City of Mesa

Signing & Pavement Marking

Design Procedures Manual

March 2007

CITY OF MESA
Great People, Quality Service!
TRANSPORTATION

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Revisions – February 2007	Page
Text change: Transportation Division to Transportation Department	all
Deleted reference to page B-14.	5
Added requirement to show striping change locations, with beginning and ending stationing, on all pavement marking and signing plans.	page 6.
Added requirement to show beginning and ending stationing of new pavement markings.	page 7 - B. 9
Added R6-1(one-way) sign to the exceptions list for mounting heights. Mounting height for R6-1 is shown in MSD-23.3.	page 8 – C. 8
Deleted static versions of individual Mesa Standard Details. Created hotlinks to current version of Mesa Standard Details.	Appendix B
Revisions – February 2007	
Updated hotlinks to point to the 2007 version of Mesa Standard Details	Appendix B

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1. INTRODUCTION AND PURPOSE

This manual contains information and illustrations of the signing and pavement markings design procedures for use on the City of Mesa Street System.

The information contained in this manual is 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 adopted by the Arizona Department of Transportation in the Arizona Department of Transportation Supplement to the MUTCD.

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.

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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Alan Sanderson, P.E. Date
Traffic Engineer
City of Mesa

2. MEETING WITH THE CITY TRANSPORTATION DEPARTMENT

A. Project Information:

Prior to meeting with the City of Mesa Transportation Department, 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. Meeting With The City of Mesa Transportation Department:

The Traffic Designer shall meet with the City of Mesa Transportation Department staff prior to beginning the pavement marking and signing design to discuss the project in detail. This discussion should address all applicable pavement marking and signing related items. 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: lane lines, edge lines, bike lane lines and centerlines shall be 60 mil[1] thick alkyd thermoplastic marking material in accordance with ADOT Standard Specification Section 704 - Thermoplastic Pavement Markings; crosswalk lines and stop bars shall be 90 mil[1] thick extruded alkyd thermoplastic marking material in accordance with ADOT Standard Specification Section 704 - Thermoplastic Pavement Markings; and, all symbols, dotted lines, 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. Verify that traffic signs will use the following criteria:
    - All sign posts shall be square tube perforated sign posts meeting the requirements of Section 607-2.03 of the ADOT Standard Specifications.
    - Use street light poles to mount signs when possible.
    - Signs to be installed per Mesa Standard Detail No. M-39.

5. One of the most important elements controlling the pavement marking design is the design speed for the section of roadway and the speed limit that will be posted. The Traffic Designer shall verify the project's design speed and posted speed limit.

6. Clarify the limits of the project and determine how the new design will match into the existing roadway.

7. A product of this meeting will be the identification of the primary City of Mesa Transportation Department contacts for the project.

8. The Traffic Designer shall supply the City of Mesa Transportation Department with the overall project schedule.

9. At this meeting, City staff will identify any specialty signing in the area of the project or any unusual roadway pavement marking needs (e.g. hospitals, park and ride facilities, freeway trailblazing, libraries, bike lanes, etc.).

C. Post Meeting Communication:

The Traffic Designer shall send to the City of Mesa Transportation Department contact any follow-up material that may be needed, particularly information that modifies or changes the concepts that were discussed during the original pre-design meeting. For example, the Traffic Designer will:

1. Prepare and distribute meeting minutes to all concerned parties.
2. Send project scope changes and design criteria changes to the project contact in the City's Transportation Department.
3. Update the project schedule and proposed submittal dates.
4. If necessary, schedule a meeting with City of Mesa to discuss review comments.

3. FIELD REVIEW

A. Site Visit:

The Traffic Designer shall visit the project site to inventory and identify physical features that may impact the pavement marking and signing designs. These features will include existing street width; curb/gutter and sidewalk locations; median configurations and dimensions; and, trees or bushes that may affect sign visibility.

B. Site Inventory:

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

1. Sign size, sign material, and the general condition of the sign.
2. Sign type and legend.
3. Posted speed limit(s).
4. Specialty signs throughout the project limits.
5. Sign post type, foundation type and label number, if available.
6. 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).
7. 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?
8. 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 new street improvement project will match into the existing street, the Traffic Designer will need to determine if additional information beyond the street improvement project limits will be needed in order to make the transition from existing to new.

D. Miscellaneous Items:

1. Landscaping features that may interfere with installation or visibility of signs.
2. Existing electrical and traffic signal cabinets and street lights within the project limits that will remain.

4. EARLY TRAFFIC ENGINEERING INPUT INTO GEOMETRIC DESIGN

A. Traffic Engineering Input:

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-12. 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 $L = S \times W$ will define lateral deflection (where L = length in feet, S = design speed, and W = offset in feet).

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 drops using the same MUTCD criteria. In addition, sign placement for lane drops should be in compliance with the criteria identified in MUTCD (2000)[1] Table 2C-4 in Section 2C.05, using Condition A. See Mesa Standard Detail M-23.5.

4. The Traffic Designer should assist in determining the lengths of storage for left or right turn lanes.

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

[1] Lane drop warning sign distances should be as shown in Table 2C-4, Condition A, using the MUTCD (2000) edition.

5. BASE DRAWINGS FOR THE STREET DESIGN

A. Plan Sheet Information:

The Traffic Designer shall obtain from the Street Designer information related to the design of the street and medians, the plan sheet border, and title block information for the project. Information not related to the pavement marking and signing design should be stripped off of the base drawings.

The following items should be included and shown on all pavement marking and signing plans.

1. All roadway curb and gutter or edges of pavement
2. Roadway stations and centerline
3. Roadway angle points and beginnings and ends of curvature
4. Roadway tapers (with beginning and ending stationing)
5. Striping change locations (with beginning and ending stationing)
6. Sidewalks
7. All right-of-way lines and utility easements
8. Driveways, local street intersections and pedestrian ramps
9. Location of all new and existing to remain streetlight and traffic signal poles
10. Limits of construction, location where new roadway will match the existing roadway
11. Locations of walls

During the course of the project, as modifications and changes are made to the basic design of the street, the Traffic Designer will need to incorporate these changes and adjust the pavement marking and signing designs as necessary.

Additionally, 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. Additional Plan Sheets:

The Traffic Designer may have to develop plan sheets for sections of street beyond the limits of the street improvement project to show pavement marking and signing work beyond the project limits. This may include pavement marking tapers, median transitions, etc.

6. PLAN PRESENTATION, SUBMITTALS AND DELIVERIES

Construction document requirements can be found in the Mesa Engineering Procedure Manual – Engineering & Design Standards, Chapter 1 (General Requirements). Specific requirements pertaining to signing and pavement marking plan sheets are shown below.

A. Plan Information:

All pavement marking and signing designs should be presented on 24" x 36" full size plan sheets drawn at 20 scale. The pavement markings and signing shall be shown on the same plan sheets. Pavement marking and signing designs should be combined and submitted for review with the entire street design project at each of the design submittals. At each design submittal, a separate submittal of just the pavement marking and signing design will be made directly to the Transportation Department.

B. Plan Content:

The pavement marking and signing plans shall clearly show the roadway improvements, including the following:

1. Roadway centerline and stations.
2. Dimensions at each location where the roadway width changes.
3. Curbs, gutters and sidewalks.
4. Limits of roadway improvements.
5. All offsets, tapers and angle points.
6. All existing to remain above ground items such as light poles, power poles, fire hydrants, existing signs, etc.
7. Street names of all roads.
8. North arrow, drawings scale, title block information, City of Mesa project number, company name and phone number, date and, on the final submittal, the Engineer's seal.
9. New pavement marking, including lane lines, edge lines, centerlines, painted medians, bike lane markings, crosswalks, stop bars, arrows, word legends and signing, with beginning and ending stationing.
10. Existing pavement marking and signing that is to remain.
11. General notes (on first sheet only) for both pavement marking and signing.
12. Any other information that may be necessary to make the plans clear and complete.

C. General Notes:

The following General Notes should appear on the first sheet of all pavement marking and signing projects. Additional notes shall be added by the Traffic Designer as may be necessary to properly clarify the intent of the design.

1. All pavement marking and signing materials and equipment shall conform to the City of Mesa standard details, MUTCD and ADOT standard specifications and standard drawings, latest editions.

2. When stripe obliteration is necessary, it shall be accomplished in conformance with ADOT Standard Specifications for Road and Bridge Construction, 2000, 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 line, edge line, bike lane line, centerline and painted median striping shall be 60 mil thick alkyd thermoplastic marking material.

   All stop bars and crosswalks shall be 90 mil thick extruded alkyd thermoplastic marking material.

4. All symbols and word legends shall be Type I preformed plastic pavement marking.

5. The Contractor shall paint all raised median island noses reflectorized yellow, 10 L.F. past the ends of the median islands.

6. The lane width dimensions for all pavement markings are to the center of the striping or, in the case of double striping, to the center of the double striping.

7. All existing signs that will be removed shall be salvaged and delivered to the City of Mesa. Contractor shall make arrangements with the City to deliver signs to the City of Mesa Sign Yard at 300 E. 6th Street.

8. All signs, except R6-1 one-way, delineators, object markers, end-of-road 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-23.1 and M-23.3 for mounting heights of R6-1 one-way, delineators, object markers, end-of-road markers and chevrons.

9. Contractor shall submit sign formats for all signs to the City for approval prior to fabrication.

10. Contractor shall obtain from the City all block numbers for street name signs and bus route numbers for all bus stop signs.

D. Sign Summary Table:

The Traffic Designer shall include a sign summary table as part of the signing design. A copy of the table format will be provided to the Traffic Designer by the Engineering Division. The sign summary table shall include the following information: sign number, station, direction of travel that the sign is viewed, legend, sign size (height and width), sign area (sq. ft.), post type, number of posts, sign mounting height, total post length, foundation type and offset. Additional plan sheets with miscellaneous details will be included as necessary to clarify the intent of the design.

E. Submittals:

The Traffic Designer will coordinate with the Street Designer to include the pavement marking and signing designs with the submittals of plans for the entire street improvement project to the City of Mesa for review. These submittals shall be made with full size plan sheets plotted on vellum. Final plans will be submitted on mylar and accompanied with a copy of the electronic files in AutoCADD format. This process is also outlined in a typical standard contract made with the City of Mesa.

1. The first submittal to the City of Mesa shall include all information necessary for the Transportation Department staff to fully understand the intent of the design. The submittal shall include the inventory of existing signing and striping. Sign summary tables are not a requirement for the first submittal.

2. The second submittal to the City of Mesa shall include all pavement marking and signing sheets, including sign summary tables and any required detail sheets. Any City of Mesa review comments on the previous submittal should be returned with subsequent submittals.

3. The third submittal to the City of Mesa shall be the final design and shall be on mylar. All sheets shall be complete, signed and sealed, and the submittal shall include an electronic copy of all design files in an AutoCADD format. Any City of Mesa review comments on the previous submittal should be returned with this submittal.

4. Additional submittals may be required if the City of Mesa has additional review comments that need to be incorporated into the plans.

7. COORDINATION WITH OTHERS

A. Geometrics:

The Traffic Designer shall ensure that the latest geometrics for the street improvement project are being shown, including traffic signal poles, street light poles, sidewalks and walls.

B. Coordination:

Prior to the final submittal of project plans to the City of Mesa, the Traffic Designer shall coordinate with all other disciplines (civil, drainage, landscaping, etc.) working on the street improvement project to avoid conflicts.

C. Adjacent Projects:

Coordination with adjacent improvement projects may be required. Projects may not match existing, but may match into future adjacent construction projects that will be completed and in place prior to the project being designed.

APPENDIX A

DESIGN REFERENCES

APPENDIX A

DESIGN REFERENCES

The following publications or their current revisions are to be used when preparing traffic signs and pavement marking designs in the City of Mesa.

Manual on Uniform Traffic Control Devices, U.S. Department of Transportation, Federal Highway Administration, 2003 Edition.

Arizona Supplement to the 2003 Manual on Uniform Traffic Control Devices, Arizona Department of Transportation, September 1, 2004 Edition.

Signing and Marking Standard Drawings, Arizona Department of Transportation, Division of Highways, Latest Edition.

Manual of Signs Approved for Use on State Highway System, Arizona Department of Transportation.

ADOT Traffic Engineering Policies, Guide and Procedures, 2000 Edition.

Uniform Standard Specifications and Details for Public Works Construction, Maricopa Association of Governments, 1998 Edition.

1999 Amendment to the Uniform Standard Specifications and Details for Public Works Construction, Maricopa Association of Governments, Mesa Standard Details and Specifications, 1998 Edition.

Standard Specifications for Road and Bridge Construction, Arizona Department of Transportation, 2000 Edition.

Guide for the Development of Bicycle Facilities, American Association of State Highway and Transportation Officials, 1999 Edition.

Mesa Standard Details and Specifications, Latest Edition.

Mesa Engineering Procedure Manual – Engineering & Design Standards, Latest Edition.

A-2 ABBREVIATIONS

The following abbreviations apply herein:

AASHTO – American Association of State Highway and Transportation Officials

ADOT – Arizona Department of Transportation

City or COM – City of Mesa

ITE – Institute of Transportation Engineers

MAG – Maricopa Association of Governments

MUTCD – Manual on Uniform Traffic Control Devices

APPENDIX B

LINKS TO MESA STANDARD DETAILS

http://www.cityofmesa.org/engineering/2007_Mesa_Standard_Details_and_Specifications.aspx

M-20.1	10” Public Street Name Sign
M-20.2	12” Public Street Name Sign
M-21.1	10” Private Street Name Sign
M-21.2	12” Private Street Name Sign
M-21.3	Street Name Signs, Arterial/Collector To Local
M-21.4	Street Name Signs, Local to Local
M-22.1	Typical Signing for Arterial Streets
M-22.2	Sign Installations on Streetlight Poles
M-22.3	Typical Street Name Sign Post Installation
M-23.1	Object and End of Road Markers, Chevron and Delineator Installation
M-23.2	Standard Clearance for Warning Signs
M-23.3	Various Sign Installations
M-23.4	Standard Clearances &Locations for Stop Signs
M-23.5	Guidelines for Advance Placement of Warning Signs
M-23.6	Standard Handicap Parking Sign and Markings
M-23.7	Conventional Metro Signs
M-23.8	Internally Illuminated Street Name Signs
M-23.9	Sign Heights in Parking Lots
M-26	Accessible & Van Accessible Parking Signs
M-39	Sign Post Installation (Square Tubing)
M-46.1	Arterial Street Intersection (4 Lanes) W/Raised Medians
M-46.2	Arterial Street Intersection (4 Lanes) W/Striped Medians
M-46.3	Arterial Street Intersection (6 Lanes) W/Raised Medians
M-46.4	Arterial Street Intersection (6 Lanes) W/Striped Medians
M-46.5	Transition From Striped to Raised Median
M-46.6	Typical Striping Cross Sections
M-46.7	Typical Intersection Approach Striping
M-47.1	Right Turn Lane Treatments
M-47.2	Right Turn Trap Lane Treatments
M-47.3	Typical Application of Pavement Arrows
M-47.4	Dual Left Turn Lane Line Extension
M-47.5	Typical Bike Lane Layouts
M-61	Delineator