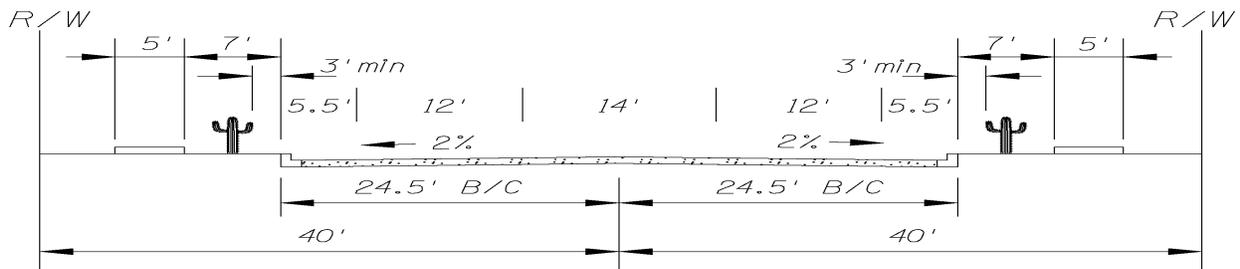


Figure 3.4-4



URBAN MINOR COLLECTOR

Terrain	Design Speed, mph	Stopping Sight Distance ¹ , ft	Horizontal Alignment		Vertical Alignment				Curbs: Type and Height, in.
			Minimum Radius, ft		Minimum Radius of Crest Vertical Curves ² , ft	Minimum Radius of Sag Vertical Curves, ft	Maximum Vertical Grade ³ , %	Maximum difference in vertical grades that does not require a vertical curve, %	
			e = -2% (NC)	e _{max} = 4%	L = K * A (A = algebraic difference in grades, %)	L = K * A (A = algebraic difference in grades, %)			
Level	40	305	775	550	44*A	64*A	9	0.5	MAG 220 Type A (6")
Rolling	30	200	350	250	19*A	37*A	11	1.0	MAG 220 Type A (6")
Mountainous	25	155	200	155	12*A	26*A	13	1.0	MAG 220 Type A (6")
Structural Section									
Structural Number, SN	≥ 2.13								

Table 3.4-6

URBAN MINOR COLLECTOR - PAVEMENT SECTION

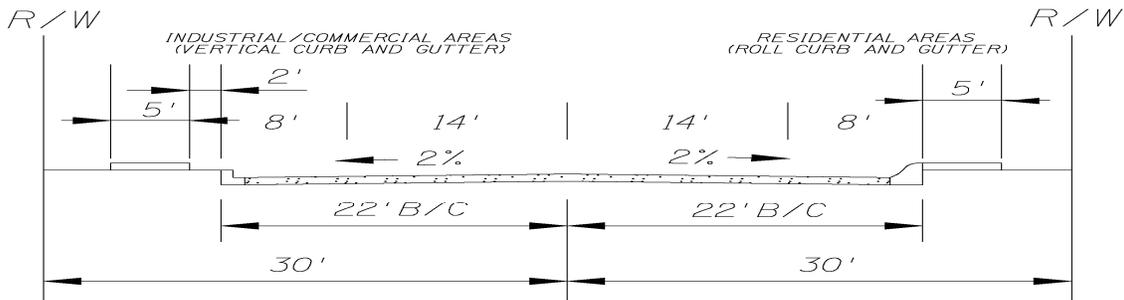


Figure 3.4-5



URBAN LOCAL

Terrain	Design Speed, mph	Stopping Sight Distance ¹ , ft	Horizontal Alignment		Vertical Alignment				Curbs: Type and Height, in.
			Minimum Radius, ft		Minimum Radius of Crest Vertical Curves ² , ft	Minimum Radius of Sag Vertical Curves, ft	Maximum Vertical Grade ³ , %	Maximum difference in vertical grades that does not require a vertical curve, %	
			e = -2% (NC)	e _{max} = 4%	L = K * A (A = algebraic difference in grades, %)	L = K * A (A = algebraic difference in grades, %)			
Level	35	250	525	375	29*A	49*A	7	2.0	MAG 220 Type C/D
Rolling	35	250	525	375	29*A	49*A	10	2.0	MAG 220 Type C/D
Mountainous	25	155	200	155	12*A	26*A	15	2.0	MAG 220 Type C/D
Structural Section									
Structural Number, SN	≥ 1.77								

Table 3.4-7

URBAN LOCAL - PAVEMENT SECTION

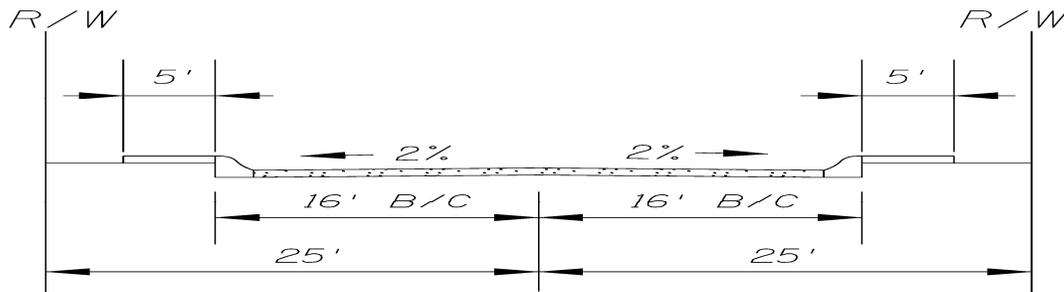


Figure 3.4-6



RURAL PRINCIPAL ARTERIAL

Terrain	Design Speed, mph	Stopping Sight Distance ¹ , ft	Horizontal Alignment		Vertical Alignment				Thickened edge of pavement
			Minimum Radius, ft		Minimum Radius of Crest Vertical Curves ² , ft	Minimum Radius of Sag Vertical Curves, ft	Maximum Vertical Grade ³ , %	Maximum difference in vertical grades that does not require a vertical curve, %	
			e = -2% (NC)	e _{max} = 6%	L = K * A (A = algebraic difference in grades, %)	L = K * A (A = algebraic difference in grades, %)			
Level	65	645	3150	1660	193*A	157*A	3	0.3	MAG 201, Type A
Rolling	60	570	2400	1330	151*A	136*A	4	0.3	MAG 201, Type A
Mountainous	55	495	1850	1060	114*A	115*A	6	0.3	MAG 201, Type A
Pavement Section									
Structural Number, SN	≥ 2.88								

Table 3.4-8

RURAL PRINCIPAL ARTERIAL - PAVEMENT SECTION

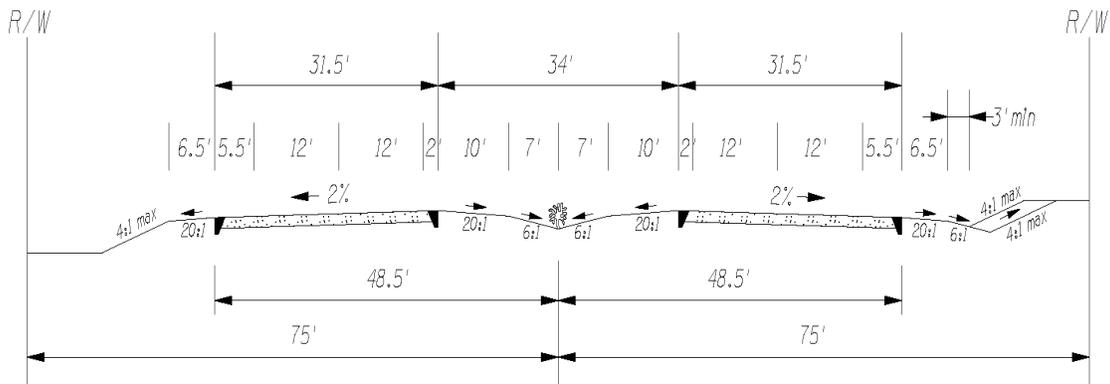


Figure 3.4-7



RURAL MINOR ARTERIAL

Terrain	Design Speed, mph	Stopping Sight Distance ¹ , ft	Horizontal Alignment		Vertical Alignment				Thickened edge of pavement
			Minimum Radius, ft		Minimum Radius of Crest Vertical Curves ² , ft $L = K * A$ (A = algebraic difference in grades, %)	Minimum Radius of Sag Vertical Curves, ft $L = K * A$ (A = algebraic difference in grades, %)	Maximum Vertical Grade ³ , %	Maximum difference in vertical grades that does not require a vertical curve, %	
			e = -2% (NC)	e _{max} = 6%					
Level	60	570	2400	1330	151*A	136*A	3	0.3	MAG 201, Type A
Rolling	55	495	1850	1060	114*A	115*A	5	0.3	MAG 201, Type A
Mountainous	45	360	1050	650	61*A	79*A	7	0.5	MAG 201, Type A
Pavement Section									
Structural Number, SN	≥ 2.88								

Table 3.4-9

RURAL MINOR ARTERIAL - PAVEMENT SECTION

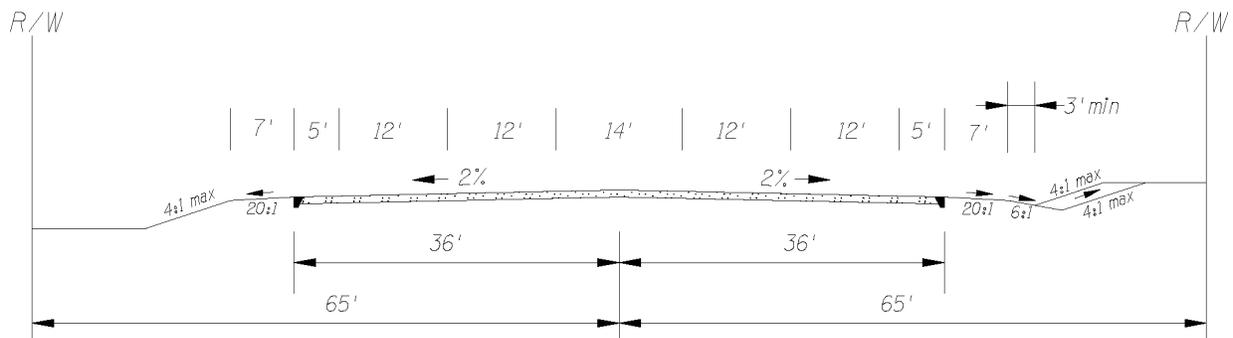


Figure 3.4-8



RURAL MAJOR COLLECTOR

Terrain	Design Speed, mph	Stopping Sight Distance ¹ , ft	Horizontal Alignment		Vertical Alignment				Thickened edge of pavement
			Minimum Radius, ft		Minimum Radius of Crest Vertical Curves ² , ft	Minimum Radius of Sag Vertical Curves, ft	Maximum Vertical Grade ³ , %	Maximum difference in vertical grades that does not require a vertical curve, %	
			e = -2% (NC)	e _{max} = 6%	L = K * A (A = algebraic difference in grades, %)	L = K * A (A = algebraic difference in grades, %)			
Level	50	425	1400	850	84*A	96*A	6	0.5	MAG 201, Type A
Rolling	45	360	1050	650	61*A	79*A	8	0.5	MAG 201, Type A
Mountainous	40	305	775	500	44*A	64*A	10	0.5	MAG 201, Type A
Pavement Section									
Structural Number, SN	≥ 2.46								

Table 3.4-10

RURAL MAJOR COLLECTOR - PAVEMENT SECTION

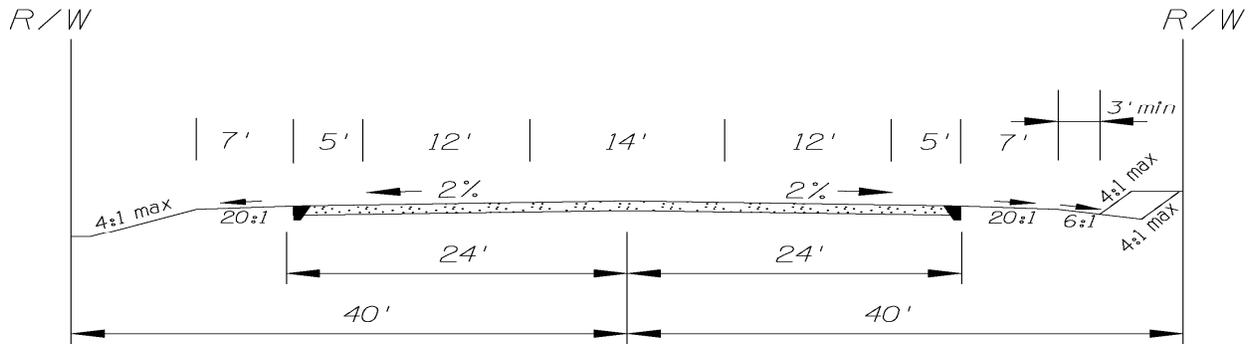


Figure 3.4-9



RURAL MINOR COLLECTOR

Terrain	Design Speed, mph	Stopping Sight Distance ¹ , ft	Horizontal Alignment		Vertical Alignment				Thickened edge of pavement
			Minimum Radius, ft		Minimum Radius of Crest Vertical Curves ² , ft	Minimum Radius of Sag Vertical Curves, ft	Maximum Vertical Grade ³ , %	Maximum difference in vertical grades that does not require a vertical curve, %	
			e = -2% (NC)	e _{max} = 6%	L = K * A (A = algebraic difference in grades, %)	L = K * A (A = algebraic difference in grades, %)			
Level	45	360	1050	650	61*A	79*A	7	0.5	MAG 201, Type A
Rolling	40	305	775	485	44*A	64*A	8	0.5	MAG 201, Type A
Mountainous	35	250	525	340	29*A	49*A	10	1.0	MAG 201, Type A
Structural Section									
Structural Number, SN	≥ 2.46								

Table 3.4-11

RURAL MINOR COLLECTOR - PAVEMENT SECTION

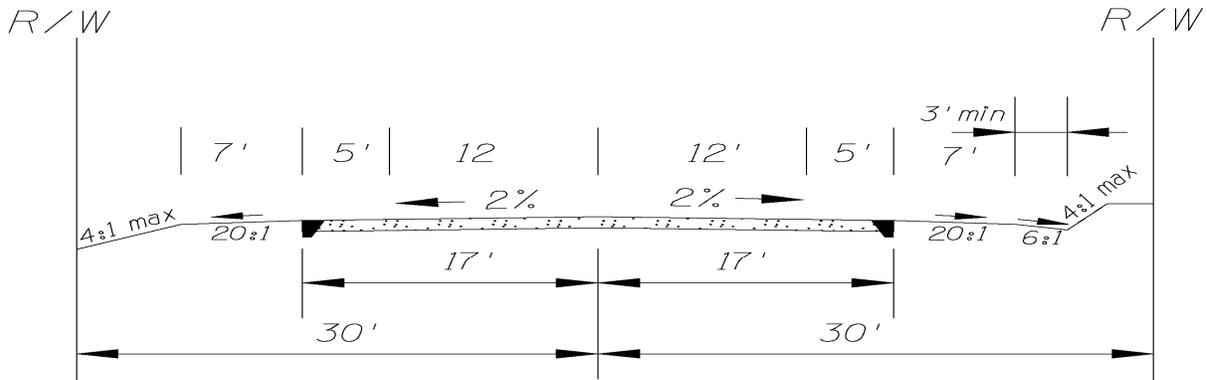


Figure 3.4-10



RURAL LOCAL

Terrain	Design Speed, mph	Stopping Sight Distance ¹ , ft	Horizontal Alignment		Vertical Alignment				Curbs: Type and Height, in.
			Minimum Radius, ft		Minimum Radius of Crest Vertical Curves ² , ft	Minimum Radius of Sag Vertical Curves, ft	Maximum Vertical Grade ³ , %	Maximum difference in vertical grades that does not require a vertical curve, %	
			e = -2% (NC)	e _{max} = 6%	L = K * A (A = algebraic difference in grades, %)	L = K * A (A = algebraic difference in grades, %)			
Level	35	250	510	340	29*A	49*A	7	2.0	MAG 201, Type A
Rolling	30	200	350	250	19*A	37*A	10	2.0	MAG 201, Type A
Mountainous	25	155	200	150	12*A	26*A	15	2.0	MAG 201, Type A
Structural Section									
Structural Number, SN	≥ 1.77								

Table 3.4-12

RURAL LOCAL - PAVEMENT SECTION

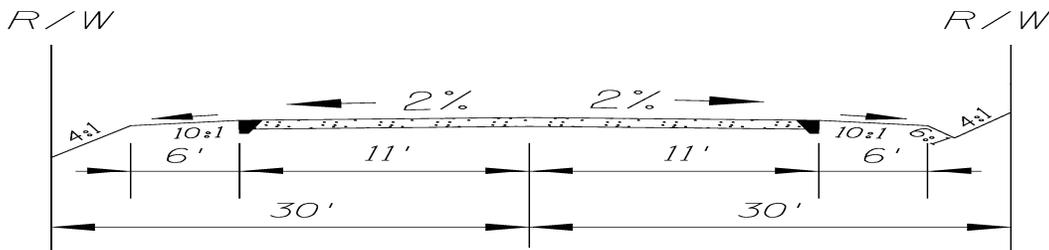


Figure 3.4-11

¹ Stopping sight distances shall be adjusted for horizontal grade.

² If passing is allowed along the vertical curve, its length shall be adjusted for passing sight distance.

Town of Cave Creek Technical Design Guidelines - Transportation



³ In most design cases maximum vertical grades must be less than shown. For grades shorter than 500 ft on rural and urban collectors only, the maximum grade may be 1% steeper on urban collectors, and 2% steeper on rural collectors.



SECTION 4 - INTERSECTION DESIGN

4.1 ANGLE OF INTERSECTION:

Right-angle intersections provide the most convenient way for the drivers to judge relative position of vehicles and approaching speeds of traffic. In the case of right-of-way or topography restrictions, intersection angles may diverge from a right-angle by a maximum of 4 degrees on arterial streets, 15 degrees on major collector streets, and by a maximum of 30 degrees for minor collector and local streets. Use of intersections with five or more intersecting approaches is not allowed.

4.2 LANE REQUIREMENTS AT INTERSECTIONS:

An exclusive turning lane permits separation of conflicting traffic movements and removes turning vehicles from the flow of through traffic. In these guidelines, turn lanes at intersections are designated as auxiliary lanes, and turn lanes at access driveways are designated as deceleration lanes. Criteria for the necessity of the auxiliary lanes at intersections are specified in this chapter. Deceleration lanes at access driveways are specified in Section 5.4-1 & 5.4-2.

4.2.1 Auxiliary Right-Turn Lanes¹:

Right-turn lanes in urban settings are required when the design right turn volume exceeds 300 vehicles per hour (VPH). For rural settings, right turn lanes are required when the outside lane has an expected volume of greater than 250 VPH and the right turn volume is greater than 55 VPH.

4.2.2 Left-Turn Lanes:

Left-turn lanes are required at all street intersections regardless of volumes, except on local roads, where an engineering evaluation may be necessary.

Dual turn lanes at signalized intersections should be considered when the turn volume exceeds 300 VPH, or the opposing through volume exceeds 1,000 VPH.

¹ For right and left turn lane warrants at access driveways see section 5.4



4.3 LANE DESIGN OF AUXILIARY & DECELERATION LANES:

Turn lanes at intersections of roadways that are built to the ultimate half or full urban section shall be designed per Figure 4.3-1. At all other intersections, including deceleration lanes at driveway entrances, turn lanes shall be built as shown in Figure 4.3-1.

Storage lengths for auxiliary lanes should be determined based on the anticipated turning volume and whether there is signalized or unsignalized traffic control. For unsignalized intersections, the storage length shall be determined based on the number of turning vehicles in an average two-minute period within the peak hour. Storage length shall never be less than 160 ft. for arterial and major collector streets, and never less than 75 ft. for minor collector and local streets. For signalized intersections, the storage length shall be 1.5 times higher than that determined for the length of queue for average number of vehicles that would store per cycle. The length of queue shall be calculated for the peak hourly AM or PM volume, whichever is highest. Length of storage lanes at signalized intersections shall never be less than 160 ft. for all street classifications.

Storage lengths for deceleration lanes should be based on the anticipated turning volumes and should be at least 100 ft. long on arterial and collector streets.

Standard rate of the widening taper for straight tapers at the opening of the deceleration lane is 1:15 for speeds higher than or equal to 45 mph, and 1:10 for speeds lower than 45 mph.

Total of storage length and length of curved or tapered transition shall never be less than the required deceleration length shown in Table 4.3-1. The subject table takes into consideration 10 mph speed reduction before entering the deceleration lane.

DECELERATION LENGTHS

Design Speed	Deceleration length
30	170
35	170
40	170
45	220
50	275
55	340
60	410

Table 4.3-1

Overall lane length shall be taken as the storage length plus transition taper, or the deceleration length, whichever is greater.

The requirement for an auxiliary lane may necessitate additional right-of-way.



AUXILIARY TURN LANES AT INTERSECTIONS

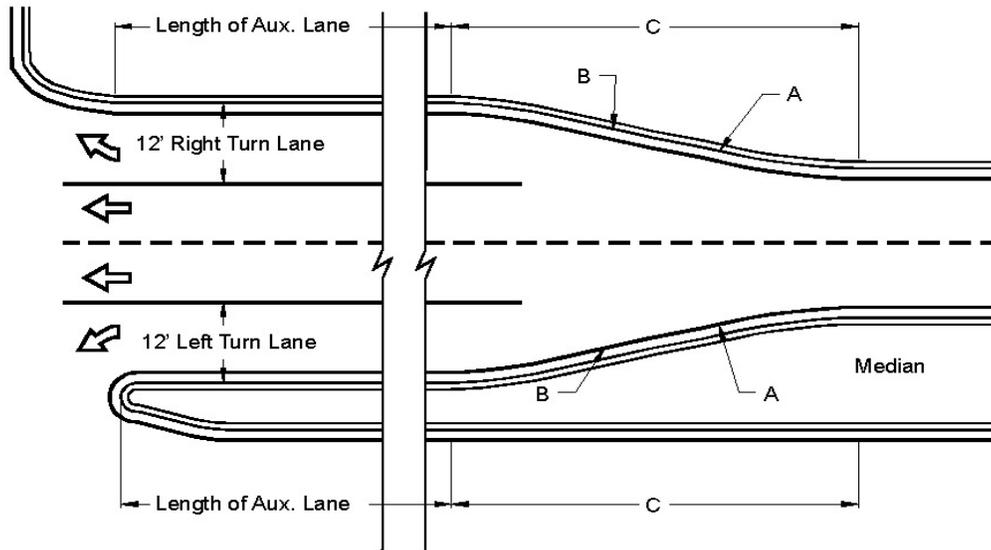


Figure 4.3-1

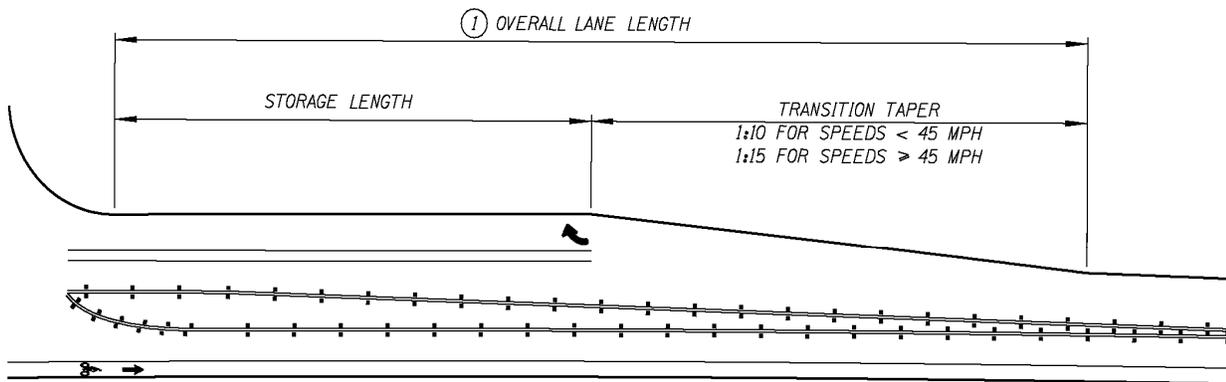
AUXILIARY TURN LANES AT INTERSECTIONS - SPECIFICATIONS

Street Classification	Dimensions, ft		
	Radius A	Radius B	Length C
Major Arterial	300	300	118
Minor Arterial	150	300	102
Collector	150	150	86

Table 4.3-2



AUXILIARY TURN LANES AT INTERSECTIONS AND DECELERATION LANES AT ACCESS DRIVEWAYS.



① Deceleration length per Table 4.3-A or Storage length plus taper length, whichever is greater.

Figure 4.3-2

4.4 MEDIAN OPENINGS:

Median openings at driveway and intersection locations shall be provided at intervals spaced no closer than shown in Tables 3.3-1 & 3.3-2. The length of the median opening should be at least the width of crossroad traveled way plus shoulders. Where crossroad is a divided highway, the width of the median of the crossroad must also be added to the length of the opening.

Vehicles with extended wheel-base such as buses, trucks, and trucks with semi-trailers turning from a minor cross road onto a major road with a median may experience encroachment onto the median. In the same fashion, vehicles turning from a major road that has a median onto a minor two-lane road may go beyond the traveled edge of the receiving lane when completing turns. In order to eliminate encroachment of turning vehicles onto a median and beyond traveled edge, minimum median opening widths shown in Table 4.4-1 shall be used.



MINIMUM WIDTHS OF MEDIAN OPENINGS FOR TWO-LANE CROSS-ROADS

Type of Intersection	Width of Median, ft	Minimum length of median opening, ft	
		Semicircular	Bullet Nose
Arterial/Minor Collector Arterial/Local Arterial/Access Point	10	90	62
	12	88	58
	14	86	53
	16	84	50
	20	80	44
	24	76	40
	28	72	40
	32	68	40
	36	64	40
40	60	40	

Table 4.4-1

4.5 INTERSECTION SIGHT DISTANCE:

In order to provide opportunity for vehicles at an intersection to safely cross or make left or right turns onto a through street, adequate intersection sight distance to the left and right of the driver must be provided. Sight distance should be based on design speed for the roadway.

The sight distance requirements outlined in Figure 4.5-1 shall be provided at all private and public street intersections and driveways. Figure 4.5-1 depicts the technique used to determine the driver's eye location and an approaching vehicle; a line is then drawn to connect these two points. Continuous unobstructed line of sight must be provided along this line and throughout the approach to the intersection, providing an unobstructed sight triangle to the side street driver. Sight lines are to be drawn on roadway and landscaping plans to represent the areas that must be free of all objects and topography in excess of 24 inches above the roadway surface, however, certain vegetation will be allowed. Vegetation placed within the sight triangle will be of a low height variety that remains below 24 inches when mature. Trees can be considered within the triangle as long as the canopies are above 7 feet, and they are a single trunk variety of not more than 12 inches in diameter.

For approach grades on the minor road of more than 3%, adjust values of the sight distance as shown in Table 4.5-1.

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**ADJUSTMENT MULTIPLIERS FOR SIGHT DISTANCE AS A FUNCTION OF
 APPROACH GRADE**

Approach Grade, %	Design Speed, mph	Multiply Sight Distance by:
-6	≤ 45	1.1
	≥ 50	1.2
-5	≤ 60	1.1
	≥ 65	1.2
-4	≥ 30	1.1
-3 to +3	≥ 15	1
+4	≥ 40	0.9
+5	≥ 30	0.9
+6	≥ 25	0.9

Table 4.5-1



INTERSECTION SIGHT TRIANGLES

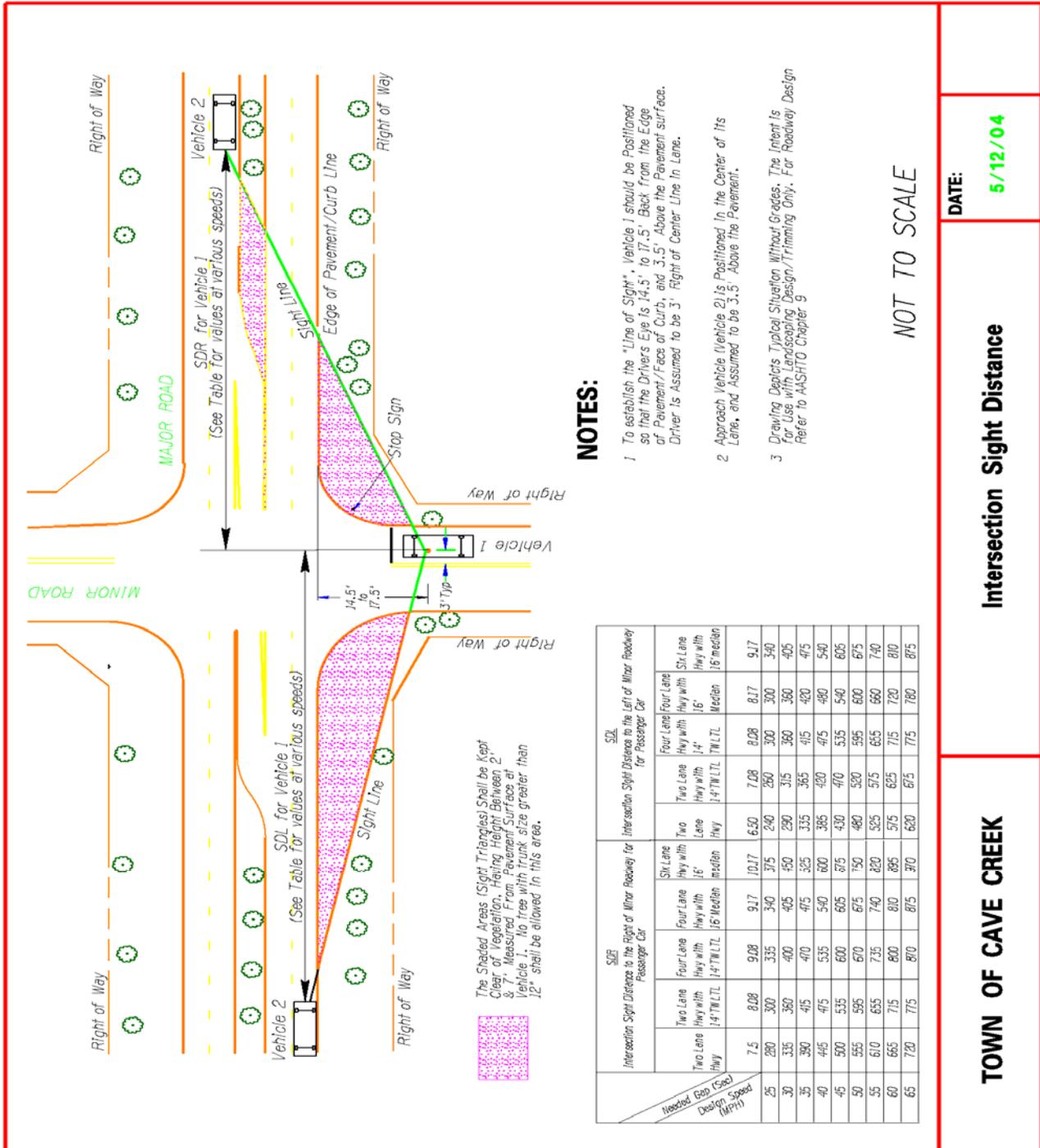


Figure 4.5-1



4.6 INTERSECTION CROSS SLOPE:

Allowable values for intersection cross slopes shall be as shown in Figure 4.5-2, except that the maximum allowable grade break on a stop sign controlled residential or minor collector street at a valley gutter can be 8.0%.

MAXIMUM ALLOWABLE CROSS SLOPES ON COLLECTORS AND ARTERIALS

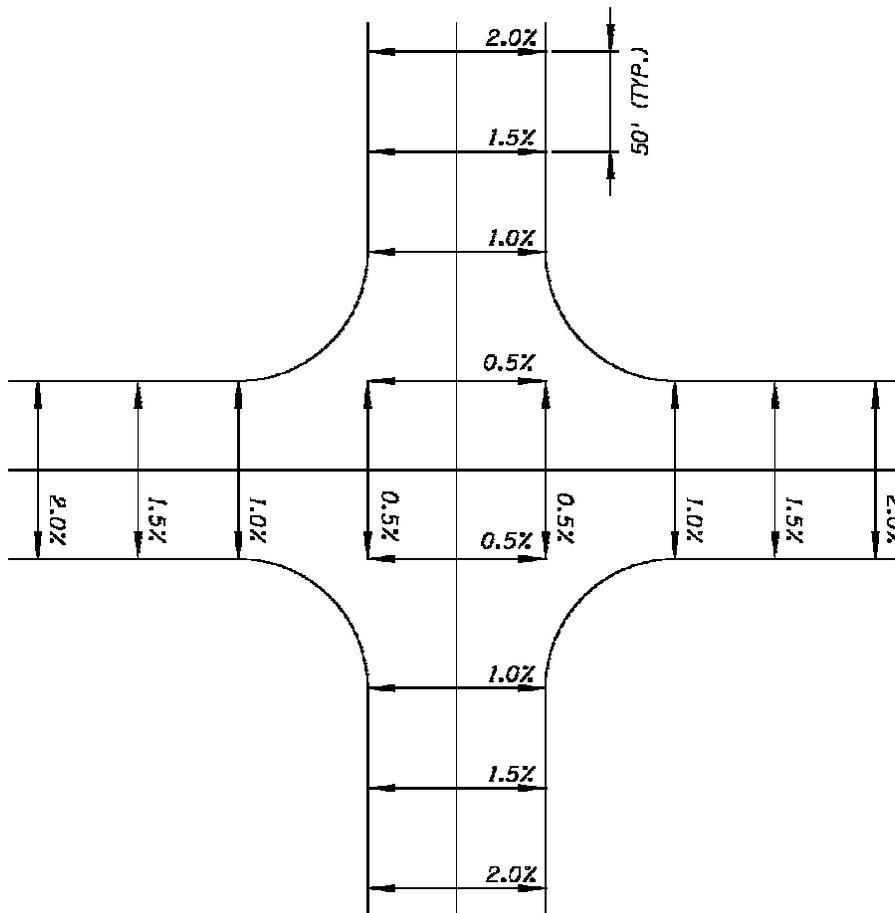


Figure 4.5-2



SECTION 5 - ACCESS CONTROL

5.1 DRIVEWAY TYPES:

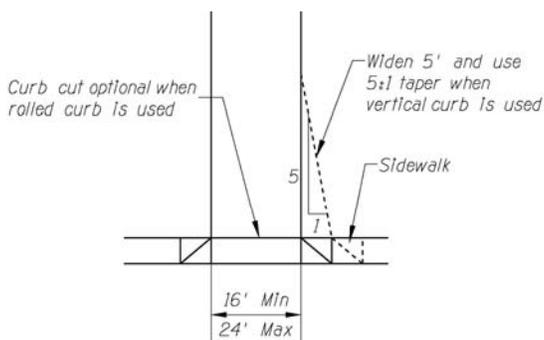
Driveway types are determined by land use and street classification as shown in Table 5.1-1.

DRIVEWAY TYPES

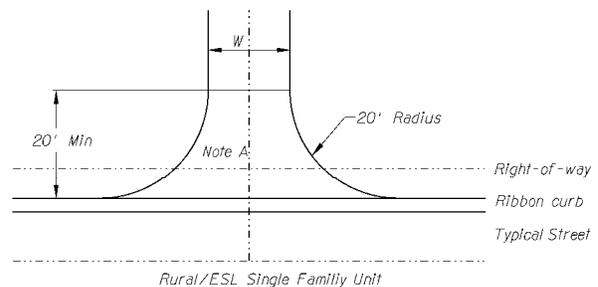
Land Use	Street Classification	Driveway Type	Driveway Width / Type of Access
Single Family	Local and Minor Collector	S-1	One single family unit: 16 to 24 ft., or width of garage opening (30 ft. max.), if garage is within 25 ft of R/W line; Two single family units: 30 ft.
	Local and Minor Collector	M-1	May be widened on egress side up to 12 ft. to provide for separate left-out lane.
Multifamily	Major Collector and Arterials	M-2	
	Commercial	Local and Minor Collector	CL-1
Major Collectors and Arterials		CH-1	Full access on collectors Right-in/right-out on arterials
		CH-2	Full Access
		CH-3	Full Access

Table 5.1-1

DRIVEWAY TYPES



S-1 Driveway. Suburban Settings



- W=16' for driveway serving one lot
- W=24' for driveway serving two lots
- Note A: Pavement section - 2" A.C./6" A.B.C. Minimum

S-1 Driveway. Rural Settings

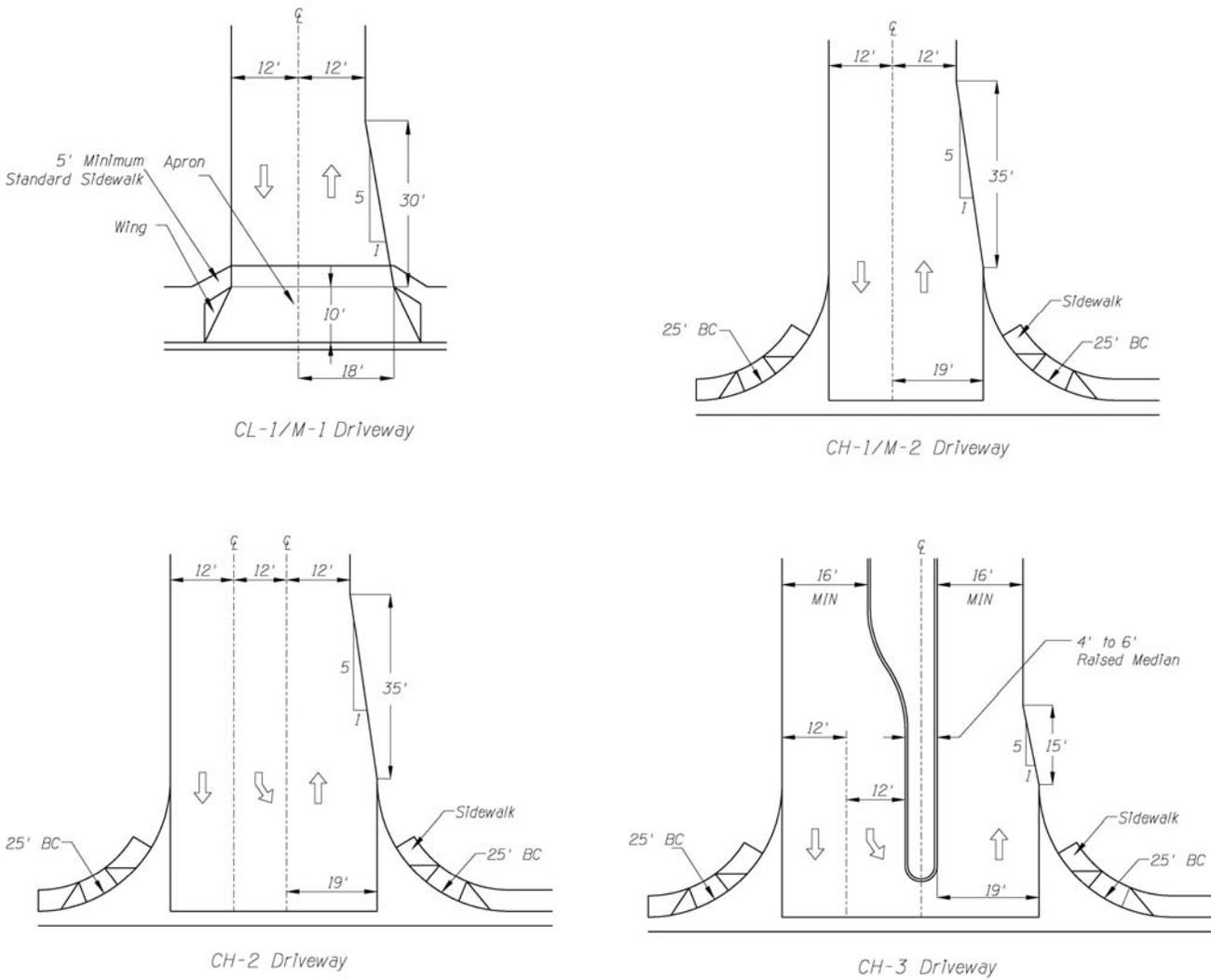


Figure 5.1-1



5.2 DRIVEWAY SPACING:

5.2.1 Distance between Adjacent Driveways:

Adequate space between driveways is critical for provision of safe turning paths and minimum interference with traffic on the main street as well as the driveway traffic. The following table lists the minimum driveway spacing for arterial and collector streets with a design Average Daily Traffic (ADT) of greater than 2000 vehicles per day (VPD). The distances are measured between the center lines of two neighboring driveways.

SPACING BETWEEN ADJACENT DRIVEWAYS

Land Use	Driveway Type	Arterial/Collector Minimum Spacing, ft.	Local Road Minimum Spacing, ft.
Single Family	S-1	Not allowed in urban areas 105 - rural arterial 80 - rural collector	65
Multi-Family	M-1	65	65
Multi-Family	M-2	330	65
Commercial	CL-1	165	N/A
Commercial	CH-2	330	N/A
Industrial	CL-1	165	N/A

Table 5.2-1

Joint access is required for two adjacent developments where a proposed new access will not meet the spacing requirements set forth in this section.

5.2.2 Driveway Corner Clearance:

Driveways located near major street intersections shall be located according to Table 5.2-2.

MINIMUM DRIVEWAY CORNER CLEARANCES

Item	Access Type	Dimension	Arterial, ft	Collector, ft	Local, ft
Distance upstream from a major intersection to:	Right-in/right-out access	A	280	225	160
	Fully directional access	B	660 major arterial 460 minor arterial	400	160
Distance downstream from a major intersection to:	Right-in/right-out access	C	280	225	160
	Fully directional access	D	660 major arterial 310 minor arterial	250	160

Table 5.2-2



DRIVEWAY SPACING

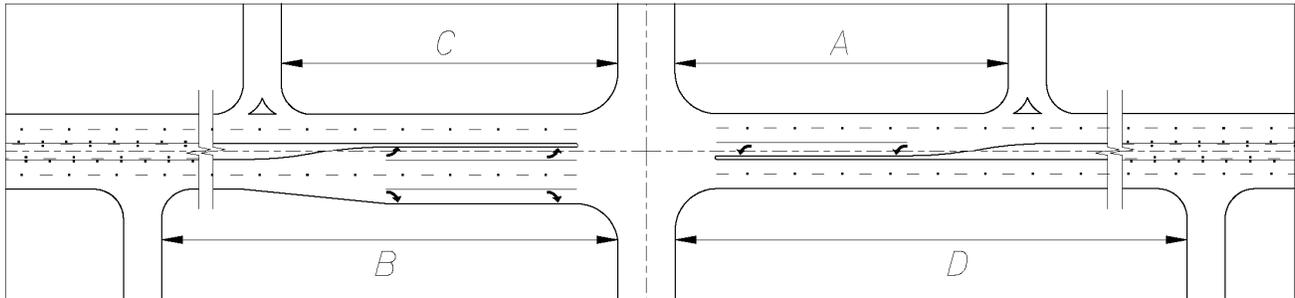


Figure 5.2-1

Driveways shall not be located at (measured to the driveway centerline):

- Within 30 feet of any commercial property line, except when it is a joint-use driveway serving two abutting commercial properties and access agreements have been exchanged between, and recorded by, the two abutting property owners;
- When the nearest edge of any driveway flare or radius must be at least 2 feet from the nearest fire hydrant, utility pole, drop inlet and/or appurtenances, traffic signals, or light pole;
- Within minimum spacing of adjacent access shown in Table 5.2-1.
- Within 25 feet of a guardrail ending.
- Within 100 feet of a bridge or other structure, except canal service roads.
- Within 100 feet of an approved median opening location on an arterial street.
- When adequate sight distance cannot be provided to vehicles on the driveway attempting to access the street (see Figure 4.5-1).

5.3 DRIVEWAY STORAGE:

Driveway storage requirements shall be based on Traffic Impact Study recommendations. In the absence of the traffic impact study, a typical storage length shall be provided as described in Section 4.3.

5.4 DECELERATION LANES AT DRIVEWAYS:

Deceleration lanes may be required on urban and collector streets in order to reduce interference with the through traffic on major street and decelerating vehicles entering driveways. Deceleration lanes aid in preservation of the level of service of arterial and collector streets as well as help maintain uninterrupted traffic flow. Deceleration lanes may be required in conjunction with commercial and



industrial type driveways. Figure 5.4-1 illustrates volume warrants for right-turn deceleration lanes for urban collector and arterial streets.

When calculating single lane design hour volume, it shall be assumed that all traffic in the same direction is distributed evenly in all lanes.

For rural streets, right-turn deceleration lanes are required when the outside lane has an expected volume of greater than 250 VPH and the right turn volume is greater than 55 VPH.

Left turn deceleration lanes for urban and rural collector and arterial streets will be required based on volume warrants shown in Figure 5.4-2.

VOLUME WARRANTS FOR RIGHT-TURN DECELERATION LANES ON URBAN ROADWAYS

Source: NCHRP 279, Illinois.

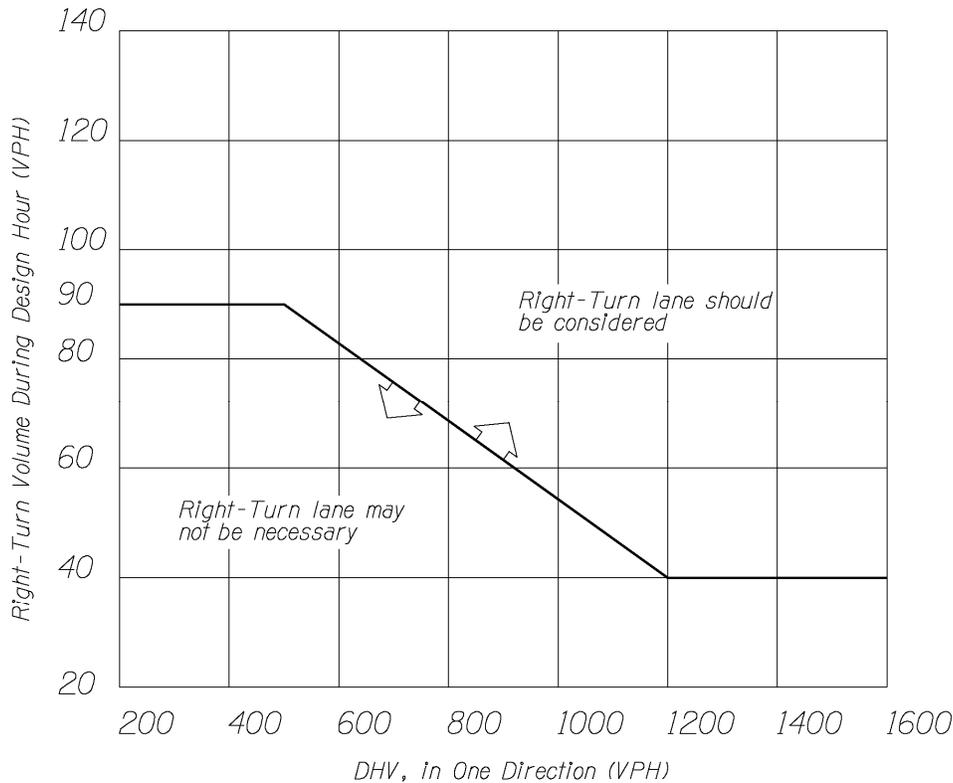


Figure 5.4-1



VOLUME WARRANTS FOR LEFT-TURN DECELERATION LANES ON URBAN ROADWAYS

Source: *Roadway Design Manual 2004 Fig. 7.14*, Maricopa County Department of Transportation.

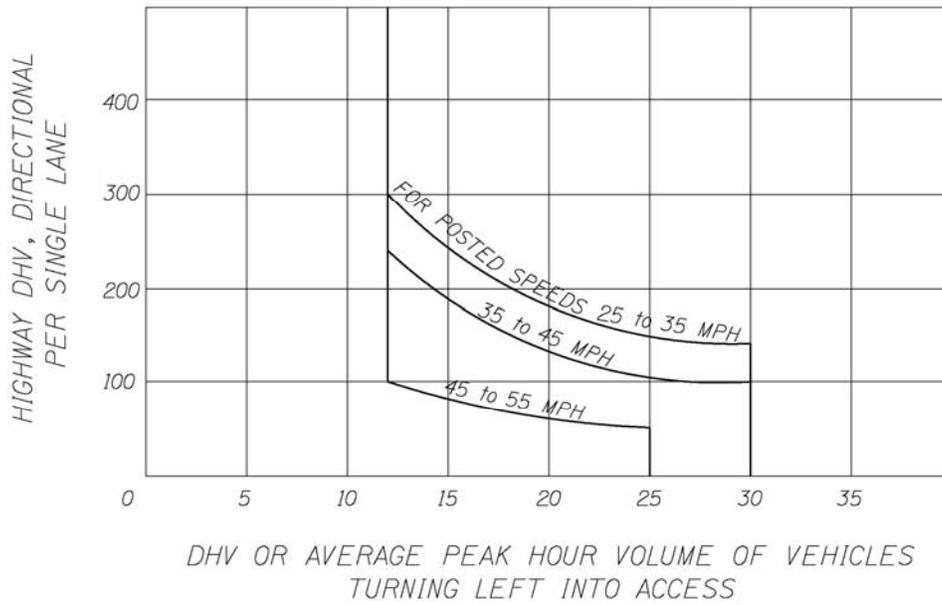


Figure 5.4-2



SECTION 6 - PAVEMENT STRUCTURAL SECTION DESIGN

6.1 DETERMINING REQUIRED STRUCTURAL NUMBER:

Flexible pavement design is based on determining a structural number (SN) that, given the subgrade conditions of the pavement, can withstand the projected number of Equivalent Single Axle Loads (ESALs). The structural number equation and design nomographs can be found in AASHTO *Guide for Design of Pavement Structures* [2], and they can be acquired through commercially available design software packages such as AASHTO’s Darwin Program. The output of these calculations is the Design Structural Number (SN). The equation is as follows:

$$\text{Log}_{10} W_{18} = Z_R * S_0 + 9.36 \log_{10} (SN + 1) - 0.2 + \frac{\log_{10} \left(\frac{\Delta_{PSI}}{4.2 - 1.5} \right)}{0.40 + \frac{1094}{(SN + 1)^{5.19}}} + 2.32 \log_{10} (M_R) - 8.07$$

Where;

- W₁₈** = Total accumulated traffic in ESALs for the design lane
- S₀** = Overall standard deviation
- M_R** = Effective roadbed soil resilient modulus
- Δ_{PSI}** = Design serviceability loss
- Z_R** = Standard normal random variable

The structural number (SN) as determined above will be compared with the minimum structural number shown in Table 6.1-1 for the appropriate roadway type. The larger structural number (SN) shall be used for pavement design.



MINIMUM STRUCTURAL NUMBER BASED ON ROADWAY TYPE

Roadway Classification		SN (Min.)
Rural	Urban	
Principal Arterial	Principal Arterial	2.88
Minor Arterial	Minor Arterial	2.88
Major Collector		2.46
	Major Collector (Industrial/Commercial)	2.88
	Major Collector (Residential)	2.13
Minor Collector		2.46
	Minor Collector (Industrial/Commercial)	2.88
	Minor Collector (Residential)	2.13
Local Road	Local Road (Residential)	1.77
Local Road (Industrial/Commercial Subdivisions)	Local Road (Industrial/Commercial Subdivisions)	2.88

Table 6.1-1



6.2 SELECTION OF LAYER THICKNESS:

After the design structural number (SN) has been determined, develop layer thickness which, when combined, will provide the load carrying capacity to meet the design structural number. The following equation is used to accomplish this.

$$SN = a_1D_1 + a_2D_2m_2 + a_3D_3m_3$$

Where;

a_i = layer coefficients representative of surface, base, and subgrade courses, respectively.
 Refer to Table 6.2-1;

D_i = actual thickness of surface, base, and subgrade courses, respectively;

m_i = drainage coefficients for base and subbase layers, respectively. Refer to Table 6.2-1.

The designer can conceive various alternative combinations of layers and thicknesses that will achieve the required design structural number (SN). Several different combinations are to be developed. The final design recommendation will be made after these alternative combinations are evaluated based on: 1) Layered design analysis, 2) Evaluation of the swell potential of the subgrade, and 3) Construction cost analysis for the pavement.

STRUCTURAL LAYER COEFFICIENT, a_i

Material Description	Structural Layer Coefficient
Asphalt Rubber	0.42*
Asphalt Concrete	0.42
Cement Treated Base	0.28
Aggregate Base	0.12
MAG Select	0.11
Stabilized Subgrade	0.16 – 0.23**

Table 6.2-1

*In order to consider the superior performance in cracking and other aging characteristics, a structural layer coefficient of 0.61 may be used for up to 2 inches of asphalt rubber concrete when used on the top surface of the pavement (use materials as required in MCDOT specification section 325).

**The coefficient for stabilized subgrade is to be determined using a non-soaked 7-day compressive strength, using ASTM D1633 Method A, and the following formula:

$$a_i = 0.15 + 0.0001 * (CSCLS)$$

Where;

CSCLS = Compressive strength of cement or lime-stabilized subgrade (psi)



DRAINAGE COEFFICIENT, m_i

Drainage Quality	Drainage Coefficient, ADOT	Water Removed Within, AASHTO [2], page II-22
Excellent	1.15	2 Hours
Good	1.07	1 day
Fair	1.00	1 week
Poor	0.93	1 month
Very Poor	0.86	Water will not drain

Table 6.2-2

Highways elevated two feet or more above the adjacent ground surface, having a minimum crowned cross-slope of 2.0%, and a graded shoulder carrying water 10 feet or more away from the outside edge of the outside lane shall be considered to have “good” drainage. Roadways designed with concrete curbs and drop inlet drainage meeting Town of Cave Creek design standards shall be considered to have “fair” drainage, and a drainage coefficient of 1.0 is recommended.

6.3 LAYERED DESIGN ANALYSIS:

The pavement structure is a layered system and each underlying layer affects the layers above it. The design equation presented in sec. 6.2 can be used to evaluate the adequacy of each layer to support the layers above it. The minimum SN for the pavement structure above a particular layer may be computed using the AASHTO formula and the resilient modulus (M_R) for that layer. The AASHTO *Guide* [2] (page II-36) should be referred to for a more complete explanation of the layered analysis approach.

A layered design analysis does not change the design structural number, but affects limits on some of the layer thicknesses. The most common impact on pavement designs is that it requires thicker layers of asphalt concrete on roadways with high traffic volume. A layered design analysis is required for Town of Cave Creek pavement designs.

6.4 CONSTRUCTION CONSTRAINTS FOR LAYER THICKNESS:

The design thickness of asphalt concrete shall be rounded upward to the nearest 1/2-inch increment. The design thickness of granular base shall be rounded to the nearest 1-inch using a minimum layer thickness of 4-inches. The designed thickness of stabilized native or base shall be rounded to the nearest 1-inch with a minimum layer thickness of 6-inches.

6.5 ROADBED SWELLING:

Expansive soils in the roadway subgrade are detrimental to pavement performance in several ways. As the resilient modulus of expansive soils is generally very low, expansion of the subgrade can reduce the ride quality and therefore decrease the pavement’s serviceability ratings.



Differential movements can crack the pavements and propagate local failures that increase maintenance costs. The pavement design process will incorporate the following measures in consideration of these detrimental effects.

Subgrade soils with a plasticity index above 15 and more than 20% passing the #200 sieve shall be considered potentially expansive. The engineer shall take additional samples or test existing samples as necessary to ensure that a minimum of 3 samples of any potentially expansive soil is tested. The treatment described in Table 6.5-1 will then be required based on the average of the three samples with the highest expansion potential. If it is not possible to obtain 3 samples representing a given expansive soil, the treatment given in Table 6.5-1 will be based on the test result of the sample with the highest expansion potential.

This method for treatment of swelling soils is a modification of a method presented in section 314 of the *Airport Pavement Design and Evaluation Manual* published by the Federal Aviation Administration [7]. That method establishes prescribed treatments of subgrade soils based on their swell potential as measured in the CBR test (ASTM D1883).

The guidelines presented here have established similar prescribed treatments, but the level of treatment is based on one-dimensional expansion potential test results. Samples for swell tests shall be re-molded to 95% of maximum dry density and at 3% below optimum moisture as determined by ASTM D698. They shall be re-molded in accordance with ARIZ 249 (ADOT *Materials Testing Manual* [4]), and tested for one-dimensional expansion in accordance with the applicable portions of ASTM D4546 applying a surcharge of 144 psf. At the discretion of the pavement designer, the surcharge load can be adjusted to match the overburden produced by a reasonable estimate of the proposed design pavement section. Testing and calculation of swell pressures will not be required.

RECOMMENDED TREATMENT FOR SWELLING SUBGRADE SOILS

Expansion Potential	Recommended Treatment
< 2%	None
2 – 5%	Stabilize* in place to a depth of 6 inches
> 5%	Stabilize* in place to a depth of 12 inches

Table 6.5-1

*The soil can be stabilized with either lime or cement by specifying the requirements of MAG Section 309 Lime Slurry Stabilization or MAG Section 311 Soil Cement Base Course. For either method a minimum compressive strength of 160 psi shall be achieved when tested as required by the specifications.

An alternative to the prescribed treatments is to remove the subgrade soils to a depth of 24 inches below the bottom of base course and replace with a non-expansive and otherwise suitable soil.



6.6 CONSTRUCTION COST ANALYSIS:

The pavement designer shall consider different pavement structures and their comparable costs. As an example, the designer may consider the following three alternatives for a given pavement design:

- Full depth asphalt
- Asphalt surface course over aggregate base course
- Asphalt surface course over aggregate base course over stabilized subgrade

The layer thicknesses are to be calculated for each alternative to achieve the design structural number required for the project. Following these calculations cost estimates for each alternative are to be prepared. The most economical alternative should be given consideration in selecting the recommended alternative. Factors such as constructability and re-use of existing materials shall be included in the evaluation. Local roads and minor collectors shall utilize the pavement design procedure in Section 6.7. Additionally, the design engineer shall make a recommendation for which alternative is believed to be most advantageous to the project.

6.7 ALTERNATIVE DESIGN METHOD FOR LOW VOLUME ROADS:

For minor collector and local roads, an alternative simple design procedure is available to pavement designers. This method utilizes sieve and PI data to evaluate the subgrade and does not require traffic analysis except as necessary to determine the roadway classification.

6.8 SAMPLING:

Test holes for the soils investigation segment of the pavement design shall be within the pavement alignment, and shall be spaced at one per eight hundred linear feet with at least one per proposed street. Each test hole shall be advanced to 24 inches below the elevation of the proposed subgrade if there is no significant cut or fill required. In areas of cut or fill, the engineer shall use their professional judgment to determine the depth of each test hole. The intent of the test hole depth is to sample and test a minimum of 2 feet of the final roadway's subgrade materials. Additional test holes shall be taken at apparent changes in soil type.

6.9 TESTING & DESIGN:

As a minimum, at least one soil sample from each test hole shall be tested for sieve analysis (AASHTO T27) and plasticity index (AASHTO T89 and T90). Tested values of the plasticity index and percent passing the #200 sieve are then applied to design charts (Design Charts 100 and 101) to determine the required asphalt pavement sections.

The designer has two options for determining the design values of PI and -#200. The first option is to plot all of the PI and -#200 values from the tested samples and select the sample resulting in the highest thickness of base course. This option shall always be used if fewer than 5 samples are used in the design.



The second option is to use a weighted average approach. This approach can be accomplished with the following steps:

- Summarize all of the -#200 and PI data on a chart along with calculated estimates for R-value and resilient modulus (M_R) using the following formulas:

$$R_{cor} = 0.018 * e^{\frac{SPF}{0.235}} + 6.0 \text{ (If } R_{cor} > 70, \text{ set } R_{cor} = 70)$$

$$SPF = 2.05 - 0.0033 * (\text{pass}\#200) - 0.017 * PI$$

Where;

PI = Plasticity Index

Pass

#200 = Percentage passing the #200 screen from the sieve analysis

SPF = Sieve and PI factor

Note: This equation for the correlation R-value is a variation of that presented in the Preliminary Engineering and Design Manual published by ADOT. The equation has been adjusted to represent soils typical to Maricopa County, whereas the ADOT equation is for soils throughout the state of Arizona.

$$M_R = \frac{1815 + 225R_{mean} + 2.40R_{mean}^2}{0.6}$$

Where;

M_R = Subgrade Soil Resilient Modulus

R_{mean} = Mean R-value as calculated below:

$$R_{mean} = \frac{2N_t R_t SD_t^2 + N_c R_c SD_c^2}{2N_t SD_t^2 + N_c SD_c^2}$$

Where,

N_t = number of measured R-values

N_c = number of correlated R-values

R_t = adjusted average of the measured R-values

R_c = adjusted average of correlated R-values

SD_t = standard deviation of the measured R-values

SD_c = standard deviation of the correlated R-values

- When the chart is completed, the engineer will be able to identify if more than one pavement section would be beneficial for the project. If more than one section will be designed, each section is to have a separate chart summarizing the test results applicable to that design.
- Use the summary chart to determine the weighted average values for PI and -#200. The weighting will tend to place more emphasis on the poorer soils rather than the better soils, and will not allow excessive variation from the average to the poorest soils encountered.



- Eliminating the test samples with the highest resilient modulus values one at a time until the standard deviation of the remaining resilient modulus values is less than 8000 arrives at the weighted average. The -#200 and PI results from these “remaining” samples are then used to calculate the weighted average.
- Calculate the weighted average values for -#200 and PI by adding one standard deviation to their remaining averages. The above three steps are shown in the below adjustments which have been made on the example in Table 6.9-1:

TEST DATA SUMMARY

Test Hole No.	PI	-#200	Correlated R-value, R _{cor}	Resilient Modulus, M _R
1	8	39	42.7	26,301
2	11	50	32.6	19,491
3	19	41	27.0	16,053
4	17	30	34.0	20,375
5	16	31	34.8	20,941
6	33	75	9.7	7,061
7	34	77	9.1	6,778
8	30	72	11.4	7,833
9	9	21	52.6	33,818
10	15	16	44.6	27,681
11	15	12	47.1	29,559
12	12	12	53.0	34,109
13	6	6	72.8	51,503
14	12	18	48.8	30,815
15	21	46	23.3	13,923
16	21	49	22.3	13,396
17	20	13	38.2	23,183
18	12	12	53.0	34,109
19	15	13	46.5	29,075
Average	17	33	37	23,474
Std. Deviation	8	23	17	11,400*
Average + Std. Deviation	25	56		

Table 6.9-1

*Note: Since 11,400 is greater than 8,000, eliminate data, beginning with the highest resilient modulus, one test hole at a time, until the standard deviation of the resilient modulus values is less than 8,000.



TEST DATA SUMMARY – WITH WEIGHTED AVERAGE

Test Hole No.	PI	#200	Correlated R-value, R _{cor}	Resilient Modulus, M _R
1	8	39	42.7	26,301
2	11	50	32.6	19,491
3	19	41	27.0	16,053
4	17	30	34.0	20,375
5	16	31	34.8	20,941
6	33	75	9.7	7,061
7	34	77	9.1	6,778
8	30	72	11.4	7,833
9				
10	15	16	44.6	27,681
11				
12				
13				
14	12	18	48.8	30,815
15	21	46	23.3	13,923
16	21	49	22.3	13,396
17	20	13	38.2	23,183
18				
19				
Average	20	43	29	17,987
Std. Deviation	8	22	13	7,962*
Average + Std. Deviation (Weighted Average)	28	65		

Table 6.9-2

*Note: Six test holes were eliminated from the data to bring the standard deviation of resilient modulus to less than 8,000.

- Plot these weighted average values on Figure 6.9-1 or 6.9-1 to determine the required base course thickness to go with the predetermined asphalt concrete thickness.
- Figures 6.9-1 & 6.9-2 are included on the following pages.

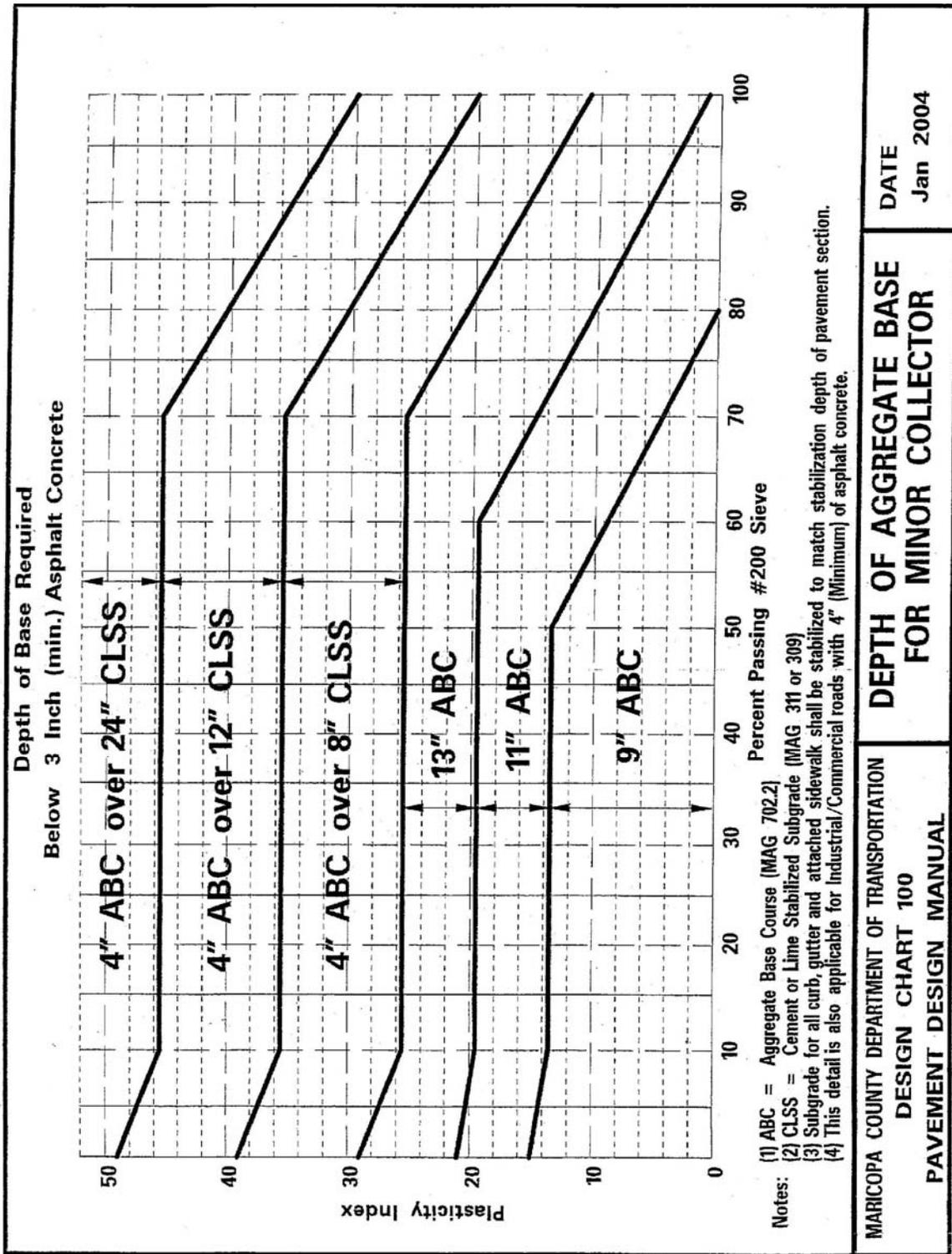
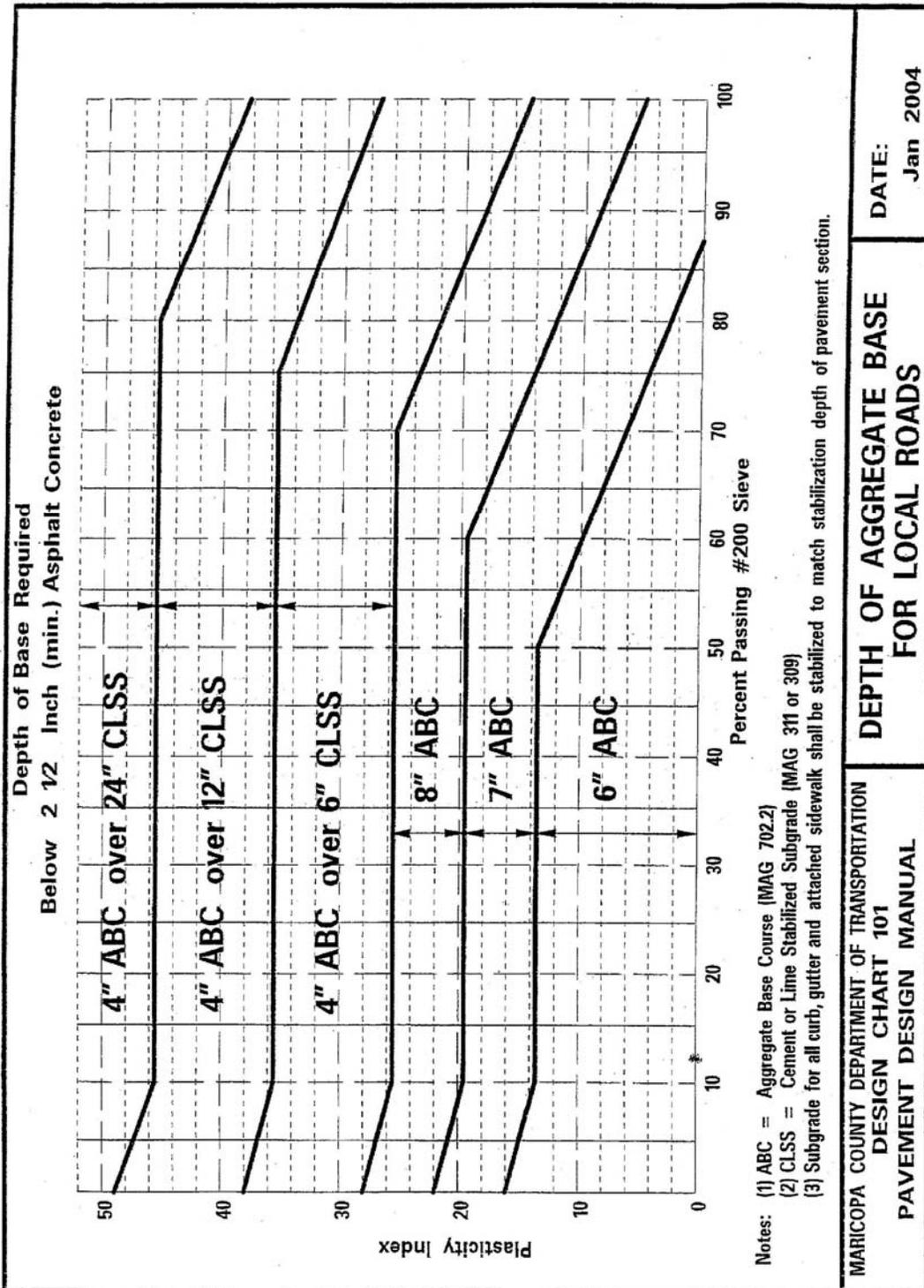


Figure 6.9-1





SECTION 7 - PRIVATE ACCESS DRIVES & DRIVEWAY REQUIREMENTS

7.1 PURPOSE:

The purpose of this section is to provide guidance on the planning, design, and construction of private access drives in conjunction with the access requirements for emergency service vehicles within the Town of Cave Creek (TOCC), Arizona. This guideline applies town-wide to all new development, redevelopment, and major renovation projects.

7.2 GENERAL INFORMATION:

Emergency vehicle access and the ability to stage an emergency vehicle once it has reached a property to perform firefighting or an emergency medical task can be greatly compromised by the topography of the site. The following criteria are the result of testing, review of emergency vehicle performance standards and nationally accepted practices. This information is not designed to be all encompassing of every situation.

This Technical Design Guideline should be used in conjunction with the following:

- The Town of Cave Creek Zoning Ordinance, latest revision.
- The International Fire Code, Section 503.
- Maricopa Association of Governments (MAG) Standard Specifications and Details.
- The Maricopa County Department of Environmental Services dust control regulations and requirements.
- The Flood Control District of Maricopa County regulations and requirements.

7.3 DISCLAIMER:

No warranty is expressed or implied in the review/approval of technical design reports and private roadway construction plans for development and/or improvement of properties within the Town of Cave Creek. Development Plans are reviewed and approved by the Town for general conformance with the Town's Ordinances, policies and standards. The Town does not assume responsibility or liability for insufficient design and/or improper construction/installation.

Review and approval by the Town does not absolve the owner, developer, design engineer, or contractor of liability for inadequate design, materials failure, poor construction or inadequate maintenance.

The civil engineer has the responsibility to design private roadway improvements and prepare design reports that meet the standards of practice for the industry and promote public safety.

Compliance with the regulatory elements, policies, and design standards documented herein, does not imply a guarantee that properties will be free from flood, geologic, and geotechnical related damage and failures. The Town and its officials, employees, and contract reviewers, assume no liability for information, data, or conclusions prepared by private engineers, architects and designers.

The data and information provided herein is offered as minimum guidelines to development regarding private roadway design. With the exception of requirements mandated by Town Codes and



Ordinances, all guidelines provided are subject to change or variation at the discretion of the Town Engineer.

The TOCC does not guarantee the accuracy and/or applicability of the standards presented in this Section. The user shall be entirely responsible for the verification of the reasonability of all proposed designs and shall incorporate alternative design methodology when appropriate.

7.4 DEFINITIONS:

For purposes of this Technical Design Guideline the following definitions shall apply:

ALL WEATHER SURFACE (AW): A road surface made up of materials compressed to 90% and capable of supporting vehicles in excess of 50,000 pound G.V.S. under any weather condition. (i.e., decomposed granite). Also see **“Hard Surface”**.

COMMON PRIVATE DRIVEWAY: A private driveway that serves more than one single-family residence.

DRIVE LENGTH: The measured distance from the entrance of the drive to the structure.

DRIVE WIDTH: The measured distance from the edges of the designated improved drivable surface.

GRADE: The degree of inclination of a slope, road, or other surface.

HARD SURFACE: A drive surface of concrete, asphalt, or pavers designed to support vehicles in excess of 50,000 pounds under any weather condition.

HOSE LAY: The extension of a hand held fire hose as it is extended around the perimeter of the structure. If the hose lay is more than 200 feet from the road to all portions of the exterior an **“Operational Platform”** is required.

OPERATIONAL PLATFORM: An area located on-site where an emergency vehicle is staged while performing emergency medical or firefighting tasks. The platform shall be 20 feet by 30 feet with a maximum cross grade of 5%. Operational platforms are required when drive or adjacent street grade is greater than 12% slope or the hose lay from the truck staging area to all portions on the exterior of the structure are greater than 200 feet.

SLOPE: The ground, road or other surface that forms a natural or artificial incline. The percentage of slope is determined by dividing the rise by the horizontal run. [% Slope = (Rise/Run x 100)].

TURN AROUND: The area required for emergency vehicles to turn a round when a structure is more than 150 feet from the road. This can be accomplished by a circular drive with an outside radius of 40' – 6", a T-Type hammerhead (16' x 76'), or a variation thereof.

TURNOUT: The area required on all extended driveways 300 feet or greater in length to a single residence. The turn-out shall widen the drive to a minimum of 20 feet in width over a minimum length of 45 feet.



7.5 STANDARD SPECIFICATIONS & DETAILS:

7.5.1 Dimensions:

Private access roads and driveways shall have an unobstructed width of not less than 20 feet and shall have an unobstructed vertical clearance of not less than 14 feet.

7.5.2 Loading Areas & Passenger Drop-Off Areas:

On private property, where Emergency Vehicle access roads are utilized for loading or unloading or are utilized for passenger drop-off or pickup, an additional 8 feet of width shall be required. This width is in addition to the minimum 20 foot access road width.

7.5.3 Pre-Existing Private Access Roads and Driveways:

Private access roads and driveways established and approved prior to the effective date of this Technical Design Guideline are not required to be widened if maintained in an operable condition. However, it is the recommendation of the Town of Cave Creek that all private access roads and driveways be brought into compliance with the minimum standards contained within this Section.

7.5.4 Authority:

The Emergency Services Provider and/or Town Engineer shall have the authority to require an increase in the minimum access widths where they are inadequate for fire or rescue operations.

7.5.6 Surface:

Private access roads and driveways shall be designed and maintained to support the imposed load of Emergency Services Vehicles and shall be surfaced so as to provide all-weather driving capabilities with an imposed live load of 66,000 pounds and with a maximum axle load of 28,000 pounds. Alternative surface materials other than paving require approval of the Town Engineer.

7.5.7 Turning radius:

The required turning radius of a private access road or driveway shall have a minimum 45-foot center line radius (35-foot inside radius, 55-foot outside radius).

7.5.8 Vehicle Passing Points:

When private access roads or driveways exceed 300 feet in length, vehicle passing points shall be installed at intervals not to exceed 300 feet.

7.5.9 Dead Ends:

Dead-end private access roads or driveways in excess of 200 feet in length shall be provided with an approved area for turning around Emergency Services Vehicles.

7.5.10 Bridges and Elevated Surfaces:

Where a bridge or an elevated surface is part of a private access road or driveway, the bridge shall be constructed and maintained in accordance with AASHTO HB-17. Bridges and elevated surfaces shall be designed for a live load sufficient to carry the imposed loads of 66,000 pounds with a maximum axle load of 28,000 pounds for Emergency Services Vehicles. Vehicle load limits shall be posted at both entrances to bridges when required by the Emergency Services Provider and/or Town Engineer.



Where elevated surfaces designed for Emergency Services Vehicle use are adjacent to surfaces which are not designed for such use, approved barriers, approved signs or both shall be installed and maintained when required by the Emergency Services Provider and/or Town Engineer.

7.5.11 Grade:

The grade of a private access road or driveway shall not exceed 15% (15ft. in 100 ft.). Cross-slope of a private access road or driveway shall not exceed a depth of 6 inches.

7.5.12 Drainage:

Water drainage shall be directed away from or piped under the private access road or driveway. Ponding of water on a private access road or driveway shall not exceed a depth of 6 inches.

7.5.13 Stabilization:

A stabilized edge meeting MAG standards or equivalent is required on all private access roads or driveways.

7.6 PRIVATE ACCESS ROADS & DRIVEWAY STANDARDS BASED UPON ACCESS GRADES:

ACCESS GRADES FROM 0 TO 12% FOR ONE SINGLE-FAMILY RESIDENCE				
Drive Length	Minimum Easement Width	Drive Width (Shoulder-Drive-Shoulder)	Drive Surface	Turn around Required
Less than 200'	20'	12'	All Weather	No
More than 200'	20'	2'-12'-2'	All Weather	Yes
More than 200'	20'	2'-12'-2'	All Weather	Yes

Table 7.6-1

ACCESS GRADES FROM 12.1% TO 15% FOR ONE SINGLE-FAMILY RESIDENCE				
Drive Length	Minimum Easement Width	Drive Width (Shoulder-Drive-Shoulder)	Drive Surface	Turn around Required
Less than 200'	20'	12'	Hard Surface	No
More than 200'	20'	2'-12'-2'	Hard Surface	Yes
More than 200'	20'	2'-12'-2'	Hard Surface	Yes

Table 7.6-2



ACCESS GRADES FOR MORE THAN 15.1% FOR ONE SINGLE-FAMILY RESIDENCE				
Drive Length	Minimum Easement Width	Drive Width (Shoulder-Drive-Shoulder)	Drive Surface	Turn around Required
Less than 200'	20'	12'	Hard Surface	No
More than 200'	20'	2'-12'-2'	Hard Surface	Yes
More than 200'	20'	2'-12'-2'	Hard Surface	Yes

Table 7.6-3

ACCESS GRADES FROM 0 TO 12% FOR TWO TO FOUR SINGLE-FAMILY RESIDENCES				
Drive Length	Minimum Easement Width	Drive Width (Shoulder-Drive-Shoulder)	Drive Surface	Turn around Required
Less than 200'	20'	2'-16'-2'	All Weather	No
More than 200'	20'	2'-16'-2'	All Weather	Yes
More than 200'	20'	2'-16'-2'	Hard Surface	Yes

Table 7.6-4

ACCESS GRADES FROM 12.1% TO 15% FOR TWO TO FOUR SINGLE-FAMILY RESIDENCES				
Drive Length	Minimum Easement Width	Drive Width (Shoulder-Drive-Shoulder)	Drive Surface	Turn around Required
Less than 200'	20'	2'-16'-2'	Hard Surface	No
More than 200'	20'	2'-16'-2'	Hard Surface	Yes
More than 200'	20'	2'-16'-2'	Hard Surface	Yes

Table 7.6-5

ACCESS GRADES FOR MORE THAN 15.1% FOR TWO TO FOUR SINGLE-FAMILY RESIDENCES				
Drive Length	Minimum Easement Width	Drive Width (Shoulder-Drive-Shoulder)	Drive Surface	Turn around Required
Less than 200'	20'	2'-16'-2'	Hard Surface	No
More than 200'	20'	2'-16'-2'	Hard Surface	Yes
More than 200'	20'	2'-16'-2'	Hard Surface	Yes

Table 7.6-6



ACCESS GRADES FROM 0 TO 12% FOR FIVE OR MORE SINGLE-FAMILY RESIDENCES				
Drive Length	Minimum Easement Width	Drive Width (Shoulder-Drive-Shoulder)	Drive Surface	Turn around Required
Less than 200'	20'	2'-16'-2'	Hard Surface	No
More than 200'	20'	2'-16'-2'	Hard Surface	Yes
More than 200'	20'	2'-16'-2'	Hard Surface	Yes

Table 7.6-7

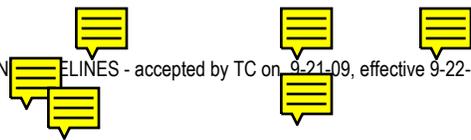
ACCESS GRADES FROM 12.1% TO 15% FOR FIVE OR MORE SINGLE-FAMILY RESIDENCES				
Drive Length	Minimum Easement Width	Drive Width (Shoulder-Drive-Shoulder)	Drive Surface	Turn around Required
Less than 200'	20'	2'-16'-2'	Hard Surface	No
More than 200'	20'	2'-16'-2'	Hard Surface	Yes
More than 200'	20'	2'-16'-2'	Hard Surface	Yes

Table 7.6-8

ACCESS GRADES FOR MORE THAN 15.1% FOR FIVE OR MORE SINGLE-FAMILY RESIDENCES				
Drive Length	Minimum Easement Width	Drive Width	Drive Surface	Turn around Required
Less than 200'	20'	20'	Hard Surface	No
More than 200'	20'	20'	Hard Surface	Yes
More than 200'	20'	20'	Hard Surface	Yes

Table 7.6-9

***Note:** Driveway width requirements may be increased at the discretion of the Emergency Services Provider and/or Town Engineer on a case-by-case basis depending upon the specific topography of the site.





**7.7 PRIVATE ACCESS ROADS & DRIVEWAY REVIEWS AND APPROVALS:
 TOWN OF CAVE CREEK**

Department	Action	Required
Planning	Zoning Clearance Approval	Yes
Engineering	Grading & Drainage Plan Review Approval	Yes
Building/Safety	Building Permit	No

Table 7.7-1

ADDITIONAL REVIEW ORGANIZATIONS

(Required Prior to Submittal of Plans to the Town of Cave Creek)

Organization	Division	Action	Required
Maricopa County	Department of Environmental Quality	Dust Control Permit	Possible
Maricopa County	Flood Control District of Maricopa County	Plan Review	Yes
Emergency Services Provider	Rural Metro Fire Department	Plan Review and Approval	Yes

Table 7.7-2



SECTION 8 - RIGHT-OF-WAY MANAGEMENT

8.1 PRINCIPLES OF ACCESS MANAGEMENT:

Constantly growing traffic congestion, concerns over traffic safety, and the ever increasing cost of upgrading roads have generated interest in managing the access to not only the roadway system, but to surface streets as well. Access management is the process that provides access to land development while simultaneously preserving the flow of traffic on the surrounding road system in terms of safety, capacity, and speed. Access management attempts to balance the need to provide good mobility for through traffic with the requirements for reasonable access to adjacent land uses.

8.2 GENERAL PERMIT REQUIREMENTS:

8.2.1 The Town of Cave Creek (TOCC) requires a Right-of-Way (ROW) Use Permit for all work done within the Town's rights-of-way.

8.2.2 Permits are necessary to assure that all work done in the rights-of-way (ROW) is:

1. Completed in the proper location with adequate spacing.
2. Built with acceptable materials and in accordance with current specifications.
3. Installed in a safe and expeditious manner.
4. Final completion is assured and acceptable.
5. All infrastructure is protected.
6. Unnecessary traffic delays or congestion to the traveling public is limited.
7. All landscaping is restored.
8. Liability issues are properly addressed.

8.3 CODES, ORDINANCES & REGULATIONS:

The TOCC administers all planning, permitting and construction processes in accordance with the following documents:

- The TOCC General Plan – Environmental Element – found @ www.cavecreek.org.
- The TOCC Town Code.
- The TOCC Zoning Ordinance & Subdivision Ordinance – found @ www.cavecreek.org.
- Maricopa Association of Governments (MAG) Uniform Standard Specifications www.mag.maricopa.gov/
- The TOCC Technical Design Guideline No. 1 – Grading & Drainage.
- The TOCC Technical Design Guideline No. 2 – Transportation.
- The TOCC Technical Design Guideline No. 3. – Utilities.
- The TOCC Technical Design Guideline No. 4 – Landscaping.



- The TOCC Technical Design Guideline No. 5 – Trails.
- TOCC Town Council approved Conditions of Approval for a specific project.
- The TOCC approved grading and drainage plan for a specific project.

8.4 COMPLIANCE:

8.4.1 Engineered Construction Drawings (Plans):

Engineered construction drawings (plans) shall be submitted for review so as to ensure that the following objectives are addressed:

- Assure the optimal utilization of the space available in the public ROW and public utility easements;
- Assure compliance with all TOCC ordinances, policies and standards.
- Assure coordination with other ROW users, agencies and TOCC project activities.
- Reduce the risk and/or inconvenience to the traveling public.
- After the application is submitted, the TOCC may add special conditions or stipulations to the permit, which are important for the applicant to review for compliance.

8.4.2 Compliance:

Right-of-Way Use Permits are reviewed in scope by the TOCC and these permits do not relieve a permittee from any of the stated standards in the Permit Requirement section above and/or any federal, state, town or industry accepted practice. It is the permittee's responsibility to insure compliance with all of the above stated requirements. Plans that have been reviewed by the TOCC do not relieve a permittee of this requirement unless the deviation from these standards is clearly specified on the plans and permit and the permittee has received; beyond the standard TOCC permit approval, an additional, written approval from the TOCC. This additional approval does not waive any other stated requirements on the plans or stipulations to the plans.

8.5 ADDITIONAL RIGHT-OF-WAY USE REQUIREMENTS:

8.5.1 Telecommunications Facilities:

All telecommunications providers who desire to construct, install, operate or maintain telecommunications facilities within the public rights-of-way shall first obtain a Right-of-Way Use Permit from the TOCC, except in cases where state law forbids establishment of a permit/license requirement. Right-of-Way Use Permit information is available by calling the TOCC Engineering Department.

8.5.2 Wireless Communications:

All providers for wireless communications infrastructure must file a pre-application with the TOCC Planning Department so as to determine the approval process prior to obtaining a ROW Use Permit. Information on scheduling a Pre-Application Conference is available by calling the TOCC Planning Department.



8.5.3 All Other Above ground Improvements:

Installation of any above ground improvements requires a pre-application, filed with the TOCC Planning Department so as to determine the approval process prior to obtaining a ROW Use Permit. Information on scheduling a Pre-Application Conference is available by calling the TOCC Planning Department .

8.6 RIGHT-OF-WAY USE PERMITS:

ROW Use Permit applications for public and private utility work located within the public ROW shall be submitted to the TOCC Engineering Department office at 37622 N. Cave Creek Road.

Include with the application a minimum of 3 sets of construction drawings, details, notes, traffic control plan, barricade plan, project schedule, insurance certificates, plating plan, a communication plan and any other necessary information. In reference to projects proposed on TOCC Arterial Roads, it is strongly encouraged that a provider submits project plans and the Traffic Control Plan as far in advance of the project as is reasonably possible, prior to application for an ROW Use Permit. However, the plans, Traffic Control Plan and a permit application may be submitted simultaneously.

Upon receiving the application and appropriate drawings, details and notes, etc., TOCC staff will log the request into the TOCC's permit system and route the documents for internal review. This review includes, but is not limited to:

- Checking for compliance with construction standards.
- Approving alignments.
- Verifying that the work is in the public rights-of-way or public utility easement.
- Determining if other work is occurring at the same time or at the same site.
- Verifying that all joint trench opportunities have been incorporated into the design.
- Checking for conflicts.
- Reviewing traffic impacts.
- Reviewing the barricade plan and verifying that all TOCC requirements have been met and incorporated into the plans.

Upon completion of the review, the ROW Use Permit application will be either issued to the applicant or returned for further modifications. Permits are issued a specified timeframe based on the estimated length of the project construction. If additions or corrections are required to the plans or permit application, the applicant will be notified and asked to make corrections and resubmit to the TOCC.



8.7 PERMIT TYPES:

8.7.1 General ROW Use Permit:

A permit is required for all encroachment in, on, above, over, under or through the TOCC's rights-of-way, including all public utility easements. The Right-of-Way Use Permit application forms are available at the TOCC Town Hall. The completed General ROW Permit Application shall be submitted to the TOCC Engineering Department.

8.7.2 Public and Private Utility Permit:

A permit is required for all utility work, public and private, that occurs within the TOCC's ROW or within public utility easements. A Utility Company ROW Use Permit Application is available at the TOCC Town Hall. The Public and Private Utility ROW Use Permit Application must be submitted to the TOCC' Engineering Department.

8.7.3 Emergency ROW Use Permit:

For emergency repairs involving loss of service, call the TOCC's Engineering Department to state the type of emergency, the location, the number of lanes closed, a contact name, estimated time to complete the repairs and a cell phone number. The appropriate construction project signage needs to be posted by the permittee as outlined within this Section. In addition, fax the barricade plan to the Engineering Department within 24 hours.

NOTE: The installation of new service is not an emergency.

8.7.4 Annual Maintenance ROW Use Permit:

A permittee who owns an improvement located within the TOCC's ROW or subcontractor may apply for an annual maintenance ROW Use Permit at the TOCC Town Hall. The annual maintenance ROW Use Permit shall be renewed every year; permitted activities include entering manholes, cabinets or other above/below ground improvements, but do not include any pavement or concrete cutting. The maintenance encroachment permit number must be shown on the associated insurance certificate.

8.8 PERMIT FEES:

Fees for all permits will be charged per TOCC policy. Permittees must also demonstrate proof of insurance as required within this Section. Permit fees and other construction costs are collected in accordance with the TOCC's adopted Engineering Fee Schedule (except as superseded by a franchise or license agreement) when each permit is issued. On joint trench projects, the surcharge fee will be apportioned to the participating utilities. Contact the TOCC Engineering Department for additional information on associated Engineering Permit fees; you may also visit the TOCC web-site @ www.cavecreek.org. for Engineering Permit fee information.



8.9 PERMIT DURATION:

The ROW Use Permit application needs to identify the anticipated length of construction (start and stop dates) in calendar days. The TOCC may require additional construction scheduling information on a case-by-case basis. The actual construction start date is subject to town approval. The ROW Use Permit is activated by calling TOCC Engineering Department a minimum of 72 hours prior to the start of construction and obtaining TOCC approval of a barricade plan (if required) prior to commencing work.

In the event a permittee has not begun construction within the approved timeframe, the associated project may be subject to additional planning and coordination efforts. If the permittee does not expeditiously complete construction in the approved timeframe, enforcement action may be taken by the TOCC. Failure to expeditiously complete the project within the permitted timeframe may result in denial of future permits until the project is completed to the TOCC's satisfaction.

8.10 INSURANCE REQUIREMENTS:

Before the TOCC will issue any ROW Use Permits, the contractor must provide a Certificate of Insurance with agreed to limits of liability and which lists the TOCC as additionally insured.

8.10.1 Permittee Liability:

The permittee is responsible for all liability imposed by law for damages arising out of or related to work performance or failure by the permittee, permittee's agents, contractors and all tiers of subcontractors under the permit. If any liability claim is made against the TOCC, its officers or employees, the permittee will defend, indemnify, and hold the TOCC harmless from any such claim.

8.10.2 Insurance Limits

No applicant is entitled to an ROW Use Permit unless a current Certificate of Insurance has been filed and maintained with the TOCC, certifying that the permittee carries public liability and property damage insurance issued by an insurance carrier authorized to do business within the State of Arizona. This insures the applicant and the TOCC and its agents against loss by reason of injuries to or death of persons or damages to property arising out of or related to work performed by the applicant, its agents or employees while performing any work under the ROW Use Permit. Such insurance is primary and provides coverage for liability assumed by the applicant under this section and needs to be provided by the permittee in the following minimum amounts:

- General Liability Insurance - \$1,000,000 each occurrence, \$2,000,000 Products and Completed Operations Aggregate and \$2,000,000 General Aggregate.
- Vehicle Liability Insurance - \$1,000,000 Combined Single Limit.
- Worker's Compensation Insurance - As required by Arizona law.
- The TOCC may set higher or lower limits of liability insurance depending on risk exposures.



8.10.3 Effective Timeframe of Insurance

Failure by the applicant to provide the TOCC with the required insurance certificate and failure by the TOCC to demand the filing by permittee of such a certificate before such a permit is issued, does not waive the permittee's obligation to provide the insurance.

The required insurance certificate must remain in effect and be kept on file with the TOCC until all work to be performed by the permittee (under the permit) has been completed. Where an encroachment involves a permanent obstruction, the required insurance certificate requirements remain in effect until the construction is removed.

The insurance certificate provides that coverage cannot expire or be canceled without providing the TOCC with a 10-day written notice of such action.

8.11 TRAFFIC CONTROL PLANS:

The purpose of a Traffic Control Plan is to proactively plan for, coordinate and minimize the impacts of encroachment and construction within the public ROW. The Traffic Control Plan is designed to help the TOCC understand what traffic impacts will occur during a construction project. The Traffic Control Plan is intended to identify the phasing of large projects, including lane restrictions, closures, plating or any restriction that could delay the traveling public.

A Traffic Control Plan needs to be submitted prior to (with plans) or accompanied by the permit application for all proposed work in or on Primary Roads. The Traffic Control Plan is subject to all TOCC review processes and will be reviewed and approved by the TOCC prior to permit issuance. Additional information and stipulations may be required on a case-by-case basis. The required Traffic Control Plan is in addition to the submission of a Barricade Plan prior to the start of construction, see Section.

The Traffic Control Plan will:

- Provide the estimated start date, preferably within 15 days of actual construction.
- Provide the duration of construction.
- Provide hours that traffic restrictions will be in place (24 hour, off-peak mid-day and off-peak night, etc.).
- Identify the length of the project and location details, including lane closures and type of work.
- Describe any construction phasing that will occur during the project, specifically how the barricading configuration will change during the duration of the project and how it will be accomplished in the project schedule.
- Provide a map of the affected area of construction, showing existing lane striping, proposed work zone, existing speed limit and detail all driveway, alleys, transit facilities, median breaks or other locations where traffic may enter/exit or be in conflict with the project work zone.
- Provide all above information on no less than 11 x 17-inch paper.



All Utility and Telecommunications Construction Plans must comply with this Technical Design Guideline. Additional plan details may be required on a case-by-case basis.

8.12 WORK HOURS IN THE RIGHTS OF WAY:

Generally, no interference with traffic flow on primary roads is permitted during the hours of 7 to 9 a.m. or from 4 to 6 p.m. unless prior authorization is obtained in writing by the TOCC Town Engineer or designee. Specific work hours may be stipulated by the TOCC on the project's Barricade Plan. Night work must have prior authorization from the TOCC and may be required by the Town Engineer or designee. In addition, certain areas of the TOCC may have seasonal or special event restrictions for construction work, as designated by the TOCC on a case-by-case basis. Contact the TOCC Engineering Department for updated seasonal or special event restrictions.

8.13 JOINT TRENCHING POLICY:

Work in the rights-of-way has significantly increased over the past several years causing disruption to the traveling public, continual pavement cuts often in the same location and conflict with other facilities within the rights-of-way. For these reasons, the TOCC has increased its management of work in the rights-of-way, enacting a joint trench process for projects being done on Primary Roads. This policy is designed to:

- Minimize the public's inconvenience with minimal lane closures.
- Decrease multiple pavement cuts that detract from the life of the street.
- Allow for proper space allocation within a limited rights-of-way area.
- Aesthetically address multiple users' needs with properly placed facilities, manholes and cabinets, etc.

8.13.1 Criteria:

The TOCC requires a permittee to joint trench a project if the project is located on a primary road and the trench is 1,000 feet or longer. Joint trenching may also be required by the TOCC on a case-by-case basis when a permittee's trench is 1,000 feet or less or on a secondary road. The requirement for joint trenching on a primary or secondary road is defined to include the entire ROW, not just curb-to-curb.

All requests for an exception to the joint trench requirement for any project must be submitted in writing to the TOCC and will be reviewed and approved by TOCC staff on a case-by-case basis.

8.13.2 Procedure:

The following procedure shall be followed when trenching within the TOCC ROW:

- Preliminary planning and design should be done by the permittee in accordance with the Arizona Utility Coordinating Committee's Joint Trench Use Model.
- See www.ci.phoenix.as.us/AGENCY/PHXEASD/cpage.html for the joint trench use model and notification form.



- The permittee must contact potential joint trench participants, as listed on file with the TOCC. Call the TOCC Engineering Department to obtain a current participant list.
- The permittee as the lead provider, must send a notice to each potential participant, either by fax, email or U.S. mail, of the joint trench opportunity, and provide proof of notice to the TOCC.
- The permittee must also post a joint trench opportunity notice on the TOCC web site. See www.ci.phoenix.az.us/AGENCY/PHXEASD/cpage.html for the AUCC Joint Trench Notification Form.
- If participation is requested by another provider, then the permittee must give a minimum 2 weeks timeframe for interested companies to supply the permittee with their needs so they can be included in the permittee's working drawing.
- As part of the project plan set, the permittee must provide a trench cross-section and a plan that depicts the details of the proposed work, including the trench, manholes, driveways, utility cabinets/facilities locations and other appurtenances. The plan must show that all location conflicts have been resolved.
- The permittee then submits 3 copies of the plan set, along with a permit application and a Traffic Control Plan to the TOCC Engineering Department for staff review and approval.

Upon TOCC approval of the plan, the permittee obtains the required permits and schedules an on-site pre-construction meeting with the TOCC Town Engineer or designee to review the proposed work, timing of work and any approved barricade plans prior to commencing any work. This is critical to ensure the positive progress of work being done in ROW.

8.13.3 Participants:

Participants in the joint trenching include public utility and telecommunication providers (both current and future licensees).

8.13.4 Failure to Participate:

Permits involving asphalt cuts and joint trench locations will only be issued once during a 2-4 year timeframe in any given location. Providers need to plan accordingly. Under extreme circumstances, the TOCC may, at its sole discretion, waive the stated timeframe requirements. A franchise agreement or license is required to use the rights-of-way. Companies not possessing a license must do so by contacting the TOCC Engineering Department.

8.14 POTHOLING (VACUUM EXCAVATION):

A TOCC Right-of-Way Use Permit is required for all utility location work. All potholing shall be done in accordance with the MAG Uniform Standard Specifications.

8.15 STREET BORING REQUIREMENTS:

All utilities or other facilities crossing existing TOCC streets, regardless of the age of the street, must be bored or punched unless permission to open cut has been given in writing by the TOCC Town Engineer or designee. The burden of proof will lie with the permittee to show that boring is not a feasible requirement. The permittee must specify the boring method on the construction plans, such as "directional boring." This requirement is used to assess appropriate boring methods. Certain types



of boring, such as use of water jets are not allowed. The permittee shall also indicate on the construction plans the anticipated impact on and restoration of existing facilities. The proposed method is approved by the TOCC on a case-by-case basis during plan review. If field conditions are such that boring has been demonstrated to TOCC Town Engineer or designee to be infeasible, then the permittee may be permitted to open cut.

8.16 UNDERGROUNDING REQUIREMENTS:

All new public utility, cable TV, telecommunications fiber optic, cellular, dark fiber or similar facilities must be installed underground. If new facilities are proposed in an area that has existing overhead lines, the new facilities will be required to go underground and any permittees with existing overhead facilities may participate in reinstalling these facilities underground when a joint trench opportunity is provided. When major upgrades are planned, utility and telecommunications providers may underground existing facilities currently on existing poles.

Installation of new facilities or major enhancements to existing facilities need to be installed underground unless it can be demonstrated that the public's general health, safety and welfare are affected by the underground installation or that the provider lacks the ability to install the facilities underground. The fact that an underground installation is more costly than an overhead installation is not, in and of itself, relevant in the consideration of a health or safety issue.

All above ground appurtenances need to be designed and installed with attention to minimizing the number of appurtenances, maximizing joint locations, combining with existing boxes and sharing facilities. All locations will meet industry standards for sight distance locations, all industry safety requirements and the aesthetic requirements of the TOCC. The issuance of a permit in violation of any of the requirements will not void the permittee's responsibility, unless the substandard installation is clearly noticed and approved in writing separately from the normal permit requirement.

8.17 BARRICADE PLAN:

Barricade Plans must be submitted to the TOCC Engineering Department a minimum of 72 hours (3 work days) prior to any proposed partial or complete street or alley closure by faxing the barricade plans to TOCC Engineering Department.

1. The TOCC Engineering Department will review all barricade plans prior to barricade plan approval and commencement of work by the permittee. Work cannot be initiated on the portion of the project requiring street barricading until approval has been obtained in writing from the TOCC Town Engineer or designee.
2. Work in/on residential streets typically does not need a separate Barricade Plan, but all signs, barricades and other necessary traffic control devices need to be located in accordance with the City of Phoenix Barricade Manual located @ <http://phoenix.gov/streets/07barman.pdf>, and the Manual on Uniform Traffic Control Devices (MUTCD), www.mutcd.fhwa.dot.gov/.



3. Design and implementation of the Barricade Plan needs to be performed by a well-trained and knowledgeable individual assigned the responsibility for traffic control devices at worksites. This individual must be American Traffic Safety Services Association (ATSSA) certified.
4. The Barricade Plan must include the identification and location of all barricades and signs, the hours of operation for the project, the construction duration and schedule, location of Variable Message Signs, detour plans, relocated traffic control signs and the project identification signs.
5. Construction project signage will be posted by the permittee as outlined in Section 8.18 of this Technical Design Guideline.
6. A copy of the approved Barricade Plan will be available at the jobsite at all times for the duration of the project.
7. Except during emergencies, pedestrian service/safety needs to be fully preserved at crosswalks (marked/ unmarked) and other facilities used by pedestrians. The six fundamental principles for successfully accommodating pedestrians through work zones are:
 - a. Traffic and pedestrian safety must be an integral and high-priority element in every project, from planning through design and construction.
 - b. Pedestrian and traffic movements should be inhibited as little as practical and planned to reduce exposure to potential hazards.
 - c. Pedestrians and motorists should be guided in a clear and positive manner while approaching, traversing and leaving work sites.
 - d. Routine inspection of traffic control devices must be performed.
 - e. Personnel must be adequately trained in the proper management of pedestrian and traffic control, so they are qualified to make work zone safety decisions in the selection, placement and maintenance of traffic control devices.
 - f. Pedestrian paths through the work zones should replicate as nearly as possible the elements of the existing path and comply with related ADA requirements.

8.18 CONSTRUCTION SIGNS:

The permittee is required to post information signs at the work site identifying the name of the utility authorizing the work. The purpose of the sign is to identify the permittee authorizing the work and the contractor performing the work. This signage is still required even when marked company vehicles are present at the work site. Required sign information also includes a phone number where a person can call and receive information about the job and leave a message. The permittee must respond to all phone messages within 24 hours. In addition, all permittees must return regular traffic control signs back to their original place and replace any signs damaged during construction. General signage requirements are listed below:



8.18.1 Specific project signage may be required by the city on a case-by-case basis.

8.18.2 Primary Roads:

Projects on Primary Roads that are either greater than 1 mile in length or have a construction timeframe of 30 calendar days or longer, must utilize the following signage:

1. Variable Message Board (VMB) sign at each end of the project indicating:
 - a. Location of construction, including cross streets names.
 - b. Direction of travel restricted.
 - c. Dates and duration.
 - d. Alternate route suggested.
2. Stationary Signs at each end of the project indicating:
 - a. Names of authorizing company and permittee.
 - b. Phone number for job information and as means to get a response to phone calls/ message.
 - c. Estimated start and completion dates for project.
 - d. Project description.
 - e. Conform to the following format:
 - At least 4 foot x 4 foot size sign, with a minimum of 4 inch to 6 inch letters (black legends/orange background) for roads posted up to 40 mph.
 - At least 6 foot x 6 foot size sign, with minimum 6 inch to 8 inch letters (black legends/orange background) for roads posted over 40 mph.
 - Type style is to be block, sans serif, medium width stroke, no more than 50 percent condensed, and not extra bold, no italic lettering so as to allow for better readability (For example: Helvetica medium typestyle).
 - Sign should have an inset border with rounded corners.

8.18.3 Other Primary and All Secondary Roads:

All projects not meeting the criteria listed above must post stationary signs at each end of the project that indicate the following:

1. Names of authorizing company and permittee.
2. Phone number for job information and to leave a message.
3. Estimated start and completion dates for project.
4. Project description.



5. Conform to the following format:
 - a. At least 4 foot x 4 foot size sign, with a minimum of 4 inch to 6 inch letters (black legends/orange background) for roads posted up to 40 mph.
 - b. At least 6 foot x 6 foot size sign, with minimum 6 inch to 8 inch letters (black legends/orange background) for roads posted over 40 mph.
 - c. Type style is to be Block style, sans-serif, medium width stroke, no more than 50 percent condensed, and not extra bold, no italic lettering so as to allow for better readability (For example: Helvetica medium type style).
 - d. Sign should have an inset border with rounded corners.

8.19 COMMUNITY NOTIFICATION:

In addition to the above signage requirements, community notification will be required where there will be significant traffic, ingress/egress, construction or noise impacts on a particular area. Community notification may take different forms depending upon the particular permitted project or work. Some possible methods of notification could include: additional signage, door hangers, community newsletters, press releases and should try to include one method of auditory/electronic delivery such as community meetings, phone message lines and web site information. The TOCC reserves the sole right to determine the appropriate community notification requirements for all permitted projects on a case-by-case basis.

8.20 INSPECTIONS:

All above ground and underground facilities and equipment placed in the ROW, and all construction work done in the ROW is subject to periodic and final inspection for compliance, with all permit requirements, as well as all applicable TOCC, state and federal laws. Permittee must notify the TOCC Engineering Department at least 72 hours prior to beginning permitted construction work in the ROW. Requests for TOCC inspections must be made 24 hours in advance of required inspections.

8.21 PAVEMENT CUTS:

No excavation is permitted in newly paved, resurfaced or sealed public streets for the following time frames:

- Construction or reconstruction of a structural section: 4 years.
- Surfacing, resurfacing or sealing of an existing structural section: 2 years.
- In the event of emergency, these periods may be waived by the TOCC.

8.22 STRIPING/MARKING REQUIREMENTS:

All striping and markings requirements, placement and removal must comply with:

- The Maricopa Association of Governments (MAG) Uniform Standard Specifications, www.mag.maricopa.gov/.
- The Manual on Uniform Traffic Control Devices (MUTCD), www.mutcd.fhwa.dot.gov/.



8.23 ABANDONED FACILITIES OR FACILITIES REMAINING AFTER EXPIRATION OF ROW USE PERMIT:

Permittee must provide for the disposition of its facilities within the ROW as outlined below. If at any time a permittee wishes to cease using and abandon facilities within the ROW, and if the permittee has not applied for and received an extension or renewal of the original ROW Use Permit from the TOCC before the current ROW Use Permit has expired.

8.23.1 Abandonment Request:

If a permittee desires to abandon its facilities within the ROW, they must submit an abandonment request to the TOCC Engineering Department. The abandonment request may designate one of three alternatives (as defined below). The TOCC then reviews and approves the request by issuing an abandonment plan. In issuing an abandonment plan, the TOCC considers and attempts to accommodate the permittee's preference; however, the TOCC retains the sole choice to designate one of the following three options:

1. Require the permittee to remove all structures, cable, equipment or facilities.
2. Permit the TOCC to accept ownership, in which case, the title to such structures, cable, equipment or other facilities vests in the TOCC.
3. Require the permittee to leave the facilities in place. If the facilities are abandoned in place, the permittee must record the facilities as "Abandoned in Place" and permanently maintain such records. Facilities that are Abandoned in Place will not need to be removed by the permittee. However, the permittee, by abandoning facilities in place, expressly permits the removal of such facilities by any future party at the sole discretion of the TOCC.

8.23.2 Removal of Facilities:

If the abandonment plan requires the removal of facilities from the ROW, and the permittee fails to remove its structures, cable, equipment or other facilities within 180 days of notification by the TOCC, then the TOCC will serve written notice of failure to comply. Furthermore, if the permittee fails to rectify the removal within 10 days from the date the notice was received, the TOCC may rectify the default as outlined below:

1. Upon removal of the structures, cable or other facilities, the TOCC may submit in writing the cost incurred. Upon the permittee's receipt of notice of such amount, it shall immediately become a lien against the permittee's company, and shall remain a lien in favor of the TOCC until the amount is paid in full, together with interest at the annual rate to be determined by the TOCC.
2. In the event no abandonment request is submitted to the TOCC, the TOCC has complete discretion to determine the disposition of all structures, cable, equipment or other facilities left within the ROW. Any costs and expenses incurred immediately becomes a lien against the permittee's company, and will remain a lien in favor of the TOCC until the amount is paid in full by the permittee, together with interest at the annual rate to be determined by the TOCC.
3. The right and remedy will not be exclusive, and the TOCC has all the rights and remedies available to it in accordance with the laws of the State of Arizona and the Town of Cave



Creek. The establishment of a lien does not preclude the TOCC from establishing additional liens upon subsequent failure or failures to remove any improvement.

Abandonment of any and all above ground facilities and appurtenances are also subject to all of the requirements stated above.

8.24 ALLEYS:

If construction or work is planned in an alley, prior to commencing work, the permittee needs to contact the TOCC Engineering Department. A Barricade Plan must be submitted to the TOCC Engineering Department at least 72 hours prior to commencing work for any work to be done in an alley.

8.25 AS-BUILTS:

The TOCC requires submittal of as-built plans for all facilities constructed or installed within public ROW or within easements that are owned by the TOCC. The permittee, who constructs facilities (not owned by the TOCC) in the public ROW or within the easement, is required to maintain the facility as-builts and provide them to the TOCC. The preferred as-built format is digital in either AUTOCAD or ArcView SHP format. The digital as-builts must conform to the Maricopa Association of Governments Computer Aided Drafting (CAD) standards and must reference the TOCC ROW Use Permit number. It is preferred that digital as-builts utilize the TOCC's base maps (streets, rights-of-way and parcels) as the foundation for the drawings.