INTRODUCTION[4-1]

One of the most important aspects of a community's urban structure is the efficient movement of people and goods. An essential tool cities can use to accomplish this goal is a comprehensive, carefully conceived thoroughfares plan which shows the existing roadway network as well as future thoroughfares that will be needed to ensure efficient movement of traffic within and through the community. The Thoroughfare and Transportation Plan designed and intended to provide an efficient, structured framework for the smooth flow of traffic throughout the area in and around the Village of Volente that will result from future growth and development. It also ensures that existing traffic movement can be accommodated by improving certain aspects of the system. The Thoroughfare and Transportation Plan is an overall guide that will enable individual developments and roadways within the Village to be coordinated into an integrated, unified transportation system. The Plan encourages the creation of neighborhoods with a minimal amount of through traffic, while providing adequate capacities for routes that are intended to move both regional and local traffic through the community. In addition, because of the relationship the Village has to various regional roadways, including FM 2769 and Lime Creek Road, people live in surrounding areas and travel into or through the Village of Volente to work, to conduct business, or to buy goods and services. While this relationship benefits the community in a number of ways, it also tends to have a tremendous impact upon the area's traffic circulation system.

The thoroughfare system is one of the most visible and permanent elements of the community structure. The alignments and rights-of-ways of the major transportation facilities are already established and most adjacent properties are subdivided, therefore it will be a continuing challenge for the Village of Volente to make significant changes to the thoroughfare system. It is important that the roadways in the Village are interconnected in order to provide local citizens with alternative routes, thereby allowing local people to bypass the major thoroughfares and ensuring that the majority of the traffic generated along the major thoroughfares is comprised of regional traffic. In addition, in making transportation decisions, consideration should be given to the preservation of scenic vistas, as well as to the fact that the Village of Volente desires to accommodate pedestrian traffic.

Particular attention should be given to preserving and enhancing the overall system's capacity and efficiency. In many ways, Volente's regional circulation system is already established and, primarily due to existing physical factors, will likely not be able to substantially change. A significant element to maintaining the integrity of the Village of Volente as a rural, Hill Country community will be the ability to work within the parameters set by these major roadways – to make them assets to the community, not barriers to the Village's growth and vitality.

It is essential that a comprehensive thoroughfare and transportation system be developed for the Village of Volente that is capable of accommodating the expanding vehicular traffic volumes which future local and regional growth will create, and also provide for alternative

4-1 From "Comprehensive Plan, Village of Bee Cave, Texas", August 2000, Prepared by Dunkin, Sefko & Associates, Inc.

routes between various areas within the Village in order to allow local people to bypass regional roadways.

The Thoroughfare and Transportation Plan also considers multi-modal transportation options, such as bicycles and pedestrians. It is the intention of the Thoroughfare and Transportation Plan to provide safe and enjoyable circulation for vehicles, bicyclist and pedestrians alike.

FUNCTIONS OF THOROUGHFARE AND TRANSPORTATION PLANNING

The Thoroughfare and Transportation Plan defines a hierarchy of roadway functions that provide for both traffic movement and property access. The Plan also provides a clear statement of future roadway alignments, capacities (i.e., number of lanes), and right-of-way requirements within the Village, it has been developed to support the Future Land Use Plan providing adequate capacity on the Village's roadways to move both people and goods.

The Thoroughfare and Transportation Plan is the basic element for ensuring the orderly implementation of roadways in conjunction with economic growth, and it facilitates the preservation of necessary rights-of-ways during the development review process. The Plan provides guidance for determining appropriate land uses by identifying the ultimate configuration of the thoroughfare network. It also serves as a guide for the programming of projects and allows for rational and systematic provision of roadway capacity. The Plan should reflect community goals, provide efficient, continuous traffic routes, complement expected land use patterns and characteristics, integrate with both the regional freeway/highway and arterial system, as well as the roadway systems of surrounding local jurisdictions, be sensitive to topographical and environmental features and constraints; and be adaptable to accommodate changing conditions and trends.

The Thoroughfare and Transportation Plan creates a comprehensive approach by which the various departments and agencies responsible for thoroughfare development can coordinate their individual efforts. Examples of these agencies include the Texas Department of Transportation (TxDOT), CAMPO, Travis County, and the Village of Volente itself. The standards and criteria contained within this element are intended to ensure consistent design practices in new roadway development or the redevelopment of certain roadways, as may be appropriate. This element was prepared by analyzing the existing system of thoroughfares and by proposing changes and recommendations for future thoroughfares based upon goals and objectives formulated during the comprehensive planning process.

The Regional and Local Traffic Circulation System

Two major thoroughfares provide nearly all of the access to and through the Village of Volente. FM 2769 serves as the major regional travel corridor through the area in an east-west direction, and Lime Creek Road provides access in a north-eastern direction. The Baseline Analysis element of the Comprehensive Plan discusses the existing major thoroughfares.

Lake Travis is one of the region's greatest treasures. It is one of the primary reasons that many people are attracted to the Volente area. While the lake is a tremendous asset, it is also a physical barrier to roadway construction. Because few, if any, possibilities are foreseen to cross the lake in north Travis County, FM 2769 and Lime Creek Road are important roadways that will continue to bear the brunt of growth. The confluence of roadway networks in the Village is similar in form to an hourglass – all regional access must flow through Volente. This condition exists because there are many environmental and physical constraints to roadway construction in the region. Consequently, traffic through Volente will certainly increase, not solely because of the growth in the Village, but because of regional growth. Therefore, the Village of Volente must resign itself to addressing regional traffic concerns while ensuring the least amount of negative impact on Volente residents. Taking all of these factors into account, the area has a sufficient number of major thoroughfares that provide transportation for regional traffic. The main challenges, therefore, are to ensure that the existing thoroughfares continue to provide adequate regional access through the Village of Volente, and to provide additional roadways in order to accommodate local traffic.

THE FUNCTIONAL CLASSIFICATION SYSTEM & THOROUGHFARE STANDARDS

To prevent functional obsolescence of the transportation facilities, the area's hierarchical system, which defines the role of each major thoroughfare, needs to be updated. This system, called a functional classification system, in turn translates into physical design features concerning thoroughfare cross-sections, pavement standards, pavement widths, and access management. The Thoroughfare and Transportation Plan element within this Comprehensive Plan is based upon this system. These functional classifications are intended to reflect the role or function of each roadway within the overall thoroughfare system (see Table 4.1).

This commonly used functional classification system consists of a hierarchy of streets that range from those which provide for traffic movement to those whose function is access to adjacent properties. The **mobility and movement function** of a thoroughfare refers to the accessibility of adjacent properties from a particular street or thoroughfares. Local streets provide the most access to the adjacent properties, but function very poorly in mobility. Principal arterials or major thoroughfares function very well mobility-wise but, because of speeds and volumes, they serve very poorly as access to adjacent roads and properties. With this in mind, streets that carry a higher volume of traffic should have a limited number of intersections and "curb cuts" (driveway openings) so traffic movement will not be impeded. This concept is referred to as the **property access function.** Collectors are intended to distribute traffic between the arterial system and individual land uses within the area. Arterial or major thoroughfares carry longer trips and should, therefore, form continuous links to carry traffic throughout areas. Collectors supplement the arterial system and should not be continuous for long distances.

Neighborhoods should be developed between arterials and major collector streets so that traffic is routed around, not through, these areas. In order to further the vision of a pedestrian-friendly community, the Village of Volente should ensure the incorporation of the trail system throughout the community (refer to the Parks and Open Space Plan). Minor collectors should penetrate the neighborhoods to collect and distribute traffic, but not provide convenient cut-through routes.

Land use planning efforts should attempt to encourage compatible land uses adjacent to streets. Commercial and retail activities should be developed in such a manner that the primary mobility function of arterial or major thoroughfares is not compromised due to poor access management.

TABLE 4.1
ROADWAY FUNCTIONAL CLASSIFICATIONS
AND GENERAL PLANNING GUIDELINES[4-1]

Classifications	Function	Continuity	Spacing (Miles)	Direct Land Access	Minimum Roadway Intersection Spacing	Speed Limit (MPH)	Parking	Comments
Freeway and Expressway	Traffic Movement	Continuous	4	None	1 mile	45 to 55	Prohibited	Supplements Capacity and arterial street system, and provides high-speed mobility
Arterial or Major Thoroughfare	Moderate distance inter-community traffic movement. Minor function-land access should primarily be at intersections.	Continuous	1/2 to 1 1/2 (1)	Restricted - some movement may be prohibited; number and spacing of driveways controlled.	1/8 mile 1/4 mile on regional route.	35 to 45	Prohibited	"Backbone" of the street system.
Collector	Primary - collect/distribute traffic between local streets and arterial systems. Secondary - land access. Tertiary - inter-neighborhood traffic movement.	Not necessarily continuous; may not extend across arterials	1/4 to 1/2 (2)	Safety controls; limited regulation. Residential access prohibited; commercial access allowed with shared driveways.	300 feet	30	Limited	Through traffic should be discouraged
Local	Land Access/Sidewalk	None	As needed	Safety controls only	300 feet	30	Permitted	Through traffic should be discouraged.

(1) Spacing determination should also include consideration of travel projections within the area or corridor based upon anticipated development.
(2) Denser spacing needed for commercial and high density residential districts.

Wherever concentrations of traffic occur on collector streets, consideration should be given to prohibit houses from fronting on these types of streets or thoroughfares. Good cluster subdivision design can allow ample lot yield while orienting houses to local streets and not to collectors.

The Village street system should consist of arterials (the major thoroughfares are already in place), collectors and local streets. Freeways and highways are generally under the jurisdiction of the Texas Department of Transportation (TxDOT). Application of a functional classification

system and design principles can help produce an optimized traffic circulation system. Major advantages include preservation of residential neighborhoods, long-term stability of land use patterns, increased values of nonresidential properties, fewer traffic accidents, and a decreased portion of urban land devoted to streets. Table 4.1 describes the most important characteristics of functional classifications. The arterial classification includes major arterials and major secondary thoroughfares. The collector classification system includes major and minor collector streets.

The following recommended cross-sections have been developed to reduce the chance of obsolescence of the area's thoroughfare system. The sections outline the various recommended standards of streets and thoroughfare cross-sections appropriate for the Village of Volente, as well as for the region.

Freeways and Highways

Freeways are high capacity highways in which direct access from adjacent properties is eliminated or significantly reduced, and where ingress and egress to the traffic lanes is controlled by widely spaced access ramps and interchanges. Freeways provide movement of high volumes of traffic at relatively high speeds. No freeways/highways are expected to be constructed within the Village of Volente in the near future, according to the CAMPO transportation plan.[4-2]

Arterial Streets

The primary urban traffic carrying system is made up of arterial streets. The primary function of arterial streets is to provide for continuity and high traffic volume movement between major activity centers (neighborhoods, commercial centers, etc.). These thoroughfares are usually spaced at approximately one-mile to two-mile intervals unless terrain or other physical barriers create a need for deviation. Access is usually limited to intersections and major driveways. The minimum major thoroughfare cross-section contains four moving lanes, two in each direction. Right-of-way requirements for major thoroughfares typically range from 60 to 140 feet, depending upon the number of lanes and use of medians.

Often, four lanes are constructed within the full right-of-way, leaving a wider median than for a six-lane thoroughfare. This concept allows for an interim solution until traffic volumes warrant the construction of the additional two inside lanes. Due to the fact that these thoroughfares will carry high traffic volumes (normally 5,000 to 70,000 vehicles per day), it is essential that they have continuous and direct alignment and that they interconnect with highways. Access to abutting property should be limited or restricted, with on-street parking strictly prohibited. Single-family residential development should not normally front on arterial streets.

Arterial streets are comprised of major and minor arterial streets. The streets range from two to six lanes with either dedicated bike lanes or wider outside lanes to accommodate shared bike traffic. Arterial streets may be undivided or may be divided with a two-way left-turn lane and/or center raised median. The shoulders (i.e., "curb basis") are wide enough to accommodate

[4-2] See footnote 2-11

pedestrian traffic, utilities and streetscaping. Table 4.2 summarizes the primary design criteria for arterial streets.

TABLE 4.2
SUMMARY OF PRIMARY DESIGN CRITERIA
FOR ARTERIAL STREETS

Functional Classification	Description	Typical ADT Range	Design Speed (MPH)	Min. Curb Basis (Ft.)	Min. ROW Width (Ft.)	FOC to FOC (Ft.)	Bike Lane Width (Ft.)	Paved Lane Width (Ft.)	Median Width (Ft.)
Minor Arterial Streets									
MNR 2WC	Two Lanes, Undivided with Shared Wide Curb Lanes	1,750 to 15,250	45	13.5	60	33		15	
MNR 2BL	Two Lanes, Undivided with Bike Lanes	1,750 to 15,250	45	12.5	62	37	5	12	
MNR 4WC	Four Lanes, Undivided with Shared Wide Curb Lanes	3,500 to 30,500	45	12.5	82	57		15+12	
MNR 4BL	Four Lanes, Undivided with Bike Lanes	3,500 to 30.500	45	12.5	86	61	5	12+12	
MNR-A 2WC-A	Two Lanes with Ribbon Curb, Undivided with Shared Wide Curb Lane	1,750 to 15,250	45	18.5	70	33		15	
MNR-A 2BL-A	Two Lanes with Ribbon Curb, Undivided with Bike Lanes	1,750 to 15,250	45	16.5	70	37	5	12	
MNR 2 SH	Two Lanes without Curb and Gutter, Undivided with Shoulder	1,750 to 15,250	45	17.0	70	36 (1)	6	12	
MNR 4 TWL-TL	Four Lanes, Undivided with a Continuous Left-Turn Lane	5,000 to 15,000	45	13.5	90	63		12	12
MNR 4 MEDIAN	Four Lanes, Divided	9,000 to 20,000	45	10.0	90	27		12	16

Notes: (1) Dimension given for edge to edge.

TABLE 4.2
SUMMARY OF PRIMARY DESIGN CRITERIA
FOR ARTERIAL STREETS (cont.)

Functional Classification	Description	Typical ADT Range	Design Speed (MPH)	Min. Curb Basis (Ft.)	Min. ROW Width (Ft.)	FOC to FOC (Ft.)	Bike Lane Width (Ft.)	Paved Lane Width (Ft.)	Median Width or Left Turn Lane(Ft.)
Major Arterial Streets									
MAU4 WC	Four Lanes, Undivided with Shared Wide Curb Lanes	3,900 to 34,000	45	12.5	82	57		15 + 12	
MAU4 BL	Four Lanes, Undivided with Bike Lanes	3,900 to 34,000	45	12.5	86	61	5	12	
MAD2 TWLTL + WC	Two Lanes, Divided with Two-Way Left-Turn Lane and Shared Wide Curb Lanes	2,500 to 17,750	45	12.5	70	45		15	12
MAD2 TWLTL + BL	Two Lanes, Divided with Two-Way Left-Turn Lane with Bike Lanes	2,500 to 17,750	45	12.5	74	49	5	12	12
MAD4 MEDIAN + WC	Four Lanes, Divided with Raised Median and Shared Wide Curb Lanes	9,000 to 35,500	45	15.0	110	30		15+12	20
MAD4 MEDIAN + BL	Four Lanes, Divided with Raised Median with Bike Lanes	9,000 to 35,500	45	15.0	114	32	5	12	20
MAD4 TWLTL + WC	Four Lanes, Divided with Two-Way Left-Turn Lane and Shared Wide Curb Lanes	5,000 to 35,500	45	15.5	100	69		15+12	12
MAD4 TWLTL + BL	Four Lanes, Divided with Two-Way Left-Turn Lane with Bike Lanes	5,000 to 35,500	45	13.5	100	73	5	12	12
MAD6 MEDIAN + BL	Six Lanes, Divided with Raised Median with Bike Lanes	18,000 to 53,250	50	14.5	140	44	5	12	23

Notes: (1) Dimension given for edge to edge.

According to the CAMPO 2025 Transportation Plan, FM 2769 and Lime Creek Road currently are both classified as "Minor Arterial Two-Lane, undivided (MNR2) through Volente. CAMPO, therefore Travis County and TxDOT, do not intend to upgrade either arterial within Volente in the near future (at least no sooner than 2025) to accommodate area growth. However, with the additional growth that is expected at least in the Volente area, these thoroughfares should be upgraded to provide for more efficient traffic flow, for safer, more controlled turning, and for safer sight distances. The Thoroughfare and Transportation Plan presents recommendations to upgrade these two arterial thoroughfares. In order to accommodate the recommended upgrades, right-of-way widths of up to 90 feet may be necessary.

Plate 4-1 delineates the two existing minor arterial thoroughfares. Improvements to the streets and widening of the rights-of-ways may be necessary in the future along all sections of these roads. At the very least a continuous left-turn middle lane or spaced left-turn medians may become necessary to provide safer left-turn movements.

Collector Streets

A collector street's primary function is to collect traffic from local access streets, as in residential neighborhoods, and expedite the movement of this traffic in the most direct route to a major arterial or other collector streets. Collector streets should be located in a manner that discourages through traffic movement. To discourage such movements, these traffic-collecting streets are typically disrupted at some point by offsetting intersections or by incorporating curvilinear design. The collector street may also be used as a local street internal to nonresidential areas or adjacent to multi-family residential areas, as well as an access route to amenities such as neighborhood parks.

There are four primary types of collector streets.

1. Collector, Residential

   A residential collector street generally serves to collect traffic from local streets within a residential district and is not intended to continue through several districts or subdivisions. Residential collector streets provide access to abutting residential properties of densities up to six (6) single-family dwellings per acre, abutting low density multi-family residential developments, and abutting low traffic intensity commercial uses. Such streets typically provide on-street parking.

2. Collector, Neighborhood

   A neighborhood collector street is characterized by serving several districts or subdivisions. Neighborhood collector streets provide limited access to abutting properties and may provide on-street parking. Typically multi-family residential developments, schools, local retail developments and public facilities are located adjacent to neighborhood collectors. Direct driveway access for detached houses should be discouraged.

3. Collector, Commercial

This type of a collector street serves as principal access to commercial developments. Large vehicles such as delivery trucks can be expected to utilize this type of collector. Driveways should be limited and designed to accommodate higher traffic volumes. On-street parking is generally limited or restricted. Multi-family residential developments may front on these collectors provided adequate off-street parking is available.

4. Collector, Primary

A primary collector street serves several subdivisions providing access from local or residential/neighborhood collectors to arterials. Primary collector streets may also be utilized to serve high traffic-generating developments as determined essential through the development review process (e.g., traffic impact analyses). Parking is restricted and access to abutting properties should be very limited.

Table 4.3 summarizes the primary design criteria for collector streets.

Booth Circle, Reed Drive and Jackson Street are examples of existing collector streets. Of the existing platted streets, at ultimate buildout, the following streets will likely serve as collector streets:

- Macks Canyon Drive
- Reed Drive
- Booth Circle
- Dodd Street, Lakeview Street, Davidson Street
- Jackson Street
- Bernard Street (if its ROW is not abandoned)
- West Drive

TABLE 4.3
SUMMARY OF PRIMARY DESIGN CRITERIA
FOR COLLECTOR STREETS

				Typical Spacings						
Functional Classification	Typical ADT Range	Design Speed (MPH)	General Length (Mi)	Between Collectors	Between Intersections	Min. Curb Basis (Ft.)	Min. ROW Width (Ft.)	FOC to FOC (Ft.)	Paved Lane Width (Ft.)	Raised Median or Turn Lane Width (Ft.)
Collector Residential	500 to 3,000	30 to 35	<1	1/4 mi.	300'	10.0	60	40	37	
Collector, Neighborhood	2,000 to 6,000	35	1 to 2	1/2 mi.	500'	10.0	64	44	41	
Collector Commercial	<10,000	35	<2	½ mi.	500’	11.0	70	48	45	
Collector, Primary										
4 Lanes	>3,500	40	>1	1/2 mi.	1,000'	≥11.0`	70	48	45	
5 Lanes		Varies	>1		1,000'	15.0	90	60	57	
4 Lanes, Divided		Varies	>1		1,000'	13.0	90	24	21	16
6-Lanes Divided		Varies	>1		1,000'	12.5	120	36	33	23

Local Streets

The internal streets within a neighborhood which provide access to residential lots and building sites should be arranged to discourage most through traffic, except that which is directly related to the area. The alignment of residential streets should be either of a curvilinear, discontinuous, looped, cul-de-sac or court configuration. Because only limited traffic is attracted to residential streets, they may have more narrow rights-of-ways and pavement widths than other types of streets. On-street parking is usually permitted. Local streets typically serve less than fifty (50) single-family dwellings.

The minimum paving width of a local street is 27 feet (30 feet FOC to FOC), and the right-of-way requirements are a minimum 50 feet in width. Local streets are usually designed to accommodate up to 1,000 vehicles per day.

CUL-DE-SACS AND SINGLE OUTLET STREETS

Cul-de-sac streets are open at one end, the closed end constructed to facilitate traffic circulation in the reverse direction. Single outlet streets serve a network of streets with one point of access. The use of islands with cul-de-sac bubbles is not recommended.

Table 4.4 summarizes the design criteria for residential cul-de-sacs.

TABLE 4.4
SUMMARY OF DESIGN CRITERIA
FOR RESIDENTIAL CUL-DE-SACS

Typical ADT Range	300		1,000	
Street Throat Width (Ft.)	30		36	
Minimum Curb Basis (Ft.)	10		10	
Radius to FOC (Ft.)	50		50	
General Throat Length (Ft.)	400	700	700	1,200
Design Speed	20	25	25	30
Radius to FOC (Ft.)	50		50	
Special Conditions			Maybe used ONLY if 2nd outlet is not available.	

In general, lengths of cul-de-sacs and single outlet streets should be limited so as to minimize response time by emergency vehicles and to provide efficient public service such as solid waste service. Also, when roadway lengths and the number of persons exclusively served by a single roadway increase, the potential hazard of temporary roadway blockage increases, directly impacting access to the development by emergency vehicles. The traffic issues pertaining to single outlets may be partially mitigated by (1) providing mid-block turnarounds (or cross streets, loop streets), (2) increased pavement widths, and (3) utilization of divided roadways.

ALLEYS

An alley is a passageway designed primarily to provide access to property. The existing/planned street network in the immediate vicinity should impact the decision for planning one-way or two-way alleys. Typically, a one-way alley should not be encouraged unless the alley is short. Parking in alleys should be restricted.

PRIVATE STREETS

A private street is a vehicular roadway under private ownership and maintenance which is not intended for use by the general public and may have its access controlled or restricted. Private streets normally serve residential properties on individual lots but may be used in commercial subdivisions as well.

Private streets are normally subjected to local government regulation in order to insure:

- Safe movement of all vehicles from a private street to the public street system.
- Adequate vehicular access to all buildings and lots by emergency and service vehicles.
- Adequate construction standards in the event such roads later become public streets.
- Adequate drainage and utilities.

Right-of-way for a private street is not dedicated to the public; however, it must be designated as a "private street, drainage, and public utility easement". The right-of-way required for private streets should be based upon the same criteria as for public streets in similar developments.

Private streets are normally designed as cul-de-sac or loop streets. In order to discourage through traffic, private streets should not form a direct link between two public streets that would normally become a thoroughfare for other traffic. Connection to two public streets to accommodate internal circulation should be permitted. In such cases, access should be restricted by security gates at one or both outlets.

A homeowner's association should be created to assume responsibility for the maintenance and taxation provisions regarding private streets. The Village should be allowed to review and approve home owner association documents with respect to private streets, including Covenants. Conditions and Restrictions and Association Bylaws. Plats should clearly delineate private streets and contain proper dedication language.

Private streets should be constructed to the same standards required of public streets within the Village. The appropriate standards will be determined by the functional classification of the street. Applicable standards will include geometric design criteria, pavement design, sidewalks, and clear zones.

The private street should not be needed to provide access to an adjacent property, or, if the street is needed, for access to the adjacent property, a joint access agreement should be executed with

the adjacent property owner for use of the private street, and the private street should be stubbed out to the property line with an open-ended cul-de-sac for future expansion. The private street should be identified on the plat as a separate lot, and any easements needed should be dedicated with the final plat.

If security gates are proposed, they should be approved by the Village and emergency services providers. A minimum vehicle stacking space of 40 feet should be provided between the gate and the nearest intersecting street right-of-way and adequate emergency vehicle turn around space should also be incorporated into the stacking space to allow vehicles to turn around without backing out into the public right-of-way.

In certain cases the Village may allow existing public streets to be converted to private streets for such purposes as providing private security, decorative pavers, landscape plantings, or other special features not normally found on public streets. In such cases all abutting property owners should request the vacation of the right-of-way. The street would then be required to comply with the private street requirements of the Village.

In certain cases the Village may allow existing private streets to be converted to public streets. In order to be accepted by the Village as public streets, the following conditions should be met:

- The streets should conform to the Village's design criteria and paving standards for public streets. The owners of the private street should provide documentation verifying the cross section construction of the private street.
- There should be no outstanding unpaid taxes owed on the streets or outstanding liens on the property.
- Existing building setbacks, lot widths, lot sizes, and yard sizes should conform to the requirements of the zoning district in which they are located, based upon the right-of-way lanes established at an appropriate distance from the edge of pavement.
- A street deed should be prepared and processed through normal procedures to dedicate the right-of-way to the public, with the concurrence of all abutting property owners. The owners of the private street should be responsible for surveying and conveyance of the right-of-way to the Village.
- Any covenants or other legal documents which created the private streets should be amended or terminated.
- Any existing security gates, overhead rock entrance ways, speed bumps, special pavement treatments, and similar facilities which do not meet Village design standards should be removed and the pavement repaired in an acceptable manner at the owners' expense.
- Private improvements left within the proposed right-of-way should require license agreements.
- Street lighting, signals, signs, drainage and other street-related infrastructure should comply with Village standards.
- Designated off-street parking and garbage container areas should not become the responsibility of the Village.

- The Village should have the right to deny acceptance of the private street if the Village does not have the necessary street maintenance funds.

SIDEWALKS AND CURB RAMPS

Sidewalks should be constructed between the curb line and the property line. The standard alignment is two feet off the property line. The sidewalk should be sloped to drain toward the roadway. Sidewalks should be constructed in accordance with the Americans with Disabilities Act to be accessible to persons with disabilities. Sidewalks on cul-de-sacs should be located on both sides of the throat and around the bubble.

Meandering sidewalks are encouraged in order to avoid trees or other natural features, provided that sufficient right-of-way is dedicated to accommodate them.

Sidewalks should include curb ramps wherever an accessible route crosses a curb. Curb ramps should be designed in accordance with the Americans with Disabilities Act to provide access for persons with disabilities. Curb ramps should be located so that they are not obstructed by parked vehicles and should not intrude into the vehicular traffic lanes. The least possible slope should be used and the slopped surfaces should be stable, firm and slip resistant. Ramp surfaces should have a detectable warning surface system integral to the walking surface. Curb ramps should be located so as to provide a continuous accessible path of travel.

DRIVEWAYS

Driveways should be constructed to assure that access is provided to abutting private property with a minimum of interference with the free and safe movement of vehicular and pedestrian traffic and to prevent traffic congestion arising from vehicular entry to or exit from abutting private property. The right of the public to free and unhampered passage of the public streets should be held paramount to other interests. Regulated limitation of access is necessary on arterials to enhance their primary function of mobility. Conversely, the primary function of local streets is to provide access.

Driveways should be concrete or asphalt paving to allow access by emergency vehicles. There should be adequate separation between curb inlets and the edge of a driveway curb return. The angle of a driveway should be approximately 90 degrees for two-way driveways, 45 to 90 degrees for one-way driveways. One-way driveways should be prohibited on two-way undivided streets. In addition, one-way driveways should be limited to developments where two-way access is unfeasible because of special considerations, such as severe site constraints, the need for circular drop-offs, or other circumstances where one-way circulation may be preferred to two-way access. Where one-way access is proposed, developments should be designed to prevent conflicts with on-site circulation in support of the one-way drives. Circular drop-offs and one-way driveways should be designed to prevent conflicts with traffic access, parking and on-site circulation. Priority, however, should be directed towards reducing the number of driveway approaches along principal roadways and arterial streets to limit conflict

points and enhance traffic flows along such roadways. Head-in, back-out parking should be prohibited on all streets and alleys where driveways are not appropriate.

All driveways should be constructed within the street frontage. Neither the driveway nor the curb returns should overlap adjacent property frontage without the approval of adjacent property owners. Common driveways should be allowed provided that a permanent joint-use access easement is obtained.

Driveways should not exceed 70 percent of roadway frontage. Driveways should be located no closer to the corner of intersecting rights-of-ways than 60 percent of property frontage or 50 feet, whichever is less. All driveways along undivided arterial streets should align with opposing streets or driveways, or be offset by a minimum of 120 feet. All driveways along undivided collector streets should align with opposing streets or driveways or be offset by a minimum of 80 feet. All driveways along divided streets should align with median breaks or be offset by a minimum of 100 feet. Alignment of driveways with opposing streets should be discouraged at signalized intersections.

Where a driveway crosses an accessible path of travel, the driveway should comply with the American with Disabilities Act.

CLEAR ZONES

A clear zone is defined as the roadside border area, starting at the edge of the traveled way, available for safe use by errant vehicles. Non-traversable hazards or fixed objects should be removed, relocated or shielded by a barrier if they are within the minimum clear zone widths.

Safety should be the foremost consideration in the placement and selection of plant material in rights-of-ways. The main focus should be the prevention of traffic hazards that can be created by the placement of landscaping which restricts the sight distance or creates roadside obstacles.

Adjacent property owners or civic organizations should be expected to maintain the landscaping located between curb or edge of pavement and the property lines. The adjacent property owners or civic organizations should also be responsible for trimming tree limbs from trees located on private property which cause an obstruction in the right-of-way. The Village should have the right to prune or remove any vegetation as determined necessary for visibility and ease of maintenance.

BIKEWAYS

The preferred method of providing bicycle travel depends on the type of user and the primary purpose of the facility. There are three different types of bicycle facilities:

1. <u>Off-Road Bikeway or Bicycle Path</u>

The bicycle path is used primarily for recreational purposes. It should be located in a park-like setting as far from the roadway as practicable. Intersections with roadways should be minimized and signed to avoid bicycle-motorist conflicts. If the path must be in the roadway right-of-way there should be a minimum distance of three feet and desirable five feet separating the path from the roadway. Separation from pedestrians is desirable where feasible. Bicycle paths are typically 8 to 12 feet in width, but no narrower than 6 feet.

2. Bicycle Lane

The bicycle lane is located within the vehicular roadway in the outside lane and is intended for the preferential or exclusive use of bicycles. The bicycle lane is usually 5 feet wide and delineated by means of pavement markers. Typically, bicycle lanes should not be used on roadways which allow on-street parking unless designed to accommodate both uses. The lane should cease far enough from intersections to allow the cyclist to merge into the traffic flow in order to avoid conflict with vehicles turning right. Bicycle lanes should always be one-way because of the hazards associated with opposing directions of traffic.

3. Bicycle Compatible Street

Most cyclists use streets that have no special markings for bicycles. Neighborhood and residential collectors are often compatible for bicycle use without additional pavement. Collectors and arterials used by commuters and experienced recreational cyclists require a minimum 12 1/2 feet outer lane for collectors and 13 1/2 feet outer lane for arterials measured from outer lane to the top of gutter for the cyclist to share the lane with a motorist. Signs may be used to define the street as a bicycle route.

The speed that a cyclist travels is dependent upon the geometric features of the traveled way, type of bicycle, weather conditions and physical condition of the rider. In determining the design speed of a bikeway, the geometric features of curvature, superelevation, grade and width of traveled way are used to produce a traveling speed that is at least as high as the preferred speed of the faster travelers. Nearly all bicyclists travel within a speed range of seven to 20 mph with an 85th percentile speed of 15 mph. Design speeds should usually be 15 mph and on long downgrades, speeds of 20 mph or more may be considered. For bike lanes and bike streets, the design speed necessary to serve motor vehicle operation will adequately serve bicycle traffic needs.

For a given design speed of a bideway, consideration should be given to the minimum radius of curvature. Where bicycle lanes and bike streets follow the roadway alignment, the curvatures designed to accommodate the motor vehicles will be more than adequate for bicycles. However, care should be taken for bikeways not paralleling roadways to insure that the minimum radius of curvature is provided to permit unbraked turns at the design speed.

Where the radius of curvature is less than 100 feet, it is advisable to widen the bikeway in order to increase the lateral space required by the cyclist as he or she leans to the inside of a turn.

Whether or not a bikeway is favorable to cyclists is largely dependent upon the grade and alignment of the bikeway. The amount of energy a cyclist expends in using a bikeway will affect the usage of the bikeway. Therefore, the grades should be kept to a minimum. A bikeway grade should not exceed ten percent. Due to Volente's topography, however, exceptions may be warranted in some instances.

In order to prevent encroachment conflicts, adequate vertical and horizontal clearances should be provided. The minimum vertical clearance for overhead obstructions is eight feet. The minimum lateral clearance to an obstruction from the edge of the bikeway is three feet. For bicycle lanes and bicycle streets, the street drainage inlet grates may prove to be a hazard. Drainage inlet grates with openings large enough to entrap narrow bicycle wheels should be prohibited. Suitable designs include, but are not limited to diagonal bars at a 45 degree angle, slotted grates with cross bars or slanted bars transverse to traffic. Long slotted grates with wide (one inch or more) openings parallel to traffic should not be used on streets.

The greatest number of conflicts between motorists, bicyclists, and pedestrians occur at intersections and crossings. Elimination of conflicts where bicycle paths cross a roadway can be accomplished by providing a grade separation, but this is not always possible or economically feasible. Appropriate signs are necessary to regulate roadway users and path users at intersections between roadways and bicycle paths. Some special treatment is required at intersections to minimize conflicts between traffic lanes and bicycle lanes.

In order to ensure that safe and efficient operation of a bikeway, there must exist adequate signs and markings to warn bicyclists of hazardous conditions or obstacles, to delineate bicycle rights of way, to exclude undesired vehicles from the route, and to warn motorists and pedestrians of the presence of bicycle traffic. The Texas Manual on Uniform Traffic Control Devices should be consulted for signage and pavement marking options and regulations.

TRAFFIC CONTROL

In general all traffic controls should comply with the Texas Manual on Uniform Traffic Control Devices.

All poles for traffic control signals and signs should be metal, not wood. Mast arm installations should be used for all signal poles.

Any persons who undertake to perform any activity within the public right-of-way should use barricades, warning signs, flags and all other appropriate traffic control warning devices and procedures about the area during the duration of the activity. Work within public rights-of-ways, detours and lane closures should have the Village's prior approval with sufficient notice to insure proper advance planning and public notifications.

Work zone traffic control principals should accomplish the following objectives:

- Warn. Any work zone on the road or sidewalk presents an unexpected situation to the motorist or pedestrian. It is essential that they be warned in advance that something unusual is occurring ahead and that some action may be required of them. This warning is accomplished by using advance warning signs such as "Road Construction Ahead" or "Men Working". Sign or vehicle mounted flashing lights can supplement the signs, particularly at night.

  The first warning sign should always be located off the roadway, out of the travel path. The warning should be given far enough in advance to allow time for driver response and reaction.

- Guide. Once a warning is provided, the next objective is to guide the motorist or pedestrian in the vicinity of the work site. Signs and barricades are used to guide motorists or pedestrians. Signs tell what action or actions are required and channelizing devices are used to show the proper path.

  For example, at a lane closure, a sign is used to tell the driver that the lane is closed and cones or barricades are used to channelize traffic to the proper path. In this way, motorists are guided through the work zone.

  Pedestrian walkways are used to guide pedestrian traffic around work zones in much the same way that drivers are directed on the road. In every case, a safe path, which is clearly delineated should be provided.

- Protect. The final objective is to protect the workers, drivers and pedestrians from hazardous situations. Barricades and barriers are used to clearly mark sections of road or sidewalk which are closed. Barricades are usually sufficient, but at particularly hazardous locations or where high speeds prevail, portable barriers may be used to separate traffic from workers or work hazards such as machinery, trenches and obstructions.

  Fencing is used to separate pedestrian traffic from hazards on the work site such as materials, machinery and trenches. At some locations, a special pedestrian barricade which also protects pedestrians from overhead hazards will be required.

OFF-STREET PARKING

The principal objectives for any off-street parking facility are the provision of safe customer service and convenience coupled with minimal interference to street traffic flow.

PARKING LOT DESIGN

Parking facilities should be designed and constructed in accordance with the following constraints:

- Parking bays should be no more than 300 feet in length. Cross-aisles or turnarounds may be required in order to avoid long dead-end aisles.

- Large parking lots should be functionally divided by internal circulation corridors or aisles into several smaller lots to prevent random or high speed movements.

- End islands should be used to delineate primary traffic aisles and to protect cars parked at the end of parking bays from turning vehicles. Concrete islands in lieu of painted areas should be provided in order to prevent vehicles from parking in such areas and thereby obstructing sight distance.

- Parking should be discouraged along entrance drives and should be limited adjacent to major circulation aisles.

- Where angled parking is used, the angle and design of parking spaces and aisles should be relatively consistent throughout a unified development. One-way angled parking aisles should be designed to alternate the direction for adjacent aisles. Proper signs and markings should be used to reinforce traffic circulation and flow.

- Each parking space should be independently accessible and should have a vertical clearance as specified in the Village's Building Code. Tandem parking spaces (one car behind another, so that one car must be moved before the other can be accessed) should be allowed for single family detached, single family attached, duplex, small lot residential, two family residential, and townhome residential uses. Tandem parking spaces should be allowed for condominium and multi-family residential uses only under the following conditions:

    - The spaces should be reserved and assigned to dwelling units which are required to have two or more parking spaces per unit (i.e., units with two or more bedrooms).

    - At least one of the spaces should be located within an enclosed garage, in order to avoid visual clutter.

    - Both of the spaces should be standard size; no compact or handicapped accessible tandem spaces should be permitted.

    - At least ten percent of the total parking spaces on the site should be unassigned spaces which are available for the use of visitors.

- Each parking and loading space should have adequate drives, aisles and turning and maneuvering areas for access and usability.

- Parking spaces should be located in such a manner as to be convenient to the uses which they serve. No more than ten percent of all the spaces should be located in the service

areas at the rear of commercial or retail centers and other locations with poor pedestrian access to the building entrances.

- Signs and curb markings should be required to indicate "No Parking – Fire Zone". Access aisles should be designed with an appropriate 25 foot inside turning radius and a 50 foot outside turning radius at turns to accommodate emergency vehicles.

- Parking and loading facilities accessed from a driveway approach should be surfaced and maintained with asphaltic concrete or other permanent hard surfacing material sufficient to prevent mud, dust, loose material and other nuisances. Materials may be pervious.

- Gravel surfacing may be permitted in other locations when deemed necessary to protect trees. In such cases, the gravel surfacing should be limited to parking stall areas within the critical root zone of the trees and should be confined by curbing or other barriers to prevent it from being carried into public roadways and drainageways. Gravel surfacing should not be permitted on slopes greater than 5 percent, within handicapped parking spaces, or along accessible pathways between handicapped parking and the building entry.

- Gravel used for parking should be crushed, angular stone, with a minimum ¾" aggregate size, and should be included as impervious cover.

- Safety barriers, fencing, wheel stops or curbing, or other restrictive barriers and directional markers should be provided to assure safety, efficient utilization, protection to landscaping and to prevent encroachment onto adjoining public or private property.

- Visibility of and between pedestrians, bicyclists and motorists should be assured when entering individual parking spaces, when circulating within a parking facility, and when entering and exiting a parking facility.

- Each parking space intended for use by the handicapped should be designed in accordance with the standards of the State of Texas.

- Bicycle spaces should be racks or lockers anchored so that they cannot be easily removed. Each space allocated for this kind of parking should be a minimum of two feet wide and six feet long.

- A minimum three foot radius clear space should be maintained around all fire protection devices (i.e.,, fire hydrants, fire department connectors, system control valves, system test pipes/headers, etc.).

- Where emergency access roadways and lanes are longer than 150 feet and terminate at a dead end, provisions for turning around vehicles and apparatus should be provided. Cul-de-sacs should have a minimum 50 feet unobstructed radius. A 30 foot by 80 foot "T"

section or "Hammerhead" turn around is also acceptable, provided that an additional ten feet of right-of-way around the 30 foot by 80 foot dimension can be provided with no obstruction over one foot high.

- Access roadways should be designed with an appropriate 25 foot inside turning radius and a 50 foot outside turning radius at turns to accommodate any emergency vehicles or apparatus.

- Pavements for emergency access roads and lanes should be all-weather pavement of either concrete or asphalt construction. Access roadways should be finished by application of an all weather driving surface with a flexible base capable of supporting loads imposed (not less than 80,000 pound live vehicle load) by all emergency vehicles and apparatus. Any pervious/decorative paving within 100 feet of any building should meet the same vehicle loading requirements.

- Asphaltic hot mix concrete emergency access roadways and lanes should be engineered not to exceed 13 percent in grade. Concrete roadways should be designed not to exceed 15 percent in grade. As an alternative, where maximum road grades of 13 or 15 percent cannot be provided, a professionally designed sprinkler system may be installed as an alternative, provided the building being considered is fully protected and the system is approved by the Fire Department.

- At least 40 percent of the required parking spaces at service stations or convenience stores with gasoline pumps should be spaces which do not abut air, water, or vacuum facilities.

- Parking spaces within an automotive repair facility or service station should be counted as required parking spaces as long as they are independently accessible.

LOADING

Each off-street loading space should consist of a rectangular area not less than 12 feet wide and 45 feet long, with a vertical clearance of not less than 15 feet.

Freight loading and trash collection facilities should be designed and located to minimize intermixing of truck traffic with other vehicular and pedestrian traffic on site. Such facilities should be located off the main access and parking aisles and away from all pedestrian corridors. Trash dumpsters should be located to provide adequate access and maneuverability for service vehicles.

Maneuvering areas for loading facilities should not conflict with parking spaces or with the maneuvering areas for parking spaces. Public right-of-way should not be used for maneuvering. All maneuvering should be contained on-site.

Rear-loading freight docks are greatly preferred to side-loading docks. For such rear-loading docks, truck circulation patterns and dock positions should be designed for left-side, back-in maneuvers to allow for better driver visibility. The apron space should be adequate to allow the truck to back and pull-out in one (1) maneuver. Where semitractor/trailer combinations are expected, the critical maneuvering and circulation areas shall be designed to accommodate trucks with a WB-50 design.

Service stations, convenience stores and other outlets where fuel is dispensed should provide an adequate maneuvering and unloading area for fuel delivery vehicles. Such facilities or areas should be designed to enable trucks to deliver fuel without interfering with on-site parking, queuing areas, internal circulation or driveway access.

QUEUING

Each queue space should consist of a rectangular area not less than 10 feet wide and 18.5 feet long with a vertical clearance as specified in the Village's Building Code. Queue spaces are not interchangeable with parking spaces.

A 12 foot by-pass lane may be required adjacent to queue lines to allow vehicles an opportunity to circumvent the drive-through activity and exit the site.
Although drive-through activities are not required to be completely separated from other activities on site, the queuing areas should be designed to enable the driver to readily identify and distinguish queuing areas from other activities on site. It is strongly recommended to locate queue lines and service areas toward remote areas of a site to avoid conflicts with parking and circulation areas. Queue areas and drive-through facilities should be clearly identified with the appropriate signage and markings.

INTERNAL CIRCULATION

Entry driveways equipped with controlled access gates should provide a minimum of 40 feet of vehicle stacking space measured from the gate to the property line.

Parking and circulation aisles should be perpendicular to the entry faces of buildings to minimize conflicting movements by pedestrians and vehicles.

Parking along the curb line adjacent to building fronts should be discouraged to provide for good pedestrian visibility. The designation of the building front curb as a fire lane to aid in the enforcement of the parking prohibition is encouraged.

The use of speed bumps to reduce internal travel speeds is discouraged for new construction. Buildings and lots should instead be configured to reduce speeds.

Continuous travelways adjacent to building fronts should be no more than 400 feet in length to discourage high speeds and to reduce conflicting pedestrian and vehicular movements.

Internal driveways or aisles that are intersected by crossing traffic should either have their centerlines aligned or offset by at least 60 feet.

Traffic squares or circles are generally discouraged. Squares or circles might be appropriate in low traffic areas if designed to encourage one-way traffic flow and if the number of intersecting driveways or aisles is minimized.

All semicircular drop-off driveways should be designed to operate in one direction only.

All internal circulation and queuing areas should be designed to accommodate the turning radii of the vehicles that will be using the site. The critical design criteria are provided by the American Association for State Highway and Transportation Officials (AASHTO) for various design vehicles according to their wheelbase.

The minimum width for an internal drive or circulation aisle with no parking is 20 feet for two-way traffic and 10 feet for one-way traffic. Additional width, up to 25 feet for two-way traffic and 15 feet for one-way traffic, may be required where traffic volumes are heavy or where obstructions or circuitous alignment necessitates a wider drive for clearance of turning vehicles. Emergency vehicle access criteria must also be met.

MIXED-USE PARKING (Shared Use Parking)

Shared parking is normally considered where the development contains at least two of the following uses which are functionally and physically related:

Office
Retail
Restaurant
Cinema
Residential
Hotel

Compact parking spaces should not exceed 25 percent of the total number of required spaces when shared parking is used.

Pedestrian links between the development and shared parking areas should be specifically designed to assure readily visible relationships between the use and the available parking. Special attention should be paid to sidewalk design, paving materials, access across internal drives and streets and access within parking structures.

All shared parking facilities should be easily accessible to all land use and adequately distributed on the site to provide the required parking for any use within 500 feet of the entrance, measured from the closest point of the parking facility.

Parking spaces which are reserved for employees or other individuals should not be included in shared parking unless hours of use are such that parking is available for others to use at different hours.

Spaces designated for handicapped use should be provided in a quantity equal to the sum of the minimum requirements for each individuals use in the mixed-use development.

CALCULATION OF PARKING REQUIREMENTS

The amount of parking should be a function of the type and the size of the land use.

DRAINAGE

GENERAL

All drainage facilities including street curbs, gutters inlets and storm sewers should be designed to intercept and transport runoff from a 25-year frequency storm. The drainage system should also be designed to convey those flows greater than a 25-year frequency up to and including a 100-year frequency storm within defined rights of way or drainage easements.

Peak flows should not be increased at any location for the 2-, 10-, 25-, or 100-year storm frequency which causes increased inundation of any building or roadway surface.
All drainage system components within public rights-of-ways or drainage easements should be manufactured and installed in compliance with public standards.

For bridges and culverts of residential streets, runoff from the 100-year frequency flow should not produce a headwater elevation at the roadway greater that either 12 inches above the roadway crown elevation or any top of upstream curb elevation, whichever is lower.

For bridges and culverts in streets other than a residential street, runoff from a 100-year frequency storm should not produce headwater elevations at the roadway greater than six inches above the roadway crown elevation or six inches above any top of upstream curb elevation, whichever is lower.

Discharge from storm sewer outfalls should not cause channel, bluff, or stream bank erosion.

STREET FLOW

The location of inlets and permissible flow of water in streets should be related to the extent and frequency of interference to traffic and the likelihood of flood damage to surrounding property for the 25-and 100-year frequency storms. Interference to traffic is regulated by design limits of the spread of water into traffic lanes, especially in regard to arterials. Flooding of surrounding property from streets is controlled by limiting curb buildup to the top of curb for a 25-year storm which is designated as the design storm. Conveyance provisions for the 100-year storm should also be made within defined rights-of-ways and easements.

Water which flows in a street, whether from rainfall directly onto the pavement surface or overland flow entering from adjacent land areas, will flow in the gutters of the street until it reaches an overflow point or some outlet, such as a storm sewer inlet. As the flow progresses downhill and additional areas contribute to the runoff, the width of flow will increase and progressively encroach into the traffic lane. On streets where parking is not permitted, as with many arterial streets, flow widths exceeding one traffic lane become a traffic hazard. Field observations show that vehicles will crowd adjacent lanes to avoid curb flow.

As the width of flow increase, it becomes impossible for vehicles to operate without moving through water in an inundated lane. Splash from vehicles traveling in the inundated lane obscures the vision of drivers of vehicles moving at a higher rate of speed in the open lane. Eventually, if width and depth of flow become great enough, the street loses its effectiveness as a traffic-carrier. During these periods it is imperative that emergency vehicles such as fire trucks, ambulances and police cars be able to traverse the street by moving along the crown of the roadway.

Storm runoff ponded on the street surface because of grade changes or because of the crown slope of intersecting streets has a substantial effect on the street-carrying capacity. The manner in which ponded water affects traffic is essentially the same as for curb flow; that is, the width of spread into the traffic lane is critical. Ponded water will often completely halt all traffic. Ponding in streets has the added hazard of surprise to drivers of moving vehicles, producing erratic and dangerous responses.

Whenever storm runoff, other than limited sheet flow, moves across a traffic lane, a serious and dangerous impediment to traffic flow occurs. Cross-flow is allowed only in case of superelevation of a curve or overflow from a higher gutter on a street with cross fall. No more than three cubic feet per second for the 25-year storm should be allowed to cross flow from a higher elevation to the lower elevation.

As the storm water flow approaches an arterial street or tee intersection, an inlet should be installed if more than three cubic feet per second for the 25-year storm enters the intersection. For a cul-de-sac with a slope greater than 7 percent, no more than three cfs for the 25-year storm should be allowed to enter the bulb of the cul-de-sac. In both situations the inlet should not be placed inside the curb return.

Valley gutters can be useful in diminishing the deterioration of pavements, particularly at intersections where flows tend to concentrate. At the intersection of two arterial streets, a valley gutter should not be used. At the intersection of two collector streets or local streets, the valley gutter may be used. At an intersection of two (2) different types of streets, the valley gutter should be used across the smaller street only.

INLETS

The primary purpose of storm drain inlets is to intercept excess surface runoff and deposit it in a drainage system, thus reducing the possibility of surface flooding.

The most common location for inlets is in streets which collect and channelize surface flow, making it convenient to intercept. Because the primary purpose of streets is to carry vehicular traffic, inlets should be designed so as not to conflict with that purpose.

The following guidelines should be used in the design of inlets to be located in streets:

- Grated curb inlets are discouraged from use due to their increased tendency to clog and problem with replacement.
- Minimum transition for recessed inlets should be ten feet.
- Curb inlets (whether in a sump or on grade) should incorporate a standard five inch depression, and be a minimum of ten feet in length.
- When recessed inlets are used, they should not decrease the width of the sidewalk.
- Design and location of inlets should take into consideration pedestrian and bicycle traffic. In particular, grate inlets should be designed to assure safe passage of bicycles.
- The use of slotted drains is discouraged except in instances where there is no alternative.

STORM DRAINS

Hydraulically, storm drainage systems consist of conduits (open or enclosed) which convey the 25-year storm, with provisions made for the 100 year storm. There are several general concepts to be observed when designing storm sewers. When followed, they will tend to alleviate or eliminate the common mistakes made in storm sewer design. The rules are as follows:

- Select pipe size and slope so that the velocity of flow will increase progressively or at least will not appreciably decrease at inlets, bends or other changes in geometry or configuration.
- Do not discharge the contents of a larger pipe into a smaller one even though the capacity of the smaller pipe may be greater due to a steeper slope.
- At connections of two different pipe sizes, match the soffits of the two pipes rather than matching the flow lines.

- For all pipe junctions other than a manhole, the angle of intersection should not be greater than 45 degrees. This includes discharges into box culverts and channels.

- No storm drain system should be allowed to go through an inlet box. Instead the inlet should discharge into the trunk line through a "y" connection. However, a stub out from one or two lots in a commercial subdivision can be tied into an existing inlet as long as it does not impede the function of the inlet and as long as the laterals and overflow provisions contain the capacity to convey the additional flows. The inlet should then be treated as a junction box.

- No pipe having a diameter greater than 50 percent of the minimum dimension of a box culvert should be allowed to discharge into that box culvert.

- Pipe should be reinforced concrete, especially within the public right-of-way.

- The 25-year hydraulic grade line should remain six inches below the theoretical gutter flow line of inlets.

- Storm drains should operate with velocities of flow sufficient to prevent deposition of solid material. The controlling velocity is near the bottom of the conduit and is considerably less than the mean velocity. Storm drains should be designed to have a minimum velocity of 2.5 feet per second.

- Maximum velocities in conduits are important because of the possibility of excessive erosion of the storm drain pipe material. Table 4.5 lists the maximum velocities allowed.

- Pipes that are to become an integral part of the public storm sewer system should have a minimum diameter of 18 inches.

Table 4.5

Maximum Velocity In Storm Drains

Type	Maximum Permissible Velocity
Storm Drains (inlets laterals)	No Limit
Storm Drains (trunk)	20fps

Source: City of Austin, Watershed Management Division

MANHOLES

Manholes provide a very important access point for maintenance purposes. Due to equipment restraints, every point along the storm sewer line should be a maximum of 250 feet from an access point for pipes 30 inches in diameter or smaller. For pipe sizes greater than 30 inches in diameter, manholes should be placed so that there is a maximum distance of 300 feet to an access point. Inlets and pipe outfalls can be considered as access points for maintenance purposes.

Manholes should also be located where more than one lateral meets the main line and should preferably be located at the first 45-degree bend within the maximum 500 feet maintenance distance in which two or more bends occur. Manholes should also be placed at locations where changes in pipe size occur.

CULVERTS

The function of a drainage culvert is to pass the design storm flow without causing excessive backwater or overtopping of the structure and without creating excessive downstream velocities. Energy losses and discharge velocities should be maintained within allowable limits when selecting a culvert structure. The system should accommodate the runoff from a 100-year frequency storm.

CULVERT HEADWALLS

The normal functions of properly designed headwalls and endwalls are to anchor the culvert in order to prevent movement due to hydraulic and soil pressures, to control erosion and scour resulting from excessive velocities and turbulence and to prevent adjacent soil from sloughing into the waterway opening. Headwalls should be constructed of reinforced concrete and may be either straight-parallel, flared or warped. They may or may not require aprons, as determined by site conditions. Headwalls should be aligned with the direction of the receiving flow when discharging into a waterway.

CONDITIONS AT ENTRANCE

The operating characteristics of a culvert may be completely changed by the shape or condition at the inlet or entrance. Therefore, design of culverts should involve consideration of energy head losses that may occur at the entrance.

For conditions where more than one box culvert is required, the upstream face of the structure should incorporate debris deflector fins to prevent debris buildup.

CULVERT DISCHARGE VELOCITIES

High discharge velocities from culverts can cause eddies or other turbulence which could damage unprotected downstream properties and roadway embankments. To prevent damage from scour and erosion in these conditions, culvert outlet protection is needed. Outlet protection is based on the discharge velocity.

LEVEL OF SERVICE AND TRAFFIC CAPACITY

Capacity is the measure of a street's ability to accommodate the traffic volume along the street. Level of service (LOS) is a phrase representative of several factors, including speed, travel time, traffic interruptions, and operating costs of a traffic facility (roadway), used to measure the quality of the facility. In addition, a roadway link refers to a specific length of a roadway,

usually between two intersections. Levels of service "A" through "F", from best scenario to worst scenario, are defined on the following Table 4.6

Table 4.6
DEFINITION OF LEVEL OF SERVICE FOR ROADWAY LINKS

LEVEL OF SERVICE (LOS)	DESCRIPTION	EXAMPLE
A and B	Light, free-flowing traffic volumes. Virtually no delays with smooth progression of traffic, and speed is generally unaffected by other vehicles. Slight decline in the freedom to maneuver from A to B.	Residential or rural streets.
C	Basically satisfactory to good progression of traffic, but at that point where individual drivers become affected by interactions with other vehicles. Light congestion, and speed is affected by the presence of other vehicles.	Urban thoroughfares at off-peak hours
D	High density, but stable, traffic flow. Speed and freedom to maneuver are restricted. Small increase in traffic flow will cause significant operational problems. This LOS is generally used to justify thoroughfare improvements.	Secondary commercial district streets at peak hours.
E	Operating conditions at or near capacity level. All speeds are reduced to low, but maintain relatively uniform, meaning generally not stop-and-go. Operations at this level are usually unstable, because small increases will cause severe speed reductions.	Primary commercial district streets at peak hours
F	Forced flow. Heavy congestion. Total breakdown with stop-and-go operation. Queues (i.e., vehicle stacking) at intersections on these lengths may exceed 100 vehicles.	Downtown areas usually in larger cities at the A.M. or P.M. peak hours.

Level of service "C" is generally the recommended minimum level of service in most communities, and is also the recommended level for roadway design purposes.

TRAFFIC IMPACT ANALYSIS

The Village should be served by adequate streets and thoroughfares, adequate to accommodate the vehicular traffic generated within the community and in the surrounding areas. Streets should provide a safe, convenient and functional system for traffic circulation; should be properly related to the Village's Thoroughfare and Transportation Plan, road classification system, this Comprehensive Plan; and should be appropriate for the particular traffic characteristics.

New subdivisions should be supported by a road network having adequate capacity, safe and efficient traffic circulation. The adequacy of the road network for developments should be demonstrated by traffic impact analyses (TIA) which take into consideration the need to accommodate traffic generated by development, land to be developed in common ownership and other developed property. TIAs should be used to determine the adequacy of the service volumes of the roadways and their intersections.

THE THOROUGHFARE AND TRANSPORTATION PLAN

A number of elements should be considered in the process of developing a Thoroughfare and Transportation Plan, including the Future Land Use Plan, regional travel demands, traffic movement and access requirements, and existing physical constraints to roadway construction (e.g.,, major topographical features, floodplains, slope constraints, etc.). The types of land uses that are existing and planned for an area affect the roadway capacity and access needs for that area. Moreover, special efforts will be required in the thoroughfare and transportation planning process to ensure that the integrity of residential neighborhoods is protected from unwanted and undesired vehicular traffic.

Balancing the movement and access functions of the thoroughfare system is another consideration in the planning process. Roadways serve two competing functions: the movement of traffic and access to individual properties. Inherent conflict exists where ingress and egress maneuvers from individual properties impede the efficient movement of traffic on major roadways, and where high traffic volumes impede turning movements into and out of private driveways. Controlling access so that these two competing functions occur on separate sections of the thoroughfare system is a primary objective of the planning process.

The primary purpose of the Thoroughfare and Transportation Plan is to provide a long-range plan to assist in thoroughfare facility planning and the dedication of needed rights-of-ways to implement such a Plan. Due to the fact that the major roadways that traverse the Village have basically established the thoroughfare system, the majority of the recommendations made are intended to promote and protect the integrity of local transportation needs. The recommended Thoroughfare and Transportation Plan is shown on Plate 4-1. One of the benefits of the Thoroughfare and Transportation Plan is the identification of areas of need, upon which resources can be concentrated for additional roadways or expansions of existing roadways, therefore, ensuring that these monies are spent efficiently. The Thoroughfare and Transportation Plan is designed to identify the proposed locations of collector and arterial streets with the intent to facilitate movement and serve higher volumes of traffic that will occur with future development.

THOROUGHFARE AND TRANSPORTATION OBJECTIVES AND RECOMMENDATIONS

Purpose Statement

The purpose of the Thoroughfare Plan is to establish guiding principles and policies that will provide Volente residents with a transportation system that will allow for an acceptable level of mobility and accessibility while maintaining safety and minimizing the negative impacts on the community.

Objectives

The guidelines and policies established within the Thoroughfare Plan are intended to advance five primary objectives:

Objective # 1. Create a transportation system that provides an efficient, structured framework for the smooth flow of traffic that emphasizes safety.

Increased population will increase traffic on the Villages roadways. A carefully planned network of roadways can help maintain adequate circulation without sacrificing public safety. The network should include a hierarchy of streets, such that each class of street is designed to serve an appropriate function. Standards for each street should balance the volume and speed of traffic, public safety, roadway construction and maintenance costs, as well as impacts upon adjacent development.

Objective # 2. Create a plan that will minimize the economic impact on the Village to own and maintain the public streets. The Village will have limited resources available for improvements to the transportation system; therefore it should plan for cost-effective investments to the roadway network.

The Village of Volente should adopt a Road Impact Fee Program. Road Impact fees are based upon the premise that funds necessary to provide for the additional transportation-related capital facilities to serve new developments should be provided by the new development projects on a fair share basis in the form of a road improvement impact fee rather than from funds raised from all the citizens of the Village. This prevents existing citizens from being burdened with the full cost of growth and lessens the overall tax burden on the citizens of the Village.

Objective # 3 Create a plan that will encourage efficient traffic movement throughout the Village and minimize congestion.

Roadways and thoroughfare planning should take into consideration the efficient movement of all traffic throughout the Village of Volente. The Village recognizes that approximately 50 percent of its land has yet to be developed. Future high growth areas should be identified and ordinances created to minimize congestion. The total population of the Village of Volente at final build out should to be considered when planning the transportation systems. Impact studies should be required for developments that consist of more than 3 homesites and commercial businesses that generate more than 25 daily trips. Information obtained from traffic impact studies should be used to generate strategies to create efficient traffic flow and determine the improvements to be funded by the contributing development. Ride-share programs and public

transportation systems should be encouraged by the Village of Volente through public communication and education.

Objective # 4 Create a transportation system that will minimize the impact on the Environmental Quality of the Village.

Stormwater runoff created by the development of roadways is a major area of environmental concern. The Village of Volente should create standards for pollutant removal associated with stormwater runoff. Designated corridors adjacent to FM 2769 and Lime Creek Road should be considered for new roadways that would minimize the potential adverse impact on the environment. The Village of Volente should participate in and educate the public about national, state and local efforts used to reduce pollution emissions from vehicles.

Objective # 5 Create a transportation system that is compatible with the preferred community image of the Village.

The creation of new streets and the improvement of existing thoroughfares should take into account the potential impact on the community image. Requirements such as roadside landscaping, adequate building setbacks, and the width of roads should ensure the rights of property owners by prohibiting road development that damages the aesthetics of existing neighborhoods and the environment.

Thoroughfare Implementation

The existing thoroughfare system within the Village of Volente has been established by three primary entities: (1) County or State participation; (2) local construction of facilities; (3) developer participation. Due to changes in State law (Impact Fees, Chapter 395 of the Texas Local Government Code), the Village will still be able to require assistance from developers in building thoroughfares (as well as water and wastewater facilities), but will require different administrative techniques.

Monies for capital improvements in communities across Texas are generally becoming more difficult to secure each year. It is necessary, therefore, for Volente to carefully manage its available funding resources in the implementation of not only the thoroughfare system, but other public facility systems as well.

The proper administration of the Thoroughfare and Transportation Plan will require the following actions:

- **Coordination of Capital Improvements**

  Many of the major streets and thoroughfares that are improved in the Village of Volente will involve cooperation with TxDOT, Travis County and, in some cases, will involve some financial participation by the Village itself. The responsibility of accommodating regional traffic should primarily lie with TxDOT, with input and help from the Village. It should be

recognized that the thoroughfare system will be built at an increment-at-a-time basis over an extended period, perhaps 20 or 30 years. **It should be of prime importance for the Village to work with CAMPO and TxDOT on major improvement projects.**

- **Subdivision Control**

The subdivision of land into building sites represents the first step in the development of urban land uses and the creation of traffic generators. Reasonable land (i.e., right-of-way) should be set aside at the time of subdivision platting so that adequate thoroughfares can be created without adversely affecting the value, stability, and long-range character of the area being developed. **Specifically, right-of-way should be dedicated in accordance with the Thoroughfare and Transportation Plan as each plat is approved.**

- **Zoning and Land Use Control**

The adequacy of existing and planned thoroughfares should be taken into consideration in all changes of zoning and land use. When such changes occur, the space allocated for street use (i.e., right-of-way) should be provided commensurate with the overall use contemplated within the area.

- **Building Lines**

Where widening of an existing thoroughfare right-of-way is contemplated, buildings should be set back to allow for the planned widening to ensure that the uses function properly with the new thoroughfare after the proposed improvement is made. In some cases, it will be desirable to establish building lines by ordinance to help ensure the orderly and uniform development of thoroughfare frontage.

- **Other Considerations**

Certain aspects of the Plan, such as access controls along major arterials, should be implemented through other design and technical standards that may or may not be included in the Village's respective Zoning or Subdivision Ordinances. Examples of other standards that should be implemented are sight and visibility standards and joint (i.e., shared) access standards. Impact fees should also be established under a separate process.