SECTION 3

DESIGN STANDARDS

3.1 INTRODUCTION. This section defines design requirements for public improvements. It is not the intent of these standards to restrict professional judgment, but rather to serve as a guide and to establish consistency in design.

These standards are the minimum required and should be considered as such. It is recommended that the Engineer in charge review each project on its own merit and impose a higher professional standard as necessary for each project. These requirements apply as required by the Subdivision Ordinance.

3.2 STREET DESIGN. All streets shall be designed to conform to the standards and technical design requirements contained within this sub-section. AASHTO, a policy on geometric design of highways and streets, shall be used as a supplement to these guidelines. In cases of conflict, a determination shall be made by the City representative, which determinations shall be final.

All new developments shall use street cross-sections with forty-four feet (44') or more of right-of-way unless a narrower section is specifically approved by the City Council.

Access to multi-family or commercial developments, shall use street cross-sections with sixty (60) feet or more of right-of-way, unless a narrower section is specifically approved by the City Council

3.2.1 STREET CROSS-SECTION STANDARDS. Requirements for the street cross-section configurations are shown in Table 3.1. These requirements are based on traffic capacity, design speed, projected traffic, system continuity and overall safety.

Alternate road cross-sections incorporating the use of a planting strip may be permitted, if applicable safety and traffic standards are met and approved by the City Council.

3.2.2 ROADWAY NETWORK DESIGN. New roadway networks shall be designed in accordance with the general planning concepts, guidelines, and objectives provided within this sub-section. The "Quality of Life" for residential occupants shall be a primary concern when designing a residential roadway network.

- An emphasis on proper street hierarchy should be adhered to, namely, local streets should access residential collectors; residential collectors should access major collectors; major collectors should access minor arterial; etc.

- An emphasis on access management should provide control of the location, design, and operation of all driveways, median openings, and street connections to a roadway.

- Roadways should be designed in a curvilinear method in order to reduce, or eliminate, long straight stretches of residential roadways which encourage speeding and cut through traffic.

- Substantial increases in average daily traffic, due to development of adjacent property on established streets not originally designed to accommodate such increases should be avoided.

- Drainage methods should concentrate on meeting the drainage needs while not impeding the movement of traffic (see drainage guidelines).

- Roads should be designed to lie within existing topographic features without causing unnecessary cuts and fills.

- A reduction in the use of cul-de-sacs should be emphasized in order to provide greater traffic circulation and less volume on collector roads. Circulation is of the utmost importance. Long blocks and excessive dead end streets should be avoided.

- Stopping sight distance must be considered at all intersections and curves to ensure the safety of the public, in accordance with AASHTO standards.

- Pedestrians and bicycle traffic should be considered in the planning and design of all developed streets.

Table 3.1
Street Cross-section Configurations

Classification	Minimum ADT or [D.U.s]	Curb Type	Maximum Grade (%)	Right of Way (feet)	Pavement Width [1] (feet)	Sidewalk Width (contiguous (feet)	Planter Strip Width
Residential Access-A	<150 [2 to 15]	high back	15	44 [2]	29	4	NA
Residential Access-B	<150 [2-15]	modified	15	50 [2]	29	4	4'
Residential Standard	150 to 1,500 [15 to 150]	high back	15	50 [2]	35	4	NA
Collector [4]	1500 to 6,000 [150 to 600]	high back	12	66	50	5[3]	NA
Arterial [4]	6,000 to 20,000	high back	10	80-100	65	6	10'
Commercial Local	NA	high back	8	60 [5]	45[5]	5	NA
Industrial Local	NA	high back	6	66 [5]	45[5]	5	NA

**Note: Sidewalk easements are required.

1 Pavement width measured from lip of curb to lip of curb.

2 A wider planter strip may be placed if a sidewalk easement is provided and a 20' minimum setback from the back of the sidewalk is required.

3 A planter strip may be placed between back of sidewalk and any wall, fence, hedge, etc. This area can be private or public. If public, a 72 foot right-of-way will be required. Alternate sections with meandering sidewalks may be proposed.

4 Configuration of major collector and higher classifications may be adjusted with proper justification and approval of City representative.

5 The minimum right-of-way and pavement width is shown. Each may be increased when required by a traffic impact study.

3.2.3 IMPROVEMENT REQUIREMENTS. All improvements including, but not limited to the following, shall be constructed in accordance with the standard specifications and drawings unless otherwise approved.

3.2.3.1 Curb, Gutter and Sidewalk. Required curb, gutter and sidewalk shall be constructed.

3.2.3.2 Driveways. Driveways shall be constructed only in approved locations. No driveways shall be constructed unless an approved site plan has been submitted.

3.2.3.3 Pavement. All streets, public or private, shall be surfaced to grade, with asphalt concrete pavement, to the required minimum width and thickness in accordance with these specifications.

3.2.3.4 Street Lighting. Street lighting shall be provided on all streets. The construction on public streets shall be in accordance with the standard drawings and these specifications. Standard Public street lights may be installed on private streets upon agreement with the City and the local power agency when applicable. Cobra Head type street lights shall be placed on all collector and arterial roadways and at all intersections. Pole spacing shall not be less than 200 feet or greater than 300 feet. Street lights installed within a subdivision shall be placed at each intersection, ends of cul-de-sacs and knuckles. Pole spacing for residential areas shall be approximately 300 feet. Other lighting may be required as determined by the City representative. Approved decorative lighting will only be allowed within a project after approval of the City representative.

3.2.3.5 Cross Gutters. No cross gutters shall be allowed across major collector or major and minor arterial streets. On commercial and industrial streets, cross gutters are generally not allowed and require approval by the City representative for their use. The City representative may prohibit construction of cross gutters on any street deemed necessary.

3.2.3.6 Handicap Ramps. When new construction occurs handicap ramps shall be constructed at all street intersections, unless otherwise approved, in accordance with current ADA and applicable City standards. In addition, when a project occurs where existing improvements are in place, handicap ramps shall be upgraded to meet current ADA and City standards.

3.2.3.7 Roadway Medians. Medians on public roadways may be allowed when approved by the City representative. Design and construction shall be in accordance with applicable standards.

3.2.3.8 Minimum Access. Proposed developments shall have only the required number of accesses to adequately address the needs of the development and only at approved locations. Too many access points or access on major routes hinder the safety and efficient travel of vehicles using these routes. In addition, too few accesses can stifle circulation and unnecessarily concentrate traffic at selected locations.

3.2.3.9 Drainage. Adequate drainage facilities shall be installed to properly conduct runoff from the roadway. Sub-drains and surface drainage facilities shall be designed in accordance with the approved drainage study. Cross gutters shall be used sparingly to maintain the public's driving comfort and in accordance with these specifications.

3.2.3.10 Traffic Control Devices. Appropriate traffic control devices and street signs, as required by the City representative, shall be installed in accordance with the MUTCD.

3.2.3.11 Pavement Marking. Appropriate pavement markings, as required by the City shall be installed in accordance with the MUTCD.

3.2.3.12 Street Trees and Landscaping. Appropriate street tree and landscaping as required by the City shall be in accordance with Santa Clara City Ordinance and the design shall be approved by the City representative.

3.2.3.13 Other Improvements. The above required improvements are not all inclusive. Other improvements needed to complete the development in accordance with current engineering and planning standard practice may be required by the City representative.

3.2.4 TECHNICAL DESIGN REQUIREMENTS. The following requirements apply to public streets.

3.2.4.1 Street Grades

A. All street grades shall have a maximum grade as shown in Table 3.1

B. A request to increase the maximum street grades shown in Table 3.1 may be considered upon submittal of a request and information justifying such a request to the City representative. Request for approval must be based upon and in accordance with the latest edition of AASHTO's “A Policy

on Geometric Design of Highways and Streets" guidelines. Any approvals for increased grades must be consistent with access requirements of fire apparatus as defined by the Fire Department. The City representative's decision will be final. Cost of construction will not be justification for approval.

3.2.4.2 Intersections

A. All street intersections should intersect at ninety degree angles.

B. In the event an acute angle intersection is proposed, the City representative may require mitigation by realigning to achieve a ninety degree intersection. If no other reasonable option for realignment exists, a skew may be allowed up to a maximum of 15 degrees from 90 degrees. Other design approaches to mitigate the skewed angle may be required by the City representative.

C. Proper combination of horizontal and vertical alignment should be obtained by engineering study and consideration of the general guidelines listed in AASHTO (Section Titled: Combination of Horizontal and Vertical Alignment, current edition).

D. Intersections should not be located on the interior of, or near, sharp curves. Intersections should be located a sufficient distance from all curves to provide proper sight distance for vehicles on the intersecting road or driveway and on the through road.

E. New intersections with more than four "legs" are generally not permitted. For arterial access, only four-leg intersections, "T" intersections and modern roundabouts are permitted. When designing local road networks, "T" and "L" intersections are desired. The "L" intersection (knuckle) will only be permitted when the street length, in either direction from the angle point, is six hundred feet (600), or less. Four-leg intersections on local road networks are generally discouraged. Where determined that a four-leg intersection is necessary, approval from the City representative shall be obtained prior to final design of the local road network. Exceptions to these requirements may be granted by the City representative on a case by case basis. The developer's engineer must provide acceptable compelling Traffic Engineering analysis justification before deviations will be granted.

F. When designing local road networks, block lengths without an intervening connector street shall not exceed eight hundred feet (800') in length unless previous approval has been obtained from the City representative. Cul-de-sacs are not considered an intervening connecting

street.

G. New access locations created by development shall be unified whenever possible to create the fewest number of access points onto arterials or major collectors. Cross use or shared access agreements shall be required where necessary.

H. Access to corner lots should be from the lesser-classified road at the greatest distance possible from the intersection, and should not be less than the distances shown below. This distance is measured from the PI of the corner curve as measured along the back of the curb.

TABLE 3.2
FACILITY TYPE
ACCESS DISTANCE FROM CORNER
(IN FEET)

Facility Type	Access distance to edge of driveway
Residential Access-A	50
Residential Access-B	50
Residential Standard	50
Collector	175
Minor Arterial *	200

*All access points shall be approved by the City representative. Distances shown may be increased as required by the City representative on a case-by-case basis. Exceptions can only be approved by the City representative upon submittals of proper traffic justification.

I. The intersection of two local roads should be designed to operate with minimal traffic control devices. For example, avoid designing an intersection to operate with a four-way stop or signal control.

J. Direct access will not be allowed for parking, loading or driveway areas that require backing maneuvers onto major collector or higher order streets. This requirement shall apply to commercial and industrial use regardless of the order or classification of street.

K. Residential and commercial developments are generally required to provide at least two improved accesses to the development depending upon the forecasted traffic volumes. Adjacent developments may be required to combine or share driveway access to public roadways. The access shall be

of proper width to accommodate the calculated traffic volumes and expected vehicle types when the area is fully developed and shall be in accordance with the Zoning Ordinance. Projected traffic volumes shall be calculated using the criteria outlined within the Traffic Impact Study requirements of these specifications.

L. Covered driveways will not be allowed unless approved by the City representative.

3.2.4.3 Intersection Spacing

A. Street intersections shall be spaced far enough apart so that the existing and projected traffic stopped to make left turns at one intersection does not interfere with traffic movements at the adjacent intersection and to not hinder the capacity or safety of the roadway. When a street intersects a low volume residential street, the minimum distance is 150 feet. When a street intersects a minor or major collector street, the minimum distance is 250 feet. Minimum distance measurements are centerline-to-centerline. The minimum spacing requirement on arterials shall be as determined by the City representative. Locations shall be based upon a number of items such as projected volumes, turning and stacking distances, intersection spacing, traffic progression, etc. Generally the minimum distance will be 650 feet for arterials and 1/4 mile for major arterials. The City representative shall review and give final approval to any intersection requests on arterials.

3.2.4.4 Maximum Design Volume

A. The maximum design volume shown on Table 3.1 shall be used unless otherwise approved by the City representative. A request to increase these volumes may be submitted for consideration to the City representative. This request shall include all necessary and required information including support and justification from the Traffic Impact Study.

Conditions which must be considered when reviewing a request for an increase in maximum design volume include hillsides, safety, parking, traffic studies, access requirements, etc.

3.2.4.5 Cul-de-Sac Streets

A. Such streets shall not exceed six hundred (600') feet in length as measured from center of cross street to center of Cul-de-sac. The turn-around pavement radius shall not be less than forty-two and one-half feet (42 1/2') (50 feet at property line). Commercial pavement radii shall be no less than forty-seven and one-half feet (47 1/2') (55 feet at property line). No road shall be ended without a properly designed cul-de-sac turnaround unless otherwise approved by the City representative. Major collectors and higher order roads shall not be permanently dead-ended.

3.2.4.6 Sidewalks

A. Sidewalk shall be required in all residential and commercial developments. See Table 3.1.

B. For developments which are within hillside areas, see the City of Santa Clara Hillside Ordinance for further requirements.

C. Sidewalks in areas of high pedestrian traffic may require greater width as determined by the City representative.

D. Meandering sidewalks must be approved by the City representative.

3.2.4.7 Curb and Gutter

A. All public or private streets shall use curb and gutter of the type shown in standard drawings unless otherwise approved by the City representative.

3.2.4.8 Planter Strips

A. Planter strip areas in road right-of-way must be landscaped with at least twenty-five percent (25), by area, of live vegetation.

B. Xeriscape landscaping must be approved by City's Representative.

C. Planter strips shall not be filled with concrete or other hard surfaces.

D. Special drainage requirements may be imposed by City's Representative to protect pavement and curb and gutter from damage due to irrigation of planter strips.

3.2.4.9 Design Speed

A. The design of geometric features such as horizontal and vertical alignment will depend on the design speed selected for each street. The design speed is primarily determined by the street function and classification, and is the maximum speed for safe and comfortable operation of a vehicle. The use of design speeds other than those listed below must be approved by the City representative who may decide that the speed provided in this sub-section be changed to that which is reasonable and prudent under the conditions and having due regard to the actual and potential hazards.

TABLE 3.3
DESIGN SPEED

Classification	Design
Residential Access - A	25
Residential Access - B	25
Residential Standard	25
Collector	35
Arterial	45
Commercial Local	30
Industrial Local	35

* Variance of design speeds on residential collectors or higher order roads may be granted by the City representative to no greater (or less) than five MPH increments when conditions warrant. Variances will not be granted for short segments of roads, but for entire contiguous stretches so that consistency and driver expectancy are maintained, which will be reviewed on a case-by-case basis with approved design criteria.

3.2.4.10 Clear Sight Distance at Intersections

A. At intersections adequate clear sight distance should be provided to permit drivers entering the higher order street from a driveway or STOP-controlled intersection to see approaching traffic from a long enough distance to allow them to decide when to safely enter the higher order street and complete their turning maneuvers in advance of approaching traffic. Clear sight distance, for both left and right turning vehicles, should be in accordance with AASHTO guidelines and generally as follows:

TABLE 3.4
SIGHT DISTANCE AT INTERSECTIONS

Through Street Design Speed	Sight* Distance
25	290
30	375
35	465
40	575
45	710
50	840
55	980

*Sight distances should be adjusted with cross road grades.

3.2.4.11 Vertical Alignment

A. Vertical curves shall be provided in all changes in grade where the algebraic difference is greater than one (1).

B. Longitudinal street grades shall not be less than 0.75 percent unless adequate alternative street drainage is provided, nor more than fifteen percent, unless specifically approved by the City representative.

C. Vertical curve stopping sight distance design shall utilize criteria recommended by the latest edition of AASHTO. K-values shall be noted on all design drawings.

D. Minimum cross slope from street crown shall be two percent and the maximum four percent unless otherwise approved by the City representative.

E. Vertical alignment with the intersection is also of special nature, and design alternatives may be required. As a guideline, the approach area where vehicles stop while waiting to enter an intersection should not exceed five (5) percent from the gutter line of the street being intersected for a distance of fifty (50) feet, though a range of fifty (50) to one hundred (100) feet is more desirable. This applies to all intersections, except those where both intersecting streets are minor or major collectors. In this situation, the landing area for a residential and major collector which is controlled by a STOP or YIELD sign should be designed for a grade of three percent for a distance of one hundred feet. Any other major intersection streets shall be approved by the City representative.

3.2.4.12 Safe Stopping Sight Distance

A. The minimum sight distance (length of roadway visible to the driver) to be provided for through traffic traveling at, or near, the design speed to stop before reaching a object in its path shall comply with the requirements set forth below (AASHTO guidelines):

TABLE 3.5
SAFE STOPPING SIGHT DISTANCE

Design Speed	Required Distance
25	150
30	200
35	250
40	325
45	400
50	475
55	550

3.2.4.13 Horizontal Curves

A. The recommended minimum centerline radius for horizontal curves are outlined below.

TABLE 3.6
HORIZONTAL CURVES

Design Speed	Curve Radius in Feet
25 MPH	185*
30 MPH	310
35 MPH	419
40 MPH	628
45 MPH	730
50 MPH	926

* For residential streets use 150.

3.2.4.14 Superelevation

A. Generally, superelevation shall not be used on urban roads with design speeds less than thirty five miles per hour unless otherwise approved by the City representative.

B. Maximum superelevation for urban roads shall be four percent unless otherwise approved by the City representative.

C. The use of superelevation shall require prior approval from the City representative.

3.2.4.15 Deceleration Lanes

A. Deceleration lanes may be required on streets in conjunction with driveways and/or intersections adjacent to a proposed development. They are specifically required when all of the following factors are determined to apply:

B. 5,000 vehicles per day are using or are projected to use the street;

C. The 85th percentile traffic speed on the street is thirty-five miles per hour or greater; or forty miles per hour for a two lane (one lane each direction) roadway; and

D. Fifty vehicles or more making right turns into the driveway or street during a one-hour peak period.

The lane lengths for a deceleration lane shall be determined on a case-by-case basis and must receive prior approval of the City representative. In addition to the above guidelines, deceleration lanes may be required in connection with the results of a Traffic Impact Study or by the City representative.

3.2.4.16 Driveway Profiles

The slope of a driveway can dramatically influence its operation. Usage by large vehicles can have a tremendous effect on operations if slopes are severe. The profile, or grade, of a driveway should be designed to provide a comfortable and safe transition for those using the facility, and to accommodate the storm water drainage system of the roadway.

Suggested treatments of driveway grades are illustrated below. While 8 percent should be the maximum allowable initial grade (G1), maximum grades of 1 to 3 percent are preferable for high-volume driveways and 3 to 6 percent for low-volume driveways.

TABLE 3.7

Driveway Type and Adjacent Street Classification	**Maximum Range for G2 (Departure Grade)**
Low Volume Driveway** on Local Street	-8% to 14%
Low Volume Driveway** on Collector Street	-4% to 8%
Low Volume Drive** on Arterial Street	-1% to 5%
High Volume Driveway*** on Any Street	-1% to 5%
* The preferable grade of G1 is 3% to 6% for low volume driveways and 1% to 3% for high volume driveways. ** Low Volume Driveway - defined as a driveway with less than 100 vehicles in the peak hour in the peak direction. *** High Volume Driveway - defined as a driveway with more than 100 vehicles in the peak hour in the peak direction.	
Maximum suggested change in Grade: Initial Grade Minus Departure Grade = 12% for any 10 feet of distance without a vertical curve.	

3.2.4.17 Alignment and Continuity - Off-Site

A. Normally, off-site pavement construction requires asphalt concrete paving to the right-of-way centerline and in some cases beyond. When asphalt pavement is existing, the developer's engineer shall submit to the City representative sufficient information prepared by the Engineer to indicate vertical and horizontal alignments are maintained and adequate drainage is provided for. The developer may be required to replace all, or any portion of existing roadway, in a manner that two-way traffic can be maintained without the use of potentially hazardous alignment transitions (vertical or horizontal) and in a manner to ensure that adequate drainage is provided for. As a minimum, there shall be twenty eight feet of paving to accommodate through traffic. Required parking and shoulders are not included in the 28 feet.

When off-site pavement construction consists of improvement to the right-of-way centerline (approximately), leading and trailing transition tapers shall be placed at each end of the improvements. Horizontal transition tapers shall be designed and constructed off site based upon the roadway speed and in accordance with the taper requirements in the MUTCD and applicable AASHTO guidelines unless otherwise approved by the City representative.

B. When paving for partial street construction, the edges of the pavement are to be protected by placing a minimum two feet of aggregate base material beyond the edge of pavement matching the pavement grade.

C. Wherever partial street construction is required, grades shall be set for the future curb line and approved by the City's Representative. The future grades shall be compatible with the curb and centerline grades for the partial street construction. It shall be required to design the roadway for a minimum of two hundred (200) feet to as much as one thousand (1000) feet beyond the development to ensure a future match.

D. Where a street abruptly ends or transitions, proper signage according to the MUTCD shall be required. Safe transitions into existing elevations shall be required where new roads transition into existing surfaces, i.e. gravel or natural surface.

3.2.5 PAVEMENT STRUCTURAL DESIGN

The structural details shown on the standard drawings are minimum requirements. The actual structural section for each roadway shall be designed by accepted Engineering design methods for flexible pavement (i.e. AASHTO**,** UDOT or CALTRANS). Required subgrade soil properties shall be obtained from an on-site geotechnical investigation. Required traffic information for design shall be approved by the City representative.

The geotechnical investigation shall be conducted by the Geotechnical Engineer. The investigation shall include a thorough exploration and sampling program of the subgrade to determine the nature and engineering properties of the on-site soils within the roadway construction area. For new construction and reconstruction projects, the minimum sampling and testing requirements are as follows.

- Excavate test holes to a minimum depth of ten feet below finished grade and street. There shall be holes for 300 feet of roadway, or as approved by City Representative.

- Calculate "R" values using AASHTO T 190-93 or ASTM D2844-69 (1975) using exudation pressure of 300 PSI corrected to 2.50 inches specimen. Calculate "CBR" values using AASHTO T 193-93 three point using T 180 (Method D) for mold compaction with exceptions as listed in 5.1.1 through 5.1.3 of Test Method T193-93.

- Minimum Testing Frequency for "R" or "CBR" values shall be as follows: Two tests with at least one test per significant soil type for roadway lengths of one foot to one thousand feet.

- Three tests with at least one test per significant soil type for roadway lengths of one thousand feet to five thousand feet.

- Four tests with at least one test per significant soil type for roadway lengths of five thousand feet to sixteen thousand feet.

- Two tests per five thousand feet of roadway with at least one per significant soil type for any roadway over sixteen thousand feet.

- Conduct sieve analysis using either AASHTO T27-91 or ASTM C136-95. Conduct a sand equivalent test to determine the presence or absence of plastic fine material using either AASHTO T176-86(1993) 4.3.2 alternate method No. 2, pre-wet 4.3.3 mechanical shaker or ASTM D2419-91 9.4.2 Procedure B, 11.6.1 mechanical shaker. Either method shall use distilled or demineralized water for the working solution. One test for each stratum of each test hole.

- Calculate density in place using the drive-cylinder method ASTM D2937-83 or nuclear method ASTM D2922-93.

- Two tests per test hole.

- Calculate resistivity and pH using test methods AASHTO T-288-91 and AASHTO T-289-91.

- One test for each corrugated metal pipe culvert location.

- Expansion index of soils shall be determined using the ASTM D4829-88 test method. This test shall be conducted whenever potentially expansive soils are encountered in a test hole.

  The above schedule represents minimum sampling and testing requirements. The Registered Professional Engineer responsible for directing and controlling the geotechnical investigation shall analyze each project to determine actual sample locations, frequency and testing program beyond the minimums given above.

  The above testing and design requirements may be waived by the City's Representative providing a prior development has already performed the above testing, design and construction on the first half of the roadway in the same location. In this case the new development shall match the existing roadway section.

3.2.6 CURB SIDE MAIL BOXES. All roadside mail boxes should be installed in accordance with applicable postal standards in the following locations: In areas where the sidewalk is next to the curb, install boxes behind the sidewalk so as to not encroach into the sidewalk; in areas where a planter strip is provided, mail boxes may be installed within the strip, provided no part extends into the sidewalk or beyond the back of the curb; in rural areas where no barrier curb is installed, a minimum clear zone of ten feet from the traveled way must be provided.

3.2.7 SIGNS AND PAVEMENT MARKINGS. All street name and traffic control signs and pavement markings required on the street system within a development or as a result of the development, shall be installed at the developer's expense in accordance with the standard drawings and MUTCD standards. A signing plan should be submitted with the engineering drawings; however, additional signing and traffic control may be added to the project as determined by the City's Representative.

3.2.8 UNDERGROUND WATER. When underground water in or adjacent to the site is encountered by geotechnical investigation or during the construction work, the City's Representative and the Project Engineer shall be notified immediately. The Project Engineer shall cause the necessary studies to be made and the required mitigation work to be installed.

3.3 SOIL STUDY GUIDELINES. The construction of all improvements is subject to the recommendations of a soils investigation report. This information shall be submitted at the same time improvement plans are submitted to the City representative. The findings contained in the soils report shall be used as the basis for the design and

construction of the project improvements unless otherwise directed by the City's Representative.

The soils investigation shall be conducted by a Geotechnical Engineer. The report shall be sufficiently comprehensive to determine the location and nature of all soils within the project construction area.

3.3.1 GEOTECHNICAL REPORT. The Geotechnical Report required by the Santa Clara City Subdivision Ordinance, (Chapter 16.20.040) and the Zoning Ordinance, (Chapter 17.48.010) shall be prepared by a Utah Professional Engineer. A Geotechnical Report shall be required for all commercial and industrial projects, and all residential lots and subdivisions. In addition to the requirements set forth in Chapter 18 of the 2000 International Building Code, the report shall include, but need not be limited to, the following information:

A. A site plan(s) showing the general site vicinity, the project boundary clearly identified, the location of any existing or proposed structures within the site, and the location of exploration test pits and/or borings.

B. A general description of the topography, drainage conditions, vegetation, surface features such as rock outcrops, existing structures, debris, and unstable or wet surface conditions.

C. A description of the proposed structure(s) and improvements to be constructed on the site, as well as anticipated structural loads.

D. Continuous logs of all test pits/borings. Soil classification shall be by the Unified Soil Classification System. Elevations, when possible, shall be shown on the tops of explorations on the same elevation datum as the project improvement plans. Elevation and depth of groundwater, if encountered, shall be shown. A description of the exploration and sampling methodology shall be provided.

The minimum exploration requirements are as follows:

D.1 For single lot projects, a minimum of 1 (one) test pit/boring shall be provided. Additional test pits/borings shall be provided for larger projects at the discretion of the City Building Official.

D.2 For subdivisions, a minimum of 1 (one) test pit/boring on each proposed lot, and 1 (one) test pit/boring per 300 lineal feet of public street proposed for construction.

D.3 For proposed planned unit developments, a minimum of 1 (one) test pit/boring per one half (1/2) acre of total area within the planned development not designated as open space areas, and 1 (one) test

pit/boring per 300 lineal feet of public street proposed for construction.

D.4 For street improvement projects, a minimum of 1 (one) test pit/boring per 300 lineal feet of public street proposed for construction shall be provided.

D.5 Exploration depths shall be a minimum of 15 feet below the proposed lowest floor elevation, including basements, in building areas and 10 feet below the finish street grade elevation in public street areas.

D.6 In areas where highly expansive soil of encountered have known to exist, soils investigations shall be based upon a minimum of 3 test pits/borings, with at least 1 test pit/boring on each lot. A highly expansive soil consists of a soil/rock that expands/swells a minimum of 8 percent (under a 60 psf surcharge) with the addition of water. Each exploration shall extend 3' minimum into the expansive soil layer, or 20' minimum total depth, which ever is less.

E. An evaluation of the site for the presence of potential geologic hazards such as expansive soils, compressible/collapsible soils, gypsiferous (soluble) soils, uncontrolled fills, shallow groundwater, and stability of slopes. The extent of any geological hazards identified on the site shall be mapped.

F. An evaluation of possible impacts of the proposed development on adjoining properties, and any mitigating measures that should be undertaken. Some impacts to be considered are: (a) extensive cuts and fills and associated slope stability; (b) surface drainage; and (c) the addition of subsurface water in sensitive soil areas.

G. Laboratory test results. Laboratory testing shall be conducted, according to American Society for Testing Materials, (ASTM) Standards, to evaluate the nature and engineering properties of the subgrade soils.

H. Conclusions and recommendations which shall contain, but not be limited to, the following information:

H.1 Site preparation and grading requirements, including the suitability of on-site soils for use as fill material, fill placement procedures, and compaction requirements, etc.

H.2 Geotechnical design considerations for drainage structures and/or erosion control, if applicable.

H.3 Procedures for mitigation of any potential geological hazard, such as

special foundation systems (in accordance with Ordinance No. 96-25), groundwater control, and any special grading recommendations such as over excavation and re-compaction, etc.

H.4 For design recommendations involving expansive soils, the soils engineer shall use a wet depth model based upon actual expected wetting conditions with a minimum depth of 3 feet. Any swell potential found is to be listed in total inches, and is to be defined with respect to an expected loaded condition of the structure to be constructed (i.e, not necessarily tested to the actual loads, but listed as an expected swell movement for expected load condition.)

H.5 Suitable foundation types, with allowable bearing pressures and estimated settlements.

H.6 Slope stability calculations shall be included as part of the report where cut/fill or natural slopes exceed 20 feet in height. Calculations shall use a recognized analysis method and show minimum factors of safety consistent with professional practice.

H.7 Design recommendations for street improvement areas, which shall include preliminary pavement design recommendations, sub-grade preparation, suitability of the on-site soils for use as pipe bedding, pipe zone, and general backfill materials, and trench excavation and stability.

I. A separate and final pavement design investigation shall be conducted prior to construction, after street locations and grades are established and the improvement plans prepared. The structural details shown on the standard drawings are minimum requirements. The actual structural section for each roadway shall be obtained from field sampling and laboratory testing. Required traffic information for design shall be approved by the City Engineer.

J. The Geotechnical Report shall list required inspections, observations, and tests necessary during construction.

3.4 DRAINAGE AND FLOOD CONTROL DESIGN. This sub-section sets forth the criteria for engineering design of drainage and flood control systems.

3.4.1 GENERAL REQUIREMENTS. All development in the City that requires a grading permit or exceeds one acre in area, and all commercial development, shall submit a Drainage Control Plan and Report.

Design of drainage systems associated with development cannot cause increases in the existing flood peak discharges downstream of the development

for 2 year,10-year, and 100-year events.

All drainage plans shall conform to the requirements set forth in this section and be approved by the Santa Clara City representative or his designee.

Drainage and flood control plans shall be designed to conform to the City Flood Control Master Plan.

Drainage facilities shall be designed using currently accepted civil engineering standards of practice, applicable safety standards, and City or other approved design specifications.

In general, each development should handle its storm water runoff in such a manner that no increase in the 2, 10, or 100-year peak storm runoff above the pre-development and/or natural state will occur on downstream properties.

In general, development changes the characteristics of drainage from sheet flow to point discharge flow. While the flow rate of water may be controlled, the effects of all point discharges must be handled to insure no detrimental effects downstream of development.

Drainage facilities should be analysed, designed, and constructed to protect the development from the 100-year peak storm runoff. Most drainage collection system capacities for new development shall be sized for a minimum of the 10-year flood event, but no significant damage or risk of personal injury may occur from the 100-year flood event. Major hydraulic structures (including bridges, large culverts, and open channels) will be designed for the 100-year flood event.

For analysis purposes of the drainage system of a drainage basin area, all of the drainage basin upstream of the proposed development should be analysed for the conditions of new and/or planned development in conformance with the City's current Land Use Master Plan. Effects on downstream property owners and the downstream flood control system shall be considered in the design and any negative impacts mitigated or design changes presented to mitigate problems to the satisfaction of the Santa Clara City representative or his designee. This may include acquisition of easements or agreements and/or construction or modification of existing improvements where needed both within the development and/or downstream. All storm drainage and flood control systems shall be separate and independent from the sanitary sewer system.

Development of any kind should not cause a natural drainage channel to be filled in, obstructed, or diverted. When modifications to a natural drainage channel are proposed within the development, such changes will be addressed in the Drainage Control Plan and Report and shown on the improvement plans, and must be approved by the Santa Clara City representative prior to proceeding. In the event that modifications to natural drainage channels are approved,

necessary easements and rights-of-way for structures and improvements shall be provided to the City.

The point where the natural drainage channel(s) of a drainage basin enters and leaves a property owner's property will not be changed without approval of the City representative.

Improvements designed to protect a development shall be considered permanent and shall be designed and constructed accordingly. Such improvements shall be maintained by the property owner or the agreed upon maintaining agency.

Development shall provide the necessary means to insure drainage within the property being developed makes use of existing facilities and/or natural washes and shall be required to construct appropriate Flood Control Master Plan improvements that meet City design standards and proper flood control requirements.

3.4.2 DESIGN CRITERIA - STREETS. Streets are a significant and important component in urban drainage and may be made use of in storm water runoff within reasonable limits. The primary purpose of streets is for traffic. Reasonable limits for the use of streets as conveyance for storm water runoff shall be set by the Santa Clara City representative. Design criteria for gutter capacity and associated lane encroachment will depend on the roadway type as shown in the table below (Table 3.8). Street designs must include surface drainage relief points (inlets). This is especially important for flat gradient areas, local sumps or depressions and cul-de-sacs. For pedestrian safety, street flows must be limited such that the product of the depth (ft.) and velocity (ft./sec.) does not exceed six (6) for the 10 year flood event and eight (8) for the 100-year flood event. Curb overtopping is not permitted for the 10 year flood event. When street encroachment limits are exceeded as indicated in table 3.8, an underground storm sewer system shall be required. Where this underground conveyance is required to limit street flows, it will be designed to handle at least the 10-year flood event.

TABLE 3.8

Street and Gutter Capacity for the *10 year* Event	
Street Classification	Maximum encroachment
Local (residential)	No curb overtopping. Flow may spread to crown of street.
Major Collector	No curb overtopping. Flow must leave at least two lanes of travel free. (One lane in each direction)
Arterial	No Curb overtopping. All travel lanes to remain open.

Streets must also provide for routing of the 100-year flood event to adequate downstream conveyance facilities. The 100-year flood event should be contained within the street right-of-way and any adjacent drainage easements.

3.4.3 DESIGN CRITERIA - STORM DRAINS. Storm drain design conveyance capacity will be sized for a minimum of the 10-year, three hour flood event. The 100-year, three hour flood event will be used for evaluation and prevention of significant damage which may result from street overflow. Inlets must have sufficient capacity to prevent local ponding from the 10-year flood event, with fifty (50) percent blockage of inlets by debris. Analysis of combined street and storm drain capacity for the 100-year flood event will be used to determine maximum ponding depths and water levels and demonstrate that these depths are non-damaging. In instances where sufficient combined capacity does not exist the storm drain size may have to be increased beyond that of the 10 year flood event.

In areas where underground water may infiltrate into the storm sewer system the pipe size should be increased accordingly. In general, ground water will not be allowed to flow to the surface and collected in streets, gutters or in any other surface flow situation that allows flow into street gutters or street right-of-way.

Design of curb inlets can allow for differences in interception capacity of inlets on a positive gradient as compared to interception capacity of inlets in sag locations. Inlet spacing and location of inlets will be designed for continuous positive grades or sag situations as appropriate. Inlets will be spaced so as to keep the street encroachment within the limits set in Table 3.8 for the 10-year flood event and those indicated in this document for the 100-year flood event. Sag points may be required to have additional inlets spaced to control the maximum level of ponding that will be allowed to occur around the sag/inlet area.

All storm drains will be designed by application of the Manning equation. Minimum design velocity shall be 2.0 ft/sec. for the storm drain pipe when flowing one-half full. The Manning's "n" value shall represent that value that will be expected during the main portion of the useful life of the pipe which may differ from that of a new pipe. The hydraulic grade line and/or water surface elevation profile will be shown for all pipe systems. The minimum storm drain diameter shall be 12-inches for smooth wall (inside of pipe) and 15-inches otherwise.

Storm drains shall not be designed for surcharged (pressure) pipe conditions unless otherwise approved by the Santa Clara City representative. When storm drains are designed for full pipe flow, or surcharged pipe conditions, the designer shall establish the hydraulic grade line considering head losses caused by flow resistance in the pipe, and changes of momentum and obstructions to flow at junctions, bends and structures. The water surface elevation profile and hydraulic grade line will be shown for the 10-year flood event and the 100-year flood event as required in the Drainage Control Plan and Report.

3.4.4 DESIGN CRITERIA - CULVERTS. In general, culverts are used to carry runoff from an open channel or ditch under a roadway to a receiving open channel or ditch. The minimum culvert diameter shall be 24-inches. All culvert crossings under a roadway shall be designed to handle the 100 year flood event (see bridges). All culvert crossings under arterial roads shall not have any road overtopping. Any other road overtopping shall be limited by the velocity/depth product and as detailed in Section 3.4.2.

A culvert entrance blockage factor of up to fifty percent should be used for small diameter culverts (< 60 inches) and culverts placed in drainages with upstream debris (the City representative or his designee must be consulted on each of these cases before final design). The 100-year flood event backwater surface profile upstream of the culvert will be determined using Santa Clara City approved method (i.e. HEC-2 or HEC-RAS) unless otherwise not required by the City. The back water must be shown to be non-damaging and be approved by the affected property owner(s). Potential paths of embankment overtopping flows will be determined and redesigned to mitigate or eliminate the potential problem, so that no significant flood damage occurs. Appropriate entrance and exit structures must be installed to minimize erosion and maintenance. The minimum culvert slope shall be 1 percent unless otherwise approved by the City representative or his designee.

3.4.5 DESIGN CRITERIA - BRIDGES. Bridges consist of major structures carrying water from major washes or drainage areas. The roadway facility handled can be any classification of roadway. Low water crossings are generally not permitted. Bridges can consist of free span structures, box culvert, multiple box culverts, multiple precast bridge sections and others.

Free-span bridges must pass the100-year flood event with a minimum of two feet of freeboard. No significant increases are allowed in upstream water levels (no upstream property damage or overtopping of embankments). A Santa Clara City approved method (i.e. HEC-2 or HEC-RAS) of analyzing for the potential upstream water surface may be required by the City. A scour analysis will be required on all bridges that encroach on the natural watercourse. The analysis will discuss the problems associated with scour around and upstream and downstream of the bridge and any mitigation that may be required.

For structures crossing FEMA designated flood plains and drainage, other state and/or federal requirements may be required, please consult the Santa Clara City representative or his designee.

3.4.6 DESIGN CRITERIA - CHANNELS

3.4.6.1. OPEN CHANNELS. There are two types of open channels; they are manmade and natural. Natural channels can be further subdivided into several sub-categories such as un-encroached, encroached, partially encroached, bank lined and others. The100-year flood event will be used for the design of all open channels unless otherwise approved by the City representative or his designee. All open channels must be designed as permanent structures and have a minimum freeboard of one (1) foot at all points, including bends. They must be designed to be low maintenance facilities and must have adequate access for their entire length.

3.4.6.2. MAN-MADE CHANNELS. Man-made channel side slopes will generally be limited to a maximum slope of 3H:1V. Flatter slopes are generally recommended for maintenance and safety reasons. Safety is a primary concern. A channel should be designed such that a person falling into it could climb out within a reasonable length. A channel that is shallow in depth or in remote areas, or in areas of restricted right of way may, upon approval, have steeper side slopes. Maximum velocities will depend on the type of material used for the channel lining. Supercritical velocities are not permitted for any material used. Drop structures and other energy dissipating structures may be required to limit velocities to control erosion and head cutting.

Maximum velocities for turf lined channels depend on the type(s) of turf mixture used. The designer should consult appropriate design literature for design details on turf lined channels. The minimum bottom width of a turf lined channel will be 6 feet unless otherwise approved by the maintenance agency. The minimum bottom width of all man-made channels shall be designed to facilitate access and maintenance.

3.4.6.3 NATURAL CHANNEL. The use and preservation of natural drainage ways shall be encouraged. Natural channels for drainage conveyance can reduce long term maintenance costs, can reduce initial costs associated with drainage, and can enhance passive recreation, and open space uses. When natural channels are incorporated into the drainage control plan, consideration shall be given to the impact of increased flows resulting from improvements (i.e. new housing developments, commercial and industrial developments, etc.) to upstream drainage basins and areas. The development or land use must provide for adequate access for maintenance and debris removal, long term degradation and erosion potential, and the need for additional set-backs for structures.

3.4.7 DESIGN CRITERIA - STORAGE FACILITIES. Generally, there are two types of storm water runoff storage: retention and detention. Retention ponds are normally intended for infiltration of stored runoff water and may require

extensive subsoil and groundwater studies as part of the design. The retention pond will require a higher level of maintenance and has additional safety concerns associated with it and will generally not be allowed.

Detention facilities (basins) are used to temporarily store runoff and reduce the peak discharge by allowing flow to be discharged at a controlled rate. The controlled discharge rate is based on either down stream channel carrying capacity, or the pre-development storm water runoff amount, or in some instances both.

Regional detention facilities are those identified by the City and will be identified in the Master Storm Drain Study and other regional drainage studies. Generally, these facilities control flow on major washes or drainage basins, are of major proportion, and are built as part of major development or mitigation plans.

Local detention facilities are usually designed by and financed by developers or local property owners desiring to improve their property. These facilities are intended to allow development of property by protecting a site from existing flooding and/or to protect downstream property from increased runoff caused by development. In small facilities, detention storage volume may be provided in small landscaped or turfed basins, parking lots, underground vaults, excess open space, or a suitable combination. In larger facilities, dual functions may be served. These larger facilities are required to reduce existing flooding to allow a development and/or control increased runoff caused by the development itself. These larger facilities may store significant flood volumes and may handle both off-site and on-site flows.

3.4.7.1 DESIGN CRITERIA - Detention facilities will generally be used to prevent local increases in the 10-year, seventy two hour and the 100-year, seventy-two hour peak flows, or the 100-year three hour storm, whichever case requires the largest volume. Post-development discharges must not exceed pre-development discharges. If downstream facilities lack adequate capacity to handle the flow, other release rates can be required by the City.

Standard hydrologic analysis and engineering practice shall be used in determining the volume of the required facilities. A minimum of one (1) foot of freeboard is required above the maximum water surface elevation of a retention or detention pond. Emergency spillways or other overflow structures will be incorporated into all designs. Structures and facilities shall be designed so as not to be damaged in case of emergency overflow. Detention basins must empty within 24 hours. The maximum depth of a detention basin should be 3 feet unless otherwise approved by the Santa Clara City representative or his designee. Below grade basins are preferred. Partially wet basins may be allowed for recreational or aesthetic purposes, but storage below permanent spillways or low-level outlets cannot

be included in control calculations. Ground water should not be introduced into detention basins without approval of the City. Multi-use (e.g. recreation) should be considered for all detention basins.

Energy dissipation and erosion protection is required at all outlet structures where storm water runoff is released into a natural or erodible channel, unless otherwise approved by the Santa Clara City representative or his designee. All basins are required to function properly under debris and sedimentation conditions. Adequate access must be provided to allow for cleaning and maintenance. All basins shall be designed as permanent facilities unless otherwise approved in writing by the City.

3.4.8 FLOODPLAINS. Flood plains are generally classified as FEMA (Federal Emergency Management Agency) and non-FEMA. Any work in and around FEMA designated and mapped Flood plains should refer to the local ordinance governing their use. All work in the FEMA floodplain requires an Flood Plain Development Permit.

In general, all building floor levels should be constructed two feet above the 100-year flood water level. Encroachments into the 100-year flood plain for all natural watercourses will not be permitted unless approved by the City. All natural drainage washes, and waterways that convey a developed 100-year flow of greater that 150 cfs will be left open unless otherwise approved. Developments located adjacent to or in flood plains may be required to stabilize the degradation and erosion of the channel by installing grade control structures and/or by other effective means. Any alteration of the flood plain is not permitted unless the proposed use can be shown to have no significant negative influence on the flood conveyance, the flood plain water level, or the alteration itself.

In the layout and design of new developments, adequate access to flood plains and erosion protection shall be provided. It is preferred that streets be positioned between flood plains and development structures. Where not possible or feasible, additional structural setbacks will be required.

Hydrologic, hydraulic, erosion, and geomorphologic studies will be required of developments adjacent to Flood plains. The City may require the placement of Flood plain or Flood way delineation signs along the boundary of lots impacted by the Flood plain or Flood way to assist in future monitoring of the Flood plain or Flood way.

3.4.9 EROSION CONTROL. Necessary measures shall be taken to prevent erosion due to drainage at all points in new developments. During grading and construction, the developer shall control all potential storm runoff so that eroded soil and debris cannot enter any downstream water course or adjoining property. All drainage that leaves a new development shall be adequately addressed to mitigate all erosion on adjacent properties and any increased flow due to

development. Erosion mitigation shall be a permanent part of the final development plans unless otherwise approved.

3.4.10 IRRIGATION DITCHES. In general, irrigation ditches shall not be used as outfall points for storm runoff drainage systems, unless such use is shown to not affect the performance of the ditch for its original intended use when substantiated by adequate hydraulic engineering analysis.

3.4.10.1 USE OF DITCHES - The irrigation ditches running through the area are laid out on very flat slopes and with limited carrying capacity. It is obvious, based on experience and hydraulic calculations, that irrigation ditches cannot, as a general rule, be used as an outfall point for storm water drainage because of physical limitations. Exceptions to the rule are when the capacity of the irrigation ditch is adequate to carry the normal ditch flow plus the maximum storm water runoff with adequate freeboard to obviate creating a hazard to those below and around the ditch. Ditches are almost always totally inadequate for use as drainage ways.

Irrigation ditches are sometimes abandoned in areas after the agricultural land is no longer farmed. Provisions must be made for ditch perpetuation prior to its being chosen and used as an outfall for storm water drainage. Use of irrigation ditches for collection and transportation of storm water runoff shall be made only when approved by the Santa Clara City representatives or his designee.

3.4.10.2 Irrigation Company Approval. Any use of, alteration of, or relocation of structures on any irrigation ditch (or canal) shall have the written approval of the irrigation company who shall take the responsibility thereof.

3.4.11 WATER QUALITY CONTROL - Storm water may be considered a non-point source of pollution. It can carry materials that may cause unwanted physical, chemical, and biological changes in receiving waters (i.e., Santa Clara River). As such, a development should construct storm water facilities to control pollutant concentrations and mass loadings discharged into receiving water systems. Some water quality parameters resulting from material transported in storm water that are of concern are sediments, hydrocarbons and oils, oxygen demand, bacteria, nutrients (carbon, nitrogen and phosphorus), metals and other toxic chemicals. Receiving waters can assimilate only a limited quantity of different storm water materials. After a threshold is reached, the material becomes a pollutant that can result in an undesirable impact on the receiving water.

Federal and state regulations may limit pollutant concentration and mass loading to receiving waters from non-point sources. Technical considerations in design should be given to prevention or reductions of non-point sources of pollution by

developments. Consideration should be given to the use of storm water management systems within developments that will reduce non-point sources of pollution such as off-line retention (infiltration) ponds, sedimentation ponds, wetlands that pass storm water through them, and reuse ponds. A goal for development should be to provide a storm water system that will have post-land-use mass loadings that are equivalent or less than pre-land-use mass loadings.

3.5 SANITARY SEWER DESIGN. This sub-section sets forth the criteria for engineering design of wastewater collection systems. All wastewater lines shall be designed to be located in roadways or other vehicle travel ways unless approved by the City Representative.

Minor additions, renovations and repairs to an existing sewer or plumbing system shall be
permitted in the same manner and arrangement as in the existing system, provided that such repairs or replacements are not hazardous and are approved by inspection. All sewer main lines installed in public or private streets shall be inspected in accordance with these Standard Specifications for Design and Construction. These lines are public lines unless otherwise approved by the City Representative.

3.5.1 DESIGN FLOWS. All sanitary sewers and appurtenances shall be designed to carry the design flows from all contiguous areas which may, within a reasonable period in the future, be tributary thereto. Trunk lines shall be designed in accordance with the system master plan.

Sanitary sewers shall be designed to carry the peak discharge as specified below; also, all sewers shall be designed to transport suspended material so as to preclude the deposition of any solids in the sewer line.

New sewer systems shall be designed on the basis of an average daily per capita flow of not less than one hundred gallons per day. Other flow rates, based on accepted engineering practice, may be submitted to City's Representative for review and/or approval. Sanitary sewer systems shall be designed to prohibit infiltration and exfiltration. To provide for peak loads, sanitary sewers shall be designed to carry not less than the flow shown in Table 3.9 when running 2/3 full.

TABLE 3.9
SANITARY SEWER DESIGN FLOWS

Laterals and sub mains gallons/capita/day	400
Mains, trunks and outfalls gallons/capita/day	250

All sewers shall be designed and constructed with hydraulic slopes sufficient to give mean velocities (when flowing one half full) of not less than two feet per second, based on Manning's formula. As a minimum, Manning's "n" value shall

be in accordance with pipe manufacturer's recommendation. An "n" value which will yield higher friction losses shall be used where disturbing influences are known or anticipated, such as disruption of flow by tributary inflows, varied pipe materials, etc. The minimum slopes to be provided shall be as shown in Table 3.10, unless approved otherwise by the City representative.

TABLE 3.10
SANITARY SEWER MINIMUM SLOPES

SEWER SIZE (Inches)	MINIMUM SLOPE (ft/100 feet)
4	2.00
6	1.00
8	0.50
10	0.40
12	0.35
15	0.30
18	0.25
21	0.20
24	0.15

Under special conditions, when justifiable reasons are given, slopes slightly less than those required for the two feet per second velocity when flowing one half full may be permitted. Such decreased slopes will only be considered where the depth of flow will be 0.3 of the diameter or greater for the design average flows, and where computations of the depth of flow in such pipes at minimum, average and peak rates of flow are submitted showing the basis of design. The Design Engineer must furnish computations for velocities and depth of flow for grades in excess of ten percent (10%) and for extremely low flow situations.

Hydraulic jumps shall be avoided whenever possible. Where velocities greater than fifteen feet per second are attained, special provision shall be made to protect against displacement by erosion and shock.

3.5.2 MINIMUM SIZE AND DEPTH. No public sanitary sewer shall be less than eight inches in diameter except as otherwise permitted in this sub-section. Minimum size of house connections shall be four inches in diameter. Minimum size of commercial connections shall be six inches in diameter. Only one residence, structure, or building shall be served by each lateral connected to the public main (Uniform Plumbing Code, Chapter 3).

The design and installation of six inch sewer mains not exceeding two hundred feet in length may be permitted for terminal sewers in cul-de-sacs and dead end or private streets in subdivisions. The equivalent flow shall not exceed that of 15 residential units. Manholes shall be required at the terminal end of these six inch mains.

Lateral size and slope shall be based on the number of fixture units. Up to ninety (90) fixture units may be allowed per four inch lateral line if the slope and

capacity are adequate. Each lateral connected to the public main shall serve only one residence, structure, or building. No connection of any sewer lateral to buildings or structures will be allowed until all downstream sewer lines have been tested and passed and all associated manholes have been raised and collared at asphalt grade.

In general, sanitary sewers shall be designed to a minimum depth of nine feet to the pipe invert in order to facilitate basements. Depth of pipe shall be measured from top of back of curb at low side of property to be served, in order to permit sewer laterals from basements to be connected. Exceptions may be granted in subdivisions or areas in which houses without basements are to be constructed. In such case a note to that effect shall be made on the plat map and on all plans presented for approval. In no case shall sanitary sewers be designed for a depth of cover less than thirty six inches over the top of the sewer pipe. All sewers shall be designed to prevent damage from super-imposed loads as well as trench loading conditions. When more shallow depths are unavoidable, consideration for approval may be given upon submittal of proper engineering design criteria to the City representative.

3.5.3 ALIGNMENT. All sanitary sewer mains shall be designed for uniform slope and alignment between manholes and shall be laid a distance of at least ten feet (horizontally) from any existing or proposed water main. In the event that a sewer main cannot be laid at least ten feet from an existing or proposed water main, then the City's Representative may authorize the implementation of the provisions of the appropriate section of the State of Utah Public Drinking Water Regulations.

All sewer laterals shall intersect the sewer main on the top third of the sewer main pipe as shown in the standard drawings.

3.5.4 SERVICE CONNECTIONS. Service connections to any public sanitary sewer shall be made only to a wye installed at the time of the sewer main installation or by a machine tap and approved saddle compatible with the main line sewer material in accordance with the standard drawings. Service connections shall be a minimum of ten (10) feet, measured horizontally, from any culinary water line. All connections and service lines must be water tight. All sewer clean-outs shall be made with standard wye fittings. New subdivisions shall install a sewer lateral from the main sewer to each proposed lot. The lateral shall be located fifteen feet from the low side lot line, unless otherwise approved, and shall extend a minimum of five to a maximum of ten feet into the property. All lateral cleanouts on new construction shall extend two (2) feet above top back of curb or finished grade with a glued on cap.

Service connections shall not be made to any sewer outfall line with a diameter greater than fifteen (15) inches unless otherwise approved by the City's Representative.

All sewer laterals connected to public sewer mains shall conform to Table 3.11. Laterals shall not be connected into main line stub ends extending from manholes.

All restaurants, food service establishments and other buildings that use high amounts of grease or oil shall install grease traps approved by the City's Representative and shall comply with City "pretreatment" standards. Multiple connections to a lateral are not permitted.

Under no circumstances shall swimming pool drains, roof drains, foundation drains, storm drains or sub-drains be connected to the sanitary sewer system.

TABLE 3.11
SANITARY SEWER LATERALS

TYPE OF UNIT OR RESIDENCE	MINIMUM SEWER LATERAL SIZE (Diameter)	MINIMUM SLOPE
Single Family Residences	4 inches	2%
Townhomes (each unit)	4 inches	2%
Multi-family Condominiums	6 inches	1%
Commercial establishments	6 inches	1%
Mobile Homes	4 inches	2%
Apartments	**4 inches minimum (see note below)**	

NOTE:
1) Lateral size and slope shall be based on the number of fixture units in the apartment, in accordance with the Uniform Plumbing Code.

3.5.5 MANHOLES. Manholes shall be installed at all changes in grade, direction, pipe size or at all intersections; and at distances no greater than four hundred feet apart. All manholes shall be accessible to maintenance vehicles, and all sewer easements shall provide at least twelve feet of unobstructed width. Drop manholes shall be provided for a sewer line entering a manhole at an elevation of two feet, or more, above the manhole invert. Floor troughs shall be furnished for all sewers entering manholes, and shall be at least as deep as the full diameter of the sewer main in the manhole. Lines entering a manhole above the main trough but less than twenty-four inches above the invert shall be provided with a slide inside the manhole to prevent sewage from getting into the manhole shelf and to minimize splashing of sewage.

A sewer main or service eight inches or larger connecting to an existing sewer main shall require a manhole at the point of connection. Where the junction consists of the same size sewers, a 0.2 foot drop shall be provided between the branch and main sewer. When a smaller sewer main joins a larger sewer main in a manhole, the top of pipe elevations shall match.

All manholes shall have eccentric manhole cones conforming to the detailed dimensions, construction details and materials as shown in the standard drawings.

Sewer manholes for all sewer mains of less than twelve (12) inches in diameter shall be a minimum four feet inside diameter. For sewers mains twelve inches in diameter or larger or over twelve (12) feet in depth, the manholes shall be not less than five feet in inside diameter. When the sum of all pipe sizes connecting to the manhole totals 24 inches or greater, the manhole diameter shall be five feet or greater.

When a sewer line is installed in a development or in a phase of a development, the line may be extended up to three feet beyond the last manhole on the line. The open end of the extension (the “stub”) shall be the bell end of the pipe and must be sealed with a water-tight plug to allow for future extension. The stub shall be grouted and sealed around the pipe as it exits the manhole, to promote a water-tight fit.

Manhole sections shall be installed no less than 14 days after date of manufacture. Each manhole section shall be clearly marked on the inside with the name of the manufacturer and the date it was manufactured.

3.5.6 UTILITY CLEARANCES. The following clearances must be maintained between sewer lines and other utilities unless otherwise approved by the City Representative:

A. Utility clearances specified in applicable laws and codes shall be adhered to.

B. Sewer mains should be placed lower than other utilities.

C. Water distribution and sewage collection lines shall be laid in separate trenches, with at least ten (10) feet of separation measured horizontally.

D. Where the water line is less than eighteen (18) inches over the sewer line, where the water line is under the sewer line, and where the horizontal separation cannot be maintained because of physical obstructions, the water line shall be protected by construction of the sewer line with 1) ductile iron pipe; 2) water supply quality materials and joints; or 3) encasement with a minimum of two (2) inches of concrete. Each of these provisions shall

extend ten feet on each side of the crossing. These provisions shall also be extended for other than ninety degree crossings to the point at which the ten (10) foot separation between the water and sewer lines is achieved.

E. Sewer laterals and mains crossing under power, gas, storm drain, telephone, traffic signal conduit and/or street lighting conduit shall have at least one (1) foot separation, measured vertically. If the required vertical clearance cannot be met, a cushion of sand and cement slurry may be used to separate the utilities, upon approval of the City Representative. Where use of sand and cement slurry are not practical, the Engineer may propose alternate methods.

F. The following horizontal clearances should be maintained between utilities:

- Water to phone lines/cable TV - five (5) feet
- Water to gas - five (5) feet
- Water to power - five (5) feet
- Water to irrigation - five (5) feet
- Water to sewer - ten (10) feet
- Water to water – three (3) feet
- Gas to power - ten (10) feet.
- Gas to sewer – five (5) feet

3.5.7 SUSPENDED CROSSINGS. When suspended crossings are required, adequate support shall be provided for all joints in the pipe utilized for the crossings. The supports shall be designed to prevent frost heave, overturning and settlement. Precautions against freezing, such as insulation and increased slope, shall be provided. Expansion jointing shall be provided between above ground and below ground sewers. For suspended crossings, the impact of flood waters and debris shall be considered. The bottom of the pipe should be placed no lower than the elevation of the one hundred year flood plain. When possible, the crossing supports shall be designed to allow for future adjustment in grade.

3.5.8 PRESSURE (FORCE) SEWER MAINS. The following defines design criteria and standards for pressure mains.

A. **Velocity:** A velocity of no less than three (3) feet per second shall be achieved at design flow. Calculation of pressure main velocity, design pressure, and hydraulic losses shall be submitted to the City's Representative for approval.

B. **Air Relief Valves:** Where required, an automatic air relief valve specifically designed for raw sewage application(s) shall be placed in the force main to prevent air locking.

C. **Slope:** To limit accumulations of gases, no segment of a force main

shall have a zero slope. Wherever possible, low points which are subject to solids accumulation shall be avoided.

D. **Termination:** Pressure mains shall enter the gravity sewer system at a manhole. If necessary, provisions shall be made to direct or baffle sewage as it enters the manhole.

E. **Design Pressure:** The pressure main and fittings, including reaction blocking, shall be designed to withstand normal pressure, pressure surges (water hammer), and total (active and passive) earth loads.

F. **Suspended Crossings:** Pressure mains used for suspended crossings shall meet applicable requirements of SECTION 3.5.7.

G. **Hydraulic Losses:** Friction losses through pressure mains shall be based on the Hazen-Williams formula. For the Hazen-Williams formula, "C" = 100 shall be used for unlined iron or steel and "C" = 120 for all other materials. Turbulent losses at fittings, bends and valves shall be determined in a similar manner. The design data shall be submitted to City's Representative for review and prior approval.

H. **Thrust Blocks:** Thrust blocks and other restraints shall be included as necessary to secure the pressure main from movement.

I. **Identification Ribbon:** A pipe locator ribbon shall be placed no less than eighteen (18) inches above the top of pipe, centered along the entire length of the pressure main. The ribbon shall be green in color and shall have the clearly printed legend, "Buried Sewer Line Below", printed continuously along its length with minimum one inch letters. The ribbon shall be not less than two (2) inches wide. For nonmetallic pressure mains, the locator ribbon shall have a metallic component, such as plastic-coated aluminum.

J. **Connection Into Existing Systems:** When connecting any sewer main or sub-main into an existing sewer system a plug shall be installed at the time the sewer is cut into, both on the downstream and upstream ends of the new line. The plug shall be a Cherne Gripper Mechanical Plug, or approved equal. The plugs shall not be removed until the new sewer system is approved and accepted by the City's Representative.

3.6 CULINARY WATER DESIGN. All culinary water mains and appurtenances within the City of Santa Clara shall be designed to provide for adequate future service for all contiguous areas which may, within a twenty year period in the future, be tributary thereto. Water trunk lines shall be designed in accordance with the system master plan.

3.6.1 DESIGN FLOW PRESSURE. Water mains shall be designed to provide a minimum residual pressure of twenty (20) psi under maximum day demand

conditions including designed fire flow (as called out in SECTION 3.6.7 of these Standards). A minimum of forty (40) psi residual pressure must be maintained under normal peak hour conditions without fire flow, as measured at the "City" side of the service connection.

3.6.2 FLOW DESIGN CRITERIA. Flow design criteria shall conform to the requirements outlined in the current edition of the State of Utah Rules for Public Drinking Water Systems. In any case where these specifications require a higher design standard than is contained in the referenced Rules, the higher design standard shall take precedence.

Peak instantaneous fire flows shall be added to peak daily domestic flows for distribution system design flow total.

Commercial or industrial areas may require special investigation to determine fire flow requirements. Existing and future static pressure and flow information used in the design must be approved by the Water Department City representative.

3.6.3 MINIMUM SIZE AND DEPTH. The minimum depth of cover (to the top of the pipe) for water mains shall be three feet below the final grade of the street with a maximum of five feet unless otherwise approved by the City representative. Where final grades have not been established, mains shall be installed to a depth great enough to ensure a minimum of three feet and a maximum of five feet of cover below future grade. The water mains shall be sized to deliver the peak instantaneous flow rate as previously outlined. The fire flow requirements and pressures shall be as previously outlined. The size of the pipe shall also be based on a five (5) foot per second (fps) velocity maximum at peak instantaneous flows, without fire flows. However, the minimum water main size to be installed shall be eight inches in diameter unless otherwise approved by the Water Department City representative.

Departures from the minimum requirements will be considered only in special circumstances. Any departure from minimum requirements identified above shall be justified by a network hydraulic analysis. Water mains in cul-de-sacs, short internal streets within subdivisions, and other areas where water mains will not be extended in the future and are not connected to fire hydrants, may be six inches in diameter if that size water main meets the water demand requirements as shown by a network hydraulic analysis.

A fire hydrant shall not be connected to a main which does not have sufficient fire flow capacity.

In locations where the City has determined line size for the future based on a Master plan Study, the master-planned line size will be installed.

3.6.4 VALVES AND HYDRANTS. The water system shall be looped and valves shall generally be spaced such that a break in any one length of main will put no more than six hundred feet of main or more than two fire hydrants out of service (whichever is less) while maintaining adequate minimum service in the remainder of the water system during repairs, except for major transmission lines, where longer spacing may be allowed. All distribution mains connecting to larger transmission mains shall have a valve installed at the connection. All fire hydrant runs shall also have a valve installed at the distribution main. Valves shall generally be located at street intersection with four (4) valves at a cross intersection and three (3) valves at a Tee intersection.

3.6.5 PRESSURE REDUCING VALVES. Pressure reducing valves shall be installed on main lines where designated by the City representative. The standard design for these pressure reducing valves and vaults shall be provided by the City Public Services Department.

3.6.5.1 SECONDARY PRESSURE REDUCING VALVES. The Water Department requires that in high-water-pressure zones (greater than 80 psi), secondary pressure reducing devices be installed by the building owner on all water connections to buildings. The locations of the high-water-pressure zones within the City can be located and identified upon request from the Public Services Department.

3.6.6 FIRE HYDRANT SPACING AND LOCATION. Generally, fire hydrants shall be spaced and located as follows:

A. At each intersection, generally on the same sides of the street.

B. In residential areas, fire hydrant spacing shall be no greater than five hundred feet and no house shall be more than two hundred fifty feet from a hydrant measured along a street access to the property being served.

C. In multiple family areas, PUD zones, P.D. zones, industrial, business or commercial areas, fire hydrant spacing shall require special investigation to determine the hydrant spacing per the current adopted fire code.

D. Generally, hydrants shall be located in line with extensions of the property line when located mid-block.

E. Hydrants shall be placed no more than five (5) feet from the back of the sidewalk. Where sidewalk is not adjacent to the curb and a four (4) foot wide or wider planter area exists, the hydrant may be placed in the planter no closer than two feet from the back of the curb. Provide a five (5) foot

elliptical radius of clearance to adjacent obstacles with the lowest water outlet not less than eighteen (18) inches or more than thirty (30) inches from the final ground elevation (see standard drawings). The "break-away" flange at the bottom of hydrants shall be installed so that it is at, or within six (6) inches above, final ground elevation.

F. All fire hydrants shall be owned and maintained by the Public Services Department and shall be installed on dedicated easements or public rights-of-way**.**

G. A fire hydrant shall be placed in the end of all cul-de-sacs or on dead end lines.

H. Fire hydrants shall not be located:

(1) within five feet of a driveway, power pole, light standard, or any obstruction

(2) or, within three (3) feet of any block wall or fence when measured to the rear of the hydrant.

3.6.7 FIRE FLOW REQUIREMENTS. Under maximum day demand conditions, fire flow shall be at least one thousand (1,000) gallons per minute at any one hydrant and must meet the requirements of the currently adopted Fire Code. The total system design shall be such that fire flows and normal peak daily flow demand can be met while still maintaining a minimum pressure of twenty (20) psi at all points in the distribution system.

A maximum water velocity of ten (10) feet per second shall be utilized when designing for fire flows and/or other emergency conditions.

High density residential, commercial or industrial areas shall require special investigation to determine fire flow requirements and hydrant spacing per the currently adopted Fire Code.

Existing and future static pressure and flow information used in the design shall be approved by the Public Services Department.

3.6.8 MISCELLANEOUS WATER SYSTEM DESIGN CRITERIA.

A. All public water mains shall be installed in a public right-of-way, dedicated roadway, or designated drainage way, with adequate access for maintenance vehicles. Pipelines will not be installed on back lot or side lot lines due to potential flood and other damage.

B. Dead-end mains shall be avoided wherever possible and if installed, shall not exceed six hundred feet. Hydrants shall be located at the end of

dead-end mains and cul-de-sac mains for flushing purposes as well as for fire protection.

C. Each building or lot shall be served by a separate line and meter except in PUD's as approved by the City representative. In some situations a common tap and service line from the main to a manifold with two metersetters and boxes may be installed to serve two adjacent properties. All lots shall have a minimum of three quarter (3/4) inch service line from the main to the meter box. Multiple housing of two units, or more, shall have a minimum of one (1) inch service. When there are more than two multiple housing units the service line shall be sized accordingly.

D. All service line taps shall be machine tapped at the time of the water main installation. Service lines shall be installed prior to testing and acceptance of the water main.

E. Water mains shall be laid at least ten (10) feet horizontally from any existing or proposed wastewater main. The distance shall be measured edge to edge. If the required separation cannot be maintained, then where approved by the City's Representative, options found in the State of Utah Public Drinking Water Regulations may be implemented.

F. When a water main crosses over a wastewater main, the water main shall be laid at such an elevation that the bottom of the water main is at least eighteen (18) inches above the top of the wastewater main. When the water main cannot be as high as eighteen (18) inches above the wastewater main, the wastewater main shall be constructed of material with pressure conduit standards for a distance of ten feet on either side of the crossing as required by the State of Utah Public Drinking Water Regulations.

G. All tees, bends, plugs and hydrants shall be provided with reaction blocking, tie rods, and/or joints designed to prevent movement, i.e. "mega lug" or approved equal. Wood blocking of future main extensions is not acceptable. When thrust restraints cannot be used, concrete thrust blocks shall be formed and poured in place and must bear against undisturbed soil, per the thrust block details in the standard drawings. Installation of concrete thrust blocks shall receive prior approval of City representative.

H. Air release vacuum assemblies and blow-off valves shall be provided on all mains twelve inches in diameter and larger, where required, to prevent damage due to air accumulations.

I. All water lines shall require a twelve gauge solid copper wire with PVC of PC insulation be installed with the line for locating purposes. The wire shall be installed and extended up at each valve, hydrant, and up each service into the meter box.

J. Sufficient valves shall be provided on water mains to minimize inconvenience and sanitary hazards during repairs. Valves shall be generally located as follows:

(1) At intervals to isolate no more than two (2) fire hydrants at any time.

(2) At minimum intervals of five hundred (500) feet in commercially zoned areas.

(3) In residential areas to isolate a maximum of thirty services (approximately six hundred (600) feet).

(4) A maximum of five valves will be required to isolate any location.

(5) Valves shall not be located in street gutters, valley gutters, or in driveways.

(6) A valve is required at the end of all temporarily dead-ended mains. The valve location is to be a minimum of ten (10) feet upstream of the cap.

(7) Valved outlet(s) for future service laterals six (6) inches in diameter and larger may be installed when approved by the City representative. (Valved outlet installation approval does not constitute a water commitment.)

(8) A shut off valve immediately adjacent to the water main shall be provided for all service laterals greater than two (2) inches in diameter and for all fire hydrant laterals.

(10) The City representative may require additional valves as deemed necessary.

3.6.9NETWORK HYDRAULIC ANALYSIS.

3.6.9.1 WHEN REQUIRED. The Water Department City representative may require that a network hydraulic analysis be conducted by the Engineer if:

- the project is a major subdivision with an internally looped system
- the project is located in the higher elevations of a low static pressure zone
- a high fire flow demand is required (greater than1500 gallons per minute)
- there will be extensive irrigation
- the new water plans will complete a loop on the current system, or
- as otherwise required by the Water Department City representative.

3.6.9.2 DESIGN. The consulting engineer should request the source hydraulic grade line (HGL) from the water department prior to the initial design where a network hydraulic analysis is required. The following information shall be submitted at the time of such a request:

- location, type of development, and the acreage or number of units with the development, and
- anticipated fire flow requirements, and
- the location where the proposed water distribution system is planned to tie into the existing system.

3.6.9.3 SUBMITTAL FOR REVIEW AND APPROVAL. The network hydraulic analysis shall be submitted with the project design for review. For larger projects, such as a major subdivision, obtaining network hydraulic analysis approval prior to submitting the water plan is preferred.

The Water Department representative shall, upon request, make a determination as to which submittal method must be followed.

The network hydraulic analysis submittal shall include two copies of the following items:

- the data input sheets, as well as the analysis results,
- information about the development (i.e., type, number of acres, number of units, fire flow requirements, etc.)
- data sheet(s) outlining all assumptions (i.e, method used to assign demands to corresponding nodes and source HGL's used)
- map identifying pipe and node numbers and their locations
- fire hydrant locations
- the name and version of software used for the analysis
- elevations of junction nodes
- staging or phasing of development, and
- appropriate off-site demands.

3.6.9.4 MISCELLANEOUS. The roughness factors to be used in the analysis should be as follows:

- C equal to 100 for all unlined cast iron pipe
- C equal to 120 for existing pipe twelve inches, or less, in diameter
- C equal to 130 for existing pipe (150 for PVC) fourteen inches, or greater, in diameter
- C equal to 130 for new pipe (150 for PVC) regardless of diameter

For any other sizes or materials not covered by the above, the consulting

engineer shall contact the Water Department City representative for guidance.

When identifying the fire flow available in a network hydraulic analysis, use the hydrant located at the development's weakest point (highest point in the development and/or last hydrant on dead-end main). Also, verify the hydrant is located at a junction node.

The elevations used in the network hydraulic analysis should be based on a project grading plan or the anticipated final elevation. If the final grading plan deviates significantly from the elevations used in the analysis, a revised analysis will be required. The analysis shall evaluate any adverse affects on the existing water system.

3.7 SECONDARY WATER OR WASTEWATER REUSE IRRIGATION SYSTEM. All secondary water irrigations systems shall be designed and constructed in accordance with the requirements outlined for culinary water systems in SECTIONS 3 and 4 of these specifications. However, all valve box covers and service connection covers shall bear the legend "Irrigation" in order to clearly differentiate between culinary and secondary systems. The pipe material shall be colored purple, or a discrete color different from the culinary water main. There shall be no cross connections between secondary and culinary water systems.

All wastewater reuse irrigation systems shall be designed and constructed in accordance with the requirements outlined for culinary water systems in SECTIONS 3 and 4 of these specifications. However, all requirements for the treating and reuse of wastewater outlined in the latest applicable Utah Division of Water Quality Standards for Utilization and Isolation of Domestic Wastewater Treatment Works Effluent shall be followed. These requirements include, but are not limited to, a reuse project plan, allowed uses, required treatment processes and water quality limits.

3.8 OTHER UTILITIES SYSTEMS DESIGN. All other utility systems shall meet the following:

3.8.1 RESPONSIBILITY. Other necessary utility installations (Gas, Electricity, Phone, and T.V.) will be coordinated and installed by the developer.

3.8.2 STREET LIGHTS. All developments shall include street lights and necessary appurtenances in accordance with the Cities specifications.

3.8.3 BURIAL OF LINES. All utility lines in subdivisions, planned unit developments, and other developments shall be underground. Lines shall be buried at a minimum depth of forty-two (42) inches for primary power. Power lines shall not be buried in any water or sewer trench.

3.8.4 LAYOUT. Utility lines shall be located within designated utility easements and in accordance with the requirements of the Technical Review Committee (TRC).

3.8.5 FRONT LOT LINE SYSTEMS. Where utilities are located in front lot lines, other utility system construction shall not begin until the completion of water, sewer, curb and gutter, and must be complete before installation of street asphalt.

3.8.6 QUALITY CONTROL. All utility trench construction shall conform to the design and testing requirements set forth in Section 4.4 (Pipeline Construction) of these standards.

3.9 TRAFFIC STANDARDS. This sub-section sets forth the criteria for access control and Traffic Impact Studies.

3.9.1 ACCESS CONTROL. The general access control requirements for arterials and collectors are provided below. All access points on these facilities shall be subject to approval by the City representative or his designated representative. Where deemed necessary, stricter requirements may be invoked.

3.9.1.1. GENERAL REQUIREMENTS. Direct access to a residential lot(s) shall not be allowed unless otherwise approved by the City representative. If allowed, additional requirements and restrictions may be imposed such as increased setbacks, circular drives, etc.

A. Driveway access should not be allowed within one hundred seventy-five (175) feet of the nearest curb line of an intersecting street for collectors and two hundred (200) feet for arterials (see section 3.2.4) unless preapproved.
B. Unless otherwise approved by City representative, access shall be limited to one driveway for each tract of property separately owned. Properties contiguous to each other and owned by, or previously owned by, the same party are considered to be one tract.
C. Driveways giving direct access may be denied if alternate access is available.
D. When necessary for the safe and efficient movement of traffic, access points may be required to be designed for right turns in and out only and will include appropriate deceleration and turning lanes.
E. When approved, or directed by the City representative, a driveway access design may be a "street type intersection" with curb returns.

3.9.2 TRAFFIC IMPACT STUDIES. A Traffic Impact Study, (TIS) is a specialized study of the impacts that a certain type and size of development will have on the surrounding transportation system. It is specifically concerned with the generation, distribution, and assignment of traffic to and from the “new

development". The term "new development" also includes properties that are being redeveloped.

A TIS shall be required for all new developments or additions to existing developments which generate 100 or more trips during the morning or afternoon peak hours or which will have a significant impact on the City's transportation system as determined by the City representative. Traffic Impact Studies are divided into three categories. The scale of development will determine which category of study will be required. Each category differs by specific analysis requirements for the study and the study's level of detail. Below is a description of each category.

CATEGORY I -- Developments which generate 100 or more new peak hour trips, but less than 500 trips during the morning or afternoon peak hours. Peak hour trips will be determined by ITE's Trip Generation Manual.

In addition to the above threshold requirements, a Category I TIS may also be required by the City representative for any specific traffic problems or concerns such as:

- proposed or existing offset intersections;
- situation with a high number of traffic accidents;
- driveway conflicts with adjacent developments;
- nearby intersections that have reached their capacity;
- proposed property rezones when there is a significant potential increase in traffic volumes;
- when the original TIS is more than two years old, or where the proposed traffic volumes in the original TIS increase by more than twenty percent.

For a Category I TIS, the study horizon shall be limited to the opening year of the full build-out of the development.

The minimum study area shall include site access drives, affected signalized intersections and major unsignalized street intersections.

CATEGORY II -- Developments which generate from 500 to 1000 new peak hour trips during the morning or afternoon peak hours.

The study horizon shall be for the year of completion for each phase of the development, the year of its completion and five years after the development's completion.

The minimum study area shall include the site access drives and all signalized intersections and major unsignalized street intersections within one-half mile of the development.

CATEGORY III -- Developments which generate above 1000 new peak hour trips

during the morning or afternoon peak hours.

The study horizon shall be for the year of completion for each phase of the development, the year of its completion, five years after the development's completion, and ten years after the development's completion.

The minimum study area shall include the site access drives and all signalized intersections and major unsignalized street intersections within one-half mile of the development.

The City Representative, or his designated representative, shall make the final decision of requiring a TIS and determining whether the study falls within Category I, II, or III.

The TIS shall be conducted and prepared by a qualified Traffic Engineer. The subject Engineer shall have special training and experience in traffic engineering and be a member of the Institute of Transportation Engineers (ITE).

Generally, the data necessary for such a study will require a description of the study area, the scope of development, turning movement traffic counts, accident analyses, roadway geometry, traffic control devices, and trips generated by the new development. The roadways and intersections within the study area shall be analyzed with and without the proposed development to identify projected impacts with regard to level of service and safety.

Where the road will operate at Level of Service "C" or better without the development, the traffic impact of the development on the roadways, and intersections within the study area shall be mitigated to Level of Service "C" or better. Mitigation to Level of Service "D" may be acceptable with the concurrence of the City. A list of mitigation improvements will be provided in the study to achieve this Level of Service.

The guidelines and specific requirements for the preparation of a TIS are found in the "City of St. George Traffic Impact Study Guidelines". All studies prepared for submittal to Santa Clara City shall follow these guidelines unless otherwise approved.

3.10 SURVEY MONUMENTATION STANDARDS. This sub-section sets forth the general standards for survey monuments.

3.10.1 GENERAL REQUIREMENTS. Only a Land Surveyor, registered in the State of Utah, shall be authorized to determine or establish the exact location for a survey monument. Only such registered Land Surveyor shall be authorized to perpetuate and reference existing Class I and II survey monuments located within the limits of public or private streets.

3.10.2 MONUMENTS. Class I or II monuments shall be set in accordance with the recorded maps so that the survey, or any part thereof, may be readily retraced. Such monuments shall be set at:

A. All angle points in survey boundary (Class II).

B. All angle points of tangency and points of curvature on and along survey boundary (Class II).

C. All street centerline intersections (Class I).

D. At a P.I. outside of right-of-way (Class II).
If the P.I. falls outside the limits of pavement then P.C.'s and P.T.'s shall be monumented with Class I. If the P.I. falls inside the pavement area then a Class I monument is required and no monumentation required for P.C.'s and P.T.'s.

E. All intersections of street centerlines at survey boundary (Class II).

F. Six hundred foot intervals, unless otherwise approved. If line of sight is not obtainable within a six hundred foot interval, then monuments will be required to be closer together unless otherwise approved by the City Surveyor.

All the above established points which fall within the limits of public or private rights-of-way shall be referenced with four permanently established reference points within a radius of twenty (20) feet to one hundred (100) feet all of which shall be outside the pavement area. The angle from tie to tie shall be as near ninety degrees as possible, radiating from the established intersection points. A copy of the survey notes documenting the setting of the reference ties shall be kept by the responsible surveyor and a copy shall be delivered to the office of the City Surveyor and of the County Surveyor's depository.

When a section corner, quarter corner or sixteenth corner falls within a fully improved roadway and must be set, or reset, the responsible surveyor shall contact the County and City Surveyor for directions and/or requirements.

All monuments shall have brass marker or aluminum cap in accordance with the standard drawings. The surveyor's registration or license number shall be stamped on the cap.

Monuments must be set prior to the final acceptance of the improvements.

Where hard rock or other physical obstructions are encountered, monument length sufficient to resist removal may vary within reasonable limits.

All monuments shall be set in such a manner that the accuracy of their relative positions is not less than second-order Class II, in accordance with the specifications established by the U.S. Federal Geodetic Control Committee. When monuments are being reset, the initial order used in the setting shall be used, but in no event shall it be less than second-order Class II.

3.10.3 TYPES OF MONUMENTS. Class I and II monuments shall be installed in accordance with City requirements.