## INDEX OF SHEETS


| Sheet No. | Description |
|---|---|
| 1 | Title Sheet |
| 2 -7 | Pavement Marking Plan |
| 8 | Pavement Marking Details |
| 9 | Signing Details |
| 10 -12 | Traffic Control Details |


# CITY OF KANSAS CITY, MO
# BENTON BLVD.
# BICYCLE FACILITY IMPROVEMENTS
# ST. JOHN AVENUE TO BLUE PARKWAY
# CITY PROJECT NO. 89020191
# CMAQ NO. 3301 (463)


STATE OF MISSOURI
DAVID J. MENNENGA
NUMBER PE-2001029636
PROFESSIONAL ENGINEER
6/2/17

GBA architects engineers
9801 Renner Boulevard
Lenexa, Kansas 66219
913.492.0400
www.gbateam.com

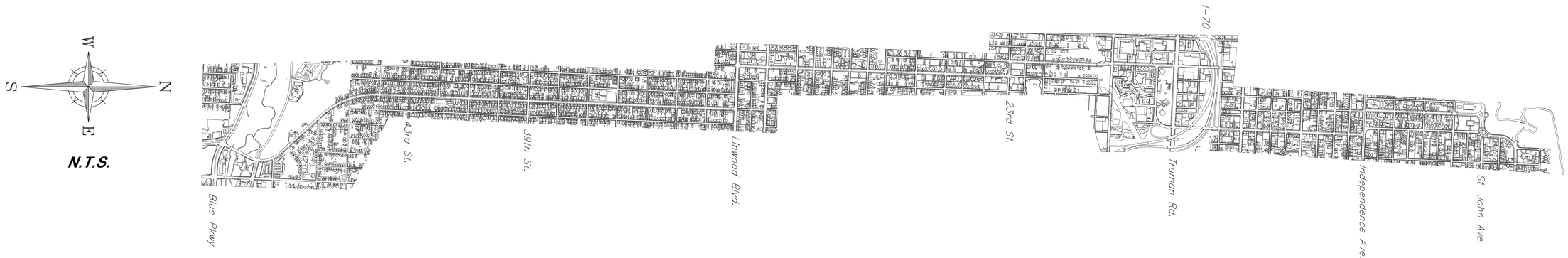

| | |
|---|---|
| DATE: | 05/17/2017 |
| DESIGN BY: | DJM |
| DRAWN BY: | CMN |
| PROJECT NO.: | 13621.01 |
| SHEET NO. | 1 |
| TOTAL SHEETS | 12 |


David J. Mennenga
Professional Engineer
License No. E-2001029636


**BENTON BLVD - BICYCLE FACILITIES**
**PAVEMENT MARKING AND SIGNING**
Kansas City, MO CMAQ No. 3301 (463)

| NO. | DATE | REVISIONS | BY | APPROVED |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

## VICINITY MAP




## UTILITY COMPANIES

**Cable & Telephone:**

AT&T
Randy Gaskin
500 E. 8th St.
Kansas City, MO 66104
offce: 913-383-6948
rg9513@att.com

Sprint
Jason Cantrell
800 NW Technology Dr.
Lee's Summit, MO 64086
cell: 913-488-8489
jason.cantrell@sprint.com

Time Warner
Melody DaMour
8221 W 119th St.
Overland Park, KS 66213
office: 913-643-1930
cell: 816-564-6911
melody.damour@twcable.com

Zayo
Dwight Davis
office: 816-254-8027
cell: 816-591-0282
dwight.davis@zayo.com

Consolidated Communications
Clarence Griffin
9701 Lackman Rd
Lenexa, KS 66219
office: 913-322-9619
cell: 816-678-9793
clarence.griffin@consolidated.com

Google Fiber
Andrea Sakla
2812 W. 47th Ave.
Kansas City, KS 66103
kc-google-uc@google.com

MCI
Don Torbett
office: 918-877-7333
cell: 918-269-4698
donald.torbett@verizonbusiness.com

CenturyLink
Andy Tuttle
435 E. Main
Gardner, KS 66030
office: 913-856-2232
cell: 913-534-7100

**Signals & Street Lights:**

KCMO Traffic Signals
Sam Akula
4800 E. 63rd St. Trafficway
Kansas City, MO 64130
office: 816-325-7453
sam.akula@kcmo.org

KCMO Street Lighting
Mahmoud Hadjian
4800 E. 63rd St. Trafficway
Kansas City, MO 64130
office: 816-513-9852
mahmoud.hadjian@kcmo.org

**Gas:**

Missouri Gas Energy
Peggy Burns-Yocum
3025 SE Clover Dr.
Lees Summit, MO 64082
office: 816-969-2218
Peggy.Burns-Yocum@thelacledegroup.com

**Power:**

KCP&L
John Wienstroer
16215 W. 108th St.
Lenexa, KS 66219
office: 913-894-3060
john.wienstroer@kcpl.com

**Storm Sewer & Sewer:**

KCMO Sewer
Khoa Nguyen
4800 E. 63rd St. Trafficway
Kansas City, MO 64130
office: 816-513-0264
khoa.nguyen@kcmo.org

KCMO Storm Water
Robert Davis
4800 E. 63rd St. Trafficway
Kansas City, MO 64130
office: 816-513-0573
robert.davis@kcmo.org

KCMO Water
Kirk Rome
4800 E. 63rd St. Trafficway
Kansas City, MO 64130
office: 816-513-0368
kirk.rome@kcmo.org

**NOTE: NO RIGHT-OF-WAY TO BE ACQUIRED FOR THIS PROJECT**

**TRAFFIC TO BE CARRIED THROUGH PROJECT**

FINAL PLANS APPROVED BY:
City of Kansas City, Missouri
Department of Public Works
414 E. 12th St.
Kansas City, MO 64106

PUBLIC WORKS DIRECTOR: Sherri McIntyre, P.E. — Date 6/2/17

CITY ENGINEER: Jeff Martin, P.E. — Date 6/2/17

PREPARED AND SUBMITTED BY:
George Butler Associates, Inc.

PROJECT ENGINEER: David J. Mennenga, P.E., PTOE — Date 6/2/17

**COVER SHEET**


D11-1 (1)

M5-1L (2)

M5-1R (3)

M5-2L (4)

M6-1L (5)

M6-3 (6)

M6-6L (7)


R3-17 (8)


R3-17aP (9)


R3-17bP (10)


R4-11 (11)


R7-9a (12)


R7-9a (13)

## SIGN LEGEND




## GENERAL NOTES

All signing equipment shall be salvaged and returned to the Owner, unless otherwise instructed by the inspector. The Owner maintains the first right of refusal of any of the equipment listed. The project inspector will make an on-site assessment to determine if the equipment should be salvaged or disposed. Any equipment that will not be salvaged shall become the property of the contractor. All equipment to be returned shall be returned in the same condition as it was prior to removal. Disassembly of equipment shall be done prior to returning the equipment.

Traffic to be carried through project. All temporary traffic control shall be based on MUTCD Typical Applications and shall be MUTCD compliant. All work shall be mobile, short duration or short-term stationary. All temporary traffic control shall be bid under the temporary traffic control devices shown on the bid estimate. Any additional devices, work, or material necessary for temporary traffic control shall be subsidiary to other bid items.

For additional specifications and details, refer to the Project Bid Manual for CMAQ 3301 (463), City Project No. 89020191.

KCMO Traffic Signals, KCMO Street Lights, KCMO Water, and KCMO Sewer utility facility location information is stored in the Missouri One Call system under the umbrella name of "City of Kansas City Water". For City map information for each of these utility's facilities, contact the respective first contact persons listed above.

MoDOT is a member of Missouri One Call (800 Dig Rite). MoDOT utility facilities include but are not limited to traffic signal cables, highway lighting circuits, ITS cables, cathodic protection cables, etc. It shall be noted in the plans or specifications that in addition to contacting MoOneCall for work on MoDOT property, the contractor shall also complete the Notice of Intent to Perform Work form located at the Missouri Department of Transportation website: http://www.modot.mo.gov/asp/intentToWork.shtml
MoDOT Customer Service: 888-275-6636 (Ask MoDOT)

## LEGEND

Permanent Sign (Installed on Project)

STATE OF MISSOURI
DAVID J. MENNENGA
NUMBER PE-2001029636
6/2/17
PROFESSIONAL ENGINEER

GBA
architects
engineers
9801 Renner Boulevard
Lenexa, Kansas 66219
913.492.0400
www.gbateam.com

David J. Mennenga
Professional Engineer
License No. E-2001029636

DATE: 05/17/2017
DESIGN BY: DJM
DRAWN BY: CMN
PROJECT NO.: 13621.01
SHEET NO.: 2
TOTAL SHEETS: 12

**BENTON BLVD - BICYCLE FACILITIES PAVEMENT MARKING AND SIGNING**
Kansas City, MO CMAQ No. 3301 (463)

| NO. | DATE | REVISIONS | BY | APPROVED |
|---|---|---|---|---|
| | | | | |
| | | | | |

**PLAN SHEET 1 OF 6**

STATE OF MISSOURI
DAVID J. MENNENGA
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PROFESSIONAL ENGINEER
6/2/17

GBA
architects
engineers

9801 Renner Boulevard
Lenexa, Kansas 66219
913.492.0400
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|---|---|
| DATE: | 05/17/2017 |
| DESIGN BY: | DJM |
| DRAWN BY: | CMN |
| PROJECT NO.: | 13621.01 |
| SHEET NO. | 3 |
| TOTAL SHEETS | 12 |

David J. Mennenga
Professional Engineer
License No. E-2001029636

# BENTON BLVD - BICYCLE FACILITIES PAVEMENT MARKING AND SIGNING

Kansas City, MO — CMAQ No. 3301 (463)

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|---|---|---|---|---|
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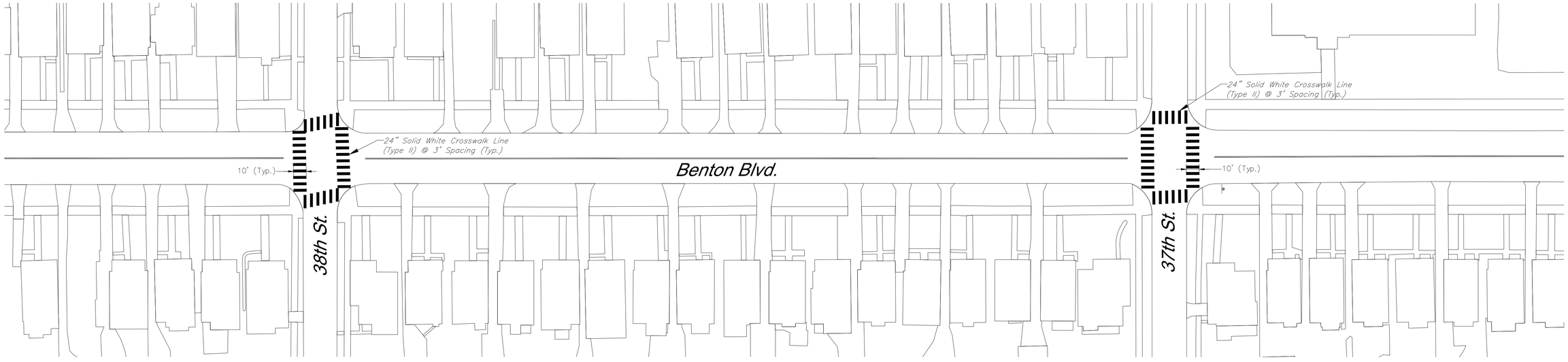


**PLAN SHEET 2 OF 6**

STATE OF MISSOURI
DAVID J. MENNENGA
NUMBER PE-2001029636
6/2/17
PROFESSIONAL ENGINEER

GBA
architects
engineers
9801 Renner Boulevard
Lenexa, Kansas 66219
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www.gbateam.com

David J. Mennenga
Professional Engineer
License No. E-2001029636

| | |
|---|---|
| DATE: | 05/17/2017 |
| DESIGN BY: | DJM |
| DRAWN BY: | CMN |
| PROJECT NO.: | 13621.01 |
| SHEET NO. | 4 |
| TOTAL SHEETS | 12 |

# BENTON BLVD - BICYCLE FACILITIES PAVEMENT MARKING AND SIGNING

Kansas City, MO — CMAQ No. 3301 (463)

| NO. | DATE | REVISIONS | BY | APPROVED |
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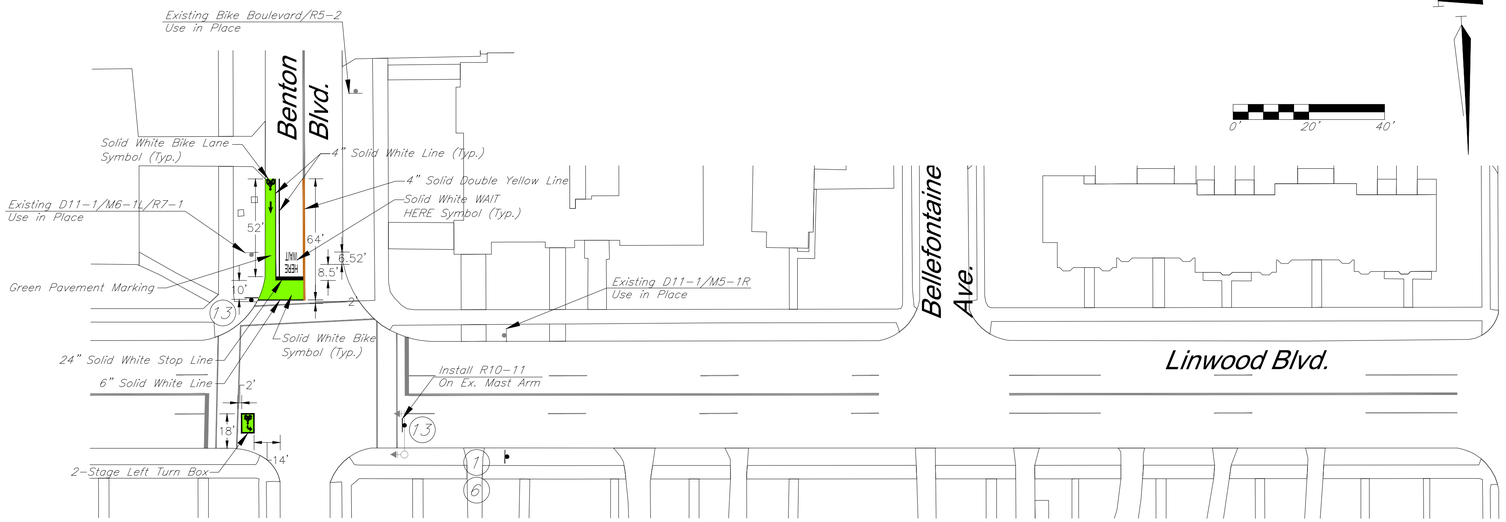


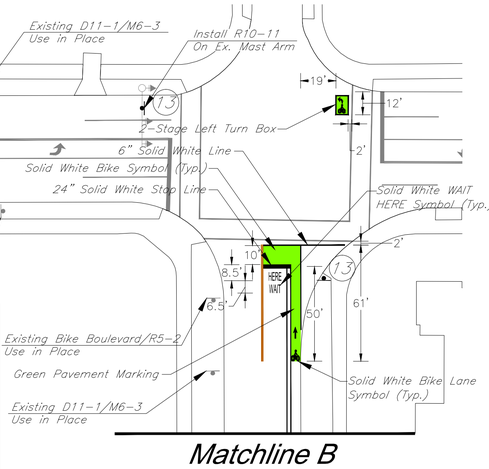


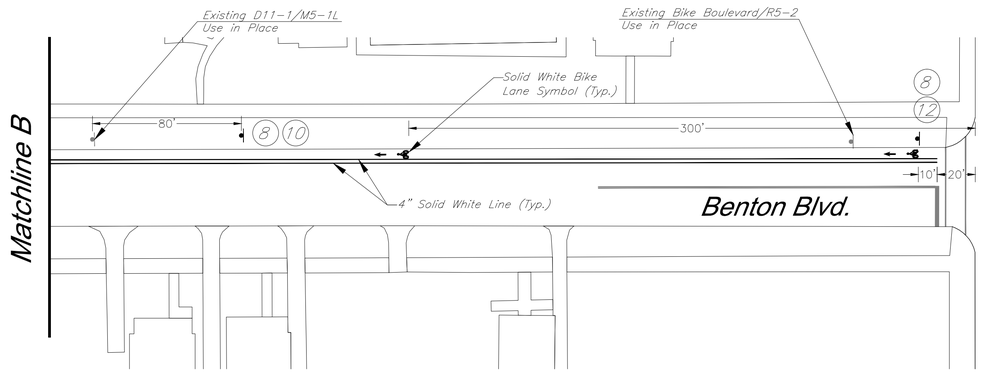


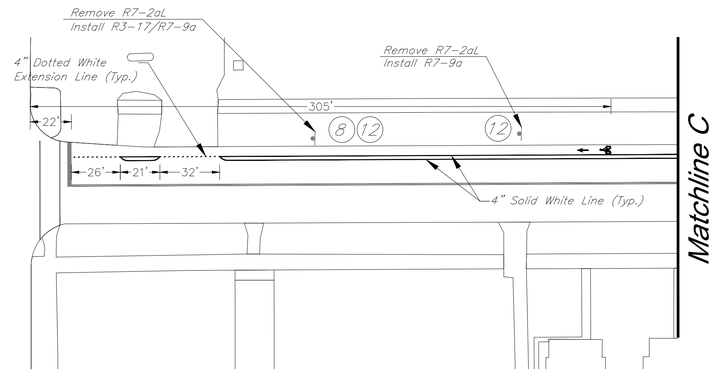


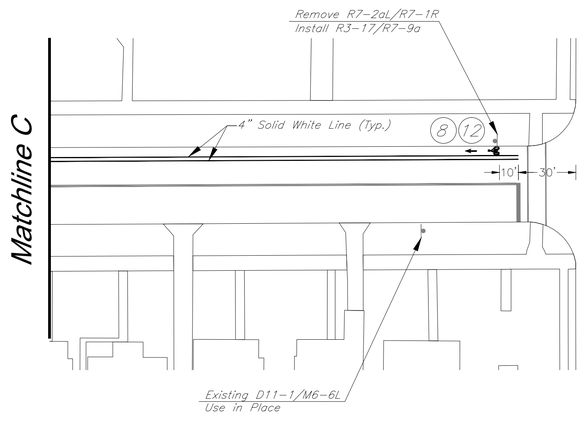


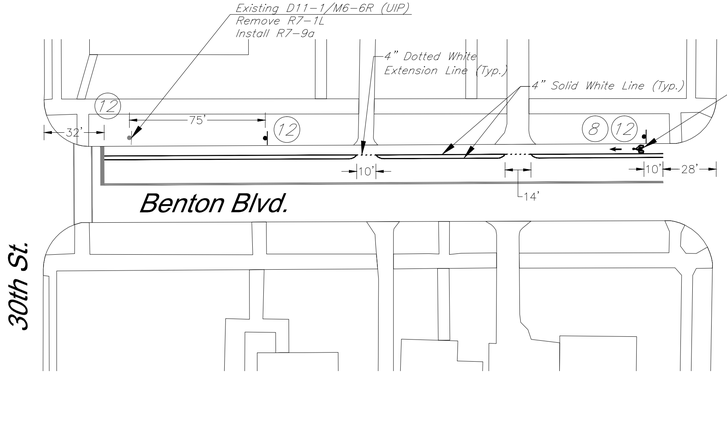


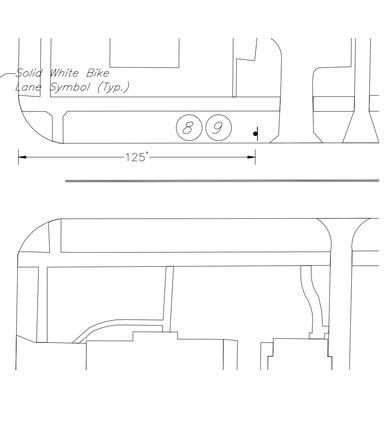


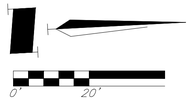


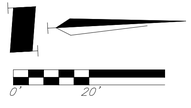

STATE OF MISSOURI
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NUMBER PE-2001029636
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6/2/17

GBA
architects
engineers
9801 Renner Boulevard
Lenexa, Kansas 66219
913.492.0400
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|---|---|
| DATE: | 05/17/2017 |
| DESIGN BY: | DJM |
| DRAWN BY: | CMN |
| PROJECT NO.: | 13621.01 |
| SHEET NO. | 5 |
| TOTAL SHEETS | 12 |

David J. Mennenga
Professional Engineer
License No. E-2001029636

# BENTON BLVD - BICYCLE FACILITIES PAVEMENT MARKING AND SIGNING

Kansas City, MO — CMAQ No. 3301 (463)

| NO. | DATE | REVISIONS | BY | APPROVED |
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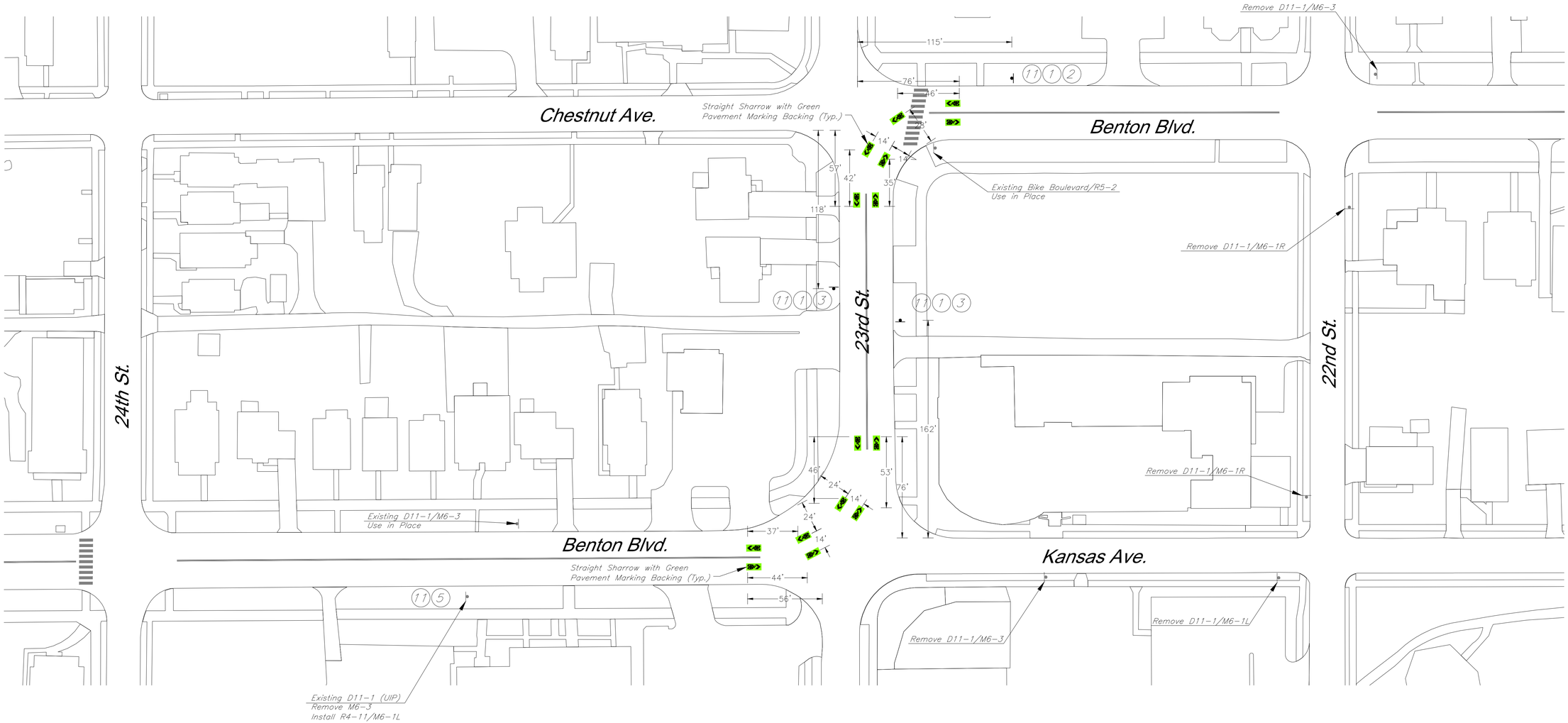


PLAN SHEET 4 OF 6

STATE OF MISSOURI
DAVID J. MENNENGA
NUMBER PE-2001029636
PROFESSIONAL ENGINEER
6/2/17

GBA
architects
engineers
9801 Renner Boulevard
Lenexa, Kansas 66219
913.492.0400
www.gbateam.com

| | |
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| DATE: | 05/17/2017 |
| DESIGN BY: | DJM |
| DRAWN BY: | CMN |
| PROJECT NO.: | 13621.01 |
| SHEET NO. | 6 |
| TOTAL SHEETS | 12 |

David J. Mennenga
Professional Engineer
License No. E-2001029636

# BENTON BLVD - BICYCLE FACILITIES PAVEMENT MARKING AND SIGNING

Kansas City, MO — CMAQ No. 3301 (463)

| NO. | DATE | REVISIONS | BY | APPROVED |
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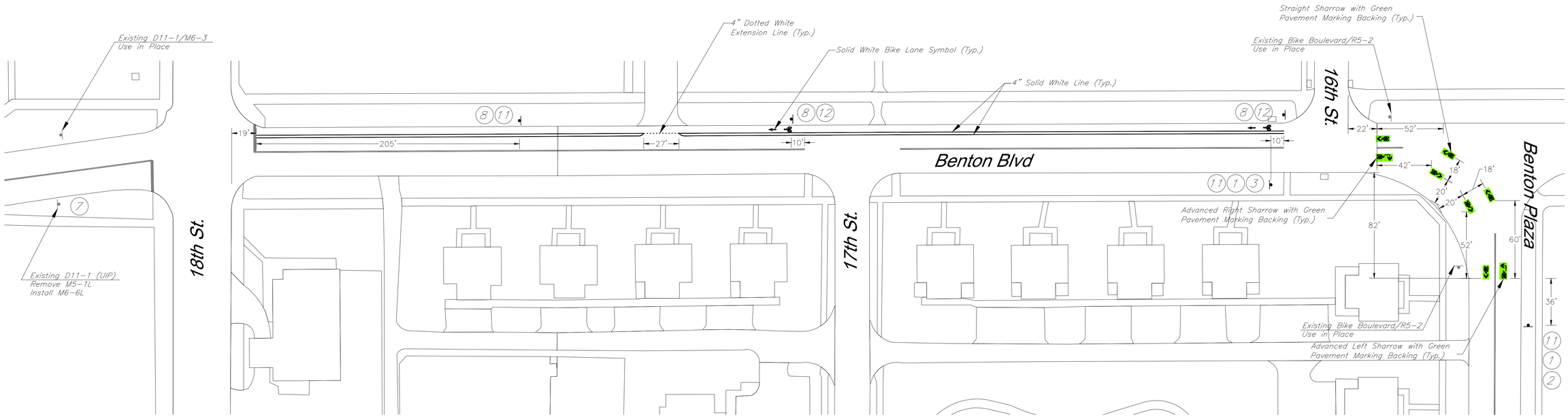
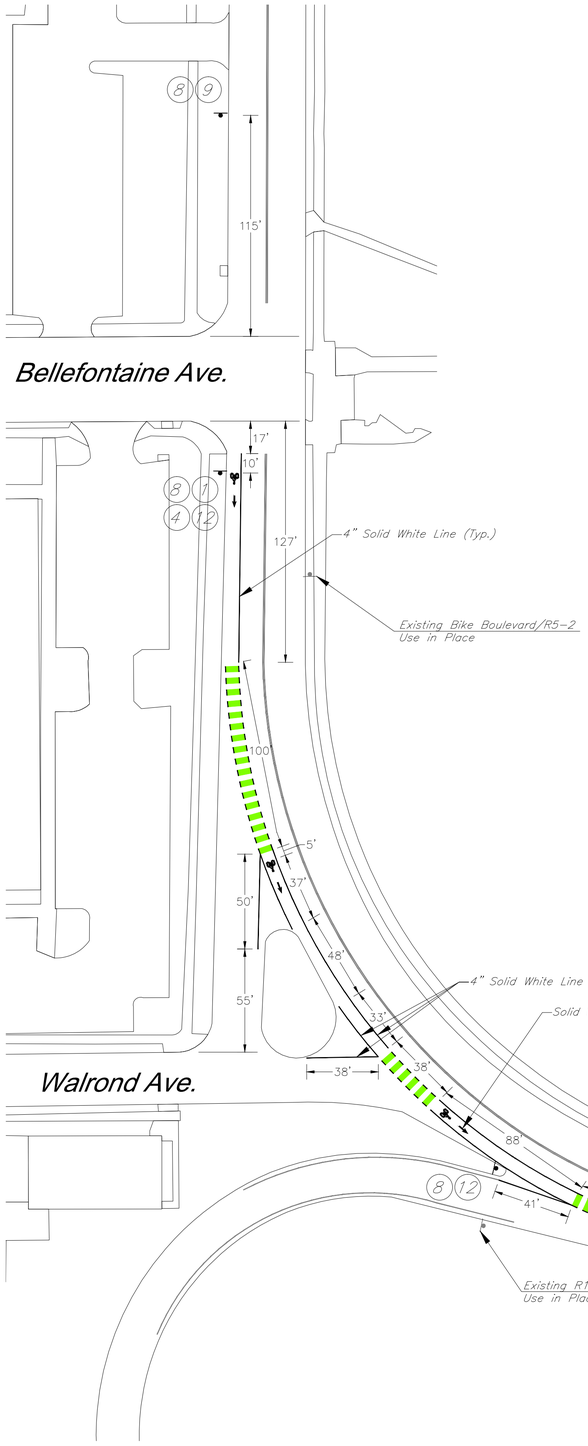
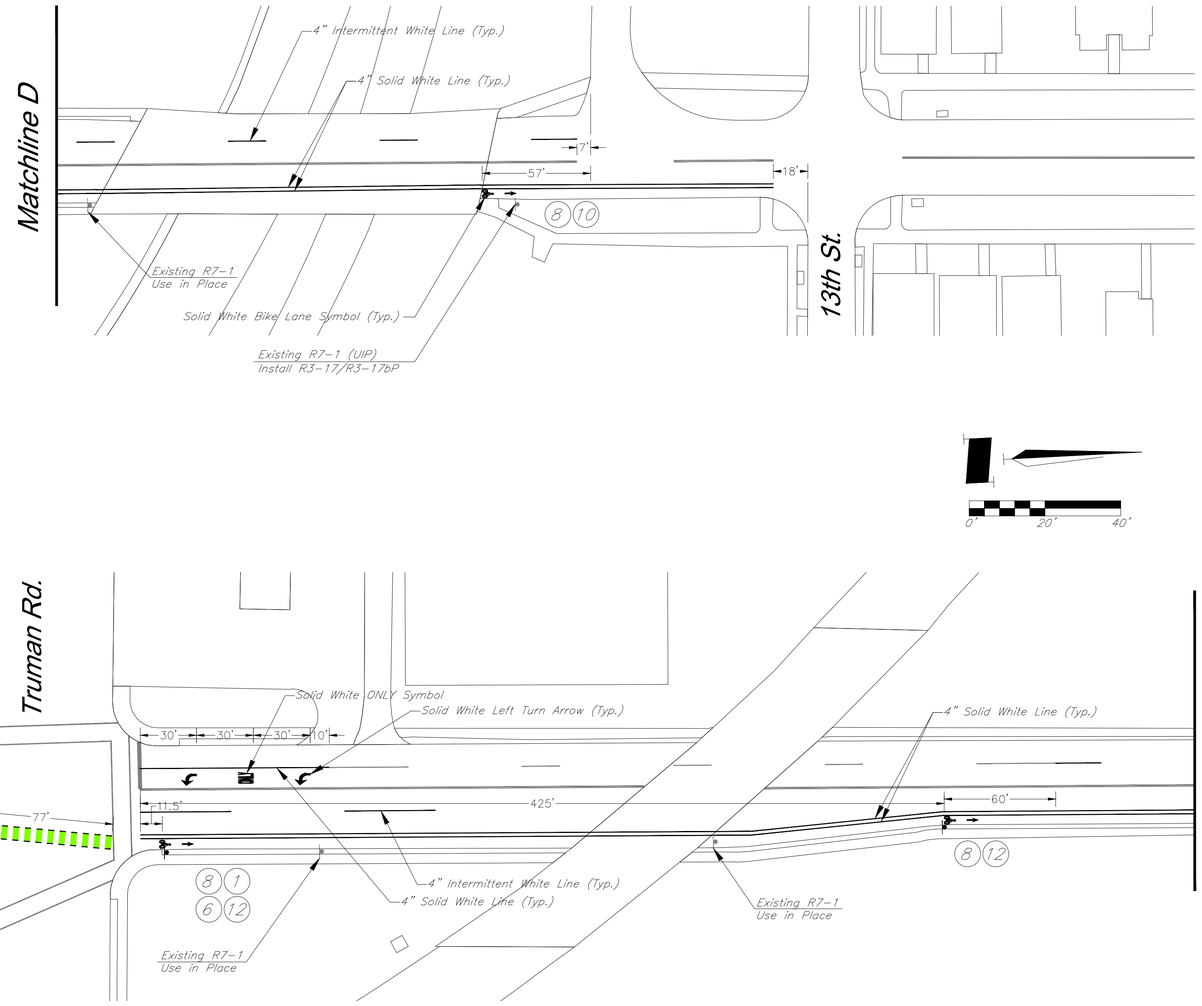



**PLAN SHEET 5 OF 6**




STATE OF MISSOURI
DAVID JOHN MENNENGA
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6/2/17
PROFESSIONAL ENGINEER

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architects
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9801 Renner Boulevard
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| | |
|---|---|
| DATE: | 05/17/2017 |
| DESIGN BY: | DJM |
| DRAWN BY: | CMN |
| PROJECT NO.: | 13621.01 |
| SHEET NO. | 7 |
| TOTAL SHEETS | 12 |

David J. Mennenga
Professional Engineer
License No. E-2001029636

# BENTON BLVD - BICYCLE FACILITIES PAVEMENT MARKING AND SIGNING

Kansas City, MO — CMAQ No. 3301 (463)

| NO. | DATE | REVISIONS | BY | APPROVED |
|---|---|---|---|---|
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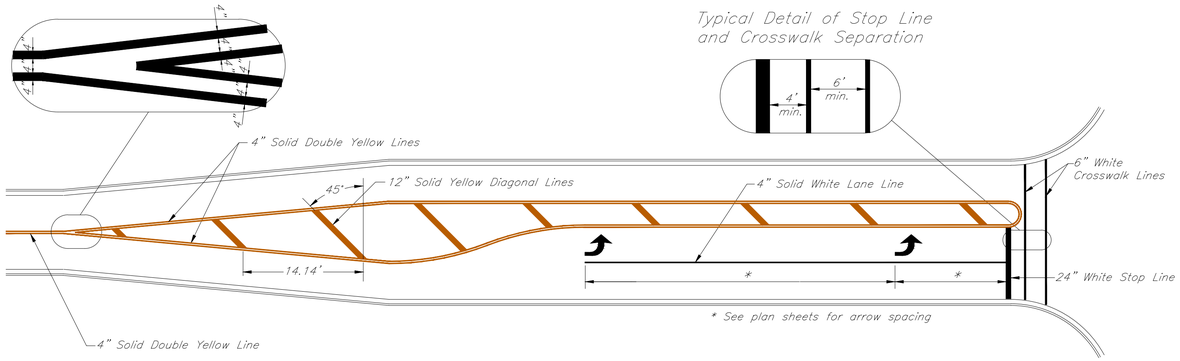
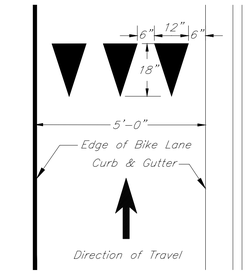
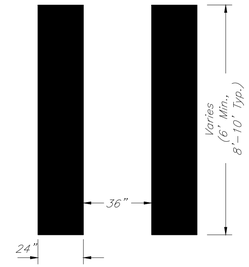
**PLAN SHEET 6 OF 6**



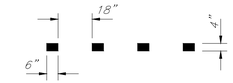

**Typical Striped Left Turn Median Markings**



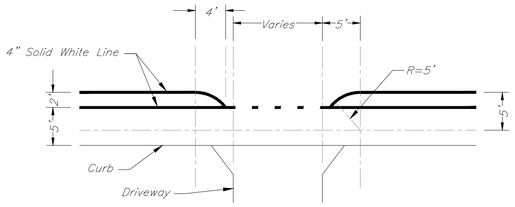

**Bicycle Yield Line Detail**



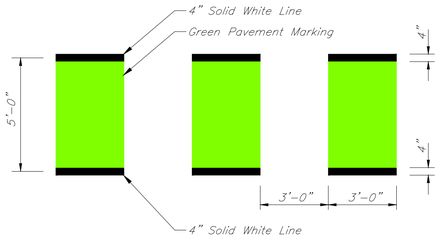

**24" Crosswalk Detail**




**4" Dotted Extension Line**




**Typical Driveway Detail**

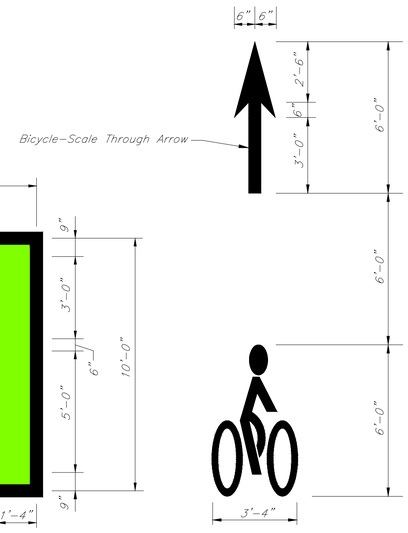



**Intermittent Cycle Track Detail**

*NOTE: Intermittent Cycle Track shall be quantified as separate quantities for 4" Solid White Line and Green Pavement Marking Paint.*


**Bicycle-Scale Yield Marking**




**Symbol Details**

*NOTE: Word & symbol markings shall be white and as per the latest edition of the MUTCD.*

## SUMMARY OF QUANTITIES*

| ITEMS | TOTAL | UNITS |
|---|---|---|
| White Thermoplastic Pavement Marking (4") | 12,923 | L.F. |
| White Thermoplastic Pavement Marking (6") | 67 | L.F. |
| White Preformed Thermoplastic Line (24") | 767 | L.F. |
| Yellow Thermoplastic Pavement Marking (4") | 252 | L.F. |
| Green Thermoplastic Pavement Marking | 3,101 | S.F. |
| White Preformed Thermoplastic ONLY Symbol | 1 | EACH |
| White Preformed Thermoplastic Left Turn Arrow (8') | 2 | EACH |
| White Preformed Thermoplastic WAIT HERE Symbol | 2 | EACH |
| White Preformed Thermoplastic Through Sharrow Symbol | 21 | EACH |
| White Preformed Thermoplastic Advanced Left Sharrow Symbol | 1 | EACH |
| White Preformed Thermoplastic Advanced Right Sharrow Symbol | 1 | EACH |
| White Preformed Thermoplastic Bike Lane with Arrow Symbol | 23 | EACH |
| White Preformed Thermoplastic Bike Symbol | 2 | EACH |
| White and Green Thermoplastic Left Turn Bike Box | 2 | EACH |

* Summary of Quantities has been prepared solely for the Contractor's convenience and is not guaranteed to be a complete list of materials needed for this project.

## PAVEMENT MARKING QUANTITIES

| LOCATION FROM | LOCATION TO | 4" SOLID WHITE LINE (L.F.) | 4" DOTTED WHITE EXTENSION LINE (L.F.) | 4" INTER-MITTANT WHITE LINE (L.F.) | 6" SOLID WHITE LANE LINE (L.F.) | 24" SOLID WHITE STOP LINE (L.F.) | 24" SOLID WHITE CROSSWALK LINE (L.F.) | 4" SOLID DOUBLE YELLOW LINE (L.F.) | GREEN PAVEMENT MARKING (S.F.) | ONLY (EACH) | ← (EACH) | HERE WAIT (EACH) | (EACH) | (EACH) | (EACH) | (EACH) | (EACH) | (EACH) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emanuel Cleaver | 46th St. | 5,413 | 42 | | | | | | | | | | | | | 7 | | |
| 38th St. | 37th St. | | | | | | 640 | | | | | | | | | | | |
| Linwood Blvd. | 29th St. | 2,814 | 21 | | 67 | 30 | 97 | 252 | 960 | | | 2 | | | | 7 | 2 | 2 |
| 24th St. | 22nd St. | | | | | | | | 825 | | | | 15 | | | | | |
| 18th St. | Benton Plaza | 1,543 | 7 | | | | | | 486 | 1 | 2 | | 6 | 1 | 1 | 2 | | |
| Benton Plaza | 13th St. | 2,953 | | 130 | | | | | 930 | | | | | | | 7 | | |
| TOTAL | | 12,723' | 70' | 130' | 67' | 30' | 737' | 252' | 3,101 S.F. | 1 | 2 | 2 | 21 | 1 | 1 | 23 | 2 | 2 |

*NOTE: Pavement markings occurring within intersections or on cross-streets are quantified with the segment to the West. Linear feet measurements denote actual length of material.*

# PAVEMENT MARKING DETAILS AND QUANTITIES

STATE OF MISSOURI — DAVID J. MENNENGA — NUMBER PE-2001029636 — PROFESSIONAL ENGINEER — 6/2/17

David J. Mennenga
Professional Engineer
License No. E-2001029636

GBA architects engineers
9801 Renner Boulevard
Lenexa, Kansas 66219
913.492.0400
www.gbateam.com

| | |
|---|---|
| DATE: | 05/17/2017 |
| DESIGN BY: | DJM |
| DRAWN BY: | CMN |
| PROJECT NO.: | 13621.01 |
| SHEET NO. | 8 |
| TOTAL SHEETS | 12 |

**BENTON BLVD - BICYCLE FACILITIES PAVEMENT MARKING AND SIGNING**
Kansas City, MO — CMAQ No. 3301 (463)

| NO. | DATE | REVISIONS | BY | APPROVED |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

## Pavement Installation Sequence

1. Sign post anchor driven into subgrade prior to the placement of the pavement.
2. Anchor sleeve driven into subgrade over the sign post anchor prior to the placement of the pavement.
3. Insert sign post into the sign post anchor and bolt in place.

## Ground Installation Sequence

1. Sign post anchor driven into the ground.
2. Anchor sleeve driven into ground over the sign post anchor.
3. Insert sign post into the sign post anchor and bolt in place.

## General Notes

In all installations the first hole above the finished grade level in all three units must be in line for insertion of the corner bolt.

All corner bolts and nuts for fastening the signs and sign post assembly shall comply the applicable ANSI standards and ASTM testing requirements and shall be subidiary items.

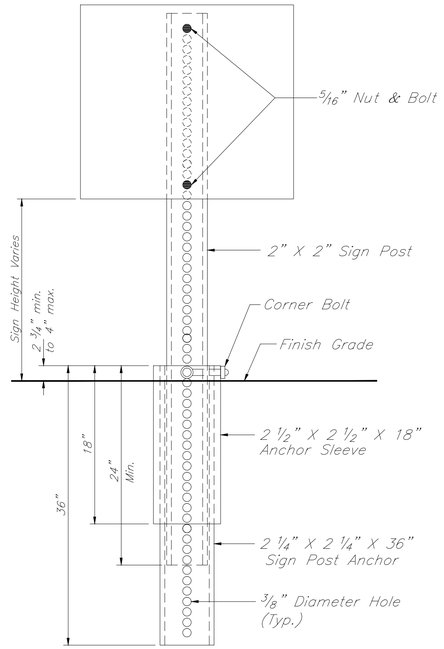
All Components shall be galvanized.

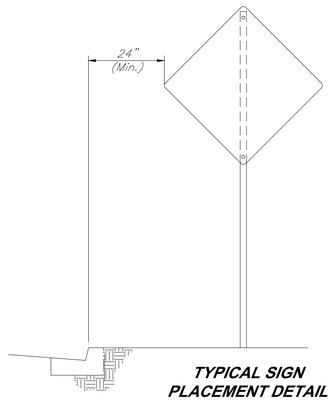
## Sign Notes:

1. All letter, number & symbol sizes, spacing & colors, and the sign colors shall conform to the current "Manual On Uniform Traffic Control Devices."
2. Sign blank material shall be as follows:

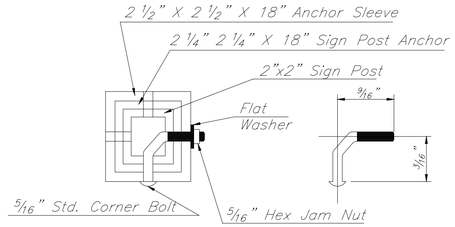
| | |
|---|---|
| Signs 36"X36" or greater | 0.100" thick |
| Guide Signs | 0.125" thick |
| All other signs | 0.080" thick |

3. All sign mounting hardware shall be galvanized.
4. All sign faces shall be fabricated using ASTM Type III Prismatic reflective sheeting.



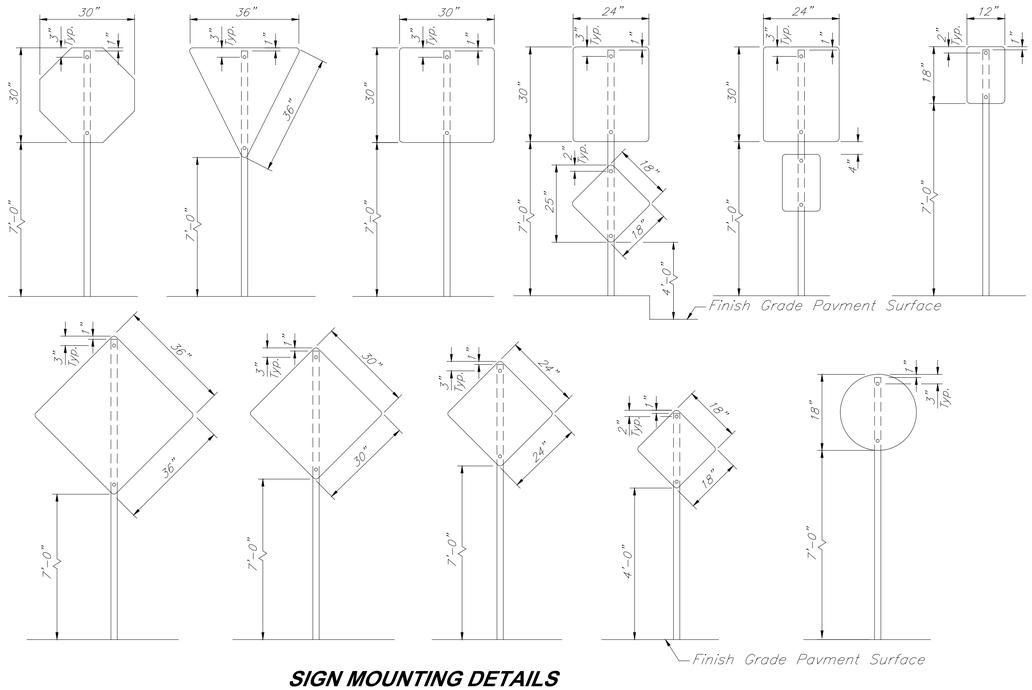

**TYPICAL SIGN PLACEMENT DETAIL**




**SECTION A-A**

**5/16" CORNER BOLT DETAIL** (all bolts)

## BREAK-AWAY SIGN POST DETAIL




## SIGN MOUNTING DETAILS

## SUMMARY OF QUANTITIES*

| ITEMS | TOTAL | UNITS |
|---|---|---|
| D11-1 (24"x18") (Bike Route) | 8 | EACH |
| M5-1L (21"x15") (Advanced Left Arrow) | 2 | EACH |
| M5-1R (21"x15") (Advanced Right Arrow) | 3 | EACH |
| M5-2L (21"x15") (Advanced Diagonal Left Arrow) | 1 | EACH |
| M6-1L (21"x15") (Left Arrow) | 1 | EACH |
| M6-3 (21"x15") (Straight Arrow) | 2 | EACH |
| M6-6L (21"x15") (Straight & Left Arrow) | 1 | EACH |
| R3-17 (24"x18") (Bike Lane) | 23 | EACH |
| R3-17aP (24"x8") (Ahead) | 3 | EACH |
| R3-17bP (24"x8") (Ends) | 5 | EACH |
| R4-11 (30"x30") (Bikes May Use Full Lane) | 6 | EACH |
| R7-9a (12"x18") (No Parking Bike Lane) | 23 | EACH |
| R10-11 (36"x48") (No Turn on Red) | 4 | EACH |
| Sign Post, Anchor, and Footing | 34 | EACH |
| Attachment to Existing Mast Arm/Signal Pole | 2 | EACH |

* Summary of Quantities has been prepared solely for the Contractor's convenience and is not guaranteed to be a complete list of materials needed for this project. All equipment, materials, and work necessary to install signs on existing posts shall be subsidiary to the sign bid item. All equipment, materials, and work necessary to remove existing signs on existing posts shall be subsidiary to the sign bid item.

## SIGNING QUANTITIES

| LOCATION FROM | LOCATION TO | D11-1 (24"x18") | M5-1L (21"x15") | M5-1R (21"x15") | M5-2L (21"x15") | M6-1L (21"x15") | M6-3 (21"x15") | M6-6L (21"x15") | R3-17 (24"x18") | R3-17aP (24"x8") | R3-17bP (24"x8") | R4-11 (30"x30") | R7-9a (12"x18") | R10-11 (36"x48") | SIGN POST, ANCHOR, AND FOOTING | SIGN MAST ARM ATTACH-MENT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emanuel Cleaver | 46th St. | | | | | | | | 8 | 1 | 2 | | 10 | | 13 | |
| 38th St. | 37th St. | | | | | | | | | | | | | | | |
| Linwood Blvd. | 29th St. | 1 | | | | | 1 | | 6 | 1 | 1 | | 7 | 2 | 8 | 2 |
| 24th St. | 22nd St. | 3 | 1 | 2 | | 1 | | | | | | 4 | | | 3 | |
| 18th St. | Benton Plaza | 2 | 1 | 1 | | | | 1 | 3 | | 1 | 2 | 2 | | 5 | |
| Benton Plaza | 13th St. | 2 | | | 1 | | 1 | | 6 | 1 | 1 | | 4 | | 5 | |
| | TOTAL | 8 | 2 | 3 | 1 | 1 | 2 | 1 | 23 | 3 | 5 | 6 | 23 | 2 | 34 | 2 |

NOTE: Signing within intersections, on cross-streets, or on adjacent portions of roadway are quantified with the segment.

## SIGNING DETAILS AND QUANTITIES

STATE OF MISSOURI — DAVID J. MENNENGA — NUMBER PE-2001029636 — PROFESSIONAL ENGINEER — 6/2/17

GBA architects engineers
9801 Renner Boulevard
Lenexa, Kansas 66219
913.492.0400
www.gbateam.com

| | |
|---|---|
| DATE: | 05/17/2017 |
| DESIGN BY: | DJM |
| DRAWN BY: | CMN |
| PROJECT NO.: | 13621.01 |
| SHEET NO. | 9 |
| TOTAL SHEETS | 12 |

David J. Mennenga
Professional Engineer
License No. E-2001029636

**BENTON BLVD - BICYCLE FACILITIES PAVEMENT MARKING AND SIGNING**
Kansas City, MO — CMAQ No. 3301 (463)

| NO. | DATE | REVISIONS | BY | APPROVED |
|---|---|---|---|---|
| | | | | |
| | | | | |

STATE OF MISSOURI
DAVID J. MENNENGA
NUMBER PE-2001029636
6/2/17
PROFESSIONAL ENGINEER

GBA architects engineers
9801 Renner Boulevard
Lenexa, Kansas 66219
913.492.0400
www.gbateam.com

David J. Mennenga
Professional Engineer
License No. E-2001029636

| | |
|---|---|
| DATE: | 05/17/2017 |
| DESIGN BY: | DJM |
| DRAWN BY: | CMN |
| PROJECT NO.: | 13621.01 |
| SHEET NO. | 10 |
| TOTAL SHEETS | 12 |

**BENTON BLVD - BICYCLE FACILITIES**
**PAVEMENT MARKING AND SIGNING**
Kansas City, MO CMAO No. 3301 (463)

| NO. | DATE | REVISIONS | BY | APPROVED |
|---|---|---|---|---|
| | | | | |
| | | | | |

## 616.8.1 (TA-1) Work Beyond the Shoulder on Divided and Undivided Highways- MT

| SPEED | SIGN SPACING (ft.) | | TAPER LENGTH (ft.) | | OPTIONAL BUFFER LENGTH (ft.) (B) | CHANNELIZER SPACING (ft.) | |
|---|---|---|---|---|---|---|---|
| | Undivided (S) | Divided (S) | Shoulder[1] (T1) | Lane[2] (T2) | | Tapers | Buffer/ Work Areas |
| 0-35 | 200 | 200 | - | - | - | - | - |
| 40-45 | 350 | 500 | - | - | - | - | - |
| 50-55 | 500 | 1000 | - | - | - | - | - |
| 60-70 | 1000 | 1000 | - | - | - | - | - |

**1** Shoulder taper length based on 10 ft. (standard shoulder width) offset **2** Lane taper length based on 12 ft. (standard lane width) offset

| ROADWAY TYPE | SIGN HEIGHT | MAXIMUM WORK ZONE LENGTH (L) |
|---|---|---|
| URBAN | 1' Portable 7' Post | 1 Mi. |
| RURAL DIVIDED | 1' Portable 7' Post | 2 Mi. |
| RURAL UNDIVIDED | 1' Portable 5' Post | 3 Mi. |

If work vehicles or equipment are located on the shoulder, refer to appropriate shoulder work typical applications.

On multi-lane, divided highways, signs advising of shoulder work or the condition of the shoulder **should** be placed only on the side of the affected shoulder.

If work is being performed in the median, signs **may** be required for both directions of travel based on the following paragraph.

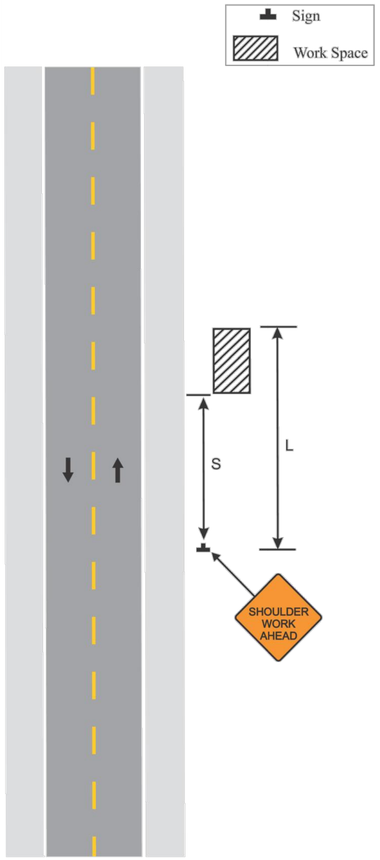
The SHOULDER WORK AHEAD sign **may** be omitted where the work space is 15 ft. or more from the edge of any shoulder, beyond the ditch line, or behind the curb. Should the roadway not have a shoulder, then 15 ft. or more from the edge of the roadway.

For short duration or mobile operations, signs **may** be reduced or eliminated if a work vehicle with activated rotating lights or strobe lights is used.

Vehicle hazard warning signals **shall** not be used instead of the vehicle's rotating lights or strobe lights.

Other appropriate signs **may** be used in lieu of the SHOULDER WORK AHEAD sign.

Where sidewalks are impacted, refer to **EPG 616.8.28 (TA-28) Sidewalk Detour or Diversion** or **616.8.28 (TA-28) Crosswalk Closures and Pedestrian Detours**.




TA-1

## 616.8-3 (TA-3) Shoulder Work on Undivided Highways - MT

| SPEED | SIGN SPACING (ft.) | | TAPER LENGTH (ft.) | | OPTIONAL BUFFER LENGTH (ft.) (B) | CHANNELIZER SPACING (ft.) | |
|---|---|---|---|---|---|---|---|
| | Undivided (S) | Divided (S) | Shoulder[1] (T1) | Lane[2] (T2) | | Tapers | Buffer/ Work Areas |
| 0-35 | 200 | - | 70 | - | 250 | 35 | 50 |
| 40-45 | 350 | - | 150 | - | 360 | 40 | 100 |
| 50-55 | 500 | - | 185 | - | 495 | 50 | 100 |
| 60-70 | 1000 | - | 235 | - | 730 | 60 | 100 |

**1** Shoulder taper length based on 10 ft. (standard shoulder width) offset **2** Lane taper length based on 12 ft. (standard lane width) offset

| ROADWAY TYPE | SIGN HEIGHT | MAXIMUM WORK ZONE LENGTH (L) |
|---|---|---|
| URBAN | 1' Portable 7' Post | 1 Mi. |
| RURAL UNDIVIDED | 1' Portable 5' Post | 3 Mi. |

In addition to shoulder work, this typical application is applicable to work beyond shoulder where vehicles and equipment are parked on the shoulder.

A protective vehicle **shall** be used while work is in progress. The protective vehicle **should** be equipped with a TMA and positioned at least 150 ft. in advance of the work space.

If encroachment onto driving surface occurs and there is not 10 ft. of driving surface available for the lane of traffic, that traffic lane **shall** be closed. Refer to appropriate lane closure typical applications.

If an arrow panel is used for an operation on the shoulder, the caution mode **shall** be displayed.

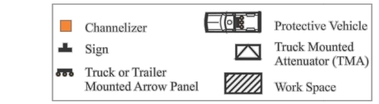
For short duration or mobile operations, signs, channelization devices, and protective vehicles **may** be reduced or eliminated if a work vehicle with activated rotating lights or strobe lights is used. However, if limited sight distance exists, a protective vehicle **should** be used. This protective vehicle **should** be equipped with a TMA and truck mounted flashing arrow panel and positioned at least 150 ft. in advance of the work space or work vehicle, as applicable. If a protective vehicle is used, a vehicle mounted sign **shall** be mounted at a recommended height of 48 in. above the road surface.

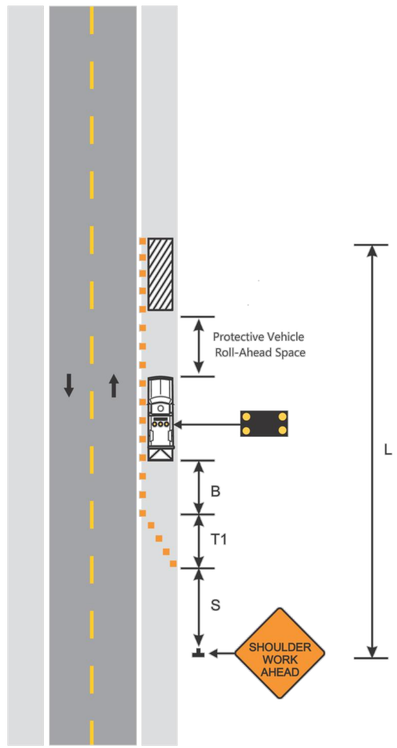
For work beyond shoulder, where vehicles and equipment are parked on the shoulder, the protective vehicle **may** be eliminated if a work vehicle with activated rotating lights or strobe lights is used.

Vehicle hazard warning signals **shall** not be used instead of the vehicle's rotating lights or strobe lights.

Additional warning signs **shall** be erected at each intersection with another state highway within the work zone. Upon the discretion of the supervisor, additional warning signs **may** be erected at other intersections within the work zone.

Other appropriate signs **may** be used in lieu of SHOULDER WORK AHEAD sign.




TA-3


GBA
architects
engineers
9801 Renner Boulevard
Lenexa, Kansas 66219
913.492.0400
www.gbateam.com

| | |
|---|---|
| DATE: | 05/17/2017 |
| DESIGN BY: | DJM |
| DRAWN BY: | CMN |
| PROJECT NO.: | 13621.01 |
| SHEET NO. | 11 |
| TOTAL SHEETS | 12 |

David J. Mennenga
Professional Engineer
License No. E-2001029636

**BENTON BLVD - BICYCLE FACILITIES**
**PAVEMENT MARKING AND SIGNING**
Kansas City, MO CMAO No. 3301 (463)

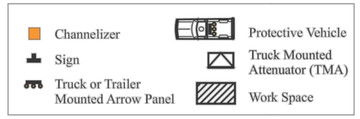
| NO. | DATE | REVISIONS | BY | APPROVED |
|---|---|---|---|---|
| | | | | |
| | | | | |

## 616.8.5 (TA-5) Shoulder Work on Divided Highways - MT

| SPEED | SIGN SPACING (ft.) | | TAPER LENGTH (ft.) | | OPTIONAL BUFFER LENGTH (ft.) (B) | CHANNELIZER SPACING (ft.) | |
|---|---|---|---|---|---|---|---|
| | Undivided (S) | Divided (S) | Shoulder[1] (T1) | Lane[2] (T2) | | Tapers | Buffer/ Work Areas |
| 0-35 | - | 200 | 70 | - | 250 | 35 | 50 |
| 40-45 | - | 500 | 150 | - | 360 | 40 | 100 |
| 50-55 | - | 1000 | 185 | - | 495 | 50 | 100 |
| 60-70 | SA -1000 and SB - 1500 | | 235 | - | 730 | 60 | 100 |

**1** Shoulder taper length based on 10 ft. (standard shoulder width) offset **2** Lane taper length based on 12 ft. (standard lane width) offset

| ROADWAY TYPE | SIGN HEIGHT | MAXIMUM WORK ZONE LENGTH (L) |
|---|---|---|
| URBAN | 1' Portable 7' Post | 1 Mi. |
| RURAL DIVIDED | 1' Portable 7' Post | 2 Mi. |




In addition to shoulder work, this typical application is applicable to work beyond shoulder where vehicles and equipment are parked on the shoulder.

A protective vehicle **shall** be used while work is in progress. The protective vehicle **should** be equipped with TMA and positioned at least 150 ft. in advance of the work space.

If encroachment onto driving surface occurs and there is not 10 ft. of driving surface available for the lane of traffic, that traffic lane **shall** be closed. Refer to appropriate lane closure typical applications.

If an arrow panel is used for an operation on the shoulder, the caution mode **shall** be displayed.

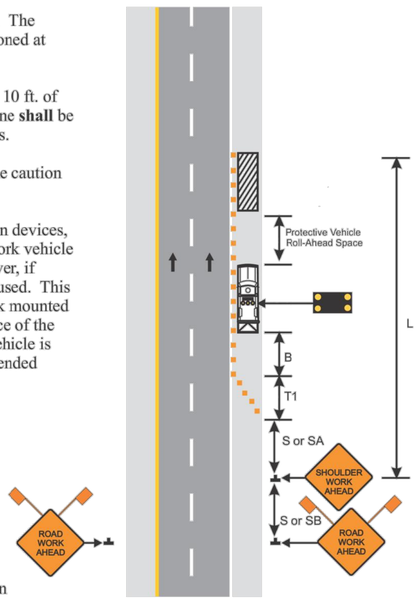
For short duration or mobile operations, signs, channelization devices, and protective vehicles **may** be reduced or eliminated if a work vehicle with activated rotating lights or strobe lights is used. However, if limited sight distance exists, a protective vehicle **should** be used. This protective vehicle **should** be equipped with a TMA and truck mounted flashing arrow panel and positioned at least 150 ft. in advance of the work space or work vehicle, as applicable. If a protective vehicle is used, a vehicle mounted sign **shall** be mounted at a recommended height of 48 in. above the road surface.

For work beyond shoulder, where vehicles and equipment are parked on the shoulder, the protective vehicle **may** be eliminated if a work vehicle with activated rotating lights or strobe lights is used.

Vehicle hazard warning signals **shall** not be used instead of the vehicle's rotating lights or strobe lights.

Additional warning signs **shall** be erected at each intersection with another state highway within the work zone. Upon the discretion of the supervisor, additional warning signs **may** be erected at other intersections within the work zone.

Other appropriate signs **may** be used in lieu of SHOULDER WORK AHEAD sign.



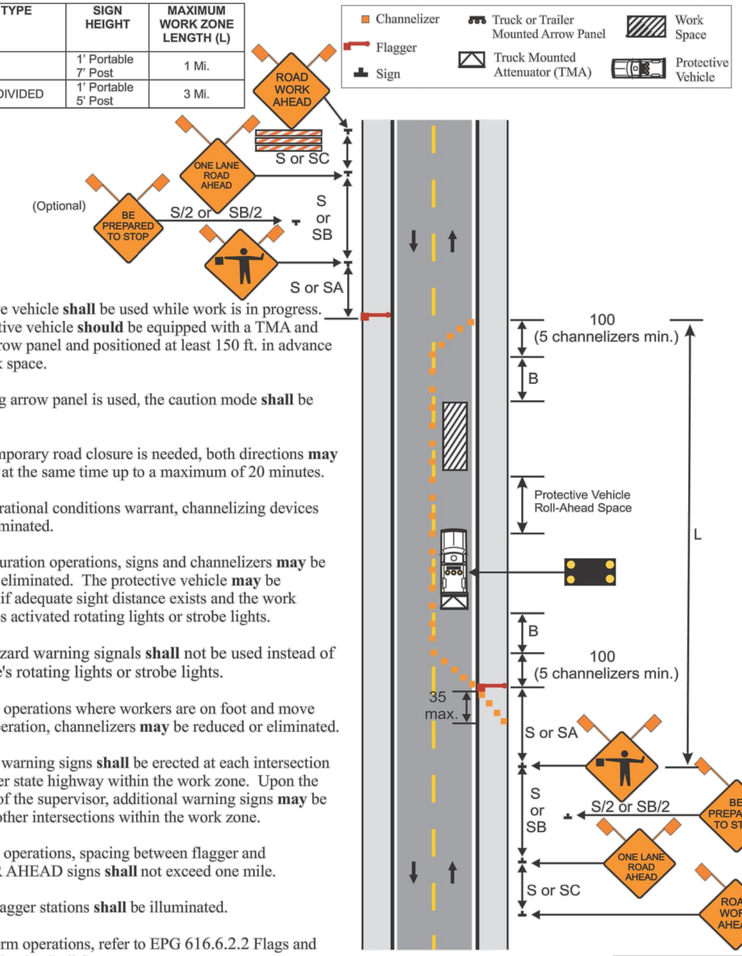



## 616.8.10 (TA-10) Lane Closure on Two-Lane Highways Using Flaggers - MT

| SPEED | SIGN SPACING (ft.) | | TAPER LENGTH (ft.) | | OPTIONAL BUFFER LENGTH (ft.) (B) | CHANNELIZER SPACING (ft.) | |
|---|---|---|---|---|---|---|---|
| | Undivided (S) | Divided (S) | Shoulder[1] (T1) | Lane[2] (T2) | | Tapers | Buffer/ Work Areas |
| 0-35 | 200 | - | - | - | 250 | - | 50 |
| 40-45 | 350 | - | - | - | 360 | - | 100 |
| 50-55 | 500 | - | - | - | 495 | - | 100 |
| 60-70 | SA – 1000, SB - 1500 and SC - 2640 | | - | - | 730 | - | 100 |

**1** Shoulder taper length based on 10 ft. (standard shoulder width) offset **2** Lane taper length based on 12 ft. (standard lane width) offset

| ROADWAY TYPE | SIGN HEIGHT | MAXIMUM WORK ZONE LENGTH (L) |
|---|---|---|
| URBAN | 1' Portable 7' Post | 1 Mi. |
| RURAL UNDIVIDED | 1' Portable 5' Post | 3 Mi. |




A protective vehicle **shall** be used while work is in progress. The protective vehicle **should** be equipped with a TMA and flashing arrow panel and positioned at least 150 ft. in advance of the work space.

If a flashing arrow panel is used, the caution mode **shall** be displayed.

When a temporary road closure is needed, both directions **may** be stopped at the same time up to a maximum of 20 minutes.

Where operational conditions warrant, channelizing devices **may** be eliminated.

For short duration operations, signs and channelizers **may** be reduced or eliminated. The protective vehicle **may** be eliminated if adequate sight distance exists and the work vehicle uses activated rotating lights or strobe lights.

Vehicle hazard warning signals **shall** not be used instead of the vehicle's rotating lights or strobe lights.

For mobile operations where workers are on foot and move with the operation, channelizers **may** be reduced or eliminated.

Additional warning signs **shall** be erected at each intersection with another state highway within the work zone. Upon the discretion of the supervisor, additional warning signs **may** be erected at other intersections within the work zone.

For mobile operations, spacing between flagger and FLAGGER AHEAD signs **shall** not exceed one mile.

At night, flagger stations **shall** be illuminated.

For long-term operations, refer to EPG 616.6.2.2 Flags and Advance Warning Rail System.

For work zone located in the vicinity of a railroad grade crossing, refer to 616.8.46 (TA-46) Work in the Vicinity of a Grade Crossing.

## 616.8.30 (TA-30) Lane Closure on Multi-Lane Undivided Highways - MT

| SPEED | SIGN SPACING (ft.) | | TAPER LENGTH (ft.) | | OPTIONAL | CHANNELIZER SPACING (ft.) | |
|---|---|---|---|---|---|---|---|
| Permanent Posted (mph) | Undivided (S) | Divided (S) | Shoulder (1) (T1) | Lane (2) (T2) | BUFFER LENGTH (ft.) (B) | Tapers | Buffer/ Work Areas |
| 0-35 | 200 | - | 70 | 245 | 280 | 35 | 40 |
| 40-45 | 350 | - | 150 | 540 | 400 | 40 | 80 |
| 50-55 | 500 | - | 185 | 660 | 560 | 50 | 80 |
| 60-70 | 1000 | - | 235 | 840 | 840 | 60 | 120 |

1 Shoulder taper length based on 10 ft. (standard shoulder width) offset. 2. Lane taper length based on 12 ft. (standard lane width) offset.

| TYPE OF ROADWAY | SIGN HEIGHT | MAXIMUM WORK ZONE LENGTH (L) |
|---|---|---|
| URBAN | 1' Portable 7' Post | 1 Mi. |
| RURAL UNDIVIDED | 1' Portable 5' Post | 3 Mi. |

- Channelizer
- Sign
- Truck or Trailer Mounted Arrow Panel
- Protective Vehicle
- Truck Mounted Attenuator (TMA)
- Work Space

(Advanced Warning Rail System) For Long Term Operations

A protective vehicle shall be used while work is in progress. The protective vehicle should be equipped with a TMA and flashing arrow panel and positioned at least 150 ft. in advance of the work space. The protective vehicle may be eliminated if the roadway is posted at 45 mph or below, the work vehicle is positioned in advance of the work space, and the work vehicle uses activated rotating lights or strobe lights.

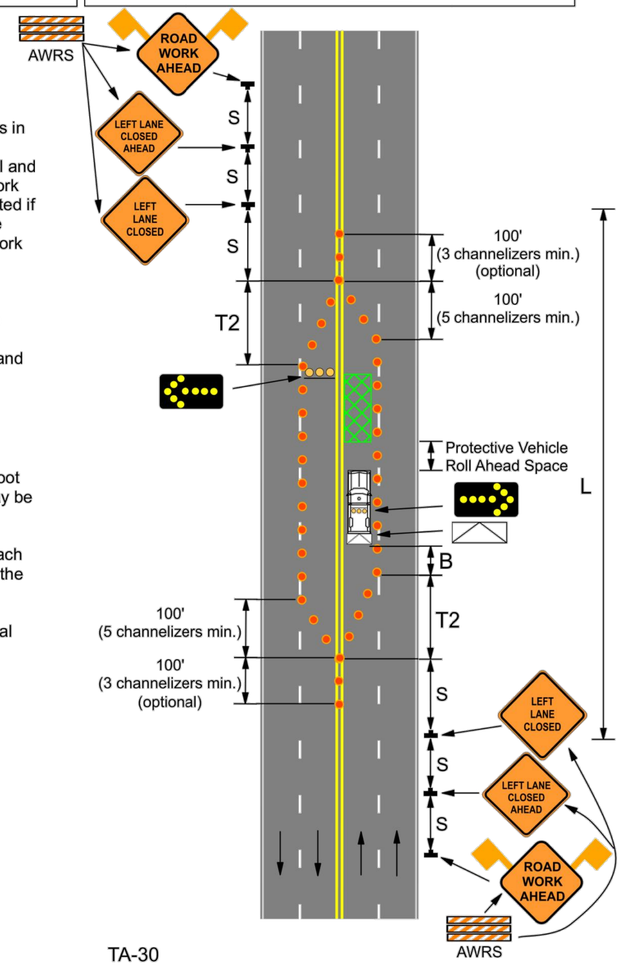
The closure of the adjacent interior lane in the opposing direction may not be necessary, depending upon the activity being performed and the work space needed for the operation.

For short duration operations, signs and channelizers may be reduced or eliminated.

For mobile operations where workers are on foot and move with the operation, channelizers may be reduced or eliminated.

Additional warning signs shall be erected at each intersection with another state highway within the work zone.

Upon the discreiton of the supervisor, additional warning signs may be erected at other intersections within the work zone.




TA-30

STATE OF MISSOURI
DAVID J. MENNENGA
NUMBER PE-2001029636
6/2/17
PROFESSIONAL ENGINEER

GBA
architects
engineers
9801 Renner Boulevard
Lenexa, Kansas 66219
913.492.0400
www.gbateam.com

| | |
|---|---|
| DATE: | 05/17/2017 |
| DESIGN BY: | DJM |
| DRAWN BY: | CMN |
| PROJECT NO.: | 13621.01 |
| SHEET NO. | 12 |
| TOTAL SHEETS | 12 |

David J. Mennenga
Professional Engineer
License No. E-2001029636

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| NO. | DATE | REVISIONS | BY | APPROVED |
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| | | | | |
| | | | | |

**TEMPORARY TRAFFIC CONTROL APPLICATIONS SHEET 3 OF 3**