

TOWN OF MARANA

Subdivision Street Standards Manual



May 2013

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1.0 INTRODUCTION & PURPOSE

1.1 Introduction

The majority of these standards were originally prepared by the Pima County Department of Transportation and Flood Control District (PCDOT & FCD). They have been modified to address the specific conditions and needs of the Town of Marana, and are presented in this manual with those modifications to guide land use planners and design engineers in the preparation of subdivision plats, development plans, improvement plans and master planning documents. The Town discourages the use of private streets, however, these standards apply equally to both public and private local roadways within all subdivisions and land development roadway construction or reconstruction within the Town of Marana, and are intended to be consistent with national standards and local policies and procedures. These standards are guidelines, which will be enforced as written, however, it is recognized that there are situations for which these standards may not be applicable. In these cases, and in cases of conflict or contradiction, sound engineering judgment consistent with accepted practice and approved in writing by the Town Engineer shall be used.

Those portions of these standards prepared by PCDOT & FCD (“Subdivision Street Standards”, Oct. 1989) have been reproduced herein under permission by Pima County.

1.2 Purpose

These standards are intended to provide for the public health, safety and welfare of the motorist and pedestrian. They are minimum standards for local streets which, if not met or exceeded, would create deficiencies resulting in a threat to public health, safety and welfare, as well as higher user costs and public losses. They have been adopted to reduce maintenance and liability costs borne by the residents of Marana.

In order to be responsive to the needs of roadway users within proposed and existing residential neighborhoods, these street development standards have been established to:

- Provide for streets of suitable location, width, and improvement to safely accommodate vehicular, pedestrian, and disabled pedestrian traffic;
- Afford satisfactory access to emergency services, sanitation, school bus, street maintenance, and utility equipment;
- Coordinate street improvements, both public and private, so as to compose a convenient system and avoid undue hardships to adjoining properties;
- Establish safe, effective, efficient, sustainable and attractive pedestrian friendly transportation systems, which provide linkages and interconnectivity of developments;
- Provide adequate continuity, length, and width for walkways;
- Provide for visual and functional enhancement of streets and walkways through the use of natural and introduced landscapes;
- Encourage traffic management plans by private developers;
- Design streets to balance traffic between automobiles and pedestrians; and
- Encourage curvilinear streets, streetscape, and route continuity between subdivisions.

1.3 Applicability

These standards are intended to apply to all residential subdivisions in Town districts R6 through RD180. Standards for developments which are residential and have greater or lesser densities will be evaluated on a case by case basis.

2.0 FUNCTIONAL CLASSIFICATION AND INCORPORATED REGULATIONS

2.1 Functional Classification

There are four (4) broad functional classifications of streets as defined by the American Association of State Highway and Transportation Officials (AASHTO): local, collector, arterial, and freeway (limited access). This document is limited in concern to the design characteristics of local streets associated with subdivisions and developments, with particular attention to residential land development.

1. **Local Streets:** Local streets serve as access to residences, businesses or other abutting properties. Local streets are generally two (2) lane undivided roads with at-grade intersections and may have frequent driveway access. Local streets are intended and designed to provide access to abutting residential areas and supply this traffic to collector roadway systems. The design volume of these streets should be less than one thousand (1000) average trips per day (Average Daily Traffic (ADT)). Local streets must be designed and posted with a minimum speed of twenty-five (25) miles-per-hour (mph). Lower design speeds may be used for mountainous roadways (see Chapter 4.12).
2. **Commercial and Industrial Subdivision Streets:** Commercial and industrial subdivision streets are to be designed in accordance with the above criteria with special consideration of expected wheel loads, vehicle dimensions and proposed use. Please refer to AASHTO's "A Policy on the Geometric Design of Highways and Streets" as well as the project's Traffic Impact Analysis for further design guidelines pertinent to these facilities (see [Appendix](#)).
3. **Local Collectors:** Local (residential) collectors (also referred to as primary residential streets) are generally limited-access two-lane roadways that are striped with centerline and multi-use lanes. These streets are intended to serve as the main access point for a subdivision (see [Appendix](#)). The design speed for this type of street should be 35 MPH (to be posted at 30 MPH) and the design volume should be no more than 2500 vehicles per day. The parking of vehicles and residential driveway access should be prohibited on these streets at all times.

It is recognized that there are specialized types of developments such as retail, office, industrial, mobile home parks, recreational, and cluster housing which vary widely in operational requirements. Design of these projects has been provided for as much as possible within this document.

2.2 Incorporated Regulations Adopted by Reference

This manual establishes engineering design practices for local roadway construction associated with land development within the Town of Marana. For items not covered herein, such as collector street and arterial designs, the engineer shall design in accordance with the latest editions of References listed in Chapter 14.0.

The following adopted standards, ordinances, or policies are also applicable and should be referred to by the design engineer as appropriate:

1. Marana Land Development Code;
2. Town of Marana General Plan;
3. Adopted Area, Community, Neighborhood and Specific plans;
4. Northwest Marana Area Plan Amendment;
5. Conditions of zoning and rezoning;
6. Town of Marana Master Transportation Plan;
7. "Floodplain and Erosion Hazard Management Ordinance", Town of Marana and PCDOT & FCD.

3.0 TRAFFIC STUDIES

Functional classification, roadway ADT, determination of number of lanes, design speed, required offsite improvements and design level of service shall be determined at the time of preliminary plat or development plan review, or master development plan preparation, as applicable (or rezoning if feasible) by the design engineer subject to approval by the Town of Marana. All projects that generate peak hour trips exceeding one hundred (100) vehicles are required to perform a Traffic Impact Analysis as a condition of Development Plan or Preliminary Plat. For developments producing less than one hundred (100) vehicular trips during the peak hour, a Traffic Impact Statement shall be submitted. This statement must be sealed by a civil engineer licensed to practice in the State of Arizona, and must include, at a minimum, peak hour traffic generation figures. For the preparation of traffic impact analysis, the guidelines contained within ADOT's "Traffic Impact Analysis for Proposed Developments" manual shall be followed, at a minimum, or as superseded by the Town of Marana's Traffic Impact Analysis Process Manual. In some cases, developments with less than one hundred (100) vehicles may be required to do a Traffic Impact Analysis if deemed necessary by the Town.

1. For local streets, in the absence of more detailed information, ADT may be estimated from the number of units and the land use according to ITE's "Trip Generation" report.
2. The potential for cut-through traffic using neighborhood streets shall be addressed. Cut-through traffic is defined as traffic that uses a residential street (or a route consisting of more than one street) solely for the purpose of connecting between two major (arterial or collector) streets. If it is expected that the volume of cut-through traffic may be significant, consideration shall be given to the use of traffic calming measures on the potentially impacted street(s). See the section in Chapter 12.0 on traffic calming devices.

The addition of proposed traffic through existing neighborhoods shall be addressed. In such cases, the new traffic forecasts are to be considered as “cut-through” traffic and the impacts on existing roadways examined. Appropriate traffic calming devices and techniques shall be identified.

3. Non-residential ADT can be examined using the “Trip Generation Handbook”, ITE.
4. Traffic demand forecasts must be made including a summary of background traffic plus approved, not-yet built development traffic, plus proposed project traffic.
5. Any project proposal, which would degrade an existing roadway below a level of service (LOS) C, must mitigate to maintain a minimum LOS C.
6. An LOS of C or better shall be maintained on all off-site roadways and intersections that fall within the development’s area of significant traffic impact (as designated by the town and as depicted in the Traffic Impact Analysis prepared for the development). Improvements are required if the roadway or the intersection will operate below LOS C due to traffic generated by the development. Such improvements shall upgrade the LOS to C or better.

4.0 STREET LAYOUT & GEOMETRIC DESIGN

All subdivision and development related street design shall conform to this document. Where not provided for herein, design engineers shall refer to those supplementary standards listed in Chapter 2.2.

4.1 Street Layout

1. All rights-of-way and street sections shall be designed and constructed to the full dimensions as shown in the [Appendix](#).
2. Where partial streets exist adjacent to the tract being developed, the remaining right-of-way must be dedicated and improvements must be made to the street as required by the Town Engineer.
3. Proposed developments shall provide for the continuation of existing arterials and collector street right-of-way where appropriate.
4. The local street system shall be arranged to encourage traffic connectivity within the development and region. Traffic calming devices such as traffic circles and circuitous through routings are to be encouraged. See Chapter 12.0, Neighborhood Traffic Management.
5. Lots fronting on major streets are to be discouraged. However, when lots must front on a major street, proposed developments will be required to provide sufficient right-of-way for local service or access streets (frontage roads) along major streets and routes. Other

treatments to protect residential properties by separation of through and local traffic will be considered.

If frontage roads are used, they shall be designed such that improper intersections with streets do not occur. Frontage streets by their nature intersect with entrance drives at close distances. However, they shall not intersect with new or existing streets at points less than that specified by Town Code (see off street parking requirements in Title 22 of the Marana Land Development Code).

Frontage roads shall have adequate turn-around areas for the design vehicle at roadway termini (see [Appendix](#)).

6. The proposed development shall provide streets in conformance with all existing specific plans, residential design guidelines, and area plans that are approved and adopted by the Town Council.
7. As determined by area plans, stub streets required for future extension shall provide temporary turnaround areas at the stub end (see [Appendix](#)).
8. Private streets are discouraged. If allowed, entrances to gated, private streets shall include a turn-around area entirely contained between the ultimate public right-of-way and the proposed gate. The turn-around area shall be designed in accordance with the requirements of Chapter 4.2 herein.
9. In order to maintain an 85th percentile speed of 25-30 MPH, it is recommended that local street tangents be no longer than 500 feet between speed control points. A speed control point is defined as a break in continuity (such as a stop-controlled intersection), a properly designed horizontal curve, or a traffic calming device.

4.2 Cul-de-sacs

Permanent dead-end streets shall be designed with an adequate turnaround area at the dead-end. In accordance with Town standards, the turnaround area may not be required on dead-end streets less than one hundred fifty (150) feet in length if Municipal services, such as fire, sanitation, school buses, maintenance equipment, delivery and repair vehicles, and postal service, can be provided without the use of the street. Turnarounds may be designed as cul-de-sacs or “T” or “Y” shaped configurations as shown in the [Appendix](#).

1. The cul-de-sac is preferred at all times for local street turnarounds because of its overall efficiency and maintainability, as well as for operational considerations pertaining to certain types of vehicles (e.g. fire trucks & school buses).
 - a) The paved turnaround radius shall be a minimum of forty-two (42) feet measured to the edge of pavement, back of rolled curb or gutter, whichever is provided.
 - b) The turnaround right-of-way radius shall be a minimum of fifty (50) feet.

2. “T” and “Y” shaped turnarounds may be used for dead-end streets which have a projected A.D.T. of eighty (80) or less. Vertical curb is required in the turn-around area, unless it is desirable to provide access to individual units. In such cases, rolled curb may be used.
3. Improvements to existing dead-end streets on abutting properties may be required during rezoning or subdivision platting. The purpose of these improvements shall be to allow proper through connection of future streets. Through connection may require that the developer remove abandoned cul-de-sac pavement on the abutting property (see [Appendix](#)), and that the full pavement section be carried to property line.
4. Where temporary turnarounds or cul-de-sacs are designed for future extension to abutting properties, a note shall appear on the final plat listing the street name and indicating the temporary nature of the cul-de-sac condition.
5. Cul-de-sacs may contain landscaping within a center area island (refer to [Appendix](#)):
 - a) Vertical curb is used around the entire center landscaped area;
 - b) The radius to the face of the curb is a maximum of eighteen (18) feet;
 - c) The cul-de-sac is large enough to allow passage of the design vehicle without wheel paths encountering the curb;
 - d) The cul-de-sacs are not proposed to be future through streets;
 - e) The landscaping does not impinge on sight visibility;
 - f) The Town of Marana shall not be responsible for maintaining cul-de-sac landscaping and a note to this effect shall be on the final plat. If landscaping is provided, the developer, or homeowners association shall obtain a license agreement from the Town prior to the installation of landscaping. Landscaping irrigation runoff shall not be permitted to drain onto the roadway surface.
 - g) No dead-end street longer than six hundred feet shall be designed to permanently remain a dead-end street. See Town of Marana Land Development Code 06.03.03K for design guidelines.

4.3 Design Speed

The minimum design speed for local streets is twenty-five (25) MPH. The design speed for residential collectors is 35 MPH. Higher design speeds may be warranted for certain roadways, and lower design speeds may be used for mountainous roadways per Chapter 4.12.

4.4 Design Vehicle

All local streets shall be designed for a WB-40 vehicle as defined by AASHTO.

Non-residential subdivision streets and parking area access lanes shall be designed for the largest vehicles (including service and delivery vehicles) anticipated to use the facilities, all in consultation with the Town Engineer. Delivery and service routes are to be clearly shown on the development plan and/or preliminary plat, as applicable. A note shall be provided designating the design vehicle.

4.5 Horizontal Alignment

Minimum horizontal curve design criteria are shown in Table 1.

TABLE 1

| Criteria | Local | Residential Collector |
|--|-------|-----------------------|
| Design Speed (mph) | 25 | 35 |
| Minimum Center Line Radius (ft) (assumes 2% normal crown) | 181 | 480 |
| Minimum Horizontal Stopping Sight Distance (ft) | 150 | 250 |

Consideration of driver expectancy and coordinated horizontal and vertical geometry shall occur in subdivision roadway design.

When two local road tangents are connected by a curve of less than the minimum radius, a “knuckle” or “eyebrow” must be constructed (see [Appendix](#)).

Compound and reverse curves are discouraged for local roads. Where this type of configuration is absolutely needed, it is recommended that tangents be placed between the curves. Tangents increase driver comfort, expectancy and safety. Where tangents are used, a minimum tangent length of one hundred (100) feet is required.

4.6 Vertical Alignment

Vertical alignment shall generally conform to the natural topography within the following limits:

TABLE 2

| Criteria | Slope |
|--|------------------------|
| Max. Gradient – Local Driveway | 14 % (in R/W) |
| Max. Gradient – Local Streets | 7 % Level, 11% Rolling |
| Max. Gradient – Non-residential Streets except Mountainous | 8 % |
| Minimum Gradient | 0.5% |

In mountainous terrain (see Chapter 4.12), local street gradients may be up to fifteen (15) percent, upon approval by the Town Engineer.

1. Normal roadway cross slope shall be two (2) percent. (one (1) percent minimum, three (3) percent maximum).
2. Cross slope for drainage design may be four (4) percent, at drainage crossings only.
3. Maximum cul-de-sac cross-slope shall be eight (8) percent.

4. Inverted crown streets are not acceptable for local streets. Inverted crowns may be used for Parking Area Access Lanes (PAAL's).
5. Minimum vertical (stopping) sight distance shall be per AASHTO's "A Policy on Geometric Design of Highways and Streets", or one hundred fifty (150) feet, whichever is more restrictive. For other design speeds and grade condition refer to AASHTO's "A Policy on the Geometric Design of Highways and Streets".
6. Landing areas are required for all stopped conditions. The maximum allowable grade for this landing area (on approaches to unsignalized intersections) is three (3) percent (six (6) percent in mountainous terrain, see Chapter 4.12), and this grade must extend at least twenty (20) feet in each direction from the outside edge of curb line of the intersecting street.
7. Vertical curves shall be required on local streets where the algebraic difference in grade exceeds one (1.0) percent. When the algebraic difference is 1.0 percent or less, a grade break shall be used. Use of the AASHTO vertical curve equation is preferred; however, a simplified method as shown below may be used. Using that method, the minimum lengths of vertical curves shall be determined by multiplying the algebraic difference in grades by the appropriate 'K' factor from the table below, or as specified in Table 3 (whichever is greater):

Vertical Curve Criteria (for grades less than ten (10) percent)

TABLE 3

| Design Speed | K Factor Crest Vert. Curve | K Factor Sag Vert. Curve | Minimum Length Curve |
|--------------|----------------------------|--------------------------|----------------------|
| 25 | 12 | 26 | 75 |
| 30 | 19 | 37 | 90 |
| 35 | 29 | 49 | 105 |

All vertical curves shall be symmetrical parabolic curves. The minimum length of a vertical curve in feet shall be three (3) times the design speed in miles per hour.

When grades are greater than ten (10) percent, vertical curves shall be lengthened in accordance with AASHTO's "A Policy on Geometric Design of Highways and Streets", to account for increased needed stopping distance.

4.7 Intersection Alignments

1. The centerlines of intersecting streets shall have an angle of intersection of as close to ninety (90) degrees as is practical. In no case will the angle of intersection be less than seventy-five (75) degrees for local street-collector/arterial intersections and sixty (60) degrees for local street-local street intersections (see [Appendix](#)).

2. Right-of-way lines at the corners of street intersections will be rounded with a curve radius of twenty-five (25) feet, or greater, as conditions may warrant. The radii must be adjusted at skew intersections to provide sufficient curvature. In all cases, adequate sight distance shall be maintained.
3. Uncurbed intersections shall only occur where a new street intersects an existing uncurbed roadway in an interim state of development. Said interim intersections shall have a minimum curve radius of forty (40) feet, except when acceleration/deceleration lanes are required. Uncurbed intersections shall have concrete headers installed to prevent pavement raveling. A transition to full height curb shall occur at the point of tangency of the radius.
4. Where acceleration/deceleration lanes are used, the curve radius may be reduced to twenty-five (25) feet. Larger radii shall not be used, however, as the travelway width will increase to unsafe dimensions. In all cases the radius shall be designed to be adequate for the design vehicle.
5. Street jogs with centerline offsets of less than one hundred thirty-five (135) feet shall not be allowed (see [Appendix](#)).

4.8 Intersection Sight Distance

Clear lines of sight shall be maintained along all streets and driveways (including PAAL's) to provide for the safety of motorists, pedestrians, and bicyclists. Sight visibility triangles shall be constructed in accordance with AASHTO criteria or as shown in the [Appendix](#) based on the design speeds of the through street and the near side and far side distance requirements from the following table:

TABLE 4

| Design Speed of Through Street (mph) | Near Side Requirement (ft) | Far Side Requirement (ft) |
|--------------------------------------|----------------------------|---------------------------|
| 20 | 180 | 140 |
| 25 | 240 | 190 |
| 30 | 300 | 240 |
| 35 | 380 | 300 |
| 40 | 480 | 370 |
| 45 | 600 | 470 |
| 50 | 740 | 580 |
| 55 | 890 | 690 |

On streets with one-way traffic and on streets with two-way traffic separated by raised median islands (i.e. no opening) only the near side sight visibility triangle is required; however a pedestrian visibility triangle shall be maintained in place of the far side triangle as shown in the [Appendix](#).

Where streets intersect in a cross configuration, each street is considered the intersecting street with the other street considered the through street for purposes of determining sight lines (see the [Appendix](#)).

The near side and far side distance requirements of sight triangles along a horizontal curve are to be measured along a chord as opposed to along the arc (see [Appendix](#)). The sight line of the sight triangles shall supercede standard building setback lines where the sight line requires a greater setback distance. Sight visibility triangles shall be depicted to scale and in a surveyable manner on all final plats, development plans, plot plans and landscape plans. The area within the sight visibility triangle must be entirely enclosed by the right-of-way, easement, or common area.

Restrictive notes pertinent to sight visibility triangles shall be required on plats, development plans, plot plans and landscape plans. No improvements between thirty (30) and seventy-two (72) inches in height relative to the adjacent roadways that might interfere with sight visibility shall be placed and/or maintained within the sight visibility triangle.

4.9 Residential and Commercial Drive Entrances

Driveway entrances present a potential hazard to the motorist and pedestrian. As such, the engineer should configure them to allow rapid and definite recognition by the traveling public.

1. On streets with vertical curbs, depressed curb (curb cuts) and aprons shall be used for driveways. Driveway aprons shall be of Portland cement concrete constructed to Town standards with a minimum length running from curb location to back of sidewalk location. Standard curb returns may be used for service entrances, provided these entrances are clearly depicted as a “service entrance” on plats and development plans.
2. On streets with roll curb, driveways shall butt to back of curb, shall not have curve radii, and may be constructed of Portland cement concrete or asphalt.
3. On existing uncurbed streets, driveways shall have returns with a radius of forty (40) feet. A six (6) inch by twelve (12) inch concrete header shall be placed adjacent to the pavement on all returns.

If curb is used for drive entrances in other applications, radii shall not be less than twenty-five (25) feet, and curbing shall not extend into the public right-of-way if the public street is uncurbed.

4. Dimensions and configurations of driveways may need to be adjusted to account for higher approach speeds (greater than forty (40) mph), traffic, roadway classification, design vehicle, and pedestrians. Measures may include widening, turn lanes, etc. Curb returns may be used in place of standard curb cuts only when one (1) or more of the following conditions occur:
 - a) The ADT of the driveway exceeds one hundred (100);
 - b) The points of access to a property should be limited for traffic control and other reasons; or

- c) Local conditions occur which involve speed, the amount of truck traffic, or the type of development and which, in the Town Engineer's opinion, require curb returns.
5. Driveways shall not be located where conflicts will be created with drainage facilities, intersections, or other improvements.
6. No residential driveways shall encroach into an intersection curb radius where residential streets intersect.
7. Commercial driveways shall conform to the Town of Marana Access Management Manual.

4.10 Roadway Superelevation

Superelevation is generally not necessary on streets designed for travel speeds of thirty-five (35) mph or less. Maximum superelevation shall be four (4) percent and runoff lengths shall be computed in accordance with AASHTO's "A Policy on Geometric Design of Highways and Streets".

4.11 Roadway Drainage Crossings

The cross-slope of roadways for drainage purposes shall not exceed four (4) percent, and comfortable speed as well as design speed must be maintained throughout the cross-slope.

Minimum cross-slopes shall maintain a two (2) foot per second velocity for the 2-year peak flow, to reduce potential deposition of material in the roadway.

4.12 Mountainous Terrain

Mountainous terrain is that condition where longitudinal and transverse differentials in ground elevation with respect to the roadway are such that:

1. Excessive benching, side hill excavation, or other cuts and fills are needed;
2. Excessive rights-of-way for either cut and fill slopes (multiple cuts and/or fills exceeding fifteen (15) feet of vertical change) or for roadway alignment are required, or;
3. Significantly lengthened roadway sections and increases in right-of-way are necessary in order to obtain acceptable horizontal and vertical alignment.

In any case, roadways to be constructed across terrain with an average cross slope of fifteen (15) percent (as defined within the Town of Marana's Land Development Code) or greater shall qualify for the mountainous terrain classification.

For local streets subject to this section, a twenty (20) mph design speed may be used, provided emergency services and school vehicles can safely traverse the roadway(s).

With prior written approval by the Town Engineer, the design engineer may utilize four (4) foot shoulder widths and steeper longitudinal slopes (private streets only). Roadside drainage provisions shall be incorporated to minimize cross-flows and material deposition within the travel way. Particular attention to stopping sight distance and sight visibility is to be incorporated into the roadway and grading design. Positive gradient slopes (those rising above the roadway) shall not be permitted within sight visibility triangles, unless they conform to Chapter 4.8.

4.13 Environmentally Sensitive Roadways

[RESERVED]

4.14 Subdivision Access

Subdivision access is important in design, as it allows for efficient routes of ingress/egress for emergency response vehicles, as well as providing for less congested access and shorter trip lengths.

1. Alternative Access requirements

- a. Subdivisions of more than thirty (30) and not more than eighty (80) lots shall in addition to the primary access have either an emergency access drive with a stabilized surface capable of supporting fire apparatus or another permanent roadway.
 - i. Portions of a subdivision (such as cul de sacs and other no-outlet areas) must also meet this requirement.
 - ii. In areas where it is determined by the Town Engineer that the provision of a secondary access is not practicable based on topography or other access constraints, the Town Engineer, in conjunction with the Fire Marshall, may allow a single point of access which may include other mitigating requirements such as intermittent turn-around areas, fire sprinkler protection systems and/or other similar measures.
- b. Subdivisions of more than eighty (80) lots shall have a minimum of two (2) permanent roadway accesses.
 - i. In areas where it is determined by the Town Engineer that the provision of a secondary permanent roadway access is not practicable, the Town Engineer may allow a single permanent roadway access which may include other mitigating requirements such as secondary emergency access, intermittent turn-around areas, fire sprinkler protection systems and/or other similar measures.
- c. Phased subdivisions that will ultimately have a secondary compliant access must comply with one of the following requirements:
 - i. At closeout of subdivision permitting and final release of assurances, a subsequent phase must already be under permit; or

- ii. At closeout of subdivision permitting and release of final assurances, a temporary roadway capable of supporting fire apparatus must be in place.
2. Entry roadway width requirements
 - a. Entry roadways with medians are required to have a minimum inside curb-to-curb entry width of twenty (20) feet.
 - b. Gated entry roadways are required to have a minimum inside curb-to-curb and/or open gate width of twenty (20) feet. Gates must be accessible to the satisfaction of the Fire Marshall.
3. Any deviations from these requirements will require a design exception in accordance with Chapter 13.

5.0 RIGHT-OF-WAY

1. Local street rights-of-way shall be in conformance with the cross sections provided within the [Appendix](#). Rights-of-way must be wide enough to encompass all publicly maintained facilities including pavement, curb, signage, sidewalks, bicycle paths, shoulders, clear-zones, road-side ditches, cut and fill slopes, street lights and access to maintain such facilities.
2. Where not otherwise required by the Land Development Code, easements may be granted in lieu of right-of-way for certain cross section elements that are not to be maintained by the Town of Marana such as utilities, sidewalk/pedestrian/equestrian ways and slopes. Such easements must specifically grant right of entry to the Town of Marana. Such right of entry shall include auxiliary areas to allow maintenance of facilities within the right-of-way and to enable remedy from hazards to the public so as to assure the public safety.
3. Additional rights-of-way may be required by the Town at intersections identified on the Major Routes Plan or at intersections with other collectors where it is deemed necessary to provide sufficient width for turning lanes, traffic interchanges, clear zones, sight visibility and other design and safety considerations.
4. Should alternative sidewalk locations be approved, or if no sidewalk construction is required, street(s) shall require a minimum of six (6) feet of right-of-way adjacent to the back of curb on each side of the street for purposes of pedestrian refuge, meters, street furniture, or other such uses (see Chapter 6.3).
5. When it is determined by the Town that, in the public interest or for the health, welfare or safety of same, vehicular access to or from a development or subdivision at a particular location should be prohibited, a one (1) foot wide no-vehicular access easement shall be dedicated to the public. Physical barriers may also be required.

6. Supplemental right-of-way and/or easements may be required at all intersections where standard right-of-way widths are unable to completely enclose sight distance triangles.
7. If parking is designed to be between the sidewalk/pedestrian way and the garage, it must be designed so as to not block or encroach onto the sidewalk.

6.0 ELEMENTS IN THE CROSS SECTION

Typical cross sections are shown in the [Appendix](#). Selection of the appropriate cross section is dependent upon the functional classification, ADT of the street, and the adjacent land use density. Additional pavement width may be provided, upon approval or requirement of the Town Engineer.

6.1 Travel Lanes

Specific applications of various lane width requirements are shown in the [Appendix](#). The design engineer shall use these figures as the basis for design considerations.

6.2 Curbing

1. Curbing shall be required on all public streets as shown in the typical cross-sections supplied herein. The purpose of curbing shall be to adequately control drainage within the street, prevent moisture from entering the subgrade, control access to abutting property, separate the roadway from pedestrian areas, delineate the traveled roadway (in lieu of edge striping), control dust, and provide adequate lateral support for the pavement structure.
2. Curbing shall be six (6) inch vertical curb and gutter (PC/COT standard detail 209 Type 1(G)) or roll type curb and gutter (MAG Detail 220 Type C). Preference shall be given to roll type curb and gutter at all times.
3. At local street to local street intersections, the minimum curb radius shall be twenty-five (25) feet to face of curb, or the minimum radius which will accommodate the turning movements of the design vehicle without encroachment into opposing lanes, whichever is greater. At local street to collector/arterial intersections, the minimum curb radius shall be forty (40) feet.
4. Wheelchair ramps shall be provided at all curb returns and shall be in accordance with MAG or PC/COT Standard Details for Public Improvements and in compliance with the latest Federal ADA guidelines, as applicable. ADA detectable warning surfaces (truncated domes per the Town of Marana standard detail) shall be applied to all wheelchair ramps and at all pedestrian refuge areas on raised islands and medians.

6.3 Sidewalks

Sidewalks shall be of Portland cement concrete constructed to PC/COT “Standard Specifications and Details for Public Improvements”, with a minimum width of five (5) feet, ordinarily placed abutting the curb. Additional sidewalk width shall be required for special pedestrian generators, such as schools, recreation sites, and certain businesses.

1. Sidewalks will be required along both sides of paved streets with curbs, or along streets where future curb grades and locations are established, in accordance with the cross-sections in the [Appendix](#).
2. Stabilized granite walking paths may be substituted for sidewalks in subdivisions with lots having a gross density of one residence per acre or less, and lots of a minimum of 12,000 square feet.
3. Sidewalks shall run the entire length of the street.
4. Streets may have sidewalks in an alternative location provided it is designed in a manner and location acceptable to the Town Engineer and the Planning Director.
5. The area between the back of curb and the roadside edge of the pedestrian walkway is the curbway. In the event a curbway is used, the minimum width for the curbway is six (6) feet.
6. A 10’ public utility, roadway maintenance, and signage easement shall be granted behind all sidewalks where no curbway is present. At locations where public utility easements are not required (such as side yards), a 5’ roadway maintenance and signage easement shall be used.
7. In very low density developments that do not require sidewalks, a four (4) foot wide walk area must be kept free from vegetation. The walk area shall be graded to provide a cross slope of two (2) percent, and shall be surfaced with stabilized granite.
8. In pedestrian areas having curbways, the developer, owner, or private association having a Recorded License Agreement may allow abutting property owners to place pea gravel, decomposed granite, ground cover, or brick in sand in the curbway and ground slope areas without a permit from the Town of Marana. The property owner shall be responsible for the maintenance and replacement of said items placed within the curbway. Street trees are encouraged and must adhere to AASHTO Roadside Development guidelines. Installation of street trees will require an approved Landscape Plan, License Agreement, and Design Exception pursuant to Section 13.0.
9. Neighborhood postal box units (NBU’s) shall be designed and located in such a manner as to not present a hazard to the motoring public or pedestrians.

10. In cases where the subdivision street system is designed in such a way that access to schools is indirect, pedestrian easements shall be required which will provide direct routes to nearby schools.

6.4 Shoulders

Uncurbed roadways are only permitted for temporary access roads. On uncurbed roadways a minimum eight (8) foot graded shoulder shall be provided in accordance with the cross sections in the [Appendix](#). Shoulder width may be reduced to four (4) feet in width in accordance with Chapter 4.12, and as shown in the [Appendix](#). The cross-slope of the shoulder shall match that of the travel lane. Where infeasible due to topography and roadside drainage considerations, adjustments may be made in accordance with AASHTO guidelines upon approval by the Town Engineer. Refer to AASHTO design guidelines for foreslope and backslope in cut areas.

6.5 Roadside Clear Zone

Clear zones shall be provided for all streets and are to be in accordance with the requirements stipulated within AASHTO's "Roadside Design Guide". Sufficient right-of-way or easements shall be granted to the Town for all clear zones.

If infeasible to provide this clear-zone, a suitable traffic barrier as defined in Chapter 6.6 and the AASHTO publication "Roadside Design Guide", shall be provided.

6.6 Roadside Vehicle Barriers

Determination of warrants for the installation of roadside vehicle barriers (barriers) shall be in accordance with AASHTO's "Roadside Design Guide. Barriers shall be installed in accordance with current ADOT Standard Specifications and Drawings.

Obstructions may also require barriers to provide for motorist safety. Refer to AASHTO's "A Policy on Geometric Design of Highways and Streets" and "Roadside Design Guide", for definitions of obstructions and applications of barriers.

6.7 Barricade Railing

Barricade railing shall be installed for protection of pedestrians whenever slopes are steeper than three-to-one (3:1) within three (3) feet of the sidewalk and the embankment height is three (3) feet or greater. The Town Engineer may determine whether the elevation differences between the sidewalk and nearby terrain warrant pedestrian barricade railing or if other special circumstances may also warrant the installation of barricade railing.

6.8 Roadside Ditches

Roadside ditches shall not be constructed within the shoulder area. Ditches constructed within the clear-zone (outside the shoulder) shall be in accordance with AASHTO's "Roadside Design

Guide”, and “ A Policy on Geometric Design of Highways and Streets”, in addition to applicable Chapters of these standards.

6.9 Cut and Fill Slopes

All cut and fill slopes shall be constructed in accordance with the Marana Land Development Code Grading Standards and AASHTO, and shall be either revegetated or stabilized as follows:

1. Cut or fill slopes three-to-one (3:1) (horizontal: vertical) or less, shall at a minimum be revegetated.
2. Cut or fill slopes two-to-one (2:1) or less, but steeper than three-to-one (3:1) shall be rock rip-rapped with filter fabric installed beneath the rock.
3. Cut or fill slopes steeper than two-to-one (2:1) shall have grouted rip-rap, earth retaining, or retaining walls as appropriate.
4. Alternative methods of stabilization may be allowed if certified as stable by a registered geotechnical engineer, subject to approval by the Town Engineer.
5. Terracing may be done in accordance with the Marana Land Development Code Grading Standards.

6.10 Landscaping in the Public Right-of-Way

1. Bufferyards where required by the Marana Land Development Code may be allowed in public right(s)-of-way. Contact the Town Engineer prior to project design if this option is desired. The Town Engineer and Planning Director will consider project safety, future expansion of the roadway, drainage concerns, adjoining land uses, and other criteria on a case-by-case basis during the review process. To the extent the Town permits this use, in the right-of-way the use will be subject to the following requirements:
 - a) Not more than fifty (50) percent of the required bufferyard depth may be allowed in the public right-of-way, except along major routes having a designated buffer;
 - b) The location and size of landscape elements shall be in conformance with standards available from the Town Engineer and and Planning Director and are subject to the Town Engineer’s and Planning Director’s approval;
 - c) The installation and maintenance of landscaping in the public right(s)-of-way shall be accomplished by the developer, owner or private association, as agreed to in the approved, recorded covenants, conditions and restrictions. Assurances shall be required, and insurance policies, in a form acceptable to the Town, shall be required for all landscaping constructed in the public right-of-way;
 - d) A perpetual License Agreement for new landscaping, irrigation, raised planters, fencing, walls, signs, art, and monuments within the public right(s)-of-way shall be required. This Agreement shall be recorded with the Pima County Recorder’s

- Office; and
- e) Turf landscaping shall not be permitted within the right-of-way, nor shall it be permitted to drain onto pedestrian ways or pavement.

7.0 SUPPLEMENTAL ELEMENTS

7.1 Turning Lanes

Pavement widening for turning movements onto arterial and collector streets may be required by the Town Engineer. Turning lanes shall be a minimum of twelve feet in width. Pavement tapers required for any of the above improvements shall be designed in conformance with Pima County's "Roadway Design Manual", and as determined within the approved Traffic Impact Analysis.

8.0 UTILITIES

The main lines of electric, gas, water, telephone and communications, sanitary sewer, and drainage facilities shall be located as shown in the [Appendix](#). Alternate locations may be used with the written permission of the affected utility and the Town Engineer. Utility companies franchised to operate in Town of Marana right-of-way for electric, telephone, and communications may be permitted under terms of adopted franchise agreements. Utility easements are required, where applicable, and shall allow for public access.

With the exception of minor service extensions to individual parcels, all longitudinal utility facilities between service points to individual parcels shall be located within street right-of-way. Strip easements may be used along streets in lieu of right-of-way if for utility purposes, and for other uses compatible with utility needs (subject to utility company approval). Access between the street and the private property shall not be denied, unless unsafe conditions will occur.

All sanitary sewer facilities shall be provided in accordance with the current Pima County Department of Wastewater Management "Manual of Engineering Standards and Procedures".

All services shall be provided or stubbed out into existing or planned parcels with all new street construction to avoid the need to remove and replace new pavement within the five (5) year pavement cut moratorium. Sewer connection stub-outs are to extend a minimum of ten (10) feet beyond the right-of-way, while other service connection stub-outs are to extend a minimum of two (2) feet beyond the right-of-way.

Service extensions (sewer and water) shall be backfilled and compacted (within the curbway and sidewalk area) to at least ninety-five (95) percent of the maximum density at optimum moisture. All utilities are to be installed in accordance with applicable utility company standards, or the PC/COT "Standard Specifications for Public Improvements", whichever is more restrictive. All utilities installed beneath the pavement, or curb and gutter shall be backfilled and compacted to ninety-five (95) percent of the maximum density at optimum moisture in accordance with the approved Grading and Paving Plans.

9.0 DRAINAGE

9.1 Street Drainage

Street drainage should not exceed fifty (50) cubic feet per second (cfs) from the base flood and in no case shall street flows exceed one hundred (100) cfs at the confluence point exiting the roadway. The runoff from a ten (10) year storm must be contained between the street curbs. The one hundred (100) year discharge must be contained within the right-of-way. Outlet structures for private retention/detention facilities, or other private drainage systems, shall not be permitted to discharge into the public right-of-way.

9.2 Storm Drain Design

All catch basins with curb inlets shall have formed concrete gutters. The minimum diameter of a storm drain is 24" for mains and 18" for laterals connecting a single catch basin.

Slotted drain is permitted in conjunction with curb and gutter. Transverse installation of slotted drain is forbidden.

The energy grade line of a storm drain shall be below finished grade of the associated roadway gutterline.

9.3 Cut-off Walls

Required cut-off wall depths shall be designed one (1) foot deeper than the scour depth as determined by the use of the approved local scour equations. However, in no case shall cut-off walls be less than one (1) foot in depth. Sliding and overturning moments may need to be analyzed for cut-off wall protected dip sections on all-weather access streets. Cut-off walls shall be placed four (4) feet out from the upstream roadway edge of pavement line, and to the edge of the shoulder downstream. The pavement shall be widened to the upstream and downstream cut-off walls.

9.4 Curb Openings

Drainage conveyed within the street while being delivered to channels or outlets may be disposed of through depressed curb openings no greater than ten (10) feet in length unless in environmentally sensitive areas, and with the approval of the Development Services Administrator. These shall be fitted with outlet aprons. When stormwater runoff is crossing pedestrian ways scuppers shall be used. Should the hydraulic design require greater conveyance than can be provided by such an opening, some other structure must be used. Roadway curb openings and drainage inlets shall be fitted with appropriate barricades as necessary, and the pavement-to-inlet grade shall not be less than two (2) percent.

At locations where runoff leaves the roadway, physical means of earth stabilization or pavement protection must not interfere with clear zone requirements, and must be traversable by errant vehicles without risk of damage to those vehicles.

10.0 PAVEMENT DESIGN

1. These pavement design standards apply to all local street improvement projects designed as a part of development. Each development that involves street construction shall submit for approval a Pavement Design Report containing the following information for each street: a tabulation of results of soil subgrade tests; projected ADT's, including construction traffic; equivalent single axle loads (ESAL) used, including construction traffic; structural numbers (SN); and pavement thickness for each street. A Pavement Design Report may be waived by the Town Engineer for parking lots in private developments. A minimum twenty (20) year pavement design life is required. The twenty (20) year design life is to be computed beginning in the build-out year. The build-out year is defined as that year when all homes/buildings are projected to be completed within the proposed development. Estimated construction traffic through build-out must be considered.

2. The following ESAL's, based on the twenty (20) year projected ADT, will be accepted for pavement design:

TABLE 5

| 20 Year ADT | ESAL |
|-------------|---------|
| <500 | 40,000 |
| 500-1,000 | 70,000 |
| 1,000-1,500 | 100,000 |
| 1,500-2,500 | 150,000 |

When the projected twenty (20) year ADT exceeds twenty-five hundred (2500), or when the engineer desires to calculate his/her own ESAL's, complete calculations, including a breakdown of the traffic by vehicle type, shall be included in the Pavement Design Report. The ESAL calculations shall be based on the twenty (20) year design period and the following ESAL factors:

TABLE 6

| Vehicle Type | Symbol | ESAL Factor |
|------------------------------------|--------|-------------|
| Passenger Car | P | .0008 |
| Bus | BUS | .6806 |
| Single Truck | LT | 0.012 |
| Single Truck (Dual rear or 3 axle) | MT | .1890 |
| Tractor-Trailer | TS | .6560 |
| Truck-Tandem Trailer | TT | .8646 |
| Tractor-Tandem Trailer | TST | 1.2604 |

Please refer to:

“Materials - Preliminary Engineering and Design Manual”, ADOT

“Guide for Design of Pavement Structures”, AASHTO

3. Subgrade sampling and testing for roadways shall be accomplished in accordance with standard ADOT procedures and the results tabulated in the Pavement Design Report. Soil support values shall be calculated in accordance with ADOT’s “Materials – Preliminary Engineering and Design Manual” and the selection of a design soil support value shall be fully documented in the Pavement Design Report.
4. Weighted structural numbers shall be calculated using the design soil support value, the appropriate ESAL, and a regional factor of 1.7. The minimum weighted structural number is to be 1.30. A minimum terminal serviceability index of 2.0 (ADOT) is acceptable for design of local streets.
5. Pavement thicknesses shall be calculated in accordance with the design equations in the ADOT manual. The layer coefficient for asphaltic concrete shall be obtained from the ADOT manual. The layer coefficient for aggregate base course is 0.12. Minimum thicknesses are to be as follows (or as determined by Soils Engineer):

TABLE 7

| Traffic ESAL’s | AC | ABC |
|-----------------------|------|-----|
| <150,000 | 2” | 4” |
| ≥150,000 and <500,000 | 2.5” | 4” |
| ≥500,000 | 3.0” | 6” |

6. Subbase material should be of significantly better quality than native soil. Subbase may not be used as part of the pavement section when the subgrade soil has an R-value of thirty (30) or greater. In addition, when subbase material is used, the thickness of the subbase may not be more than one-and-a half (1.5) times the combined thickness of the asphalt and aggregate base courses. The layer coefficient for material, which meets minimum Town of Marana standards for subbase, is 0.05. If better quality material is used, a larger layer coefficient may be used in accordance with the ADOT manual.

7. When existing streets are widened, the new pavement section shall either match the existing pavement section or meet minimum thicknesses as required in paragraph 5 above, whichever is greater. Upon completion of a pavement widening, the complete roadway cross section may be required to receive a chip seal coat or asphaltic concrete overlay, at the discretion of the Town Engineer, for the entire length of the pavement widening. Appropriate pavement markings and traffic control signage will be required with the seal coat/overlay application.
8. When through streets are designed which may ultimately connect to future developments, pavement design shall accommodate future wheel loads, including construction traffic, to account for use of the roadway as a haul-road.

11.0 TRAFFIC CONTROL SIGNAGE AND PAVEMENT MARKINGS

1. All traffic control signage and pavement markings within new subdivisions shall be posted and installed in accordance with the Manual on Uniform Traffic Control Devices (Millennium Edition) and Pima County/City of Tucson's Pavement Marking Design Manual and Signing Manual (latest editions). A separate signage and/or striping plan shall be submitted for the Town's review and approval. The plan is to be integral to the project construction documents (1st submittal of the improvement plans).
2. All temporary ends of road shall be posted with post barricades or end of road markers, five (5) feet on-center, across the pavement projection. If grading has occurred in the alignment beyond the end of road, at least two (2) permanent Type 3 barricades as described within the "Manual on Uniform Traffic Control Devices" shall be added to the road end. An advisory sign stating, "Future Roadway Extension" of 24" x 24" shall be installed at the temporary end of roadway.
3. Upon review of traffic operational characteristics and within the one (1) year warranty, the Town Engineer may request additional signage or pavement markings by the developer. Said additions shall be provided at no cost to the Town.
4. All private streets shall be posted "NOT A TOWN MAINTAINED STREET - PRIVATE" where they intersect public streets.
5. Pavement markings are to be thermoplastic and meet "Standard Specifications for Public Improvements", PC/COT. Seal coated streets with pavement markings are to comply with ADOT standards and have two (2) applications, one of paint, the other of thermoplastic.
6. Street name signs shall be reflective, shall state the direction of the street, and shall have the primary name at least four (4) inches high. Prefixes, suffixes, and directions may be no less than two (2) inches high. The directional prefix shall be in the upper left corner of the sign.

12.0 NEIGHBORHOOD TRAFFIC MANAGEMENT

Traffic calming measures consist of traffic control devices and physical elements constructed in the roadway that control access to neighborhoods, change travel patterns or regulate the flow of traffic through a neighborhood. Such measures include speed humps, traffic circles/roundabouts, chokers, diverters and others.

The need for traffic calming measures should be considered when addressing the potential for cut-through traffic in a new subdivision. If it appears that the volume of cut-through traffic may be significant, consideration should be given to using traffic calming measures on the impacted streets.

The traffic calming measures to be used in the Town are currently under development and will be included in this document at a later date.

13.0 DESIGN EXCEPTIONS

It is recognized that land is unique, and there may be alternative design solutions to those mandated by these standards that will satisfy AASHTO, Fire Code, and other standards.

In the event an engineer wishes to employ alternative standards, a design exception report may be submitted to the Town to substantiate the proposal. As required, the design exception report must, at a minimum, provide:

1. The section of these standards from which relief is desired;
2. The supporting standards for the proposed alternative;
3. An approval letter from the Northwest Fire District;
4. Approvals from any affected utilities; and
5. Other justification, as deemed appropriate by the applicant.

Five (5) copies of the design exception report will be submitted to the Town of Marana Development Coordinator, together with an application and fees (if applicable).

The design exception report will be reviewed by the Subdivision Engineer, Planning Director, and others as deemed necessary. A recommendation will be forwarded to the Planning Commission at its next available meeting, but no later than two (2) weeks from the date of application.

14.0 DEFINITIONS

AASHTO: The American Association of State Highway and Transportation Officials.

AVERAGE DAILY TRAFFIC (ADT): The total traffic for the year divided by 365.

ALL-WEATHER CROSSING: Any intersection of a street with a drainage pattern where the runoff from a one hundred (100) year flood does not exceed one (1) foot in depth over the roadway.

BUILDING SETBACK: The right-angle distance from a point on or within street right-of-way to the closest point of any building structure.

CC & R's: An acronym for Covenants, Conditions and Restrictions.

COLLECTOR STREET: A street designed to distribute traffic between local streets and arterial streets. See PCDOT's "Roadway Design Manual" for further discussion.

CROWN: A cross-slope of difference in elevation between the high point of a street and the gutter line, adjacent to the pavement edge, for any given cross section. Crown is normally expressed as a percentage.

CURB CUT: A depressed segment of a vertical roadway curb.

CURB RETURN: A curved segment of a curb used at each end of an opening in the roadway curb.

CURBWAY: The area between the back of curb and the roadway edge of the sidewalk.

DESIGN YEAR: The year during which the roadway improvements shall reach life expectancy with normal maintenance, generally twenty (20) years.

DEVELOPER: The private party in whose interest engineering documents, plats and plans are submitted for the purposes of review and regulation of private land development in the Town of Marana.

DRIVEWAY: A point of vehicular access between a street and an abutting property.

ENGINEER: The design engineer or engineer of record.

FRONTAGE ROAD: A local street or road auxiliary, located on the side of a collector or arterial street, which provides service to abutting property and adjacent areas while controlling access.

FUNCTIONAL CLASSIFICATION: A way of distinguishing between street types by the purpose each serves, such as freeway (limited access), arterial, collector, and local streets.

HOMEOWNERS' ASSOCIATION (HOA): A legal entity established for the purpose of owning and maintaining commonly held private real property.

INTERIM PAVING: Paving placed to designed grades that can be expanded to a permanent improvement at a future time.

INVERT: The difference in elevation between the low point of a street and a chord line connecting the outer edges of pavement or gutter lines.

LEVEL OF SERVICE (LOS): A general term describing the operating conditions a driver will experience while traveling on a particular roadway facility. Where roadway conditions are fixed, level of service varies primarily with volume.

LOCAL STREET: A street that primarily serves as access to residences or other abutting properties.

MAJOR ROUTES PLAN: The most recent version of the Plan, as adopted by the Mayor and Council.

MINIMUM: The least quantity or amount allowable for a singular design condition, and may not be an acceptable state in consideration of other aspects of project design.

NO-ACCESS EASEMENT: A strip of land across which vehicular traffic is prohibited, except emergency and utility vehicles.

OFF-STREET PARKING: Any space provided for vehicular parking not within the street right-of-way.

ON-STREET PARKING: The parking lane adjacent to travel lanes in a traveled roadway.

ONE-WAY STREET: A street that has only one legal direction of travel.

TOWN: Town of Marana, a political subdivision of the State of Arizona.

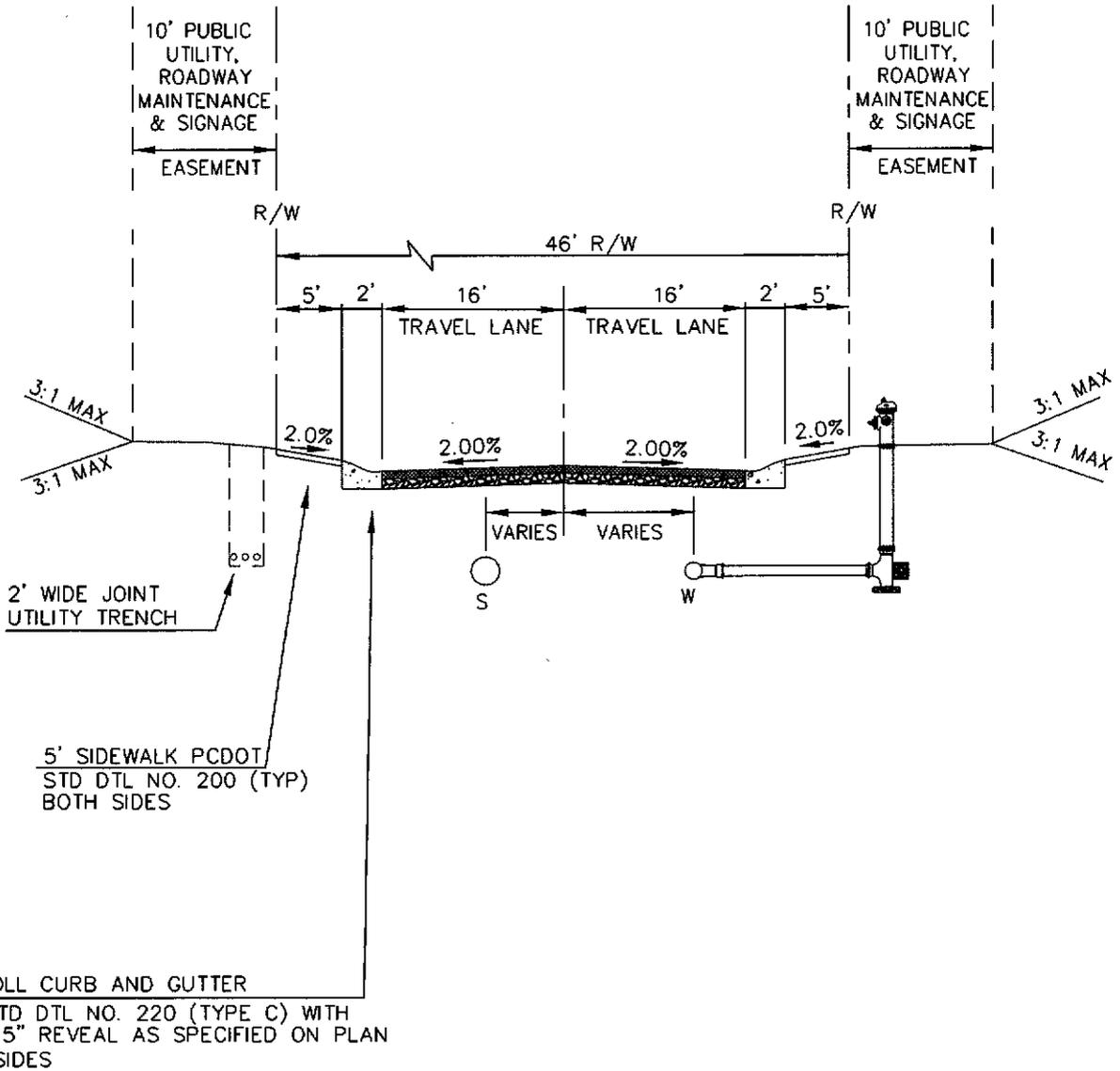
TOWN ENGINEER: The Director, Public Works Department, or his designated subordinate, in accordance with Arizona Revised Statutes.

15.0 REFERENCES

1. “A Policy on Geometric Design of Highways and Streets”, American Association of State Highway and Transportation Officials (AASHTO).
2. “Roadside Design Guide”, AASHTO.
3. “Manual on Uniform Traffic Control Devices”, United States Department of Transportation, Federal Highways Administration, (FHWA).
4. “Guide for Design of Pavement Structures”, AASHTO.
5. “Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT≤400), AASHTO.
6. “Highway Capacity Manual”, Transportation Research Board, (TRB).
7. “Trip Generation”, ITE.
8. “Trip Generation Handbook”, ITE.
9. “Traffic Engineering Manual of Approved Signs”, Arizona Department of Transportation (ADOT).
10. “Materials-Preliminary Engineering and Design Manual”, ADOT.
11. “Traffic Impact Analysis for Proposed Developments”, ADOT; or as superceded by the Town of Marana.
12. “Bridge Design and Detailing Manual”, ADOT.
13. “Construction Standards – Construction, Bridge, Signing and Marking”, ADOT.
14. “Construction Standard Drawings”, ADOT.
15. “Signing and Marking Standard Drawings”, ADOT.
16. “Pima County Roadway Design Manual”, and applicable references therein, Pima County Department of Transportation & Flood Control District, (PCDOT & FCD).
17. “Standard Specifications for Public Improvements”, Pima County/City of Tucson, (PC/COT).
18. “Standard Details for Public Improvements”, PC/COT.
19. “Pavement Marking Design Manual”, PC/COT.
20. “Traffic Signing Manual”, PC/DOT.
21. “Drainage and Channel Design Standards for Local Drainage for Floodplain Management within Pima County, Arizona”, PCDOT & FCD.
22. “Stormdrain Design Guidelines and Standard Plans”, PCDOT & FCD.
23. “Manual of Engineering Standards and Procedures”, Pima County Wastewater Management Department (PCWMD).
24. “Standard Specifications and Details”, City of Tucson Water Department, (COTWD).
25. The Town of Marana Traffic Impact Analysis Process Manual.
26. The Town of Marana Neighborhood Traffic Management Program Manual.

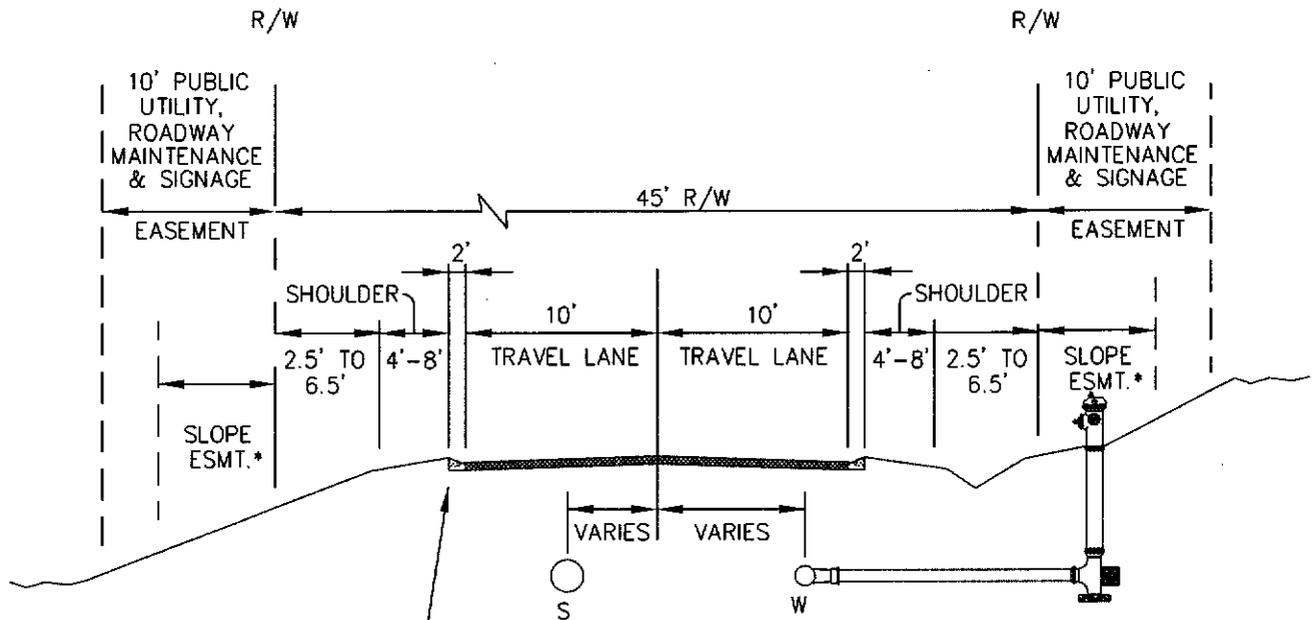
APPENDIX: STANDARD DETAILS

| DETAIL | TITLE |
|--------|--|
| 1. | Local Street Curbed Section- 46 Foot Right-of Way |
| 2. | Local Street Mountainous Terrain Section- 45 Foot Right-of-Way |
| 3. | Residential Collector Street Section- 62 Foot Right-of-Way |
| 4. | Commercial and Industrial Street Section- 60 Foot Right-of-Way |
| 5. | Street Jogs |
| 6. | Street Intersections |
| 7. | Standard Cul-de-Sac |
| 8. | Offset Cul-de-Sac |
| 9. | Cul-de-Sac Landscaping |
| 10. | Temporary Cul-de-Sac |
| 11A. | Eye-Brow Type Cul-de-Sac |
| 11B. | Eye-Brow Type Knuckle |
| 12. | “T” and “Y” Type Turnarounds |
| 13. | Typical Sight Visibility Triangles |
| 14. | 4-Way Intersection Sight Visibility Triangles |
| 15. | Curvilinear Roadway Sight Visibility Triangles and Areas |



NOT TO SCALE

| | | | | |
|----------|---|---|---|--------------|
| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | TYPICAL ROADWAY LOCAL STREET 46' WIDE R.O.W. | | 1 |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |



24" ROLL CURB AND GUTTER
 MAG STD DTL NO. 220 (TYPE C) WITH
 4" OR 5" REVEAL AS SPECIFIED ON PLAN
 BOTH SIDES

* WHERE APPLICABLE

RESTRICTIONS:

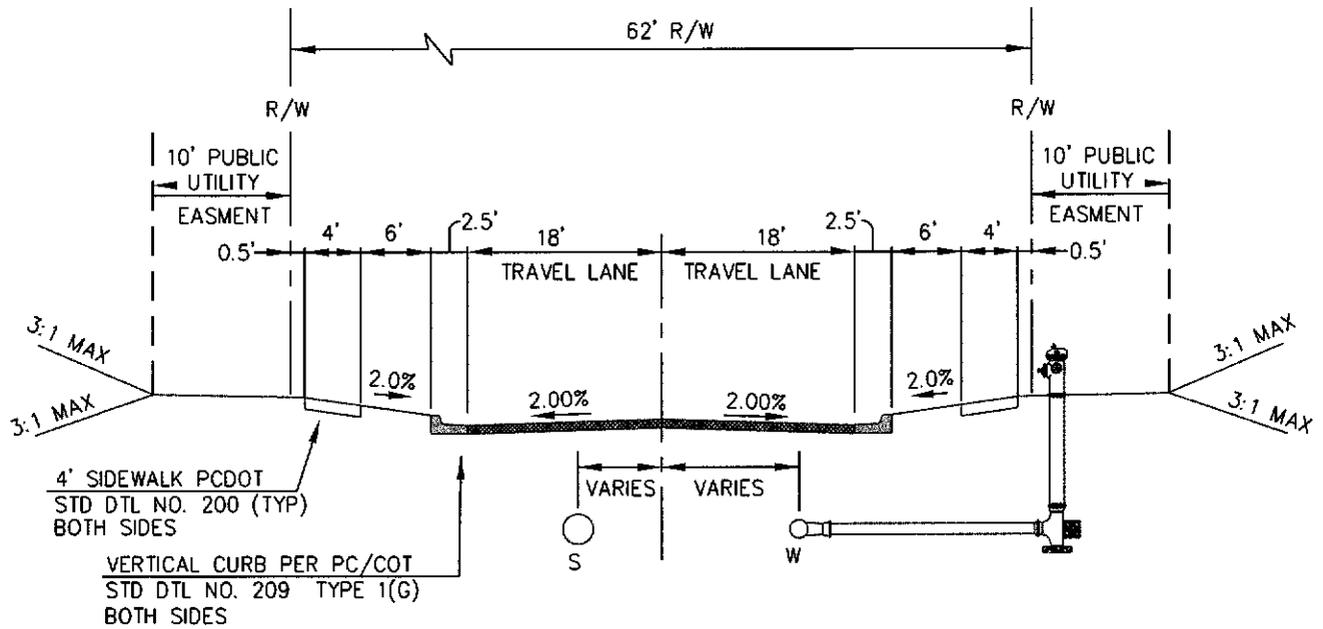
DIVIDED ROADWAYS OR ISLANDS ARE NOT PERMITTED.
 SEE CHAPTER 4.12 FOR APPLICATION.

8' SHOULDERS ARE TO BE USED EXCEPT AS NOTED
 BELOW AND IN CHAPTER 4.12.

SHOULDER WIDTH MAY BE VARIED BY THE ENGINEER
 TO SAVE NATIVE GROWTH. HOWEVER, IT MUST CONFORM
 TO CHAPTER 6.

NOT TO SCALE

| | | | | |
|----------|---|---|---|--------------|
| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | PAVED LOCAL STREET MOUNTAINOUS TERRAIN | | 2 |
| REVISED: | | 45' WIDE R.O.W. | | |
| 3/04 | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |

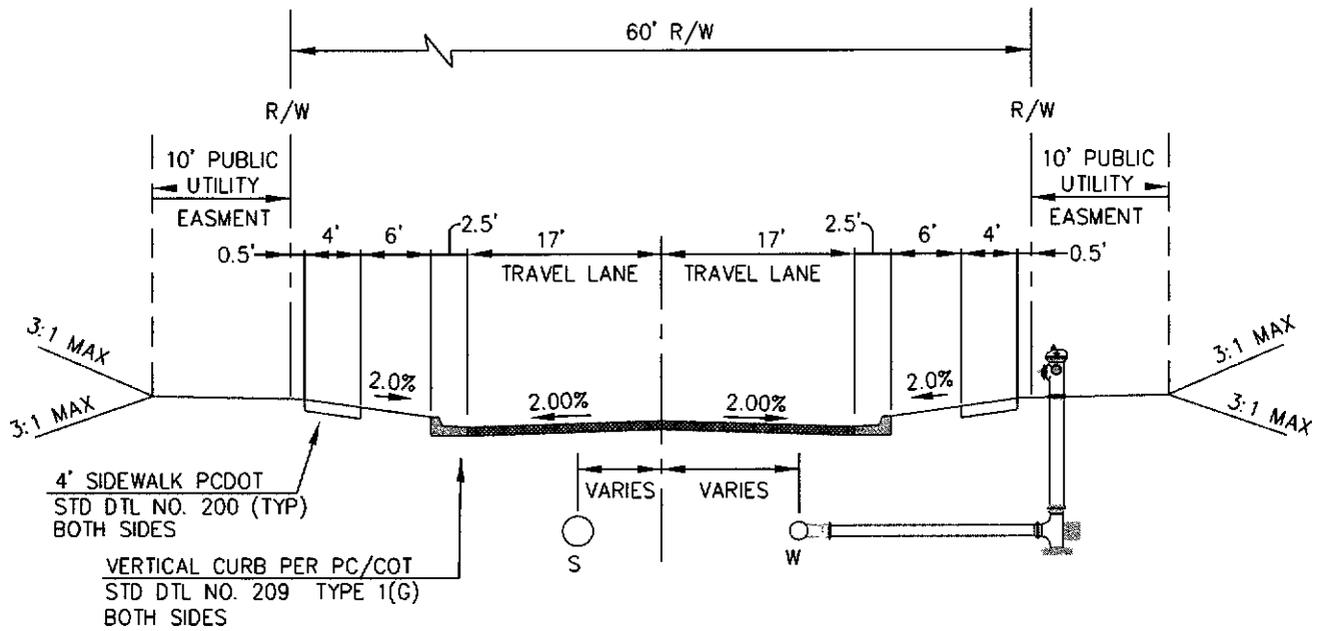


NOTE:

ASSUMES NO STREET PARKING AND NO DIRECT DRIVEWAY ACCESS.

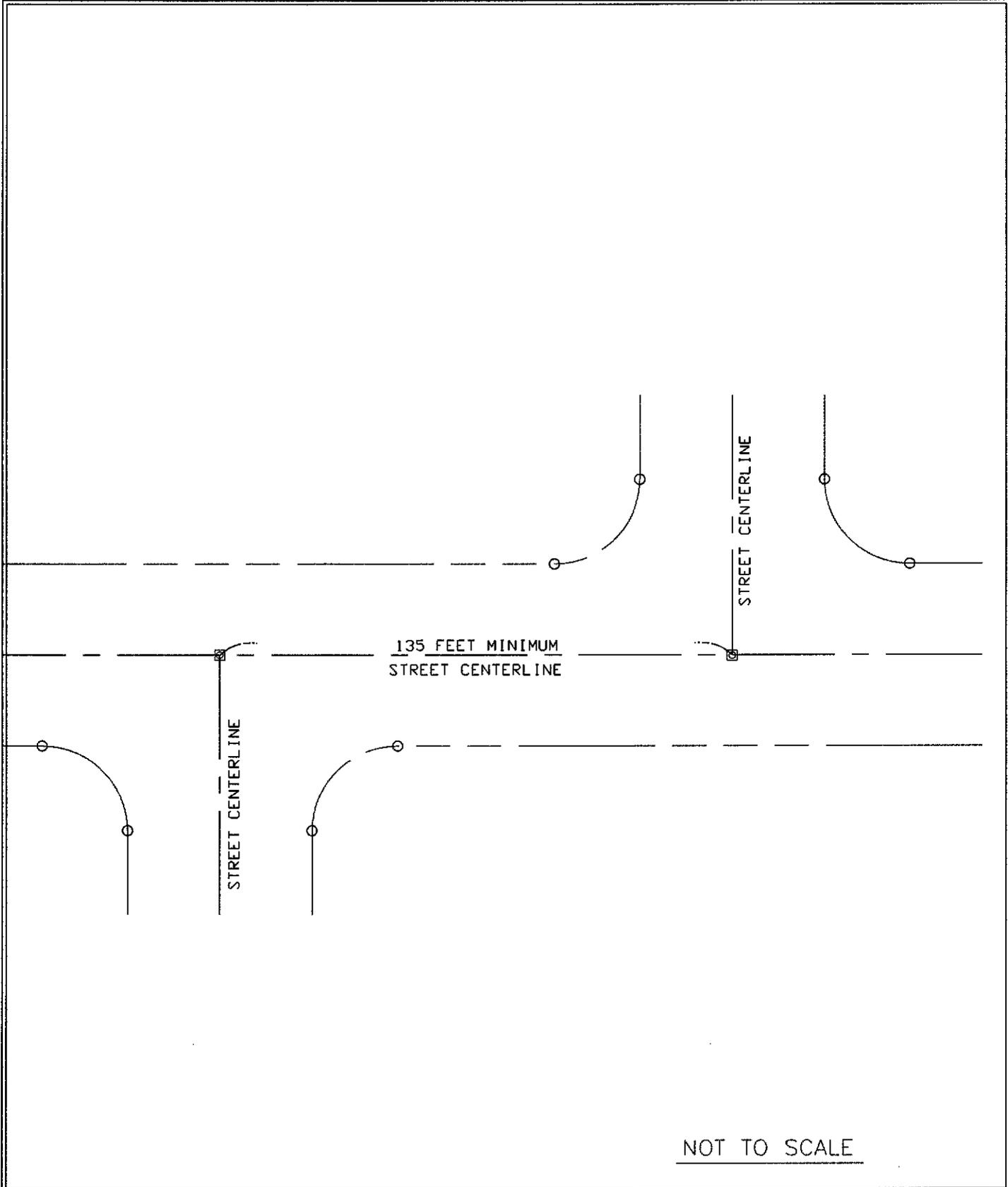
NOT TO SCALE

| | | | | |
|----------|--|---|--|--------------|
| ISSUED: | | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS | | DETAIL NO. |
| 3/04 | | RESIDENTIAL COLLECTOR 62' WIDE R.O.W. | | 3 |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |

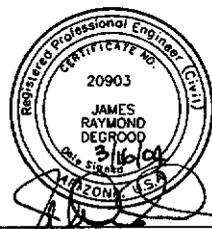


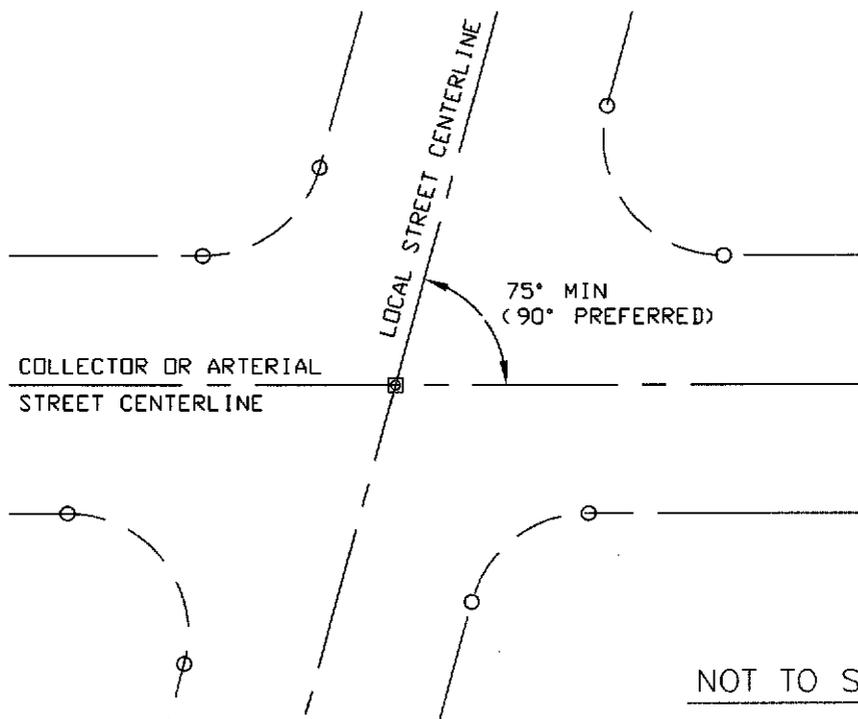
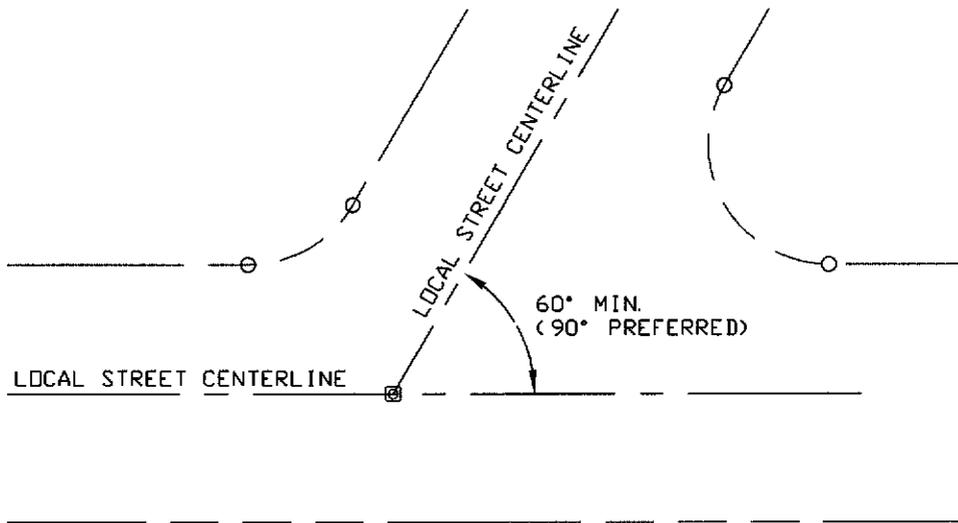
NOT TO SCALE

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| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | COMMERCIAL & INDUSTRIAL STREET | | 4 |
| REVISED: | | 60' WIDE R.O.W. | | |
| 3/04 | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |

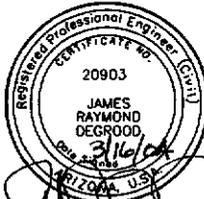


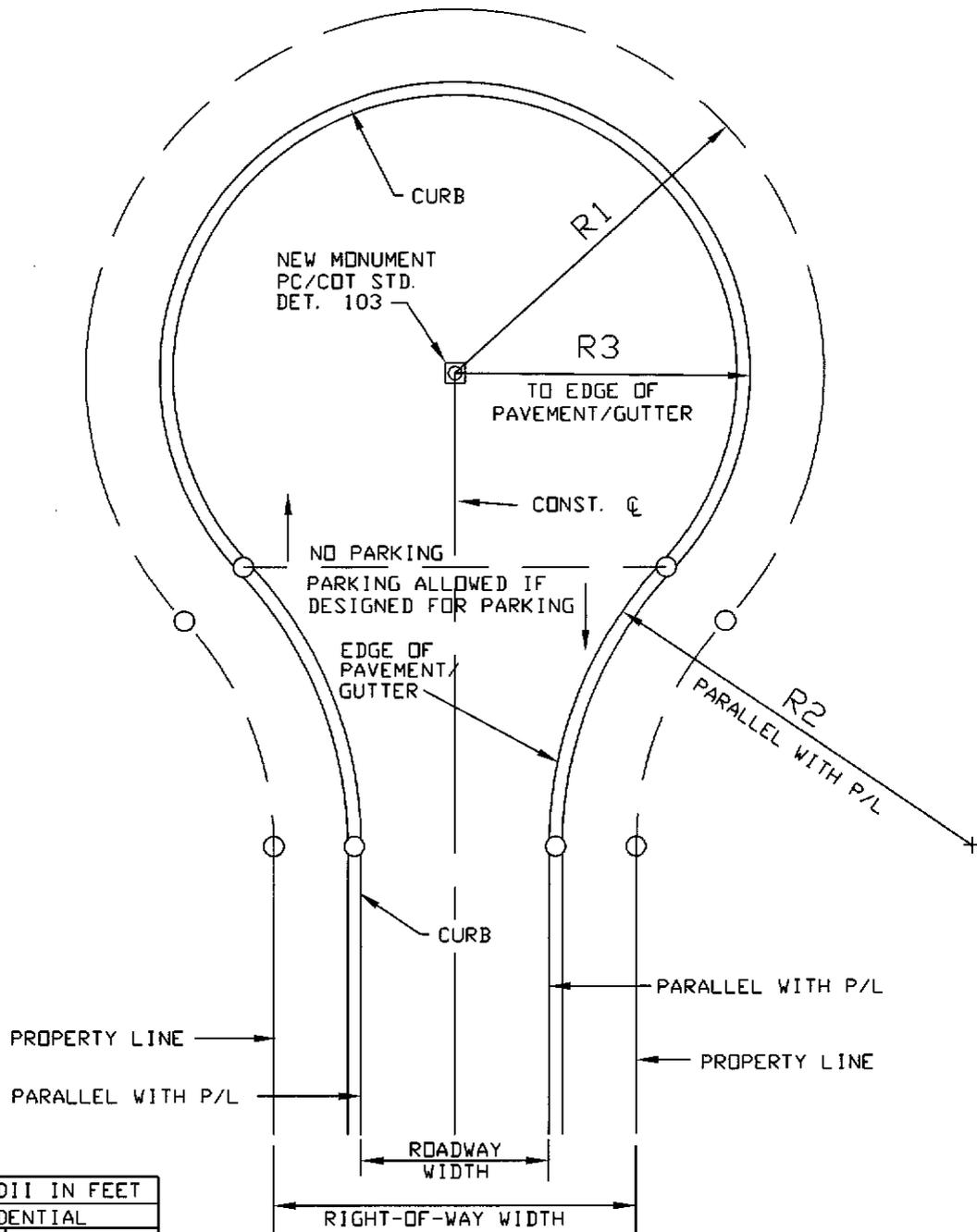
NOT TO SCALE

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| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | LOCAL STREET JOGS | | 5 |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |



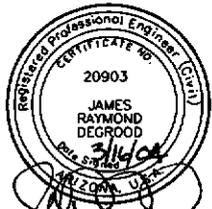
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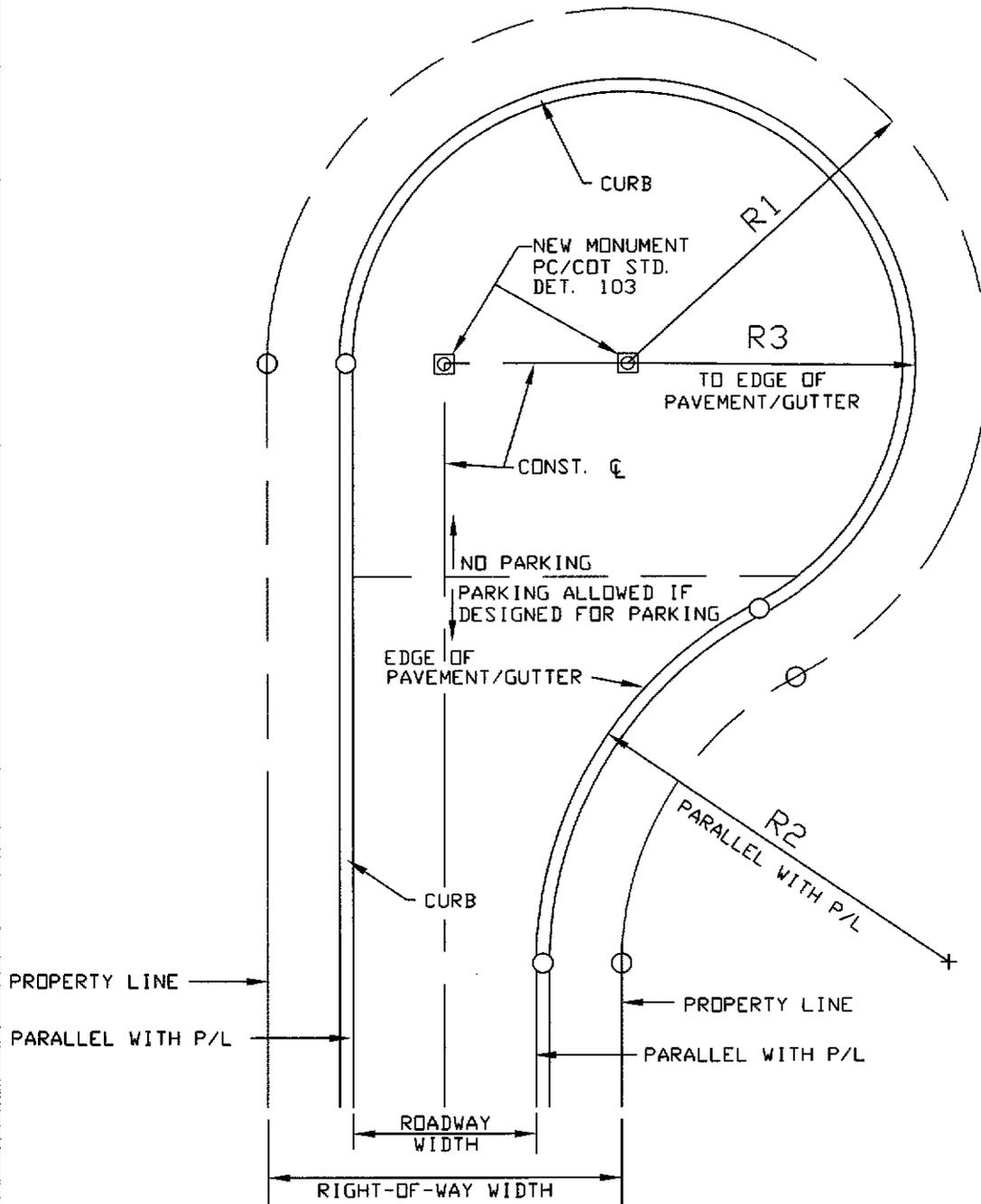
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| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | LOCAL STREET INTERSECTIONS | | 6 |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |



| MINIMUM RADII IN FEET | |
|-----------------------|----|
| RESIDENTIAL | |
| R1 | 50 |
| R2 | 50 |
| R3 | 42 |

NOT TO SCALE

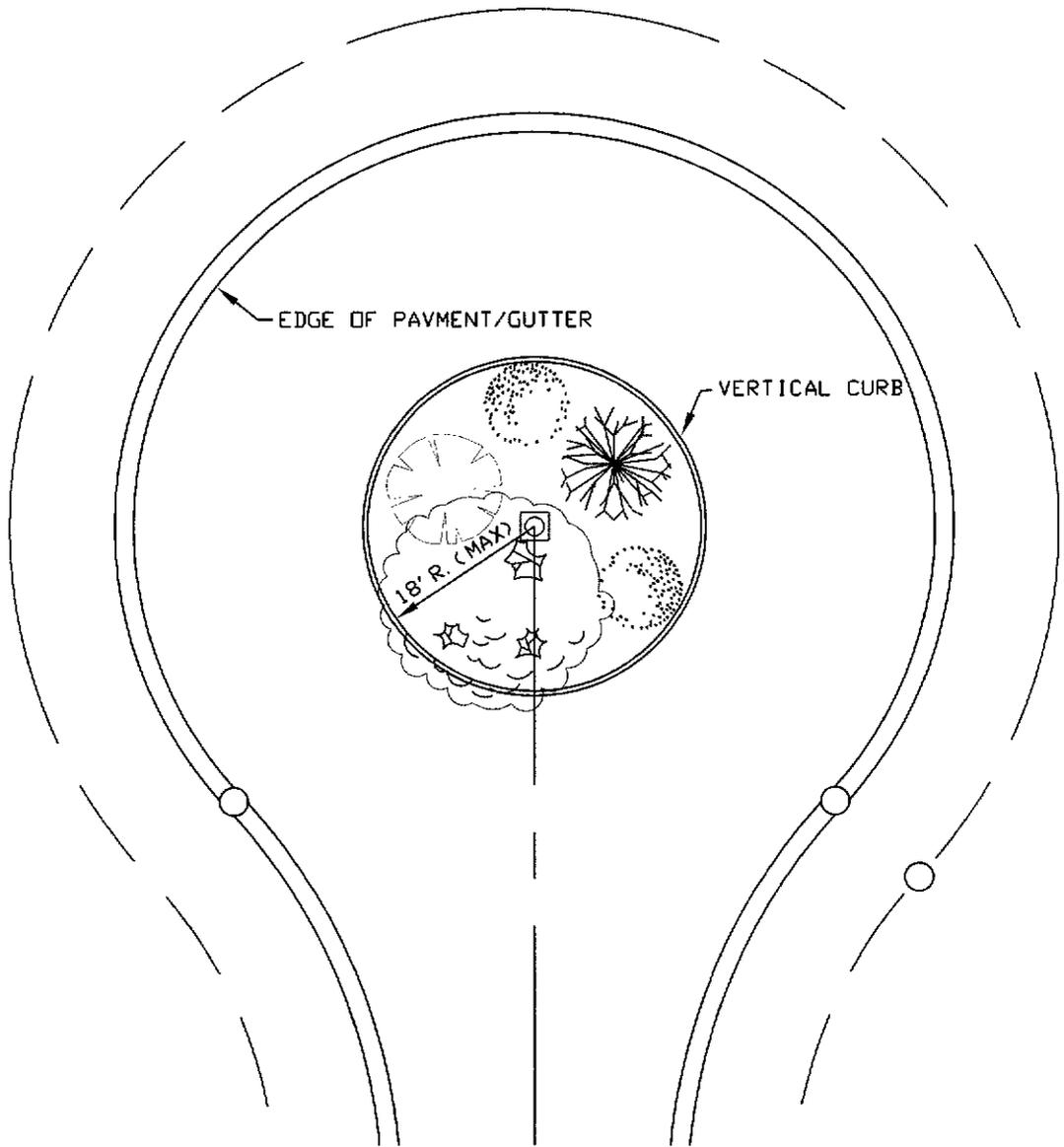
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| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | STANDARD CUL - de - SAC | | 7 |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |



| MINIMUM RADII IN FEET | |
|-----------------------|----|
| RESIDENTIAL | |
| R1 | 50 |
| R2 | 50 |
| R3 | 42 |

NOT TO SCALE

| | | | | |
|----------|---|---|---|--------------|
| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | OFFSET CUL- de - SAC | | 8 |
| REVISED: | | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | SHEET 1 OF 1 |
| 3/04 | | | | |



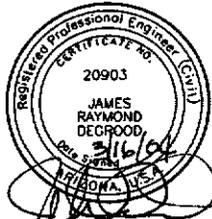
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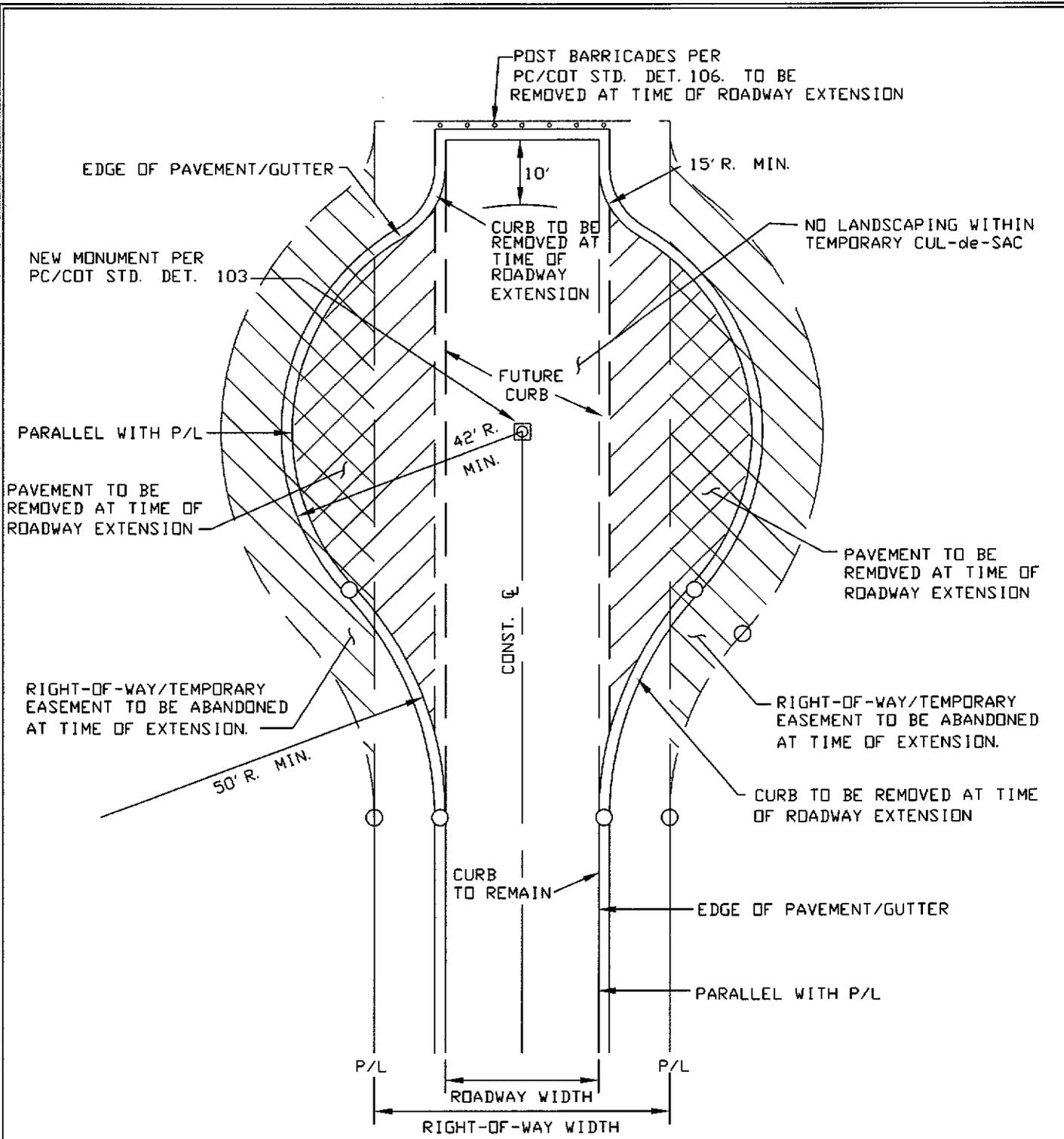
FOR FURTHER CUL-de-SAC INFORMATION
SEE THE STANDARD CUL-de-SAC DETAIL.

LANDSCAPE MATERIALS MUST BE SELECTED AND
PLACED SO AS NOT TO INTERFERE WITH
DRIVERS' VISIBILITY WITHIN THE MEDIAN BY
TWO HORIZONTAL LINES LOCATED 30' AND 72'
ABOVE FINISHED GRADE OF THE ROADWAY
SURFACE.

LANDSCAPING/VEGETATION INSTALLED BY THE
DEVELOPER/HOMEOWNER'S ASSOCIATION SHALL
NOT BE MAINTAINED BY THE TOWN OF MARANA.
A LICENSE AGREEMENT MUST BE EXECUTED
AND APPROVED BY THE TOWN ENGINEER PRIOR
TO CONSTRUCTION.

NOT TO SCALE

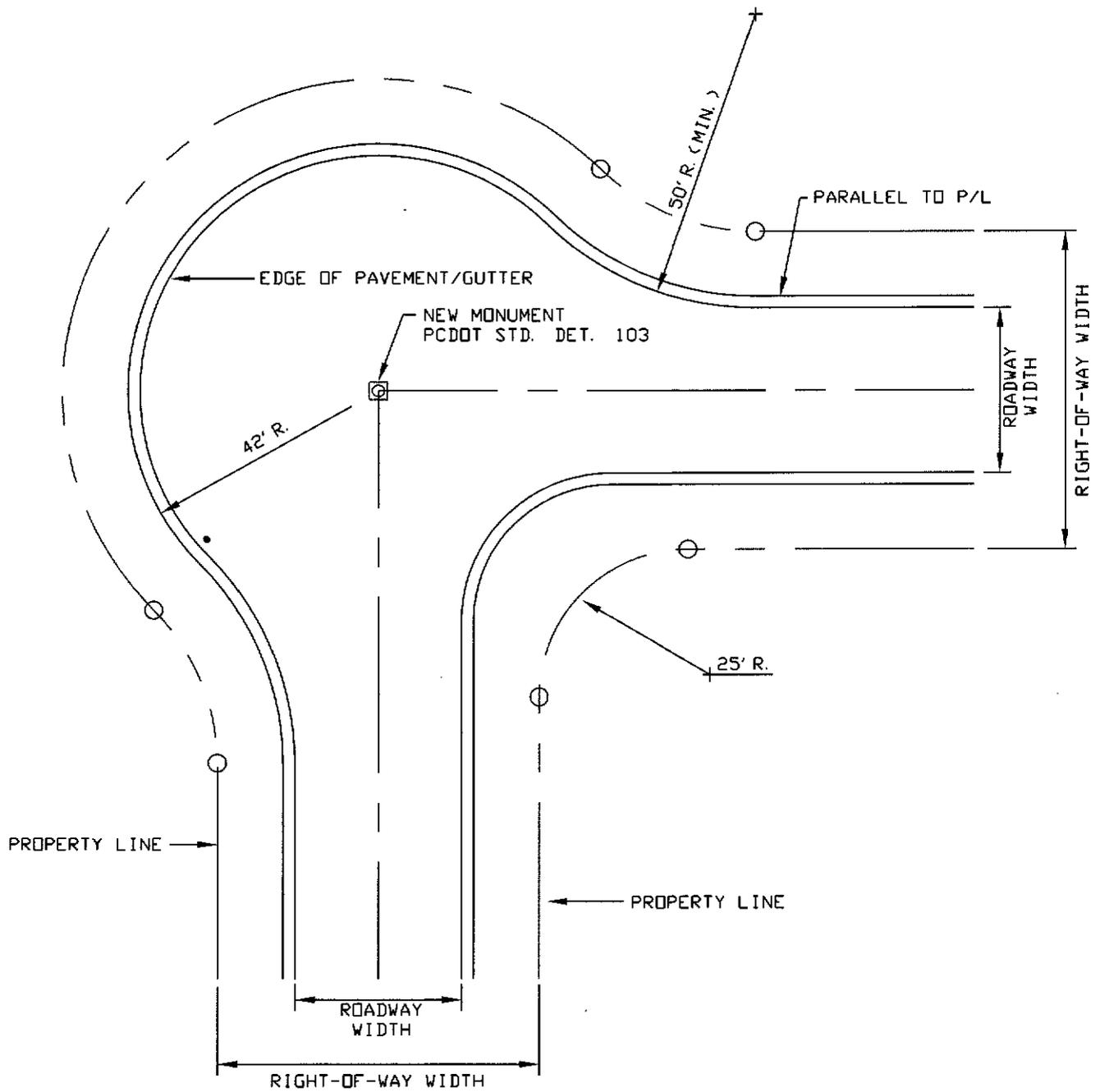
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| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | CUL - de - SAC LANDSCAPING DETAIL | | 9 |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |



NOTE:
 DEVELOPER TO INSTALL APPROPRIATE SIGNAGE FOR DEAD-END STREET.
 SIGNAGE TO BE REMOVED AT TIME OF ROADWAY EXTENSION.

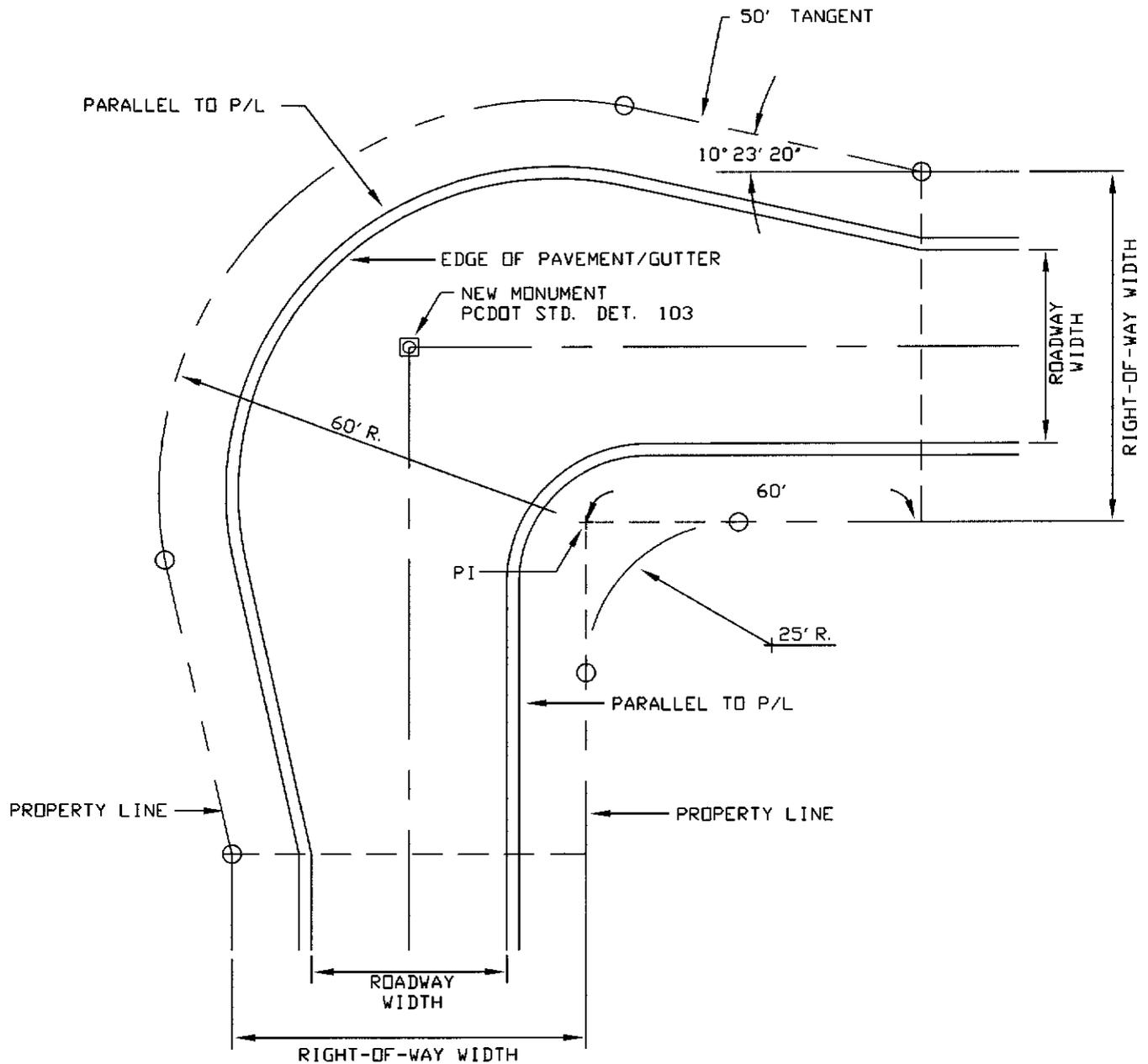
NOT TO SCALE

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| ISSUED: | | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS | | DETAIL NO. |
| 3/04 | | TEMPORARY CUL - de - SAC | | 10 |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |



NOT TO SCALE

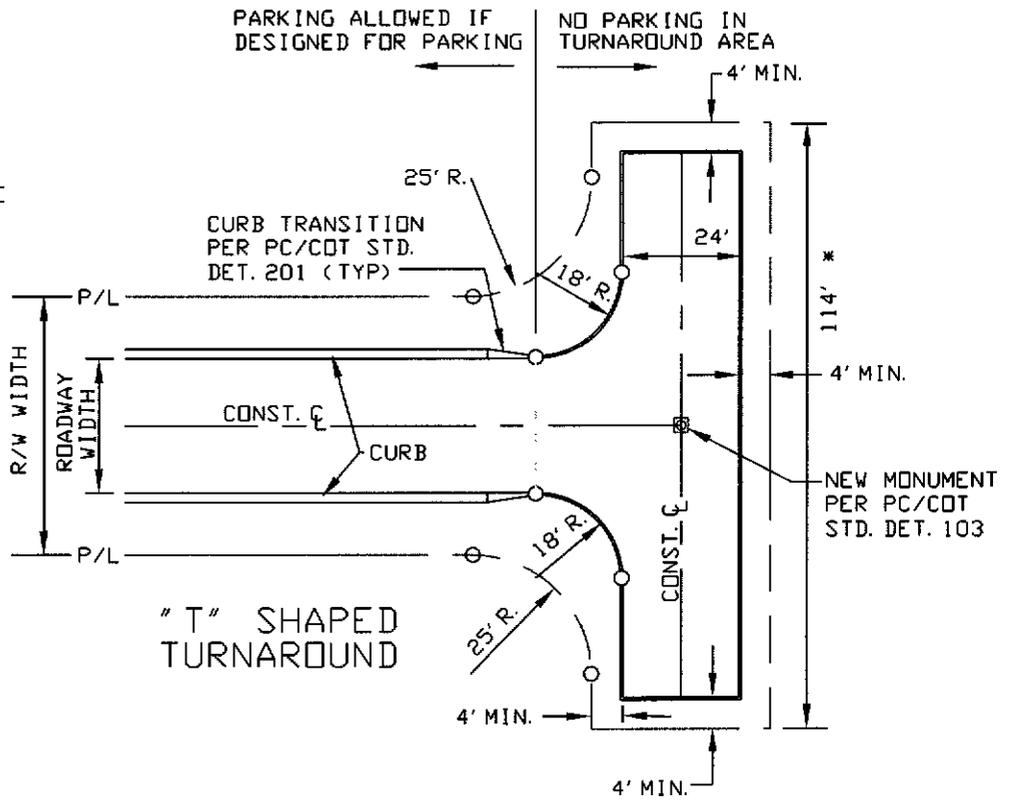
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| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | EYE-BROW TYPE CUL-de-SAC | | 11A |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |



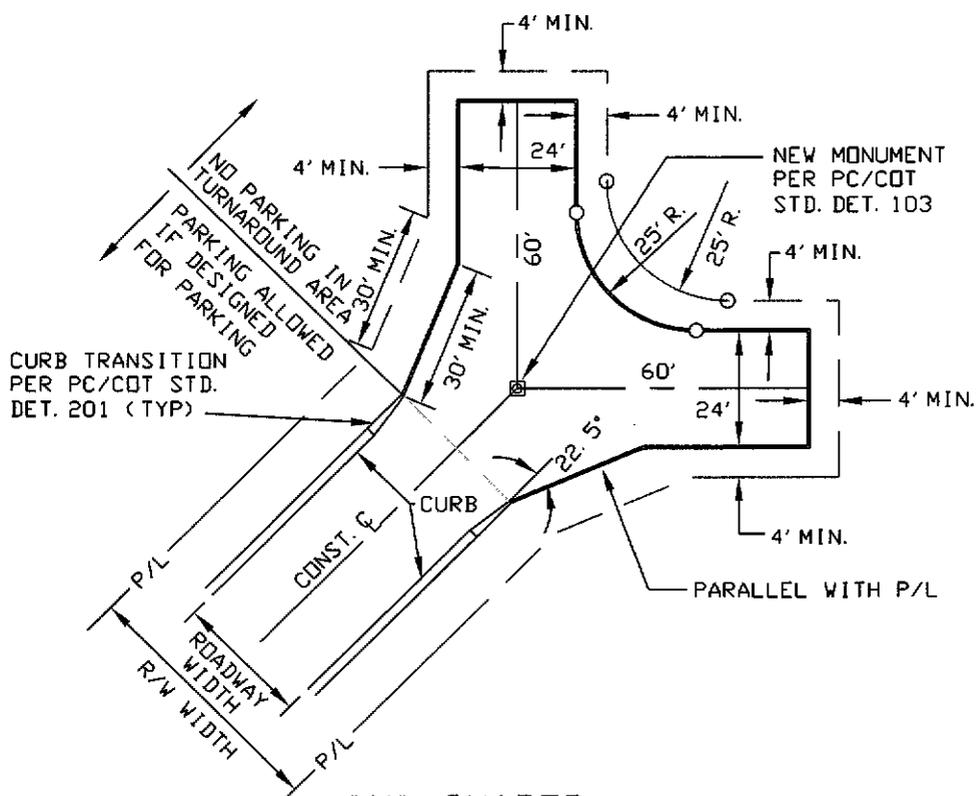
NOT TO SCALE

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| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | EYE-BROW TYPE Knuckle | | 11B |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |

* MAY BE REDUCED IN ACCORDANCE WITH FIRE DEPARTMENT CRITERIA

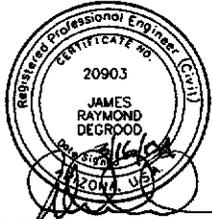


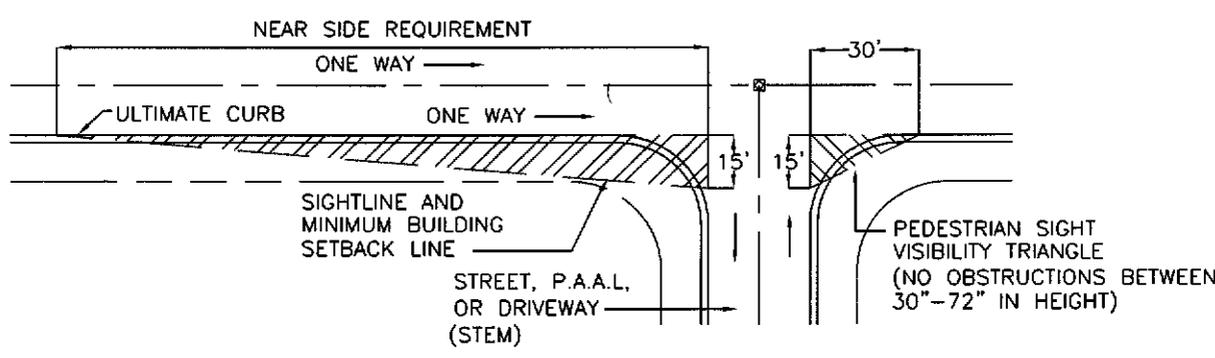
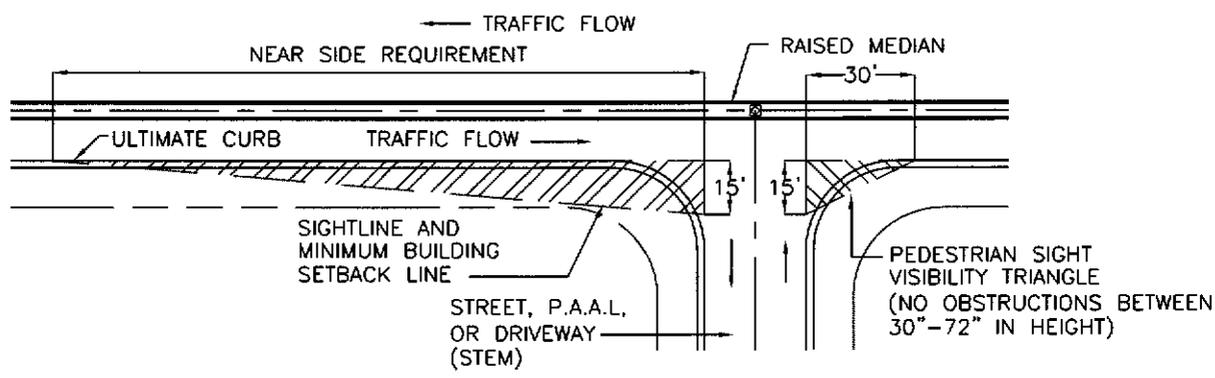
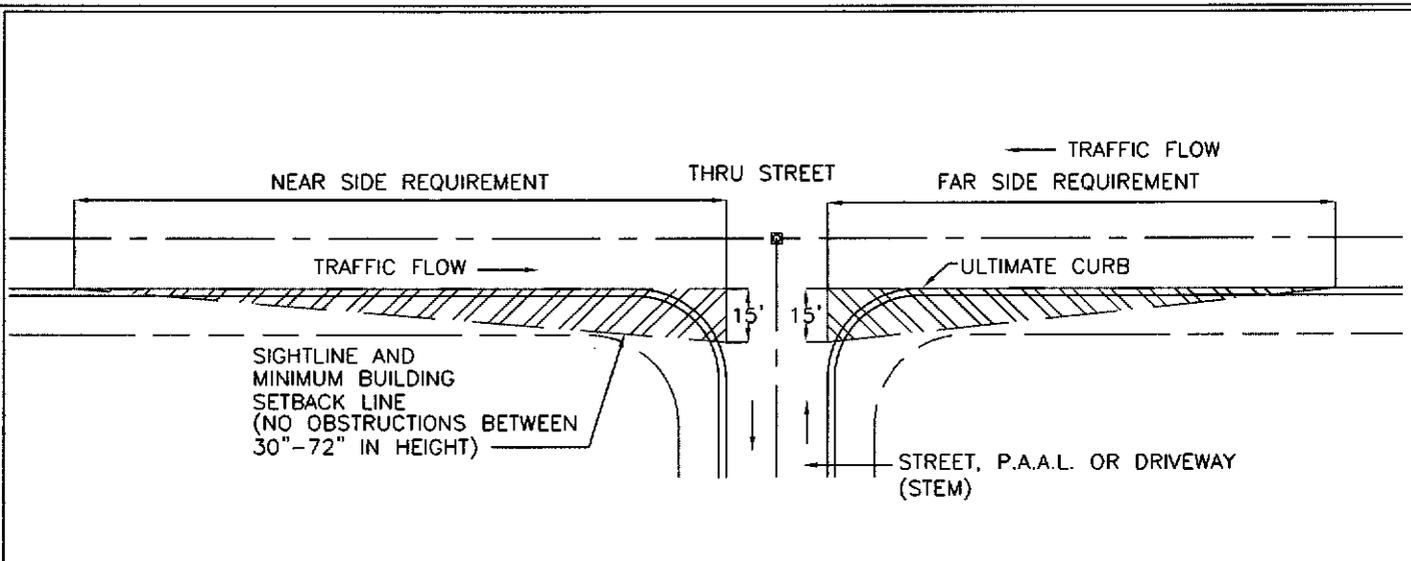
"T" SHAPED TURNAROUND



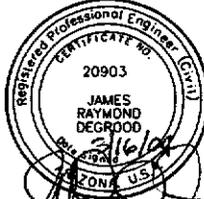
"Y" SHAPED TURNAROUND

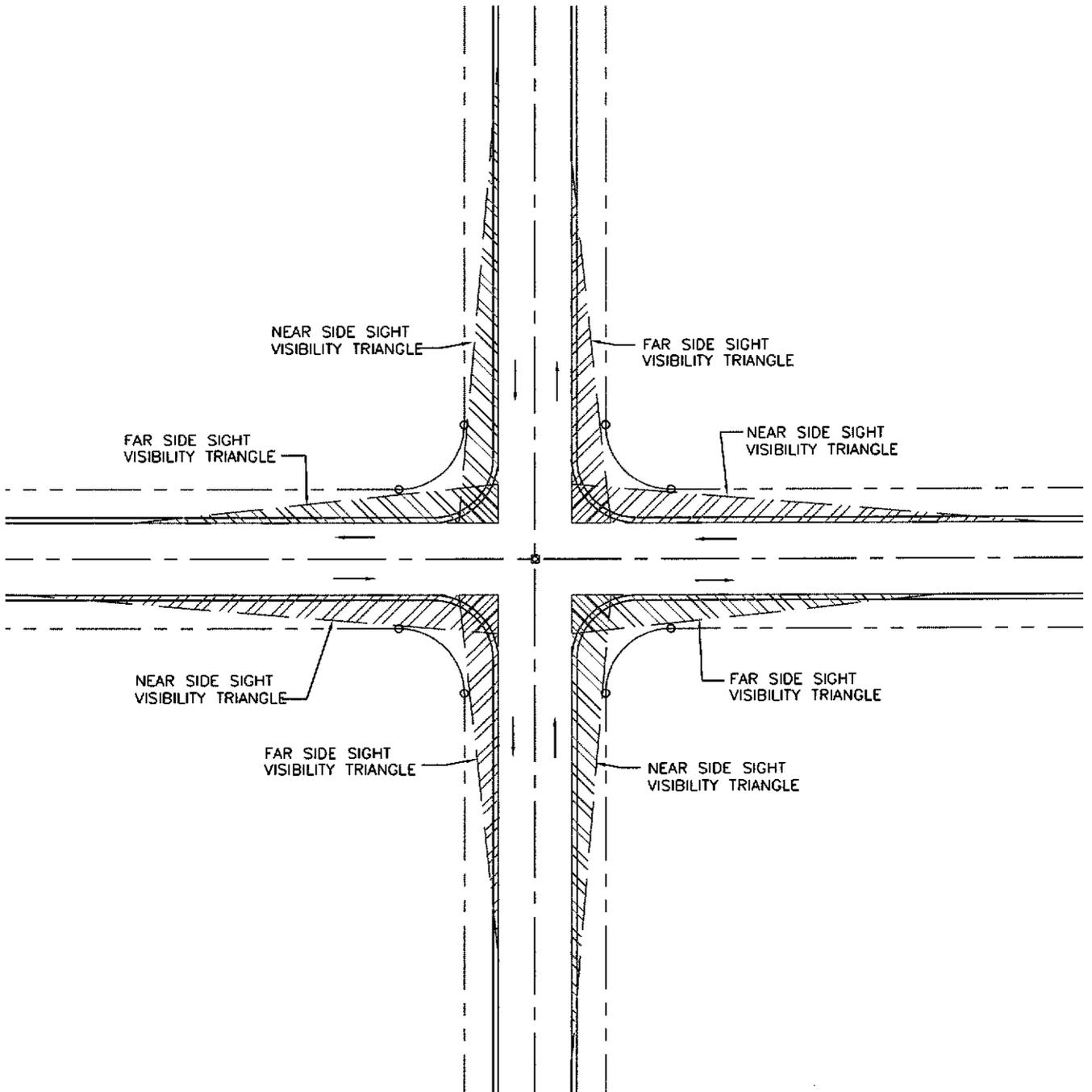
NOT TO SCALE

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| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | TURNAROUNDS "T" AND "Y" TYPES | | 12 |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |



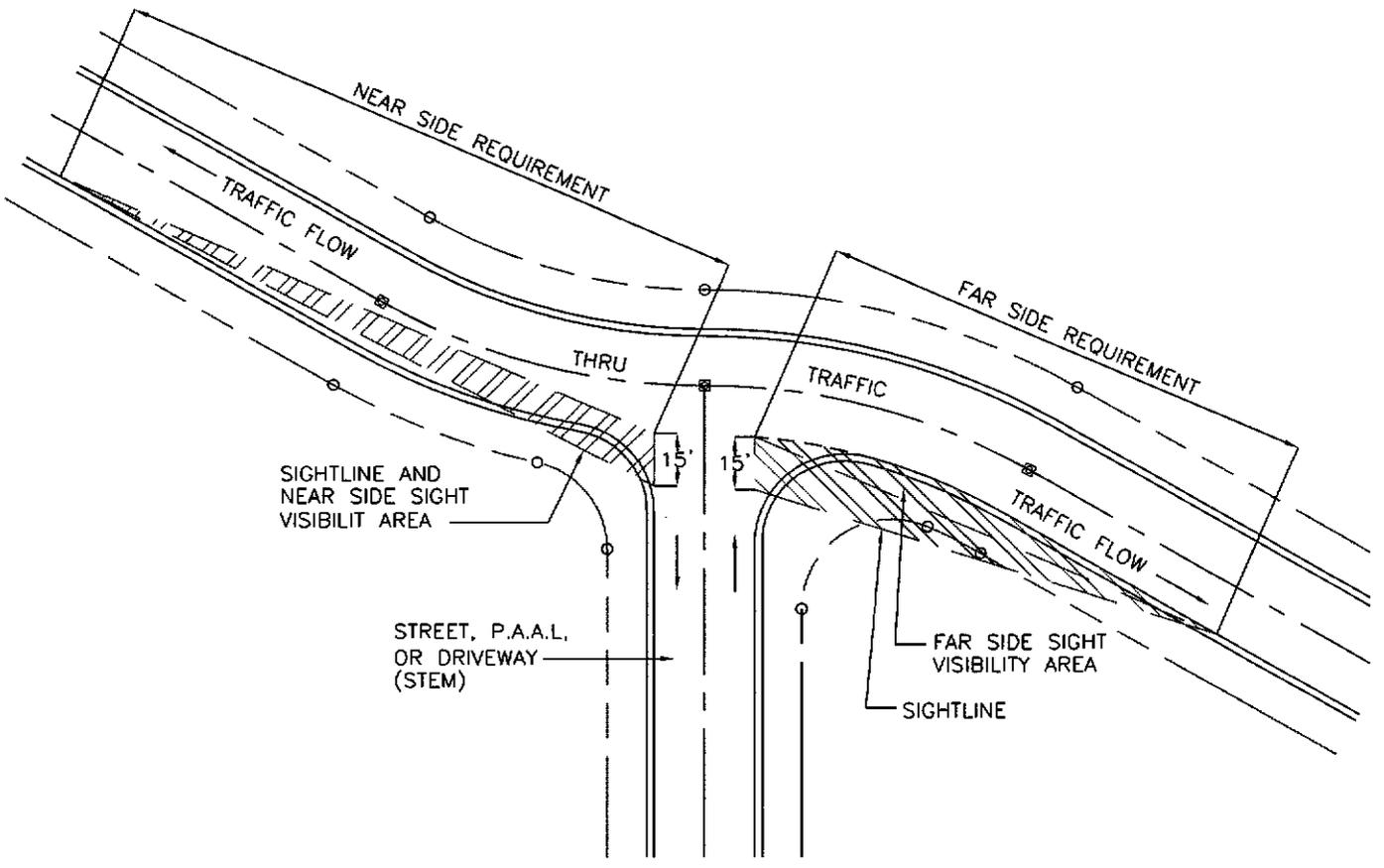
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| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | TYPICAL SIGHT VISIBILITY TRIANGLES | | 13 |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |

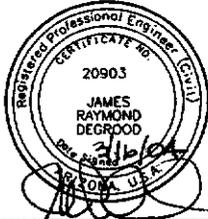


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| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. |
| 3/04 | | 4-WAY INTERSECTION SIGHT VISIBILITY TRIANGLES | | 14 |
| REVISED: | | APPROVED FOR DISTRIBUTION James R. DeGrood, P. E. | | SHEET 1 OF 1 |
| 3/04 | | | | |



NOT TO SCALE

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| ISSUED: |  | MARANA DEVELOPMENT SERVICES SUBDIVISION STREET STANDARDS |  | DETAIL NO. | | |
| 3/04 | | CURVILINEAR ROADWAY SIGHT VISIBILITY TRIANGLES AND AREAS | | 15 | | |
| REVISED: | | | | | APPROVED FOR DISTRIBUTION James R. DeGroot, P. E. | SHEET 1 OF 1 |
| 3/04 | | | | | | |