CHAPTER 4

TRANSPORTATION

4.1 STREETS & RIGHTS-OF-WAYS

4.1.1 INTRODUCTION

A. General Overview

This section describes geometric requirements for various street classifications within the City of Goodyear. The requirements described herein are primarily based on safety considerations; therefore, standards that provide a greater degree of safety may be used or required within reasonable economic limits, but standards that provide a lesser degree of safety may not be used.

While every effort has been made to ensure the accuracy and completeness of these guidelines, the City of Goodyear shall not be held responsible for any errors or omissions. It shall be the sole responsibility of the Designing Engineer to ensure a correct design and the accuracy and completeness of construction documents containing his or her signature.

B. Use of National Standards

1. Geometric Design Standards - The American Association of State Highway and Transportation Officials' (AASHTO) "Policies on Highway Design" are approved references and shall be used together with this manual for the geometric design of roadways.
2. Traffic Control Standards - All traffic control devices shall be designed in accordance with this manual, together with the MUTCD as prepared by the U.S. Department of Transportation, and the ADOT supplement to the MUTCD.

C. Traffic Related Studies

A TIA may be required to be submitted in conjunction with a Rezone, Site Plan, or Preliminary Plat application. The need for this report is generally a function of the development size. Contact the City Traffic Engineer to determine if a TIA is required for a specific development.

D. Preliminary Plats & Site Plans

Plan sets associated with these documents shall provide the following information:

1. Show all existing and proposed streets, medians, turn lanes, and bus bays. Provide a cross section detail of the full right-of-way for each road that is different in right-of-way width, pavement width, or median width (excluding turning lane variances).
2. Provide centerline dimensions and other information required to show the street curvatures, intersection offsets, etc., to enable City

staff to verify compliance with the Subdivision Ordinance and applicable design standards.

3. Show the proposed locations of all bike paths, multi-use trails, equestrian trails, etc. that are located within the property boundaries. Refer to the City's approved General Plan to identify all required paths and trails.

4. Show all SVTs, PUEs, and other easements associated with City roadways.

E. Private Streets & Roadways

1. All private streets or roadways must be identified as tracts, and the associated Final Plat shall have all applicable note pertaining to private streets on the cover sheet, as detailed in Chapter 1 of these standards.

F. Street Types

Standard street cross sections are illustrated in the City's Standard Engineering Details. Developing properties shall provide for public streets as outlined in the City's General Plan or by the Phoenix-metro standard grid alignments in cases where the streets are not shown on the current General Plan.

1. Freeways and Expressways (Parkways)

a. Freeways will be designed to safely handle very large volumes of through-traffic.

(1). Direct access will be limited to interchanges normally spaced at one-mile intervals.

(2). Design, construction, and operation shall be provided by ADOT, MCDOT, and/or the City of Goodyear.

b. Expressways provide for efficient movement of large volumes of through-traffic. Direct access is limited to designated intersections.

2. Arterial Streets

a. Arterial streets provide regional continuity and carry large volumes of traffic.

b. Arterial streets are divided into two primary types: Major Arterial and Minor Arterial, per City Standard Details. In addition to the two primary types of arterial streets, there is also a separate standard for City Center Arterial Streets and for Scenic Arterial Streets.

c. Full access to abutting land uses from an arterial street is limited to median openings.

d. Residential lots shall NOT have direct access onto or off of arterial streets.

3. Collector Streets

a. Collector streets provide access to abutting land uses, handle local traffic, and provide access to the arterial street system.

b. Collector streets are divided into three primary types: Major Collector, Minor Collector, and Commercial/Industrial Collector, per City Standard Details. In addition to the three primary types of collector streets there is also a Special Use Major Collector Street and a Special Use Minor Collector Streets. The details for a Special Use Major Collector Street and a Special Use Minor Collector Street shall be used only at locations where the City desires to match an existing street cross-section and only when the City Engineer has approved the use.

c. Residential lots shall NOT have direct access onto or off of collector streets.

4. Local Streets

a. Local streets provide direct access to abutting land uses, handle local traffic, and provide access to the collector street system.

b. Local streets are divided into two types: Local (also sometimes referred to as Residential Local or Local Residential) and Commercial/Industrial Local, per City Standard Details.

5. Private Streets

a. Private streets shall be owned and maintained by the Individual, HOA or POA that owns the tracts within which the private streets are located.

b. Private streets provide direct access to abutting land uses, handle local traffic, and provide access to the local or collector street system.

c. Minimum cross sectional dimensions for private streets shall be per City Standard Details.

6. Marginal Access Roads

a. Marginal access roads are local roads located within the Major road right-of-way that run parallel to the Major road. They provide direct access to the abutting property while controlling access to the major street.

b. Marginal access roads shall not intersect a major street or a collector street.

c. Marginal access road openings to major streets, at a local street intersection, shall have a minimum 30-foot wide separation island between the major street traffic lanes and the marginal access road, which shall be provided within the major street right-of-way.

7. Unless identified in the City's General Plan, the classification and location of streets is determined during the development site planning or platting process. Planning for City streets is influenced by several factors and includes, among other things, plans for adjacent developments which have recently been approved. The City Engineering Department will review the plans for each proposed development and will specify any changes required to keep conformity with previously planned and approved street alignments. The City Engineering Department will also provide direction for the classification of each street involved in a proposed development.

G. Street Names

Street names shall be consistent with the natural alignment and extension of existing streets and the "MAG Address and Street Assignment Policy". New street names shall not duplicate in whole or in part, nor shall they be close to or confusing with, other existing street names. The City Council reserves the right to modify any street name such that it is in conformance with City standards.

H. Intersections

1. Arterial streets normally intersect other arterial streets at one-mile intervals. Arterial streets may intersect other streets as approved by the City Engineering Department.
2. Collector streets normally intersect other collector streets or arterial streets at the half-mile (2640 feet) and quarter-mile (1320 feet) interval. Other collector-to-arterial intersection intervals may be approved by the City Engineering Department.
3. Local streets may intersect collector streets at a minimum interval of one every 125 feet. Local streets do NOT intersect arterial streets.

4.1.2 GENERAL INFORMATION

A. Street Name Signs

1. All new developments shall provide for street name signs and posts at all intersections per approved City Standard Details.
2. Private streets shall be signed by the Developer in the same manner as streets signs for public streets (see item 1 above).

B. Survey Monuments

1. All developments shall provide survey monuments at section corners, street centerline intersections, street centerline alignment changes (PCs or PI if it is within street pavement), and subdivision corners.
2. All section corners, section quarter corners, and centers of section shall be a brass cap in a hand hole per MAG Standard Detail 120-1-A. All other required survey monuments shall be a brass cap on the surface per MAG Standard Detail 120-1-B or 120-1-C, as appropriate. All existing monumentation shall be preserved both horizontally and vertically.

C. Irrigation Facilities

1. All new developments shall provide for continued and undiminished service of affected irrigation systems.
2. The Developer is responsible for coordinating with irrigation system owners (typically RID or BID) for the design and construction of new facilities.
3. Private irrigation facilities shall be located on private property and sized to carry at least the same flow as the existing ditch, or as may otherwise be directed by the City Engineering Department. The Designing Engineer shall submit appropriate data to support the design.
4. Where there is need to cross, or remain in, public rights-of-way, it shall be done at approximately 90 degree angles and shall be tiled with RGRCP in accordance with the criteria outlined in ASTM Specifications Section C-361.

D. Barricades

1. All new developments shall provide for barricades at all dead end streets and incomplete streets per City Standard Details, and MAG Standard Detail 130-B.
2. New barricades shall be constructed per MAG Standard Detail 130-B, modified with red and white reflectorized stripes using engineer grade reflective sheeting.
3. Barricades installed with phased construction may be relocated within the same development, if the condition of the materials is acceptable to the City.

E. Sidewalks

1. Sidewalks shall remain within City right-of-way, PUE, or landscape tract.
2. Developers are encouraged to enhance the visual quality of street frontage areas through the use of detached sidewalks. See the City

Standard Details for allowable detached sidewalk landscape area widths.

4.1.3 DESIGN STANDARDS

A. Street Location and Arrangement

1. All streets included in an adopted city streets and highways plan shall be platted in conformance with that plan.
2. Street layout shall provide for the continuation of such streets as the City Engineer may designate.
3. Street layouts should conform to any approved neighborhood plans.
4. Certain streets, as designated by the City Engineer, shall be extended to the property boundary to provide future connection with adjoining properties.
5. Local streets shall be so arranged as to discourage their use by through-traffic.
6. Where a proposed subdivision abuts or contains an existing or proposed major street, the City may require marginal access roads or reverse frontage roads with non-access easements along the major street, or such other treatment as may be justified. This is to protect residential properties from the nuisance and hazard of high volume traffic and to preserve the traffic function of the major street in other types of developments.
7. Streets shall be so arranged in relation to existing topography as to produce desirable lots of maximum utility and streets of reasonable gradient, and to facilitate adequate drainage.
8. Maximum length of blocks, measured along the centerline of the street and between intersecting street centerlines, shall be 1500 feet. When lot areas average one-half acre or more, or where extreme topographic conditions warrant, this maximum may be exceeded by 500 feet.
9. The minimum number of access points required for single family and multi-family residential projects are regulated by the International Fire Code, as amended by the City of Goodyear.

B. Street Right-of-Way and PUE Requirements

1. The right-of-way requirements shown in the City Standard Details are based on the width needed for street improvements constructed to meet the ultimate development requirements. When necessary, the right-of-way width shall be sized to include auxiliary lanes, transit facilities, or other required facility.
2. PUEs shall be provided adjacent to all roadway types. Dry utilities shall be placed within the PUE except where they must cross a

roadway. Cut or fill slopes (at maximum 10H:1V grades), sidewalks, bicycle paths, trails, traffic control devices, information signs, fire hydrants, landscaping, and other public facilities to be located adjacent to street pavements may be located within the PUE with prior approval by the City Engineer.

3. Right-of-way widths or PUEs in excess of the standard widths may be required in special circumstances, including but not limited to situations where:

   a. Cut or fill slopes cannot be confined within the standard width;

   b. Minimum sight distance lines on horizontal curves are not within standards;

   c. Minimum sight distances at intersections are not within standards;

   d. Auxiliary lanes or bus stops are to be provided.

4. Cul-de-sac streets shall terminate in a circular right-of-way turnaround 50 feet in radius. A PUE of a width appropriate to the road type shall be provided around this turnaround.

C. Pavement Cross Section Slopes

1. Typical Street Cross Sections

   a. Undivided Streets - Undivided streets should have a normal crown that is a two-way cross slope with the cross-sectional high point on the street centerline.

   b. Divided streets

      (1). Divided streets should have cross slope on each pavement section.

      (2). The high point of each slope on each pavement section shall occur on the edge of the pavement nearest to the median.

   c. See City Standard Details for intersection cross slope standards.

   d. Unusual conditions may cause cross slope requirements to vary, but normally the desirable cross slope is 2 percent, with a maximum cross slope of 3 percent. Any deviation from the desirable cross slope is subject to review and approval by the City Engineering Department.

2. Street Dip Sections

   When storm drainage runoff flows cannot be conveyed under a street by means of a pipe or culvert, a dip section may be used. When a dip section is designed, a minimum 8-foot wide valley gutter having a one-way slope across the right-of-way (with no crown in the street) shall be used. Cut-off walls shall be installed per City Standard

Details. Curbing and medians shall not be raised within the dip section. Transitions back to normal street cross slopes will be required at both ends of the dip section.

a. Dip sections on arterial streets are NOT allowed.

b. Dip sections on collector streets are strongly discouraged and will require specific approval by the City Engineering Department.

c. Dip sections on local streets are discouraged and will be reviewed closely to verify that other options for conveying the flows cannot be used.

3. Right Turn Lanes

a. Right turn lanes constructed into private developments shall be 9" class "A" concrete. A 2% cross-slope will be provided to a 3-foot valley gutter between the through lane and right turn lane. Storage length and taper to be per City of Goodyear Standard Details.

D. Traffic Calming Devices

1. Traffic calming devices within the City rights-of-way or on private streets shall be designed and installed in accordance with the City Neighborhood Traffic Management Program.

E. Medians

1. Median Widths

The width of a median is measured from back of median curb to back of median curb. If the median has no curb, the width is measured between the centers of the continuous, painted median stripes. Median widths shall be per the City Standard Details.

2. Paved Medians

A median less than 4 feet wide shall be paved. The paved surface should be crowned and have the same cross slope as the street pavement. Acceptable median paving materials and methods are shown in the City Standard Details.

3. See the landscape section of this manual for grading and landscaping requirements. See the City Standard Details of typical street cross sections for additional information.

F. Curbs

1. Vertical Curbs

a. Vertical curbs are required for all streets except local streets. Vertical curbs may be used on local streets if drainage considerations or vehicular access issues make such use desirable.

b. Concrete and asphalt curbs that are extruded onto pavement may be permitted on a temporary basis (for periods less than one year) in commercial/industrial developments.

c. Vertical curbs with gutter are to be constructed in accordance with MAG Standard Detail 220 Type "A". Vertical curb and gutter type shall match the adjacent pavement slope to the gutter cross slope direction. The curb height shown on the standard detail is 6 inches, but the following variations may be used when approved by the City Engineering Department:

(1). Where fire lane or public maintenance vehicle access to abutting property must be provided over the curb, MAG standard roll curb or MAG mountable curb Type "F" (MAG Standard Detail 220-2) shall be used. A modified ribbon curb may be used for temporary Fire Department access roads as shown in the City Standard Details.

(2). If drainage conditions of an arterial street are significantly improved, the vertical curb height may be increased to 8 inches maximum and the width of the gutter may be increased to 24 inches.

(3). Curb height through the return shall be reduced (or transitioned) to match an adjacent curb height.

(4). A vertical curb 4 inches in height may be used to control vehicle access on local residential streets.

2. Roll Curb

Except where vertical curb is required for drainage or access control, roll curbing shall be used on local streets adjacent to residential lots, and is to be constructed in accordance with MAG Standard Detail 220 Type "C" or City Standard Details.

3. Cut-Off Walls

In locations where dip sections are permitted to allow drainage flows to cross roadways, cut-off walls conforming to City Standard Details shall be installed:

a. Cut-off walls shall be at least 3 feet deep and have a top that is flush with the pavement surface.

b. The cut-off walls shall extend across the flow path in the dip section to protect the pavement structure during runoff flows from a 100-year storm event.

c. Transitions will be required between the regular curbs and the cut-off walls at each end of the dip section.

4. Curb Returns

a. Vertical curb shall be used through the curb return from PC to PT regardless of whether the tangent curb sections are vertical or roll curb.

b. All curb returns shall be provided with sidewalk from PC to PT of the same width as that provided for the sidewalk behind the tangent curb sections. If sidewalk is not provided adjacent to the return or behind either tangent curb section, the curb return sidewalk width shall be equal to the greater width as required for the adjacent street types. ADA sidewalk ramps with detectable warnings are required to be constructed where appropriate.

c. Curb Return Radii

All street intersections shall be constructed with concrete vertical curb returns and ramps per MAG Standard Details, and must meet the minimum ADA requirements, including use of detectable warnings. See Table 4.1.1 for specific requirements regarding curb return radii and right-of-way cutoffs at the City standard intersections.

TABLE 4.1.1 - Curb Return Radii & Right-of-Way Cutoffs

BACK OF CURB RETURN RADIUS				
STREET TYPE	ALL ARTERIALS	ALL MAJOR COLLECTORS	ALL MINOR COLLECTORS	ALL LOCALS
ALL ARTERIALS	35 FEET	30 FEET	30 FEET	30 FEET
ALL MAJOR COLLECTORS	30 FEET	30 FEET	30 FEET	30 FEET
ALL MINOR COLLECTORS	30 FEET	30 FEET	30 FEET	20 FEET
ALL LOCALS	30 FEET	30 FEET	20 FEET	20 FEET

RIGHT-OF-WAY CUTOFFS (NOT RADIUS) AT INTERSECTIONS
ALL LOCALS TO LOCALS ….....…….. 12 FEET x 12 FEET
ALL LOCALS TO ANY OTHER TYPE ….…. 20 FEET x 20 FEET
ALL OTHER CUTOFFS …… 33 FEET x 33 FEET

G. Selection of a Design Speed

The design of geometric features such as horizontal and vertical curves will depend upon the design speed selected for the street. The choice of the design speed is primarily determined by the street classification. The design speed is the maximum speed for the safe operation of a vehicle that can be maintained over a specific section of a street when conditions are so favorable that the design features of the street govern.

The design speed shall be greater than the posted speed limit. Typically, this will include speeds 10 mph over the posted speed limit but may be more as conditions warrant. The following posted speeds should be used as a guideline:

1. Expressway/Freeway - Posted Speed Limit 65 mph
2. Arterial Streets - Posted Speed Limit 45 mph
3. Collector Streets - Posted Speed Limit 35 mph
4. Local Streets - Posted Speed Limit 25 mph
5. Rural Roads - Posted Speed Limit 50 mph

H. Horizontal Curves

1. Minimum Radii of Curvature

a. The minimum radius of curvature will be determined by the design speed or by the stopping sight distance. In general, the minimum centerline radius is 900 feet for arterial streets, 500 feet for collector streets and 100 feet for local streets.

b. Consideration of Stopping Sight Distance

(1). When walls, buildings, bridge piers, cut slopes, vegetation, or other obstructions are near the roadway on the inside of a curve, they can block a driver's view of the road ahead. If they are too close, the driver will not have sufficient distance along the curved roadway to stop when a hazardous condition comes into view.

(2). For design, the driver's eye elevation shall be taken at 3.5 feet above the center of the inside lane (the driving lane closest to the inside of the curve).

(3). The hazardous condition is an object 0.5 feet high in the center of the inside lane.

(4). The line-of-sight is assumed to intercept the view obstruction at the midpoint of the line-of-sight two feet above the center of the inside lane.

(5). The clear distance, "M", is measured from the center of the inside lane to the view obstruction.

(6). The AASHTO publication A Policy on Geometric Design of Highways and Streets depicts these relationships and provides a table of minimum stopping sight distances for various design speeds.

2. Reduced Design Speeds on Curves

a. The reduction of a street design speed on a curve should be avoided. However, where physical restrictions prohibit increasing the radius of the curve or the clear distance "M", the design speed for the curved section may be reduced.

b. In such circumstances, signing in accordance with the MUTCD and the ADOT Supplement to the MUTCD is required. The difference between the design speed for the roadway approaching the curve and the design speed for the curve shall not be greater than 10 miles per hour.

c. The design speed for a curved roadway section shall not be reduced if the reduction would occur at the end of a long tangent or at any location where high approach speeds may be expected.

3. Compound Curves

Compound curves should be avoided.

a. If site conditions make the use of compound curve unavoidable, the shorter radius shall be at least two-thirds the length of the longer radius when the shorter radius is 1,000 feet or less.

b. Compound curves are not permitted when design speeds require the shorter radius to be greater than 1,000 feet.

c. Compound curves are not permitted on two-lane roads.

4. Tangent Sections between Reverse Curves

A minimum 100-foot tangent section shall be provided between two curves that curve in the opposite direction for all local and minor collector streets, and as required by the City Engineering Department for all other circumstances.

I. Superelevation in Curves

1. Superelevation is discouraged on horizontal curves.

2. Superelevation Standards:

a. A maximum superelevation of 0.02 ft/ft may be used when the standard radius cannot be provided due to circumstances beyond the control of the Engineer, and the general alignment cannot be changed.

b. Superelevations greater than 0.02 ft/ft may not be used.

3. Transition for Superelevation:

a. The length of superelevation transition shall be based on the superelevation rate and the width of rotation. The axis of rotation shall generally be about the pavement centerline. For superelevation design, refer to the AASHTO publication, A Policy on Geometric Design of Highways and Streets.

b. With respect to the beginning or ending of a horizontal curve, one-third of the transition should be on the curve and two-thirds of the transition should be on the tangent pavement section.

4. Drainage on Superelevation Curves

Whenever superelevation is allowed on a divided street, a storm drainage system to collect the runoff along the median curb shall be provided. It is preferred that the structure be a curb opening type catch basin. In no case shall nuisance water from the higher traveled way be allowed to cross the lower traveled way.

J. Vertical Alignment

1. Longitudinal Street Grades

a. For freeways, expressways, and arterial streets the maximum grade shall be 6 percent.

b. For collector and local streets, the maximum grade shall be 9 percent.

c. The minimum longitudinal street grade for all streets is 0.4 percent. Wherever possible, longitudinal street grades greater than or equal to the minimum grade shall be provided.

d. Where necessary, grades less than 0.4 percent may be used as approved by the City Engineering Department. In no case shall the longitudinal street grade be less than 0.15 percent as measured at any curb.

2. Vertical Curves

A vertical curve is required when grade changes are equal to or greater than 1.5 percent for local streets, 1.0 percent for collector streets, and 0.5 percent on other major roadways. Local streets may also use a series of grade breaks at a 25-foot minimum spacing in lieu of a vertical curve.

a. The minimum length of the vertical curve is 100 feet for local streets.

b. All sections of a street's vertical alignment must meet passing and stopping sight distance requirements for the design speed.

c. The design speed of a road shall not be reduced due to a vertical curve.

d. For further details, see the AASHTO publication, A Policy on Geometric Design of Highways and Streets.

3. Combined Horizontal and Vertical Curves

When horizontal and vertical curves are combined, the horizontal curve shall lead and follow the vertical curve. For additional information on this topic, refer to the AASHTO publication, A Policy on Geometric Design of Highways and Streets.

K. Intersections

Although all intersections share certain common elements, they are not subject to generalized treatment.

1. Typical designs for intersections found in the City are illustrated in the City Standard Details. However, to minimize conflicts and provide for anticipated traffic movements, each intersection shall be evaluated with regard to its individual characteristics and shall be designed based on the following:

a. Traffic factors such as capacities, turning movements, vehicle size and operating characteristics, vehicle speed, pedestrian movements, transit operations, and accident history;

b. Physical factors such as topography, existing conditions, and channelization requirements;

c. Human factors such as driving habits, reaction to surprises, decision and reaction time, and natural paths of movement.

2. Angle of Intersection

A right-angle intersection provides the shortest crossing distance for intersecting traffic streams. It also provides the most favorable condition for drivers to judge the relative position and speed of intersecting vehicles. Where special conditions exist, intersection angles may diverge from a right-angle by a maximum of 2 degrees on expressway/freeway, arterial, major collector, and commercial / industrial collector streets, and by a maximum of 4 degrees on minor collector and all local streets.

3. Alignment and Profile

Intersections occurring on horizontal or crest vertical curves are undesirable. When there is latitude in the selection of intersection

locations, vertical or horizontal curvature should be avoided. A line or grade change is frequently warranted when major intersections are involved. If a curve is unavoidable, it should be as flat as site conditions permit. Where the grade of the through-roadway is steep, flattening through the intersections is desirable as a safety measure.

4. Intersection Sight Distance

In order to provide the opportunity for vehicles on a stop-controlled intersection leg to safely cross or make left or right turns onto a non-controlled intersection leg, adequate sight distance must be provided.

a. Two SVTs may be drawn on either side of a driveway, or four SVTs per intersecting roads to represent the areas that must be free of all objects, vegetation and topography.

b. All objects within SVTs shall be kept clear in the range of two feet and seven feet above the pavement.

c. SVTs shall be calculated per City Standard Details with the following exception:

SVT on local to local street intersections, and at all commercial and industrial driveways, shall have minimum dimensions of 33 feet by 33 feet as shown in the City Standard Details. SVTs shall be located along right-of-way lines rather than curb lines.

5. Valley Gutters at Street Intersections

a. Concrete valley gutters per City Standard Details shall be constructed at all minor collector and local street intersections where the drainage pattern requires them.

b. Concrete valley gutters per MAG Standard Detail 240 may be used in residential developments as approved by the City Engineering Department.

c. Asphalt valley gutters are not allowed on public streets.

d. Wide valley gutters as provided in the City Standard Details shall be used in dip crossings and other locations where traffic controls will not stop a vehicle within 100 feet of the valley gutter, or as required by the City Engineering Department.

6. Turning Lanes

A separate turning lane permits separation of conflicting traffic movements and removes turning vehicles from the intersection area. The storage and taper length requirements and other pertinent information relating to turning lanes can be found in the City Standard Details.

a. Right turn lanes shall be provided on all arterial to arterial and arterial to collector street intersections. See the City Standard Details for storage and taper length requirements.

b. Right turn lanes shall be provided at all new driveways that access onto arterial streets and parkways.

c. For left turn lanes at signalized intersections, dual turn lanes should be considered when identified by the City Engineering Department or when:

(1). The turn volume exceeds 200 vehicles per hour,

(2). The opposing through-volume exceeds 1,000 vehicles per hour, or

(3). The delay to left turning vehicles exceeds 45 seconds.

d. Abrupt reduction of alignment and sight distance standards should be avoided. The length of these lanes depends on several factors and shall be determined on a case-by-case basis.

e. Driveways shall not be permitted within a right turning lane for any street intersection involving an arterial street.

L. Median Design

Raised medians are required on arterial and major collector streets to separate traffic flows, channelize left turns, and reduce conflicts. On minor collector streets, commercial/industrial collector streets, and commercial/industrial local streets, flush or painted medians provide space between the through-traffic lanes for left turning vehicles.

1. Raised Medians

Raised medians, where required, shall be provided in accordance with City Standard Details.

2. Spacing and Location of Median Openings

If a street has a raised median, it is not possible to provide an opening in the median for every street intersection or driveway location. Median openings shall be located in harmony with the driveway spacing criteria established in the City Standard Details but shall be no greater than allowed by the following criteria:

a. Major arterial streets:

(1). Full median openings shall not be located closer than a quarter-mile apart.

(2). Partial median openings, which allow only left in turns (not left out), may be located at eighth-mile intervals.

b. Minor arterial and major collector streets:

Full median breaks shall not be located closer than an eighth-mile apart.

3. Configuration of Median Openings

a. For street intersections with legs intersecting at an angle of 88 to 90 degrees, configuration of the median opening shall meet the requirements of City Standard Details.

b. Streets intersections with legs at an angle less than 88 degrees require the approval of the City Engineering Department on a case-by-case basis.

4. Medians on Superelevated Roads

Median openings on curves with superelevation exceeding 0.02 ft/ft will not be permitted.

5. Flush Medians

Flush, painted medians are required on minor and commercial collector roadways.

M. Rubberized Asphalt Pavement Cross-Sections

1. Rubberized asphalt pavement shall be used as the final surface course on Arterial and Major Collector Streets that are within a 1/4-mile radius of a residential area as designated on the City's Land Use Plan. Refer to City Standard Detail G-3216 for minimum pavement design sections. Exceptions to this specification must be submitted in writing to the City Engineer and approvals must be received in writing.

4.1.4 Street Access and Driveways

All driveways serving property abutting public streets in the City shall conform to the following guidelines:

A. Driveway Design

1. Width

The width of a driveway shall be the width at the throat of the driveway exclusive of wings or return radii.

2. Construction

a. Residential Driveways:

With vertical curb – Construct driveways per MAG Standard Detail 250.

b. Commercial, Industrial, and Multi-Family Residential Driveways:

Roll and vertical curb – Construct driveways per MAG Standard Detail 251.

B. Driveway Spacing

Minimum driveway spacing shall conform to the requirements established in the City Standard Details.

C. Driveway Location Limitation

It is encouraged that driveways be shared between two abutting commercial properties. Driveways that eliminate or severely reduce the access for an adjacent property will not be permitted.

D. Protection of Access

Except at approved access points, for proper control of driveway access, a vehicular non-access easement shall be granted to the City along all expressway/freeway, arterial, and collector streets, and open space when abutting property develops.

E. Driveways

Driveways approved for use in the City are shown in the City Standard Details.

1. Residential Development Driveways

a. Single Family Residential Development

(1). Driveways serving single family residential units shall be D-1 Type driveways as shown in City Standard Detail, G-3236.

(2). Only one driveway per lot is allowed. See “Limitations on Residential Access” in this chapter for residential driveways in which two access points are allowed.

(3). The minimum driveway length is 20 feet. This minimum length shall be maintained clear of both sidewalk and structures such that a 20-foot long vehicle may park in the driveway without impeding pedestrian access to the sidewalk or being completely or partially beneath a structure. If no sidewalk is provided, this distance shall be taken from the back of curb.

(4). The maximum driveway grade is 12 percent as measured along the centerline of the driveway.

b. Multi-Family Residential Development

The D-2, D-3, and D-4 Type driveways shall be used to serve multi-family developments.

(1). Type D-2 is for low volume driveways. D-2 can serve more than three off-street parking stalls for more than two dwelling units, or may be used for low volume driveways such as well sites and lift stations.

(2). Type D-3 is for high volume driveways. D-3 can serve more than 50 dwelling units and is normally accessed from an arterial or collector street.

(3). Type D-4 driveways shall be used when a separate left turn lane is needed.

(4). The minimum driveway length is 80 feet for D-3 and D-4 Type driveways, and 30 feet for D-2 Type driveways, as measured from the street back of curb (the width of a decel lane may be included in the measurement) to the first drive aisle turn or parking stall.

c. Limitations on Residential Access

(1). Residential properties (other than multi-family developments) that have frontage on a local street as well as on an arterial or collector streets shall only access the local street.

(2). In some instances, residential parcels fronting only on an arterial or collector street may be given access when no other alternate public access is available. When such access is allowed, the driveway shall be circular or it shall have a turnaround area to ensure that there is no need for backing onto the street.

2. Commercial and Industrial Development Driveways

a. Driveways for commercial and industrial developments shall be Types D-3 through D-8 where accessed from parkway, arterial, major collector, minor collector streets, or at other locations as directed by the City Engineering Department.

b. The unimpeded, uninterrupted minimum length for inbound access on a commercial or industrial driveway from an arterial street shall be 80 feet, as measured from the street back of curb (the width of a decel lane may be included in the 80-foot measurement) to the first drive aisle turn or off-street parking stall. The unimpeded, uninterrupted minimum length for inbound access on a commercial or industrial driveway from a collector street shall be 50 feet, as measured from the street back of curb to the first drive aisle turn or

off-street parking stall. Modifications to the minimum lengths stated above must be based on the recommendations of an approved TIA, and will require approval from the City Engineer.

c. Driveways opposite median openings shall at a minimum meet the dimensions of D-4 or D-8 Type driveways.

d. Industrial access is not permitted on arterial or major collector streets.

e. Slopes on a commercial/industrial driveway shall not exceed 12 percent. Grade breaks shall not exceed 9 percent and shall be spaced no closer together than 20 feet.

3. Non-residential Driveway Grades

Driveway profile standards are illustrated in the City Standard Details.

4.1.5 Bridges, Retaining Walls and Structural Clearances

A. Bridges

1. Bridge Roadbed Width

The clear width of all bridges, including grade separation structures, shall equal the full width of the physical improvements consisting of sidewalk, street, median, and curb and gutter.

2. Approach Guardrail

If a vehicular railing or safety-shaped barrier is provided and is within 10 feet of a traveled way with or without a sidewalk, approach guardrails shall be installed on all approach ends in accordance with AASHTO guidelines.

3. Cross Slope

a. The bridge crown is normally centered on the bridge.

b. A straight cross slope in one direction shall be used for one-way bridges. The cross slope shall match the slope of the approach pavement.

4. Railings

ADOT standard design railings shall be used for all bridge structures. The four approved types of railings are described below:

a. Vehicular Barrier Railings

The primary function of these railings is to retain and redirect errant vehicles.

b. Combination Vehicular and Pedestrian Railings

These railings perform the dual function of retaining both vehicles and pedestrians on the bridge. These railings consist of two parts:

(1). a concrete barrier railing with a sidewalk

(2). a metal hand railing or fence-type railing

c. Pedestrian Railings

These railings prevent pedestrians from accidentally falling from the structure and, in the case of the fence-type railing, prevent objects from being thrown to the roadway below the bridge.

d. Bridge Approach Railings

(1). Approach railings are required at the ends of bridge railings exposed to approach traffic. On divided highways, with separate one-way traffic structures, they shall be placed to the left and right of approaching traffic.

(2). On two-way roadbeds with a clear width less than 60 feet across the structure, approach railings shall be placed on both sides of the structure.

(3). When the clear width is 60 feet or more, approach railings shall be placed only to the right of approaching traffic.

(4). Several types of approach railings are available, including Metal Beam Guardrail, Bridge Approach Guardrail (Types I and II), and Safety-Shape Barriers. The type of approach railing selected should match the rail to be used on the bridge. When long runs of guardrail (such as embankment guardrail) precede the bridge, the guardrail should connect to the bridge railing and thus serve the approach railing function.

(5). Approach railings shall be flared at their exposed end. The greatest flare offset possible should be used commensurate with the approach roadway. For detailed information, refer to the AASHTO publication, Roadside Design Guide.

B. Retaining Walls

1. Types and Uses

Recommended types of retaining walls include reinforced concrete and structural masonry. Heavy timber construction is not encouraged and will require special review and consideration by the Engineering

Department. The walls shall also include integral attachments for railing and weep drainage where applicable.

2. Aesthetic Considerations

a. In general, the materials and design of retaining walls shall match or blend with the adjacent natural features, landscaping, and/or buildings. The surface of a retaining wall should have a low light reflectance. Suggested surface treatments include exposed aggregate, stucco or mortar wash, native stone, or other surfaces as approved by the Development Policy Committee.

b. The height of retaining walls shall not exceed 6 feet. Terracing is encouraged and the length of the alignment of the retaining walls should be foreshortened by vertical grooves, periodic offsets, height changes, or other configurations as approved by the Development Policy Committee.

3. Safety Railings

A safety railing is required on or adjacent to vertical faces such as retaining walls, wing-walls, abutments, etc., where the vertical fall is two feet or more. The safety railing shall be constructed per City Standard Details and shall be placed on top of the vertical face structure. On tiered retaining walls railing shall be required on the top tier. This standard does not apply to retaining walls within or between residential lots.

4. Building Safety Permit

All retaining walls greater than 1 foot in height will require a permit from and will be inspected by the Building Safety Division. Any perimeter wall or wall that is adjacent to an arterial or major collector street and has an exposed face that is greater than 8 feet in height will require approval from the Engineering Department and Planning & Zoning Division before a Building Permit is issued or construction begins.

C. Structural Clearance

1. Horizontal Clearance

a. Fixed objects other than street lights, signal poles, utility boxes, street sign poles, fire hydrants and other water appurtenances, landscaping, and utility poles will not be allowed within 10 feet of the traveled way.

b. A lesser clearance will only be allowed when other controls make the desired clearance unreasonable, and if appropriate traffic barriers are installed. In no case shall a fixed object be allowed within two feet of a traveled way.

c. The horizontal clearance to bridge piers, abutments, and retaining walls on all streets shall be not less than 10 feet from the edge of the traveled way.

2. Vertical Clearance

a. The minimum vertical clearance shall be 16.5 feet over the entire width of the traveled way of expressway, parkway, freeway, arterial, or collector streets.

b. On all other streets, the minimum vertical clearance shall be 14.5 feet.

4.1.6 Side Slopes

A. Side Slope Standards

Side slopes should be designed for functional effectiveness, ease of maintenance, and pleasing appearance. See City Standard Details for minimum and maximum slope requirements.

1. Steeper slopes may be approved in areas more than 30 feet back of curb when soils are not highly susceptible to erosion, or when a cut is not more than 4 feet.

2. Consult the AASHTO publication Roadside Design Guide for additional information. Cuts or fills greater than 4 feet shall be reviewed by the Development Policy Committee.

B. Slope Rounding

The top of all cut slopes shall be rounded where the material is other than solid rock. A layer of earth overlaying a rock cut also shall be rounded. The top and bottom of all fill slopes for or adjacent to a traveled way, sidewalk, or bicycle path shall also be rounded.

4.1.7 Street Construction Requirements

A. Construction Standards

1. All construction shall conform to the latest MAG Standard Details and Specifications together with this manual and the City Standard Details.

2. A right-of-way Construction Permit is required for all work within the right-of-way.

3. All contractors working within the right-of-way shall provide the City with proof of insurance in a form and with limits of coverage acceptable to the City.

4. The minimum pavement width for a street widening shall be 12 feet. When improvements occur on a rural arterial and the existing

roadway does not match the new profile, the existing section will need to be removed to match the new cross section.

5. All work within the right-of-way shall be inspected and approved by the City.

6. All newly constructed public ways shall be kept barricaded and access denied to the public until such public way is accepted by the City and all traffic control devices are installed to the approval of the City.

7. All new pavements shall remain in a new uncut condition for a period of 5 years from the date of acceptance by the City. New pavement is defined as follows: addition of new layer of asphalt, cape seals, hot in-place recycling, microsurfacing/ thin-lift overlay, mill and fill, mill and overlay, new construction, open-graded surface course, and rehabilitation and reconstruction. Proposed projects should avoid all pavement cuts within that 5-year period. If a pavement cut is unavoidable a fine per the "Pavement Cut Fines Schedule", as established by City Code, will be assessed.

   The following pavement treatment types are considered maintenance and not new pavement: chip seals, crack filling and sealing, fog seals, joint crack seals, joint repairs, pavement patching, scrub sealing, slurry seals, spot high-friction treatments, and surface sealing. Pavement cuts within a pavement maintenance area will not be assessed for the "Pavement Cut Fines Schedule".

8. Prior to the expiration of the two-year warranty and before the required sealant s applied, all pavement cracks 1/4-inch or wider shall be cleaned and prepared in accordance with MAG Section 337 before crack sealing. Crack sealing shall also be performed around all manholes, valve boxes, survey monuments, and other facilities within the roadway and along all curb and gutter lines in accordance with MAG. After the crack sealing has been completed and before the expiration of the two-year warranty, the streets shall be sealed as follows unless the City agrees to accept an in-lieu payment for the work.

   All new pavement, except rubberized asphalt, shall be sealed as follows:

   a. Streets paved with rubberized asphalt do not need to be sealed;

   b. Unless the City determines that an alternative treatment is required based on the condition of the asphalt, paving on Local Streets shall be sealed with a minimum of a High Density Mineral Bond.

   c. Unless the City determines that an alternative treatment is required based on the condition of the asphalt or unless the City agrees to accept an in-lieu payment for the work, paving on Arterial and Collector Streets shall be sealed with a minimum of a Rubberized Micro Surface.

d. If the City determines an alternative treatment is required, the alternative treatment shall be used to seal the paving on the streets being sealed. Alternative treatments shall be limited to those treatments included in the City's approved pavement management plan.

e. If the City agrees to accept an in-lieu payment, the in-lieu payment will be the cost of applying, testing, inspecting and striping the roadway at the current cost at the 2-year warranty period. In-lieu payments may only be accepted to satisfy the obligation to seal Arterial and Collectors Streets.

f. At the direction of the City Engineer, new thermoplastic markings, fire hydrant reflectors, symbols and raised pavement markers shall be applied following the application of the sealant.

B. Construction of Less-Than-Ultimate Cross Section Improvements

1. Construction of the full street cross section is required for interior streets of a development.

2. Construction of the full half-street cross section is required for the perimeter streets of a development. When approved by the City Engineering Department, an in lieu payment for the cost of the perimeter street improvements may be paid by the Developer in the place of constructing the improvement. Unless a Developer is responsible for the construction of a full median, the Developer shall submit an in-lieu payment for fifty percent (50%) of the costs of the median and median landscaping. If a development is approved for an in lieu payment, rather than to construct the perimeter street, the amount of the payment will be determined by following the City's In Lieu Payment Calculation Worksheet. This worksheet is available from the City Engineering Department.

3. When major arterial streets are constructed, 4 of the 6 lanes of the full street or 2 of the 3 lanes of the half street may be required to be constructed at the time of development. Where so elected, the City may financially participate and require that the additional lane(s) be constructed as part of the project.

4. The determination as to whether the unconstructed lanes will be on the outer edge of the cross section or adjacent to the median location will be made on a case-by-case basis.

C. Construction of Half-Streets

Construction of half streets is discouraged and shall only be permitted in special circumstances. Where approved, minimum pavement widths and temporary turnarounds may be required to satisfy emergency vehicle passage and turning needs.

D. Pavement Transitions

When development causes the widening of a portion of the pavement of an existing road, pavement transitions are required at each end of the widened portion. Design of the various features of the transition between pavements of different widths should be consistent with the design standards of the superior facility. See City Standard Details for minimum transition dimensions.

1. Pavement Transitioning Requirements

a. The transitions should be made on a tangent section whenever possible.

b. Locations with horizontal and vertical sight distance restrictions should be avoided.

c. Whenever feasible, the entire transition should be visible to the driver of a vehicle approaching the narrower section.

d. Intersections at grade within the transition area should be avoided.

4.1.8 Subdivision Street Planning

Refer to Chapter 15, Subdivision Regulations, of the City Code of Ordinances for information regarding the development and design of Subdivisions.

Subdivision street plans should be designed to produce the minimum number of intersections and wash crossings. Street layout and planning shall also be done in a manner that discourages pass-through traffic by the general public but maintains good connectivity to and from adjacent neighborhoods.

A. Existing and Proposed Streets

Existing streets and proposed streets shown on the City General Plan, Roadway Functional Classification Plan, or other City-approved Transportation Plan shall be incorporated into the design of new subdivisions. Exceptions will require approval by the Development Policy Committee and City Council.

B. Street Abandonment

An existing street may be abandoned if it is not a street indicated in the Roadway Functional Classification Plan of the City's General Plan or an Area Plan, and will not eliminate reasonable access to existing properties. The abandonment shall occur prior to the submittal of a Final Plat to City Council.

C. Cul-de-Sac Street Lengths

A cul-de-sac street is a street that serves more than one property owner and has only one direct access to the public street system. The following requirements apply to both public and private streets:

1. The length of a cul-de-sac is measured from the intersection of right of way lines to the extreme depth of the turning circle along the street centerline.
2. A cul-de-sac street shall not be longer than 325 feet, and it shall not serve more than 25 single family dwelling units.
3. Cul-de-sac lengths may also be limited by the maximum length of dead-end water lines. See Chapter 5 (Water) of this manual for further information.
4. Exceptions may be made where topography justifies but shall not be made merely because the tract has restrictive boundary dimensions, wherein provision should be made for extension of street pattern to the adjoining unplatted parcel and a temporary turn around installed

D. Dead-End Streets

1. Dead-end streets will be required where a street connection is necessary to serve adjacent properties that will develop at a future date.
2. When a dead-end street is required and it serves more than 4 lots or is longer than 150 feet, a temporary turnaround shall be provided. In addition, the length and number of lots on a dead-end local street shall be the same as that of a cul-de-sac street.

E. Bubbles

Bubbles are roadway areas expanded to provide a turnaround and additional access or lot frontage on minor collector and local streets.

1. Bubbles are required at intersections where each street extends in only one direction from the intersection.
2. Bubbles are permitted between intersections to improve accessibility to odd-shaped sites or on minor collector streets where direct access is not permitted.
3. The outside radii for bubbles shall be 55 feet.
4. The use of bubbles (except for a cul-de-sac) on other-than-local streets will be reviewed on a case-by-case basis. Radii appropriate for these bubbles will be established as part of that review.

F. Alleys

Alleys may be permitted as allowed by the Goodyear Zoning Ordinance and/or PAD zoning approval.

G. Intersections

1. Street jogs with centerline offsets less than 250 feet will not be permitted along arterial and major collector streets. Street jogs with centerline offsets less than 250 feet will not be permitted on minor collector or commercial/industrial collector streets where interlocking left turns will occur.
2. Offsets as small as 125 feet are allowed on minor collector, commercial/industrial collector, and all local streets where interlocking left turns will not occur.
3. Street intersections with more than four legs and Y-Type intersections where legs meet at acute angles shall be avoided; provision of T-Type intersections for local streets shall be encouraged.

H. Intersecting Tangents

Where a curvilinear street intersects another roadway, a tangent section shall be provided as follows:

1. Local streets intersecting a collector street shall have a tangent section of centerline at least 150 feet in length measured from the right-of-way line of the intersected street;
2. When the local street curve has a centerline radius greater than 400 feet and is perpendicular to the right-of-way line of the intersected street (at the point of intersection), a tangent length shall at a minimum be provided from the centerline of the intersected street to the right-of-way line of the intersected street.

I. Horizontal Alignment

1. When tangent centerlines deflect from each other more than 10 degrees and less than 90 degrees, they shall be connected by a curve with a minimum centerline radius of 500 feet for minor collector and commercial/industrial collector streets or 100 feet for all local streets.
2. Between reverse curves there shall be a tangent section of centerline not less than 100 feet for local streets. The length of tangent sections for collector and arterial streets shall be determined by the City Engineering Department. See the Horizontal curves section of this document for further information on reverse curve requirements.

4.1.9 Technical Reports and Technical Design Requirements

A. Site Plan/Preliminary Plat

Preliminary design information for roadways shall be provided along with the submittal of a Site Plan or a Preliminary Plat. At a minimum, the preliminary design information shall address the following subjects:

1. Traffic Impact Study, as outlined in MCDOT standards, and a Traffic Circulation Study.
2. Roadway cross sections (include the relevant City Standard Detail number)
3. Auxiliary and additional lanes
4. Parking requirements
5. Pedestrian, bicycle, equestrian, and multi-use facility requirements
6. Special features and their influence

B. Design Study

Developers are responsible for submitting a Design Study Report to validate the design shown on the construction plans. The Design Study Report should not be excessively long or complex; rather it shall briefly describe the basis of the design and the assumptions made, explain "special" solutions to problems encountered, etc.
The following sections shall be contained in the report:

1. Soils Report

   A Soils Report shall be submitted with new street construction plans indicating "R" value, sieve analysis, and plastic index of the subgrade, and street structural cross section design.

2. Drainage Report

   A Drainage Report shall be submitted with new street construction plans or the Grading Plans. This report shall be prepared per Chapter 3 of this manual.

3. Pavement Evaluation Report

   a. A Pavement Evaluation Report shall be submitted with new street construction plans when it is proposed to match existing pavement. The Design Engineer is responsible for investigating and evaluating the existing pavement structure.

   b. If the existing pavement meets City Standards, it may be matched by trimming a minimum of one foot for a longitudinal match, or two feet for a perpendicular match. Exact points of matching and method of trimming (sawcut or wheelcut) shall be determined in the field by the City.

c. If the existing pavement does NOT meet City Standards, the pavement must be removed to the limits of the project, or as directed by the City Engineer.

4. Supplemental sketches, details, calculations, and design rationale.

4.1.10 STREETLIGHT REQUIREMENTS

A. General Requirements

1. All streetlights shall use Light Emitting Diode ("LED") lighting fixtures.

2. Dual mast arm light poles shall be installed within the medians of all streets in the City of Goodyear. If, however, a street that will, upon completion have a median but the street is only partially constructed and the median is not completed, streetlights shall be alternating. This situation occurs when a development constructs its half-street improvements, but the median cannot be completed until the development on the other side completes its half-street improvements.

B. Arterial Street

1. Except as otherwise provided in Tables 4.1.3 and 4.1.4. streetlights on all categories of arterial streets shall use 113 Watt 10,400 lumen 4,000 CRI Light Emitting Diode (LED) lighting with 20-year life photo control. Except when a dual mast arm is to be installed in a median, arterial streets shall be illuminated on both sides of the street. Except as otherwise provided in Tables 4.1.3 and 4.1.4, street light spacing shall comply with the Spacing and Mounting Height Criteria for the applicable category of arterial street in Table 4.1.2.

2. Once the right-of-way permit is issued, adherence to streetlight locations is expected. Exceptions may be granted for shifts up to 5 feet parallel to the roadway when underground obstructions are encounter upon the written approval of Engineering Inspector. Shifts in streetlight placement allowed hereunder shall not interfere with a driveway.

3. Streetlights shall be located approximately 1-foot back of sidewalk where the sidewalk abuts the curb. Where the sidewalk is detached to create a landscaped area, streetlights shall be located approximately 4-feet back of the curb. The intent is to keep obstructions, including streetlights, out of the sidewalk.

C. Collector Streets

1. Except as otherwise provided in Tables 4.1.3 and 4.1.4, streetlights on all categories of collector streets shall use 95 Watt 8,600 lumen 4,000 K CRI LED lighting with 20-year life photo control. Except when a dual mast arm is to be installed in a median per Table 4.1.2, collector streets shall be illuminated on both sides of the street when there are four (4) or more through lanes of traffic or when there is a raised, landscaped median. Except as otherwise provided in Tables 4.1.3 and 4.1.4, streetlight spacing shall comply with the Spacing and Mounting Height Criteria for the applicable category of collector street in Table 4.1.2.

2. Streetlights shall be located approximately 1-foot back of sidewalk where the sidewalk abuts the curb. Where the sidewalk is detached to create a landscaped area, streetlights shall be located approximately 4-feet back of the curb.

D. Residential Local Streets

1. Streetlights on residential local streets shall use 60 Watt 5,300 lumen 4,000K CRI LED lighting with 20-year life photo control. Residential local streets shall be illuminated on one side of the street. Streetlight spacing shall comply with the Spacing and Mounting Height Criteria for residential streets in Table 4.1.2.

2. Streetlights shall be located approximately 1-foot back of sidewalk where the sidewalk abuts the curb. Where the sidewalk is detached to create a landscaped area, streetlights shall be located at least 3-feet from back of curb to face of pole.

E. Dark Sky Street Light Design

1. Dark Sky Street Lighting Design providing for reduced level of lighting may apply in areas designated as “Lighting Zone 1” pursuant to Article 10 of the Goodyear Zoning Ordinance.

2. If Dark Sky Street Lighting Design is applicable and the Dark Sky Street Light Table 4.1.3 indicates that lighting is to be mounted on traffic signal poles and no traffic signal exists, then streetlights on all four corners shall be installed using a 132 Watt 16,000 lumen 4,000K CRI LED lighting with 20-year life photo control. These street lights shall be placed in such a manner that the traffic signal can be installed at a later date with no interruption of street light service

TABLE 4.1.2 – Standard Street Light Design

STREET TYPE	LUMINAIRE (WATTS)	MOUNTING HEIGHT (FT)	SPACING MIN/MAX (FT)	POLE SPACING
RESIDENTIAL LOCALS	60	28	190/210	(1) ONE SIDE
ALL MINOR COLLECTORS	95	31.5	100/150	ALTERNATING
ALL MAJOR COLLECTORS	95	31.5	200/200	MEDIAN
ALL MAJOR COLLECTORS	95	31.5	175/225	ALTERNATING
ALL MINOR ARTERIALS	113	39.5	175/225	ALTERNATING
ALL MINOR ARTERIALS	113	39.5	200/200	MEDIAN
ALL MINOR ARTERIALS	113	39.5	100/150	ALTERNATING
ALL MAJOR ARTERIALS	113	39.5	100/150	ALTERNATING
ALL MAJOR ARTERIALS	113	39.5	200/200	MEDIAN
ALL MAJOR ARTERIALS	113	39.5	150/200	ALTERNATING

TABLE 4.1.3 – Dark Sky Street Light Table

THROUGH STREET CLASS	SIDE STREET CLASS	INTERSECTION TYPE	STANDARD LOCATION	FC	NO. OF POLES	WATTS	POLE HEIGHT	ARM	MOUNTING HEIGHT	POS	DIM A	DIM B
LOCAL	LOCAL	CROSS/TEE	ON CORNER	0.76	1	60	31’	2’	31’	A	24'	39'
MINOR COLLECTOR	LOCAL	CROSS/TEE	OPPOSITE CORNERS	1.12	2	95	31’	2’	31’	A	34'	39'
MAJOR COLLECTOR	LOCAL	CROSS/TEE	OPPOSITE CORNERS	0.95	2	113	31’	2’	31’	A	48'	49'
MINOR COLLECTOR	MINOR COLLECTOR	CROSS/TEE	OPPOSITE CORNERS	1.08	2	95	31’	4’	31’	A	34'	56'
MAJOR COLLECTOR	MINOR COLLECTOR	CROSS/TEE*	OPPOSITE CORNERS	0.89	2	113	31’	4’	31’	A	48'	56'
MAJOR COLLECTOR	MAJOR COLLECTOR	CROSS/TEE*	OPPOSITE CORNERS	1.15	2	132	31.5’	8’x8’	39.5’	A	48'	70'
MINOR ARTERIAL	MINOR COLLECTOR	CROSS/TEE*	OPPOSITE CORNERS	1.53	2	132	31.5’	8’x8’	39.5’	A	60'	56'
MAJOR ARTERIAL	MINOR COLLECTOR	CROSS/TEE*	ALL CORNERS	1.39	4	113	30’T	8’	30’	B	34'	94'
MINOR ARTERIAL	MAJOR COLLECTOR	CROSS/TEE*	ALL CORNERS	1.34	4	113	30’T	8’	30’	B	48'	82'
MAJOR ARTERIAL	MAJOR COLLECTOR	CROSS/TEE*	ALL CORNERS	1.84	4	132	30’T	8’	30’	B	48'	94'
MINOR ARTERIAL	MINOR ARTERIAL	CROSS/TEE*	ALL CORNERS	2.04	4	132	30’T	8’	30’	B	48'	87'
MAJOR ARTERIAL	MINOR ARTERIAL	CROSS/TEE*	ALL CORNERS	1.59	4	132	30’T	8’	30’	B	48'	99'
MAJOR COLLECTOR	MAJOR ARTERIAL	CROSS/TEE*	ALL CORNERS	1.32	4	132	30’T	8’	30’	B	60'	99'

* Alternate locations for these intersections are found in Table 4.1.4

T – Light to be mounted on traffic single pole

TABLE 4.1.4 – Dark Sky Intersection Alternate Locations

THROUGH STREET CLASS	SIDE STREET CLASS	INTERSECTION TYPE	ALTERNATE LOCATION	FC	NO. OF POLES	WATTS	POLE HEIGHT	ARM	MOUNTING HEIGHT	POS	DIM	
											A	B
MAJOR COLLECTOR	MINOR COLLECTOR	CROSS/TEE	MEDIAN	1.03	2	4X95	25'	8'x8'	33'	C	58'	n/a
MAJOR COLLECTOR	MAJOR COLLECTOR	CROSS/TEE	MEDIAN	1.33	2	4X113	25'	8'x8'	33'	C	72'	n/a
MINOR ARTERIAL	MINOR COLLECTOR	CROSS/TEE	MEDIAN	1.74	2	4X113	25'	8'x8'	33'	C	58'	n/a
MAJOR ARTERIAL	MINOR COLLECTOR	CROSS/TEE	MEDIAN	1.59	2	4X113	32'	8'x8'	40'	C	58'	n/a
MINOR ARTERIAL	MAJOR COLLECTOR	CROSS/TEE	MEDIAN	1.31	2	4X113	25'	8'x8'	33'	C	72'	n/a
MAJOR ARTERIAL	MAJOR COLLECTOR	CROSS/TEE	MEDIAN	2.07	2	4X132	32'	8'x8'	40'	C	72'	n/a
MINOR ARTERIAL	MINOR ARTERIAL	CROSS/TEE	MEDIAN	1.98	2	4X133	32'	8'x8'	40'	C	77'	n/a
MAJOR ARTERIAL	MINOR ARTERIAL	CROSS/TEE	MEDIAN	1.81	2	4X134	32'	8'x8'	40'	C	77'	n/a
MAJOR ARTERIAL	MAJOR ARTERIAL	CROSS/TEE	MEDIAN	1.7	2	4X135	32'	8'x8'	40'	C	89'	n/a

F. Developer Responsibility

1. Developers of residential subdivisions, apartments, condominiums, commercial, industrial projects, and all permitees are responsible for the design, materials, and installation costs of all Street lighting on public streets within and adjacent to their project.
2. APS – Specific Requirements – All costs for streetlight installation including construction and energization are to be addressed in streetlight construction contract between developer and APS. The Developer shall be financially responsible for the installation, operation and maintenance of the street lights for a two-year service term during the two-year warranty period.

G. Design Guidelines

1. Streetlight layout and design shall include existing and known future streetlight location information for all streets adjacent to and across from the proposed development.
2. Streetlights shall be shown on all roadway right-of-way adjacent to private developments. The Developer shall pay all City permit fees. Design conflicts shall be resolved by the Developer to the satisfaction of the electrical utility company and City of Goodyear. It shall be Developer's responsibility to coordinate conflict resolution with electric utility company facilities, including vertical clearances without compromise to the uniformity in the lighting design.
3. Streetlight layout and design shall include two (2) streetlights at each arterial street intersection and one streetlight at all other intersections.
4. Label specific locations, sizes, and dimension from the center line and/or monument line along with the following:

    a. Existing and proposed underground utilities
    b. Existing and proposed overhead utilities
    c. Face of curb
    d. Width of sidewalk
    e. Width of any PUE
    f. Edge of right-of-way
    g. Edge of pavement

5. There shall be a minimum six (6) feet of clearance between streetlight poles, fire hydrants, and City water services facilities. Three (3) feet clearance required for service taps (water/sewer) and two (2) feet clearance required from storm drains and city sewer facilities. Street lights shall not be installed within twenty-five feet of a traffic signal pole that is illuminated.

6. The public streetlight system shall be installed in the right-of-way unless right-of-way is not available. Where right-of-way is not available and where an easement allows for streetlight equipment, the engineer may design equipment within the easement with approval from the City Engineer.
7. Any public street cul-de-sac having a depth of one hundred fifty (150) feet or greater from face of nearest curb of interesting street to cul-de-sac radius point shall have a streetlight or lights located in the cul-de-sac.
8. Public street lighting plans shall show luminaire and streetlight pole type including assigned street number.
9. The streetlight design shall be submitted on E size sheets (24 inches by 36 inches). Plans shall be prepared so the north is to the top or right side of the sheet. The scale for the streetlight plan shall be 1-inch equals 20 feet or 1-inch equals 40 feet. See Plan Review requirement for electronic submittal.
10. Design line characteristics are as follows:
    a. Solid medium for proposed street improvements
    b. Light and/or dashed for existing street improvements
    c. Bold for streetlight system design
11. On local, collector and arterial streets, all existing and/or proposed driveways and ADA ramps shall be shown on the streetlight plans.
12. In areas where standard vertical curb, roll curb or sidewalk do not exist, all poles shall be centered at least then (10) feet from edge of asphalt pavement.
13. Information needed on each set of plans:
    a. Vicinity Map
    b. Legend
    c. Construction Notes
    d. Streetlight Notes
    e. General Notes as Required
    f. Project Number/Kiva number, SDEV Number, CSPR Number, Project Title and Address, if applicable (36-point minimum font)
    g. Blue Stake Caution Label
    h. Quantities List
    i. City Project Number, if applicable
    j. Utility provider

4.1.11 SUPPLEMENTAL DEVELOPMENT GUIDELINES

A. General Information

1. To achieve reasonable uniformity, deviations away from the point of radius up to 25 feet may be permitted.
2. Private streetlights should be labeled in the streetlight plans per APS Standards.
3. In cases where the required location for streetlights are in conflict with underground or overhead utilities and streetlights may be set back a minimum of two feet back of curb. However, any setback deviation must be approved by Engineering Department, Streetlight Section.
4. All streetlight poles and equipment shall be shown on streetlight plans with station and offset dimension.
5. Streetlight equipment shall conform to approved manufacturers per current utility company standards.
6. When proposed streetlights are to be located in near vicinity of an airport runway, the Developer shall provide all necessary pole height clearance calculations for review by COG Street lighting.
7. Developer shall provide additional details of any items not covered by COG standard details requested by the City Engineer.
8. Streetlight general notes shall be included on streetlight plans. See General Notes.

4.1.12 STREETLIGHT LOCATION LAYOUTS

In order to provide the designer with guidelines for various roadway scenarios, typical roadway configurations with corresponding spacing recommendations are shown in Standard Details. These layouts are show as examples only. The design engineer should use their professional judgment when designing all type of scenarios.

4.1.13 BRIDGE SPECIFICATIONS

A. General Information

1. This section applies to poles and luminaires installed on all bridge decks regardless of utility service area. Bridge mounted pole details and specifications are provided by APS.
2. Consulting Engineer shall coordinate with bridge structural engineer to design foundations for pole into bridge wall. See streetlight pole specifications for design criteria.
3. Cast in place junction box is required within 3’ of each pole mounted on a bridge.

4. Conduit between junction boxes on a bridge shall be a minimum of 2.5” in diameter.
5. Streetlight pole spacing shall be in accordance with typical spacing criteria corresponding to roadway designation as described in the design guidelines section.
6. Consulting Engineer shall provide details showing the installation of expansion couplings in bridge abutments.

4.2 TRAFFIC SIGNALIZATION

4.2.1 INTRODUCTION AND DEFINITIONS

A. Purpose

1. This section describes the design criteria for traffic signals within the City’s jurisdiction. The requirements described herein are primarily based on safety considerations. Therefore, standards that provide a greater degree of safety may be used, within reasonable economic limits, but standards that provide a lesser degree of safety may not be used without prior approval from the City’s Traffic Engineer.
2. While every effort has been made to ensure the accuracy and completeness of these guidelines, the City is not responsible for any errors or omissions. It shall be the sole responsibility of the Design Engineer to ensure proper design and accuracy, and the completeness of construction documents containing that Engineer’s seal.
3. Recognizing the liability implications associated with traffic signal design and operations, all traffic signal designs for traffic signals that will be the operational responsibility of the City should be conducted by professionals experienced in the design of traffic signals. Such individuals shall be Registered Professional Engineers (Civil Engineer or Electrical Engineer) in the State of Arizona and should be a Registered by the Institute of Transportation Engineers (ITE) as a Professional Traffic Operations Engineers (PTOE.

B. Applicable Standards

The following documents represent applicable standards documents, in order of precedence and hierarchy:

1. Manual on Uniform Traffic Control Devices, current edition.
2. Arizona Department of Transportation Supplements or Addenda to the MUTCD.
3. City of Goodyear Approved Products List for Traffic Signals, current edition.

4. City of Goodyear Standard Details.
5. City of Goodyear Engineering Standards.
6. ADOT Standard Specifications for Road and Bridge Construction, current edition, including any Supplements/Addenda.
7. Arizona Department of Transportation Standard Traffic Signal Details, current edition, including any Supplements/Addenda.

4.2.2 TRAFFIC SIGNAL NEEDS STUDY

All proposed traffic signals shall be justified by a complete and comprehensive Traffic Signal Needs Study. All Traffic Signal Needs Studies shall be supported by traffic data taken from the site within the last six months for any warrant based on existing traffic or pedestrian volumes. Signal warrants based on future traffic volumes shall be supplied with explanation of the logic by which the traffic volumes were derived.

A. Traffic Signal Needs Study Requirements

1. Spacing

   Spacing between adjacent signals shall be a concern and shall be analyzed by the party proposing any new signal. Typical signal spacing should be no closer than 1/2-mile between signals. Closer spacing may be proposed with supporting analysis, but is subject to the review and written approval of the City Traffic Engineer.

2. Signal Coordination Analysis

   A Signal Coordination Analysis shall be part of a traffic signal analysis. Unless a Signal Coordination Analysis is prepared by the City, a traffic signal needs study for proposed traffic signals located within 1/2-mile or less of any adjacent traffic signal shall include a Signal Coordination Analysis showing how the proposed signal may interact with neighboring signals under coordination. This Signal Coordination Analysis shall analyze both the AM and PM weekday peak periods, based on existing cycle lengths and any proposed changed cycle lengths deemed necessary to suitably operate the new signal in sync with adjacent signals. In cases of commercial developments of land uses typical of high weekend peak traffic, analysis periods may include weekend data, as directed by the City Traffic Engineer. The City Traffic Engineer shall establish the time frames and geographic limits of the Signal Coordination Analysis prior to the analysis being performed. The Design Engineer shall be responsible for obtaining any and all necessary data for this analysis.

3. Authentication

All Traffic Signal Needs Studies shall be submitted to the City for review and approval, sealed by a Registered Professional Engineer experienced in the procedures and application of such procedures as set forth in the MUTCD and other industry standards.

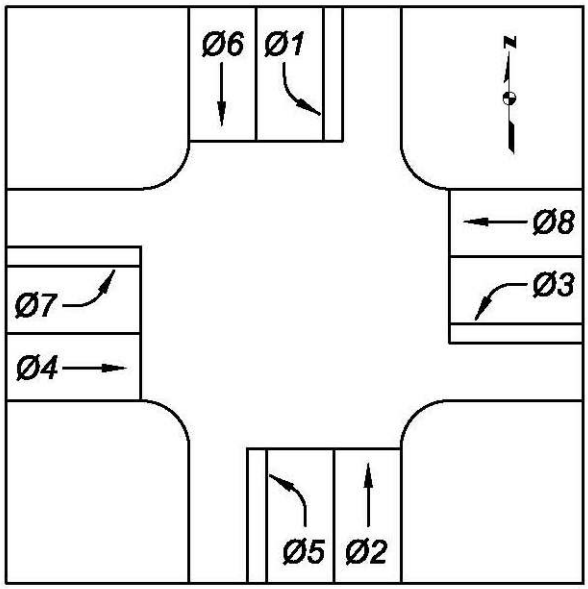
4. Approval

Only traffic signal warrant and signal coordination studies approved in writing by the City Traffic Engineer shall justify the legal installation of a traffic signal. Satisfaction of a signal warrant alone does not necessarily justify installation of a traffic signal, as noted in the MUTCD, and is still subject to the review and approval of the City Traffic Engineer. Such approvals may include requirements such as responsibility for installation of associated interconnect conduit and cables. Conduit and pull boxes may be installed for future traffic signals. Above ground equipment shall not be installed and the signal shall not be turned on until the intersection is meeting signal warrants and the City Traffic Engineer approves the installation of the traffic signal.

4.2.3 SIGNAL PHASING & TIMING

Only approved phasing, standardized by direction and as approved by the City Traffic Engineer, shall be utilized. Existing signals being modified shall be converted to standard phasing directions as part of the overall modifications, if not already in compliance.

FIGURE 4.2.1 – Traffic Signal Phasing



A. Left Turn Arrows

1. All left turn arrow phases shall be “lagging” left and shall be justified by analysis and justification comparing the volumes of left turning traffic with the volumes of oncoming traffic via the MCDOT Cross Product methodology (MCOT PGP 3-3.5-0). When approved by the City Traffic Engineer, “leading” left turns may be used in conjunction with “lagging” left turns to improve traffic flow.
2. Phasing shall be designed to be safe and to avoid trapping left turn vehicles who may believe it is safe to turn on a yellow display, when oncoming through-traffic still has a green indication (the “trap” condition).

B. Right Turn Arrows

1. Right turn arrows may be considered whenever an exclusive right turn lane exists on an approach and left turn arrows are used on the adjacent street.
2. Locations where the right turn arrow is implemented shall provide NO U-TURN signs for the movement that would be in conflict with the right turn arrow.

C. Other Phasing Cases

It is recognized that a variety of other cases may manifest themselves in the way of arrow combinations, phasing, and preemption needs. Any and all phasing sequences shall be supported by analysis, shown on the plans, reviewed and approved by the City Traffic Engineer prior to construction and implementation.

D. Signal Timing

Traffic signal timing development for actual use in the field, installation, and maintenance shall be the responsibility of the Design Engineer, subject to review and approval by the City Traffic Engineer.

4.2.4 SIGNAL PREEMPTION

A. Emergency Vehicle Preemption

1. All new traffic signals, and all existing traffic signals being modified, shall be designed to provide emergency vehicle signal preemption.
2. Preemption shall be through the use of optical devices, such as a strobe light on the approved emergency vehicle, light sensitive sensor at the traffic signal (typically mounted on the mast arm or other location offering adequate visibility), and interface card(s) in the controller cabinet.

3. In cases of vertical and horizontal curvature, preemption sensors may need to be mounted on additional poles located upstream from the traffic signal. The desirable unobstructed preemption visibility distance shall be 1,800 feet, unless dealing with a development driveway with limited length.

4. Preemption cables shall run un-spliced from the sensor on the signal support structure to the controller cabinet terminals.

B. Railroad Preemption

1. All traffic signals located within 500 feet of any at-grade rail crossing shall be considered for railroad preemption. The Design Engineer shall coordinate with and make all arrangements with the railroad, including specifics on how and where any interfaces shall occur, and whether the circuit is “normally open” or “normally closed”. Any relays required in the signal controller cabinet to support proper preemption operation shall be identified by the Design Engineer and shown in the project plans as provided and included as part of the project.

2. Typical preference shall be for a preemption operation capable of being provided by the City’s standard traffic signal controller without the use of special equipment or external “black box” logic, and should provide for continued limited signal operation for directions and movement combinations that are not in conflict with the rail crossing during the preemption event. The preemption sequences shall be shown on the plans.

3. Internally illuminated NO RIGHT TURN signs may be utilized if field conditions warrant extra emphasis, in conformance with the provisions of the MUTCD.

4. All traffic signal plans with railroad preemption shall contain a note indicating the railroad agency contact person and telephone number, as well as any specific coordination elements and permits necessary for the Contractor, on the plan sheets.

C. Transit Priority

The City does not provide transit priority features at traffic signals. Any proposals for transit priority shall be submitted to and approved by the City Traffic Engineer.

4.2.5 PLANS

A. Drafting

1. All Traffic Signal Plans shall be developed in AutoCAD (.dwg) or Microstation (.dgn) format.

2. The Design Engineer shall submit plans electronically to the Engineering Department, Plan Review Division through the City's Electronic Plan Review System. All plans shall be submitted at a 100% level of completion. A submittal package shall consist of a complete set of Plans, Specifications, Signal Warrant Study, left turn arrow analysis, voltage calculations (if requested by the City), conduit capacity calculations (if requested by the City), and Engineer's Estimate (if requested by the City).
3. Final approved plans shall be sealed and signed by a Registered Professional Engineer (Civil or Electrical) of the State of Arizona.
4. At the end of the design project, CADD files shall be submitted to the City's Engineering Department on CD ROM, with each plan sheet as a stand-alone file with no reference files, electronic Engineer's seal, or attachments. Specifications shall be provided in Microsoft Word format, current version. Engineer's Estimates shall be provided in either Microsoft Word or Excel formats.

B. Sample Plans

1. Sample plans of recent City-approved traffic signals may be requested from the Engineering Department as a guide, but the Design Engineer must recognize the possibility that recent design criteria or site required revisions may be necessary.
2. A typical stand-alone traffic signal plan set shall consist of the following sheets with typical content:

a. Cover Sheet:

(1). Project Title

(2). Location

(3). Project Number

(4). Design Engineer's name and PE seal, Firm name, address, telephone number

(5). City logo (for City CIPs only)

(6). Vicinity map showing project location(s) relative to entire City

(7). Approval Signature lines for the City Traffic Engineer

(8). List of utility companies and contacts within project limits

(9). Bench mark.

b. Notes Sheet (or Plan View Sheet):

(1). Obtain latest notes from the City and add notes specific for project under design.

c. Plan View Sheet:

(1). A separate sheet detailing signing and striping modifications may be necessary if extent of such work causes undue clutter on the Signal Plan View Sheet. If separate Signing and Striping Plans are created, they may be in 1inch = 40 feet scale.

(2). Scale shall be 1inch = 20 feet.

(3). Use exploded views or blowups of specific areas, if necessary, to enhance clarity of information.

(4). ADOT Traffic Engineering CADD Standards and ADOT symbology shall be used and symbols shall be identified in a legend.

(5). Use English units.

(6). Use City border and title block (for City CIPs only).

(7). Show “existing” features dashed, and in light pen weight, for:

i. Centerline

ii. Curb & gutter/edge of road

iii. Sidewalk & wheelchair ramps

iv. Utilities – Both overhead and underground, identified by type, such as manhole covers, valves, hydrants

v. Bus stops

vi. Striping & signing, including dimensions of lane widths

vii. Right-of-way lines (Existing & Proposed), including dimensions from face of curb

viii. All Easements (Utility, Drainage, etc.)

ix. Existing traffic signal features (support structures, conduits, pull boxes)

x. Street names

xi. North Arrow, indicating scale of drawing.

(8). Show “new” features solid, in bold pen weight:

i. New centerline (if applicable)

ii. New signing & striping

iii. Lane widths

iv. Support structures & callouts

v. Vehicle signals

vi. Vehicle signal phase designation

vii. Pedestrian signals with phase designation

viii. Luminaires

ix. Cabinets & callouts

x. Electric service cabinets & callouts

xi. Pull boxes

xii. Conduit & callouts

xiii. Detection

d. Schedule Sheet:

(1). Use City standard layout format.

(2). Distinguish between existing and new equipment and conductors by using dash symbology and light pen weight for existing, and solid symbology and bolder pen weight for new equipment and conductors, per ADOT symbology.

(3). Distinguish between existing and new by using “existing” and “new” callouts in the Schedules.

(4). Indicate locations by station and offset for all support structures, cabinets, and poles.

(5). In areas where support structures are placed in areas of future development, indicate elevation of support structure base so structure elevation is compatible with future grades.

(6). Include IMSA cable color code and conductor assignment by phase and circuit type.

(7). Show current City Approved Materials List for Traffic Signals on plans.

e. Detail Sheets:

(1). Detail Sheets shall be created and used in plan sets as needed or required by the City.

(2). Scale of drawings shall be sufficient for their purpose.

4.2.6 CONDUCTORS

The following sections provide design level information on conductor requirements:

A. General Information

1. Where indicated that conductors are to be sized for associated loads/uses, load and voltage drop calculations shall be performed by the Design Engineer. The maximum tolerable voltage drop between the controller cabinet and field device shall not exceed 3%.

2. Splicing of electrical conductors for street lighting and commons shall occur only in pull boxes and cabinets. IMSA cables, CCTV cables, video detection cables, loop detector lead-in cables, preemption cables and interconnect cables shall run un-spliced from controller cabinet to device (or loop pull box). Under no circumstances will splicing be allowed within any conduit.

B. IMSA Multi-Conductor Cable

1. IMSA No. 14 AWG solid core copper multi-conductor cable shall be used to provide electrical circuits to all traffic signals, pedestrian signals and pedestrian pushbuttons. IMSA cables may be used to provide linkage to other electrical circuits such as railroad cabinets, beacons, internal to structures, etc.

2. Conductor size and number of conductors per cable shall be appropriate for the intended number of displays, associated electrical loads, plus future left and right turn arrow phases per each support structure. The standard size of conductor shall be No. 14 AWG solid core copper, unless voltage calculations, based on a maximum allowable loss of 3% (3.6 VAC), indicate the need for a larger conductor size.

3. Designers shall minimize the variety of IMSA cable sizes. Typically, a 20 conductor (minimum) cable is sufficient for all structures, unless unique signal arrangements are used.

4. One IMSA cable shall be routed un-spliced from each support structure to the controller cabinet. Thus, if eight support structures are proposed, eight cables, running un-spliced from each support structure to the controller cabinet, are required. Cables between support structures and controller cabinets shall contain an adequate number of conductors to serve existing and future phases, plus at least 3 spare conductors.

TABLE 4.2.1 – Traffic Signal Wiring Plan

Phase/Corner	Upright	Type A Pole	Type A3 Pole	Add On/Leading	Ped Post
1	Red/Black Orange/Black Green/Black	Red/Black Orange/Black Green/Black	Red/Black Orange/Black Green/Black	Black/Red Orange/Red Blue/Red	
2	Red Orange Green	Red Orange Green	Red Orange Green	Red/White Black/White Green/White	
3	Red/Black Orange/Black Green Black	Red/Black Orange/Black Green Black	Red/Black Orange/Black Green Black	Black/Red Orange/Red Blue/Red	
4	Red Orange Green	Red Orange Green	Red Orange Green	Red/White Black/White Green/White	
5	Red/Black Orange/Black Green Black	Red/Black Orange/Black Green Black	Red/Black Orange/Black Green Black	Black/Red Orange/Red Blue/Red	
6	Red Orange Green	Red Orange Green	Red Orange Green	Red/White Black/White Green/White	
7	Red/Black Orange/Black Green Black	Red/Black Orange/Black Green Black	Red/Black Orange/Black Green Black	Black/Red Orange/Red Blue/Red	
8	Red Orange Green	Red Orange Green	Red Orange Green	Red/White Black/White Green/White	
2 Ped	Black Blue	Black Blue	Black Blue	Red/Green Blue/black	
4Ped	Black Blue	Black Blue	Black Blue	Red/Green Blue/black	
6Ped	Black Blue	Black Blue	Black Blue	Red/Green Blue/black	
8 Ped	Black Blue	Black Blue	Black Blue	Red/Green Blue/black	
Ped Button DC+ Ped Button Comm	White/Black White	White/Black White	White/Black White		White/Red White
Northeast Southeast Southwest Northwest	Red Tape White Tape Blue Tape Green Tape	Douible Red Tape Double White Tape Double Blue Tape Double Green Tape	Triple Red Tape Triple White Tape Triple Blue Tape Triple Green Tape		4x Red Tape 4x White Tape 4x Blue Tape 4x Green Tape

C. Street Lighting

1. Street lighting shall be provided on all traffic signal structures.
2. Street lighting on traffic signal structures shall conform to the City's current Approved Products List. Lighting shall be controlled by a photocell and lighting contactor mounted in the meter pedestal. Meter pedestals shall provide an AUTO/OFF/ON toggle switch for controlling and testing lighting circuits.
3. All street lighting conductors shall consist of two individual conductors (No. 10 AWG Minimum Size) with XHHW insulation, black in color and of adequate size to accommodate at least four luminaries (existing plus future) at each intersection. Provide one circuit with two breakers in the meter pedestal cabinet.
4. Watertight fuses shall be utilized in the pull box adjacent to street lights.

D. Signal Common

1. One signal common of adequate size (No. 6 AWG minimum size), to accommodate the electrical load of the installed signals plus all future signals, shall run from the controller cabinet, around the intersection to each corner pull box. This conductor shall be stranded, with white insulation.
2. A smaller gauge, individual THW conductor, shall be connected to the larger gauge common in the corner pole box and routed to the support structure to serve the vehicle and pedestrian signal heads.

E. Pedestrian Pushbutton Common

The pedestrian pushbutton common shall be contained within the IMSA cables to each structure.

F. Detector Cables

1. Video detection power and image cabling shall conform to the manufacturer's specifications. Consult the City's current Approved Products List for acceptable brands.
2. Design Engineers shall acknowledge that specific manufacturers will NOT support warranties for video detection if "approved equal" brands of cable have been used or specified. Use ONLY the brands and models specified by the specific manufacturer.
3. Video cables shall run un-spliced from the device to the controller cabinet.

G. Interconnect

1. All traffic signals, including existing signals being modified, shall have interconnected facilities added/included as a part of the design. Interconnect cable shall be 96-fiber loose tube SMFO cable in trunk runs between intersections. Runs between splice vaults and the controller cabinet shall be 12-fiber loose tube SMFO cable. See the City's Approved Material List for information on the current Fiber Optic Cable.
2. Plans shall detail all appropriate fusion splicing and enclosures, and identify size and locations of splice enclosures and end treatments.
3. In the controller cabinets, the Design Engineer shall arrange for appropriate connections resulting in an operating system for interconnect to the traffic signal controller and any applicable CCTV or other Information Transmission System (ITS) devices. The Design Engineer shall consult with the City Traffic Engineer to identify specific fibers to connect in trunk lines to avoid conflicts of fiber assignment.

H. Emergency Vehicle Preemption Cable

1. Emergency vehicle preemption cables shall conform to the current City Approved Products List. No "approved equal" has been established for this item.
2. Emergency vehicle preemption cable shall run un-spliced from the controller cabinet to the sensor.
3. Any proposed signal modifications that disturb any conduits containing emergency vehicle preemption cables will require installation of new cable from the cabinet, back to the affected preemption sensors to accomplish the above requirement.
4. Absolutely no splices are allowed in preemption cables.
5. In the controller cabinet, the Design Engineer shall arrange for appropriate terminal strips, interface cards, and connectors, and identify same on the project plans.

I. Grounding

A No. 8 AWG solid copper conductor, with green insulation, shall be used in all PVC conduits containing electrical voltage circuits. Generally, the ground bond wires are connected to the ground rod in the cabinet to form a continuous grounded system.

4.2.7 CONDUITS

A. Material

1. PVC conduits, of adequate size, shall be used for all underground installations. Conduits above ground or otherwise exposed to weather or sunlight shall be rigid galvanized conduit to the end of the first conduit section or sweep that is below ground, at which point a rigid-to-PVC adapter shall be used.
2. The use of HDPE material is allowed for conduits bored under paved areas, if it conforms to the UL listing and schedule 40 thickness requirements, and is terminated with bell ends.

B. Installation Method

1. Conduits under existing streets and paved or concrete areas shall be bored unless boring is met with refusal due to rocky conditions in which case trenching would be permitted.
2. Trenching shall be allowed only in unpaved areas, unless otherwise pre-approved in writing by the City Traffic Engineer. Trench warning tape conforming to ADOT specifications and placement shall be utilized when conduit is installed in open trench.
3. Mule tape with tracer wire shall be installed in all empty conduit.

C. Size

1. Conduits shall utilize sizes in 1/2-inch increments, and shall be sized such that no more than 40% of the cross-sectional area conduit capacity is utilized. Calculations of conduit capacity for the four most occupied conduits shall be provided to the City.
2. Street crossing conduits shall consist of three separate 3-inch Schedule 80 conduits.

   The three conduits shall be assigned as follows:

   a. One conduit exclusively used for electrical circuits (IMSA cables, lighting, common, bond, etc.).
   b. One conduit exclusively used for non-electrical circuits (video detection cable, fiber optic cable, preemption cable).
   c. One conduit as a spare which shall contain an insulated ground wire.

3. Conduits between the controller cabinet and main pull box in the controller cabinet corner shall typically be 4-inch PVC conduits.

   The four conduits shall be assigned as follows:

   a. Two conduits exclusively used for electrical circuits
   b. Two conduits exclusively used for non-electrical circuits

4. Interconnect shall be routed to a No. 9 pull box which shall be connected to the cabinet foundation with a two-inch conduit, bypassing the traffic signal home run pull box.
5. The controller cabinet shall typically have the abovementioned conduits (unless capacity calculations indicate otherwise), plus a 1-inch vertical PVC sleeve in the foundation for installation of a ground rod, and a separate 2-inch conduit for electrical service conductors. A City template shall be used in configuring the conduit layout inside the controller cabinets.
6. Conduits into support structures shall generally be 3-inch PVC conduits, assuming the above capacity constraints can be met.
7. Conduit for interconnect duct shall typically be two 2-inch conduits over one 3-inch conduit.

4.2.8 CONTROLLERS

A. General Information

1. A traffic signal controller conforming to the current City Approved Material List, with Ethernet port, shall be used, unless directed otherwise by the City Traffic Engineer.
2. Design engineers shall confirm latest configuration data with the City to ensure the controller will be compatible with the new signal system protocols.

4.2.9 CONTROLLER CABINETS

A. Cabinet Requirements

An ADOT Type V controller cabinet shall typically be used unless directed otherwise by the City Traffic Engineer. The typical configuration to be called out on the plans shall include an MMU, BIU, 60-amp surge suppression, detector rack, shelf, LED and goose neck work lights, and all load switches and flasher modules.

B. Video Cabinet Requirements

The Design Engineer shall include, on the project plans, an upgraded rack power supply sufficient to provide the extra power consumed by the video detection system.

C. Location

1. Typically locate the controller cabinet and foundation in a safe location that offers good visibility of the displays for maintenance personnel, is not in a low area where water will collect, does not obscure visibility to drivers observing oncoming traffic, and is protected from collision but is not a safety nuisance to pedestrians or

others. The controller cabinet should typically be located on the same corner as the electrical service source, but not at the expense of pedestrian safety or the other factors listed above, with a minimum distance of 20 feet between the two.

2. If necessary, guard posts may be used to protect the cabinet location.
3. See 4.2.7 (Conduits) regarding conduits and sleeves for the controller cabinet foundation.

4.2.10 DETECTION

A. General Information

1. Video imaging detection shall be used to detect vehicular traffic on all new or modified traffic signals that do not already have video detection. Refer to the current City Approved Products List for video detection manufacturers, and design to conform to manufacturers' specifications.
2. Please note that some manufacturers require very specific items without "equal" substitutions, in order to honor warranties.

4.2.11 CCTV

A. General Information

1. All signalized intersections shall be provided with a dome CCTV camera at a minimum 25-foot height on one corner, with associated video equipment and cables to provide streaming video and camera control to the City's Traffic Management Center via fiber optic interconnect. Designers shall ensure structural adequacy of any support system proposed for a CCTV camera. Refer to the current City Approved Products List.
2. CCTV camera location shall be coordinated with and approved by the City Traffic Engineer, and offer the best visibility for traffic observation.

4.2.12 ELECTRICAL SERVICE

A. Relocation, Reconstruction, or Additional Loads

All electrical services and modifications to existing electrical service resulting from relocation, reconstruction or additional loads being added shall be coordinated with the providing Utility by the Design Engineer.

B. Location

Typically, the controller cabinet and electrical service should reside on the same corner or quadrant of the intersection. Design shall route conduit from service pedestal directly to the controller cabinet.

C. Plans

1. Plans shall contain the name, company, and telephone number of the electrical service utility company contact. Any specific instructions from the utility company regarding service installation shall be clearly shown on the plans, on the Signal Plan View Sheet.
2. Plans shall indicate the service address, as assigned through the City, so Contractor's permit corresponds to the correct service address and does not conflict with other City-assigned addresses for the area.
3. The Design Engineer shall be responsible for verifying the size of conduit to the utility source (pole, transformer base, etc.) and exact process and materials the Contractor will be expected to provide information (e.g. conduit stubbed out of pedestal foundation, conduit sweep at base of service pole, quadrant of pole for conduit attachment, trench only requirements, depth of conduit, inspection procedures, required pull ropes, who is to supply/pull service conductors, etc.) to the utility company. Such process shall be detailed in the Special Provisions and/or plan sheets.

D. Meter Method

1. Typically, a meter pedestal cabinet is used, located as close as allowed by the utility company, 5-foot minimum, within City right-of-way.
2. Meter pedestal, conforming to the current City Approved Products List, shall be called out on plans and shall contain a photocell and contactor to serve the illuminated street name signs/traffic signals (120 VAC) and street light fixtures (240 VAC).

E. Material

1. The meter pedestal shall be 100-amp capacity, 120/240 volt, serving the street name signs/traffic signals (120 VAC) and street light fixtures (240 VAC).
2. A toggle switch with AUTO/OFF/ON positions shall be provided for testing circuits.
3. Breakers shall be labeled with engraved plastic with white letter on a black background as to what they serve. Labels shall be self-adhesive and able to withstand temperatures up to 140 degrees F.
4. If necessary, use guard posts to protect the cabinet location.
5. All meter pedestals shall have an engraved metal address tag secured to the meter pedestal with metal rivets.

4.2.13 PEDESTRIAN FEATURES

A. Traffic Signals

1. All pedestrian features in the vicinity of the traffic signal shall comply with the latest edition of the MUTCD and the ADA Guidelines.
2. All traffic signals shall provide overlapping filled-in man/hand symbol countdown LED pedestrian signals and ADA-compliant pedestrian pushbuttons conforming to the current City Approved Products List, and R10-3b pedestrian button signs. Typically, all corners will be connected with crosswalks unless specifically directed otherwise by the City Traffic Engineer.

B. Pedestrian Crosswalks

1. The design and installation of stand-alone pedestrian crosswalks (unsignalized intersection) with electrical devices to control or warn oncoming traffic of pedestrians are required to be reviewed and approved in accordance with the procedures set forth in these guidelines, including justification by an approved Engineering Study.

4.2.14 PULL BOXES

A. General Requirements

All pull boxes shall be secured with Pentahead stainless steel locks.

B. Size

1. A polymer 20-inch deep Number 7 pull box with 8-inch extension shall be utilized on all corners. Each pull box shall be indicated on the signal plan view to contain a ground rod and connected to the grounding system. All pull box foundations shall conform to the City's Standard Details.
2. A polymer 20-inch deep Number 7 pull box with 8-inch extension shall be used along the fiber optic interconnect route. Typical spacing between number 7 boxes along an interconnect route shall be 800-feet. All pull box foundations shall conform to the City's Standard Details.
3. A reinforced concrete Fiber Optic Splice Vault (ADOT #9 with spring assisted lid) shall be provided at each traffic signal controller corner, with a 2-inch conduit directly to the controller cabinet. The interconnect duct shall then connect to this box and splice enclosures contained within the box. This provision applies even in the event the duct is to be installed in the future, with approximately 5 to 10-feet of the duct system installed in both directions from the box to avoid future disruption of the box when connecting the future duct system. All pull box foundations shall conform to the City's Standard Details.

4. Number 5 and number 3-1/2 pull boxes shall not be used, unless approved by the City Traffic Engineer.

5. All pull boxes and splice boxes shall be polymer, and provided with Pentahead, stainless steel locking bolts and appropriate wording on lids (CITY OF GOODYEAR TRAFFIC SIGNAL, FIBER OPTIC). All pull box foundations shall conform to the City's Standard Details.

C. Location

1. Pull boxes shall not be placed in the roadway.

2. Pull boxes shall not be placed in sidewalk and pedestrian ramps.

3. Pull boxes and conduit placement in existing concrete areas shall require removal and replacement of complete slabs to existing joints. No slot cutting or saw cutting of areas inconsistent with original slab joint design shall be allowed.

4. Where possible, disruption to existing landscaping and facilities shall be minimized in locating pull boxes and conduits. When removal of landscape is necessary, the plans shall contain specific call-outs that note "remove existing landscape"

5. Pull boxes shall not be placed in medians.

D. Modification to Existing Intersections

1. When an existing traffic signal is being modified, pull boxes affected by the modification shall be examined in the field prior to design. Cracked boxes, cracked lids, or boxes being entered for wiring purposes that do not comply with the size provisions shown above, shall be designed to be replaced with appropriately sized boxes.

2. Pull boxes located in existing concrete shall require the complete slab to be removed and replaced. No "slot" saw cutting shall be planned in any design.

3. Any existing pull boxes being replaced shall have the pull box foundations reconstructed to conform to the City's Standards Details.

4.2.15 LIGHTING

A. General Information

1. Street lighting shall be provided at each intersection, as a component of the traffic signal installation, and integral to the signal support structures. Typical lighting design shall provide LED lighting on all traffic signal structures.

2. The Design Engineer shall verify and account for any overhead obstructions, and resolve such obstructions as necessary in order to

obtain appropriate clearance distance or approved alternative lighting arrangements.

3. Existing street lights within 25 feet of a new traffic signal pole with a luminaire shall be removed.

4.2.16 SIGNAL SUPPORT STRUCTURES

A. Support Structures

1. Signal support structures shall include and provide internally illuminated street name signs using LED illumination with high intensity sign sheeting and graffiti sheathing. Signs shall be powered with a separate 120V-AC circuit. Sign text/symbology shall be provided as directed by the City Traffic Engineer.
2. The use of span wire supporters for temporary or permanent signal installations are not allowed unless approved by the City Traffic Engineer.
3. Typically, two structures are located on each corner, to support a mast arm assembly and a free-standing support for pedestrian, near-right and far-left indications. The Design Engineer is responsible for location the support structures in such a manner as they comply with industry standards for roadside structures and are not a hazard to the traveling or pedestrian public. Any portion of the signal structure or attachments shall be closer than 24 inches from the face of any roadside curb.
4. Concrete used in mast arm support bases shall have a minimum compressive strength of 4000 psi as specified in the MAG Standard Specifications (i.e. “MAG AA”).
5. All signal displays and placement shall comply with the current edition of the MUTCD. Traffic signal heads shall conform to the current City Approved Products List and be compatible with the support structure.
6. Designers shall attempt to align the end of the mast arm head with the lane line separating the left turn lane and adjacent through lane as much as possible. Mast arm length and sidewalk width shall be considered in the design. Designs that are intended to be temporary on roadways known to be widened and improved in the future shall incorporate the head and structural support placement policies described herein, otherwise approved for deviation by the City Traffic Engineer on a case-by-case basis. The intent is to minimize future relocation and modifications of support structures and components.
7. ADA access requirements require any structure with a pedestrian pushbutton provide a paved concrete or asphalt sidewalk or walkway to the face of the structure. All structures must account for this

requirement, including those adjusted in response to field conditions during construction.

8. The City utilizes two types of traffic signal structures based on geographic location within the City.

   a. The City requires decorative support structures in the locations illustrated in the Standard Details, and allows the decorative support structures elsewhere. These standards are based on the City of Tempe specifications as found on pages 18 through 25 and details as found in T-540 to T-577 in the "City of Tempe, Arizona, Modular Traffic Signal Specifications" Approved equipment and manufacturers have been listed in the City's Approved Material list as found on the City's website.

      (1). Support structures designed for an interim condition shall be located on their ultimate locations, whenever possible, to minimize relocations and modification upon future improvements. The Design Engineer shall verify a 17-foot minimum clearance for the present and future conditions.

      (2). The Design Engineer shall provide structure section and wiring design that allow for future turn signal head configurations. All "far right side" structures (usually structures with mast arms) shall provide paneling and structural members to allow expansion to a 5-section vertical head, providing for existing or future right turn arrows. Structure design shall be such that in order to change from a 3-section to 5-section head, replacement of the front panel and internal head support nipples is all that is required. No horizontal support members shall require modification or replacement to accomplish this change.

      (3). All traffic signal structure panels shall be interchangeable and installed without modification regardless of manufacturer.

      (4). One "far-right" hand side signal face shall be provided between the vertical legs of the support structure, above the pedestrian signal. This head may be either a 5 or 3-section head, depending on initial phasing, but able to ultimately accommodate a 5-section head without modification to the support structure's horizontal internal supports.

      (5). One "far-left" hand signal face shall be provided between the vertical legs of the support structure, above the pedestrian signal. This head may be either a 5 or 3-section head, depending on initial phasing, but able to ultimately accommodate a 5-section head without modification to the support structure's horizontal internal supports.

      (6). All luminaire arms shall be 69 inches in length.

(7). All mast arm traffic signal structures shall include an internally illuminated street name sign.

(8). The color of all signal structure components shall be Tempe Bronze.

b. The City allows ADOT traffic signal poles in the locations illustrated in Standard Details. These standards are based on the ADOT Traffic Signals and Lighting Standard Drawings (Current Edition).

(1). Support structures designed for an interim condition shall be located in their ultimate location, whenever possible, to minimize relocations and modification upon future improvements. The Design Engineer shall verify a 21-foot minimum clearance for the present and future conditions.

(2). All traffic signal poles with a traffic signal mast arm shall include a 96.75-inch x 30-inch x 12-inch internally illuminated street name sign.

(3). When a 5-section head is required, Q heads shall be used at all time. Q-2 heads are not allowed.

(4). Louvered aluminum backplates, black in color, shall be used on all signal heads.

(5). The color of all signal pole components (poles, signal mast arms, luminaire mast arms and the internally illuminated street name sign) shall be powered coated Tempe Bronze. A color sample and coating certification shall be approved by the City Traffic Engineer prior to ordering.

4.2.17 DOME CAMERAS

A dome camera with pan/tilt/zoom capabilities, and all controller devices, communications interface, and modem shall be provided at every signalized intersection. The Design Engineer shall accommodate and specify camera placement, cabling, and associated equipment, conforming to the City's current Approved Products List.

4.2.18 INTERCONNECT

A. General Information

1. A polymer 20-inch deep Number 7 pull box with 8-inch extension shall be placed at approximately 800-foot intervals. Lids shall be marked CITY OF GOODYEAR FIBER OPTIC. All pull box foundations shall conform to the City's Standard Details.

2. A reinforced concrete Fiber Optic Splice Vault (ADOT #9 with spring assisted lid) shall be provided at each existing traffic signal location and proposed traffic signal locations and at all one mile

arterial streets. All pull box foundations shall conform to the City's Standard Details.

3. The Design Engineer shall identify the intended means and equipment necessary for interconnection of the proposed traffic signal or any existing traffic signal being modified. The proposed plans shall indicate the means, route, splicing details and transceiver description of any interconnect, as approved by the City Traffic Engineer.

4.2.19 REMOVAL AND SALVAGE

A. General Information

1. Any existing traffic signal poles, arms, equipment, and cabinets that are to be removed shall be salvaged and transported to the location identified by the City Traffic Engineer.
2. Existing wiring, trash, debris, excess spoil, concrete boxes, and wood that will not be reused shall be removed and disposed of at the Contractor's expense.
3. Existing foundations that will not be reused shall be removed completely and backfilled using a flowable material as specified by MAG standards.

4.2.20 SIGNING & STRIPING

A. General Information

1. Typically, each approach to a new traffic signal shall have a new stop line and new crosswalk. Plan notes shall indicate that the striping shall not be installed until immediately prior to signal activation, so as not to mislead the public into believing the new signals are malfunctioning.
2. All new signals shall include provisions for a TRAFFIC CONTROL CHANGE sign with flags, on each approach for 30 days.
3. Locations where a right turn arrow is used shall have mast arm mounted NO U-TURN signs for the associated left turn movements.

4.2.21 EQUIPMENT SUBMITTALS

A. General Information

1. All new and modified traffic signals shall bear a note on the plans indicating that the Contractor is to provide four sets of equipment submittals to the City Traffic Engineer for review and approval prior to ordering or installing any equipment. Level of detail and procedure of what the materials should be is the same as the ADOT process, except only four sets of submittals shall be required.

2. Anywhere these criteria or the City's current Approved Products List specifies a specific brand and model, that brand and model must be provided without exception.

4.2.22 AS-BUILT PLANS

See the As-Built Chapter of the EDS&PM.

4.2.23 PERMITS

All Permits and acquisition of Standards referred to herein shall be solely the responsibility of the Contractor and the Design Engineer, as appropriate. All Permits shall be obtained and paid for by the Contractor.

4.2.24 CONSTRUCTION

A. General Information

1. Inspections of material, equipment, and workmanship will take place during the entire duration of the construction process. Prior to commencement of construction activities, the Contractor shall:

   a. Schedule a preconstruction meeting with the City Traffic Engineering Inspector.

   b. Supply a three-week schedule of work to the City Traffic Signal Foreman at the preconstruction meeting. The schedule of work shall be updated weekly.

2. The Contractor shall perform a ring-out test of the intersection in the presence of the City Traffic Signal Inspector and make all terminations in the controller cabinet.

3. The Contractor shall correctly phase tape the field wiring, perform a ground resistance test by a certified independent testing agency, and make all necessary adjustments to meet operational requirements.

4. The Contractor shall be responsible for securing a Police Officer and marked patrol vehicle while working within the roadway of any signalized intersection, and/or at all other times as directed by the City Engineering Inspector.

4.3 TRANSIT

4.3.1 INTRODUCTION

A. Purpose

This section provides specifications for locating bus stops and transit amenities such as bus benches and transit shelters. It includes street geometrics for bus bays, standard signage, review, and submittal requirements.

B. Applicability

1. The information presented in this document is intended for use by all those involved in the development and improvement of the City.
2. These guidelines are generalizations, applicable to most situations. They are not intended as detailed engineering solutions; each site will have its own unique set of needs. However, the City review process will expect compliance to these standards as is reasonable and prudent.
3. Developers are responsible for obtaining all City approvals and permits necessary to complete the transit improvements.

C. Goals

1. The goal of these guidelines is to provide a clean, safe, comfortable and convenient environment for users of Goodyear's transit system, and to provide developers a framework in which transit amenities are located and designed for new projects.
2. All transit improvements will be designed to meet the regulations set forth by the ADA.

4.3.2 CRITERIA FOR BUS STOPS

A. Location

1. The standard location for bus stops in the City is at the half-mile and one-mile intervals, at any location where an arterial street intersects another arterial street, and at other locations along arterial streets as identified by the City Engineering Department.
2. Bus stops shall generally be located as close to intersections as possible, and should be constructed on the far side of an intersection.
3. Near-side bus stops (those stops located immediately before an intersection) will be considered when placement of a far-side stop is not feasible or when that stop will be located near buildings with high volumes of transit riders. These types of stops may also be located where a high-volume bus transfer location would otherwise require a pedestrian crossing at a busy street.
4. On occasion, a mid-block bus stop may be utilized to provide access to a major generator, but it is generally discouraged due to the likelihood that pedestrians would cross streets mid-block rather than at an intersection

B. Design and Construction

1. See the City Standard Details for detailed information regarding the location and configuration of bus bays.

2. Where a development or subdivision is walled off from the street, it is recommended that steps be taken to allow easy pedestrian access. This could include a pedestrian access path linking various sections of the development to the bus stop or a system of offset walls around developments which allows pedestrian passage.
3. All transit stop furniture must be placed outside the standard 5-foot sidewalk. A minimum 7-foot clearance is required between transit components and fire hydrants, switch boxes, mail boxes, etc.
4. Unless circumstances require otherwise, a minimum 10 feet of curb shall extend tangent from the curb return prior to beginning the entry taper for a bus bay facility.

C. Accessibility

All transit facilities shall comply with the applicable provisions of the ADA. In general, a 36-inch clearance is to be maintained between bus stop components to allow for maneuvering by wheelchairs. A minimum clear length of 96 inches (measured from the curb or roadway edge) and a minimum clear width of 60 inches (measured parallel to the roadway) shall be provided at transit locations where a lift or ramp is to be deployed.

4.3.3 TRANSIT AMENITIES

Passenger waiting areas shall be comfortable and provide a sense of security. The waiting areas may include a varying range of improvements depending upon ridership and specific needs. Below are typical transit amenities and conditions under which they should be employed:

A. Benches

Benches shall be located at bus stops where the concentration of waiting passengers is not sufficient to warrant provision of a bus shelter.

B. Shelters

Shelters shall be located at bus stops where there will be a concentration of waiting passengers at exposed locations. Shelters are appropriate along arterial and major collector streets, or adjacent to high-activity centers. In a development, any requirement for bus shelters may be waived if adequate exterior shading and architectural shelter is provided by the Developer.

C. Landscaping

1. Shade trees and other protective landscaping should be provided wherever possible. This landscaping could be considered part of the development’s frontage landscape and could count towards any

landscaping requirements which may apply. Considerations for selection and location of landscaping include:

a. Trees should be mature and have an adequate canopy to shade the seating area.

b. Low-water consumption trees and shrubs should be used.

c. Tree location should consider the solar orientation of the transit stop. Priority should be given to providing shading from afternoon summer sun.

d. Transit landscaping should be compatible with other frontage landscaping.

2. All landscaping shall be carefully located so as not to obstruct the visibility of either the transit user or the bus operator. The Developer, property owner, HOA or POA shall be responsible for the maintenance of landscaping at bus stops.

3. See the Landscaping Chapter of this manual for a list of approved trees and vegetation.

4.3.4 BUS STOP MAINTENANCE

A. General Information

1. Repair of items that pose a safety problem shall be performed within 24 hours; repairs that do not pose safety problems shall be completed within 3 days.

2. Regular maintenance shall include but is not limited to:

a. Full wash-down of shelter and accessories

b. Removal of all dirt, graffiti, and pasted material

c. Litter pick up around stop or shelter/accessories to a distance of 10 feet

d. Manual or chemical removal of weeds

e. Pruning of obstructing tree growth

f. Touch up of paint scratches

4.3.5 SUBMITTAL REQUIREMENTS AND REVIEW PROCEDURES

A. Approval

1. The design and location of bus stops or other transit facilities shall be approved by the City during the development approval process.

2. When approved by the City Engineering Department, developers may deposit funds in lieu of construction and installation of stipulated transit amenities. The amount of funds to be deposited

shall be determined during the project review process and shall be paid to the City prior to issuance of any permits.

4.4 BIKEWAYS

4.4.1 INTRODUCTION

A. Preface

These Engineering Standards as presented in this section are derived primarily from the "Arizona Bicycle Facilities Planning and Design Guidelines" as prepared by the Facilities Planning Committee, Arizona Bicycle Task Force, November 1, 1988. Additional references include the Guide for the Development of Bicycle Facilities (AASHTO, 1999) and the MUTCD.

B. Purpose

This section has been prepared for both private and public development and improvement projects within the City. The use of this section will establish uniform bicycle facilities in the City and throughout the region, and will be in conformance with Federal and State Highway Administration Guidelines.

C. Definitions

1. Bikeway: Any road, path, or way which in some manner is specifically designated as being open to bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes.
2. Bicycle Lane: A portion of the roadway which has been designated by striping, signing and pavement markings for the preferential or exclusive use of bicyclists.
3. Bicycle Route: Shared facilities to provide continuity to other bicycle facilities (usually bike lanes) or to designate preferred routes through high demand corridors. Routes may be signed but not striped.
4. Bicycle Path: Physically separated from motor vehicle traffic by an open space or barrier, and within either the highway right-of-way or an independent right-of-way.

4.4.2 LOCATION CRITERIA

A. Accessibility

1. Bicycle facilities should be located along a route where they can be maintained.

2. Consideration shall be given to the frequency of access points.
3. Where reasonable and prudent, bikeways shall serve activity centers along a direct course.
4. Where bikeways cross freeways, canals, railroad tracks, etc., proper crossing facilities shall be provided.
5. Routes should be developed that minimize delays for the cyclist.
6. Where possible, stop signs shall be oriented to restrict cross traffic rather than the bike traffic.

B. Safety

1. Bike paths and pedestrian paths should be separate, per Arizona Bicycle Facilities Planning and Design Guidelines and City Standard Details.
2. Two-way paths immediately adjacent to a roadway should be discouraged.
3. Sidewalks may be used as bike paths only under conditions approved by the City Engineering Department.
4. Bicycle lanes shall be one-way and in the same direction as vehicular traffic.

C. Security

Bicycle parking devices that provide for protection from theft and damage should be placed at common trip destinations, i.e. work, library, mall, etc. See the City Zoning Ordinance and Section 4.4.6 below for further information regarding bicycle parking.

D. Riding Environment

1. Steep grades greater than 6% uphill should be avoided.

4.4.3 SELECTION CRITERIA

A. Bicycle Paths

1. Paths should be used to serve corridors not served by streets and highways.
2. Paths should offer opportunities (shorter routes) not provided by the road system.
3. Paths should be considered where they can provide a recreational opportunity or a high speed commuter route.

B. Bicycle Lanes

1. Bicycle lanes shall be designed for preferential or exclusive use of bicyclists.
2. Bicycle lanes should be established along streets with significant bicycle demand.
3. Special effort should be made to ensure that appropriate levels of service are maintained including sweeping, lane markings, and lighting where required.

C. Bicycle Routes

1. Routes are shared facilities and should be developed to provide continuity with other bicycle facilities or as designated preferred routes through high demand corridors.
2. Routes are usually signed but do not require striping.

D. Wide Curb Lanes

1. These are placed along streets in corridors where there is significant bicycle demand on major arterial streets, and are unmarked and unsigned.
2. Wide curb lanes are appropriate where traffic speeds and volumes are tolerable for shared roadway facilities.

4.4.4 DESIGN CRITERIA

A. Roadway Improvements

1. On new roadways, curb inlets should be used and drainage grates and covers should be kept out of cyclists' path.
2. Railroad highway grade crossings should ideally be at a right angle to the bicycle facility. Consideration shall be given to the materials on the crossing surface and to the flangeway depth and width.
3. Pavements should be free of holes, cracks, bumps, and other surface irregularities. Where possible, joints shall be filled, pavement edges shall be uniform and void of drop-offs, and edges shall be level with pavement.

B. Bicycle Routes

Routes should be marked as connectors to other bike facilities and as touring routes. It is desirable to furnish sign information for directional changes and for distance marking for long routes.

C. Bicycle Paths

1. Bicycle paths are facilities on exclusive rights-of-way and with minimal cross flow by motor vehicles.

2. A minimum right-of-way width of 10 feet may be required where essential for circulation or access to schools, playgrounds, shopping centers, transportation, and other community facilities.
3. The desirable minimum paved width for a bike path is 8 feet. A 2-foot minimum graded area shall be maintained on each side of the path.
4. In general, the minimum design speed for a paved bicycle path is 20 mph; however, this speed should be substantially less in areas of multiple use, high traffic volume, and unpaved surfaces.
5. Where possible, grades shall be 6% or less, particularly on long inclines.
6. Sight and stopping distances are important considerations in the design of bicycles paths.
7. Intersections present challenging design considerations, and those with the most favorable conditions shall be used. The ideal intersection design for a bicycle path crossing is grade separation.
8. Signing must be included in the design criteria for both regulatory and informational purposes. General guidelines for markings are provided in the MUTCD.
9. Pavement markings for bicycle paths (and lanes) should follow the same general guidelines as for road markings, with particular attention given to non-slip treatments.
10. Pavement selections for bicycle paths should be selected similarly to highway selections, with particular care to how the edges are constructed. Broom finish or burlap drag concrete surfaces are preferred over trowel finishes.

D. Multi-use Paths

1. Motor vehicle use is limited to maintenance and emergency vehicles only.
2. Fixed lighting is highly desirable on paths that may be used at night, for underpasses, at intersections, and to provide a sense of security.

4.4.5 RIGID PAVEMENTS

A. Introduction

1. Rigid pavements are created by mixing portland cement with crushed rock. Commonly known as concrete, a rigid pavement retains a long life span with a very low maintenance cost. Concrete pavements are used in specialized locations such as bus bays, deceleration lanes, and on-street parking areas.

2. It is not typical to pave a standard City road with a concrete pavement.

B. Purpose

This section provides reference to design standards for producing and paving with concrete. This will include providing mix design requirements, material production requirements, and placement requirements.

C. Standard Design and Construction Manuals

Standards for the design and production of concrete pavements include:

1. MAG Standard Details and Specifications,
2. City of Goodyear Engineering Standards.

4.4.6 ASPHALT PAVEMENTS

A. Introduction

The installation of AC and Rubberized Asphalt Concrete (RAC) on all City streets shall conform to MAG Standard Details and Specifications, City of Goodyear Engineering Standards as applicable to the installation of asphalt pavement through the permit process, unless noted below.

1. Applicable MAG sections include, but are not limited to:

a. Section 321 Asphalt Concrete
b. Section 325 Asphalt-Rubber Asphalt Concrete
c. Section 329 Tack Coat
d. Section 330 Asphalt Binder
e. Section 701 Aggregate
f. Section 702 Base Materials
g. Section 710 Asphalt Concrete Materials
h. Section 717 Asphalt-Rubber Asphalt Concrete Materials

B. General Information

1. Night Work

Night work for paving will not be permitted without written approval from the City Engineer. Certain processes associated with a paving project such as striping may be performed at night where appropriate and where it would not create noise levels that would impact residents.

2. Dust Prevention

   The Contractor shall take whatever steps, procedures, or means necessary to prevent dust caused by his construction operations. The dust control measures shall be maintained at all times during construction of the project, to the satisfaction of the Engineer, in accordance with the requirements of the "Maricopa County Health Department Air Pollution Control Regulations". Prior to the pre-construction conference, the Contractor shall have an approved dust control plan, approved by the MCAQD. For information and requirements for dust control plan submittal please contact:

   Maricopa County Air Quality Department
   1001 North Central Avenue, Suite 400
   Phoenix, Arizona 85004
   (602)-506-6010

3. Clean Up

   It shall be the Contractor's responsibility to immediately clean up any spillage or tracking which may occur. Failure to prevent spillage and keep the job site, haul routes, and adjacent streets clean shall be justification to stop work until adequate procedures and resources are provided to resolve the problem.

C. Exceptions/Modifications from MAG Specifications

1. Aggregate: All aggregate material will be tested using the LA Abrasion test method at least 45 days prior to installation of the asphalt mix for any paving project larger than 500 tons. The test results shall be supplied no later than five (5) days prior to the installation date.
2. Mix Designs: Certain mix designs shall be preapproved by the Engineering Dept. annually. These mix designs shall be posted as approved for use on specific street types. Any mix designs submitted for installation that have not been preapproved shall require submittal at least two weeks prior to the installation date. No changes to the mix design may be made without approval by the city Engineer.
3. Pavement Thickness: Pavement thickness shall be determined by the City of Goodyear Standard Details and installed in lifts as specified in that detail (Detail 3216).
4. Rubberized Asphalt pavement shall be used as the final surface coarse on Arterial and Major Collector Streets that are within a 1/4-mile radius of a residential area as designated on the City’s Land Use Plan

5. Pavement fabric interlayer are not required, unless specifically requested by the City Engineer.

4.5 TRAFFIC SIGNS & MARKINGS

4.5.1 DESIGN SPECIFICATIONS

The following publications or their current revisions along with the design criteria in this section shall apply to the preparation of traffic signs and markings design plans.

A. Publications

1. "Manual on Uniform Traffic Control Devices for Streets and Highways" - U.S. Department of Transportation, Federal Highway Administration, Current Revision.
2. "Signing and Marking" - Standard Drawings, ADOT.
3. "Traffic Control Manual for Highway Construction and Maintenance" - ADOT 1989.
4. "Policies, Guide and Procedure Manual" – ADOT.
5. "Uniform Standard Specifications for Public Works Construction" – MAG.
6. "Uniform Standard Details for Public Works Construction" – MAG.
7. "MCDOT Pavement Marking Manual" - MCDOT
8. "City of Phoenix Barricade Manual"

4.5.2 DESIGN STANDARDS

A. General

Design shall be in accordance with the MUTCD unless modified by the City as noted herein.

B. Striping

1. Unless otherwise noted on the plans, all permanent longitudinal striping (lines, chevrons) shall be 60 mil hot-sprayed thermoplastic, and all lateral striping (crosswalks and stopbars), pavement symbols, arrows, and legends shall be 90 mil hot sprayed thermoplastic.
2. The Developer shall be responsible for maintaining all markings during the warranty period, and may opt to install reflectorized temporary traffic paint for longitudinal markings (unless directed otherwise by the Engineering Department), reapplying as needed at 0.015" (15 mil) minimum thickness. At the end of the warranty

period, all temporary traffic paint shall be restriped with thermoplastic at the required thickness.

3. City striping and marking standards are to be shown per MUTCD, MCDOT Pavement Marking Manual, and City Standard Details for street cross sections.

4. Retro-Reflective Pavement Marker Requirements

a. Blue retro-reflective pavement markers shall be used as a method of identifying fire hydrant locations. Retro-reflective pavement markers shall be per the City Approved Materials List.

b. Blue marker installations shall conform to the following required marker installation locations:

(1). Two-Way Streets or Roads and Private Drives in apartments, condos, etc.: Markers should be placed 6 inches from edge of painted centerline on the side nearest the fire hydrant. If the street has no centerline, the marker should be placed 6 inches from the approximate center of the roadway on the side nearest the hydrant.

(2). Streets with Left Turn Lanes at Intersections: Markers should be placed 6 inches from edge of the painted white line (designating the left turn lane) on the side nearest the hydrant.

(3). Streets with Continuous Two-Way Left Turn Lanes: Markers should be placed 6 inches from the edge of the painted yellow barrier line on the side nearest the fire hydrant.

(4). Street with Raised Medians: Markers should be placed 6 inches from lip of gutter on the side nearest the fire hydrant, and on the top of median curb on the side opposite the fire hydrant.

(5). Freeways and Expressways: Because of higher maintenance at these locations if placed on the roadway, markers should be placed on the shoulder 1 foot to the right of the painted edge line opposite the right-of-way fire hydrant location.

4.5.3 STANDARD PLAN LAYOUT

A. General

1. Signing and pavement marking design shall be shown in the same plan view.

2. Plan sheets are to be complete and to scale 1 inch = 40 feet.

3. Entire length of project is to be shown in plan view. “Typical Sections” representative of striping and/or signing will not be accepted.

4. A street name detail sheet at 1 inch = 100 feet is required for all projects that require street plans and is to include an indexed and referenced Street Sign Schedule.
5. Signing and Pavement Marking Plans shall include all existing signing and pavement markings for a minimum of 1,250 feet past the limits of construction and shall include all transitions and tapers.
6. Right-of-way lines shall be shown and appropriately dimensioned.
7. Control points shall be stationed and clearly identified.

B. Standard Plan Sheet Notes

1. These notes, along with any additional project-specific notes, shall be placed on the lead Signing and Pavement Marking Plan sheet.
2. All pavement markings, signing, and construction shall conform to ADOT Standard Drawings and Specifications unless otherwise specified in the MUTCD.
3. Traffic control shall conform to the City of Phoenix "Traffic Barricade Manual", and/or as approved by the City Engineer.

C. Signing

1. All signs shall be graphically depicted in the direction of travel.
2. All signs shall be stationed and referenced to the appropriate MUTCD sign designation with size noted.
3. Existing signs will be identified to remain, be removed, or be relocated consistent with Note 2 above.
4. Designer shall field-verify all existing advance or approach signing applicable to the project. Reference signs on Plan sheet, including location or station, and note status of sign.

D. Striping

1. Existing striping shall be fully shown (as screened lines or lightly inked pen lines), identified by type and width, and completely dimensioned across roadway.
2. Raised pavement markers shall be graphically shown in plan view and referenced by construction notation.
3. All new striping shall be clearly identified, noting color and line width.
4. All striping shall be fully dimensioned across roadway and tied to a construction centerline or monument line at each side of an intersection.

5. All pavement arrows, legends, crosswalks, etc. shall be located by station or dimension lines.

6. Raised pavement markers shall be installed per City Standard Details and ADOT Standard Drawing, No. M-19, with a City-approved bituminous adhesive.

7. All existing pavement markings which conflict with proposed markings shall be removed by waterblasting or other City-approved method prior to the installation of new pavement markings. Removal shall be to the satisfaction of the City Engineering Department representatives. When excessive damage to the asphalt is caused by the Contractor, the Contractor shall be responsible to correct the damaged area to the satisfaction of the City Engineer, at the Contractor's expense.

4.5.4 STRIPING INSTALLATION STANDARDS

A. General

1. Unless otherwise noted on the plans, all permanent longitudinal striping (lines, chevrons) shall be 60 mil hot-sprayed thermoplastic, and all lateral striping (crosswalks and stopbars), pavement symbols, arrows, and legends shall be 90 mil hot sprayed thermoplastic.

2. City striping and marking standards shall comply with the requirements for MUTCD, MCDOT Pavement Marking Manual, and City Standard Details for street cross sections.

3. The Developer shall be responsible for maintaining all markings during the warranty period, and may opt to install reflectorized temporary traffic paint for longitudinal markings (unless directed otherwise by the Engineering Department), reapplying as needed at 0.015" (15 mil) minimum thickness. At the end of the warranty period, all temporary traffic paint shall be restriped with thermoplastic at the required thickness