

**City of Mesa**

**Signing & Pavement Markings  
Design Procedures Manual**

**Revision January 2014**



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## 1. INTRODUCTION

This manual contains general requirements and design procedures for signing and pavement marking plans that are subject to submittal to the City of Mesa.

The intent of this manual is to establish standard procedures that will be used by traffic engineering consultants when designing signing and pavement markings for City of Mesa projects.

The information contained in this manual at the time of original publication was consistent with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), U.S. Department of Transportation, Federal Highway Administration, as supplemented by the Arizona Department of Transportation.

Users of this manual are encouraged to submit changes and suggestions for review. Comments should be referenced to the specific section or detail. Reasons and comments should be provided along with how to contact the originator of the comments. All comments will be reviewed and, if appropriate, incorporated into the manual when updated.

Should questions arise in the use of the information shown in this manual, they should be referred to the City of Mesa Transportation Department.



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1-23-14

Date

## 2. PROJECT STARTUP

### A. Project Information

The traffic engineering member of the project design team should obtain or develop a description of the project showing all proposed improvements and the project limits. The traffic designer should become familiar with all aspects of the project.

### B. Identification of Applicable Design Items

The traffic designer shall identify all design items that apply to signing and pavement markings. Examples are listed below.

1. Current design standards that will control the design shall be identified. A list of current design standards is included in Appendix A.
2. Verify which pavement marking materials are to be used. Generally, the following criteria will be utilized (as outlined in the signing and pavement markings general notes): Lane lines, edge lines, bike lane lines, centerlines, and painted medians shall be City approved paint; crosswalk lines and stop bars shall be 90 mil thick extruded alkyd thermoplastic marking material in accordance with ADOT Standard Specification Section 704 - Thermoplastic Pavement Markings; and, all symbols and word markings shall be Type I material in accordance with ADOT Standard Specification Section 705 - Preformed Plastic Pavement Marking.
3. Raised pavement markers will be used only when directed to do so by City of Mesa Transportation Department. When they are used, they will delineate lane lines, centerlines, two-way left turn lanes, island noses, and fire hydrant locations, unless otherwise directed by the Transportation Department.
4. Traffic signs shall be installed using the following criteria:
  - Signs to be installed per Mesa Standard Details M-20 through M-25, M-47.01, and M-47.02.
  - All sign posts shall be square tube perforated sign posts per Mesa Standard Detail M-39 meeting the requirements of Section 607-2.03 of the ADOT Standard Specifications.
  - Street light poles shall be used for sign mounting when possible.
5. Pavement markings to be installed per Mesa Standard Details M-46 through M-47.
6. The most important element controlling the pavement marking design is the design speed for the section of roadway. The traffic designer shall verify the project's design speed and posted speed limit. Generally, the design speed is equal to the posted speed limit plus 5 mph.
7. Clarify the limits of the project and determine how the new design will match into the existing roadway.

### **C. Coordination with the City of Mesa**

For unique situations and in cases where current design standards cannot be met, the traffic designer shall coordinate with the City of Mesa to determine the desired design policies and procedures.

Examples are:

- Lane configurations at non-standard intersections
- Lane widths at non-standard roadways
- Stop sign placement, especially within large-scale developments
- New signal installations
- Phased projects
- Projects requiring temporary or interim signing and pavement markings

### **D. Coordination with Other Disciplines and Adjacent Projects**

The traffic signer shall coordinate with all other disciplines of the project (civil, lighting, traffic signals, landscaping, etc.) as well as adjacent projects to avoid conflicts and to ensure the integrity of the signing and pavement marking design. The coordination efforts shall be continued throughout the project.

### **3. FIELD REVIEW**

#### **A. Site Visit**

The traffic designer shall visit the project site to inventory and identify physical features that may impact the signing and pavement marking designs. These features will include existing street width; curb/gutter, sidewalk, and pedestrian ramp locations; median configurations and dimensions; existing street lighting; existing electrical and signal cabinets; and vegetation, landscaping features, or structures (e.g. walls, fences, monument signs) that may affect sign, intersection, or driveway visibility.

#### **B. Site Inventory**

The traffic designer shall perform an inventory of existing signing and existing pavement markings. This inventory shall record the following:

- Sign size, sign material, and the general condition of the sign.
- Sign type and legend.
- Posted speed limit(s).
- Specialty signs (bus stops, guide signing, numbered bike routes, hospitals, etc.).
- Sign post type, foundation type, and label number, if available.
- The pavement marking configuration at the location where the new street improvements will meet or match the existing street (e.g. lane widths, median treatment, bike lane, or shoulder treatments).
- Driveway locations and the operation of driveways. For example, are turning movements being restricted at a driveway, is there unique channelization that may have to be modified or reinstalled, and will sight distance at the new driveways be impacted by signing and/or landscaping?
- Side street pavement markings and signing. Will stop signs, street name signs, stop bars, etc., need to be relocated or replaced?

#### **C. Existing Roadway**

While reviewing the existing conditions where a new street improvement project will match into the existing street, the traffic designer will need to determine if additional signing and pavement marking modifications beyond the street improvement project limits will be needed in order to make the transition from existing to new.

#### 4. GEOMETRIC DESIGN

The traffic designer should be an early, active member of the project design team and should provide information and early input to the development of the project as follows:

1. Provide the design team with criteria that will control lateral deflections (lane shifts) in the street and in the pavement markings. Street improvements will be designed using the formulas found in the MUTCD, Section 3B.09 and Figure 3B-14. For streets with a design speed of 40 mph or less, the formula  $L = WS^2 \div 60$  will define lateral deflection requirements. For streets with a design speed of 45 mph or more, the formula  $L = WS$  will define lateral deflection (where L = length in feet, W = offset in feet, and S = design speed).
2. Assist in defining length of roadway tapers. Street improvements should be designed so travel lane tapers meet the criteria as determined using the formulas found in the MUTCD described in item 1 above.
3. Assist in defining length of taper for lane reduction using the same MUTCD criteria described in item 1 above. In addition, sign placement for lane reductions should be in compliance with the criteria identified in the MUTCD (2009, AZ Supplement) Table 2C-4 in Section 2C.05, using Condition A. Also see Mesa Standard Detail M-23.05. Lane reduction arrows are only required on arterials.
4. Assist in determining the lengths of storage for left or right turn lanes.
5. If the roadway alignment cannot be designed to the design speed, the traffic designer shall assist in determining an advisory speed including the necessary signage.

Additional transportation design requirements can be found in the Mesa Engineering Procedure Manual - Engineering & Design Standards, Chapter 2 (Public Street Improvements).



## 5. PLAN REQUIREMENTS

### A. General

1. Signing and pavement markings shall be shown in the same plan view unless otherwise specified by the City of Mesa.
2. Signing and pavement markings shall be in compliance with the latest editions of the MUTCD as supplemented by ADOT, the City of Mesa Standard Details, and this manual.
3. Plans shall be presented on 24" x 36" full size sheets and drawn to a scale of 1" = 20' unless otherwise approved by the City.
4. All plans shall have a title block and border consistent with the roadway design plans.
5. Roadway conditions shall be shown for a minimum of 300 feet past the limits of construction, or to the nearest logical intersection connection, or as required by the City for adequate transitions and tapers to maintain traffic at the design speed.
6. Typically, marked crosswalks shall only be provided at signalized intersections and shall be designed per Mesa Standard Detail M-46.07, Detail A. This detail is to be shown on all pavement marking plans (if applicable). In case of dual curb ramps at intersections or curb ramps at mid-block locations, the crosswalks shall be centered on the ramps.
7. The plans shall match the requirements that may be stipulated with the Development Agreement (e.g., access points, lane widths, bike lanes, provisions for transit stops, pavement in interim stages, etc.).
8. During the course of the project, as modifications and changes are made to the basic design of the street and/or relevant items such as street light pole locations, the traffic designer will need to incorporate these changes and adjust the signing and pavement marking designs as necessary.
9. Additional information pertaining to plan sheet layout and requirements can be found in the Mesa Engineering Procedure Manual – Engineering & Design Standards, Chapter 1 (General Requirements).

## **B. Cover Sheet Information**

The signing and pavement marking plans shall have their own cover sheet. The cover sheet shall contain the following:

1. Signing and Pavement Markings General Notes (see [7.A](#))
2. Key map
3. Sheet index
4. Existing speed limit and design speed
5. Signing legend (showing only items used on plans)
6. Pavement marking legend (showing only items used on plans)

## **C. Plan Sheet Information**

The following items shall be shown on all signing and pavement marking plans:

1. North arrow
2. Drawing scale
3. Roadway curb and gutter or edge of pavement
4. Sidewalks and pedestrian ramps
5. Driveways and local street intersections
6. Street names
7. Match lines (with stations)
8. Centerline stations in 100-foot intervals
9. City limits, right-of-way, and easements (with dimensions)
10. Limits of construction; location where new roadway will match the existing roadway
11. Limits of removal of pavement markings
12. New and existing signs, graphically depicted in the direction of travel with the correct MUTCD designation, sign code, size, station, and offset
13. Existing signs, including advance or approach signing applicable to the project, screened back and designated to remain, to be removed and salvaged, or to be relocated
14. Existing striping screened back, identified by color, type, and width, and lane widths completely dimensioned across the roadway (e.g., 4" double yellow, 8" solid white, etc.)
15. New striping correctly depicted noting color, type, and line width (e.g., 4" double yellow, 8" solid white, etc.)
16. New pavement arrows, crosswalks, symbols, and legends, located with dimensions

17. New stop bars, dimensioned to a physical feature that can easily be located in the field, e.g. face of curb of intersecting street
18. Lane widths of new striping, dimensioned across the entire width of the roadway at each and every transition point (e.g., at beginning and ending of tapers, turn lanes, lane reductions/additions, striping change locations etc.)
19. Lane widths of curb lanes at all roadway and curb angle points
20. Dimensions indicating length of turn lanes and gaps, taper lengths, lead ups and lead aways at intersections, and curved edge lines
21. Striping change locations with beginning and ending stations and offsets
22. Striping and curb angle points with stations and offsets
23. Radii of striping curves
24. Control points, clearly identified and dimensioned to a physical feature that can easily be located in the field
25. Calculations pertaining to the signing and pavement design including standards used (e.g. sight visibility, taper lengths, advisory speeds, curve design)
26. New and existing streetlights, traffic signal poles, and traffic signal loops
27. Existing and proposed landscaping, vegetation, or structures (e.g., walls, fences, monument signs, cabinets) that may obstruct signs or sight visibility at driveways and intersections
28. Any other information necessary to make the plans clear and complete and convey the intent of the signing and pavement marking design

#### **D. Additional Plan Sheets**

The traffic designer may have to develop plan sheets for sections of roadway beyond the limits of the street construction to accommodate the signing and pavement marking design procedures outlined in this manual. This may include pavement marking tapers, median transitions, signing, etc.

## 6. SUBMITTAL REQUIREMENTS

Submittal requirements can be found in the Mesa Engineering Procedure Manual – Engineering & Design Standards, Chapter 1 (General Requirements). Typically, public works projects are coordinated by a project manager in the City of Mesa Engineering Department, while private projects are processed through the Development and Sustainability Department.

**IMPORTANT NOTE:**

Written responses to the City's review signing and pavement markings comments shall be provided, indicating where revisions were made, further discussion is necessary, or explaining why an item was not addressed. Failure to provide this information will result in plans being returned without review and could delay plan approval.

## 7. APPENDIX

### A. Signing and Pavement Markings General Notes

The following general notes should appear on the first sheet of all signing and pavement marking plans. Additional notes shall be added by the traffic designer as may be necessary to properly clarify the intent of the design.

1. All signing and pavement marking materials and equipment shall conform to the City of Mesa Standard Details, MUTCD and ADOT Standard Specifications and Standard Drawings, latest editions.
2. When striping obliteration is necessary, it shall be accomplished in conformance with ADOT Standard Specifications for Road and Bridge Construction, 2008, Section 701-3.06. If paid for per foot, refer to Section 701-5.05. Grinding is not an acceptable form of obliteration. Painting over striping does not constitute stripe obliteration.
3. All lane lines, edge lines, bike lane lines, centerlines, and painted medians shall be City approved paint.
4. All stop bars and crosswalks shall be 90 mil thick extruded alkyd thermoplastic marking material.
5. All symbols and word legends shall be Type I preformed plastic pavement marking.
6. The contractor shall paint all raised median island noses reflectorized yellow, 10 L.F. beyond the radius points.
7. The lane width dimensions for all pavement markings are from the face of curb to center of stripe or center of stripe to center of stripe unless noted otherwise.
8. All existing signs that will be removed shall be salvaged and delivered to the City of Mesa. The contractor shall make arrangements with the City to deliver signs to the City of Mesa Sign Yard at 300 E. 6<sup>th</sup> Street.
9. All signs, except R6-1 one way signs, delineators, object markers, chevrons, and signs that are otherwise noted, shall be mounted at a height of 7 feet measured from the bottom of the sign to the top of curb or top of roadway at edge of pavement. See Mesa Standard Details M-23.01 and M-23.03 for mounting heights of R6-1 one way signs, delineators, object markers, and chevrons.
10. The contractor shall submit sign formats for all signs to the City for approval prior to fabrication.
11. The contractor shall contact the City to obtain block numbers for metro signs and internally illuminated street name signs and bus route numbers for all bus stop signs.

## **B. Design References**

The following publications (latest editions) are to be used when preparing traffic signing and pavement marking designs in the City of Mesa.

***Mesa Standard Details and Specifications***

***Mesa Engineering Procedure Manual*** – Engineering & Design Standards

***Manual on Uniform Traffic Control Devices***, USDOT, FHWA

***Arizona Supplement to the Manual on Uniform Traffic Control Devices***, ADOT

***Uniform Standard Specifications and Details for Public Works Construction***, MAG

***Mesa Amendments to MAG Uniform Standard Details and Specifications for Public Works Construction***

***A Policy on Geometric Design of Highways and Streets***, AASHTO

***Signing and Marking Standard Drawings***, ADOT, Division of Highways

***Manual of Signs Approved for Use on State Highway System (MOAS)***, ADOT

***Traffic Engineering Policies, Guides and Procedures (PGP)***, ADOT

***Standard Specifications for Road and Bridge Construction***, ADOT

***Guide for the Development of Bicycle Facilities***, AASHTO

### **C. Abbreviations**

The following abbreviations apply herein:

AASHTO – American Association of State Highway and Transportation Officials

ADOT – Arizona Department of Transportation

City – City of Mesa

FHWA – Federal Highway Administration

MAG – Maricopa Association of Governments

MUTCD – Manual on Uniform Traffic Control Devices

USDOT – U.S. Department of Transportation

## D. Summary of Applicable Mesa Standard Details, 2013 Edition

M-19.01	Typical Street Section
M-20.01	10" Public Street Name Sign
M-20.02	12" Public Street Name Sign
M-20.03	Dead End Street Combination Sign
M-20.04	Double Street Name Sign
M-21.01	14" Private Street Name Sign
M-21.02	16" Private Street Name Sign
M-21.03	Street Name Signs, Arterial/Collector to Local
M-21.04	Street Name Signs, Local to Local
M-21.05	Conventional Metro Signs Addressing Scheme
M-21.06	Internally Illuminated Street Name signs Addressing Scheme
M-21.07	Conventional Metro and Internally Illuminated Signs Standard Layout
M-21.08	Conventional Metro and Internally Illuminated Signs Dual Name Layout
M-22.01	Typical Signing for Arterial Streets
M-22.02	Sign Installations on Streetlight Poles
M-22.03	Typical Street Name Sign Installation
M-23.01	Object and End of Road Markers, Chevron and Delineator Installation
M-23.02	Standard Clearance for Warning Signs
M-23.03	Various Sign Installations
M-23.04	Standard Clearances & Locations for Stop Signs
M-23.05	Guidelines for Advance Placement of Warning Signs
M-23.06	Standard Handicap Parking Sign and Markings
M-23.07	Sign Heights in Parking Lots
M-24	Business Access Sign
M-24.01	Business Name Sign
M-24.02	Combined Business Name Signs
M-25	Accessible & Van Accessible Parking Signs
M-39	Sign Post Installation (Square Tubing)
M-46.01.1	Arterial Street Intersection (4 Lanes) W/4' Raised Medians
M-46.01.2	Arterial Street Intersection (4 Lanes) W/8' Raised Medians
M-46.01.3	Arterial Street Intersection (4 Lanes) W/8' Raised Medians – Section Detail
M-46.02	Arterial Street Intersection (4 Lanes) W/Striped Medians
M-46.03.1	Arterial Street Intersection (6 Lanes) W/4' Raised Medians
M-46.03.2	Arterial Street Intersection (6 Lanes) W/8' Raised Medians
M-46.04	Arterial Street Intersection (6 Lanes) W/Striped Medians
M-46.05.1	Transition From Striped to 4' Raised Median
M-46.6	Typical Striping Cross Sections
M-46.05.1	Transition From Striped to 4' Raised Median
M-46.05.2	Transition From Striped to 8' Raised Median
M-46.07	Typical Intersection Approach Striping
M-47.01	Right Turn Lane Treatments
M-47.02	Right Turn Trap Lane Treatments
M-47.03	Typical Application of Pavement Arrows
M-47.04	Dual Left Turn Lane Line Extension
M-47.05	Typical Bike Lane Layouts
M-61	Delineator

**Note:** Please make sure to always refer to the latest edition of the Mesa Standard Details (available at <http://www.mesaaz.gov/engineering/mesastandardandspecs.aspx>)