DESIGN STANDARDS

SECTION DS 3

STREETS

DS 3-01 GENERAL:

A. INTENT: The intent of these Design Standards is to provide minimum standards for the design of public streets. These standards are intended to insure that streets are designed to serve the ultimate level of development as shown in the *City General Plan.* The street design may employ specific traffic calming measures as approved and/or required by the Director of Public Works which are included in the City's *Neighborhood Traffic Calming Policy*. Private Street Standards have been adopted by the City of Vacaville as a separate document and may be obtained from the office of the City Engineer.

B. GOVERNING CRITERIA: These Design Standards, in conjunction with the most current edition of the CALTRANS *Highway Design Manual* and the American Association of State Highways and Transportation Officials (AASHTO), *A Policy on Geometric Design of Highways and Streets*, and the most current requirements regarding the American with Disabilities Act (ADA) shall govern the engineering design of all public streets within the City of Vacaville. In the event that there is a conflict between these documents or with other "Current Standards" so defined hereafter, the Director of Public Works shall determine which document governs. Additionally, if there are criteria or issues not addressed in these documents, the Director of Public Works will determine the criteria to be used in the design. All street improvements shall be designed in accordance with current accepted engineering practices. These Design Standards are minimum standards and are intended to assist the Design Engineer, but not substitute for competent work. The City Engineer/Director of Public Works at their sole discretion may require more stringent requirements for unusual circumstances, special conditions, and/or environmental constraints.

C. CURRENT STANDARDS: Street design shall be completed in accordance with all current applicable laws, standards, and regulations, including but not limited to the *CALTRANS Highway Design Manual*, ADA, AASHTO, American Society For Testing and Materials (ASTM), American Concrete Institute (ACI), and the *City of Vacaville Municipal Code*, *Grading Ordinance*, *Storm Water Management Plan*, and City Standard Specifications which include the Design Standards, Construction Standards and the Standard Drawings.

DS 3-02 STREET CLASSIFICATIONS:

A. Street classifications described in paragraph D below are based on the City of Vacaville General Plan (City General Plan).

B. The standard street sections are shown in the Standard Drawings. All streets shall include curb, gutter and sidewalk except as otherwise allowed by these Design Standards.

C. The classification of each street shall be designated on the Tentative Map or Development Plan application for each project and will be addressed in the City conditions of approval for the project.

D. For the purposes of geometric and structural design, streets shall be classified according to the City General Plan and the following requirements, whichever is more stringent:

1. **Cul-De-Sac:** A street terminated with a bulb with only one public entrance/exit.
2. **Residential:** A street servicing traffic volumes up to 2,500 vehicles per day.
3. **Collector:** A street servicing traffic volumes up to 10,000 vehicles per day, or with school or park frontage.
4. **Industrial:** A street servicing primarily industrial land uses with no on-street parking.
5. **Arterial:** A street leading to major traffic generators such as but not limited to Interstate Highway 80 and 505, major residential, commercial or other industrial areas.

DS 3-03 STRUCTURAL SECTIONS:

A. The following criteria shall govern the design of structural sections for proposed street improvements.

B. The design of the structural pavement section for all street sections shall be based on the Traffic Index (T.I.) as shown in **Table DS 3-1** and the Resistance Value ("R" value) of the subgrade of the proposed street. T.I. values listed in **Table DS 3-1** may be raised by the City Engineer/Director of Public Works if actual /projected traffic volumes and/or percentage of trucks warrant higher values.

C. The thickness of the various components of the road structural section shall be determined by the tables, charts, formulas and procedures contained in the *CALTRANS Design Manual*, or as directed by the Director of Public Works. In no case will sections be allowed less than those shown in **Table DS 3-1**.

TABLE DS 3-1

MINIMUM STRUCTURAL SECTION

Street Classification	TI	Min. A.C.	Min A.B. Section
Arterials	10	6.0	15.0
Industrial/Industrial Cul-de-sac	10	6.0	15.0
Collector	8	4.5	11.5
Residential	6	3.5	7.5
Residential Cul-de-sac	6	3.5	7.5

D. Street improvements shall be designed in accordance with a Geotechnical Soils report except that in no case will structural sections be allowed less than those shown in **Table DS 3-1.** The report shall be submitted to the City Engineer with the Initial Project Plan submittal for development projects. The Geotechnical Soils report shall include a map of the project area showing proposed and existing streets, contours, locations of test samples, "R" value results and the proposed structural pavement sections. The "R" value shall be determined by California Test Method No 301. An "R" value of 5 shall be used when a Geotechnical Soils Report and "R" value tests are not available. The suitability of the native material for the proposed street subgrade shall be discussed within the report. Recommendations for excavation, fill placement, compaction, and any ground water remediation shall also be addressed. The report shall be signed by a registered civil or geotechnical engineer and shall be bound in an 8 ½ " x 11" format.

E. A layer of geotextile fabric shall be used between native material and aggregate base course for all streets. The Design Engineer's attention is directed to the Construction Standards contained in the City Standard Specifications for the requirements for the geotextile fabric wherever this material is specified throughout Section DS 3 Streets of the Design Standards.

DS 3-04 STREET GEOMETRICS:

A. MINIMUM DESIGN SPEED: The design of the horizontal and vertical geometrics for the street shall be based on design speed for the type of street shown in **Table DS 3-2** and the *Caltrans Design Manual*, but the street horizontal centerline radius shall not be less than the value shown in **Table DS 3-3**.

TABLE DS 3-2

MINIMUM DESIGN SPEED

Street Classification	**Minimum Design Speed**
Cul-De-Sac	30 mph
Residential	30 mph
Collector	35 mph
Industrial	Determined by the Director of Public Works
Arterial	

B. MINIMUM STREET GEOMETRICS: The minimum street intersection radii, and horizontal curvature radii associated with the different street classifications are shown on **Table DS 3-3**.

TABLE DS 3-3

MINIMUM STREET GEOMETRICS

Street Classification	**Intersection Curb Return Radii[1]**		**Horizontal Curve Radii**
	Curb Face	**Right-of-Way[2]**	**Centerline**
Residential	27 feet[3]	20 feet	300 feet
Collector	27 feet[4]	varies	425 feet
Industrial	50 feet	varies	See footnote 5
Arterial[6]	50 feet	varies	See footnote 5

[1] Where streets of differing Classification intersect, the larger radius requirement shall apply.

[2] The right-of-way radii at intersections may need to be modified to include a 45° chord to accommodate the Accessible Ramp.

[3] The Intersection Radius for Residential Street Low Profile Curb is measured to the gutter flow line.

[4] The curb face radius for the intersection of a Collector with a Collector shall be increased to 40 feet.

[5] The horizontal curve radius for the centerline is based upon the design speed of the street which shall be determined by the Director of Public Works.

[6] Additional right-of-way and/or pavement will be required for accessible ramps, bus turnouts, at intersections and driveways, for acceleration lanes, deceleration lanes, and additional (left and right) turn lanes as specified by the City Engineer/Director of Public Works.

C. TURN LANES: Collector, Industrial, and Arterial streets may need to provide additional widening and right-of-way if turn lanes are required by the Director of Public Works.

1. Turn lanes provided in new construction shall be a minimum of 12 feet in width. On existing streets, if adequate width is not available, turns lanes may be reduced to 10 feet in width with the approval of the Director of Public Works.

2. Right turn lanes may be required when specified by the Director of Public Works.

3. Left turn lanes shall be required as specified by the Director of Public Works at signalized intersections and at intersections of Arterial Streets with other public or private streets or major driveways.

4. The storage length of the turn lane at the intersection shall be based upon estimated traffic volumes and calculations submitted by the Design Engineer and accepted by the Director of Public Works. The minimum storage length regardless of the results of the calculations shall be not less than 100 feet.

D. RAISED MEDIANS: Raised medians shall be designed as follows:

1. Median Curbs shall be installed in accordance with the Standard Drawings.

2. The standard cross section for a raised median shall be 16 feet and narrow to 4 feet in width (measured at the face of curb) to accommodate a left turn lane.

3. Raised medians installations where not landscaped shall consist of colored stamped concrete, paving stones, decomposed granite and boulders, or other improvements as approved by the Director of Public Works. The color of the paving stones or stamped concrete shall be subject to the approval of the Director of Public Works.

4. The design for stamped concrete within the raised median shall be a minimum of 4 inches thick over 4 inches of Class II Aggregate Base Rock.

5. The scope of landscaping and/or decorative hardscape within the median shall be determined by the Director of Public Works on a case by case basis.

6. The design for medians shall include drainage improvements. Fully enclosed scupper drains are discouraged.

DS 3-05 PROFILE AND CROSS SLOPE STANDARDS:

A. The **minimum profile grade** on new streets shall be 0.50 percent on non-arterial streets, and 0.35 percent on arterial streets.

B. The **maximum profile grade** on new streets shall not exceed 12.0 percent unless approved by the Director of Public Works.

C. The **cross slope** on new streets shall be 2.0 percent.

D. When widening an existing street, the street **cross slope** should match the existing cross slope as much as possible, but in no case shall the cross slope be less than 1.5% or more than 4.0%. Additionally, the cross slope of the widening shall not be less than the cross slope of the existing pavement. A variable overlay of existing pavement may be required to flatten the cross slope when widening streets with existing cross slopes in excess of 4.0 percent.

E. When **two streets intersect**, neither street shall have **a profile grade greater than** 3.0 percent for a minimum distance of 40 feet measured from the curb line of the intersecting street, unless otherwise approved by the Director of Public Works.

F. The surface grades of the asphalt concrete pavement within the intersection shall be designed to provide continuous positive drainage. No **slope within the intersection** shall be less than 1.5% or greater than 4% unless otherwise approved by the Director of Public Works.

G. The **minimum vertical curve length** allowable at the intersection of two grades shall be 50 feet. Vertical curves on all streets may be omitted where the algebraic difference in grades does not exceed 2.0 percent.

DS 3-06 INTERSECTION SPACING

Table DS 3-4 includes the minimum acceptable intersection spacing between street centerlines.

TABLE DS 3-4

INTERSECTION SPACING

Intersection Roadway Classification	Minimum Acceptable Intersection Spacing
Residential with Residential or Collector	200 feet
Collector with Residential or Collector	500 feet
Collector with Arterial	1320 feet[1]
Arterial with Collector	500 feet
Arterial with Arterial	1320 feet[1]

[1] This minimum requirement does not apply where a raised median is provided on arterial streets to separate conflicting movements. The offset distance of intersections with Arterial streets shall be long enough not to interfere with the operation of turn lanes located on the Arterial Street. Street intersections with Arterial Streets are preferred to be offset at a minimum of 500 feet in length.

DS 3-07 PARTIAL STREETS:

A. Partial streets may be permitted by the City Engineer/Director of Public Works where the ultimate right-of-way cannot be dedicated or where the complete street cannot be constructed.

B. The minimum right-of-way width shall be at least one-half of the ultimate right-of-way width, but in no case shall the width be less than the minimum width to provide 32 feet of pavement measured from the face of curb. When partial streets are constructed, parking will be considered only adjacent to the curb. All other areas shall be posted "No Parking".

C. When only a portion of a street is constructed, the edge of the new pavement (not adjacent to curb and gutter) shall be protected by installation of a 2-foot wide compacted aggregate base rock (six inches deep) shoulder and a minimum of a 2–foot wide earth choker placed at the edge of the pavement.

D. The crown of the partial street construction shall be located at the ultimate centerline location.

DS 3-08 CUL-DE-SACS:

A. Cul-de-sac design for a Residential street classification shall conform to the Standard Drawings.

B. Cul-de-sac design for an Industrial street classification shall be terminated with a bulb which shall have a right-of-way radius of 60 feet and a curb radius of 50 feet. All other geometrics of the cul-de-sac shall be submitted to the City Engineer/Director of Public Works for approval.

C. No cul-de-sac shall exceed 600 feet in length, measured from the intersection of the centerline of the connecting street to the radius point of the bulb.

DS 3-09 ELBOW INTERSECTION (EXPANDED CORNER):

Expanded corners will be considered for approval by the City Engineer/ Director of Public Works on a case by case basis. At locations approved by the Director of Public Works, expanded corners shall be designed in accordance with the Standard Drawings.

DS 3-10 STOPPING SIGHT DISTANCE:

A. INTERSECTION STOPPING SIGHT DISTANCE: Current design standards of Caltrans for sight distance shall apply at intersections, with the exception of the Corner Sight Distance standard discussed in Section 405.1 of the *Caltrans Highway Design Manual*. The manual specifies that a 7.5 second corner sight distance shall be used at unsignalized public road intersections, and that the Stopping Sight Distance standard may be used if costs are excessive. It is the City's policy that the Stopping Sight Distance standard is acceptable for urban conditions, and that the Corner Sight Distance standard is more appropriate for rural intersections, which are the normal case for Caltrans design standards. Intersection sight distance shall be determined as shown on the Standard

Drawings, by assuming a 15 foot setback and 3 feet from centerline to the driver's eye measured from the prolongation of the curb lines of the major (through) street. Even in the case where a crosswalk is present across the minor street, the sight distance shall be determined assuming a 15 foot setback to the driver's eye measured from the prolongation of the curb lines of the major street.

B. STREET SECTION STOPPING SIGHT DISTANCE: The minimum allowable stopping sight distance on a public street section shall meet Caltrans standards for Stopping Sight Distance and a design speed as set forth in **Table DS 3-2** except as provided for below.

1. Cul-de-sacs with sag and crest curves shall be designed to allow adequate visibility for Stopping Sight Distance. Nighttime conditions, however, may warrant the installation of additional street lighting to provide that same visibility. The object height for these stopping sight distance calculations shall be 6 inches.

2. Stopping Sight Distance for Industrial and Arterial Streets shall be based upon design speeds established by the Director of Public Works on a case by case basis. Arterial and Industrial streets shall be designed in accordance with AASHTO and Caltrans Standards, with the exception of sight distance criteria. The sight distance criteria specified in paragraph A, "Intersection Sight Distance," shall apply.

C. EXPANDED CORNER DESIGN STOPPING SIGHT DISTANCE: Since there are only turning vehicles and no cross traffic around residential expanded corners, the critical governing factor is adequate Stopping Sight Distance when turning the corner. Stopping Sight Distance shall be provided in accordance with the Standard Drawing, Expanded Corner Design Stopping Sight Distance Triangle, which is based upon a 15 MPH design speed is acceptable for these turning conditions.

D. DRIVEWAY SIGHT DISTANCE Sight distance for private residential driveways shall be controlled by requiring visibility triangles on each side of the driveway in accordance with the Standard Drawings. Sight distance for commercial driveways shall correspond to the Intersection Stopping Sight Distance considering the appropriate design speed for the intersecting street.

E. MISCELLENIOUS IMPROVEMENTS: Placement of soundwalls, fences, above ground utility structures, signs and landscaping shall comply with the criteria established for intersection sight distance.

DS 3-11 BIKE LANES AND PATHS

A. Bike lanes or off-street bike paths may be required on or adjacent to any street, creek way, or other location by the Director of Public Works based upon the Bike Way Plan of the Transportation Element included in the City General Plan, a Specific Plan, or Policy Plan.

B. Bike lanes and Paths shall be designed in accordance with the applicable provisions of the CALTRANS *Highway Design Manual* and any other standards adopted by the City of Vacaville for Bike Lanes and Bike Paths.

C. The minimum structural section for a Bike Path shall consist of 2 inches of asphalt concrete, 6 inches of aggregate base rock, over compacted subgrade in accordance with of the City Standard Specifications.

D. Centerline striping will not be required unless otherwise specified by the Director of Public Works.

DS 3-12 PERMANENT BARRICADES:

A. Barricades shall conform to the Standard Drawings and this section of the Design Standards. Signing and Markings for barricades shall conform to the *Manual of Uniform Traffic Control Devices (MUTCD)* along with the *California Supplements to the MUTCD* except as amended by the Standard Drawings.

B. An "End of Street Barricade" shall be constructed where improvements are temporarily terminated on a street but are intended for extension in the future.

C. An "End of Sidewalk barricade shall be constructed at the end of sidewalks where pedestrians cannot safely continue beyond the end of the sidewalk.

DS 3-13 DRIVEWAYS:

A. Driveways shall be designed in accordance with the Standard Drawings and the current requirements for the ADA.

B. The location of all driveways shall be subject to the approval of the City Engineer/Director of Public Works:

C. Driveways shall not be allowed in an intersection (between the curb returns).

D. The edge of commercial and industrial driveways shall be a minimum of 60 feet from a curb return or as recommended by the Director of Public Works.

E. A traffic engineering study may be required at developer's expense to resolve special circumstances.

F. No driveway will be allowed within 5 feet of a side property line. Exceptions may be approved by the City Engineer for joint driveways or in unusual cases.

G. When driveways are abandoned or relocated, the driveway sections must be removed and replaced with standard curb and gutter and sidewalk.

H. Total width of all driveways on any particular parcel frontage shall not exceed 50 percent of the width of the parcel without the approval of the Director of Public Works.

I. Residential corner lots, where uncontrolled right turns are permitted, shall maintain the minimum clearances between the curb return (approach and departure leg) and the edge of the driveway as shown on **Table DS 3-5**. These clearances are based upon a 27 foot return radius; returns with a radius other than 27 feet shall have driveway locations approved by the Director of Public Works.

TABLE DS 3-5

Approach Grade %	Minimum Clearance (Ft)
-12 thru -10	18
-9 thru +19	13
+10 thru +12	8

DS 3-14 ACCESSIBLE RAMPS:

Accessible Ramps shall be installed at all intersections and at other locations where required by the City Engineer/Director of Public Works in accordance with the Standard Drawings.

DS 3-15 CURB AND GUTTER:

A. Curb and gutter shall be installed with each street section in accordance with the Standard Drawings.

B. Residential Low Profile Curb shall be used on all streets in residential developments except as follows:

1. Where a planter strip is located between the curb and sidewalk unless otherwise determined by the City Engineer/Director of Public Works that the Low Profile Curb is more suitable for the project conditions.

2. On Arterial Streets.

3. On Collector Streets where no driveways exist.

4. At curb inlets.

5. Along the length of the arc between curb returns at street intersections and on the inside curve of an Expanded Corner.

6. At locations identified by the City Engineer/Director of Public Works.

C. Vertical curb and gutter shall be used on all streets except as provided for in paragraph B above unless the City Engineer/Director of Public Works makes a determination that the Low Profile Curb should be used in the design.

DS 3-16 VALLEY GUTTERS:

Valley gutter will be not be allowed on through streets. Valley gutters will be permitted on cul-de-sac streets only with the specific approval of the City Engineer/Director of Public Works when the intersection cannot reasonably be

drained to an underground system. Valley gutters, where approved, shall conform to the Standard Drawings.

DS 3-17 SIDEWALKS: Sidewalks shall be installed in accordance with the Standard Drawings and the following criteria:

A. The required width of sidewalks for all developments will be determined by the City Engineer/Director of Public Works.

B. Where obstructions are situated within street-side sidewalks, a minimum of 4 feet of clear uninterrupted sidewalk area shall be provided. Where it is necessary to widen the sidewalk beyond its standard width to attain the 4-foot clearance, the widened area shall extend a minimum of 5 feet beyond each side of the obstruction and a 10 feet taper on each side of the widening shall be required.

C. Where sidewalks end in fill areas, the fill shall be extended beyond the end of the sidewalk for a minimum distance of 5 feet

D. The widths of sidewalks shall be measured from the back of the curb (see Standard Drawings) and shall conform to **Table DS 3-6.**

Table DS 3-6

Sidewalk Location/Type	**Width** (feet)
Downtown Commercial	9.5
Commercial	7
Meandering Residential	6
Residential vertical curb	5.0
Residential low profile	4.5

DS 3-18 BUS TURNOUTS:

Bus turnouts shall be provided on Arterial streets and on streets with school sites at locations determined by the Director of Public Works. Bus turnouts shall conform to the Standard Drawings.

DS 3-19 MAINTENANCE ROADS:

A. A gravel access road shall be provided in the design for temporary and permanent storm drain ditches in accordance with Section DS -4, Storm Drain Design Standards of the City Standard Specifications.

B. A minimum15-foot wide maintenance road shall be provided for City owned utilities (including but not limited to storm drain, water, and sanitary sewer piping and related facilities) that are not constructed under a paved street: The Director

of Public Works will establish the width of the maintenance road for multiple utilities within a single access on a case by case basis pursuant to the following requirements:

1. The maintenance road shall be constructed over subgrade scarified to a minimum depth of 6 inches and compacted to minimum 90% relative compaction unless a Geotechnical Soils report includes other recommendations.

2. In-tract (Within the subdivision or site plan boundary): A maintenance road shall be constructed with a layer of geotextile fabric below 4 inches of compacted Aggregate Base rock (90% relative compaction) under a 6-inch layer of Portland cement concrete paving reinforced with 6 x 6 x 10 x 10 gauge wire. The concrete road shall be scored with a 5-foot grid pattern and have a deep joint every 15feet.

3. Off-tract (Outside the subdivision or site plan boundary in easements through vacant or undeveloped land): A maintenance road shall be constructed of a 6-inch layer of crushed 1 ½ inch maximum, open graded rock over a layer of geotextile fabric unless otherwise directed by the Director of Public Works.

DS 3-20 PROJECT PLAN REQUIREMENTS:

The Project Plans shall include the following information in addition to the requirements of Section DS-2, Project Plans, Preparation, Submittal, and Processing of the City Standard Specifications:

A. Street and maintenance road centerline layout information, including but not limited to ties to centerlines of intersecting streets, and curve data (delta angle, length, tangent and radius) for all centerline curves shall be shown on the Plan View of Project Plans. Stationing of each Beginning of Curve (BC) and End of Curve (EC) and street intersection shall be noted. Station equations shall be shown at all intersections when applicable.

B. Vertical curve data shown on the Profile View of Project Plans shall consist of the point of intersection elevation, tangent gradients, point of vertical intersection and the length of curve, stationing of the Beginning of Vertical Curve (BVC) and End of Vertical Curve (EVC).

C. Locations of existing and proposed driveways shall be shown on the Plan view.

D. Dimensions or distance offset from street station line to curb face or gutter flow line and dimensions for all other improvements shall be shown.

E. Plan and Profile view of streets and maintenance roads with adequate dimensioning and notation of proposed and existing elevations to allow for construction staking and inspection of the work.

F. When median curbing is included with the project scope, the following note shall be included on the Project Plans. “Deep joints shall be provided at 10 foot

intervals and score lines shall be provided at 5 foot intervals for median curb construction."

G. Construction details as described in Section DS 3-19, Maintenance Roads, of the City Standard Specifications.