

# **Monthly Developer/Consultant Process Training**

## **Traffic Management Design**

Session 11 Part 1: Traffic Signals, Kassem Elkhalil, PE

Session 11 Part 2: Street Lights, Marisa Conlin, PE

Session 11 Part 3: Roundabouts, Lissette Acevedo, PE, PTOE

Wednesday, January 9, 2019



# TRAFFIC SIGNAL DESIGN

# Objectives

- Traffic Signal Warrants
- Traffic Signal Design

# TRAFFIC SIGNAL WARRANTS



- Traffic signals are warranted based on the MUTCD traffic signal warrants
- Warrants are evaluated based on engineering studies of the existing and projected traffic conditions, pedestrian and physical characteristics, and number of accidents at the intersection

# DESIGN PLAN - PREPARATION

1. City Traffic Engineer will provide
  - Sample plan set
  - CAD cell library
  - Latest general notes
  - Standard specification details from Buzzsaw
  - Traffic signal guidelines
2. Field meeting with consultant to identify
  - Location of power source
  - Locations of potential/existing traffic control devices

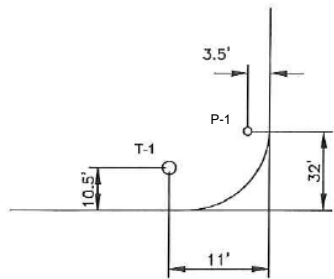
# TRAFFIC SIGNAL DESIGN PLAN

- Cover sheet
- General Notes
- Index sheet
- Quantity Summary Sheet
- Existing, Removal, Proposed Signal Layout Sheets
- Detail Standard Sheets
- Signs and pavement marking sheet(s)
- Detailed ADA Ramp Sheet(s)
- Detailed corner sheets
- Summary of conduit and cable sheet
- Signal pole location sheet

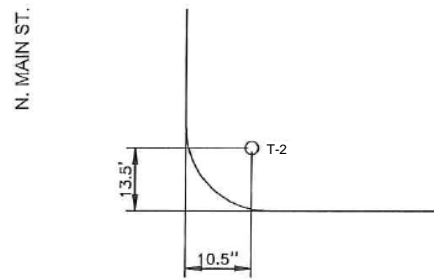
# TRAFFIC SIGNAL DESIGN PLAN

- Show utility overhead/underground
- Numbering/labeling of signal infrastructure assets on all layout sheets
- Show photo enforcement equipment (red camera) if applicable
- Preemption (If needed)

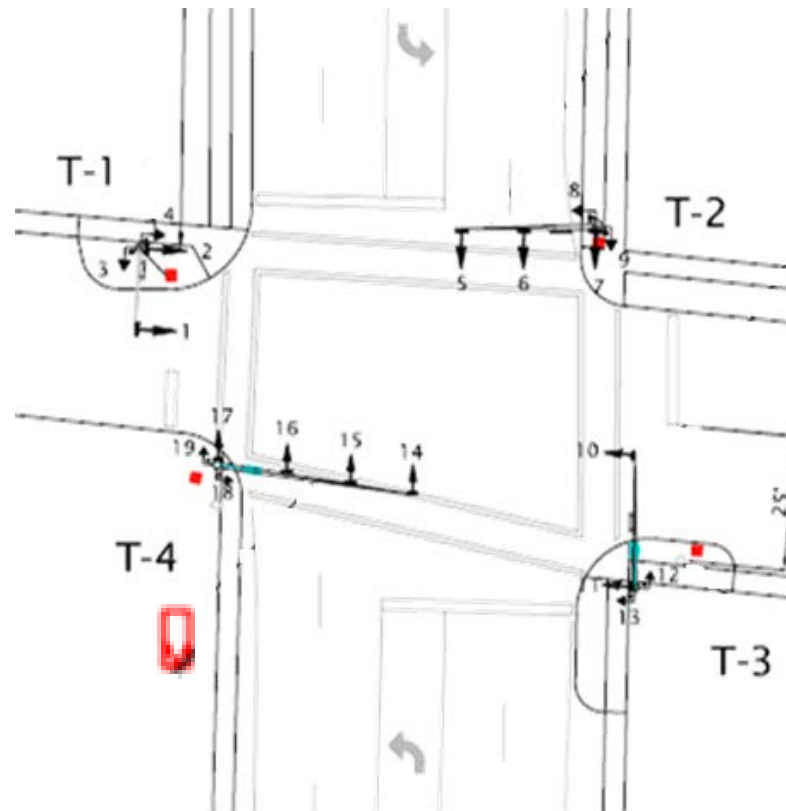
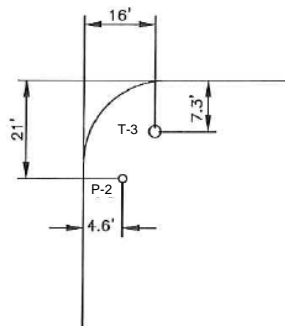
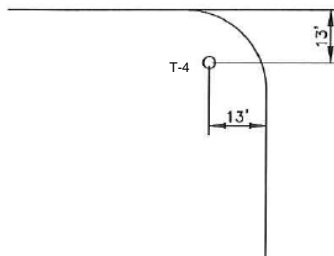
# POLE LOCATION & NUMBERING



W. LONG AVE.

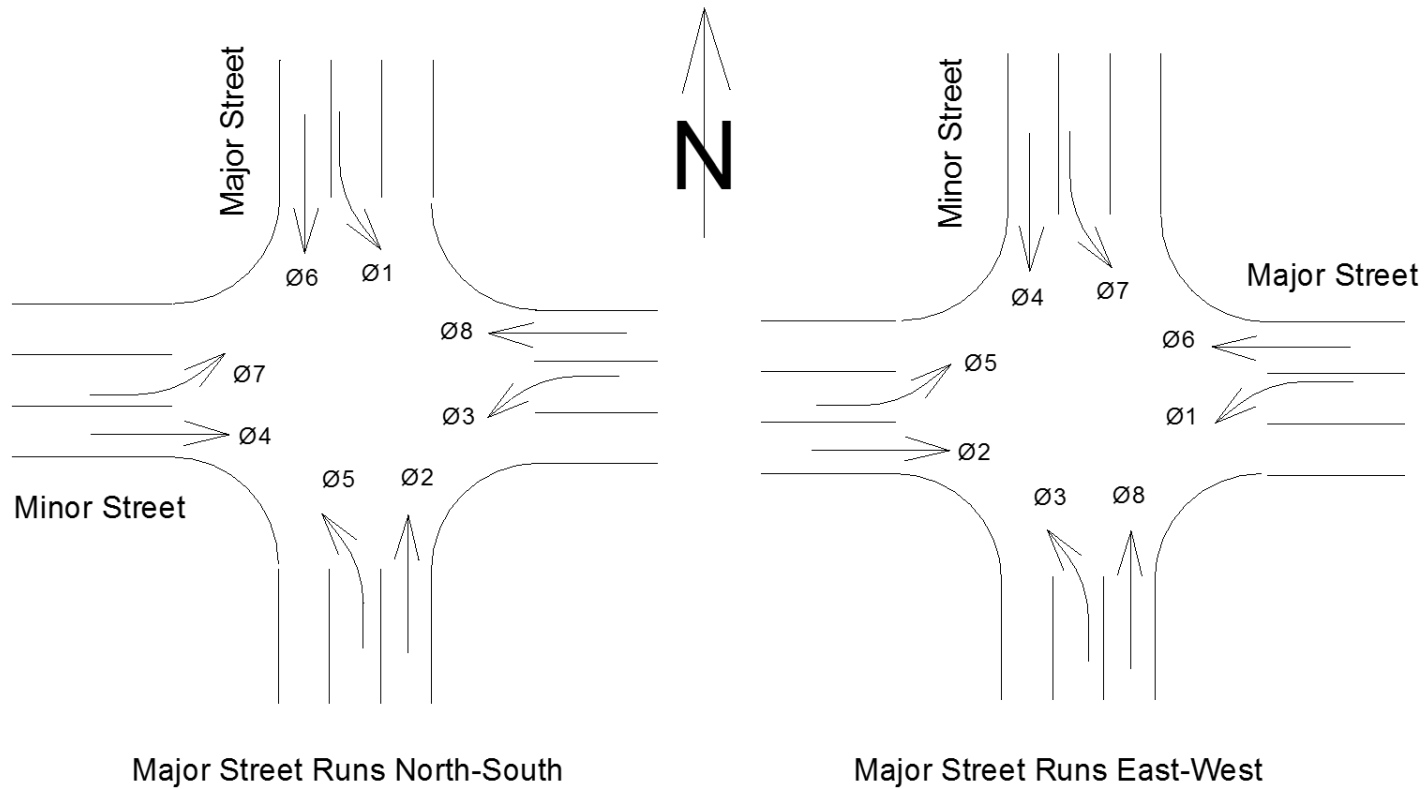


E. LONG AVE.





# NEMA PHASING



# TRAFFIC SIGNAL DESIGN PLAN

- Respond to city comments
- Resolve any utility conflicts
- Circulate for signatures
- Submit (deliver or mail)
  1. Electronically archived files (USB – AutoCAD and 11” x 17” PDF)
  2. 11” x 17” hard copy of signed and sealed plans



# Contact Information

For any further questions, you may contact

**Kassem Elkhail, P.E.**

Email: [Kassem.ElKhalil@fortworthtexas.gov](mailto:Kassem.ElKhalil@fortworthtexas.gov)

Phone: 817-392-8742





# STREET LIGHT DESIGN

# Objectives

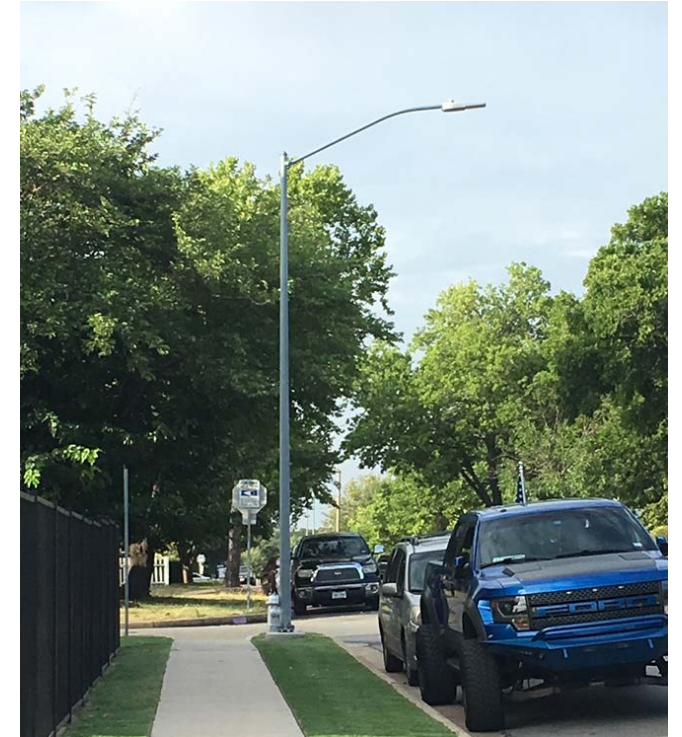
- Street Light Overview
- Street Light Policies
- Street Light Design Requirements
- Pre-Qualified Contractors

# Street Light Overview

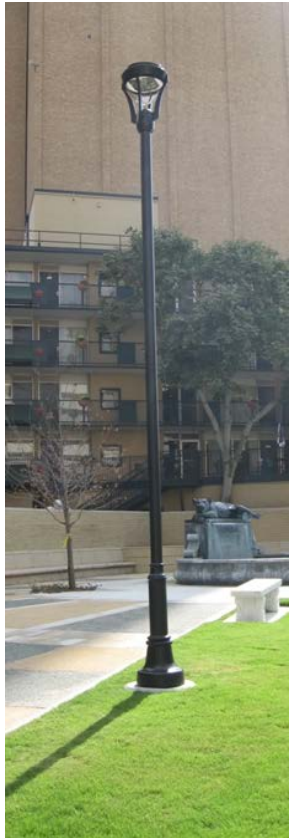
- City of Fort Worth owns & maintains lighting system
  - Utility agreements are for CFW ownership and CFW system access
  - CFW owns poles, foundations, arms, wires, & lights
- Citywide Lighting Analysis estimates 67,000 lights
  - 41,000 Neighborhood
  - 22,000 Arterial
  - 4,000 Texas Department of Transportation (TxDOT)

# Street Light Policies

- 2001 – Policy for the Installation of Community Facilities Agreement (CFA) adopted
- 2005 – CFA Section VIII Street Light Policy revised
- 2012 – Street Light Standards Update: decorative pole selection
- 2014 – Policy 31.29 Street Lighting adopted:  
Adopted CFA Policy & LEDs become standard fixture
- 2018 – Policy 31.29 Update: existing structural supports and in-kind materials may be used



# Street Light Policies: Decorative Poles



City Hall



Berry



Washington



Oleander/  
Arlington



Terrell Heights



Saturn/W 7<sup>th</sup>



# Street Light Design Requirements

- Street Light Checklist
- Standard Detail Sheets
  - D621 – Street Luminaire Pole and Fixture Details
  - D622 – Street Luminaire Pole Foundation Details
  - D623 – Street Luminaire Riser Connection Details
  - D624 – Street Luminaire Conduit and Ground Box Details
  - D625 – 240-480 Volt Single Phase Metered Pedestal
- Street Light Luminaire Specifications
  - Arterial – 200W HPS Equivalent
  - Freeway – 400W+ Equivalent
  - Residential – 100W Equivalent
- Construction Specifications

# Pre-Qualified Contractors

- Requirements
  - Annual Financial Statement
  - References
  - Equipment Schedule
  - Contracting Experience
- Renewal Process
  - Required every 2 years
  - Submit Annual Financial Statement
- Contact: [Kourtney.Davis@fortworthtexas.gov](mailto:Kourtney.Davis@fortworthtexas.gov)

# Contact Information

For any further questions, you may contact

**Kourtney Davis, Graduate Engineer**

Email: [Kourtney.Davis@fortworthtexas.gov](mailto:Kourtney.Davis@fortworthtexas.gov)

Phone: 817-392-6753





# ROUNDAABOUT DESIGN

# Objectives

- Design Guidelines
- Additional Documentation
- Process

# City of Fort Worth Design Guidelines

\*\*\*Diameters may vary based on site constraints and differing design and accommodation Vehicles



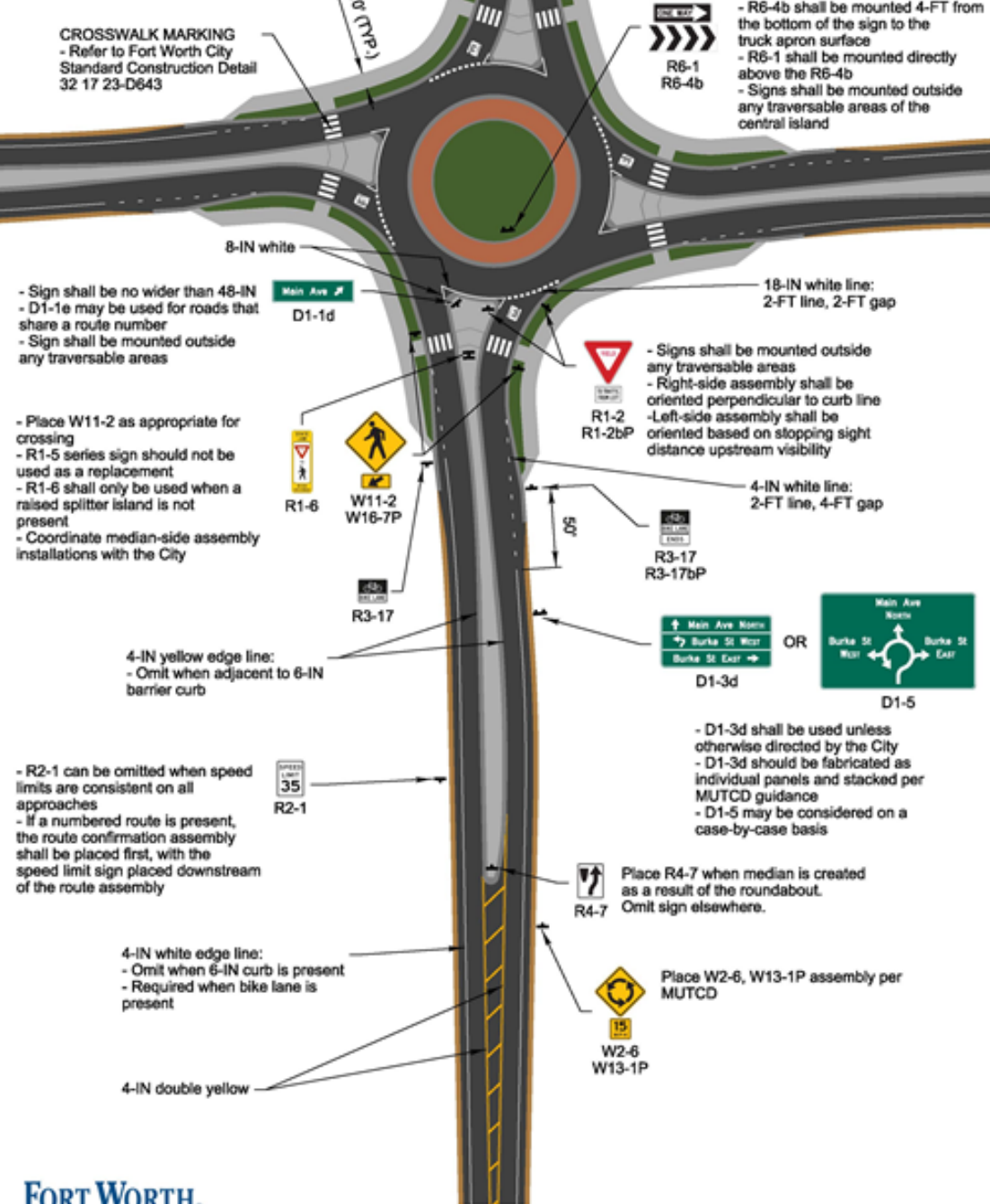
	Urban Single-Lane	Multilane (Two-Lane, Case 1)
Inscribed Circle Diameter <sup>(1), (5)</sup>	120 – 150 ft	150 – 190 ft
Circular ROW Footprint <sup>(2)</sup>	150 – 190 ft	180 – 230 ft
Design and Accommodation Vehicle <sup>(3)</sup>	WB-62/WB-67; Fire Truck Check on Pavement	WB-62/WB-67; Fire Truck Check on Pavement
Fastest Path Entry Speed, V1	< 23 mph	< 25 mph
Minimum Grade	0.8%	0.8%
Maximum Longitudinal Grade	4.0%	4.0%
Maximum Cross Slope	2.0%	2.0%
Typical Daily Service Volume <sup>(4)</sup> (veh/day), 4-leg RAB	Up to approx. 25,000	Approx. 25,000 to 55,000
Volume Range (sum of entering and conflicting volumes) <sup>(4)</sup>	0 to 1,000 veh/hr (likely to be sufficient)  1,000 to 1,300 veh/hr (two-lane may be needed, addtl analysis required)	1,300 to 1,800 veh/hr (two-lane likely to be sufficient) Approach-by-approach analysis required to calculate lane assignments
Entry Radius	65 – 75 ft	70 – 85 ft (typical)
Entry Angle	20 – 40 degrees	20 – 40 degrees
Entry Width, F-F <sup>(5)</sup>	16 – 21 ft	24 – 26 ft
Parkway Width (Back-of-Curb to ROW)	10 – 20 ft	10 – 22 ft
Circulatory Roadway Width <sup>(5)</sup> , F-F	18 – 20 ft	25 – 28 ft
Inner Circulatory Lane Width <sup>(5)</sup>	n/a	12 - 13ft
Outer Circulatory Lane Width <sup>(5)</sup>	n/a	13 – 15 ft
Exit Width	16 – 18 ft	24 – 28 ft
Truck Apron Width	12 – 15 ft	8 – 14 ft
Approach Gore Width <sup>(5)</sup>	n/a	See Case 2 and Case 3 next page
Minimum Tangent between Approach Curves	75 ft	75 ft
Entry tangency (for path overlap check)	n/a	26 – 50ft
Exit tangency (for path overlap check)	n/a	26ft +
Stopping Sight Distance	See separate guidance document	See separate guidance document
Crosswalk Pedestrian Refuge Width, ft	7ft minimum, face-of-curb to face-of-curb	7ft minimum, face-of-curb to face-of-curb

## Design Guidelines Contd.

	Case 2	Case 3
Lane Discipline	Lane discipline entering only	Lane discipline entering and circulating
Number of Trucks in Peak Hour per Approach (WB-62 or larger)	>120	>120
Context	Suburban / Rural Light Industrial Heavy Industrial	Suburban / Rural Light Industrial Heavy Industrial
ICD <sup>(1)</sup>	160 – 205 ft	175 – 210 ft
Entry Width	28 – 32 ft	28 – 34 ft
Circulatory Roadway Width, F-F	26 – 28 ft	28 – 34 ft
Inner Circulatory Lane Width	12 – 13 ft	13 – 15 ft
Outer Circulatory Lane Width	12 – 15 ft	15 – 19 ft
Exit Width	26 – 28 ft	28 – 32 ft
Approach Gore Width	2 – 6 ft	4 – 8 ft
Controlling Radius <sup>(2)</sup>	>70 ft, 110-130 ft typical	>70 ft, 110-130 ft typical
Controlling Radius Length	70+ ft	70+ ft

Multilane (Two-lane) Case 2, or Case 3 Design Criteria – Table 2

**CROSSWALK MARKING**  
- Refer to Fort Worth City Standard Construction Detail 32 17 23-D643



- Sign shall be no wider than 48-IN  
- D1-1e may be used for roads that share a route number  
- Sign shall be mounted outside any traversable areas

- Place W11-2 as appropriate for crossing  
- R1-5 series sign should not be used as a replacement  
- R1-6 shall only be used when a raised splitter island is not present  
- Coordinate median-side assembly installations with the City

4-IN yellow edge line:  
- Omit when adjacent to 6-IN barrier curb

- R2-1 can be omitted when speed limits are consistent on all approaches  
- If a numbered route is present, the route confirmation assembly shall be placed first, with the speed limit sign placed downstream of the route assembly

4-IN white edge line:  
- Omit when 6-IN curb is present  
- Required when bike lane is present

4-IN double yellow

- R6-4b shall be mounted 4-FT from the bottom of the sign to the truck apron surface  
- R6-1 shall be mounted directly above the R6-4b  
- Signs shall be mounted outside any traversable areas of the central island

- Signs shall be mounted outside any traversable areas  
- Right-side assembly shall be oriented perpendicular to curb line  
- Left-side assembly shall be oriented based on stopping sight distance upstream visibility

4-IN white line:  
2-FT line, 4-FT gap

R3-17  
R3-17bP

D1-3d OR D1-5

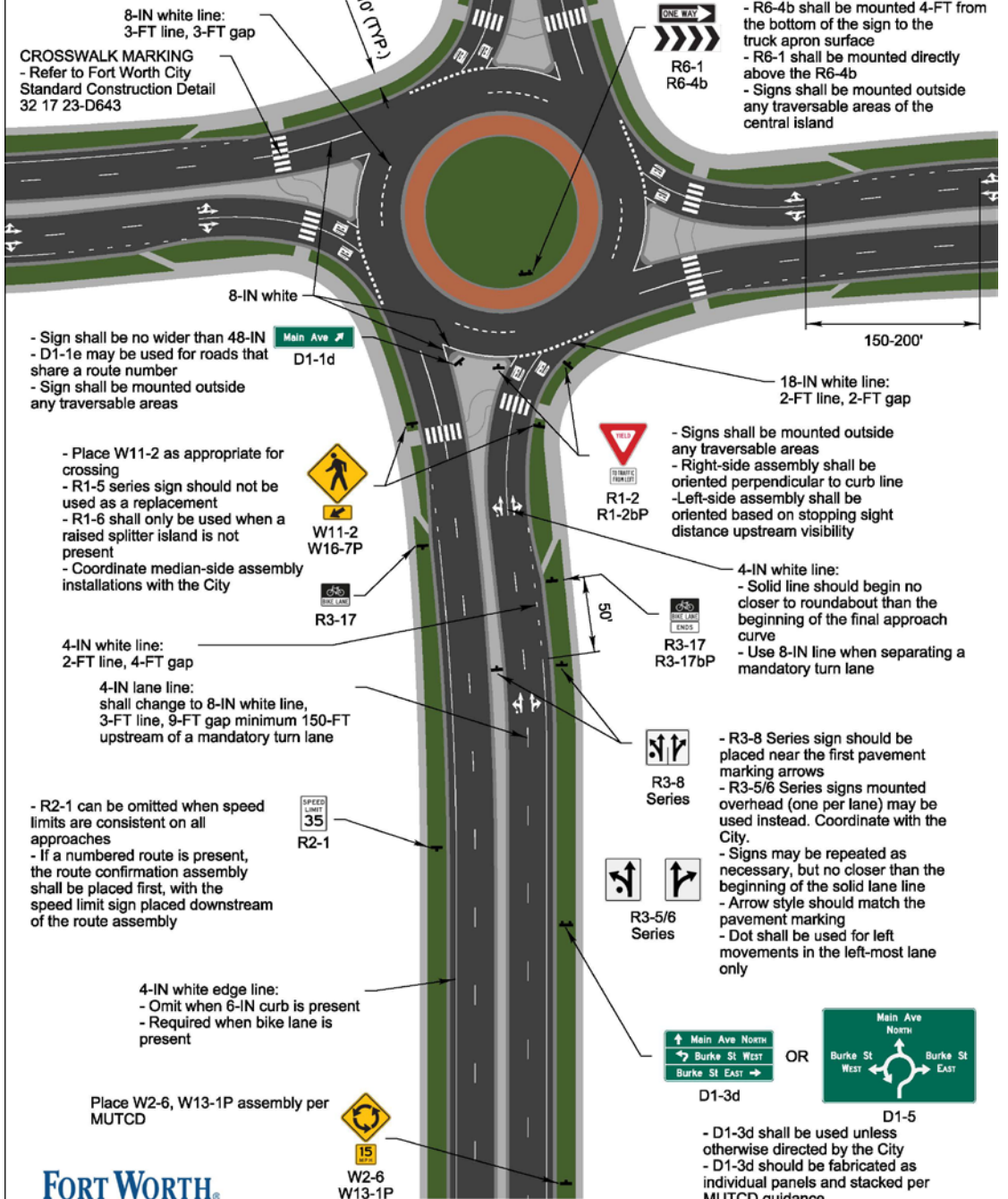
- D1-3d shall be used unless otherwise directed by the City  
- D1-3d should be fabricated as individual panels and stacked per MUTCD guidance  
- D1-5 may be considered on a case-by-case basis

Place R4-7 when median is created as a result of the roundabout. Omit sign elsewhere.

Place W2-6, W13-1P assembly per MUTCD



**TYPICAL SIGNING & MARKING**  
Single-lane Roundabout



- Sign shall be no wider than 48-IN  
- D1-1e may be used for roads that share a route number  
- Sign shall be mounted outside any traversable areas

- Place W11-2 as appropriate for crossing  
- R1-5 series sign should not be used as a replacement  
- R1-6 shall only be used when a raised splitter island is not present  
- Coordinate median-side assembly installations with the City

4-IN white line:  
2-FT line, 4-FT gap  
4-IN lane line:  
shall change to 8-IN white line, 3-FT line, 9-FT gap minimum 150-FT upstream of a mandatory turn lane

- R2-1 can be omitted when speed limits are consistent on all approaches  
- If a numbered route is present, the route confirmation assembly shall be placed first, with the speed limit sign placed downstream of the route assembly

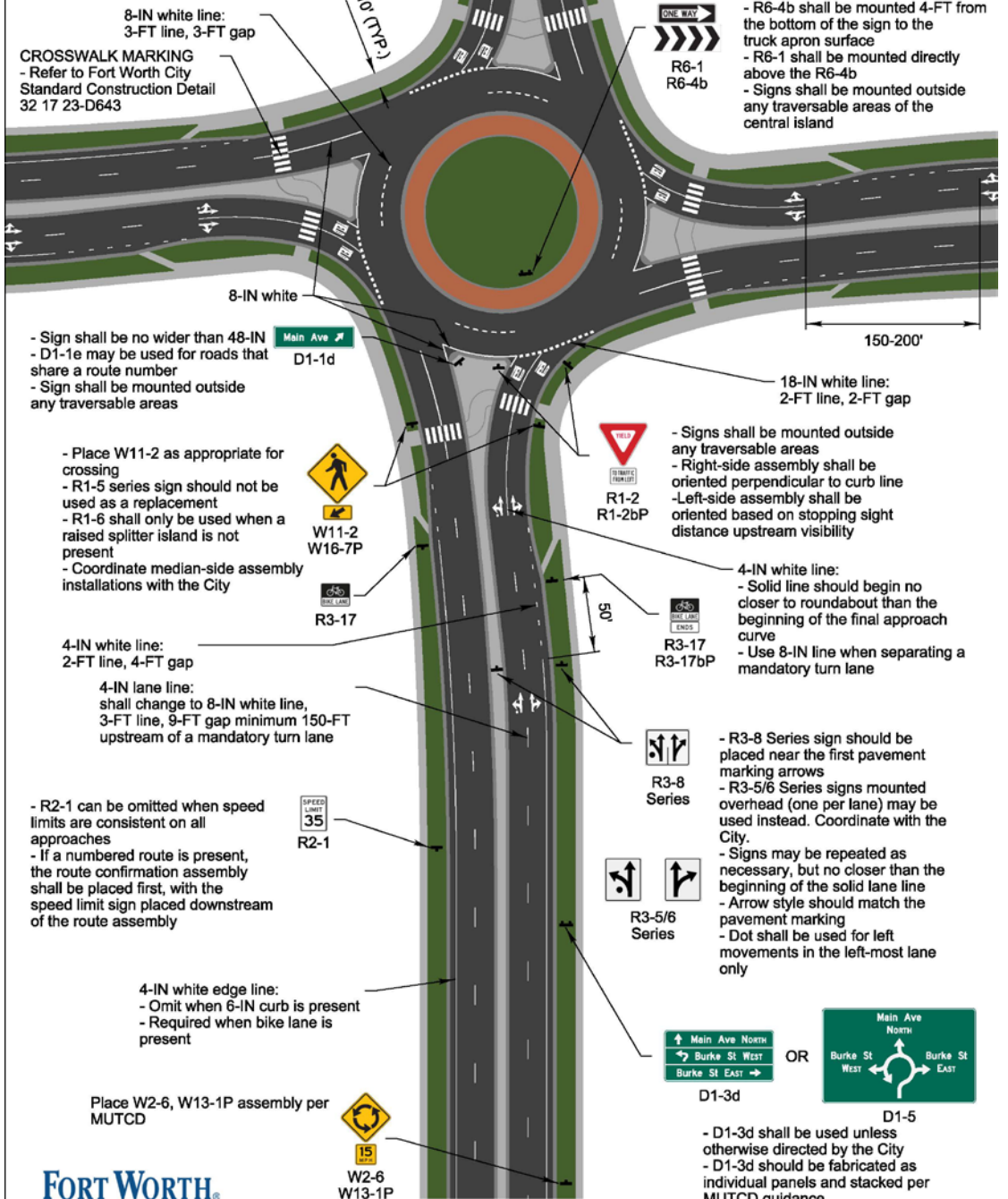
4-IN white edge line:  
- Omit when 6-IN curb is present  
- Required when bike lane is present

Place W2-6, W13-1P assembly per MUTCD



**TYPICAL SIGNING & MARKING**  
Multilane Roundabout

**CROSSWALK MARKING**  
- Refer to Fort Worth City Standard Construction Detail 32 17 23-D643



- Signs shall be mounted outside any traversable areas  
- Right-side assembly shall be oriented perpendicular to curb line  
- Left-side assembly shall be oriented based on stopping sight distance upstream visibility

- Signs shall be mounted outside any traversable areas  
- Right-side assembly shall be oriented perpendicular to curb line  
- Left-side assembly shall be oriented based on stopping sight distance upstream visibility

4-IN white line:  
- Solid line should begin no closer to roundabout than the beginning of the final approach curve  
- Use 8-IN line when separating a mandatory turn lane

- R3-8 Series sign should be placed near the first pavement marking arrows  
- R3-5/6 Series signs mounted overhead (one per lane) may be used instead. Coordinate with the City.  
- Signs may be repeated as necessary, but no closer than the beginning of the solid lane line  
- Arrow style should match the pavement marking  
- Dot shall be used for left movements in the left-most lane only

- R3-8 Series sign should be placed near the first pavement marking arrows  
- R3-5/6 Series signs mounted overhead (one per lane) may be used instead. Coordinate with the City.  
- Signs may be repeated as necessary, but no closer than the beginning of the solid lane line  
- Arrow style should match the pavement marking  
- Dot shall be used for left movements in the left-most lane only

- D1-3d shall be used unless otherwise directed by the City  
- D1-3d should be fabricated as individual panels and stacked per MUTCD guidance  
- D1-5 may be considered on a case-by-case basis; typically on multilane arterials



**TYPICAL SIGNING & MARKING**  
Multilane Roundabout



## Additional Documentation Required

### Design Parameters

- Design approach speed
- Number of Lanes
- Design vehicle

### Traffic Volume to support Roundabout Layout

- Number of Lanes

### Performance Check

- Fastest Path Analysis
- Auto turn Analysis to support design vehicle



## Process:

- Follow design guidelines
- Submit plans to city including additional documents for review
- Project Manager will submit a request for Peer review through Capital Delivery Division to MSA for collector and major thoroughfare only.
- Task Order for the Peer review is generated
- Once peer review is complete, either a meeting is held with the designer or the comments are forwarded to the designer.



## Contact Information

For any further questions, you may contact

**Lissette Acevedo, PE, PTOE, PMP**

Email: [Lissette.Acevedo@fortworthtexas.gov](mailto:Lissette.Acevedo@fortworthtexas.gov)

Phone: 817-392-2722

Questions?