GUIDELINES FOR SUBDIVISION STREETS

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Chapter Sixteen

SUBDIVISION STREETS

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Chapter Sixteen

SUBDIVISION STREETS

16-1.0 GENERAL

16-1.01 Purpose

Maximum livability, safe and efficient traffic movement, and economical construction and maintenance are consistent and compatible objectives for residential subdivision streets. Many deficiencies of subdivision design may be attributed to a singular approach and a lack of understanding of or consideration for the other intimately related facets of planning and design. To plan effectively and to realize optimum benefits, there is a need for close cooperation and exchange of data among governmental units at all levels, including school and park departments, and especially a strong need for reference to common objectives and standards.*

It is the intent of these guidelines to assist municipalities in the achievement of these objectives. Local governments should compare their existing subdivision ordinances with these guidelines and should consider adopting these guidelines in part or in whole. This would foster a certain amount of consistency from town to town for the design of the subdivision street system.

Although these guidelines are not inviolable, they do represent sound engineering practice and provide sufficient flexibility to allow for their application throughout the State. Before being adopted by a municipality, the town engineer should review these guidelines to assure that they are applicable to the municipality. Because the narrative provides much more information than can be shown in the tables, the tables should not be adopted without including the accompanying discussions.

16-1.02 Authority

These guidelines are in accordance with Section 13b-31a of the Connecticut General Statutes, which states: "The commissioner of transportation shall develop guidelines for the design and construction of roads and streets in residential subdivisions. Such guidelines shall be based upon considerations of safety, maintenance

*Excerpt from Recommended Guidelines for Subdivision Streets (1984) developed by the Institute of Transportation Engineers (ITE).

and cost effectiveness and shall be distributed to municipal and regional planning agencies throughout the state who may use such standards in the adoption of municipal subdivision regulations".

16-1.03 Background

In recognition of the varied regulations that exist throughout the State and the lack of information covering the specifics of subdivision street design in generally accepted references, the General Assembly directed the Commissioner of the Connecticut Department of Transportation (the Department) to establish criteria for residential subdivision streets.

The Department has incorporated information from a variety of sources to assure that state-of-the-art practices are employed in the development of subdivision designs. The recommendations of the American Association of State Highway and Transportation Officials (AASHTO) and the Institute of Transportation Engineers (ITE) form the basis for these guidelines; however, comments from various municipalities, regional planning agencies and trade associations have been considered and incorporated, where applicable.

16-1.04 Application

It should be noted that these guidelines are applicable to the suburban and rural areas of the state, and not necessarily to the larger urban areas, where land for subdivision development is generally not available. Urban residential streets are normally laid out in a grid pattern and are addressed in the 1984 AASHTO Green Book, A Policy on Geometric Design of Highways and Streets, Chapter V, "Local Roads". Tables 13E and 14-3.0G in the Highway Design Manual present the Department's criteria for local urban streets.

These recommended guidelines are specifically directed at conventional, single family, residential subdivisions. Condominiums and apartment complexes, trailer and mobile home parks, recreational developments and water oriented communities may not lend themselves to the guidelines contained herein and should be addressed on an individual basis.

Whenever a subdivision is proposed, the town's traffic circulation plan must be taken into account. For example, if a 20-lot subdivision is proposed then, in accordance with these guidelines, the required street width is 22 ft. However, if the town's plan of development indicates the street proposed by the developer will someday be a connector highway, then this subdivision street should be built to higher standards. In this example, this would make the street 32 ft or wider.

Section 16-3.0 establishes the individual design elements of the street and pedestrian systems; Section 16-4.0 cites elements of intersection design.

16-2.0 STREET CLASSIFICATION

Within the residential subdivision, streets are generally classified under one of three headings -- light residential street, residential street or residential collector street. The subdivision as a whole then feeds its traffic to Collector streets as defined in the AASHTO Green Book, Chapter VI and Section 6-1.0 of this manual. Residential subdivision streets are classified as follows:

16-2.01 Light Residential Streets

These streets are relatively short and service less than 50 homes. They make up the basic element of the subdivision. In many cases, they will dead end with one of a variety of turnaround treatments. Traffic volumes are low with a maximum of approximately 500 vehicles per day (vpd), of which 1% to 2% are heavy commercial vehicles.

16-2.02 Residential Streets

These streets generally have more activity than the Light Residential Street and service more homes (approximately 50 to 150), including those on connecting Light Residential Streets. Volumes range from 500 to 1500 vpd, with 1% to 2% heavy commercial vehicles.

16-2.03 Residential Collector Streets

The purpose of this street classification is to receive all of the traffic from within the subdivision and convey it to the major street system (collector street). Residential Collector Streets are the most direct within the subdivision, serving from 150 to 300 homes or more. Volumes range from 1500 to at least 3000 vpd, with 1% to 2% heavy commercial traffic.

16-2.04 Expandable Subdivision Streets

The expandable street is not an actual classification of street but a situation which arises often as subdivisions are developed throughout the State. If the probability exists that a dead-end street will be opened to future development, then it should be designed to accommodate the future traffic. For example, if a Light Residential Street has 20 homes but another 100 units are planned in 15 years, then the street falls under the Residential Street classification. The developer should also review the other streets in the subdivision to assure they can handle the future volumes.

16-3.0 ELEMENTS OF STREET DESIGN

The recommended design criteria for street and pedestrian systems in the subdivision are summarized in Table 16-3.0A. Each element has been assigned a reference number to key the discussion to the text of this section. This is intended to clarify the use of specific values and to guide the user in his/her individual interpretation and evaluation.

16-3.01 Number of Homes

In developing these numbers, only single family detached homes have been considered. If local zoning considerations dictate multiple dwellings, it will be necessary to modify these guidelines in accordance with good engineering practice. Subdivision roads having significantly more than 300 homes will require the special attention of the municipality. The AASHTO Green Book and this manual should be used to review these major generators.

16-3.02 Average Daily Traffic (vpd - Vehicles per Day)

These values were developed from the ITE publication "Trip Generation: An Informational Report" (1982). For the purpose of these guidelines, it is assumed that each home generates 10 trips per day. Peak hour traffic ranges from 8% (A.M.) to 10% (P.M.) of the total Average Daily Traffic (ADT).

16-3.03 Right-of-Way Width

The right-of-way width includes the area between adjacent property lines required to contain the following:

1. pavement (including on-street parking, where provided);
2. curbing and/or sidewalk, where required;
3. municipal and public utilities;
4. traffic signs, street light, mailboxes, etc.;
5. drainage structures;
6. area for snow storage;
7. clear zone for the safe recovery of a low speed errant vehicle; and
8. horizontal and intersection sight distance requirements.

The specified widths in Table 16-3.0A provide for the above, and possibly more. Where this is the case, it is recommended that full grading of the entire right-of-way width <u>not</u> be mandatory.

TABLE 16-3.0A

RESIDENTIAL SUBDIVISION STREETS
RECOMMENDED DESIGN GUIDELINES

Section	Design Element	Light Residential Street	Residential Street	Residential Collector Street
16-3.01	Number of homes	50	50 to 150	150 to 300
16-3.02	Avg. Daily Traffic(vpd)	500	500 to 1500	1500 to 3000
16-3.03	Right-of-Way Width (ft)	50	60	70
16-3.04	Pavement Width (ft) (1)	22	28	30
16-3.05	Parking	SEE	SECTION	16-3.05
16-3.06	Curb Type (2):			
	Without parking	N,M	M,V	V
	With parking	M,V	V	V
16-3.07	Sidewalk Width (ft)	Not Required	4 to 6	4 to 6
16-3.08	Sidewalk Offset from Curb (ft)	DNA	6	8
16-3.09	Design Speed (mph)	30	30	35
16-3.10	Stopping Sight Distance (ft):	200	200	250
16-3.11	Grade (%)			
	Desirable	4	4	4
	Maximum	10	10	10
16-3.12	Min. Curve Radius (ft)			
	Normal Crown	300	300	450
	Superelev (.04 ft/ft)	DNA	DNA	345
16-3.13	Min. Tangent (ft)	50	50	100
16-3.14	Cul-de-sacs			
	Max. Length	20 Homes	DNA	DNA
16-3.15	Min. Pavement Structure (in)			
	Bituminous Concrete	3	3	4
	Base Course	6	6	6
	Subbase	6	6	6
16-3.16	Driveways			
	Min. Width (ft)	10	10	10
	Radius (ft)	5	5	5
	Max. Grade (%)	SEE	SECTION	16-3.16
16-3.17	Drainage	SEE	SECTION	16-3.17
16-3.18	Utilities	SEE	SECTION	16-3.18
16-3.19	Street Lighting	SEE	SECTION	16-3.19

Notes:

(1) Add 6 ft to the pavement width if there is less than 2 parking spaces allowed per home.

(2) N = No Curb
M = Mountable Curb
V = Vertical Face Curb

16-3.04 Pavement Width

A minimum pavement width must allow for the safe passage of moving vehicles in each direction, exclusive of other interference, such as on-street parking. Parking of this type will occur occasionally within all residential subdivisions; however, the rate of occurrence will be a function of density, off-street parking availability and local ordinances (see Section 16-3.05).

Generally in subdivisions, lots with garages and/or sufficient driveway lengths are commonplace. In fact, many community regulations require adequate off-street parking facilities for residences and may restrict parking on the streets. The values in Table 16-3.0A reflect the occasional overflow parking and vehicle breakdowns. The 22-ft width for Light Residential Streets will not allow two opposing vehicles to pass a parked vehicle; however, short street lengths and low volumes make this rare occurrence tolerable. Assuming the average parked vehicle occupies 7 ft of actual street space, both the 28- and 30-ft widths for the higher street classifications will accommodate the occasionally parked vehicle without unnecessarily restricting traffic.

If the subdivision does not allow for at least two off-street parking spaces per home, then 6 ft should be added to the widths provided in the table. For Residential and Residential Collector Streets the added widths provide for the necessary width for vehicles parked on both sides of the street. The 28-ft width for Light Residential Streets assumes parking on one side of the street with an occasional vehicle parked opposite. If it is required to allow for parking on both sides, then a 34-ft minimum width should be used. This allows for two parked vehicles (14 ft) and two 10-ft lanes for through traffic.

As can be seen, the presence of on-street parking significantly affects pavement widths. Other factors affecting this width include housing density, street length, and alignment. Both density and street length have an effect on the probability of two opposing vehicles meeting adjacent to parked vehicles.

Terrain can affect the selection of a pavement width. In rolling and mountainous areas, consideration should be given to wider streets to account for the occasional parked vehicle or other hazard. This does not apply to high density developments where adequate width for clear passing is provided.

16-3.05 Parking

Section 16-3.04 discusses the pavement widths of subdivision streets as related to availability of off-street parking. In general, if two off-street parking spaces are being provided for each home, then the minimum width of roadway can be based on the table values. If only one space per unit is being provided, then 6 ft should be added to the pavement width. Local regulations, where they exist, may govern the above selection.

Studies have shown that curb parking is a primary factor in accidents on all types of streets. The number of children killed and injured each year as a result of entering the street from behind parked cars is tragic. For these reasons, every attempt should be made to require sufficient off-street parking to minimize curb parking.

16-3.06 Curb Type (N-No Curb, M-Mountable, V-Vertical Face)

The type and location of curbs appreciably affect driver behavior and, in turn, the safety and utility of a highway. Curbs often serve two or more of the following purposes: drainage control, pavement edge delineation, right-of-way reduction, esthetics, delineation of pedestrian walkways, reduction of maintenance operations, and assistance in orderly roadside development. Wherever sidewalks are present, curbing should be provided to offer some protection to pedestrians. In most cases for subdivisions, curbing offers more advantages than disadvantages and should be used for most projects. To be considered a curb, some raised aspect or vertical element is required.

Vertical curb includes most types of granite and concrete curbs. Although the initial expense of the curb may be high, its durability may be beneficial over the life of the roadway.

Bituminous Concrete Lip Curbing (BCLC) is the most common type of mountable curb. Its advantage is that it provides almost all the benefits of curbing but is still relatively inexpensive and easy to install. The main disadvantage of this type curbing is its lack of durability when compared to concrete or stone curb. Also, vehicle mounting is more prevalent where the mountable curb is used.

16-3.07 Sidewalk Width

In today's typical subdivision, sidewalks have the following functions:

1. providing a safer environment for children playing on their block;
2. protecting children walking to and from schools and neighborhood parks; and
3. providing an area for adults to walk to and from neighborhood shopping and transit stops.

Sidewalks should ordinarily be provided along streets used for pedestrian access to schools, parks, shopping areas, and transit stops. Paved sidewalks should also provide midblock access to these types of generators. Wider sidewalks may be considered next to higher density pedestrian generators, such as schools, transit stops, and churches.

In the very low-density subdivisions, walking distance to regular elementary schools is often excessive. In communities where all such travel is by way of school buses, there will be less need for sidewalk construction as a standard policy.

Section 7-118a of the Connecticut General Statutes requires that curb cuts, or handicap ramps shall be designed at "all pedestrian crosswalks to provide adequate and reasonable access for the safe and convenient movement of physically handicapped persons. Such cuts shall meet the following specifications: (1) The cut shall have a surface that is textured and nonslip; (2) the cut shall be at least 36 inches wide, but not more than 40 inches wide; and (3) the cut shall have a slope not greater than four degrees fifty minutes (12:1) and shall be leveled at the bottom".

16-3.08 Sidewalk Offset from Curb

Where a border area is provided between the curb face and the street edge of sidewalk, the following advantages are realized:

1. Children walking and playing have an increased safety buffer from street traffic.
2. Conflict between the pedestrians and garbage or trash cans awaiting pickup at the curb is eliminated by using the border area for such temporary storage.
3. The warped area necessary for a proper driveway ramp design is minimized by having a major portion of the ramp fall within the border area.

4. Danger of collision by run-off-the-road vehicles is minimized by placement of the walk at the maximum practical distance from the curb because the errant driver has more room to recover.

5. Conflict between pedestrians and snow storage is minimized or eliminated.

6. Pedestrians are less likely to be splashed by passing vehicles.

The offset values provided in Table 16-3.0A consider the above as well as the design speed of the facility. Where right-of-way restrictions dictate a sidewalk next to the curb, an additional sidewalk width of 1 to 2 ft is desirable to accommodate some of the above considerations.

16-3.09 Design Speed

The minimum design speed for a street within the subdivision should be 30 mph, although a lower limit may be posted. A lower design speed is not consistent with the actual operating speeds experienced in residential areas. Light Residential and Residential Streets need not be designed for higher speeds because these roads tend toward low vehicle speeds. This is because the streets usually have short lengths, on-street parked vehicles and driver concern for children and pets in the area. Residential Collector Streets require a 35 mph design speed to account for higher anticipated volumes and vehicle operating speeds.

16-3.10 Stopping Sight Distance

Sight distance is the length of roadway ahead that is visible to the driver. The minimum stopping sight distance (SSD) made available should be sufficiently long to enable a vehicle traveling at the design speed to stop before reaching a stationary object in its path. In determining the SSD for subdivision streets, the AASHTO criteria has been referenced. For a design speed of 30 mph, an SSD of 200 ft is required. At 35 mph, the SSD equals 225-250 ft.

The SSD will be measured from a height of eye of 3.5 ft to an object height of 6 inches. Special consideration should be given to streets which are expected to experience a high volume of on-street parking, because the parked vehicles will restrict the driver's horizontal line of sight.

16-3.11 Maximum Grade

Grades for subdivision streets should be as flat as possible as is consistent with the surrounding terrain. Although a grade of 4% is considered desirable, the need to match existing contours may be critical; therefore, a maximum grade of 10% is permissible under these conditions. A minimum grade of 0.5% is recommended for drainage purposes. Grades up to 12% may be considered on short sections of streets and in hilly terrain.

16-3.12 Minimum Curve Radius

The radii presented in Table 16-3.0A are measured from the inside curbline or edge of the street. For a normal crowned section an adverse cross slope of .015 ft/ft is assumed. Steeper cross slopes will require a greater radii to compensate for the higher friction factors. For roads with a normal crown section, a radius of 300 ft is adequate for a 30-mph design speed. At 35 mph, a radius of 450 ft is the recommended minimum. Superelevation may be considered for Residential Collector Streets if the above minimum cannot be achieved. A maximum rate of superelevation of .04 ft/ft is recommended. This will enable the use of 345-ft radius for this classification of street. Light Residential and Residential Streets should not be superelevated.

16-3.13 Minimum Tangent

Any abrupt reversal in horizontal alignment should be avoided. Such a change makes it difficult for a driver to keep within his/her own lane. In the case of the Residential Collector Road, it is also difficult to superelevate both curves adequately, and hazardous and erratic operation may result. A reversal in alignment can be safely accommodated if a tangent section is provided between the two curves. The values provided in Table 16-3.0A are the minimum tangent length recommended in subdivisions; however, longer tangents are desirable, where practical.

16-3.14 Cul-de-Sacs

Cul-de-sacs, or dead-end streets, should be designed for a maximum ADT of 200 vpd. This volume of traffic relates to a 20-home generation, assuming 10 trips per day per single unit dwelling. Depending on the size of the lot frontages, the maximum length of cul-de-sac will vary. For example, if the local zoning requires a minimum lot frontage of 100 ft, then the maximum cul-de-sac length would be 1000 ft, assuming homes are on both sides of the street. The recommended maximum length is generally between 700 and 1000 ft. However, local conditions may require a longer length to more efficiently use the space available. Due to the possibility that an emergency may occur and that the road may be blocked, the use of more than 20 homes on the cul-de-sac is not recommended.

As discussed in Section 16-3.04, expandable subdivisions deserve special consideration. If it is expected that a cul-de-sac will be extended for future development, then the street must be designed as a residential street, providing adequate width for future traffic. Expansion of existing cul-de-sacs should include the reconstruction of the street to accommodate the higher volumes of traffic.

The most common end treatment for a cul-de-sac is the circular turnaround. When used, it is desirable to provide for an outside turning radius of 45 ft to accommodate small fire apparatus, garbage trucks, snow plows, etc. A minimum of 30 ft is necessary for larger passenger cars. If parking is to be allowed within the circular section of pavement, then larger radii should be used. If radii are greater than 45 ft, the resulting expanse of pavement may be unsightly. In this case, the use of a center island may be considered, providing a 25-ft wide roadway is maintained around the island for maneuverability. On any dead-end street, it is not desirable to place a driveway lot entrance directly opposite the end of the street leading into the turnaround area. To provide for the right-of-way requirements, an extra 10 to 15 ft should be added to the radius.

Under certain conditions, a "hammerhead" or "Tee" type turnaround may be considered. These are most applicable where blocks are very short and the number of homes to be served is very small (5 homes). Furthermore, it is not desirable to place driveway entrances at the ends or caps of the turnaround.

16-3.15 Pavement Structure

A pavement structure is a layered system designed to distribute surface traffic loads to the subgrade. The performance of this structure is directly related to the physical properties and condition of the roadbed soils; therefore, the values given in Table 16-3.0A are provided only as a guide and are not meant to replace the recommendations of a competent soils engineer.

A flexible pavement structure consists of three layers -- the surface or wearing course, the base, and the subbase. The surface course is a mixture of aggregate and bituminous materials. In addition to its major function as the structured portion of the pavement, it should also be designed to resist the abrasive forces of traffic, to reduce the amount of surface water penetrating the pavement, to provide skid resistance and to provide a smooth, uniform riding surface. For the use of bituminous concrete, Classes I or II is recommended. The thickness should be 3 inches on light residential and residential streets and 4 inches on residential collector streets with their higher traffic volumes.

The base is directly below the surface course and performs its major function as a structural portion of the pavement. In general, 6 inches is the minimum depth of this course for all subdivision streets. Type of bases include Processed Aggregate Base or Bituminous Concrete - Class IV. Other premixed and stabilized mixtures are also available.

The subbase is placed directly on the roadbed under the other two courses. Its main functions, aside from structural support, are to prevent the intrusion of fine-graded roadbed soil into the base course, to minimize the damaging effects of frost action, to help in preventing the accumulation of free water within or below the pavement, and to provide a working platform for construction equipment. Because lower quality material may be used, the proper use of a subbase is often the most economical solution to construction of pavements over poor roadbed soils. The minimum recommended depth of subbase is 6 inches.

All pavement structure placements should reflect the requirements of the Department's Standard Specification for Roads, Bridges, and Incidental Construction.

16-3.16 Driveways

Driveways are deceptively simple in appearance and, therefore, do not always receive the design consideration that they merit. Common deficiencies include inadequate width, substandard curb radii, excessive grades and breakover angles which relate to car bottoming, and inadequate sight distance.

A minimum width of 10 ft is recommended for residential driveways. A maximum of 20 ft is desirable in order to maintain control of access by limiting one vehicle to enter or exit at a time. Driveways within these ranges will accommodate passenger cars and small trucks. Where additional maneuvering is required for, say, a two-car garage, driveways should be widened beyond the sidewalk and/or the street line.

Passenger cars describe inside and outside radii of 13 and 23 ft, respectively, for a normal turn into driveways. To accommodate this vehicle, a 5-ft radius should be provided on each side of the driveway entrance. For streets that are 30 ft or wider, this curb radius will allow the design vehicle to enter or exit the drive without encroaching over the centerline. Temporary encroachment will occur on streets less than 30-ft wide; however, this can be tolerated due to the low traffic volumes.

The grade of a driveway and the transition into that grade deserve some discussion. The maximum allowable grade for a residential driveway is 15%. However, when driveways are unpaved, the maximum grade should be 10% to guard against the erosion of unpaved driveways. Whether a driveway has a positive or negative grade, the entrance to the driveway should always slope up from the gutter 4 to 6 ft to prevent roadway surface drainage from entering the property. The grade of this ramp should be between 8 and 10%. In transitioning to the actual slope, it is important not to exceed a change in grade of 12% in 10 ft. Desirably, the use of an 8% change in 10 ft is encouraged to prevent car "bottoming" on a crest or to prevent "bumper drag" in sags.

To allow a driver to safely exit from a driveway, adequate sight distance needs to be provided at all driveways. The criteria from section 16-4.02 on intersection sight distance also applies to driveways. For most driveways the most common maneuver is to back out and change directions in the street. Wherever possible, greater sight distances should be provided to compensate for the extra time it takes to make this maneuver. Also when backing out, the driver will have a harder time to see around obstacles such as, trees, bushes, poles, fences, walls, etc. To compensate for these items, a greater set back distance should be provided, if practical.

16-3.17 Drainage

Drainage should be designed in accordance with the Connecticut Department of Transportation's Drainage Manual. Generally, the drainage of subdivisions should be designed so that no flooding or damage will occur from a storm having a 10-yr frequency of surface runoff. Special attention to low points along subdivision streets is suggested. Watercourse crossings require a minimum 25-yr design; however, where it is necessary to maintain traffic or prevent isolation, a design of 50 yrs is desirable.

16-3.18 Utilities

Utility lines, whether above or below ground, should be located so as to minimize the need for later adjustment and to permit servicing with minimum interference to street traffic. Longitudinal installations preferably should be placed underground in the grassy area between the curb and the sidewalk. Facilities under the pavement should be limited to lateral service connections. If it is anticipated that additional utilities will be required, sleeves should be placed under the full width of the pavement before placing the pavement.

Where longitudinal installations are to be located above ground, they should be placed as near as practical to the right-of-way line. If sidewalks are present, these facilities should be located at least 1 ft behind the outside edge of sidewalk. In extreme cases, poles may be located in the grassy area between the sidewalk and the curb but never closer than 2 ft from the face of the curb.

The developer should coordinate all utility related activities with the applicable agency, assuring that the specific needs of each are fully addressed.

16-3.19 Street Lighting

Modern street lighting should be required at every intersection and in areas of high pedestrian activity. Illumination design should be in accordance with the latest recommendations of the Illuminating Engineering Society, published from time to time as an American National Standard Practice. Because the effectiveness of illumination is a direct product of the distribution type selected, coupled with mounting height, bracket length and orientation, a competent illuminating engineer should review all proposed street lighting in subdivisions.

16-4.0 INTERSECTION DESIGN

Proper intersection design is critical to the safe and efficient movement of traffic through a subdivision. For this reason, discussion of this design consideration has been expanded in the following sections.

In general, some basic principles should be understood before designing an intersection:

1. Light residential and residential streets should be designed to minimize through traffic movements. Offset and T-type intersections discourage this through traffic, reduce average traffic speeds and minimize traffic volumes.

2. Street patterns should minimize excessive vehicular travel. Although strict application of this principle may conflict with other principles, excessive indirect travel is annoying to the area's liveability.

3. The number of intersections within a subdivision should be minimal. Consistent with other principles, the fewer intersections there are, the fewer accidents there will be. Notwithstanding, from the standpoint of potential hazard, the use of two T-type intersections is preferable to one 4-way intersection.

4. Intersections with abutting major collector streets should be kept to an absolute minimum and placed so as not to detract from the efficiency of the major street.

Table 16-4.0A provides recommended criteria for the design of intersections in residential subdivisions. As with Section 16-3.0, each element has been assigned a reference number to key discussion within the text of the following sections.

16-4.01 Design Speed

This element refers to the speed of a vehicle as it approaches an intersection. For any particular leg of the intersection, the approach speed is equal to the design speed of that leg. That is, if a residential street intersects a residential collector street, the approach speed along the residential collector is 35 mph and the approach speed of the residential street is 30 mph. Light residential streets will also be designed with a 30-mph design speed.

TABLE 16-4.0A

RESIDENTIAL SUBDIVISION STREETS
RECOMMENDED INTERSECTION DESIGN GUIDELINES

Section	Design Element	Light Residential Street	Residential Street	Residential Collector Street
16-4.00	ADT	500	500 to 1500	1500 to 3000
16-4.01	Design Speed (mph)	30	30	35
16-4.02	Minimum Intersection Sight Distance (ft)	200	200	285
16-4.03	Vertical Alignment (%)			
	Intersection	2	2	2
	Approaches	3	3	3
16-4.04	Minimum Angle of Intersection (deg)	60	60	60
16-4.05	Minimum Curb Radius (ft) when Intersecting with:			
	Light Residential	20	20	25
	Residential	20	20	25
	Residential Collector	25	25	25
	Collector	DNA	DNA	30
16-4.06	Minimum Centerline Offset (ft) where Through Street is:			
	Residential	125	150	DNA
	Residential Collector	150	150	200
	Collector	DNA	1300	1300
16-4.07	Minimum Approach Tangent (ft)	30	30	50

16-4.02 Intersection Sight Distance

Each intersection contains several potential vehicle conflicts. The possibility of these conflicts actually occurring can be greatly reduced through the provision of proper sight distance and appropriate traffic controls. The operator of a vehicle approaching an intersection should have an unobstructed view of the entire intersection and sufficient lengths of the intersecting streets to permit control of his/her vehicle to avoid collision.

There are four types of controls that apply to intersections, in general. They are no control, yield control, stop control on the minor street only, and stop control on all legs. The latter includes traffic signals. The selection of a specific type of control is directly related to the availability of adequate sight distance to approaching drivers as discussed in the following paragraphs.

Where an intersection is not controlled by stop signs or signals, the operator of a vehicle must be able to perceive a hazard in sufficient time to alter his/her speed or stop as necessary before reaching the intersection. (Intersections with yield control are similar to those with no control). To achieve the required sight distance, a sight triangle, void of obstructions, must be established at all corners of the intersection. The legs of this triangle require a minimum length equivalent to the stopping sight distance (SSD) for a particular approach, which is 200 ft for light residential and residential streets and 250 ft for residential collectors.

At a minimum, it is suggested that stop signs be placed on the minor leg(s) of an intersection. In this case, it is necessary to provide sufficient sight distance to the stopped driver for a safe entry into the intersection. This distance is provided in Table 16-4.0A, which is 200 ft along light residential and residential streets and 285 ft along residential collector streets. It should be assumed that the driver's eye will be located 10 ft from the normal shoulder line (curb line or edge of pavement) of the crossing street. The height of the driver's eye shall be assumed to be 3.5 ft and the height of object shall also be 3.5 ft.

Stop control on all legs of an intersection should be considered only in those situations where even the minimal sight triangle described in the previous paragraph cannot be achieved, because the indiscriminate use of stop signs fosters disrespect for these and other signs. The basic requirement for all controlled intersections is that approaching drivers must be able to see the control device soon enough to stop comfortably. For this purpose, stopping sight distance is adequate. The added height of the stop sign or signal will provide an added factor of comfort.

16-4.03 Vertical Alignment (%)

Intersection areas should be designed to be as flat as possible. In more difficult terrain where this becomes economically impractical, a maximum of 2% intersection grade is recommended. It is also important to provide a reasonably level "landing" area for vehicles on all approaches; therefore, approach grades within 50 ft of the intersection should not exceed 3%.

16-4.04 Angle of Intersection

Within subdivisions, most intersections will connect at or near a 90-degree angle, which is desirable. If, due to geographical or other considerations, a skewed angle is deemed necessary, then in no case should this angle be less than 60 degrees (or greater than 120 degrees). Greatly skewed intersections tend towards higher accident rates due to reduced visibility and less definition of the "normal" intersection.

16-4.05 Minimum Curb Radius

As curb radii are increased, paving costs and intersection crossing distances required for pedestrian crossings are increased. Also, higher turning speeds are encouraged. Substandard radii result in unnecessary lane encroachment, increased traffic conflict and related accident potential. Table 16-4.0A provides recommended curb radii for the various intersections encountered in subdivisions. In general, access to adjacent major highways should be designed with 30-ft curb radii to facilitate ease of entry from the highway. Once in the subdivision, 25-ft radii are adequate for intersections involving residential collector streets. Intersections consisting of light residential and/or residential streets only are best accommodated with 20-ft radii. These smaller radii may result in occasional lane encroachment, but this can be tolerated due to the low volumes experienced.

16-4.06 Minimum Intersection Offset

Basically, there are two kinds of intersections found in subdivisions -- the 3-way (T-type) intersection and the 4-way (cross type) intersection. Multi-leg intersections (over four) are undesirable from the control and safety standpoint.

Intersections involving high volume streets are best served by the cross type design with stop control on all legs. Where the volumes on the intersecting streets are low, however, the T-type intersection is a safer design, and its use is encouraged throughout the subdivision. One disadvantage to this type is "corner-cutting" when inadequate offset exists between adjacent intersections. To reduce this potential conflict, offsets between adjacent centerlines are provided in Table 16-4.0A. For example, where the through street is classified as a residential collector street, intersecting light residential and/or residential streets should be spaced at least 150 ft apart. If one of the adjacent intersecting streets is a residential collector, then an offset of 200 ft is required.

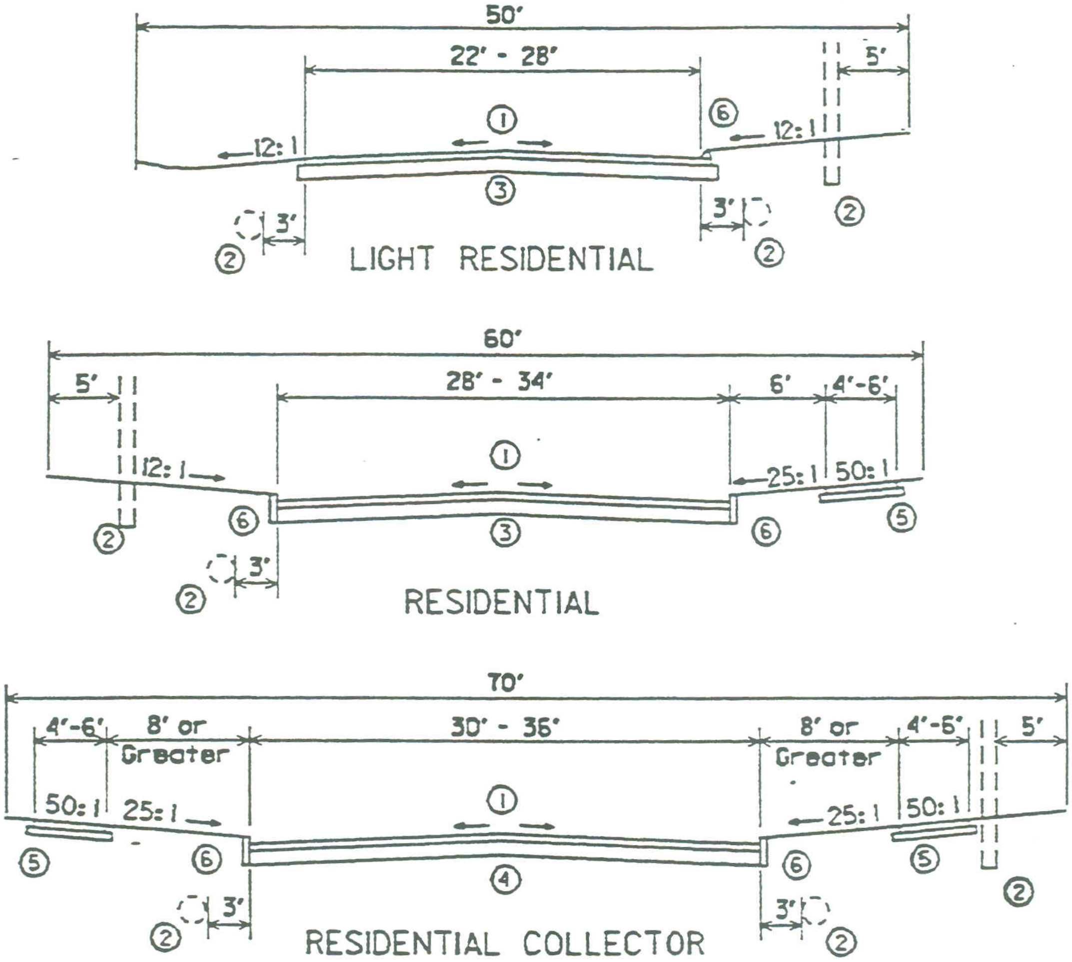
In addition to intersections within the subdivision, the table includes connections to major highways. Because the function of a collector is to provide greater mobility with less access to adjacent land, a distance of 1300 ft between intersecting streets is desirable. Distances less than 1300 ft may be considered, providing the major route is minimally impacted.

16-4.07 Minimum Approach Tangent

It is desirable to provide a tangent section of roadway on intersection approaches when the street leg has a minimal radius curve. The values in Table 16-4.0A will be applied to approaches using a radius of less than 500 ft. Curves with greater radii are flat enough not to require a minimum tangent length.

16-5.0 CROSS SECTION

Figure 16-5.0A provides a typical cross section for a subdivision street.



1 Pavement Cross Slope - .015 ft/ft

2 It is recommended that utilities be placed underground in the grass strip adjacent to the roadway at least 3' from the back of curb or the edge of pavement. Depth is to be determined by the utility company. Poles, if used, should be placed as far from the roadway as practicable and behind any sidewalks, if possible.

3 Min. Pavement Structure - 3" Bituminous Concrete on 6" Base on 6" Subbase

4 Min. Pavement Structure - 4" Bituminous Concrete on 6" Base on 6" Subbase

5 Concrete Sidewalk - 4" Concrete on 6" Gravel Base

6 See Section 16-3.06 for Curb type

Typical Cross Section
(Subdivision Street)
Fig. 16-5.0 A