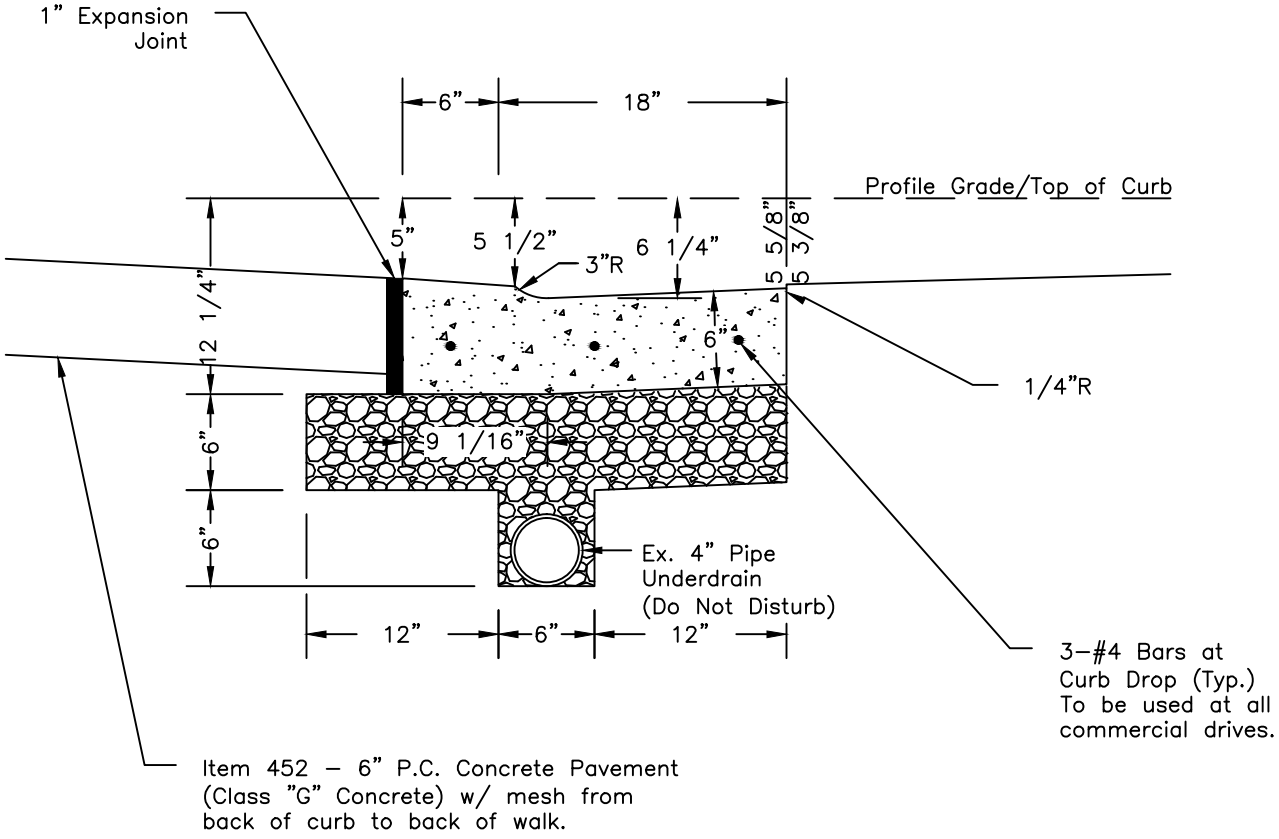
STANDARD CONSTRUCTION DRAWINGS
CITY OF HILLIARD

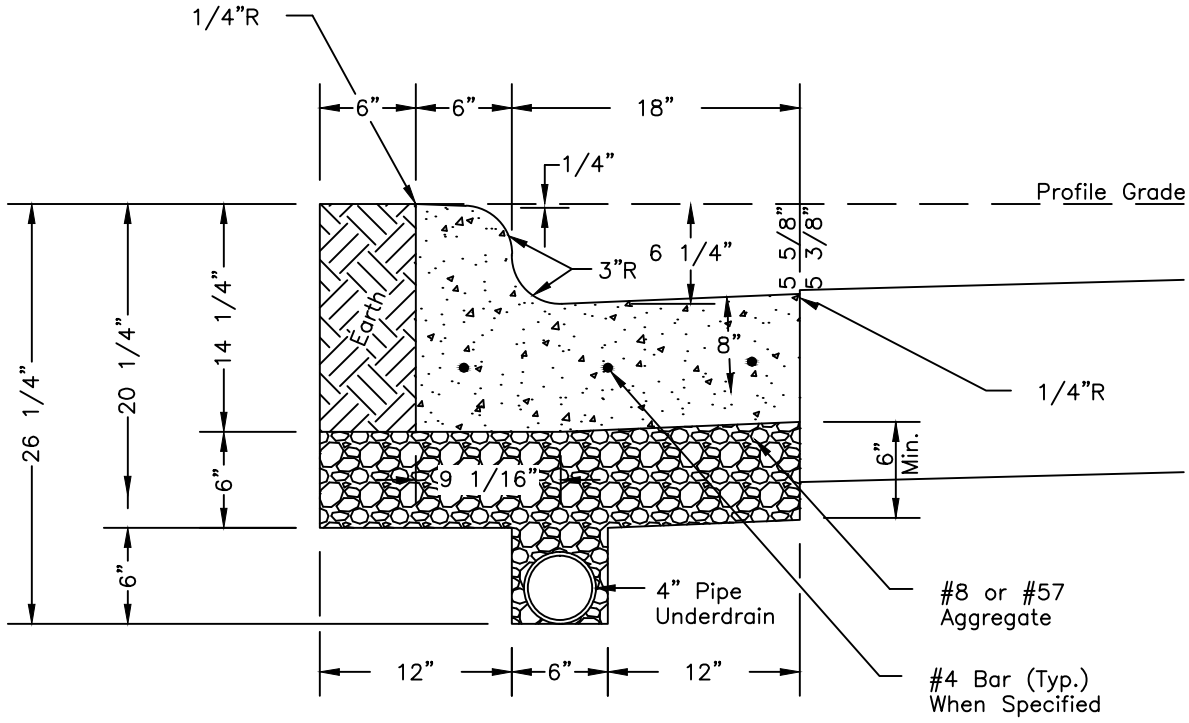


APPROVED CITY ENGINEER DATE	CURB DETAIL DROP CURB AT DRIVE ENTRANCES	CITY OF HILLIARD, OHIO STANDARD CONSTRUCTION DRAWING
SCALE: 1" = 1'		1/1 CD-1

S:\Public Service - Engineering\Hilliard Standards\Drawings\ACAD\Curb Details.dwg, 4/25/2013 8:18:20 AM

Notes:

1. Concrete shall be per Section 499 – P.C. Concrete, Class G.
2. 1.59 CF of concrete per LF.
3. All exposed surfaces of concrete curb & gutter shall have a brush finish.
4. When specified, 3–#4 bars spaced at 9" on center shall be used for reinforcement.



APPROVED CITY ENGINEER DATE	ITEM 609 SPECIAL 8" CONCRETE COMBINED CURB & GUTTER	CITY OF HILLIARD, OHIO STANDARD CONSTRUCTION DRAWING
SCALE: 1" = 1'		1/1 CG–2

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Notes:

1. Concrete shall be per Section 499 – P.C. Concrete, Class G.
2. 1.59 CF of concrete per LF.
3. All exposed surfaces of concrete curb & gutter shall have a brush finish.
4. When specified, 3–#4 bars spaced at 9" on center shall be used for reinforcement.

APPROVED CITY ENGINEER DATE	ITEM 609 SPECIAL 8" CONCRETE COMBINED CURB & GUTTER	CITY OF HILLIARD, OHIO STANDARD CONSTRUCTION DRAWING
SCALE: 1" = 1'		1/1 CG–R2

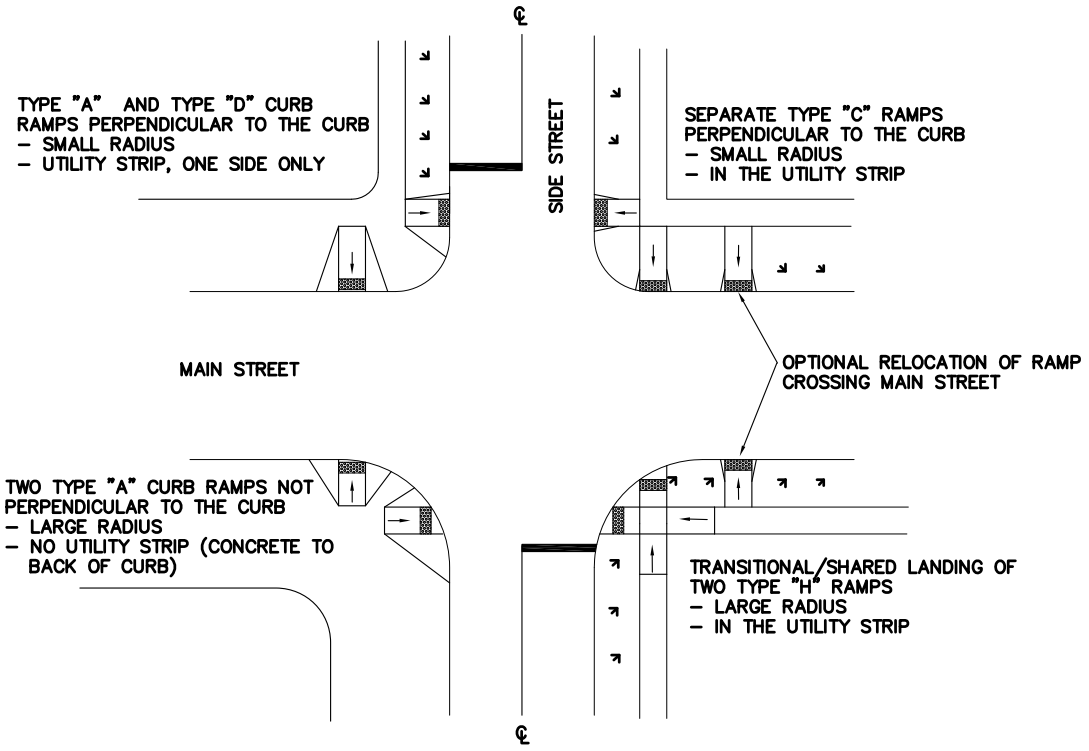
GENERAL NOTES, CURB RAMPS

1. CURB RAMP COMPONENTS: THE CURB RAMP INCLUDES THE RAMP PANEL, FLARED SIDES, AND LANDING WHEN NEEDED.

2. MATERIAL: THE RAMP PANEL AND FLARED SIDES SHALL BE CONCRETE. THE USE OF BRICK OR PAVERS IS NOT PERMITTED.

3. CURB RAMP TYPE: CURB RAMPS SHALL BE SPECIFIED BY THE APPROPRIATE TYPE AND SHALL BE PERPENDICULAR TO THE CENTERLINE OF THE CROSSING STREET
   - TYPE A – RAMP WITH LONG FLARES
   - TYPE C – RAMP IN UTILITY STRIP
   - TYPE D – RAMP OBSTRUCTED ON ONE SIDE
   - TYPE G – RAMP WITH RECESSED LOWER LANDING.
   - TYPE H – RAMP WITH RECESSED LOWER LANDINGIN A UTILITY STRIP
   - TYPE L – MEDIAN RAMP WITH CENTER LANDING
   - TYPE P1 – COMBINED PERPENDICULAR AND PARALLEL RAMP
   - TYPE P2 – COMBINED PERPENDICULAR AND PARALLEL RAMP IN ONE DIRECTION

NOTE: CITY OF HILLIARD ORDER OF PREFERENCE IS (1) KEEP RAMPS IN LINE WITH APPROACH WALKS AND (2) KEEP RAMPS IN FRONT OF SIDE STREET STOP SIGNS. RAMPS THAT DIRECT PEDESTRIANS INTO THE MIDDLE OF AN INTERSECTION AT AN ANGLE ARE NOT PERMITTED. WHEN RAMPS ARE NOT PERPENDICULAR TO THE CURB, A LANDING RECESSED SHALL BE PROVIDED AT THE BOTTOM OF THE RAMP & THE GRADE BREAK SHALL BE PERPENDICULAR TO THE DIRECTION OF TRAVEL. EXAMPLES OF RECOMMENDED CURB RAMP ALIGNMENTS ARE SHOWN BELOW:



	CURB RAMP GENERAL NOTES	CITY OF HILLIARD, OHIO
DATE: March 6, 2015		STANDARD CONSTRUCTION DRAWING
SCALE: NTS		1/12 CR–1

4. CURB RAMPS AT ALLEY AND ARTERIAL CROSSINGS SHALL BE 8" THICK CONCRETE

5. RAMP RUNNING SLOPE: THE RUNNING SLOPE SHALL BE 5% TO 7.7%. THE RUNNING SLOPE MAY BE INCREASED TO 10 % WITH PRIOR WRITTEN CITY APPROVAL.

6. RAMP CROSS SLOPE: THE MAXIMUM CROSS SLOPE SHALL BE 1.56%.

7. FOR NEW CONSTRUCTION, MINIMUM RAMP WIDTH AND LANDING SIZE SHALL BE:
   - SIDEWALKS: 5' RAMP AND 5'X5' LANDING
   - MULTI-USE PATHS: 8' RAMP AND 5'X8' LANDING
   - LANDING AT INTERSECTING SIDEWALKS – WHEREVER SIDEWALKS INTERSECT, THERE SHALL BE A LANDING MEETING THE ABOVE REQUIREMENTS.

10. IN RETROFIT SITUATIONS, THE RAMP WIDTH MAY MATCH THE EXISTING APPROACH SIDEWALK OR MULTI-USE PATH OR 4' MINIMUM, WHICHEVER IS GREATER. THE MINIMUM LANDING SIZE SHALL BE 4' BY THE WIDTH OF THE EXISTING APPROACH WALK OR MULTI-USE PATH.

11. ALL JOINTS BETWEEN NEW AND EXISTING MATERIALS SHALL BE FLUSH.

12. LONG FLARES: THE LENGTH MEASUREMENT OF THE FLARE AT THE FACE OF CURB SHALL BE A MINIMUM OF 10 TIMES THE CURB HEIGHT

13. 1-FT FLARES: THE MEASUREMENT OF THE FLARE AT THE FACE OF CURB SHALL BE A MINIMUM OF 1-FT.

14. STREET COUNTER SLOPE: THE COUNTER SLOPE AT THE BASE OF THE RAMP SHALL BE A MAXIMUM OF 5% FOR A MINIMUM OF 2-FT.

15. RAMPS AT MARKED AND UNMARKED CROSSINGS: AT MARKED CROSSINGS THE RAMP AND STREET LANDING MUST BE FULLY CONTAINED WITHIN THE MARKED CROSSWALK. AT UNMARKED CROSSINGS THE RAMP AND STREET LANDING MUST BE WITHIN THE PEDESTRIAN RIGHT-OF-WAY AS DEFINED BY CITY CODE.

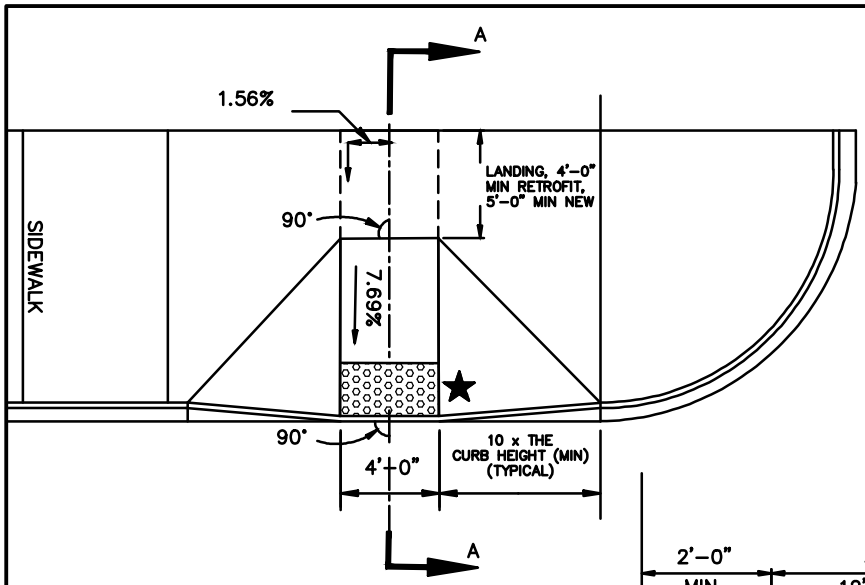
16. SURFACES: RAMP, FLARE, AND LANDING SURFACES MUST BE STABLE AND SLIP RESISTENT. RAMPS SHALL BE MEDIUM BROOMED TRANSVERSE TO THE DIRECTION OF TRAVEL. GRATINGS, VALVE BOXES, AND UTILITY BOXES SHALL NOT BE LOCATED IN THE RAMP, LANDING, OR TRANSITION AREAS.

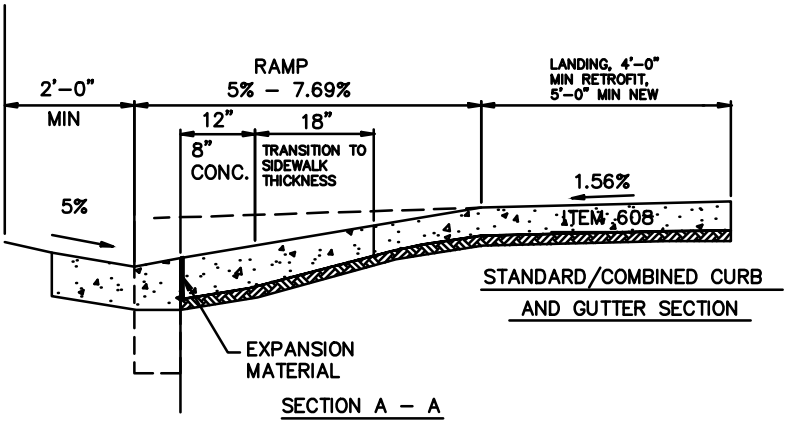
17. OFFSET INTERSECTIONS: AT OFFSET 'T' INTERSECTIONS RAMPS BETWEEN OFFSET STREETS MAY BE DELETED IF THE CENTERLINES OF OFFSET STREETS ARE NO MORE THAN 200-FT APART.

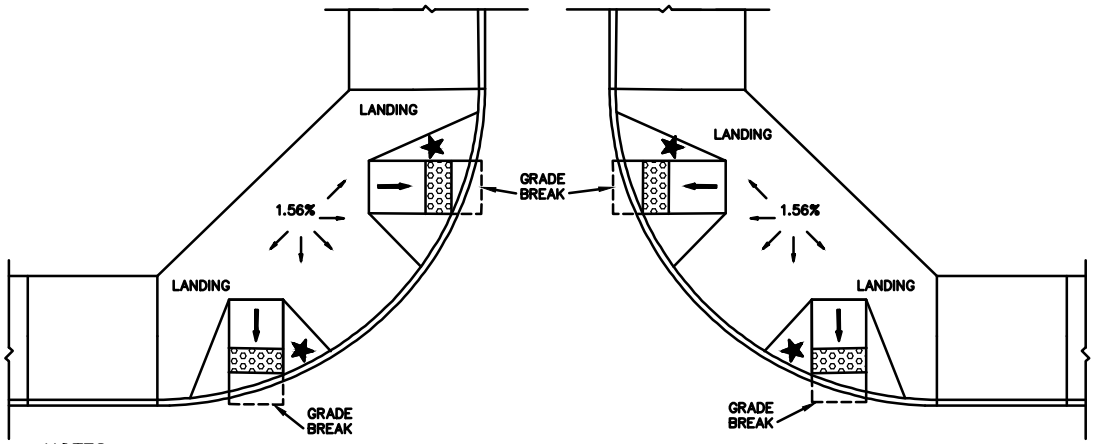
18. OPPOSING RAMPS SHALL HAVE A PEDESTRIAN WALKWAY ACROSS THE STREET, ATLEAST 7' WIDE, WITH A CROSS SLOPE (LONGITUDINAL STREET SLOPE) OF NO GREATER THAN 1.56%. VERTICAL CURVES SHALL BE INSTALLED AS NEEDED.

19. FOR SIDEWALK OR MULTI-USE PATH CROSSINGS OF PRIVATE DRIVEWAYS:
   - PEDESTRIANS HAVE THE RIGHT OF WAY FOR CROSSINGS OF UNSIGNALIZED PRIVATE DRIVEWAYS (RESIDENTIAL AND COMMERCIAL): THEREFORE, THE SIDEWALK OR PATH SHOULD EXTEND THROUGH THE DRIVEWAY AT GRADE WITH NO CURB RAMP OR DETECTABLE WARNING.
   - IN LOCATIONS WHERE TREE LAWN WIDTHS ARE NARROW MAKING THE DRIVEWAY APPROACH TOO STEEP TO PROVIDE A SAFE TRANSITION FOR VEHICLES BETWEEN THE STREET AND DRIVEWAY, THE SIDEWALK OR PATH MAY DROP IN ELEVATION 10'-15' ON EITHER SIDE OF THE DRIVEWAY. NO CURB RAMP OR DETECTABLE WARNING IS REQUIRED IN THIS CASE. THE MAX CROSS SLOPE SHALL BE 1.56%.
   - AT LARGE COMMERCIAL UNSIGNALIZED DRIVEWAYS, PROVISIONS FOR SIDEWALKS AND PATHS AND THE NEED FOR RAMPS AND DETECTABLE WARNINGS SHALL BE EVALUATED ON A CASE-BY-CASE BASIS.
   - LARGE COMMERCIAL SIGNALIZED DRIVEWAYS SHALL BE TREATED AS PUBLIC STREET INTERSECTIONS WITH RESPECT TO LOCATION AND DESIGN OF ALL SIDEWALKS, MULTI-USE PATHS, CURB RAMPS, AND DETECTABLE WARNINGS.

	CURB RAMP GENERAL NOTES	CITY OF HILLIARD, OHIO
DATE: March 6, 2015		STANDARD CONSTRUCTION DRAWING
SCALE: NTS		2/12 CR-1





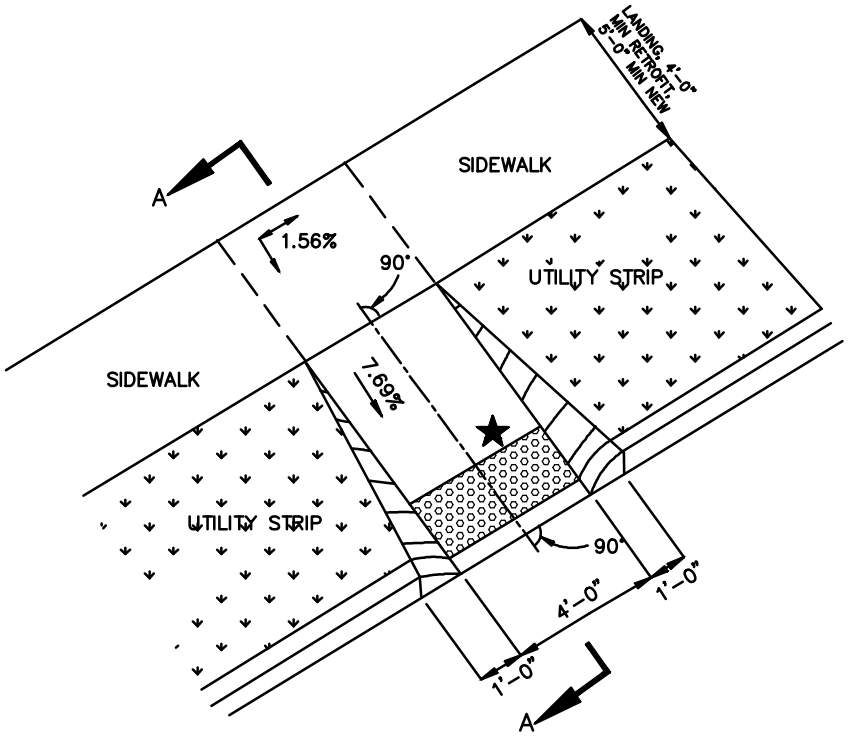


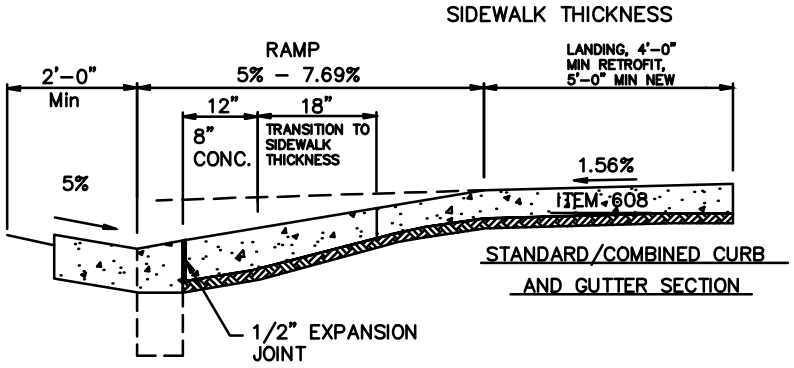
NOTES:

1. RAMP SHALL NOT ORIENT PEDESTRIANS INTO THE CENTER OF AN INTERSECTION. WHEN PLACED WITHIN THE RADIUS, A TYPE A RAMP SHALL BE ORIENTED DIRECTLY ACROSS FROM THE OPPOSING RAMP, PERPENDICULAR TO THE CENTERLINE OF THE CROSSING STREET.
2. THE 5% MAXIMUM COUNTERSLOPE WHERE THE BOTTOM OF THE RAMP MEETS THE STREET APPLIES TO BOTH STRAIGHT CURB AND CURB AND GUTTER SECTIONS
3. WHEN RAMPS ARE NOT PERPENDICULAR TO THE CURB, A RECESSED LANDING SHALL BE PROVIDED AT THE BOTTOM OF THE RAMP AND THE GRADE BREAK SHALL BE PERPENDICULAR TO THE DIRECTION OF TRAVEL

★ SEE SHEET 12/12 FOR DETECTABLE WARNING DETAILS

	CURB RAMP TYPE A	CITY OF HILLIARD, OHIO
DATE: March 6, 2015	RAMP WITH LONG FLARES	STANDARD CONSTRUCTION DRAWING
SCALE: NTS		3/12 | CR-1



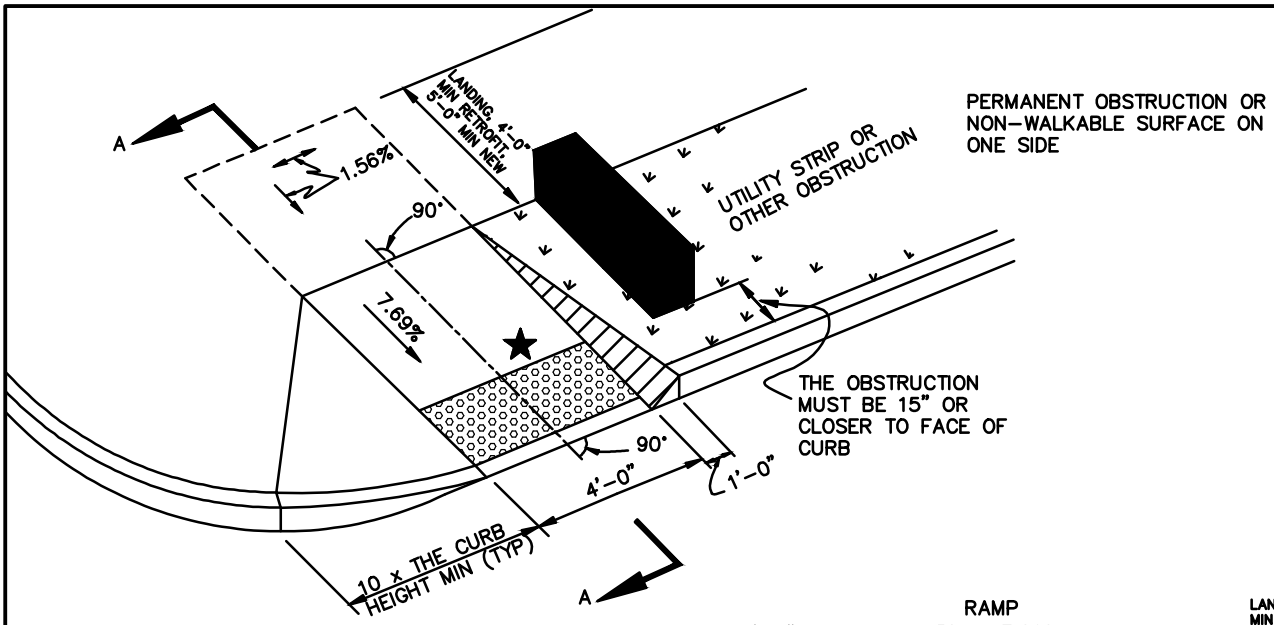


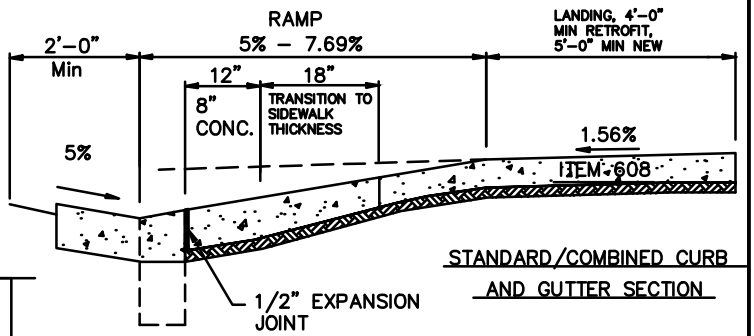
SECTION A – A

NOTES:
1. RAMP SHALL NOT NOT BE PLACED IN FRONT OF A STOP SIGN OR IN FRONT OF THE NORMAL STOPPING LOCATION OF VEHICLES AT A STOP OR SIGNAL CONTROLLED INTERSECTION. A TYPE H RAMP SHOULD BE USED INSTEAD.
2. THE 5% MAXIMUM COUNTERSLOPE WHERE THE BOTTOM OF THE RAMP MEETS THE STREET APPLIES TO BOTH STRAIGHT CURB AND CURB AND GUTTER SECTIONS

★ SEE SHEET 12/12 FOR DETECTABLE WARNING DETAILS

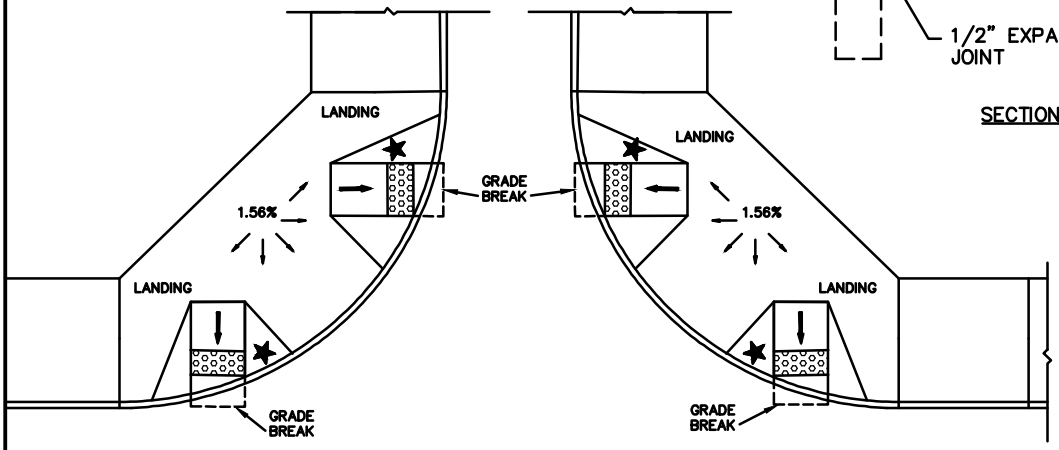
	CURB RAMP TYPE C	CITY OF HILLIARD, OHIO
DATE: March 6, 2015	RAMP IN UTILITY STRIP	STANDARD CONSTRUCTION DRAWING
SCALE: NTS		4/12 CR–1





STANDARD/COMBINED CURB AND GUTTER SECTION

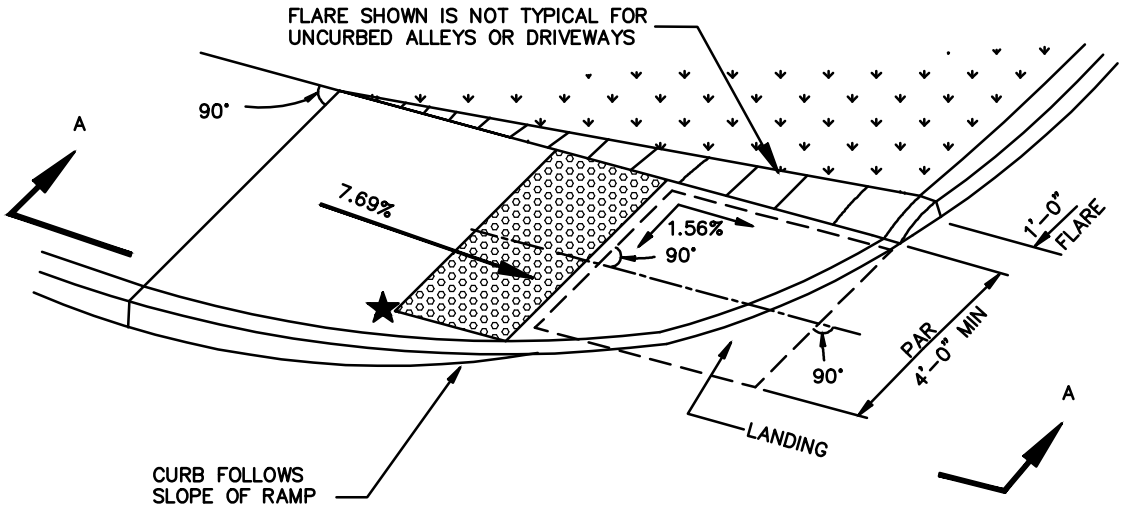
SECTION A – A

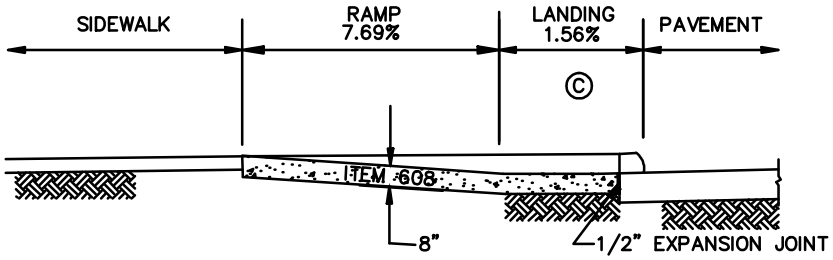


NOTES:
1. RAMP SHALL NOT ORIENT PEDESTRIANS INTO THE CENTER OF AN INTERSECTION. WHEN PLACED WITHIN THE RADIUS, A TYPE "D" RAMP SHALL BE ORIENTED DIRECTLY ACROSS FROM THE OPPOSING RAMP, PERPENDICULAR TO THE CENTERLINE OF THE CROSSING STREET.
2. THE 5% MAXIMUM COUNTERSLOPE WHERE THE BOTTOM OF THE RAMP MEETS THE STREET APPLIES TO BOTH STRAIGHT CURB AND CURB AND GUTTER SECTIONS
3. WHEN RAMPS ARE NOT PERPENDICULAR TO THE CURB, A RECESSED LANDING SHALL BE PROVIDED AT THE BOTTOM OF THE RAMP AND THE GRADE BREAK SHALL BE PERPENDICULAR TO THE DIRECTION OF TRAVEL

★ SEE SHEET 12/12 FOR DETECTABLE WARNING DETAILS

	CURB RAMP TYPE D	CITY OF HILLIARD, OHIO
DATE: March 6, 2015	RAMP OBSTRUCTED ON ONE SIDE	STANDARD CONSTRUCTION DRAWING
SCALE: NTS		5/12 | CR-1





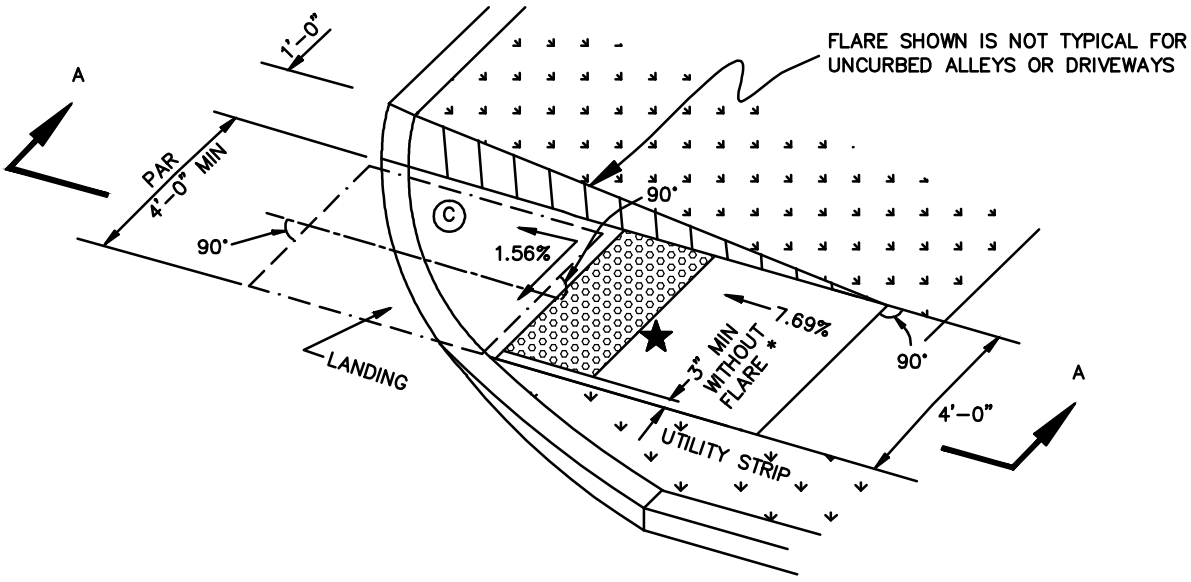
SECTION A–A

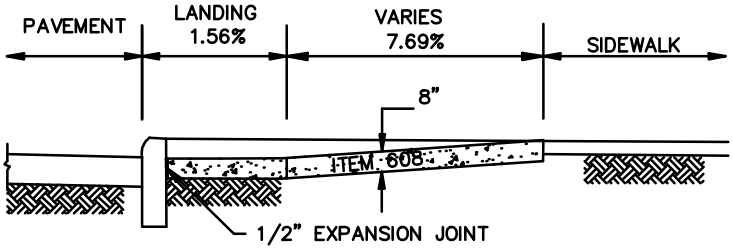
SUPPLEMENTAL NOTES

A. THE BOTTOM EDGE OF THE RAMP SHALL CHANGE PLANES PERPENDICULAR TO THE LANDING.
B. THE EDGE OF THE CURB SHALL BE FLUSH WITH THE EDGE OF THE ADJACENT PAVEMENT AND GUTTER.
C. THE LANDING AT THE BOTTOM OF THE RAMP SHALL BE >= 2.5–FT BY 4–FT WITH A MAXIMUM CROSS SLOPE OF 1.56% IN TWO DIRECTIONS.
D. THE PEDESTRIAN ACCESS ROUTE (PAR) BETWEEN THE TWO RAMPS SHALL HAVE A MAXIMUM OF 1.56% CROSS SLOPE WITH A 5% MAXIMUM RUNNING SLOPE
E. THE 5% MAXIMUM COUNTERSLOPE WHERE THE BOTTOM OF THE RAMP MEETS THE STREET APPLIES TO BOTH STRAIGHT CURB AND CURB AND GUTTER SECTIONS

★ SEE SHEET 12/12 FOR DETECTABLE WARNING DETAILS

	CURB RAMP TYPE G	CITY OF HILLIARD, OHIO
DATE: March 6, 2015	RAMP WITH RECESSED LOWER LANDING	STANDARD CONSTRUCTION DRAWING
SCALE: NTS		6/12 | CR–1





SECTION A–A

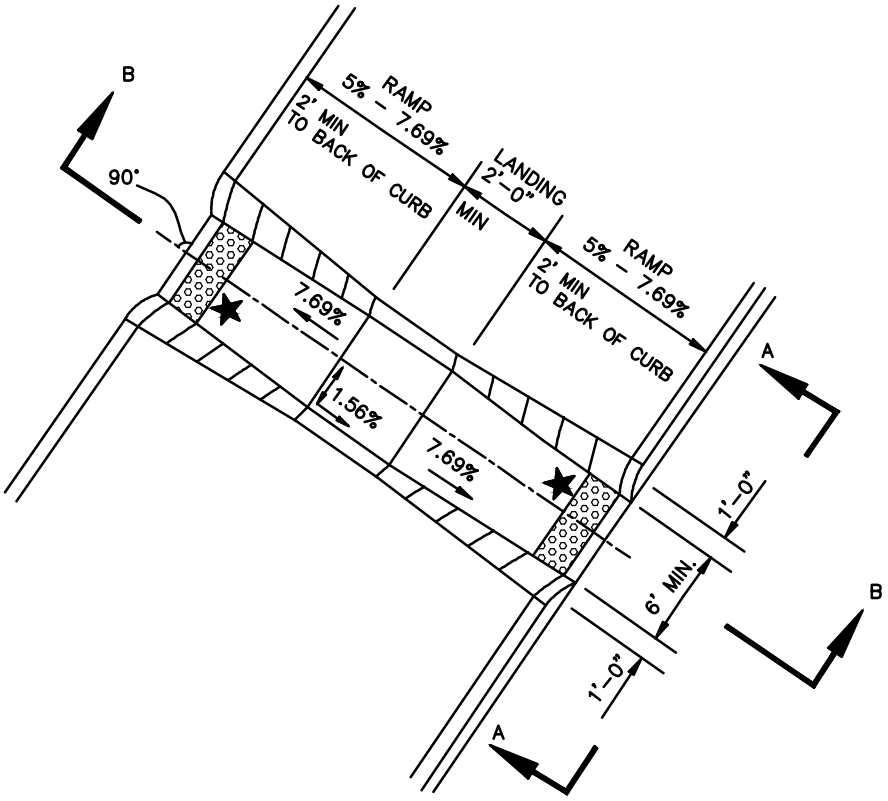
SUPPLEMENTAL NOTES

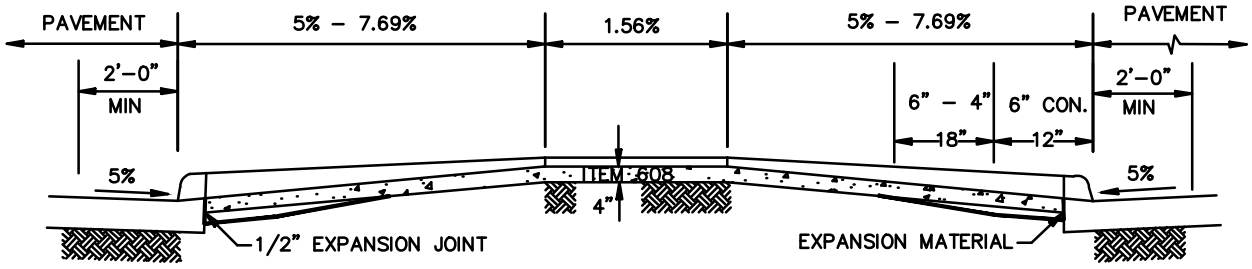
A. THE BOTTOM EDGE OF THE RAMP SHALL CHANGE PLANES PERPENDICULAR TO THE LANDING.
B. THE EDGE OF THE CURB SHALL BE FLUSH WITH THE EDGE OF THE ADJACENT PAVEMENT AND GUTTER.
C. THE LANDING AT THE BOTTOM OF THE RAMP SHALL BE >= 2.5–FT BY 4–FT WITH A MAXIMUM CROSS SLOPE OF 1.56% IN TWO DIRECTIONS.
D. THE PEDESTRIAN ACCESS ROUTE (PAR) BETWEEN THE TWO RAMPS SHALL HAVE A MAXIMUM OF 1.56% CROSS SLOPE WITH A 5% MAXIMUM RUNNING SLOPE
E. THE 5% MAXIMUM COUNTERSLOPE WHERE THE BOTTOM OF THE RAMP MEETS THE STREET APPLIES TO BOTH STRAIGHT CURB AND CURB AND GUTTER SECTIONS

* THIS IS FOR EMBEDDED (NON–SURFACE APPLIED) DETECTABLE WARNINGS ONLY

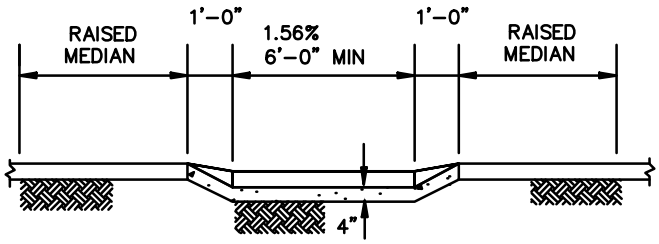
★ SEE SHEET 12/12 FOR DETECTABLE WARNING DETAILS

	CURB RAMP TYPE H	CITY OF HILLIARD, OHIO
DATE: March 6, 2015	RAMP WITH RECESSED LOWER LANDING IN UTILITY STRIP	STANDARD CONSTRUCTION DRAWING
SCALE: NTS		7/12 CR–1





SECTION B–B

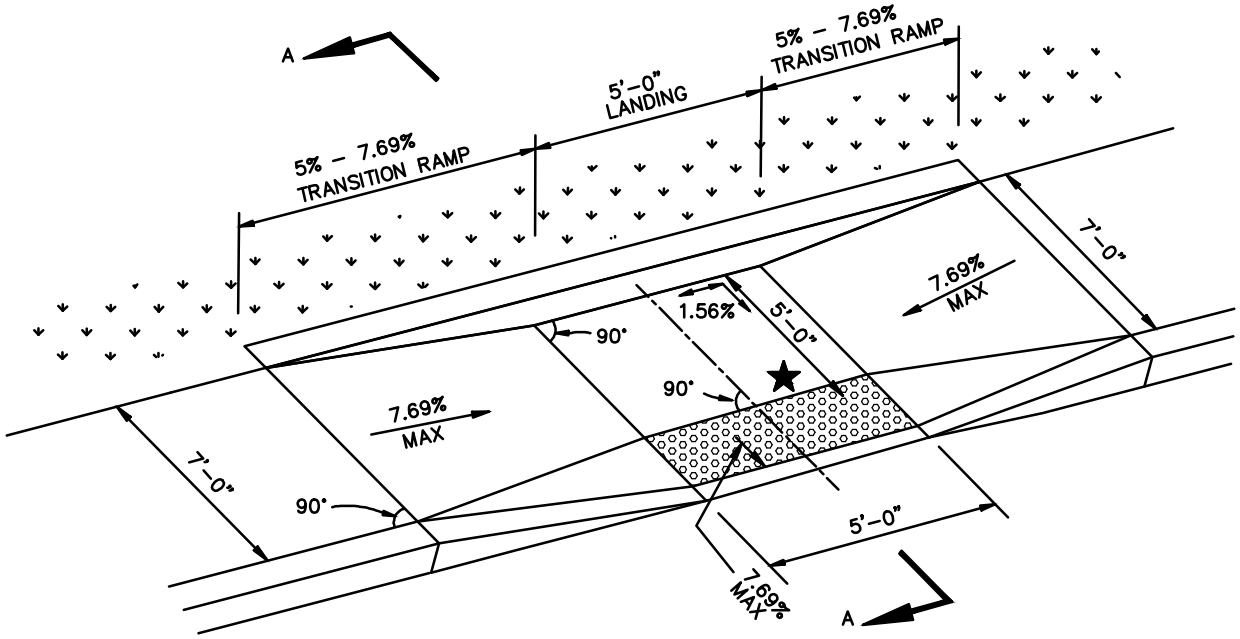


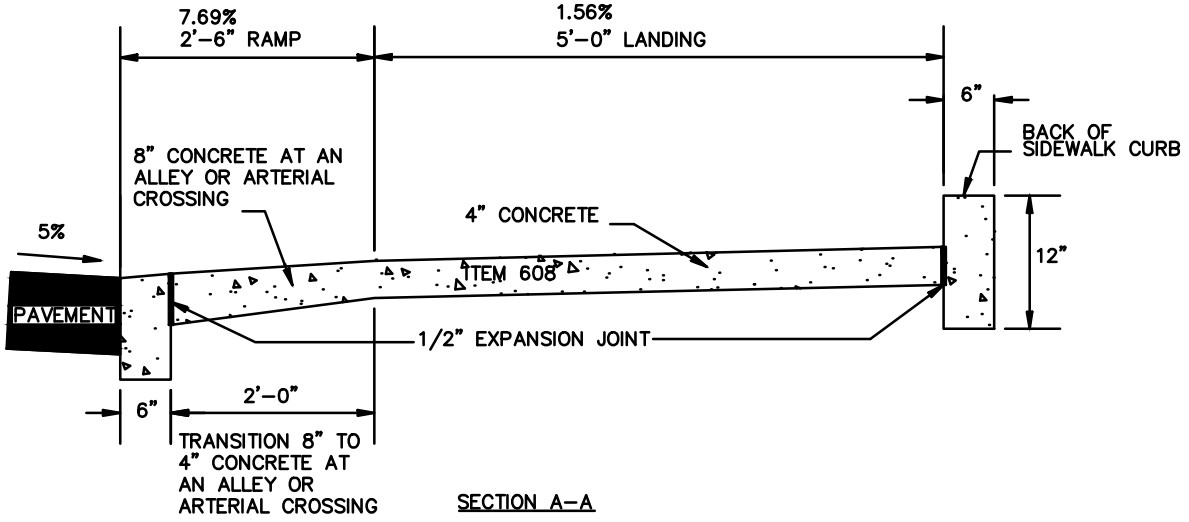
SECTION A–A

RAMPS MAY BE OMITTED IN MEDIANS IF PEDESTRIANS CAN CROSS THROUGH THE MEDIAN AT STREET GRADE

★ SEE SHEET 12/12 FOR DETECTABLE WARNING DETAILS

	CURB RAMP TYPE L	CITY OF HILLIARD, OHIO
DATE: March 6, 2015	MEDIAN RAMP WITH CENTER LANDING	STANDARD CONSTRUCTION DRAWING
SCALE: NTS		8/12 | CR–1



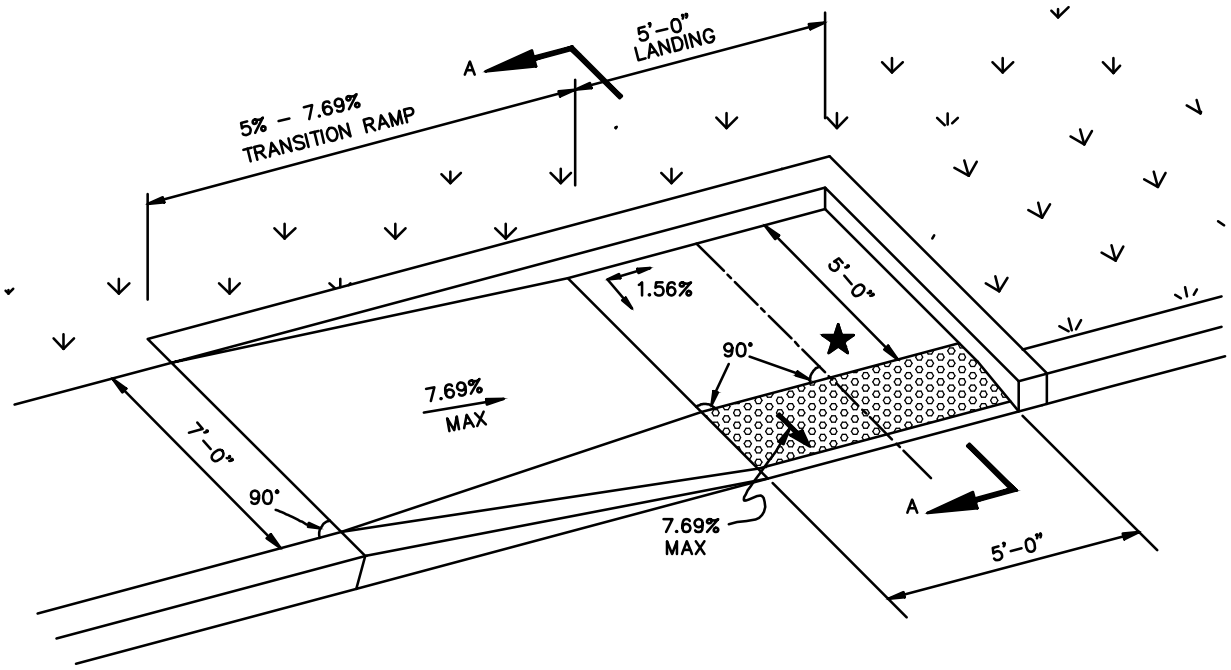


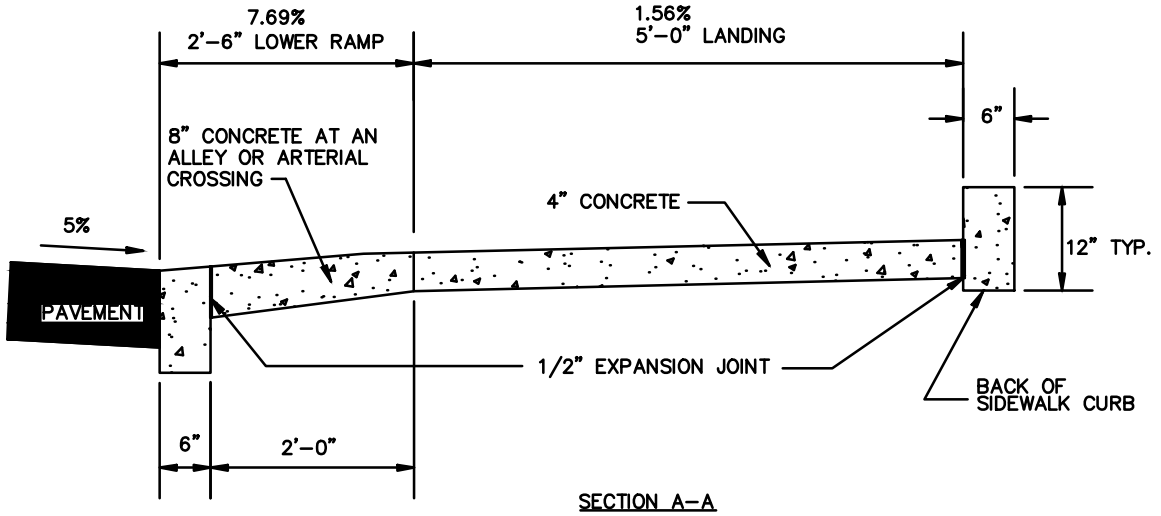
SECTION A–A

THE 5% MAXIMUM COUNTERSLOPE WHERE THE BOTTOM OF THE RAMP MEETS THE STREET APPLIES TO BOTH STRAIGHT CURB AND CURB AND GUTTER SECTIONS

★ SEE SHEET 12/12 FOR DETECTABLE WARNING DETAILS

	CURB RAMP TYPE P1	CITY OF HILLIARD, OHIO
DATE: March 6, 2015	COMBINED PERPENDICULAR & PARALLEL RAMP	STANDARD CONSTRUCTION DRAWING
SCALE: NTS		9/12 | CR–1





SECTION A–A

THE 5% MAXIMUM COUNTERSLOPE WHERE THE BOTTOM OF THE RAMP MEETS THE STREET APPLIES TO BOTH STRAIGHT CURB AND CURB AND GUTTER SECTIONS

★ SEE SHEET 12/12 FOR DETECTABLE WARNING DETAILS

	CURB RAMP TYPE P2	CITY OF HILLIARD, OHIO
DATE: March 6, 2015	COMBINED PERPENDICULAR & PARALLEL RAMP IN ONE DIRECTION	STANDARD CONSTRUCTION DRAWING
SCALE: NTS		10/12 | CR–1

NOTES

1. DETECTABLE WARNINGS SHALL BE PROVIDED WHEREVER A CURB RAMP CROSSES A VEHICULAR WAY. EXCLUDING UNSIGNALIZED DRIVEWAY CROSSINGS. SEE #19 OF GENERAL CURB RAMP NOTES.

2. DETECTABLE WARNINGS SHALL BE PROVIDED 24" IN THE DIRECTION OF TRAVEL AND EXTEND THE FULL WIDTH OF THE CURB RAMP OR FLUSH SURFACE. THE DETECTABLE WARNING SHALL BE LOCATED ADJACENT TO THE CURB LINE.

3. DETECTABLE WARNINGS SHALL BE PLACED 6" TO 8" BEHIND THE FACE OF CURB AND BEHIND CURB JOINT

4. CAST IN PLACE OR ANY NON-SURFACE APPLIED DETECTABLE WARNING SHALL HAVE A MIN OF 3" OF CONCRETE ON EACH SIDE OF THE WARNING.

5. MATERIALS SHALL COMPLY WITH C.O.C. SUPPLEMENTAL SPECIFICATION 1551 WITH THE FOLLOWING NOTED EXCEPTIONS:

   A. BRICK RED IS THE ONLY APPROVED COLOR UNLESS OTHERWISE APPROVED IN ADVANCE IN WRITING BY THE CITY ENGINEER

   B. TYPE "A", "B" AND "C" DETECTABLE WARNING SURFACES ARE NOT APPROVED

   C. TYPE "D" THIN TILE AND THIN MOLDED SHEET GOODS ARE APPROVED ON RETROFIT INSTALLATIONS ONLY.
      - THE PRE-APPROVED TYPE "D" MATERIAL IS "ARMOR TILE TACTILE SYSTEMS" FLAT SURFACE APPLIED MAT.
      - OTHER MATERIALS MAY BE SUBSTITUTED FOR THIS PRODUCT IF PRIOR APPROVAL IS GRANTED TO THE CITY ENGINEER

   D. TYPE "E" PRE-MANUFACTURED WET-SET PROJECTS ARE APPROVED FOR USE ON NEW CONSTRUCTION ONLY. THESE PRODUCTS MUST BE 24" WIDE AND ½" THICK. ONE PIECE PANELS SHOULD BE USED FOR SIDEWALK INSTALLATIONS. ALL PRODUCTS MUST BE APPLIED ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS AND GUIDELINES. THE TYPE "E" PRODUCTS PRE-APPROVED FOR USE IN THE CITY OF HILLIARD ARE LISTED BELOW.

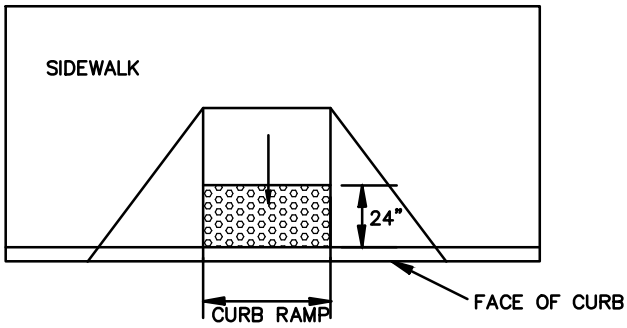
      - ENGINEERED PLASTICS, INC. – ARMOR-TILE CAST IN PLACE SYSTEMS
      - ADA SOLUTIONS, INC. – COMPOSITE (WET SET) REPLACEABLE TWS UNIT
      - ARMORCAST PRODUCTS COMPANY – CAST IN PLACE DETECTABLE WARNING PANEL
      - OTHER MATERIALS MAY BE SUBSTITUTED FOR THE ABOVE LISTED PRODUCTS IF PRIOR APPROVAL IS GRANTED BY THE CITY ENGINEER.

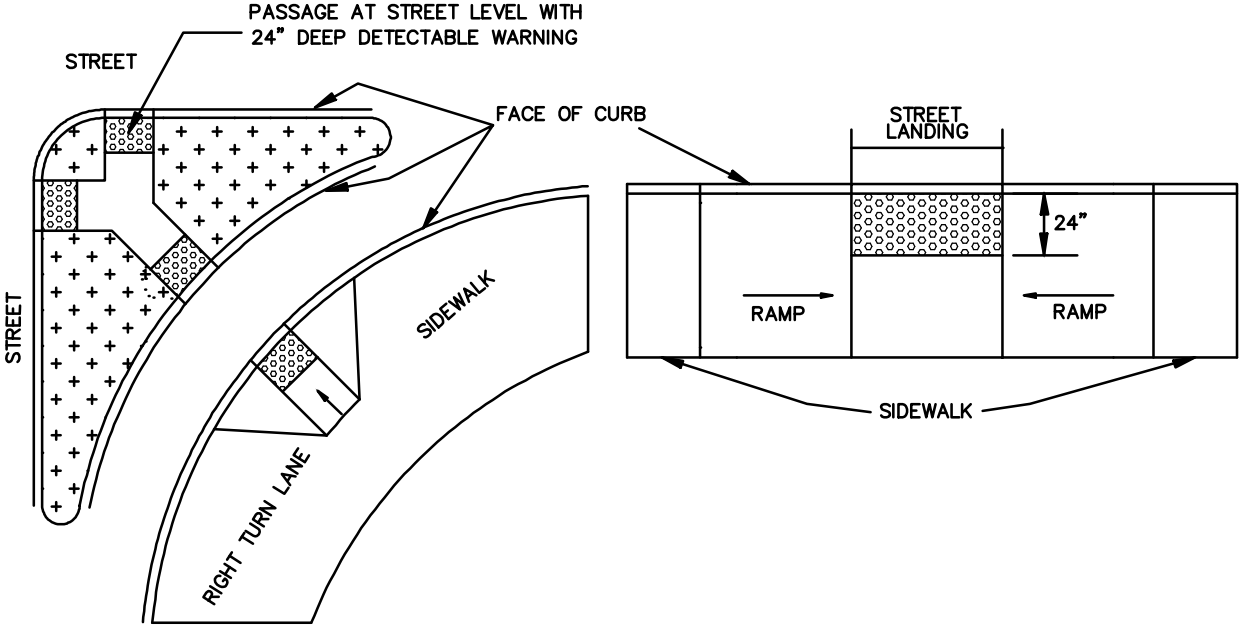
   E. DETECTABLE WARNINGS SHALL EXTEND THE ENTIRE WIDTH OF THE CURB RAMP FOR SIDEWALKS AND MULTI-USE PATHS LOCATED PARALLEL TO A PUBLIC STREET (SIDE PATHS).

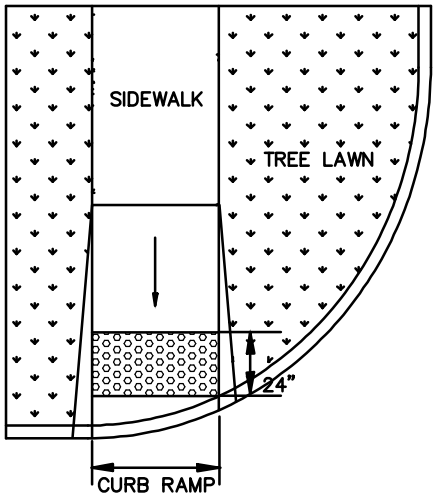
   F. DETECTABLE WARNING STRIPS MUST COMPLY WITH ADA SPECIFICATIONS FOR RAMP AREA, INCLUDING RUNNING SLOPE, CROSS-SLOPE, FLATNESS AND SMOOTHNESS CRITERIA AS WELL AS FLUSH TRANSITIONS BETWEEN THE CONCRETE RAMP AND THE DETECTABLE WARNING SURFACE.

   G. ALL DETECTABLE WARNING STRIP INSTALLATIONS SHALL BE WARRANTED BY THE INSTALLING CONTRACTOR AND MANUFACTURER TO BE FREE OF DEFECTS FOR A PERIOD OF THREE (3) YEARS FROM THE DATE OF INSTALLATION. THE DETECTABLE WARNING STRIP SHALL LOSE NO MORE THAN FIVE PERCENT (5.0 %) OF TRUNCATED DOMES DUE TO DELAMINATION BECAUSE OF PRODUCT FAILURE. SURFACE SHALL BE WARRANTED FOR THAT 3-YEAR PERIOD FROM FADING, CHIPPING, CRACKING, PEELING, OR LOSS OF COLOR DUE TO THE EXPOSURE TO WEATHERING, DE-ICING SALTS, AND SUNLIGHT.

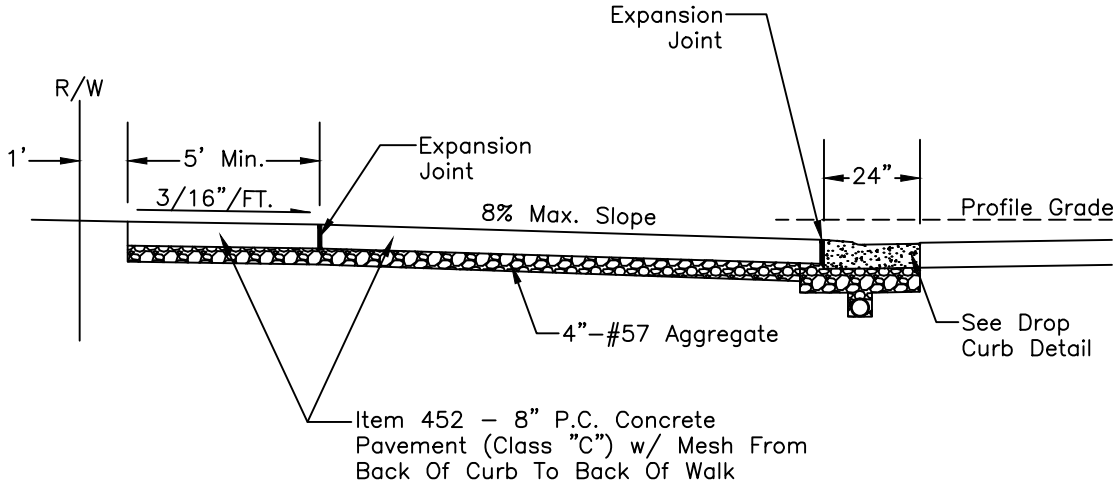
	CURB RAMP DETECTABLE WARNING NOTES	CITY OF HILLIARD, OHIO
DATE: March 6, 2015		STANDARD CONSTRUCTION DRAWING
SCALE: NTS		11/12 | CR-1



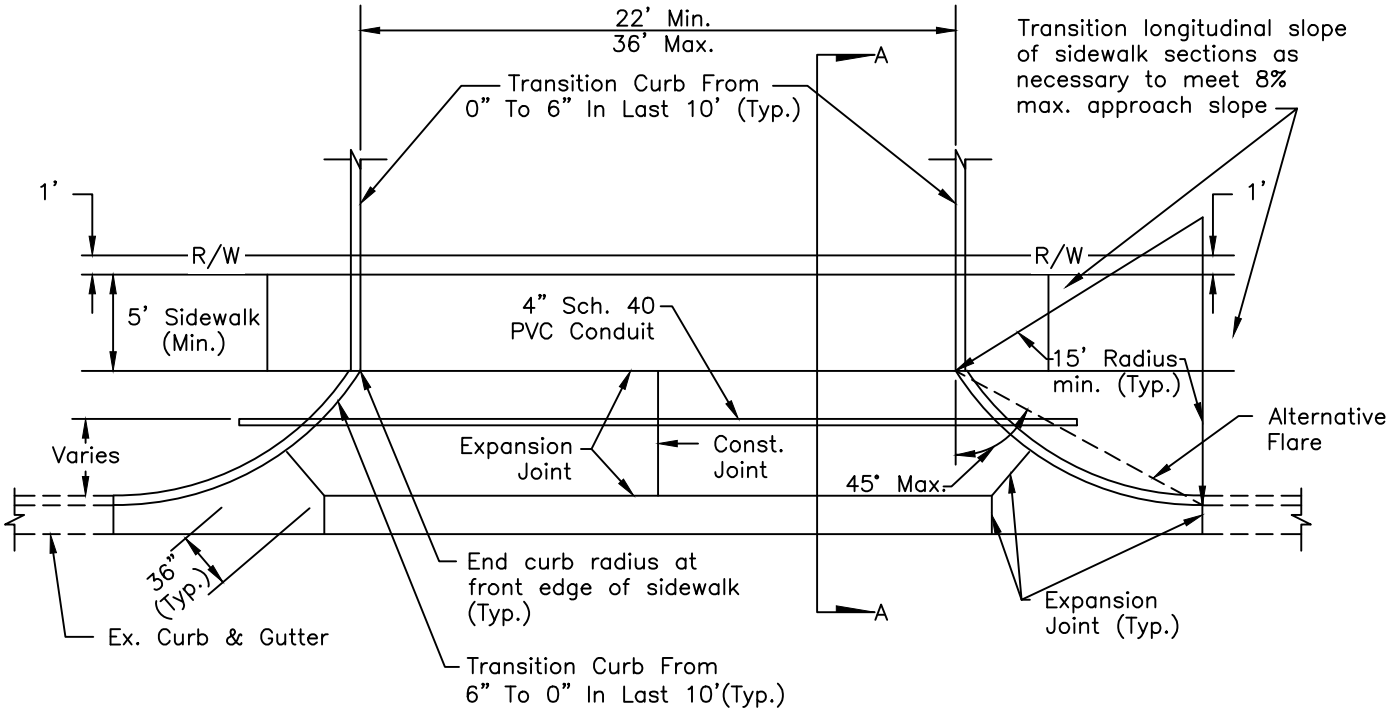




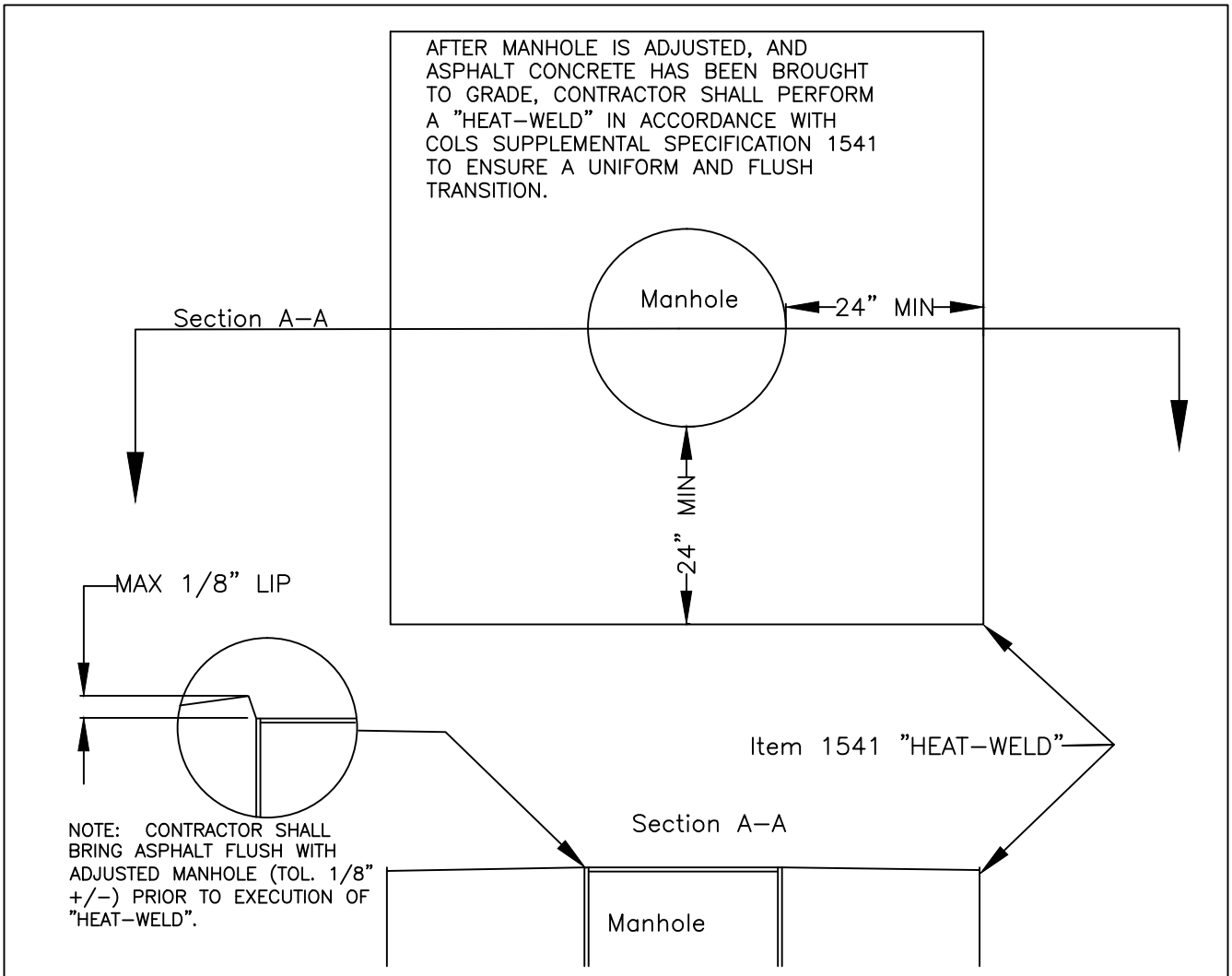
	CURB RAMP	CITY OF HILLIARD, OHIO
DATE: March 6, 2015	DETECTABLE WARNINGS	STANDARD CONSTRUCTION DRAWING
SCALE: NTS		12/12 CR-1



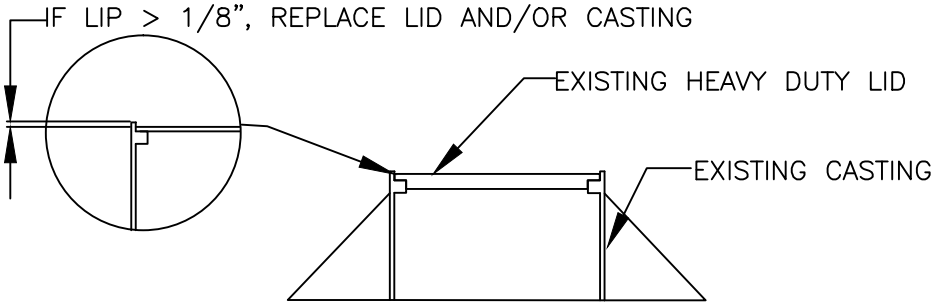
SECTION A–A



APPROVED CITY ENGINEER DATE	DRIVE DETAIL COMMERCIAL ENTRANCE	CITY OF HILLIARD, OHIO STANDARD CONSTRUCTION DRAWING
SCALE: NTS		1/1 DD–1



NOTE: IF LID DOES NOT FIT FLUSH (1/8" +/– TOLERANCE), CONTRACTOR SHALL REPLACE CASTING AND/OR LID TO PROVIDE FLUSH FIT (1/16"+/–). REPLACEMENT SHALL FIT SPECIFICATIONS AND PERFORMANCE OF EXISTING STRUCTURE. IF SUITABLE REPLACEMENT DOES NOT EXIST, BOTH CASTING AND LID MUST BE REPLACED.



APPROVED CITY ENGINEER DATE	MANHOLE ADJUSTED TO GRADE	CITY OF HILLIARD, OHIO STANDARD CONSTRUCTION DRAWING
NOT TO SCALE		1/1 MHA–1

Notes:

1. General Description: LED Roadway Fixture, 4000K color temperature.
2. Housing: One piece die cast aluminum integral heat sink. Meet 2G vibration per ANSI C136.32–2001.
3. Finish: Corrosion resistant polyester powder paint, minimum of 2.0 mil thick. Black or Dark Bronze.
4. Mounting: Slipfitter with +/– 5 degree of adjustment for leveling. Adjustable for 1¼"–2" mounting pipe.
5. Labeling: UL listed for wet locations.
6. Distribution: Structured LED array optimized for roadway photometric distribution.
7. Approved Manufacturer: G.E. EANA LED Roadway Light, or approved equal.

   *Voltage: 480V
8. Lamp: Rated L75 at 50,000 hours.

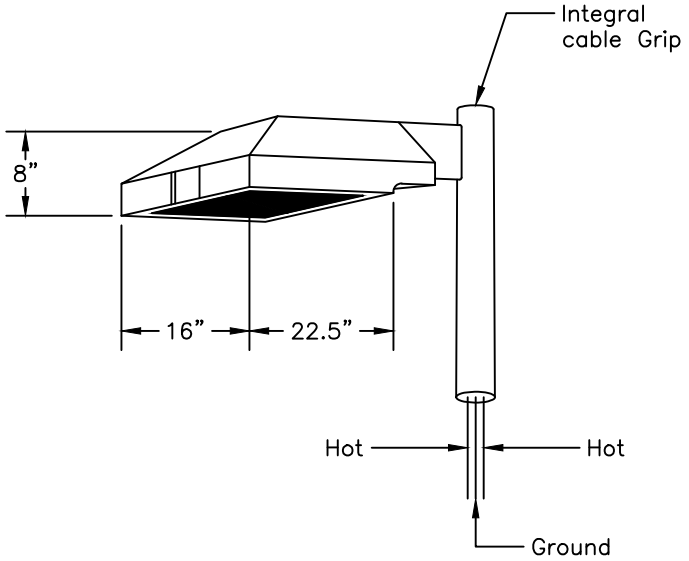
APPROVED	THOROUGHFARE STREET LUMINAIRE	CITY OF HILLIARD, OHIO
Clyde R Seidle 9–1–15 CITY ENGINEER DATE		STANDARD CONSTRUCTION DRAWING
SCALE: N/A		1/2 SL–4

9. Cable: Provide #12 THWN, stranded copper 600V, 90 degrees Celsius conductors. Wire to luminaire. Secure pole wiring with cable grip provided with luminaire. Provide adequate length to extend minimum 2 feet out of hand hole.

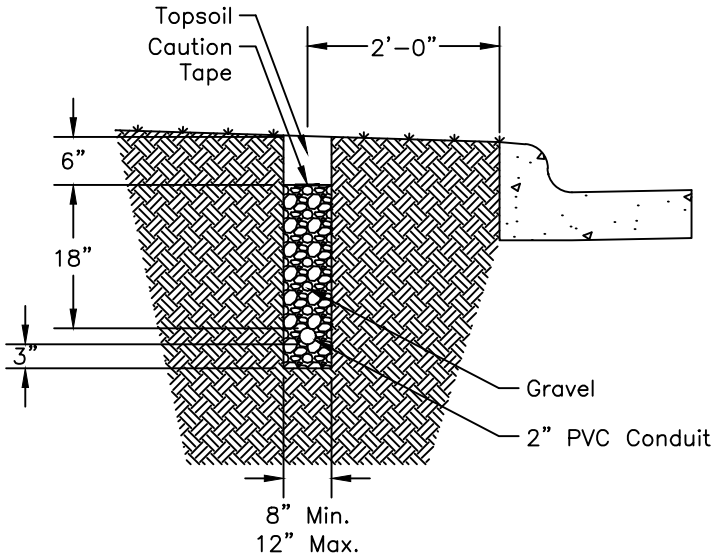
10. Execution: All luminaires shall be plumb and level. Adjust lamp socket assembly to Type II or Type III cutoff. All lamps shall be operational prior to inspection. All surfaces shall be cleaned of dirt, debris, etc. free of scratches, dents, etc.

11. Method of Measurement: See City of Columbus specifications section 1000.19 or ODOT section 625.20.

12. Basis of Payment: See City of Columbus specifications section 1000.20 or ODOT section 625.21.



APPROVED Clyde R Seidle 9-1-15 CITY ENGINEER DATE	THOROUGHFARE STREET LUMINAIRE	CITY OF HILLIARD, OHIO STANDARD CONSTRUCTION DRAWING
SCALE: 1/2" = 1'		2/2 SL-4



CONDUIT PARALLEL TO BACK OF CURB

Notes:

1. Trenching: Conduit trenches shall have vertical walls and be excavated to a depth that permits conduit to be laid at 2'-0" below finished grade with a gravel cover, above and below. Backfill gravel to topsoil limit. Trenches shall be located adjacent to and parallel with curbs or pavements and shall not deviate more than 6" from the lines designated. Trenches shall not exceed 12" in width. Remove excess soil after backfilling.

2. Gravel: Shall be uncrushed washed gravel and pass a 1/2" sieve. Pour in place and compact to 95% standard proctor in layers not exceeding 6" each. City to inspect during construction.

3. Topsoil: Shall be clean, loose friable, loamy topsoil free of subsoil or refuse. Topsoil may be from the site or imported. Topsoil shall be placed and spread over the areas designated to a depth sufficiently greater that that shown so that after natural settlement the compacted work will conform to the elevations shown.

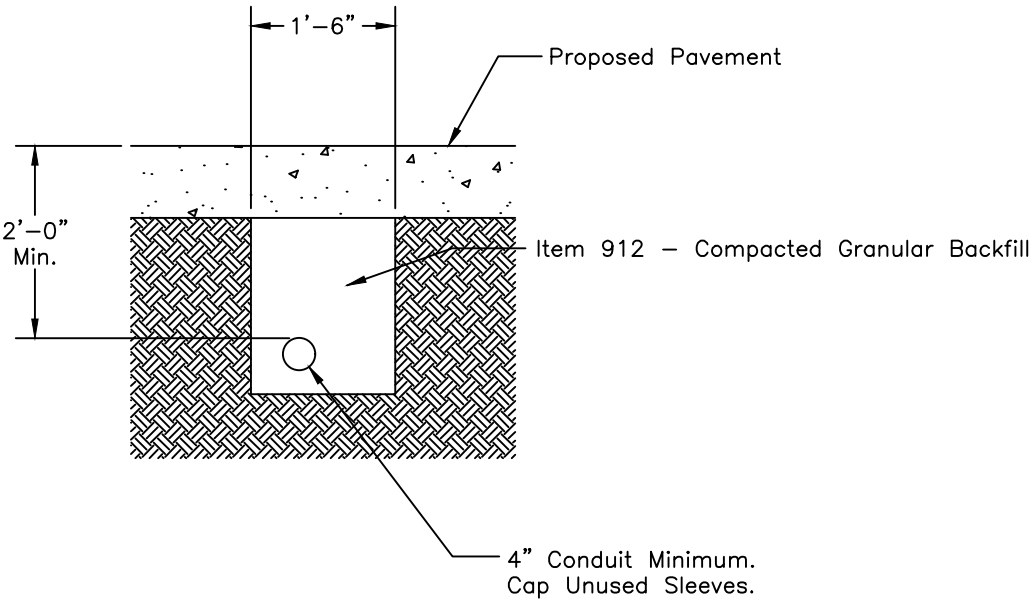
4. Conduit: Shall be heavy wall rigid nonmetallic schedule 40 PVC for use above and below ground or concrete encased. Rated for 90 degrees Celsius conductors and use in direct sunlight. Material shall be UL listed and comply with NEMA TC2-1978 and F.S. #WC-1094A. Provide in 10' sections. Seal all joints watertight. Glue joints with PVC cement. Bush all ends. All bends shall use long radius preformed elbows.

5. Conduit caps: Provide molded plastic or rubber capping device that only permits wire to pass through while preventing dirt, water, etc. from entering.

6. Pull wire: All empty conduit installed for future lighting shall contain a No. 10 AWG copper-clad pull wire.

7. Caution tape: 3" wide red plastic tape with black letters reading "CAUTION BURIED LINE BELOW". Bury above conduit 6" maximum below grade. Run continuous in all trenches not covered by pavement. City to inspect prior to burying.

APPROVED Clyde R Seidle 9-1-15 CITY ENGINEER DATE	UNDERGROUND CONDUIT/TRENCH DETAILS	CITY OF HILLIARD, OHIO STANDARD CONSTRUCTION DRAWING
SCALE: 1/2" = 1'		1/3 SL-6



4" CONDUIT UNDER PROPOSED PAVEMENT & UNDER COMMERCIAL DRIVES BY OPEN TRENCH

Notes:

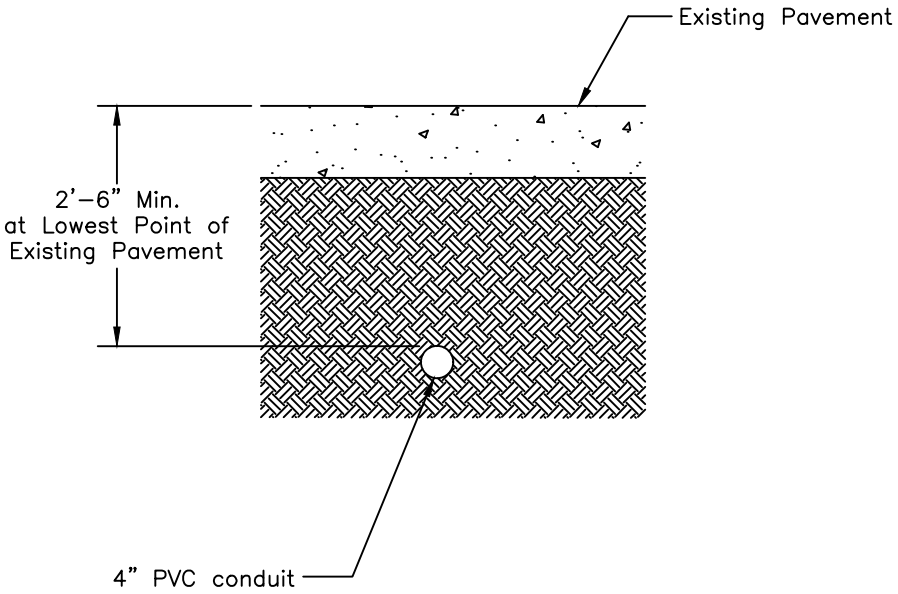
1. Trenching: Sleeve trenches shall have vertical walls and be excavated to a depth that permits sleeves to be laid at 2'–0" below finished grade with 3" concrete encasement around conduit sleeves. Sleeve trenches shall be located perpendicular to the road centerline unless otherwise specifically noted. Maintain inline with conduit setback dimensions at intersections and at curb cuts. gravel cover, above and below.

2. Conduit: Shall be a minimum of 4–inch Schedule 40 PVC conduits and fittings.

3. Conduit caps: Provide molded plastic or rubber capping device that only permits wire to pass through while preventing dirt, water, etc. from entering.

4. Pull wire: All empty conduit installed for future lighting shall contain a No. 10 AWG copper–clad pull wire.

APPROVED	UNDERGROUND CONDUIT/TRENCH DETAILS	CITY OF HILLIARD, OHIO
Clyde R Seidle 9–1–15 CITY ENGINEER DATE		STANDARD CONSTRUCTION DRAWING
SCALE: 1/2" = 1'		2/3 SL–6



4" CONDUIT UNDER PROPOSED PAVEMENT & UNDER
COMMERCIAL DRIVES BY HORIZONTAL DRILLING

Notes:

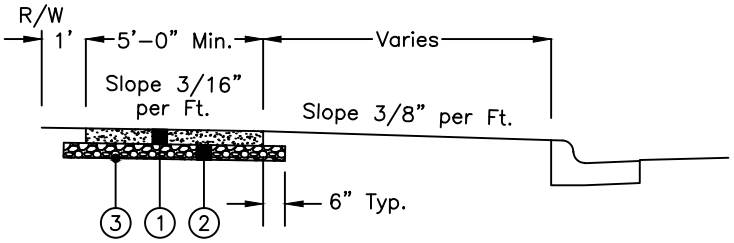
1. Conduit sleeves placed under existing pavement or paved shoulders shall be installed by drilling, subject to approval of the City Engineer. If placed by drilling, the bore shall not exceed the conduit diameter by more than 5 percent. Conduit shall be placed with a minimum amount of disturbance to the roadway.

2. Conduit: Shall be heavy wall rigid nonmetallic Schedule 40 PVC (725.05) for use above and below ground or concrete encased. Rated for 90 degrees Celsius conductors and use in direct sunlight. Material shall be UL listed and comply with NEMA TC2–1978 and F.S. #WC–1094A. Provide in 10' sections. Seal all joints watertight. Glue joints with PVC cement. Bush all ends. All bends shall use long radius preformed elbows.

3. Conduit caps: Provide molded plastic or rubber capping device that only permits wire to pass through while preventing dirt, water, etc. from entering.

4. Pull wire: All empty conduit installed for future lighting shall contain a No. 10 AWG copper–clad pull wire.

APPROVED	UNDERGROUND CONDUIT/TRENCH DETAILS	CITY OF HILLIARD, OHIO
Clyde R Seidle 9–1–15 CITY ENGINEER DATE		STANDARD CONSTRUCTION DRAWING
SCALE: 1/2" = 1'		3/3 SL–6



(1) Item 608 – 4" Concrete Walk

(2) Item Special – 4" Aggregate Base (#57 Stone)

(3) Item 204 – Subgrade Compaction

Notes:

1. Item numbers refer to the City of Columbus, Ohio Standard Construction and Material Specifications, Division of Engineering, current edition and all work shall be done in accordance with these specifications.
2. Sidewalks shall be constructed with P.C. concrete (Class C, Item 499) which shall contain 5% to 8% entrained air and a 3" maximum slump.
3. Where driveways cross the sidewalk, the concrete shall be 6" thick for residential driveways and 8" thick for commercial driveways. See Hilliard Standard Drawings DD–1 and DD–2.
4. Length and slope of driveway ramps are variable according to the distance of the sidewalk from the curb.
5. All concrete shall be placed in one course and finished with a wood float.
6. Expansion joints shall be placed wherever new concrete touches existing construction and at intervals of 30' or less.
7. Water and gas valve boxes in the sidewalk area shall be adjusted to proper grade.
8. Roof drains shall extend under the sidewalk and through the curb. See Columbus Standard Drawing 2320 Dr. A.
9. Forms shall be made of lumber 2" nominal thickness or of equally rigid metal.
10. Immediately after finishing, concrete shall be cured in an approved manor.
11. Notify the City of Hilliard, Building Department @ 876–7361 at least 24 hours before concrete is to be placed for the inspection of the form work. In no case may concrete be placed without approval of the form work by the City.
12. Concrete shall be protected from freezing in accordance with Section 451.061 of Item 451 when the air temperature is predicted to be below 35°F at any time during the next 72 hours.

APPROVED CITY ENGINEER DATE	SIDEWALK SPECIFICATIONS	CITY OF HILLIARD, OHIO STANDARD CONSTRUCTION DRAWING
SCALE: 1/4" = 1'		1/1 SW–1

City of Hilliard Sign Specifications

Street Name Signs - General Specifications

Plan Designation: Item 630 Street Name Sign, Type ( ), As Per Plan

Plan Unit: Per Each

Plan Payment: Payment for each street name sign shall include brackets, stiffeners, stickers, and all incidental hardware to mount the street name sign(s) on the designated support type.

Submittals: Sign Fabricator shall submit preliminary layout of street name signs to the City of Hilliard Engineer (lschamp@hilliardohio.gov) or the City of Hilliard sign shop (signshop@hilliardohio.gov) before manufacturing signs. Layout shall be to scale and shall include all dimensions. Failure to submit a scaled layout could result in rejection of the street name sign and replacement will be at the manufacturer's expense.

New Street Name Approval & Submittals: All new street names shall be submitted to the City of Hilliard for pre-approval (email: mkelnhofer@hilliardohio.gov). For any street name greater than ten (10) characters (including prefix or suffix), a sign layout in accordance with these specifications shall be submitted prior to pre-approval of a new street name to ensure that the street name can adequately fit on the maximum sign blade without modification to font, lettering size, or standard spacing.

The following specifications apply to all street name signs in the City of Hilliard:

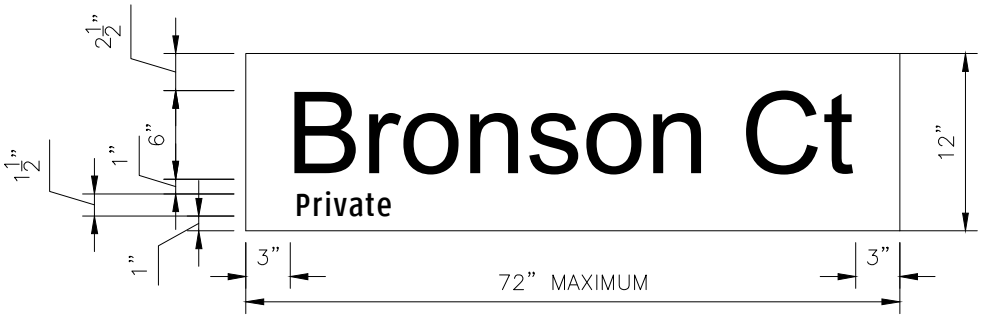
- All street name signs shall be made on an aluminum sign blank (0.0080 thickness).
- All street name signs shall use a white retroreflective sheeting made with prisms (ASTM D4956 Type IV or VIII as designated for each sign type provided below) with a blue electrocut film (color: 1175 - FHWA Blue) to create a blue sign with white lettering.
- Street name legends, prefixes, and suffixes shall be printed Federal Highway Administration, Office of Transportation Operations' Clearview Font Type 2-W using standard letter spacing. Legends, prefixes, and suffixes shall be centered horizontally and vertically on the sign face. If a street name contains a drop letter (y, p, j, etc.), the name shall be shifted ½" up on the sign face. Lettering sizes and clear spacing shall conform to the various sign types provided below.
- A modified Clearview Font is only permitted for existing street names in order to fit on the maximum sign blades designated for the various sign types provided below. All new street names shall comply with the standard provisions established herein.
- All street name sign installations shall include a City of Hilliard identification sticker, which provides the month and year that the sign is installed. Stickers shall be obtained from the City of Hilliard sign shop (contact: Dave Dale - (614) 334-2355).

	TRAFFIC CONTROL NOTES AND DETAILS	CITY OF HILLIARD, OHIO
DATE: July 30, 2015	STREET NAME SIGNS	STANDARD CONSTRUCTION DRAWING
SCALE: N.T.S.	GENERAL SPECIFICATIONS	1/10 TC-1

City of Hilliard Sign Specifications

Street Name Signs - General Specifications (cont.)

- These standards shall apply to all public street intersections and to intersections of a public street with a named private driveway. Non-reflective public or private street name signs within the public right-of-way are prohibited on new installations. Existing street name signs that do not meet these standards shall be upgraded as part of the normal city sign maintenance schedule.
- At locations where a named private driveway intersects a public street, the word "Private" shall be positioned beneath the private street name as shown in the example below.



	TRAFFIC CONTROL NOTES AND DETAILS	CITY OF HILLIARD, OHIO
DATE: July 30, 2015	STREET NAME SIGNS	STANDARD CONSTRUCTION DRAWING
SCALE: N.T.S.	GENERAL SPECIFICATIONS	2/10 TC-1

City of Hilliard Street Name Sign Reference Table

		Installation			Post, Anchor & Bracket			Sign Size & Layout				
Type of Intersection	Speed Limit of Major Street	Type of Mounting	Number of signs per intersection (min)	Vertical Clearance of Sign from Street	Post Type (galvanized; black in Old Hilliard)	Anchor Type (galvanized)	Bracket Type (galvanized; black in Old Hilliard)	Sign Blade Height	Sign Blade Max Length	Initial Upper Case Letter Height	1/2-inch Rounded Border	Single or Double Sided
Type A - Signalized - Mast Arm (all new City signal installations)	any	Overhead (On Mast Arm)	one per arm	on arm	N/A	N/A	Band or Cable-Mntd	20"	96"	12"	Yes	Single
Type B - Signalized - Strain Pole (existing signals or former FCEO signals)	Any	Side/Corner (On Strain Pole)	2 signs on 2 poles (opposite corners)	15'	N/A	N/A	2 cantilevered brackets & double-tee stiffeners (4 bands per sign)	20"	72"	9"	No	Double
Type C - Roundabout	Any	2 Posts per sign (in splitter islands)	one sign per splitter island	5'	2" square x 14 gauge galvanized w/ rain caps	2-1/4" square x 42" long; 8" min lap	N/A	16"	72"	7"	Yes (& chevron-arrow)	Single
Type D - Unsignalized - Arterial or Collector - high speed (includes subdivision street at Arterial/Collector - e.g. Dublin Rd cross streets)	40+ MPH	Side/Corner & Cantilevered (On Post)	1 sign @ T intersection; 2 signs @ X intersection	12'	2" square x 12 gauge galvanized w/ rain caps	2-1/4" square x 48" long; 18" min lap	2 cantilevered brackets & double-tee stiffeners	16"	72"	8"	No	Double
Type E - Unsignalized - Arterial or Collector - low speed (includes subdivision street at Arterial/Collector - e.g. Cemetery Rd cross streets)	25 - 35 MPH	Side/Corner & Cantilevered (On Post)	1 sign @ T intersection; 2 signs @ X intersection	12'	2" square x 12 gauge galvanized w/ rain caps	2-1/4" square x 48" long; 18" min lap	2 cantilevered brackets & double-tee stiffeners	12"	72"	6"	No	Double
Type F - Unsignalized - Subdivision (e.g. internal subdivision streets - not primary street intersection with arterial or collector)	25 MPH	Side/Corner & Cross-Mounted (On Post)	One (2 if street name changes at cross street)	10'	2" square x 12 gauge galvanized - without rain caps	2-1/4" square x 30" long; 8" min lap	12" square post bracket & 12" cross piece bracket	9"	60"	5"	Yes	Double

Note:

SNS legends, prefixes, and suffixes shall be printed in FHWA **Clearview Font Type 2-W** using standard horizontal letter spacing and edge spacing. Lettering size and space reductions are permitted only on existing street names. New subdivision street names shall comply with all standards.

DATE: July 30, 2015

SCALE: N.T.S.

TRAFFIC CONTROL NOTES AND DETAILS

STREET NAME SIGNS

REFERENCE TABLE

CITY OF

HILLIARD, OHIO

STANDARD CONSTRUCTION DRAWING

3/10

TC-1

Type A Street Name Signs

Type A signs are to be installed at all signalized intersections with mast arms.

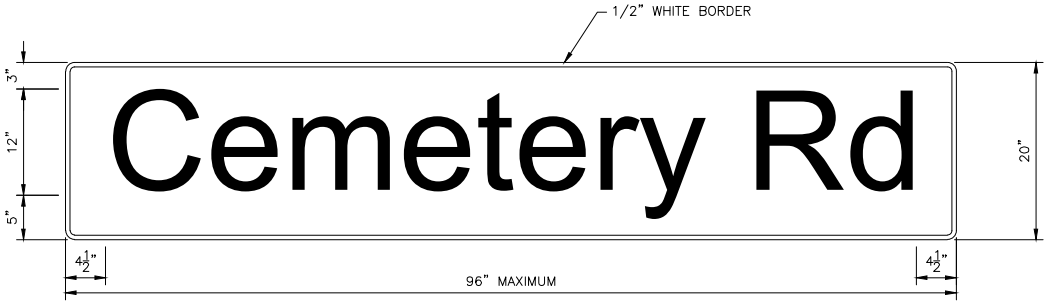
Installation. Signs shall be mounted on the mast arm. The preferred location is centered between signal heads as far left as possible over the oncoming lanes of traffic. One sign per arm.

Brackets. No brackets are required for Type A installations. Each sign shall be mounted to the arm using a band or cable-mounted system (Astro-Brac or approved equal).

Sign Size. The sign blade shall be 20" high. Maximum sign blade length shall be 96".

Sign Material. Sign sheeting material shall comply with ASTM D4956 Type VIII (3M Diamond Grade LDP 3970, Avery Dennison MVP Prismatic T-7500, or approved equal).

Sign Layout. The initial upper case letter height shall be 12". Prefixes and suffixes shall be the same size as the legend. A ½-inch white border with rounded corners shall be provided. A 4 ½ -inch clear space shall be provided between the edge of the sign and the edge of the first and last letter (horizontally). The sign shall be single sided with the backs of the signs painted black.



	TRAFFIC CONTROL NOTES AND DETAILS	CITY OF HILLIARD, OHIO
DATE: July 30, 2015	STREET NAME SIGNS	STANDARD CONSTRUCTION DRAWING
SCALE: N.T.S.	TYPE A	4/10 TC-1

Type B Street Name Signs

Type B signs are to be installed at all signalized intersections with strain poles.

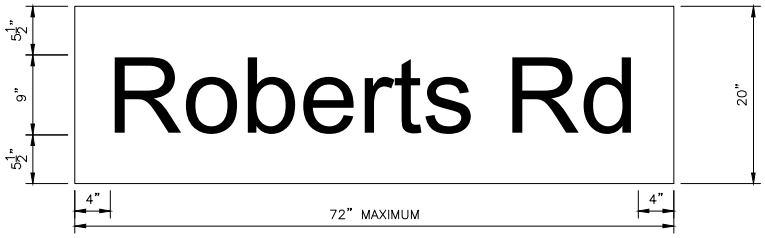
Installation. Signs shall be mounted on opposite corners on the traffic signal strain pole. Judgment may be used in determining the appropriate location based on visibility. Two signs may be installed per pole. The vertical clearance between the adjacent ground and the bottom of the lowest sign shall be 15 feet.

Brackets. Two cantilevered square brackets and double tee stiffeners (Sign-Fix, Xcessories Squared, or approved equal) shall be used. Each sign shall be banded to the vertical pole using four bands.

Sign Size. The sign blade shall be 20" high. Maximum sign blade length shall be 72".

Sign Material. Sign sheeting material shall comply with ASTM D4956 Type VIII (3M Diamond Grade LDP 3970, Avery Dennison MVP Prismatic T-7500, or approved equal).

Sign Layout. The initial upper case letter height shall be 9". Prefixes and suffixes shall be the same size as the legend. No border shall be used for signs that use cantilevered brackets for installation. A 4-inch clear space shall be provided between the edge of the sign and the edge of the first and last letter (horizontally). The sign shall be double sided.



	TRAFFIC CONTROL NOTES AND DETAILS	CITY OF HILLIARD, OHIO
DATE: July 30, 2015	STREET NAME SIGNS	STANDARD CONSTRUCTION DRAWING
SCALE: N.T.S.	TYPE B	5/10 TC-1

Type C Street Name Signs

Type C signs are to be installed at all roundabout locations.

Installation. Signs shall be mounted in the splitter islands with one sign per island at each leg of the roundabout. The vertical clearance between the adjacent top of curb and the bottom of the sign shall be 5 feet. The horizontal clearance between the edge of the sign and the face of the splitter island curb shall be 2' minimum.

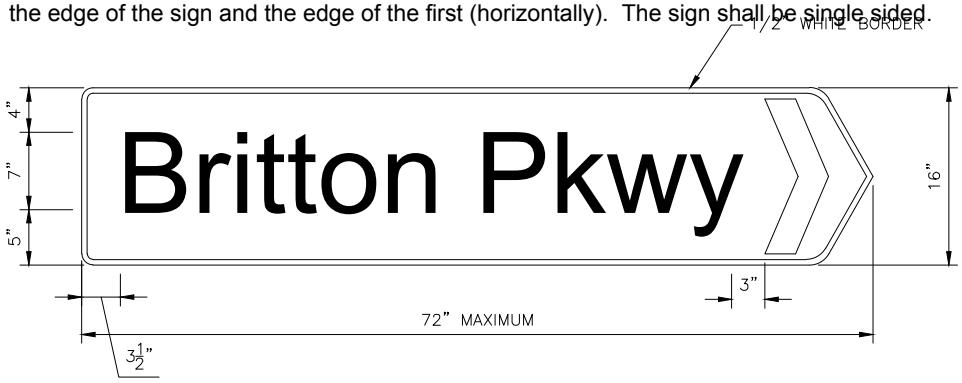
Brackets. No brackets are used for Type C sign installations.

Post/Anchor. Type C street name sign supports shall be two 2-inch square x 14 gauge square galvanized posts with die-cut knock-outs (typical regulatory sign posts). Pyramid rain caps shall be used. A single break-away anchor shall be used for each post. Anchors shall be 2 ¼-inch square, 42 inches long, and embedded such that 2 inches of the anchor remains above ground level. The overlap of the post within the anchor sleeve shall be 8 inches minimum. For all signs installed in concrete or paver islands, a six-inch PVC pipe box out shall be provided for the post anchor. The PVC box out shall be installed prior to pouring concrete or placing pavers. After the sign post anchor is installed, granular material shall be installed between the post anchor and the PVC box out.

Sign Size. The sign blade shall be 16" high. Maximum sign blade length shall be 72".

Sign Material. Sign sheeting material shall comply with ASTM D4956 Type VIII (3M Diamond Grade LDP 3970, Avery Dennison MVP Prismatic T-7500, or approved equal).

Sign Layout. The initial upper case letter height shall be 7". Prefixes and suffixes shall be the same size as the legend. A ½-inch white border with rounded corners and a chevron-style arrow shall be provided. A 3 ½ -inch clear space shall be provided between the edge of the sign and the edge of the first (horizontally). The sign shall be single sided.



	TRAFFIC CONTROL NOTES AND DETAILS	CITY OF HILLIARD, OHIO
DATE: July 30, 2015	STREET NAME SIGNS	STANDARD CONSTRUCTION DRAWING
SCALE: N.T.S.	TYPE C	6/10 TC-1

Type D Street Name Signs

Type D signs are to be installed at unsignalized intersections along arterial or collector streets with speed limits of 40 mph or greater. This includes intersections of a primary subdivision street and the arterial/collector street. Examples include the intersections of Alton Darby Road/Strider Lane and Dublin Road/River Landings Blvd.

Installation. At four-way intersections, two pairs of signs should be installed, mounted on opposite corners. At three-way (tee) intersections, one pair of signs should be installed. Judgment may be used in determining the appropriate location based on visibility. Two signs should be installed per pole. The vertical clearance between the adjacent ground and the bottom of the lowest sign shall be 12 feet. Signs shall be erected so that one sign does not block visibility of the other sign.

Brackets. Two cantilevered square brackets and double tee stiffeners (Sign-Fix, Xcessories Squared, or approved equal) shall be used.

Post/Anchor. Type D street name sign supports shall be 2-inch square x 12 gauge square galvanized posts with die-cut knock-outs. Pyramid rain caps shall be used. A single break-away anchor shall be used. Anchors shall be 2 ¼-inch square, 48 inches long, and embedded such that 2 inches of the anchor remains above ground level. The overlap of the post within the anchor sleeve shall be 18 inches minimum.

Sign Size. The sign blade shall be 16” high. Maximum sign blade length shall be 72”.

Sign Material. Sign sheeting material shall comply with ASTM D4956 Type VIII (3M Diamond Grade LDP 3970, Avery Dennison MVP Prismatic T-7500, or approved equal).

Sign Layout. The initial upper case letter height shall be 8”. Prefixes and suffixes shall be the same size as the legend. No border shall be used for signs that use cantilevered brackets for installation. A 4-inch clear space shall be provided between the edge of the sign and the edge of the first and last letter (horizontally). The sign shall be double sided.

	TRAFFIC CONTROL NOTES AND DETAILS	CITY OF HILLIARD, OHIO
DATE: July 30, 2015	STREET NAME SIGNS	STANDARD CONSTRUCTION DRAWING
SCALE: N.T.S.	TYPE D	7/10 TC–1

Type E Street Name Signs

Type E signs are to be installed at unsignalized intersections along arterial or collector streets with speed limits of 35 mph or less. This includes intersections of a primary subdivision street and the arterial/collector street. Examples include the intersections of Avery Rd/Dixon Dr, Davidson Road/Heather Ridge Dr, and Scioto Darby Rd/Hoffman Farms Dr.

Installation. At four-way intersections, two pairs of signs should be installed, mounted on opposite corners. At three-way (tee) intersections, one pair of signs should be installed. Judgment may be used in determining the appropriate location based on visibility. Two signs should be installed per pole. The vertical clearance between the adjacent ground and the bottom of the lowest sign shall be 12 feet. Signs shall be erected so that one sign does not block visibility of the other sign.

Brackets. Two cantilevered square brackets and double tee stiffeners (Sign-Fix, Xcessories Squared, or approved equal) shall be used.

Post/Anchor. Type E street name sign supports shall be 2-inch square x 12 gauge square galvanized posts with die-cut knock-outs. Pyramid rain caps shall be used. A single break-away anchor shall be used. Anchors shall be 2 ¼-inch square, 48 inches long, and embedded such that 2 inches of the anchor remains above ground level. The overlap of the post within the anchor sleeve shall be 18 inches minimum. When one or more sign erected on a 2-inch square post exceeds 60 inches, the anchor shall be modified with flanges to provide additional stability and reduce torque from wind loading.

Sign Size. The sign blade shall be 12" high. Maximum sign blade length shall be 72".

Sign Material. Sign sheeting material shall comply with ASTM D4956 Type VIII (3M Diamond Grade LDP 3970, Avery Dennison MVP Prismatic T-7500, or approved equal).

Sign Layout. The initial upper case letter height shall be 6". Prefixes and suffixes shall be the same size as the legend. No border shall be used for signs that use cantilevered brackets for installation. A 3-inch clear space shall be provided between the edge of the sign and the edge of the first and last letter (horizontally). The sign shall be double sided.

	TRAFFIC CONTROL NOTES AND DETAILS	CITY OF HILLIARD, OHIO
DATE: July 30, 2015	STREET NAME SIGNS	STANDARD CONSTRUCTION DRAWING
SCALE: N.T.S.	TYPE E	8/10 TC-1

Type F Street Name Signs

Type F signs are to be installed at unsignalized intersections within subdivisions with speed limits of 25 mph only. Type F signs apply to internal neighborhood streets, not the intersection of the primary subdivision street and the arterial/collector street.

Installation. One pair of signs should be installed unless the street name changes on either side of a street. Judgment may be used in determining the appropriate location based on visibility. Two signs should be installed per post. The vertical clearance between the adjacent ground and the bottom of the lowest sign shall be 10 feet.

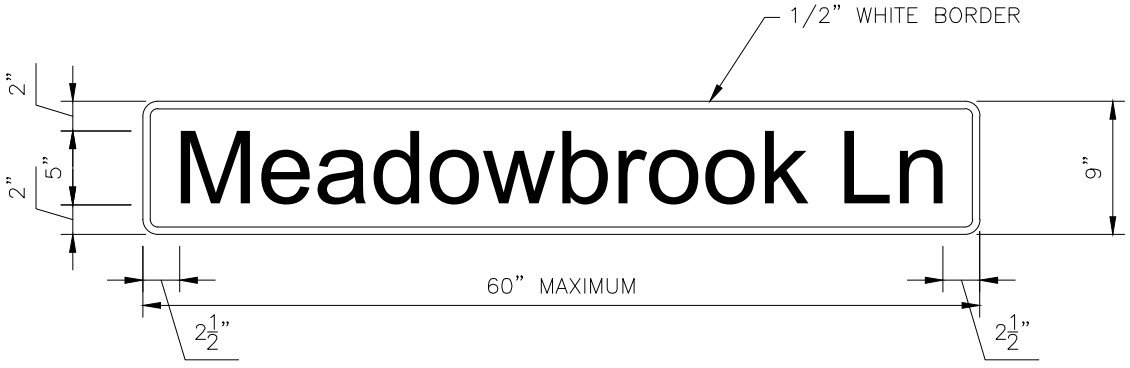
Brackets. One 12-inch square post bracket and one 12-inch cross piece bracket shall be used. Note: Type F signs are mounted using a cross-mounted system, not cantilevered like Type D and Type E street name signs.

Post/Anchor. Type F street name sign supports shall be 2-inch square x 12 gauge square galvanized posts with die-cut knock-outs. Pyramid rain caps are not used. A single break-away anchor shall be used. Anchors shall be 2 ¼-inch square, 30 inches long, and embedded such that 2 inches of the anchor remains above ground level. The overlap of the post within the anchor sleeve shall be 8 inches minimum.

Sign Size. The sign blade shall be 9" high. Maximum sign blade length shall be 60".

Sign Material. Sign sheeting material shall comply with ASTM D4956 Type IV (3M High Intensity Prismatic 3930, Avery Dennison High Intensity Prismatic T-6500, or approved equal).

Sign Layout. The initial upper case letter height shall be 5". Prefixes and suffixes shall be the same size as the legend. A ½-inch white border with rounded corners shall be provided. A 2 ½ -inch clear space shall be provided between the edge of the sign and the edge of the first and last letter (horizontally). The sign shall be double sided.



	TRAFFIC CONTROL NOTES AND DETAILS	CITY OF HILLIARD, OHIO
DATE: July 30, 2015	STREET NAME SIGNS	STANDARD CONSTRUCTION DRAWING
SCALE: N.T.S.	TYPE F	9/10 TC-1

Street Name Sign Support and Anchor Specifications

Plan Designation: Item 630 Street Name Sign Support and Anchor (Type ___), As Per Plan

Plan Unit: Per Each

Plan Payment: Payment for each street name sign support shall include the appropriate length anchor and the appropriate post length required to obtain the required minimum lap length and the proper vertical clearance for the various street name sign types. Payment for the sign supports shall include the pyramid rain caps, rivets, bolts, nuts, and all incidental hardware needed for a complete installation.

Type A Street Name Sign Supports and Anchors. Type A street name signs are installed on mast arms at signalized intersections. A separate support and anchor are not required.

Type B Street Name Sign Supports and Anchors. Type B street name signs are installed on strain poles at signalized intersections. A separate support and anchor are not required.

Type C Street Name Sign Supports and Anchors. Type C street name sign supports shall be two 2-inch square x 14 gauge square galvanized posts with die-cut knock-outs (typical regulatory sign posts). Pyramid rain caps shall be used. A single break-away anchor shall be used for each post. Anchors shall be 2 ¼-inch square, 42 inches long, and embedded such that 2 inches of the anchor remains above ground level. The overlap of the post within the anchor sleeve shall be 8 inches minimum. For all signs installed in concrete or paver islands, a six-inch PVC pipe box out shall be provided for the post anchor. The PVC box out shall be installed prior to pouring concrete or placing pavers. After the sign post anchor is installed, granular material shall be installed between the post anchor and the PVC box out.

Type D Street Name Sign Supports and Anchors. Type D street name sign supports shall be 2-inch square x 12 gauge square galvanized posts with die-cut knock-outs. Pyramid rain caps shall be used. A single break-away anchor shall be used. Anchors shall be 2 ¼-inch square, 48 inches long, and embedded such that 2 inches of the anchor remains above ground level. The overlap of the post within the anchor sleeve shall be 18 inches minimum.

Type E Street Name Sign Supports and Anchors. Type E street name sign supports shall be 2-inch square x 12 gauge square galvanized posts with die-cut knock-outs. Pyramid rain caps shall be used. A single break-away anchor shall be used. Anchors shall be 2 ¼-inch square, 48 inches long, and embedded such that 2 inches of the anchor remains above ground level. The overlap of the post within the anchor sleeve shall be 18 inches minimum.

Type F Street Name Sign Supports and Anchors. Type F street name sign supports shall be 2-inch square x 12 gauge square galvanized posts with die-cut knock-outs. Pyramid rain caps are not used. A single break-away anchor shall be used. Anchors shall be 2 ¼-inch square, 30 inches long, and embedded such that 2 inches of the anchor remains above ground level. The overlap of the post within the anchor sleeve shall be 8 inches minimum.

Old Hilliard District. In the Old Hilliard District, the above street name sign support and anchor specification apply except all sign supports and hardware shall be black.

Conservation District. In the Conservation District, the type C-F street name sign support and anchor specifications for unsignalized intersections are per Hilliard standard construction drawing TC-3. The vertical clearance and installation requirements provided herein the table on sheet 3/10 apply.

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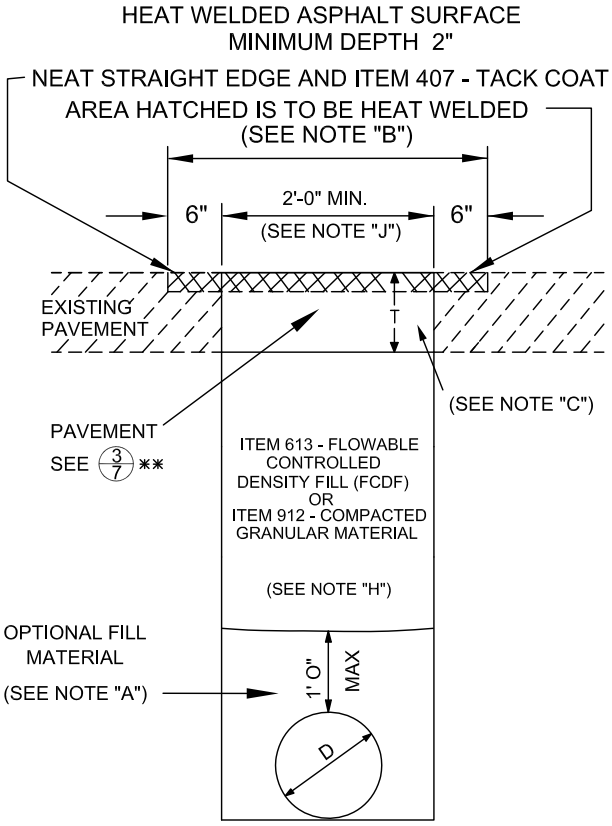
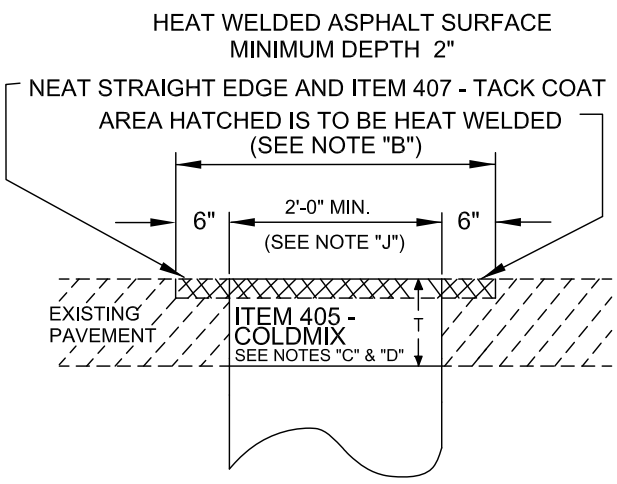
STANDARD CONSTRUCTION DRAWINGS
CITY OF COLUMBUS



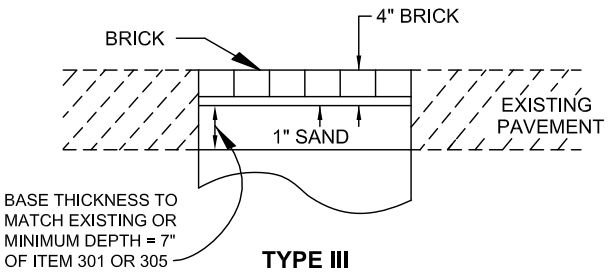
TYPE I

STANDARD FLEXIBLE ASPHALT REPAIR WITH HEATWELD SURFACE (SEE NOTE "B")



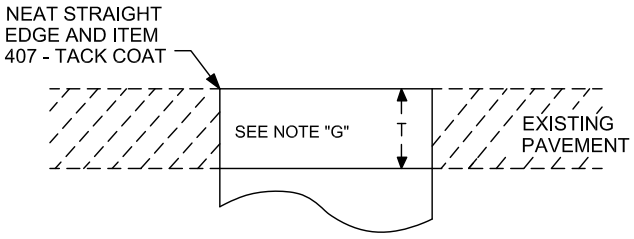
TYPE II

WINTER OPERATIONS FLEXIBLE ASPHALT REPAIR WITH HEATWELD SURFACE (SEE NOTE "E")



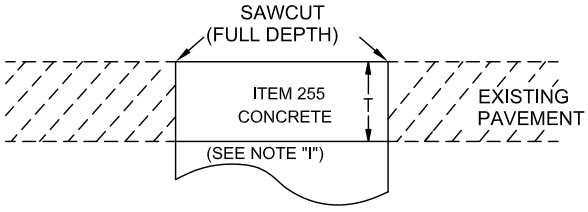
TYPE III

BRICK STREET REPAIR (SEE NOTE "F")



TYPE IV

ALLEY REPAIR



TYPE V

CONCRETE STREET REPAIR OR CONCRETE BUS PAD

BACKFILL FOR ALL TYPES SHALL MEET THE REQUIREMENTS SHOWN IN TYPE I ABOVE.

T: MATCH EXISTING PAVEMENT THICKNESS, HOWEVER, MINIMUM OF 10" ON ALL STREET CUTS AND 6" ON ALL ALLEYS.

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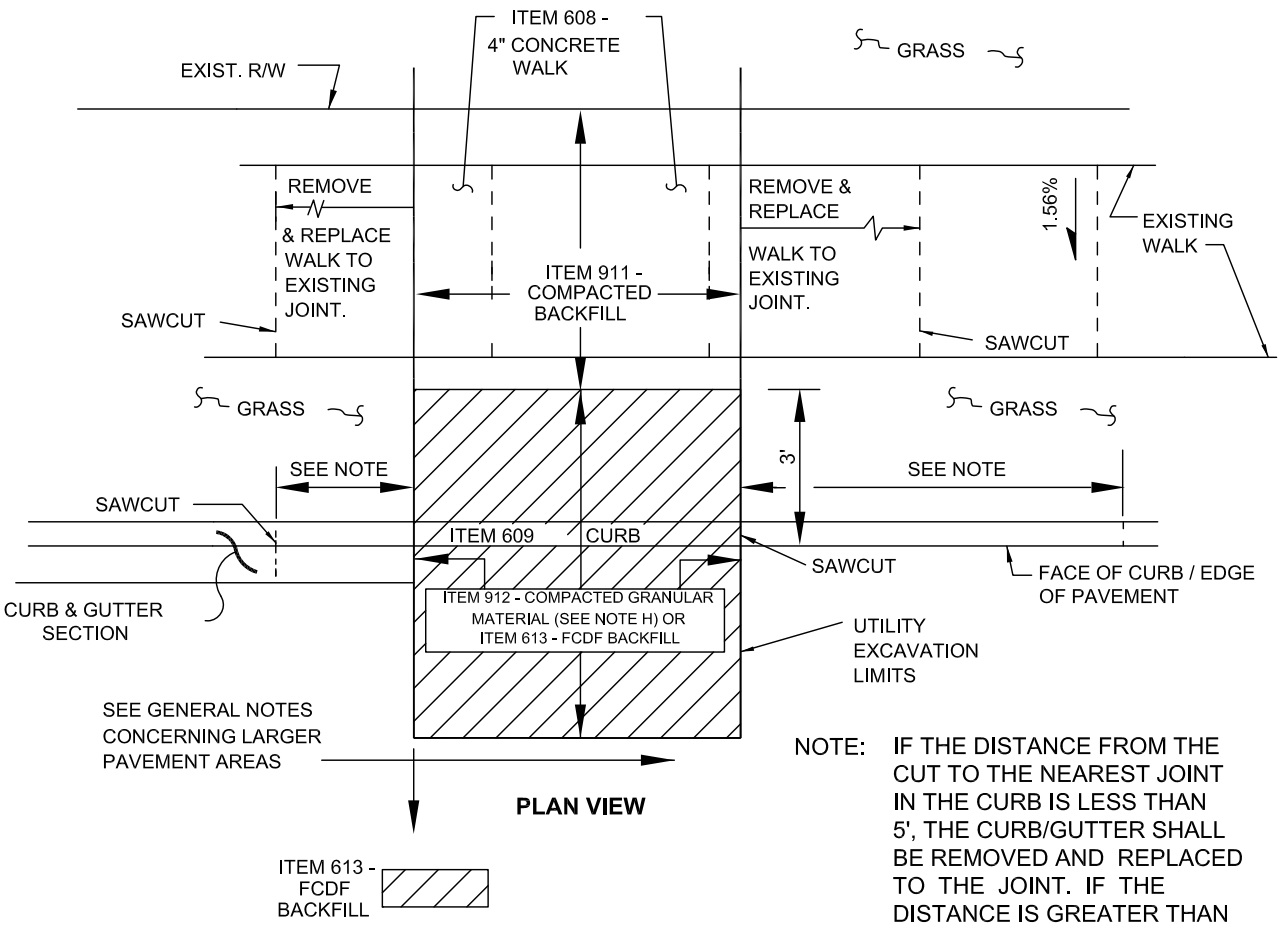
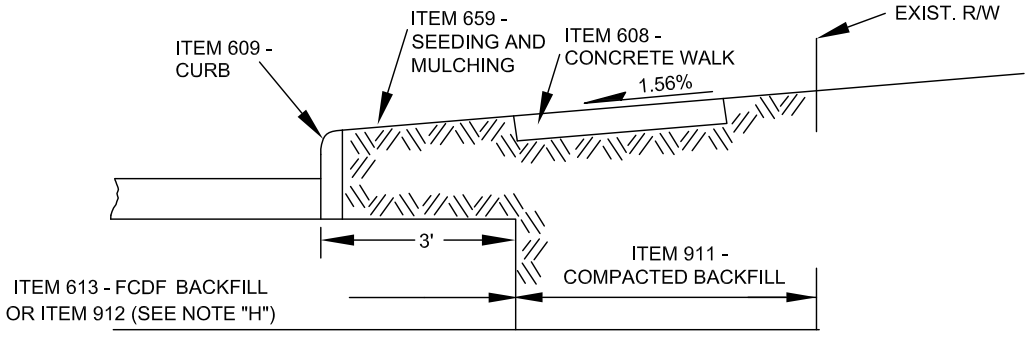
SIDEWALK AND CURB REPAIR DETAILS



NOTE: IF THE DISTANCE FROM THE CUT TO THE NEAREST JOINT IN THE CURB IS LESS THAN 5', THE CURB/GUTTER SHALL BE REMOVED AND REPLACED TO THE JOINT. IF THE DISTANCE IS GREATER THAN 5', THE CURB MAY REMAIN.



BOTTOM OF EXCAVATION

ALL GRASS AREAS SHALL BE SEEDED IN ACCORDANCE WITH ITEM 659 - SEEDING AND MULCHING.

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GENERAL NOTES

EXCAVATION PERMIT REQUIRED: A CITY OF COLUMBUS STREET EXCAVATION PERMIT IS REQUIRED FOR ALL EXCAVATIONS WITHIN THE PUBLIC RIGHT-OF-WAY, AS SET FORTH BY COLUMBUS CITY CODE, CHAPTER 903 AND ISSUED IN ACCORDANCE WITH PROVISIONS IN THE GENERAL RULES AND REGULATIONS OF THE DEPARTMENT OF PUBLIC SERVICE.

SCOPE OF WORK

THIS WORK SHALL CONSIST OF PAVEMENT REMOVAL, NECESSARY EXCAVATION, AND PAVEMENT REPLACEMENT IN ACCORDANCE WITH THE DETAILS SHOWN HEREIN. ALL WORK AND MATERIALS SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT CITY OF COLUMBUS CONSTRUCTION AND MATERIALS SPECIFICATION (CMSC).

PROCEDURES USED FOR THE PAVEMENT REMOVAL AND REPLACEMENT SHALL NOT CAUSE SPALLING OR CRACKING OF ADJACENT PAVEMENT.

WHEN THE PAVEMENT IS REMOVED AND THE CONTRACTOR IS UNABLE TO COMPLETE THE REQUIRED REPLACEMENT IN TIME FOR IT TO BE OPENED TO TRAFFIC AS INDICATED ON THE PERMIT, THE EXCAVATION SHALL BE FILLED WITH A BITUMINOUS PATCH MATERIAL WITH A DURABLE SURFACE OR PROPERLY PLATED. (AS PER CITY CODE CHAPTER 903 &/OR SHEET 7 OF THIS STANDARD DRAWING) THE CONTRACTOR WILL BE REQUIRED TO MAINTAIN THESE PATCHES WHILE THEY ARE IN SERVICE. THE COST OF PLACING, MAINTAINING, AND REMOVING AND DISPOSING OF THE TEMPORARY PATCHES OR PLATES WILL BE AT THE CONTRACTOR'S EXPENSE.

WHEN ITEM 613 FCDF IS USED AS A BACKFILL, NO PAVEMENT SHALL BE PLACED UNTIL BLEED WATER HAS BEEN EVAPORATED FROM THE FCDF SURFACE OR HAS BEEN DRAINED OR REMOVED FROM THE SURFACE. ITEM 613 FCDF IS NOT PERMITTED AS A TEMPORARY DRIVING SURFACE.

THE BACKFILLING PAVEMENT REPAIR AND/OR HEAT WELDING SHALL BE DONE BY THE CONTRACTOR OR PERMITEE IN ACCORDANCE WITH CITY SPECIFICATIONS. IF DESIRED, ANY OR ALL OF THIS WORK CAN BE PERFORMED BY THE CITY OF COLUMBUS. THE CITY SHALL COLLECT APPROPRIATE FEES AT THE TIME THE PERMIT IS ISSUED FOR SAID WORK.

RESTORATION OF ANY SIDEWALK, CURB, STREET PAVEMENT, ETC., SHALL OCCUR NO LATER THAN 30 DAYS AFTER CONCLUSION OF ANY UTILITY REPAIR OR INSTALLATION ACTIVITY. CONSTRUCTION ACTIVITY COMPLETED DECEMBER THROUGH APRIL SHALL BE RESOLVED NO LATER THAN MAY 31ST. ADDITIONAL PERMITS SHALL NOT BE ISSUED UNTIL THE VIOLATIONS ARE CORRECTED TO THE SATISFACTION OF THE DEPARTMENT OF PUBLIC SERVICE. IN ADDITION, EACH VIOLATION MAY BE DEALT WITH IN ACCORDANCE WITH SECTION 903.99 OF THE COLUMBUS CITY CODE.

** PAVING STANDARDS FOR LARGE TRENCHES OR PAVING AREAS

THE PAVEMENT REPAIR SECTION SHALL CONFORM TO 3" OF ITEM 448 - ASPHALT CONCRETE ON EITHER 7" OF ITEM 301 - ASPHALT CONCRETE BASE OR ITEM 305 - PORTLAND CEMENT CONCRETE BASE.

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WHEN A TRENCH EXCEEDS 100 FT. IN LENGTH, THE REPAIR SHALL INCLUDE PLANING A FULL LANE WIDTH (OR ANY OTHER LANE WIDTH AS DIRECTED BY THE DEPARTMENT OF PUBLIC SERVICE) TO A DEPTH OF 1½" FOR THE ENTIRE LENGTH OF THE TRENCH. THE PLANED AREA SHALL THEN BE REPAVED WITH A PAVER IN ACCORDANCE WITH CURRENT CITY STANDARD SPECIFICATIONS. ITEM 423 - CRACK SEALING, TYPE 1 SHALL BE APPLIED TO EXPOSED JOINTS ONCE THE PAVING OPERATION HAS BEEN COMPLETED.

WHEN TRENCHING WORK CROSSES LANES, ALL AFFECTED LANES SHALL REQUIRE PLANING AND RESURFACING AS DESCRIBED ABOVE. THIS WORK SHALL INCLUDE ALL OF THE AFFECTED PAVEMENT AREA.

SPECIAL NOTES

NOTE 'A' : WHEN USING FLOWABLE CONTROLLED DENSITY FILL (FCDF), THE OPTIONAL FILL AREA OVER THE CONDUIT MAY BE BACKFILLED WITH SAND, GRANULAR MATERIAL, OR OTHER SUITABLE 912 MATERIAL, FOR A DISTANCE NOT TO EXCEED 1 FT. A PROTECTIVE BARRIER OF VISQUEEN OR SIMILAR MATERIAL IS PERMITTED.

NOTE 'B' : FOR TYPE I AND TYPE II CUT REPAIRS, THE AREA TO BE HEAT WELDED IS TO INCLUDE THE CUT AND EXTEND FOR 6" BEYOND EACH SIDE OF THE CUT FOR A NOMINAL DEPTH OF 2".

NOTE 'C' : FOR TYPE I AND TYPE II PAVEMENT REPAIR, THE ITEM 448 - HOT ASPHALT CONCRETE OR ITEM 405 - COLD MIX SHALL BE PLACED IN LIFTS NOT EXCEEDING 3" AND COMPACTED WITH A COMBINATION VIBRATORY PLATE COMPACTOR, OR A VIBRATORY STEEL WHEELED ROLLER WITH A MINIMUM CERTIFIED FORCE OF 2000 POUNDS. IN ALL CASES THE SURFACE LIFT SHALL BE COMPACTED WITH THE VIBRATORY STEEL WHEELED ROLLER. WHEN PLACING ITEM 405 - COLD MIX FULL DEPTH, MATERIAL TEMPERATURE SHALL BE 70 DEGREES OR ABOVE.

NOTE 'D' : COLD MIX SHALL BE ITEM 405 - COLD MIX OR OTHER COLD MIX APPROVED BY THE CITY OF COLUMBUS. IN LIEU OF COLD MIX, THE CONTRACTOR MAY STOCKPILE ITEM 448 - ASPHALT CONCRETE AND REHEAT IT TO PLACE IN CUT AS PAVEMENT REPAIR. TYPE II PAVEMENT REPLACEMENT SHALL CONSIST OF FULL DEPTH ITEM 405 - COLD MIX FOR SMALL EXCAVATIONS. LARGE EXCAVATIONS SHALL REQUIRE A MINIMUM OF 7" OF FAST SETTING PORTLAND CEMENT AND 2" OF ITEM 405 - COLD MIX.

NOTE 'E' : THE COLD MIX IS TO BE REPLACED WITH ITEM 448 - ASPHALT CONCRETE WHICH IS TO BE HEAT WELDED AS SET FORTH IN NOTE 'B'. THIS WORK SHALL BE PERFORMED AS SOON AS ASPHALT IS AVAILABLE.

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NOTE 'F' : REPAIR OF BRICK STREETS

1. BRICKS REMOVED FROM A REPAIR AREA SHALL BE STORED IN A SAFE PLACE BY THE CONTRACTOR FOR REUSE. THE CONTRACTOR WILL BE RESPONSIBLE FOR REPLACING ANY BRICKS THAT ARE STOLEN OR DAMAGED, AT NO ADDITIONAL COST TO THE CITY.

2. IF BRICKS ARE SUPPLIED BY THE CONTRACTOR, THEY MUST FIRST BE APPROVED BY THE CITY BEFORE THEY ARE USED.

3. SAW CUTTING: ALL PARTIAL BRICKS SHALL BE SAWCUT. FURTHER, NO BRICK WILL BE PERMITTED TO BE CUT, FOR REPLACEMENT, TO A LENGTH LESS THAN 1/2 ITS ORIGINAL LENGTH. THIS MAY REQUIRE SAW CUTTING OF ADJACENT UNDISTURBED BRICK(S).

4. THE EXISTING BASE MATERIAL SHALL BE CUT BACK TO AS NEARLY VERTICAL AS POSSIBLE. IF SHEARING OF THE ADJACENT BASE RESULTS, THE CONTRACTOR SHALL REMOVE ADDITIONAL BASE MATERIAL UNTIL A VERTICAL FACE IS ACHIEVED.

5. THE MAXIMUM WIDTH OF A BRICK MORTAR JOINT SHALL BE 1/2". THIS RESTRICTION SHALL ALSO APPLY TO THE JOINT FORMED ADJACENT TO THE PERIMETER OF A REPAIR AREA, WHERE THE ROWS MAY NOT BE PARALLEL TO ONE ANOTHER.

6. MORTARING OF JOINTS: ALL JOINTS SHALL BE MORTARED WITH A 50/50 MIXTURE BY VOLUME OF SAND AND CEMENT SO AS TO PROVIDE A FLUSH FINISH. THIS MAY REQUIRE MORE THAN ONE APPLICATION. FURTHER, MECHANICAL VIBRATION WILL BE REQUIRED FOR CONSOLIDATION OF DRY MORTAR MIX.

NOTE 'G' : FOR ALLEY REPAIRS, THE PAVEMENT REPLACEMENT SHALL CONFORM TO THE TYPE AND THICKNESS OF THE EXISTING PAVEMENT. CHIP AND SEAL TYPE ALLEYS SHALL REQUIRE MATCHING THE EXISTING THICKNESS OF PAVEMENT WITH THE APPROPRIATE COMBINATION OF MATERIALS BASED ON THE SIZE OF THE EXCAVATION. THE MINIMUM SHALL CONSIST OF 6" OF ITEM 448 - ASPHALT CONCRETE. FINISHED CONCRETE PAVEMENT IS NOT PERMITTED. MATERIALS USED SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT CMSC.

IF MORE THAN 1/3 OF THE WIDTH OF AN ALLEY IS REMOVED, THE PAVEMENT SHALL BE REPLACED AS PER TYPE 1 AND THEN OVERLAYED OVER THE TOTAL WIDTH OF PAVEMENT AND LENGTH OF TRENCH.

NOTE 'H' : ITEM 912 - COMPACTED GRANULAR MATERIAL:
THIS METHOD OF BACKFILL CAN ONLY BE USED WITH FULL TIME CITY INSPECTION. AN INSPECTION FEE MUST BE POSTED WHEN THE PERMIT IS ISSUED.

NOTE 'I' : CONCRETE BASE OR PAVEMENT
IF PAVING REQUIREMENTS ALLOW FOR SUFFICIENT CURING TIME SO THAT FAST SETTING CONCRETE IS NOT NEEDED, STANDARD CONCRETE BASE OR PAVEMENT MAY BE PLACED AS PER THE CMSC. THIS OPTION MUST BE NOTED ON THE PERMIT APPLICATION AND APPROVED BY THE CITY OF COLUMBUS.

NOTE 'J' : THE TRENCH WIDTH FOR SMALL PIPES AND CONDUITS SHALL BE OF SUFFICIENT WIDTH TO ALLOW FOR THE PROPER PLACEMENT OF THE BACKFILL MATERIAL. THE PAVEMENT PORTION OF THE TRENCH SHALL BE A MINIMUM OF 2 FT. IN WIDTH. THIS IS TO ALLOW FOR THE PROPER COMPACTION OF THE ASPHALT PAVEMENT. IF THE TRENCH FOR PLACING CONDUIT IS NARROWER THAN 2 FT. THEN THE PAVEMENT PORTION SHALL BE CUT BACK TO PROVIDE THE 2 FT. MINIMUM FOR PAVING OPERATIONS.

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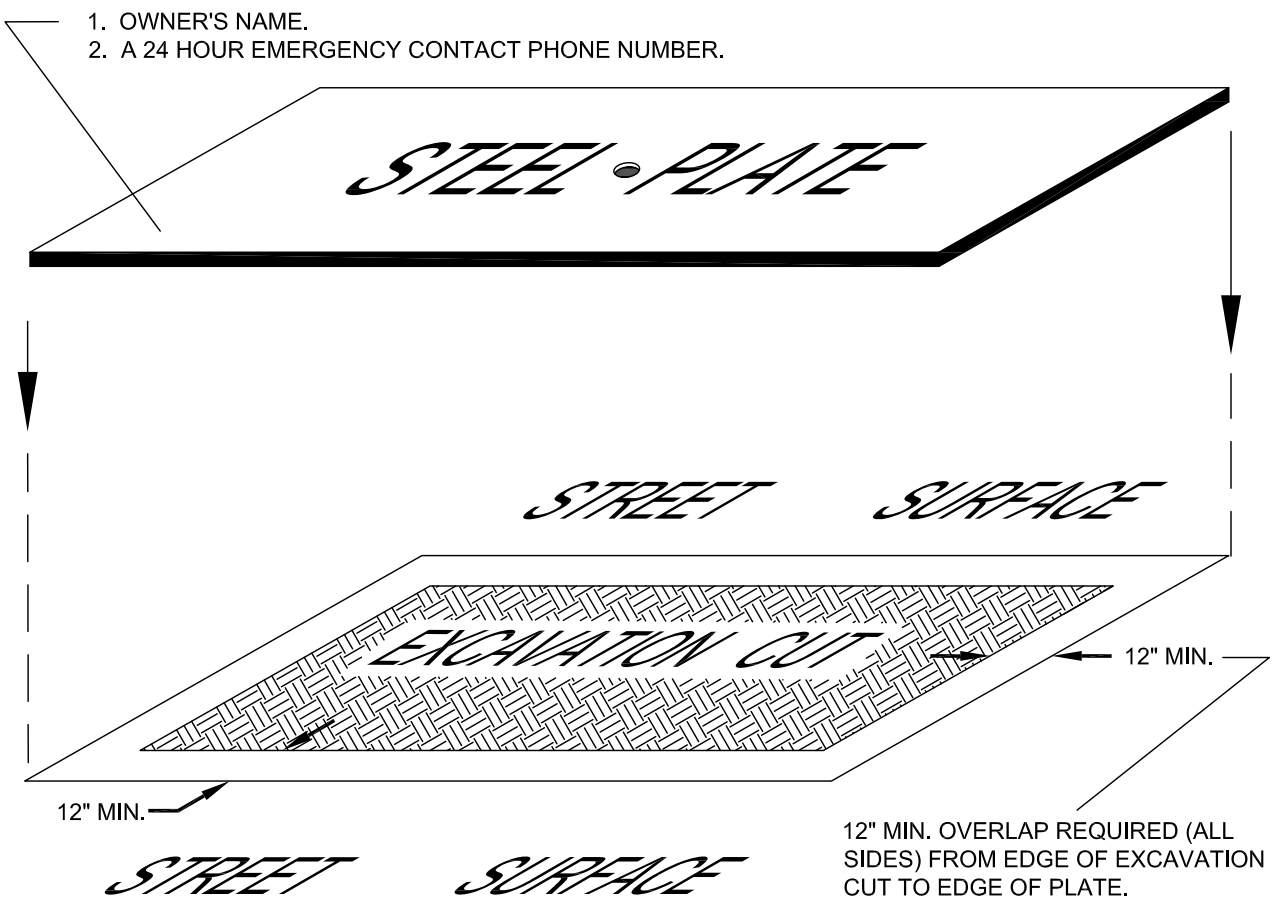


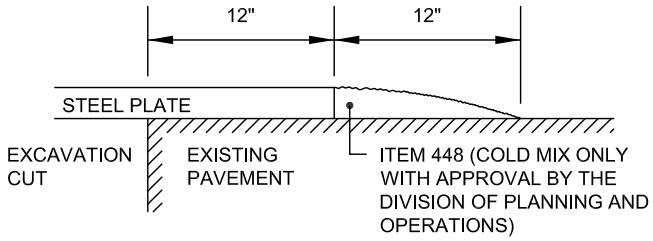
ALL STEEL PLATES MUST HAVE THE FOLLOWING INFORMATION CLEARLY AND LEGIBLY 'ETCHED' INTO THEIR TOP SURFACE:

1. OWNER'S NAME.
2. A 24 HOUR EMERGENCY CONTACT PHONE NUMBER.

MINIMUM THICKNESS OF STEEL PLATES	
SIZE OF PLATE	THICKNESS
4' x 4'	1/2"
4' x 6'	3/4"
LARGER	1"

NO STEEL PINS ARE PERMITTED.

SEE SHEET 7 FOR SIGNING REQUIREMENTS.



STEEL PLATE REQUIREMENTS

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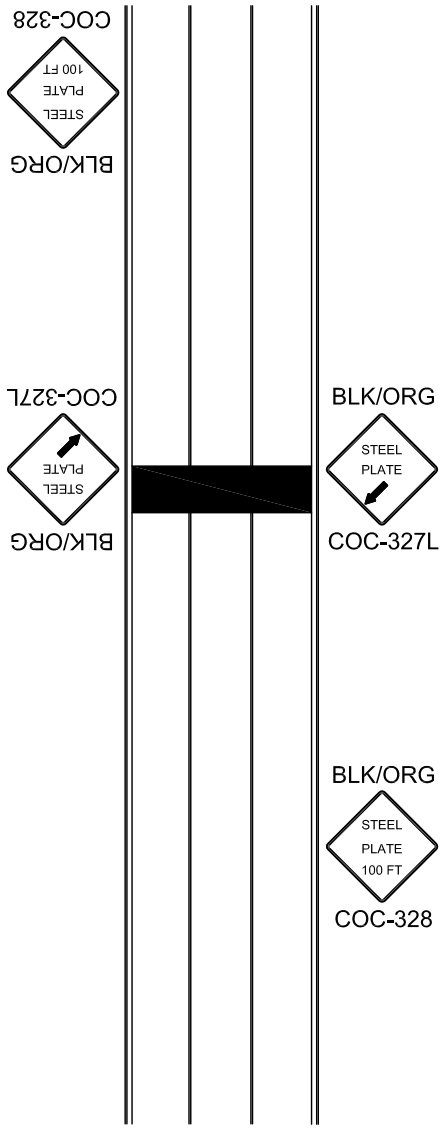
SIGNS ARE TO BE 36"x36" FOR RESIDENTIAL AND DOWNTOWN AREAS AND 48"x48" ON MULTI-LANE, HIGH SPEED (45 MPH OR GREATER) ROADWAYS.

SIGN COC-327 (R/L) IS REQUIRED AT ALL PLATE LOCATIONS. SIGN COC-328 IS REQUIRED WHEN POSTED SPEED IS 35 MPH OR GREATER.

SIGNS SHOULD BE PLACED IN ALL DIRECTIONS THAT ARE AFFECTED.

SIGNS SHOULD BE DUAL MOUNTED ON MULTI-LANE, ONE-WAY ROADWAYS.

ALL SIGNS SHALL BE MOUNTED IN ACCORANCE WITH THE OHIO MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (OMUTCD).



STEEL PLATE REQUIREMENTS

PAVEMENT & UTILITY CUT REPAIR STANDARDS

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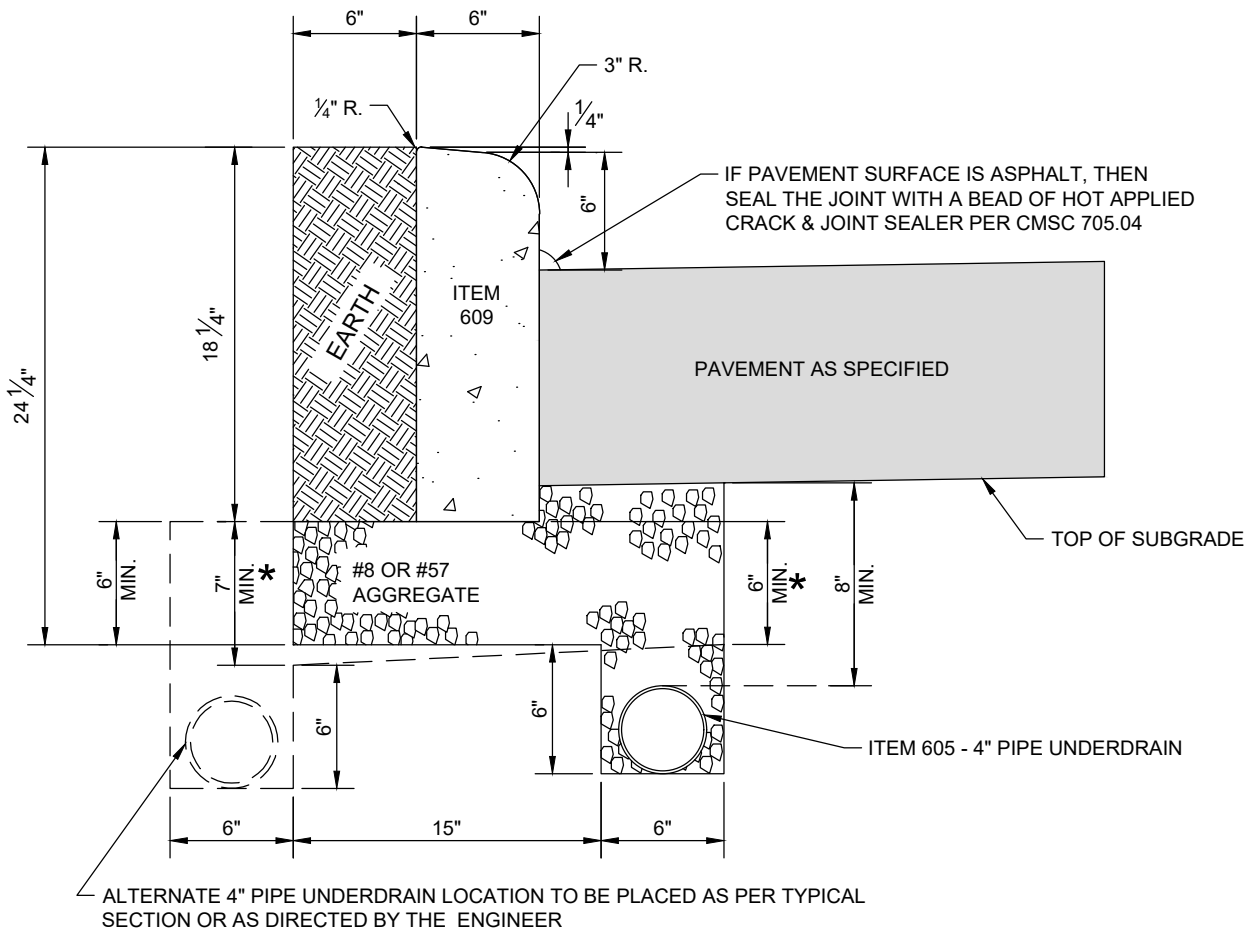

* CURB AGGREGATE COURSE-WHERE THE ROADWAY PAVEMENT HAS AGGREGATE BASE, MATCH THE BOTTOM OF THE CURB AGGREGATE COURSE TO THE TOP OF SUBGRADE. ENSURE ROADWAY SUB BASE MEETS UNDERDRAIN AGGREGATE.

IF THE TOP OF THE SUBGRADE IS BELOW THE BOTTOM OF THE CURB, THE UNDERDRAIN SHALL BE ADJUSTED TO KEEP THE TOP OF THE UNDERDRAIN AT LEAST 8" BELOW THE TOP OF THE SUBGRADE; AGGREGATE DEPTH BETWEEN BOTTOM OF CURB AND TOP OF UNDERDRAIN MAY VARY IF THIS OCCURS.

SUBGRADE COMPACTION SHALL BE COMPLETED BEFORE UNDERDRAIN INSTALLATION.

WHEN A CURB AND GUTTER INLET IS INSTALLED, THE TOP OF THE CASTING SHALL BE THE SAME AS THE TOP OF CURB ELEVATION. THE EDGE OF PAVEMENT ELEVATION SHALL BE 3/8" HIGHER THAN THE GRATE WHEREVER THEY MEET.

FOR REPLACEMENT WORK, THE CURB SHALL BE REMOVED AT AN EXISTING JOINT OR NO CLOSER THAN 5 FEET FROM AN EXISTING JOINT.

1/2" EXPANSION MATERIAL WILL BE INSTALLED BEHIND THE CURB WHEN A CONCRETE WALK, DRIVE, OR OTHER CONCRETE ITEM IS ADJOINING IT.

UNDERDRAIN IS NOT REQUIRED WHEN CURB IS ALONG CONCRETE MEDIAN.

0.74 C.F. CONCRETE PER L.F.

CURB, STRAIGHT 18"

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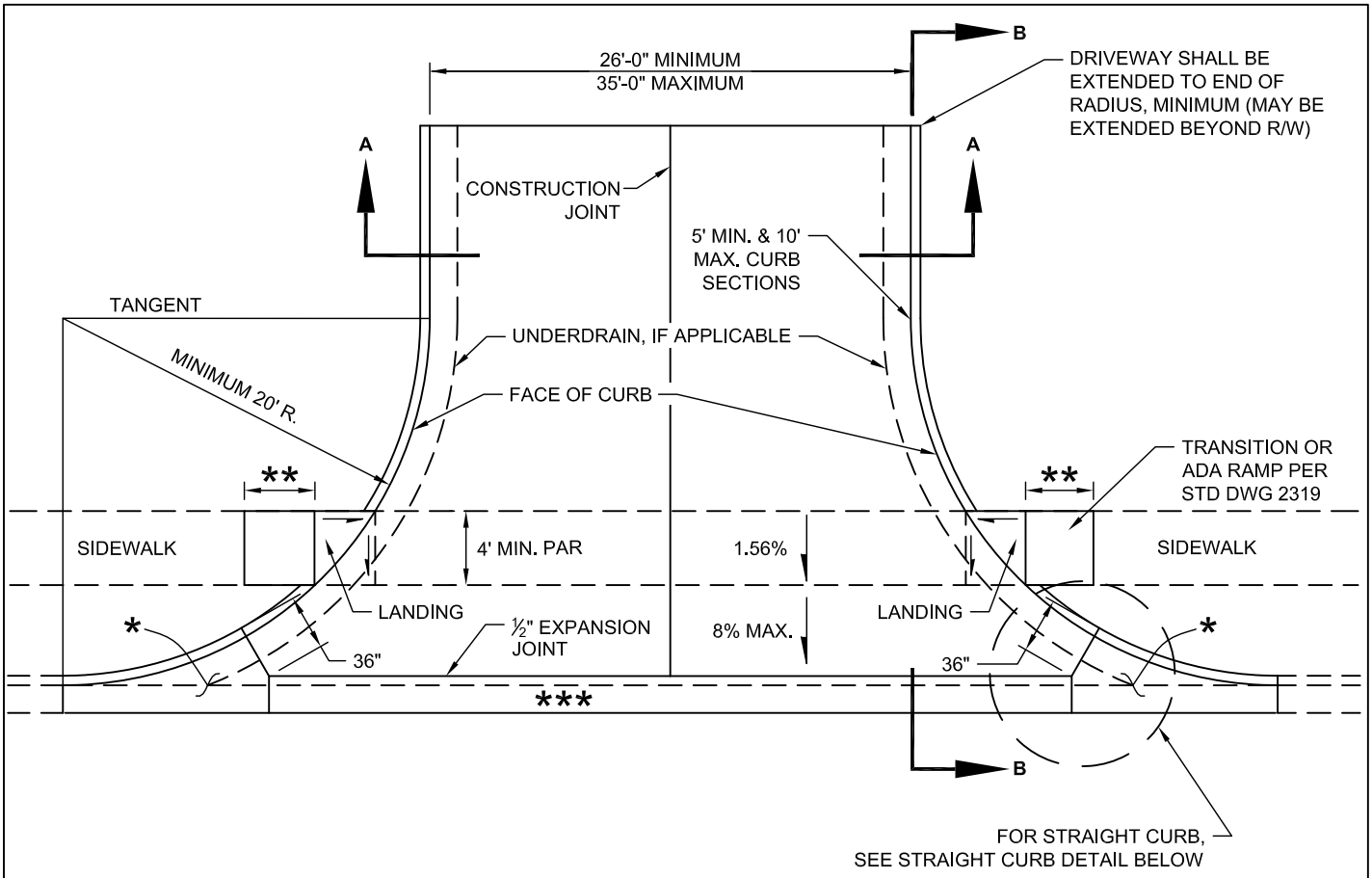


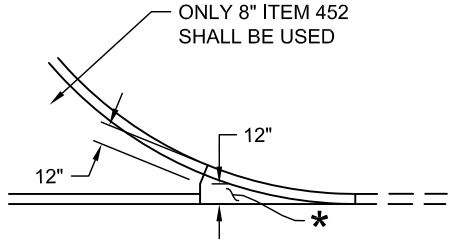
* PAVEMENT & CURB MAY BE POURED INTEGRAL WITH PRIOR C.O.C. APPROVAL.

** 8" THICK CONCRETE SIDEWALK FOR 1 FULL PANEL (MIN. 5 FT.) BEYOND EDGE OF DRIVE.

*** MAINTAIN 4" PIPE UNDERDRAIN. CURB OR COMBINED CURB AND GUTTER SHALL BE TAKEN OUT AND REPLACED WITH CONCRETE, SEPARATED FROM THE DRIVE BY 1/2" PREMOLDED EXPANSION JOINT. WHEN LESS THAN 5 FT. OF A CURB SECTION REMAINS AFTER THE CURB CUT IS LOCATED, IT SHALL ALSO BE REMOVED AND REPLACED. CURB/GUTTER SHALL BE CONSTRUCTED IN MINIMUM 5 FT. SECTIONS AND MAXIMUM 10 FT. SECTIONS.

PAR = PEDESTRIAN ACCESS ROUTE. SET PAR THROUGH APPROACH AT SIDEWALK GRADE TO AVOID RAMP OR TRANSITION. IF NOT POSSIBLE, THEN MINIMIZE TRANSITION FROM SIDEWALK TO APPROACH.

NO DOWELS REQUIRED ON DRIVES.



STRAIGHT CURB DETAIL

DRIVEWAY, NON-RESIDENTIAL WITH RADIUS CURBED ROADWAY

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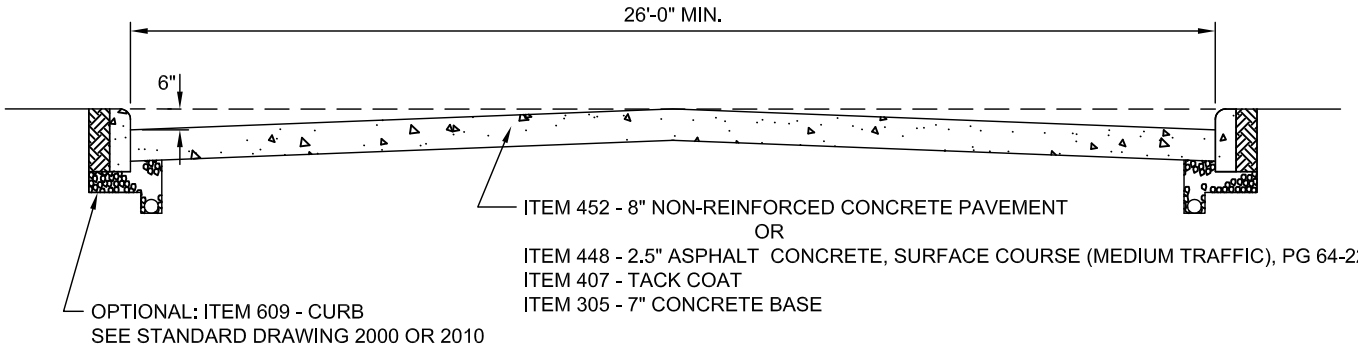
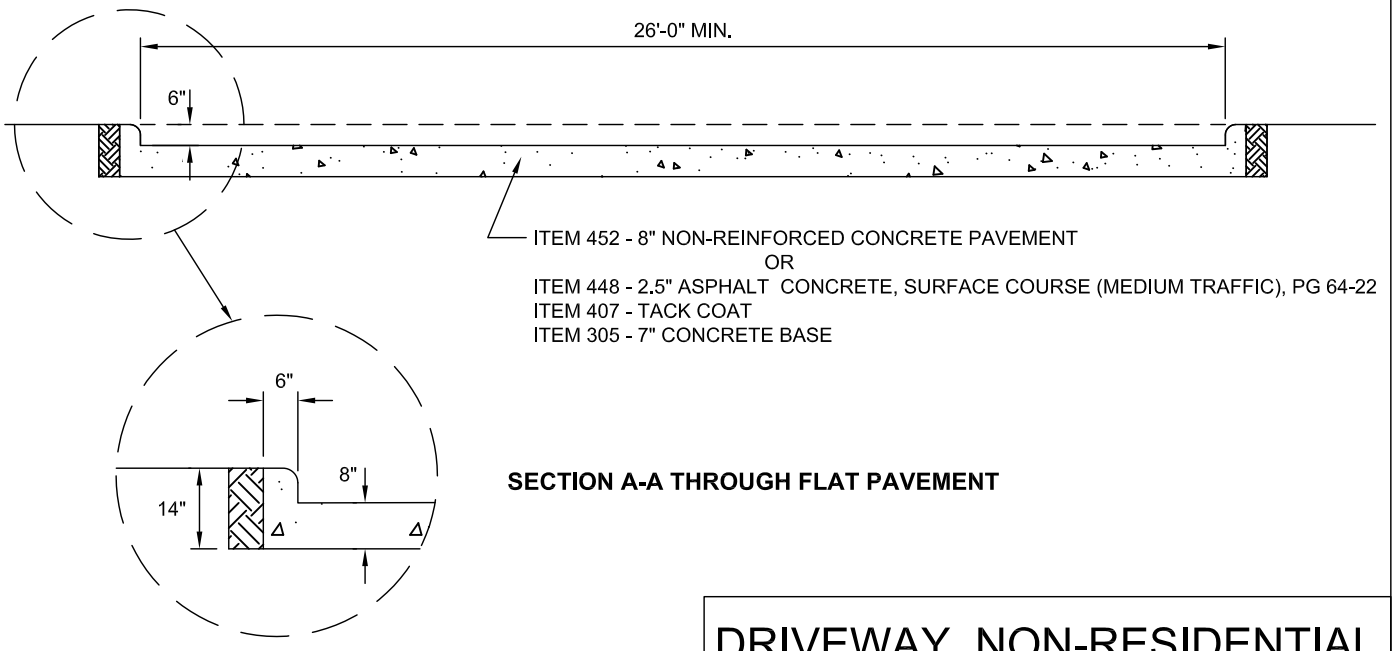


SECTION A-A THROUGH CROWNED PAVEMENT



SECTION A-A THROUGH FLAT PAVEMENT

DRIVEWAY, NON-RESIDENTIAL WITH RADIUS CURBED ROADWAY

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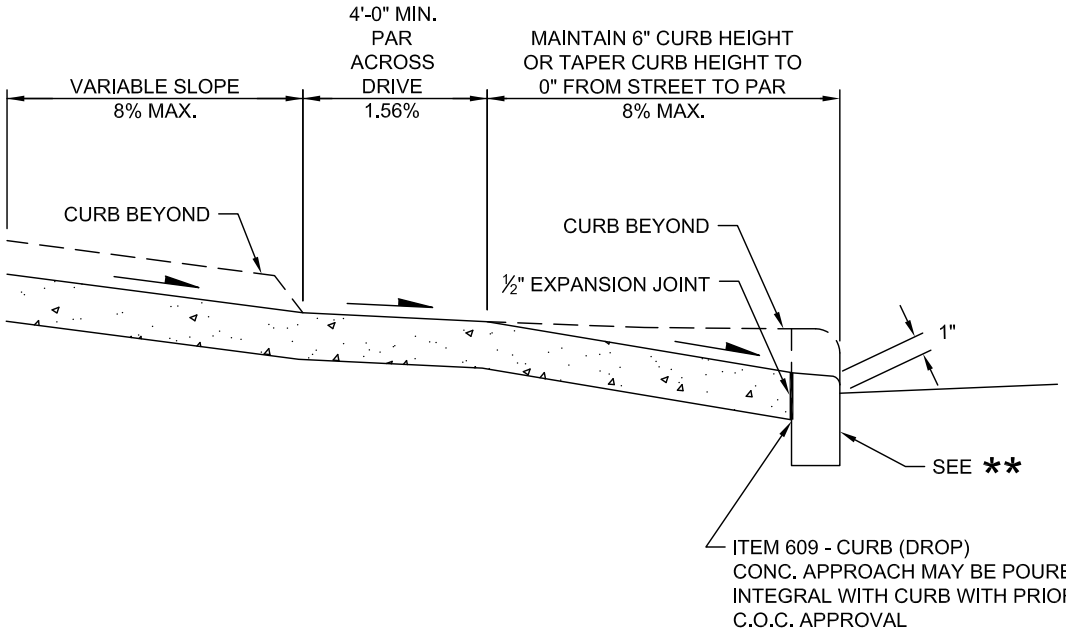
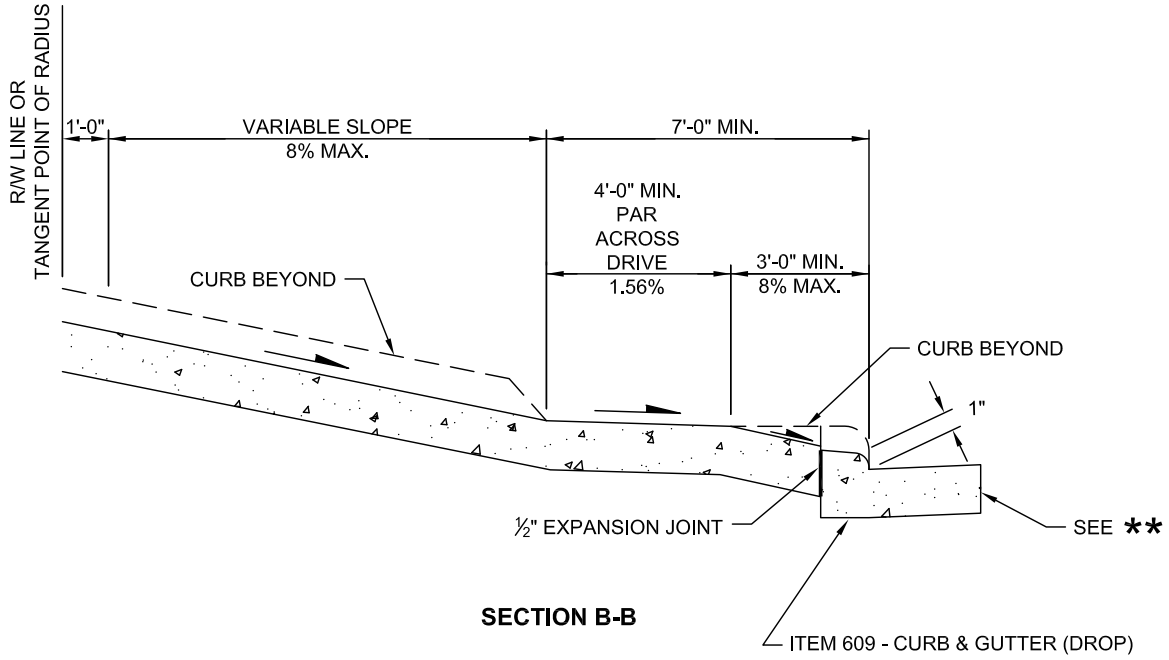
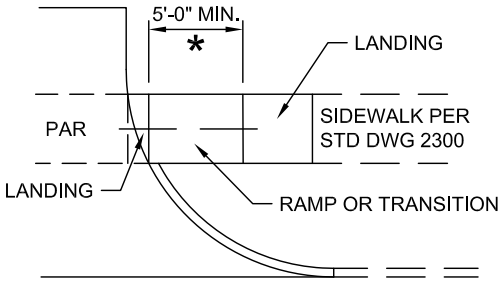




SECTION B-B



PAR = PEDESTRIAN ACCESS ROUTE. SET PAR THROUGH APPROACH AT SIDEWALK GRADE TO AVOID RAMP OR TRANSITION. IF NOT POSSIBLE, THEN MINIMIZE TRANSITION FROM SIDEWALK TO APPROACH.

* 8" CONCRETE.

** STRAIGHT CURB OR CONCRETE CURB & GUTTER.

DRIVEWAY, NON-RESIDENTIAL WITH RADIUS CURBED ROADWAY

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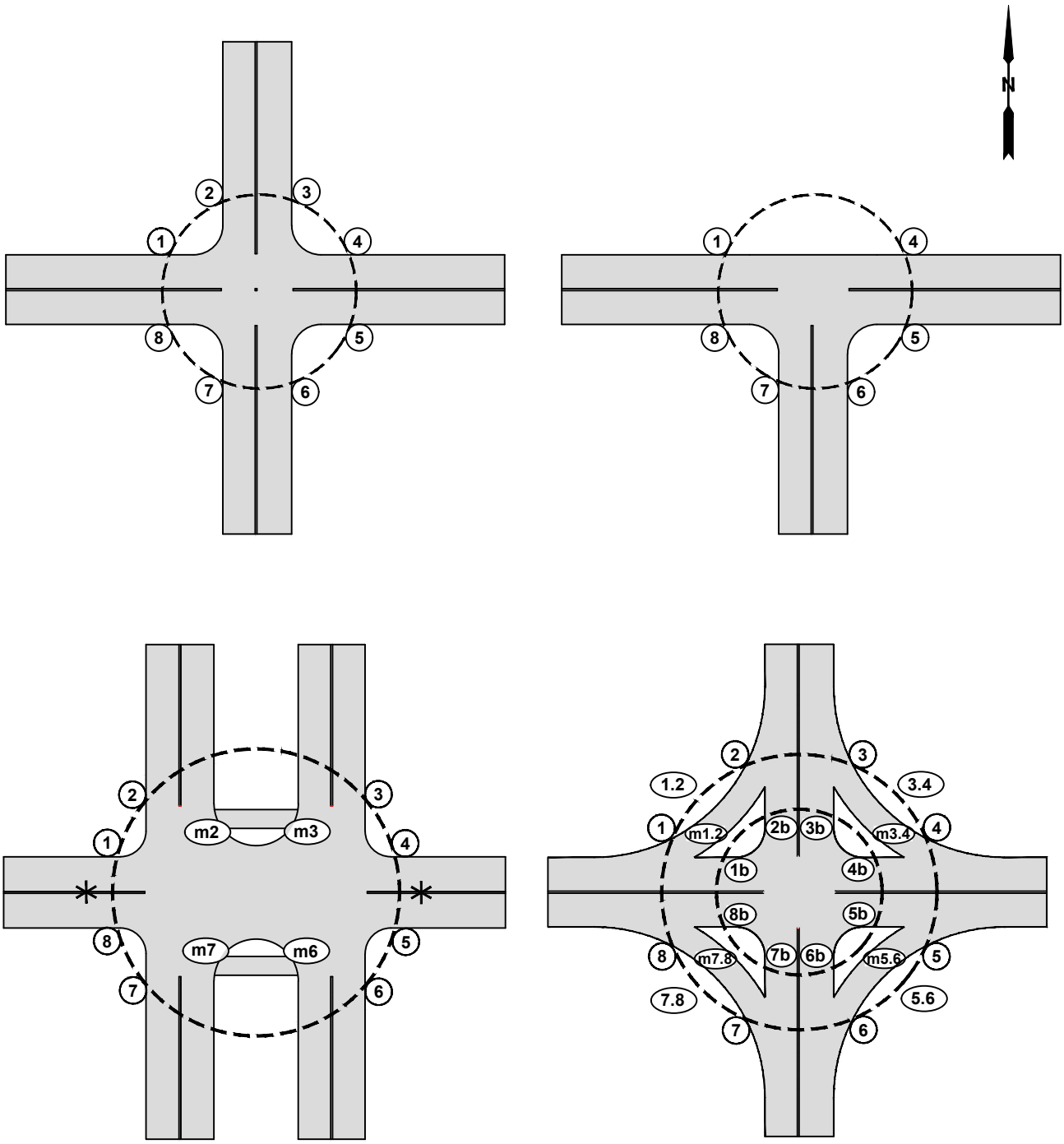

ALL NUMBERING BEGINS FROM THE NORTHWEST CORNER AND GOES CLOCKWISE. EACH CORNER HAS ITS SPECIFIC NUMBER THAT SHALL BE USED IF CURB RAMPS ARE IN THESE LOCATIONS.

* MEDIAN RAMPS ON THE WEST AND/OR EAST LEGS WOULD BE M1, M8, AND M4, M5 RESPECTIVELY.

INTERSECTION CURB RAMP NUMBERING SYSTEM

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GENERAL NOTES, CURB RAMPS

1. CURB RAMPS SHALL BE INSTALLED PER STD DWGS 2300, 2319, CMSC 608, AND DPS ADA RULES AND REGULATIONS.
2. MATERIAL: THE RAMP PANEL AND FLARED SIDES SHALL BE CONCRETE.
3. RAMP TYPES ARE CATEGORIZED BELOW IN TIERS BY REQUIRED ORDER OF USE. LOCATING THE RAMP AS CLOSE AS POSSIBLE TO THE INTERSECTION FOLLOWING THE CURB RAMP DESIGN BOUNDARY CONTAINED IN THE ADA RULES AND REGULATIONS IS THE FIRST PRIORITY. THE DESIGNER SHALL NOT USE A LOWER TIERED RAMP WITHOUT FIRST DETERMINING AND HAVING JUSTIFICATION THAT THE UPPER TIER RAMPS ARE NOT CONSTRUCTIBLE.

CITY OF COLUMBUS RAMP TYPE HIERARCHY

TIER 1 (THESE PERPENDICULAR RAMPS SHOULD BE UTILIZED WHENEVER POSSIBLE.)

- TYPE D
- TYPE C
- TYPE A

TIER 2 (PARALLEL RAMPS SHOULD ONLY BE USED DUE TO RIGHT OF WAY (ROW) OR OTHER SPACE CONSTRAINTS WHERE A TIER 1 RAMP CANNOT BE USED.)

- TYPE P-6 (6' OF ROW AVAILABLE)
- TYPE P-7 (7' OF ROW AVAILABLE)
- TYPE P-5 (5' OF ROW AVAILABLE)
- TYPE P-4 (4' OF ROW AVAILABLE)

TIER 3 (TIER 3 RAMPS CAN ONLY BE USED WITH WRITTEN APPROVAL BY THE CITY ENGINEER OR DESIGNEE. TIER 3 RAMPS SHALL BE IDENTIFIED IN THE DESIGN SCOPE OR APPROVAL REQUESTED BY THE DESIGNER JUSTIFYING THAT THIS RAMP TYPE IS NECESSARY.)

- TYPE J (MODIFIED ALLEY RAMP), USE SHOULD BE LIMITED DUE TO DRAINAGE CONCERNS
- RADIAL RAMPS
- SINGLE SHARED RAMPS

SPECIALTY RAMPS (SHALL ONLY BE USED FOR THE LISTED SITUATION, OR WRITTEN APPROVAL BY THE CITY ENGINEER OR DESIGNEE.)

- TYPE G - ONLY TO BE USED ON ALLEY CROSSINGS
- TYPE H - ONLY TO BE USED ON ALLEY CROSSINGS
- TYPE L-1 - ONLY FOR MEDIAN CROSSINGS
- TYPE L-2 - ONLY FOR MEDIAN CROSSINGS
- PEDESTRIAN PADS - USED FOR ACCESS TO PUSHBUTTONS WHERE THERE IS NO EXISTING SIDEWALK. THE INTENT IS TO PROVIDE ACCESS TO CROSS THE INTERSECTION IN BOTH DIRECTIONS WITHOUT ENTERING THE STREET TO ACCESS TO OTHER CROSSING. THE FOLLOWING IS THE ORDER OF PREFERENCE ON PEDESTRIAN PADS:
  1. PP-1 TWO CONNECTED RAMPS WITH UTILITY STRIP
  2. PP-2 TWO CONNECTED RAMPS WITH SIDEWALK AGAINST CURB
  3. PP-3 USED AS SINGLE SHARED RAMP THAT CAN ACCESS BOTH CROSSWALK LEGS AND THE PUSHBUTTON
  4. PP-3 USED TO ONLY ACCESS THE LEG OF THE INTERSECTION CONTROLLED BY THE PUSHBUTTON

4. RAMP RUNNING SLOPE: THE RUNNING SLOPE SHALL BE NO GREATER THAN 7.69%.
5. ALL JOINTS BETWEEN NEW AND EXISTING MATERIALS SHALL BE FLUSH.
6. LANDINGS:
   - LANDINGS SHALL HAVE A MAXIMUM 1.56% SLOPE IN ALL DIRECTIONS FOR ALL CURB RAMP TYPES.
   - A PARALLEL RAMP, CONSTRAINED ON TWO (2) SIDES, E.G., TYPE P-7, SHALL HAVE A LANDING 5-FT WIDE BY 5-FT DEEP A PARALLEL RAMP, CONSTRAINED ON ONE (1) SIDE, E.G., TYPES P-4, 5, & 6, SHALL HAVE A LANDING NO LESS THAN 4-FT MINIMUM BY 5-FT. THE 5-FT DIMENSION SHALL BE PROVIDED AS SHOWN IN THESE STANDARD DRAWINGS.

CURB RAMP GENERAL NOTES

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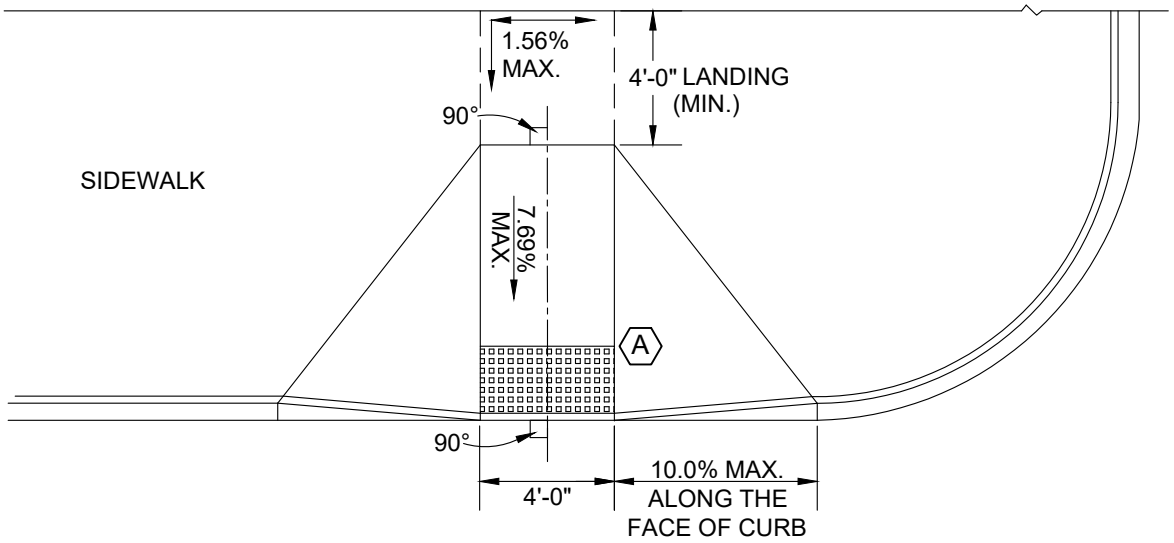
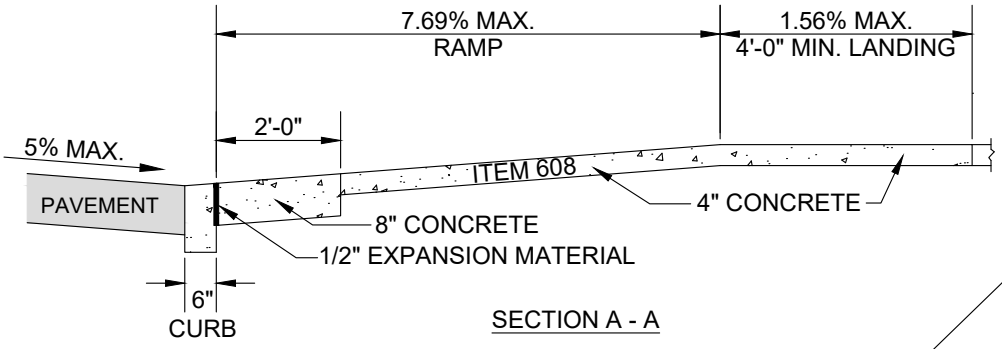
- ALL PERPENDICULAR RAMPS SHALL HAVE A LANDING NO LESS THAN 4-FT MINIMUM BY 4-FT. A PERPENDICULAR RAMP THAT IS CONSTRAINED AT THE BACK OF SIDEWALK SHALL HAVE A LANDING 4-FT BY 5-FT. THE 5-FT DIMENSION SHALL BE PROVIDED IN THE DIRECTION OF RAMP RUN, AS SHOWN IN THESE STANDARD DRAWINGS.
- LANDING AT INTERSECTING SIDEWALKS - WHEREVER SIDEWALKS INTERSECT, THERE SHALL BE A LANDING.

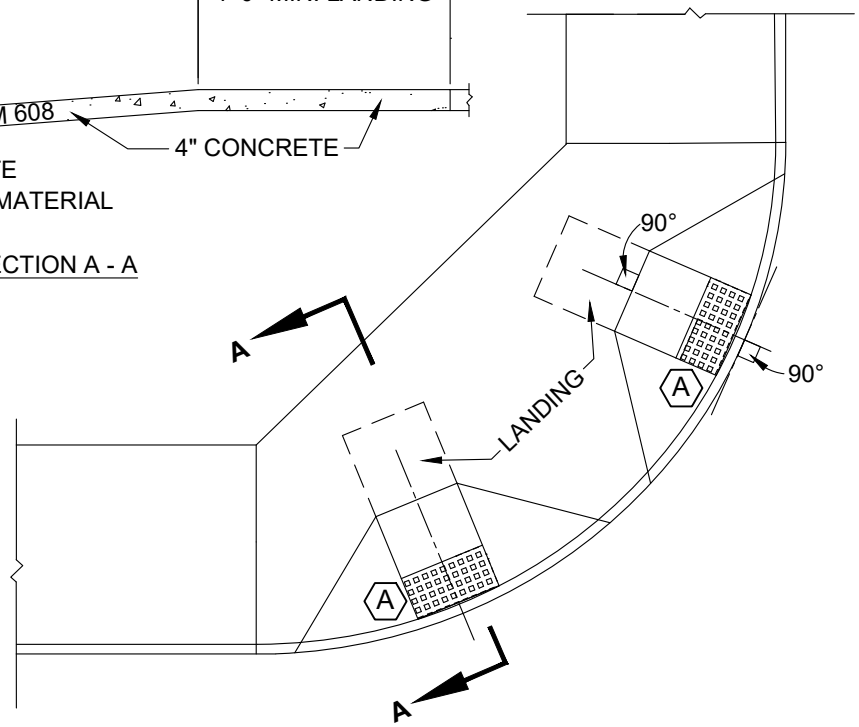
7. STREET COUNTER SLOPE: THE COUNTER SLOPE AT THE BASE OF THE RAMP SHALL BE A MAXIMUM OF 5% FOR A MINIMUM OF 2-FT.
8. CLEAR SPACE: AT MARKED CROSSINGS THE RAMP AND STREET CLEAR SPACE MUST BE FULLY CONTAINED WITHIN THE MARKED CROSSWALK. AT UNMARKED CROSSINGS THE RAMP AND CLEAR MUST BE WITHIN THE CURB RAMP DESIGN BOUNDARY.
9. SURFACES: RAMP, FLARE, AND LANDING SURFACES MUST BE STABLE AND SLIP RESISTANT. RAMPS SHALL BE BROOM FINISHED, TRANSVERSE TO THE DIRECTION OF TRAVEL. GRATINGS, VALVE BOXES, AND UTILITY BOXES SHALL NOT BE LOCATED IN THE RAMP OR LANDING.
10. DETECTABLE WARNINGS: DETECTABLE WARNINGS SHALL BE INSTALLED ACCORDING TO THESE STANDARD DRAWINGS, CMSC 608, AND DPS ADA RULES AND REGULATIONS.
11. CURB WALLS MAY BE NECESSARY FOR CURB RAMP CONSTRUCTION WHERE SPACE RESTRICTION DO NOT ALLOW FOR GRADING WITHIN ROW AT A 3:1 SLOPE OR FLATTER. THE MAXIMUM HEIGHT OF 6" THICK, NON-REINFORCED CURB WALL IS 12" ABOVE THE SIDEWALK SURFACE. THE BURIED PORTION OF THE NON-REINFORCED CURB WALL SHALL BE EQUAL TO THE EXPOSED REVEAL. RETAINING EMBANKMENT TO A HEIGHT OF MORE THAN 12" ABOVE THE SIDEWALK WILL REQUIRE A DESIGNED RETAINING WALL OR CELLULAR WALL.
12. RAMPS MUST BE CONSTRUCTED TO ALLOW FOR POSITIVE DRAINAGE. THE RAMP ITSELF SHALL NOT HOLD EXCESS WATER AND THE ADJACENT PAVEMENT SHALL NOT BE ALTERED TO INHIBIT FLOW OF WATER. IF AN EXISTING CONSTRAINT PREVENTS BUILDING THE RAMP AND ADJACENT AREA WITH POSITIVE DRAINAGE IT MUST BE BROUGHT TO THE CITY'S ATTENTION PRIOR TO CONSTRUCTION AND FINAL DESIGN APPROVED BY THE CITY.

CURB RAMP GENERAL NOTES





SECTION A - A



CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS

GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.

CURB RAMP
TYPE A

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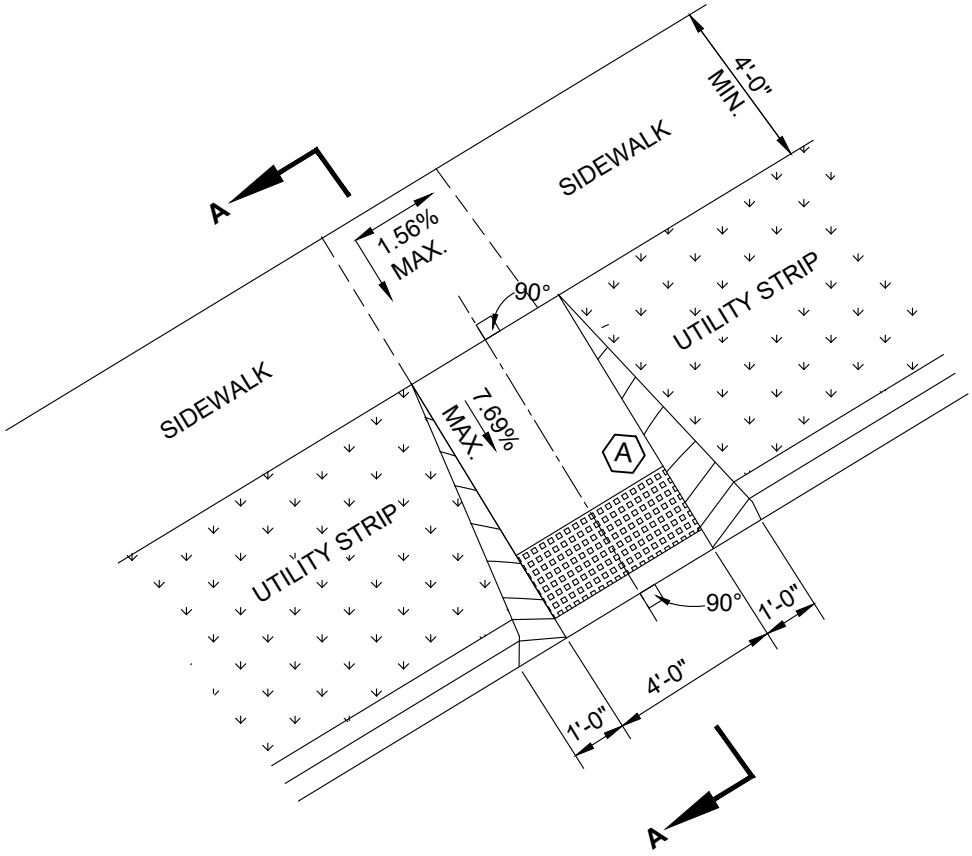

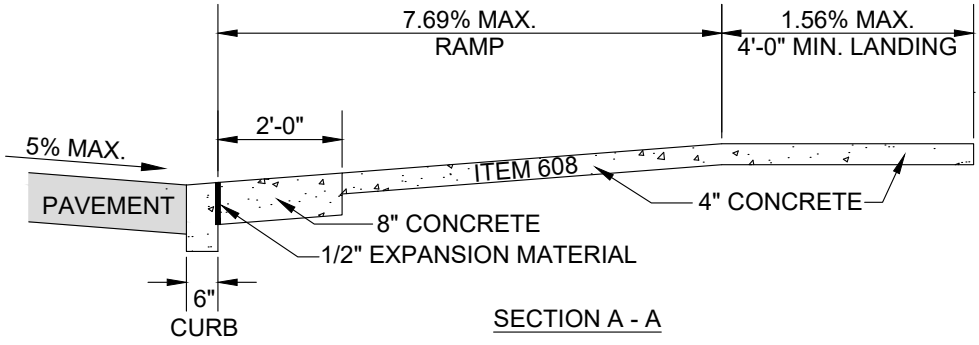

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CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS

GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.

CURB RAMP TYPE C

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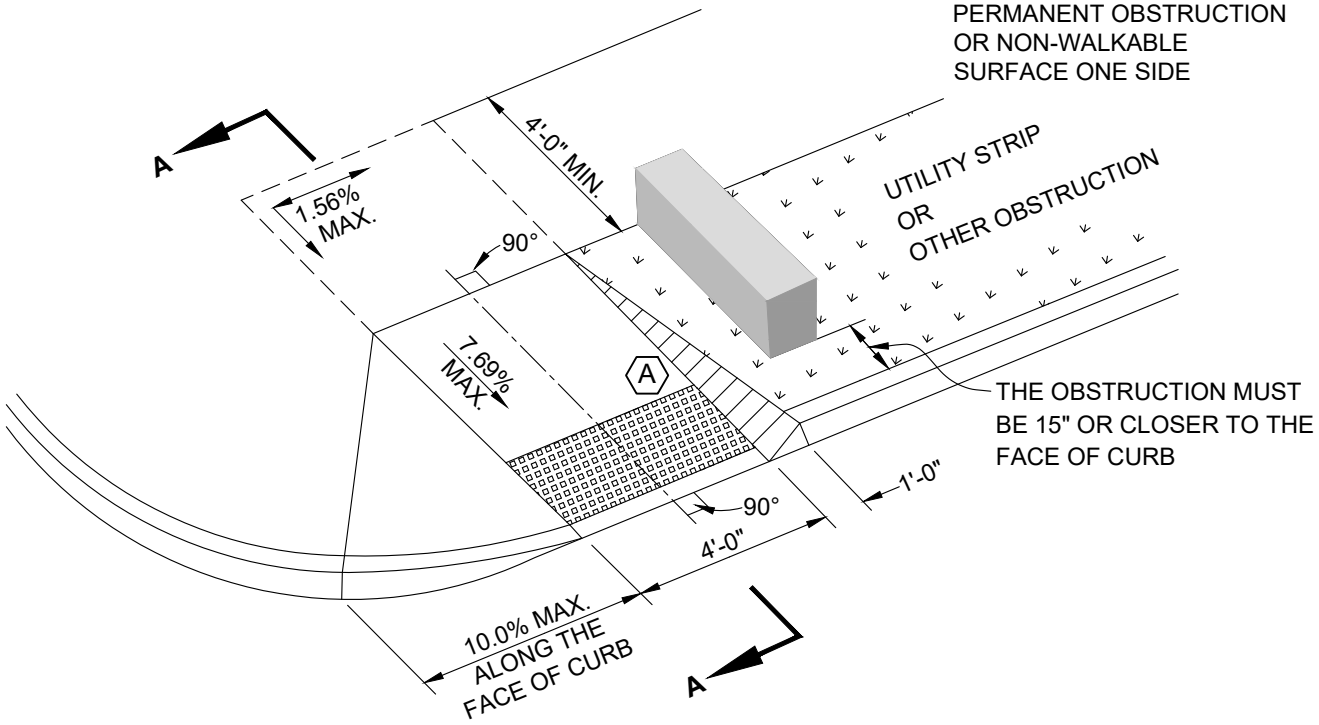

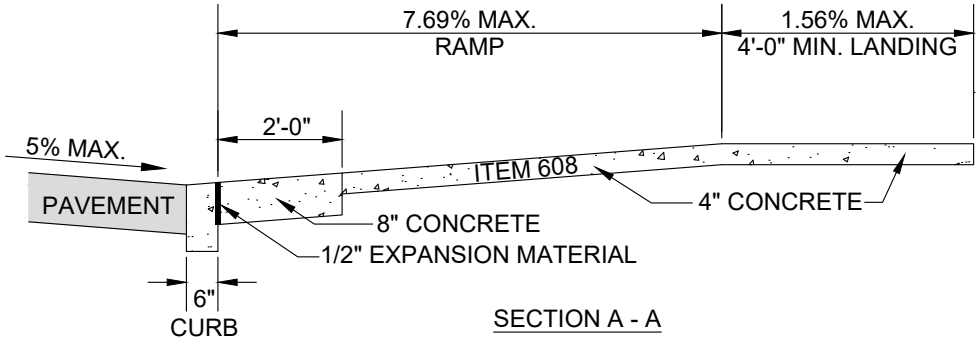

SECTION A - A

CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS

GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.

CURB RAMP TYPE D

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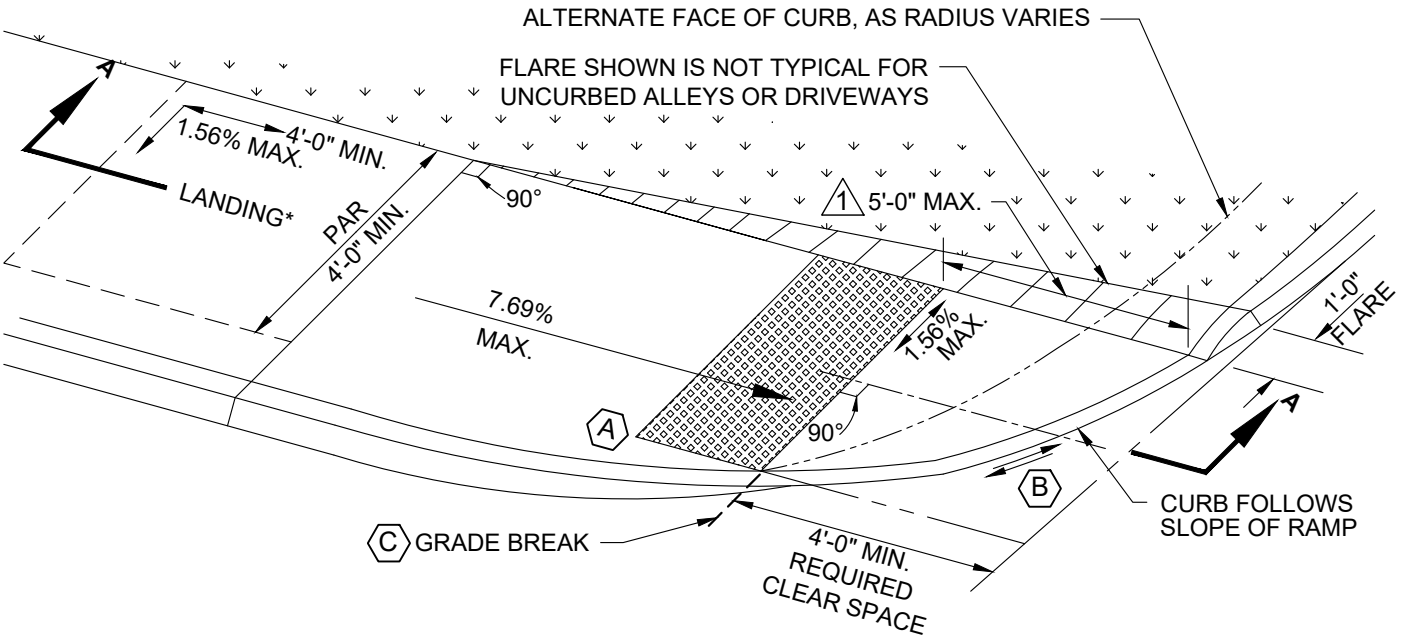
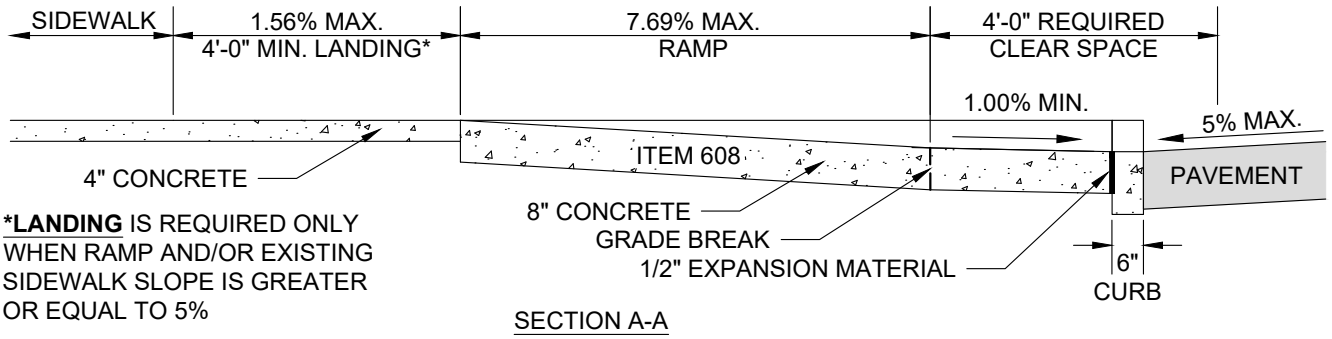
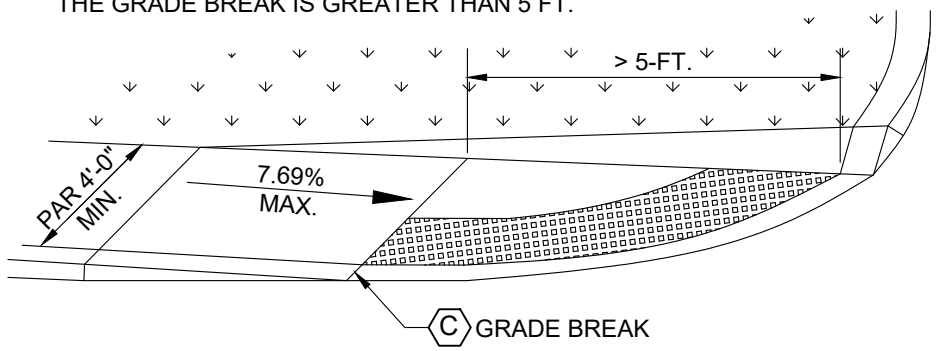




***LANDING** IS REQUIRED ONLY WHEN RAMP AND/OR EXISTING SIDEWALK SLOPE IS GREATER OR EQUAL TO 5%

SECTION A-A

1 DETAIL TO BE USED WHEN DISTANCE FROM BACK OF CURB TO THE GRADE BREAK IS GREATER THAN 5 FT.



CODED NOTES:

- (A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS
- (B) PROVIDE POSITIVE DRAINAGE ALONG CURBLINE, SHOULD BE 1.00% MINIMUM SLOPE
- (C) WHERE THE DISTANCE FROM EITHER END OF THE BOTTOM OF THE GRADE BREAK TO THE BACK OF CURB IS GREATER THAN 5-FT, THE DETECTABLE WARNING SHALL BE PLACED AT THE BACK OF CURB

CURB RAMP TYPE G

GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.
2. THE EDGE OF THE CURB WITHIN THE CLEAR SPACE SHALL BE FLUSH WITH THE EDGE OF THE ADJACENT PAVEMENT AND GUTTER.

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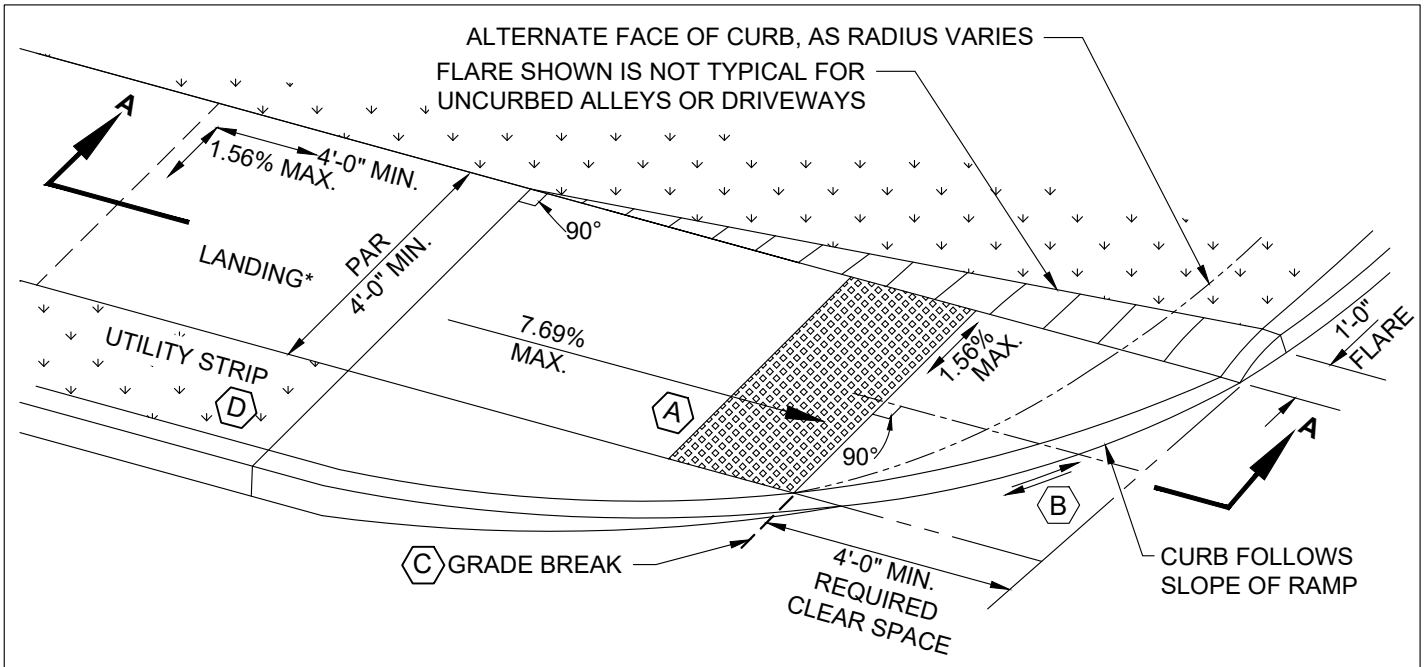

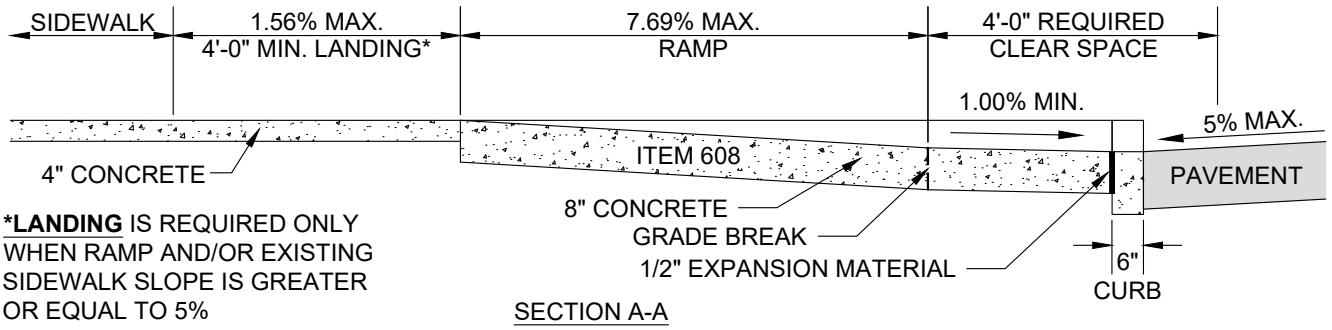

***LANDING** IS REQUIRED ONLY WHEN RAMP AND/OR EXISTING SIDEWALK SLOPE IS GREATER OR EQUAL TO 5%

SECTION A-A

CODED NOTES:

Ⓐ SEE SHEET 21 FOR DETECTABLE WARNING DETAILS

Ⓑ PROVIDE POSITIVE DRAINAGE ALONG CURBLINE, SHOULD BE 1.00% MINIMUM SLOPE

Ⓒ WHERE THE DISTANCE FROM EITHER END OF THE BOTTOM OF THE GRADE BREAK TO THE BACK OF CURB IS GREATER THAN 5-FT, THE DETECTABLE WARNING SHALL BE PLACED AT THE BACK OF CURB

Ⓓ FOR THE LENGTH OF THE RAMP, THE UTILITY STRIP MAY BE REMOVED AND REPLACED WITH 8" CONCRETE (ITEM 608), PROVIDED THE UTILITY STRIP IS NO WIDER THAN 2-FT

GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.
2. THE EDGE OF THE CURB WITHIN THE CLEAR SPACE SHALL BE FLUSH WITH THE EDGE OF THE ADJACENT PAVEMENT AND GUTTER.

CURB RAMP TYPE H

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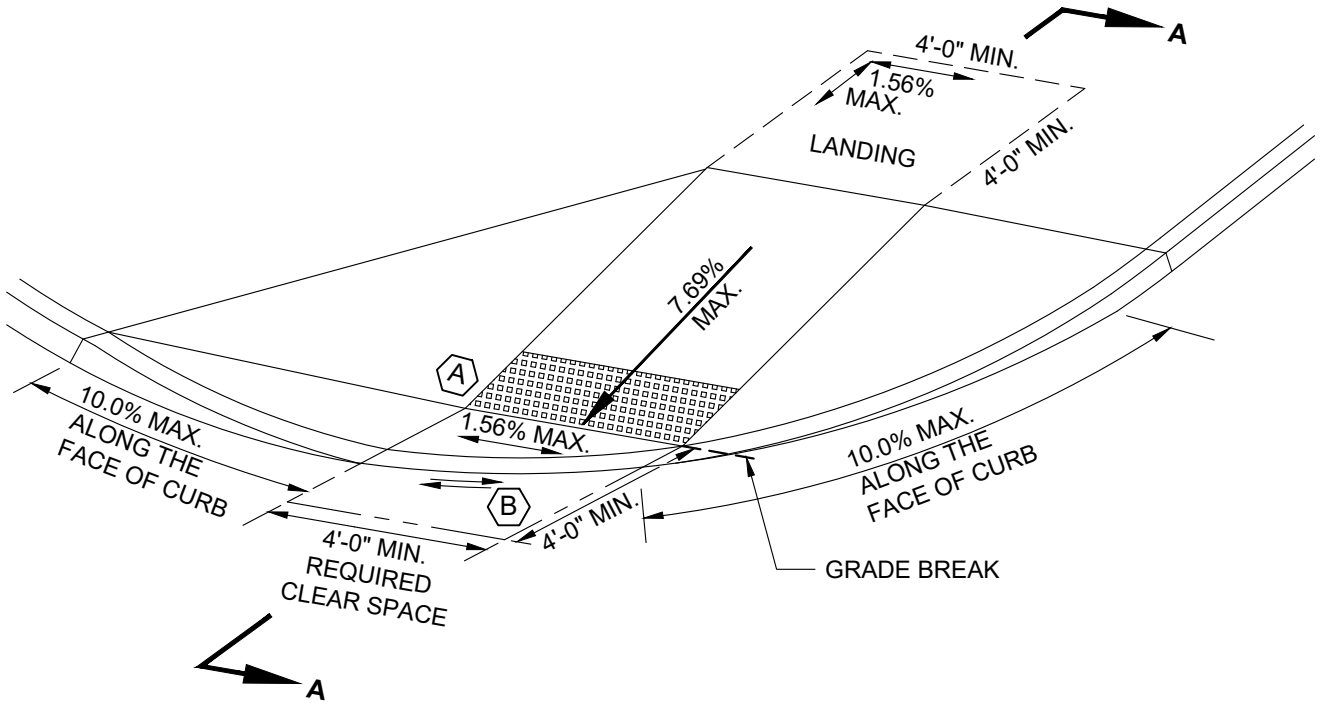

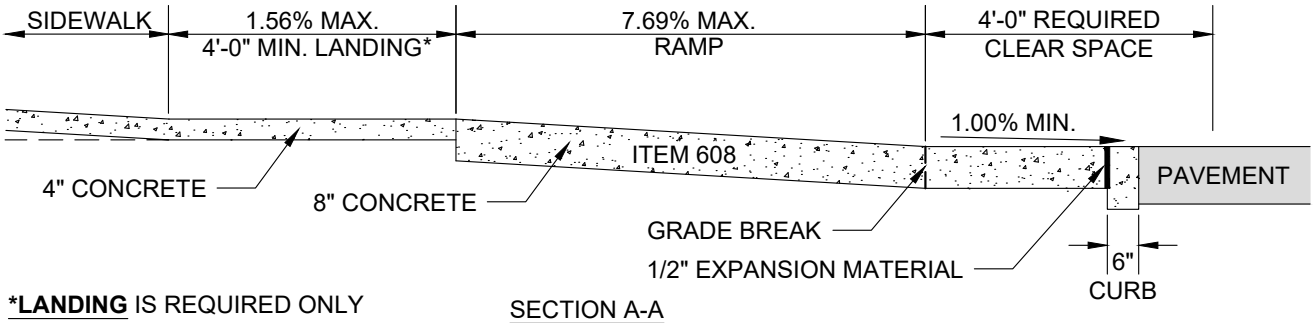

SECTION A-A

***LANDING** IS REQUIRED ONLY WHEN RAMP AND/OR EXISTING SIDEWALK SLOPE IS GREATER OR EQUAL TO 5%

CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS

(B) PROVIDE POSITIVE DRAINAGE ALONG CURBLINE, SHOULD BE 1.00% MINIMUM SLOPE

CURB RAMP TYPE J

GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.
2. THE EDGE OF THE CURB WITHIN THE CLEAR SPACE SHALL BE FLUSH WITH THE EDGE OF THE ADJACENT PAVEMENT AND GUTTER.

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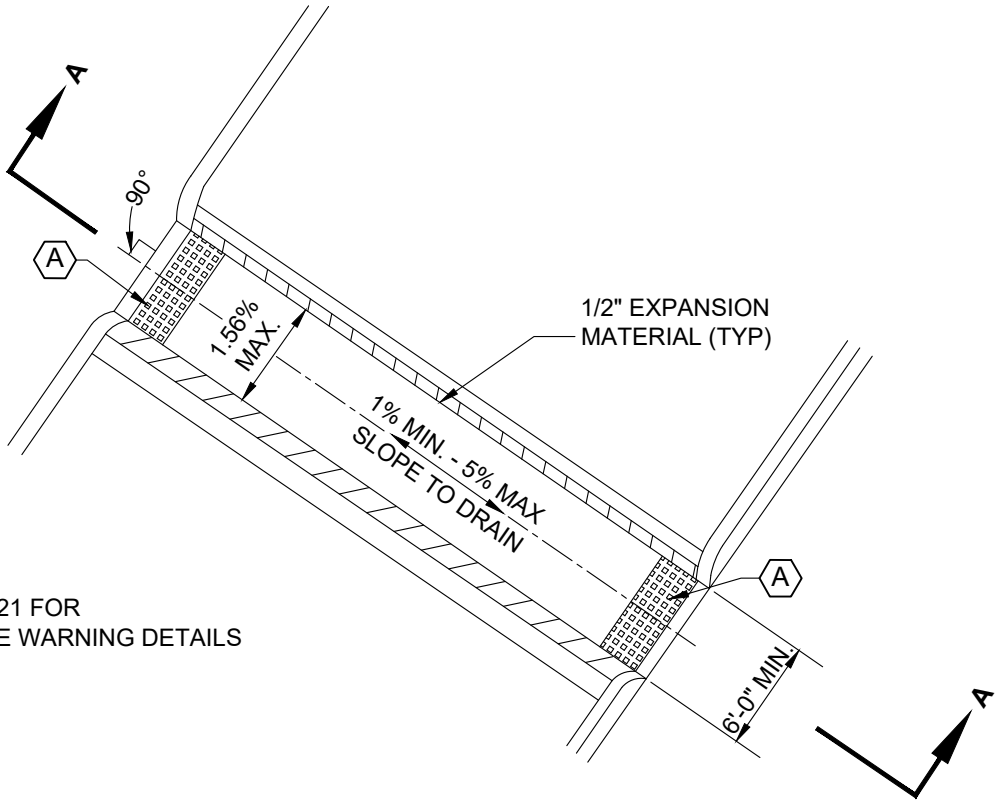
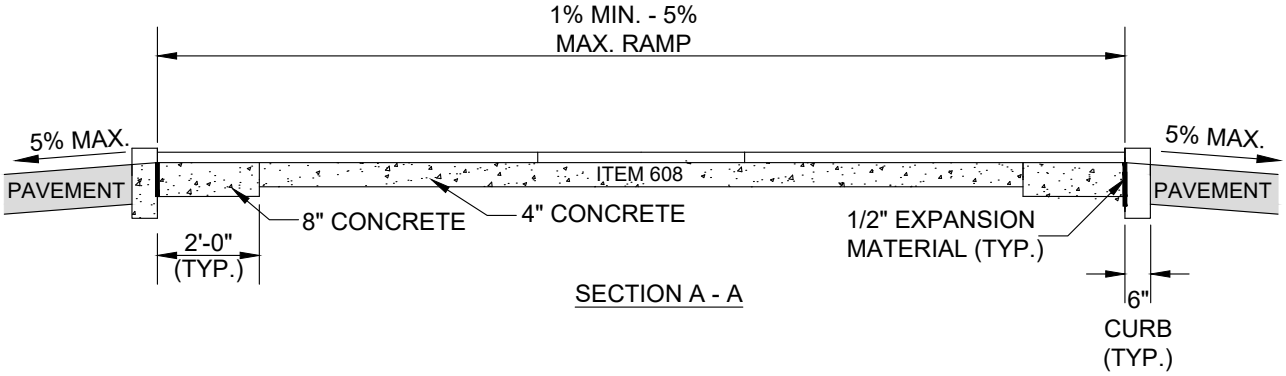


CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS



SECTION A - A

GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.
2. RAMP L-1 SHALL BE USED IN ALL CIRCUMSTANCES WHERE NOT PROHIBITED BY DRAINAGE ISSUES. AN L-1 RAMP SHOULD NOT BE PLACED IN A WAY THAT WOULD CONVEY THE CURB FLOW OF WATER THROUGH THE MEDIAN PASSTHROUGH. WHERE THE ROADWAY CROSS-SLOPE DIRECTS WATER TOWARDS THE MEDIAN AND FLOWS THROUGH THE GUTTER LINE ADJACENT TO THE PASSTHROUGH, USE AN L-2 RAMP.
3. MEDIANS / ISLANDS WITHIN COMMERCIAL DRIVES REQUIRE DETECTABLE WARNINGS ONLY WHEN OPPOSING CURB RAMPS REQUIRE DETECTABLE WARNINGS. (SEE SHEET 21 OF 21, NOTE 1)

CURB RAMP TYPE L-1

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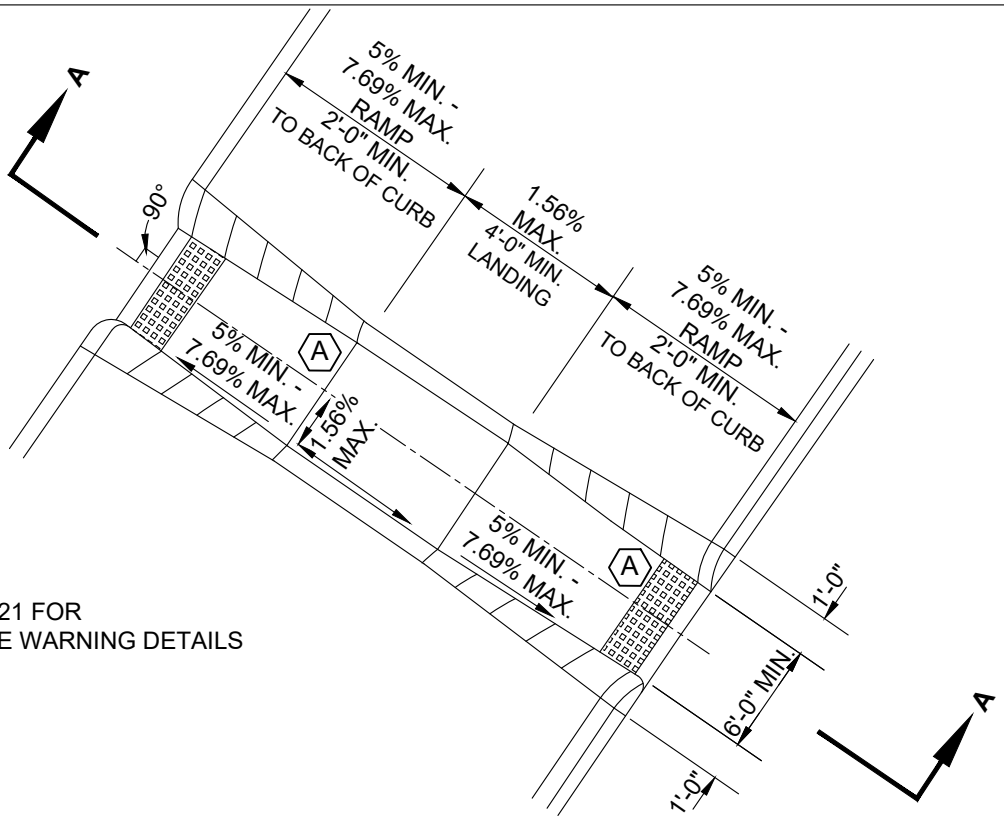
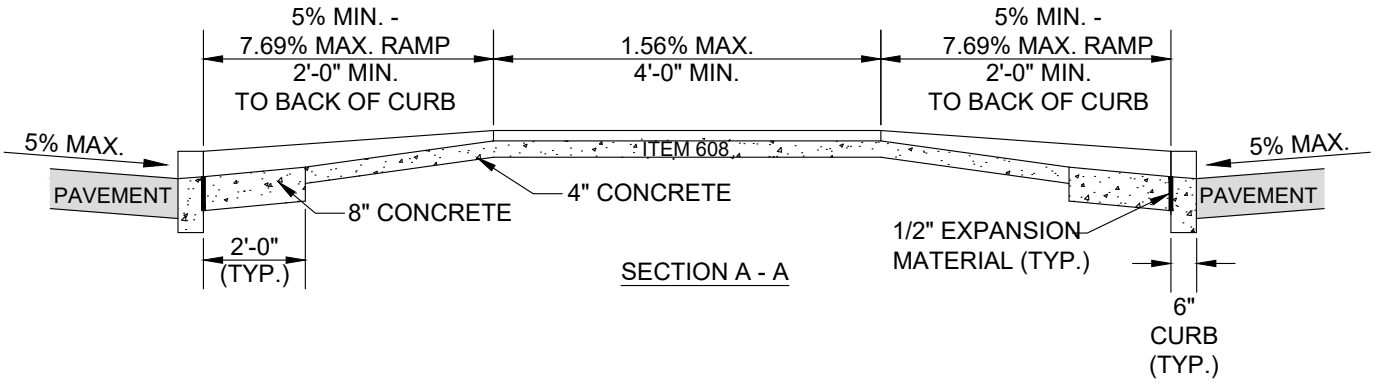


CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS



GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.
2. MEDIANS / ISLANDS WITHIN COMMERCIAL DRIVES REQUIRE DETECTABLE WARNINGS ONLY WHEN OPPOSING CURB RAMPS REQUIRE DETECTABLE WARNINGS. (SEE SHEET 21 OF 21, NOTE 1).
3. TYPE L-2 RAMPS ARE ONLY TO BE INSTALLED WHEN IT IS NOT POSSIBLE TO INSTALL A TYPE L-1 RAMP DUE TO DRAINAGE ISSUES.
4. TYPE L-2 RAMPS CAN ONLY BE USED ON MEDIANS 8 FEET WIDE OR MORE.

CURB RAMP TYPE L-2

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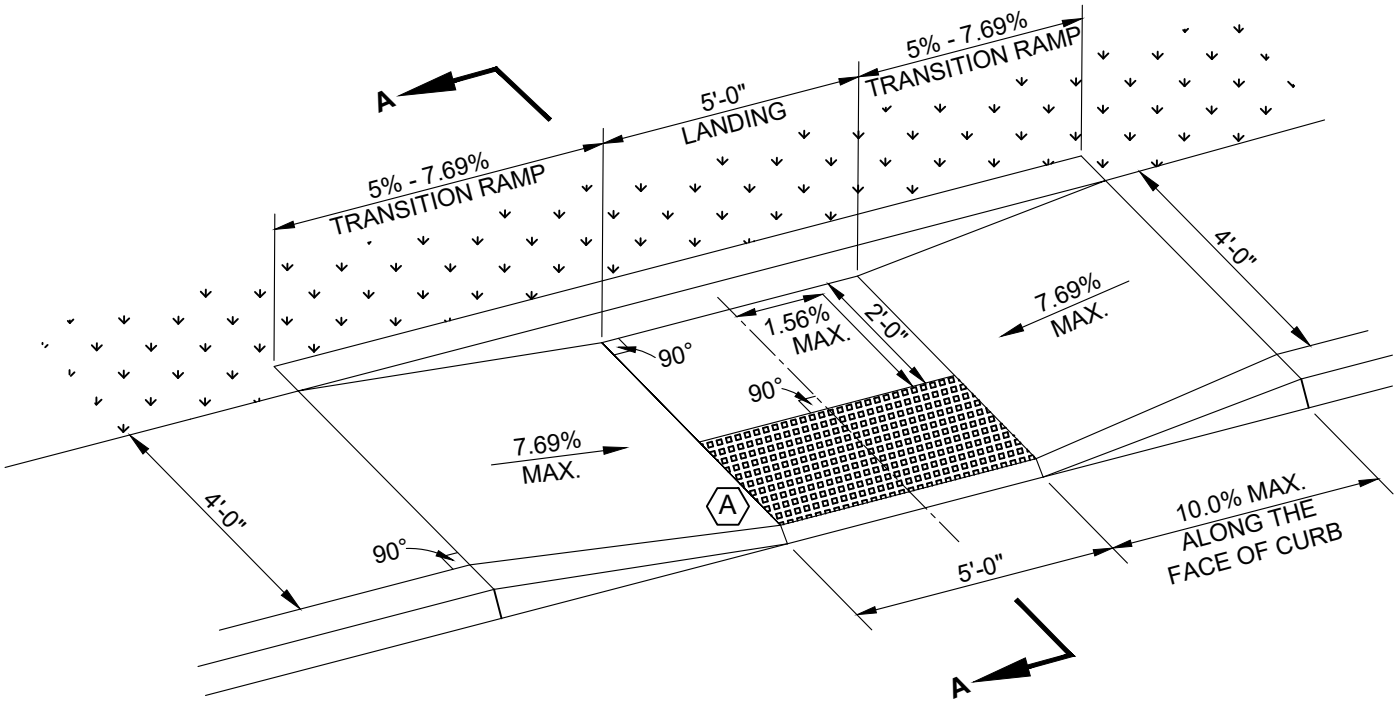

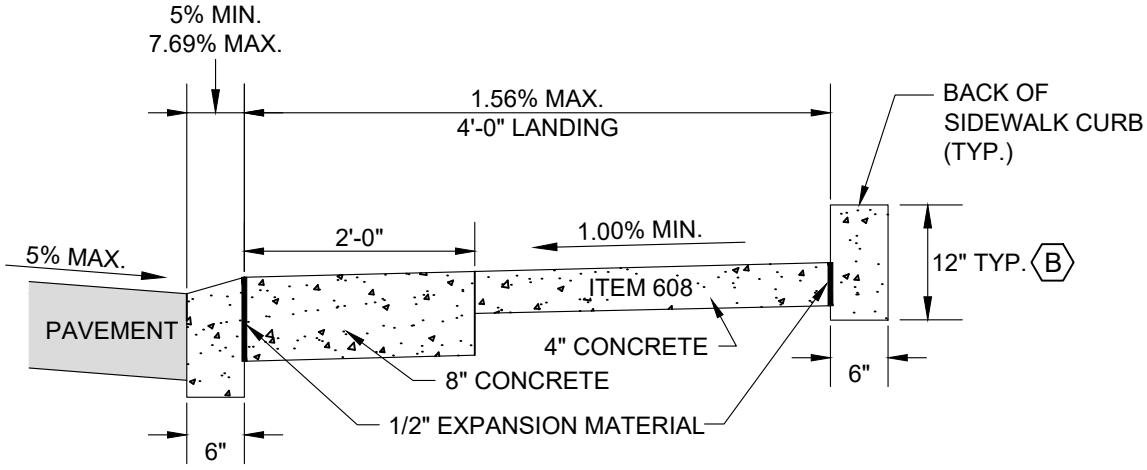

SECTION A-A

CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS

(B) EXPOSED REVEAL MUST EQUAL BURIED DEPTH; 12" MAXIMUM REVEAL; FOR ADDITIONAL DETAILS SEE CURB WALL SPECIFICATION

GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.

CURB RAMP TYPE P-4

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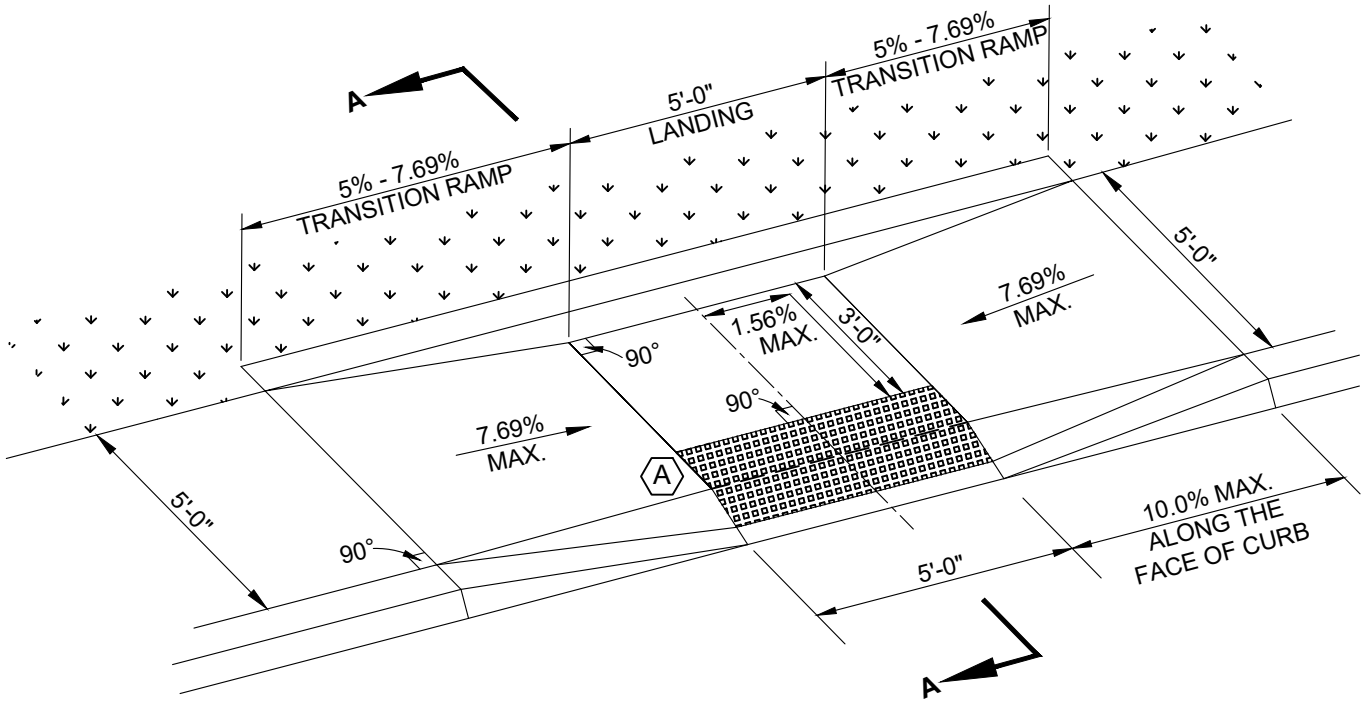

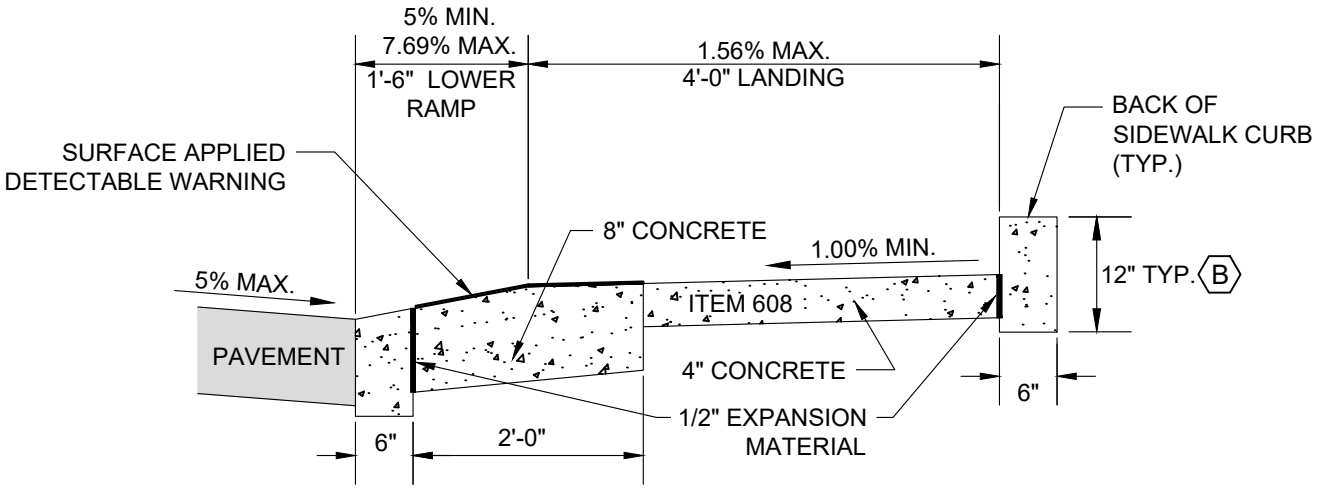

SECTION A-A

CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS

(B) EXPOSED REVEAL MUST EQUAL BURIED DEPTH; 12" MAXIMUM REVEAL; FOR ADDITIONAL DETAILS SEE CURB WALL SPECIFICATION

GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.

CURB RAMP TYPE P-5

CITY OF COLUMBUS, OHIO
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DIVISION OF DESIGN AND CONSTRUCTION

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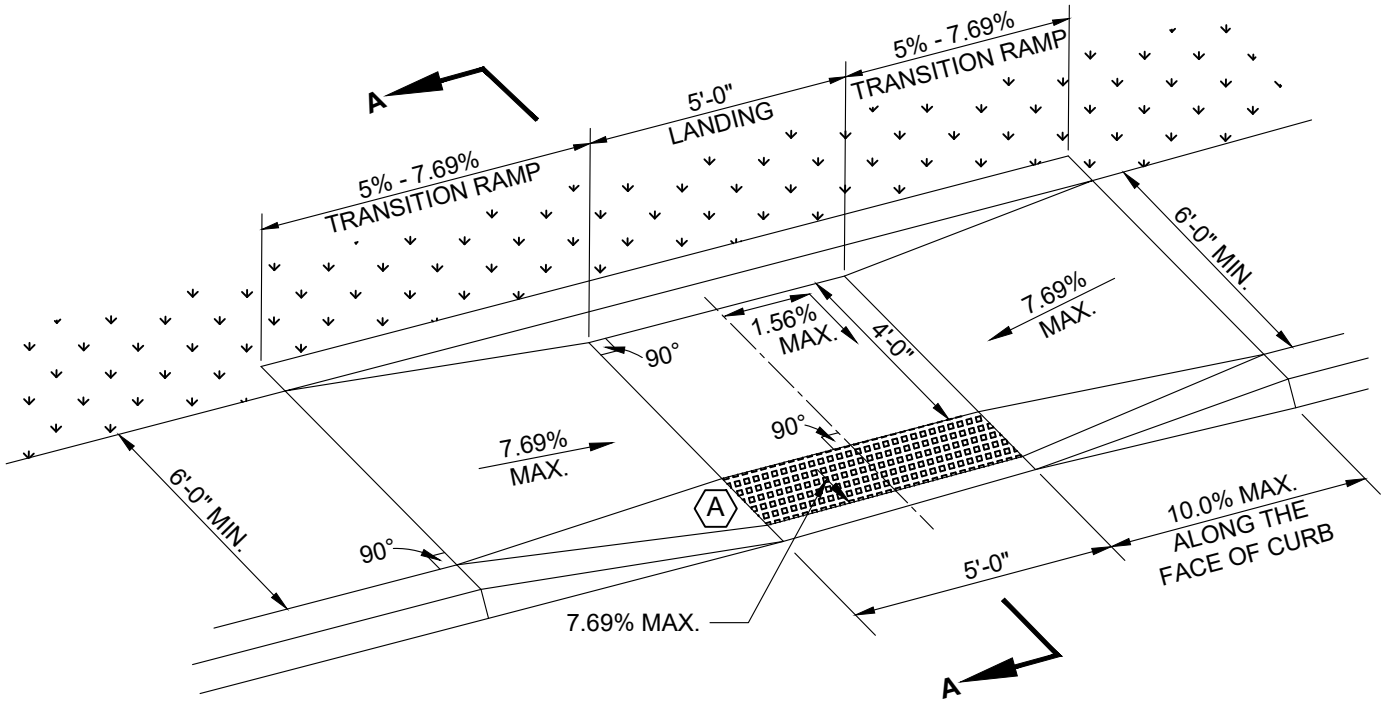

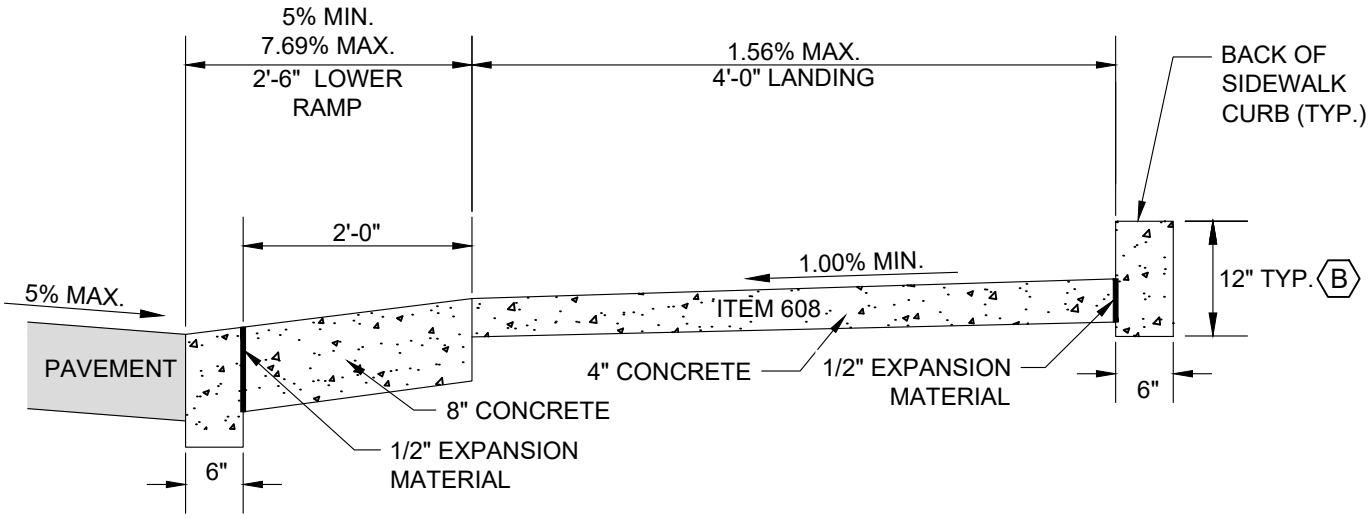

SECTION A-A

CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS

(B) EXPOSED REVEAL MUST EQUAL BURIED DEPTH; 12" MAXIMUM REVEAL; FOR ADDITIONAL DETAILS SEE CURB WALL SPECIFICATION

GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.

CURB RAMP TYPE P-6

CITY OF COLUMBUS, OHIO
DEPARTMENT OF PUBLIC SERVICE
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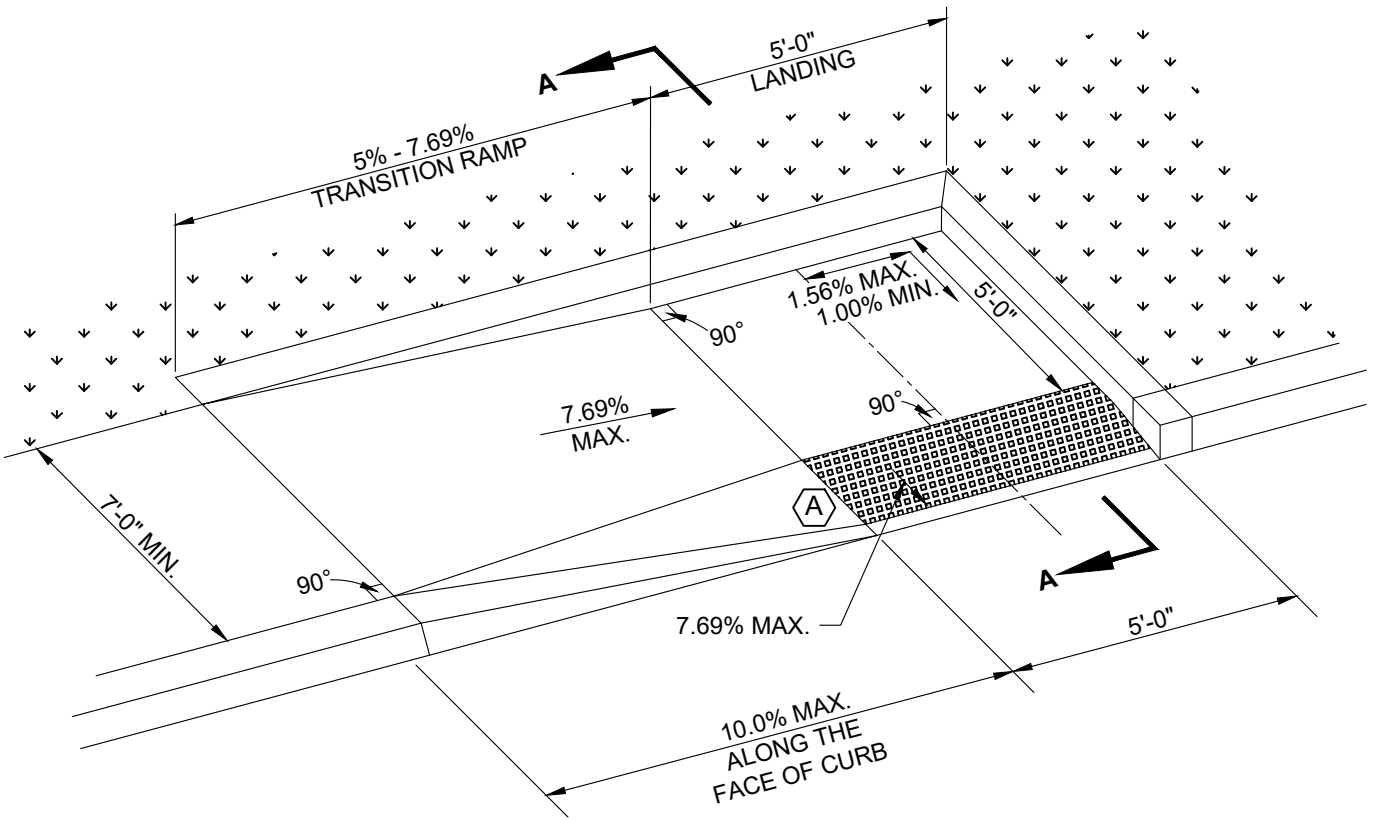

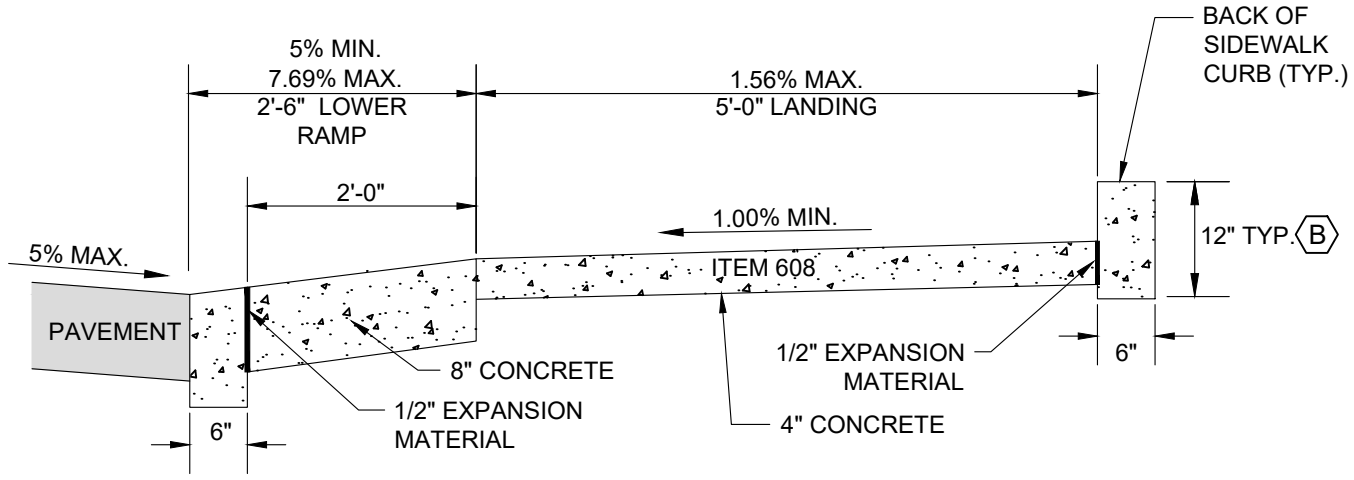

SECTION A-A

CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS

(B) EXPOSED REVEAL MUST EQUAL BURIED DEPTH; 12" MAXIMUM REVEAL; FOR ADDITIONAL DETAILS SEE CURB WALL SPECIFICATION

GENERAL NOTES:

1. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.

CURB RAMP TYPE P-7

CITY OF COLUMBUS, OHIO
DEPARTMENT OF PUBLIC SERVICE
TRANSPORTATION DIVISION

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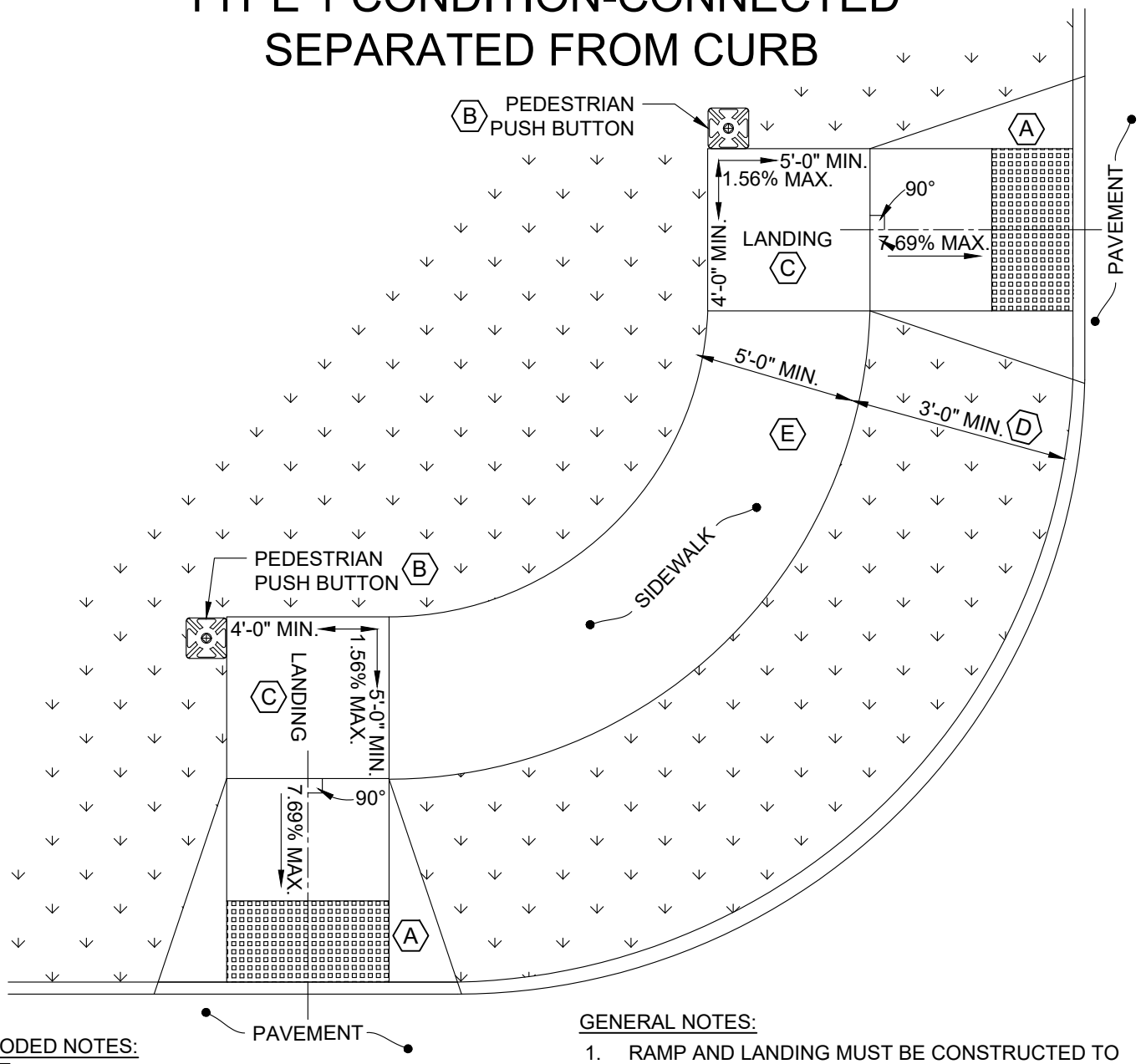
PEDESTRIAN PAD (PP)
TYPE 1 CONDITION-CONNECTED SEPARATED FROM CURB



CODED NOTES:

(A) USE 1-FT FLARES ON CURBED ROADWAY. ON UNCURBED ROADWAY RAMP SHALL BE CONSTRUCTED WITHOUT FLARES, SEE STANDARD DRAWING FOR DETECTABLE WARNING PLACEMENT DETAILS. THE FRONT TWO FEET OF THE RAMP AND FLARES SHALL BE CONSTRUCTED USING CONCRETE 8" THICK AND TRANSITIONING TO 4" CONCRETE FURTHER THAN 2 FEET FROM THE BACK OF THE CURB

(B) ORIENTATION/LOCATION OF PUSH BUTTON/PEDESTAL TO BE PER POLICY

(C) LANDING SHALL BE 5-FT BY 5-FT WHEN SURROUNDED BY CURB WALL, AND THE PEDESTRIAN PUSH BUTTON SHALL BE INTEGRAL WITH THE CURB WALL

(D) IF UTILITY STRIP IS LESS THAN 3-FT, SIDEWALK SHALL BE CONSTRUCTED ADJACENT TO CURB, SEE PP-2

(E) SIDEWALK WIDTH AND LANDING DEPTH MAY BE REDUCED TO 4' DUE TO CONSTRAINTS.

GENERAL NOTES:

1. RAMP AND LANDING MUST BE CONSTRUCTED TO DRAIN, TYPICALLY TOWARDS THE ROADWAY, BUT MAY VARY BASED ON EXISTING TOPOGRAPHY. WEEP HOLES ARE NOT PERMITTED FOR DRAINAGE.
2. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.

CURB RAMP TYPE PP-1

CITY OF COLUMBUS, OHIO
DEPARTMENT OF PUBLIC SERVICE
DIVISION OF DESIGN AND CONSTRUCTION

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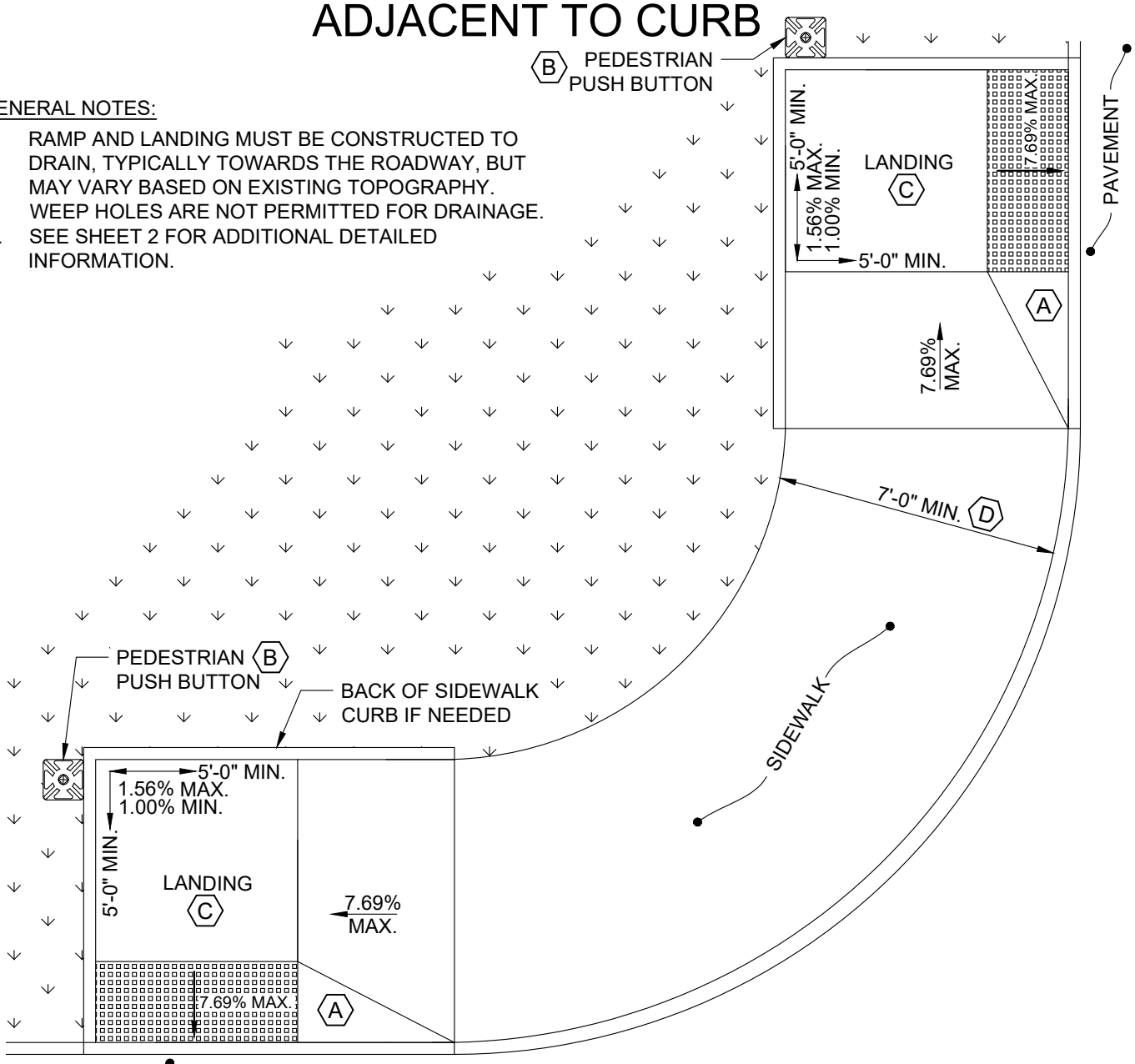
PEDESTRIAN PAD (PP)
TYPE 2 CONDITION-CONNECTED ADJACENT TO CURB



GENERAL NOTES:

1. RAMP AND LANDING MUST BE CONSTRUCTED TO DRAIN, TYPICALLY TOWARDS THE ROADWAY, BUT MAY VARY BASED ON EXISTING TOPOGRAPHY. WEEP HOLES ARE NOT PERMITTED FOR DRAINAGE.
2. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.

CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS. THE FRONT TWO FEET OF THE RAMP AND FLARES SHALL BE CONSTRUCTED USING CONCRETE 8" THICK AND TRANSITIONING TO 4" CONCRETE FURTHER THAN 2 FEET FROM THE BACK OF THE CURB

(B) ORIENTATION/LOCATION OF PUSH BUTTON/PEDESTAL TO BE PER POLICY

(C) WIDTH OF THE RAMP AND LANDING MAY BE REDUCED TO 4-FT WHERE NO CURB WALL IS PRESENT

(D) SIDEWALK WIDTH MAY BE REDUCED TO 5-FT MIN. WHEN CONSTRAINED. SEE RAMP TYPE P-4, SECTION A-A FOR RAMP AND LANDING

CURB RAMP TYPE PP-2

CITY OF COLUMBUS, OHIO
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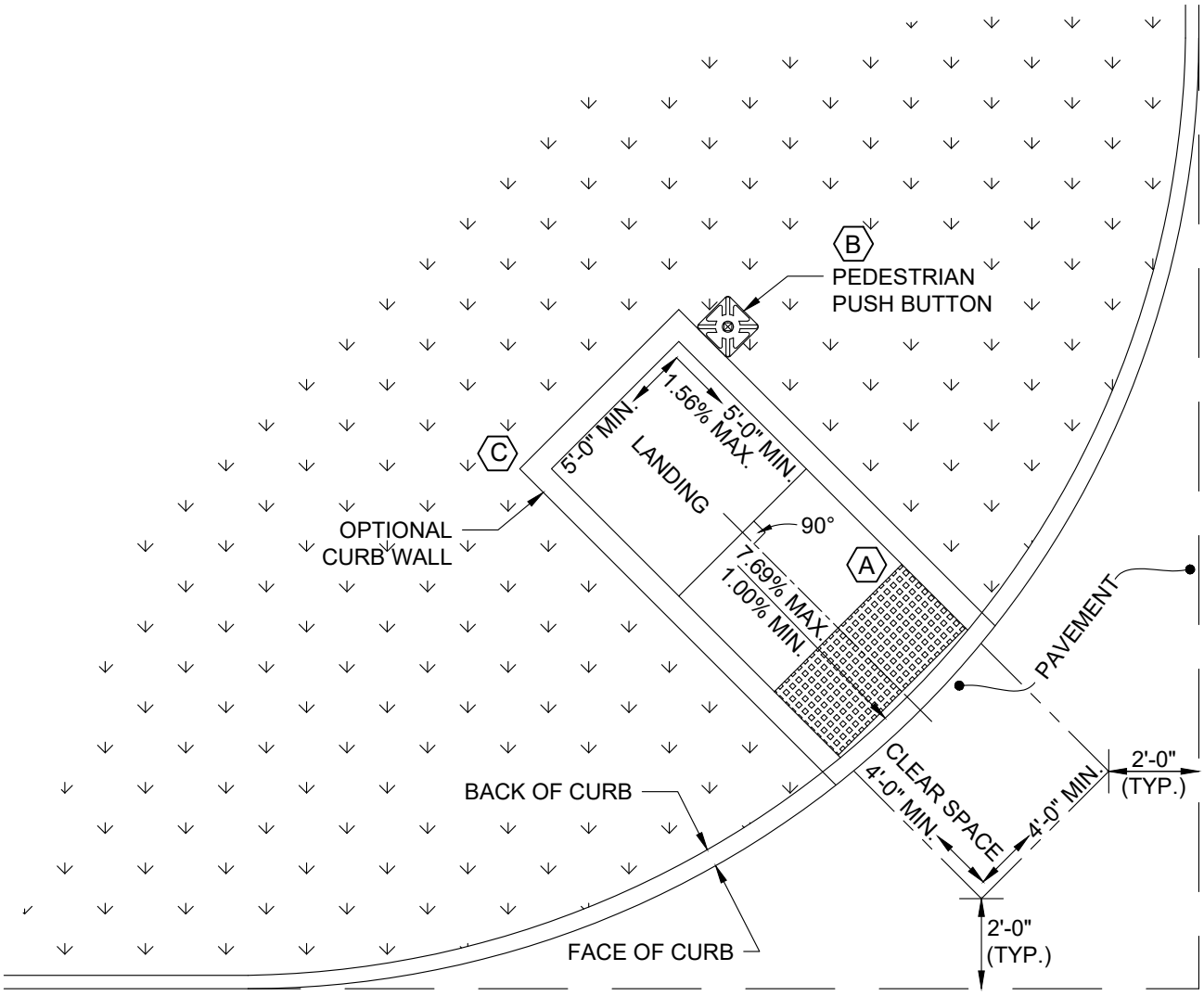
PEDESTRIAN PAD (PP)
TYPE 3 CONDITION-SHARED
CURB IS PRESENT



CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS. THE FRONT TWO FEET OF THE RAMP AND FLARES SHALL BE CONSTRUCTED USING CONCRETE 8" THICK AND TRANSITIONING TO 4" CONCRETE FURTHER THAN 2 FEET FROM THE BACK OF THE CURB

(B) ORIENTATION/LOCATION OF PUSH BUTTON/PEDESTAL TO BE PER POLICY

(C) CURB WALL MAY BE NECESSARY BASED ON EXISTING TOPOGRAPHY. IF CURB WALL IS NOT CONSTRUCTED, THE LANDING WIDTH CAN BE REDUCED TO 4'x4'.

GENERAL NOTES:

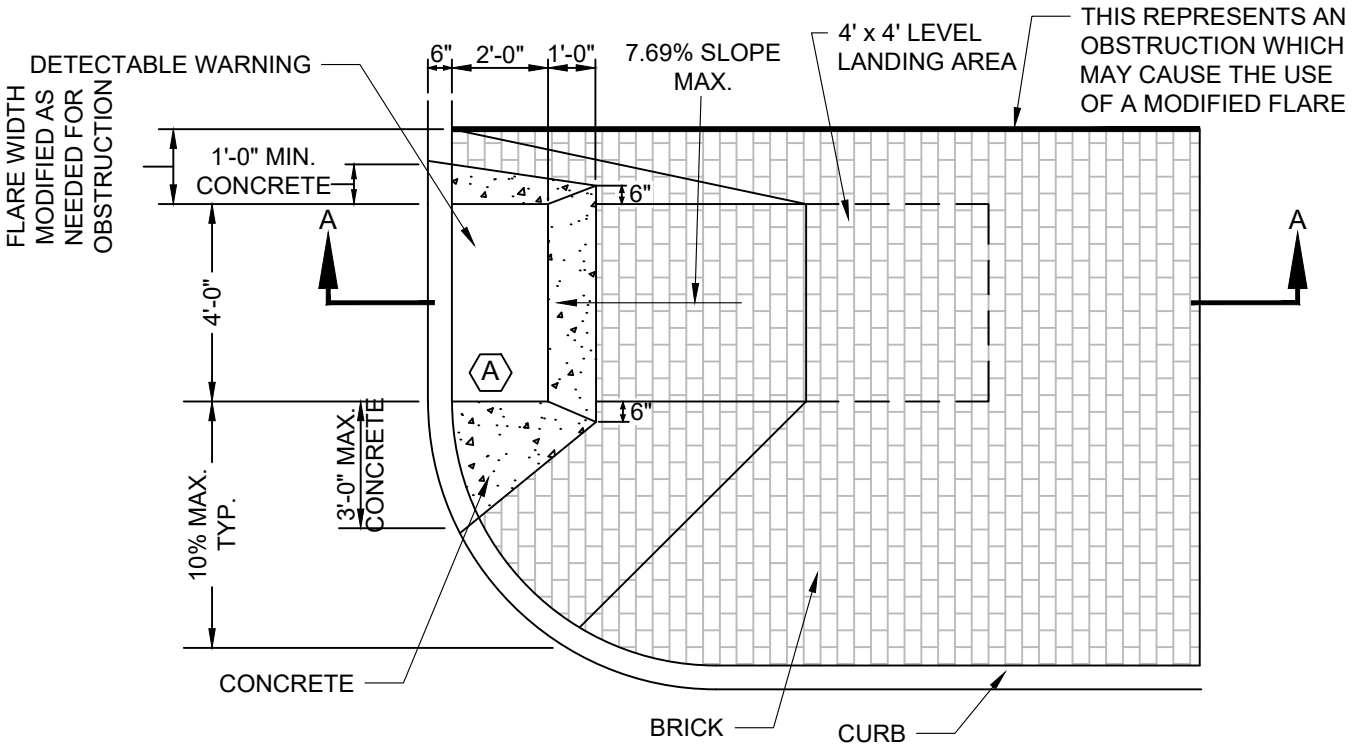
1. RAMP AND LANDING MUST BE CONSTRUCTED TO DRAIN, TYPICALLY TOWARDS THE ROADWAY, BUT MAY VARY BASED ON EXISTING TOPOGRAPHY. WEEP HOLES ARE NOT PERMITTED FOR DRAINAGE.
2. SEE SHEET 2 FOR ADDITIONAL DETAILED INFORMATION.

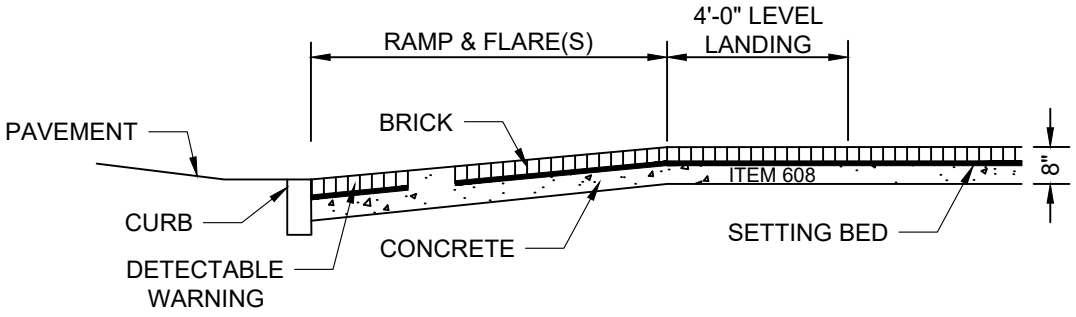
CURB RAMP
TYPE PP-3

CITY OF COLUMBUS, OHIO
DEPARTMENT OF PUBLIC SERVICE
DIVISION OF DESIGN AND CONSTRUCTION

STD DWG
2319

3/30/2018





SECTION A-A

1. WRITTEN APPROVAL FROM THE CITY ENGINEER OR AN AUTHORIZED REPRESENTATIVE SHALL BE OBTAINED PRIOR TO THE DESIGN OR CONSTRUCTION OF GRANITE OR AN ALTERNATE MATERIAL CURB RAMP.
2. ALONG WITH THE REQUIREMENT OF THIS SHEET FOR BRICK OR GRANITE CURB RAMPS, ALL OTHER APPLICABLE REQUIREMENTS OF 2319 SHALL BE FOLLOWED.
3. BRICK OR GRANITE CURB RAMPS SHALL BE TYPED PER 2319. TYPICALLY TYPE A OR TYPE D WILL BE USED. ALL APPLICABLE DIMENSIONS AND REQUIREMENTS FOR THE SELECTED TYPE OF RAMP SHALL BE FOLLOWED.
4. LONG FLARES WILL BE USED WHEREVER POSSIBLE. A MODIFIED FLARE SHALL BE USED WHEN AN OBSTRUCTION EXISTS.
5. THE INSTALLATION OF THE BRICK OR GRANITE PAVERS SHALL BE DONE PER STD DWG 2301, BRICK SIDEWALK.

CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS

PERPENDICULAR CURB RAMP BRICK SIDEWALK

CITY OF COLUMBUS, OHIO
DEPARTMENT OF PUBLIC SERVICE
DIVISION OF DESIGN AND CONSTRUCTION

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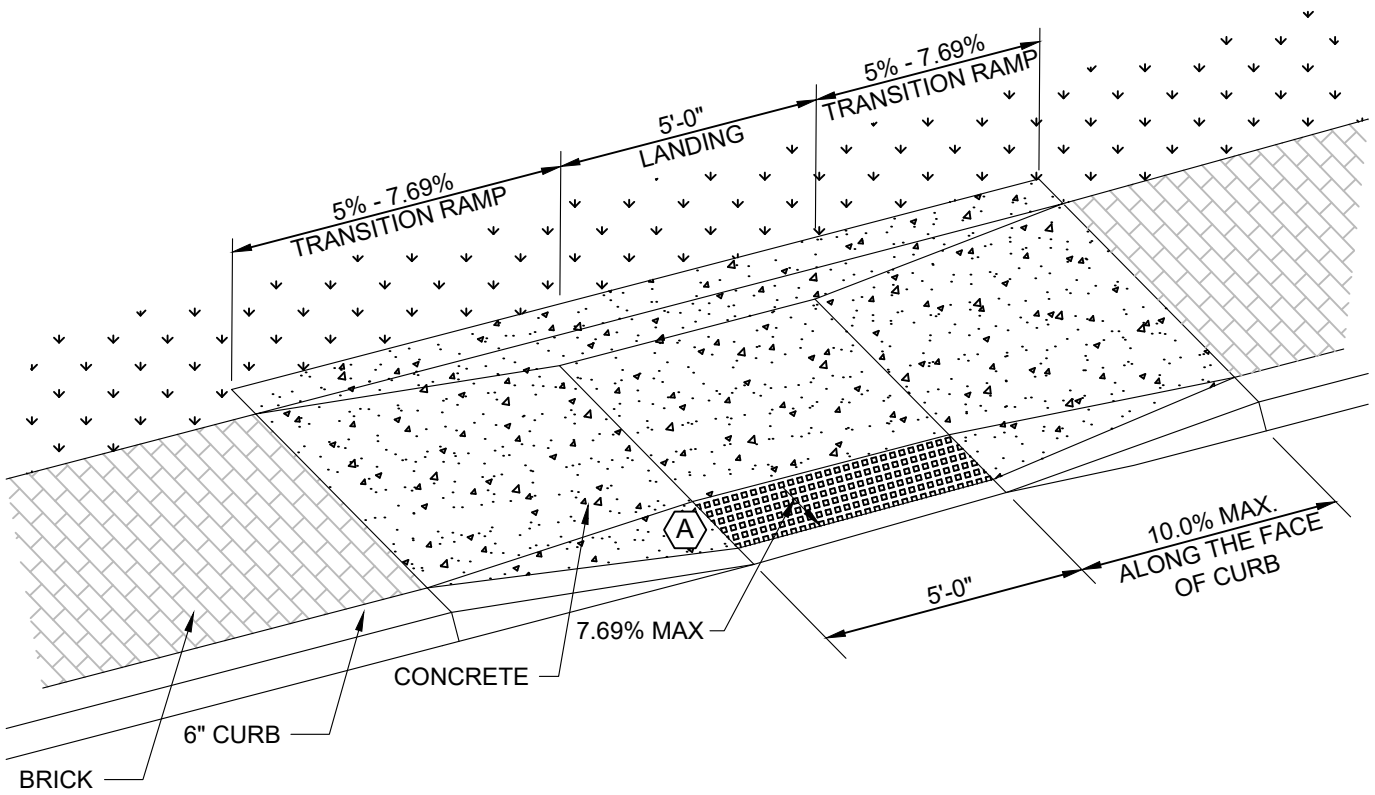

1. WRITTEN APPROVAL FROM THE CITY ENGINEER OR AN AUTHORIZED REPRESENTATIVE SHALL BE OBTAINED PRIOR TO THE DESIGN OR CONSTRUCTION OF GRANITE OR AN ALTERNATE MATERIAL CURB RAMP.
2. ALONG WITH THE REQUIREMENT OF THIS SHEET FOR BRICK OR GRANITE CURB RAMPS, ALL OTHER APPLICABLE REQUIREMENTS OF 2319 SHALL BE FOLLOWED.
3. BRICK OR GRANITE CURB RAMPS SHALL BE TYPED PER 2319. TYPICALLY TYPE A OR TYPE D WILL BE USED. ALL APPLICABLE DIMENSIONS AND REQUIREMENTS FOR THE SELECTED TYPE OF RAMP SHALL BE FOLLOWED.
4. LONG FLARES WILL BE USED WHEREVER POSSIBLE. A MODIFIED FLARE SHALL BE USED WHEN AN OBSTRUCTION EXISTS.
5. THE INSTALLATION OF THE BRICK OR GRANITE PAVERS SHALL BE DONE PER STD DWG 2301, BRICK SIDEWALK.

CODED NOTES:

(A) SEE SHEET 21 FOR DETECTABLE WARNING DETAILS

PARALLEL CURB RAMP BRICK SIDEWALK

CITY OF COLUMBUS, OHIO
DEPARTMENT OF PUBLIC SERVICE
DIVISION OF DESIGN AND CONSTRUCTION

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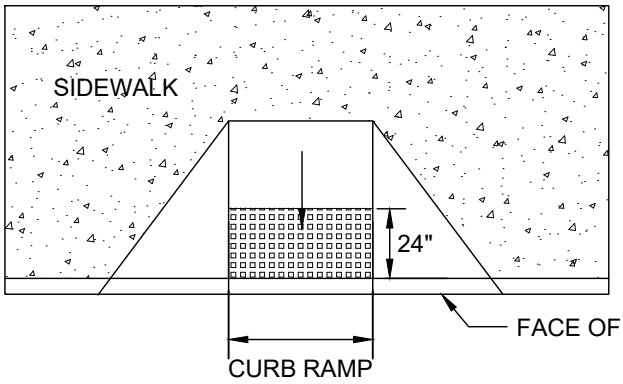
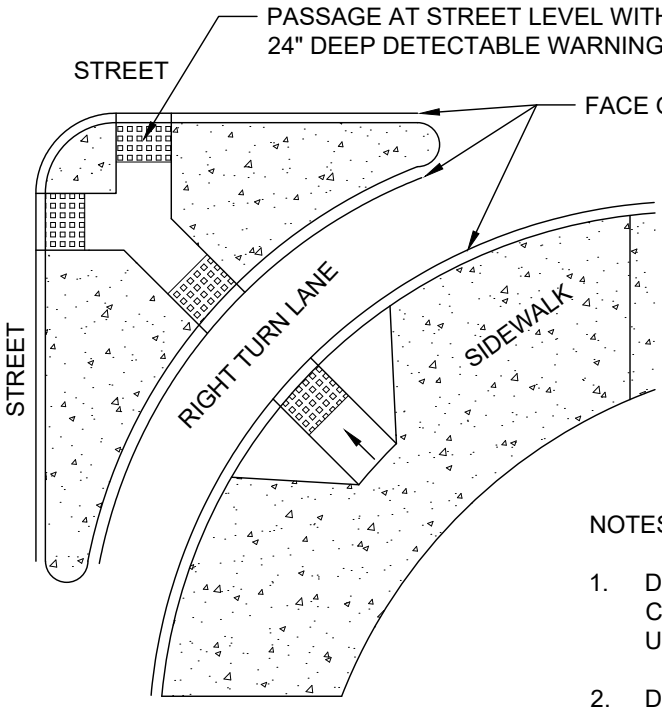
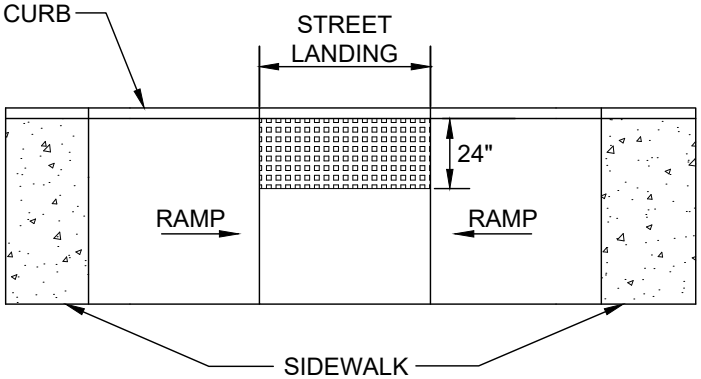






NOTES:

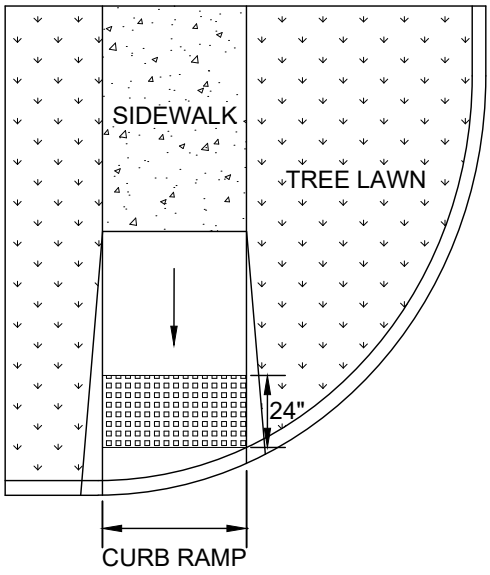
1. DETECTABLE WARNINGS SHALL BE PROVIDED WHEREVER A CURB RAMP CROSSES A VEHICULAR WAY. EXCLUDING UNSIGNALIZED DRIVEWAY CROSSINGS.

2. DETECTABLE WARNINGS SHALL BE PROVIDED 24" IN THE DIRECTION OF TRAVEL AND EXTEND THE FULL WIDTH OF THE CURB RAMP OR FLUSH SURFACE. THE DETECTABLE WARNING SHALL BE LOCATED ADJACENT TO THE CURB LINE.

3. MATERIALS SHALL COMPLY WITH CMSC 608 AND DPS ADA RULES AND REGULATIONS.

4. DETECTABLE WARNINGS SHALL BE PLACED 6" TO 8" BEHIND THE FACE OF CURB AND BEHIND THE CURB JOINT.

5. CAST IN PLACE OR ANY NON-SURFACE APPLIED DETECTABLE WARNING SHALL HAVE A MINIMUM OF 3" OF CONCRETE ON EACH SIDE OF THE WARNING.



CURB RAMP DETECTABLE WARNINGS

CITY OF COLUMBUS, OHIO
DEPARTMENT OF PUBLIC SERVICE
DIVISION OF DESIGN AND CONSTRUCTION

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3/30/2018
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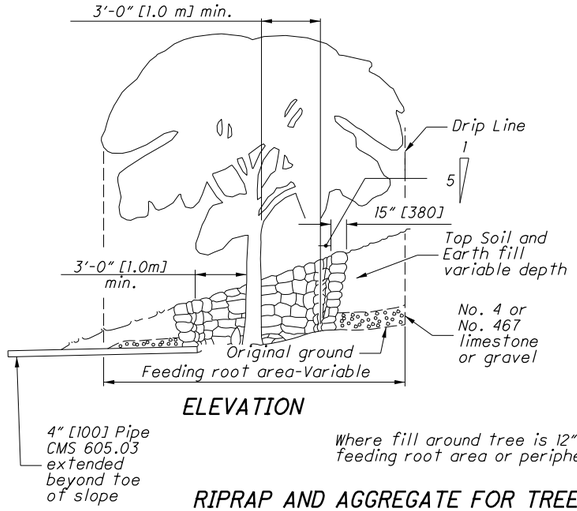
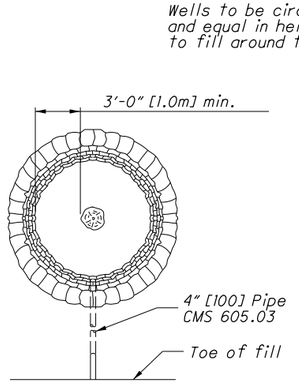
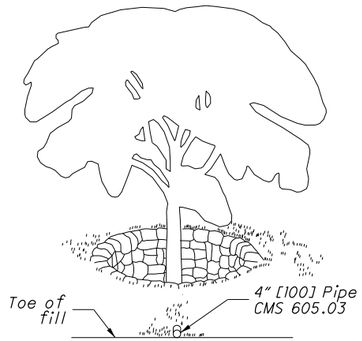
STANDARD CONSTRUCTION DRAWINGS
ODOT



ELEVATION



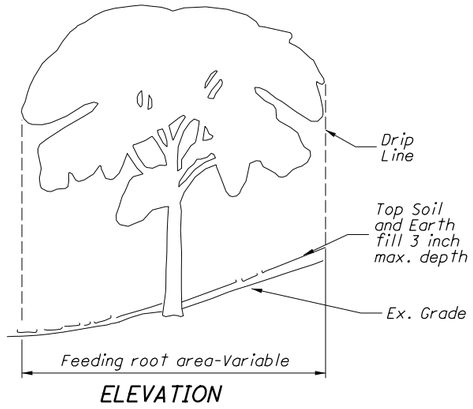
PLAN



FRONT VIEW

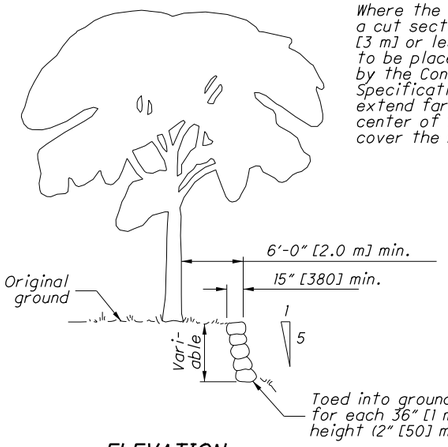
Where fill around tree is 12" [300] or more in depth over any part of the feeding root area or periphery of the tree, a well is to be constructed as shown.

RIPRAP AND AGGREGATE FOR TREE PROTECTION AND AERATION IN FILL



ELEVATION

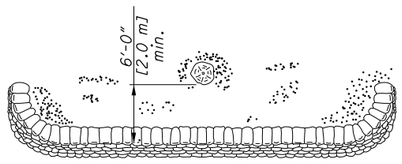
TREE ROOT PROTECTION IN FILL



ELEVATION

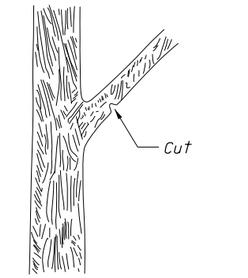
Where the top of the slope in a cut section is within 9 feet [3 m] or less of a tree, riprap is to be placed as shown, augmented by the Construction & Materials Specifications. Walls are to extend far enough from the center of the tree to amply cover the roots.

FRONT VIEW

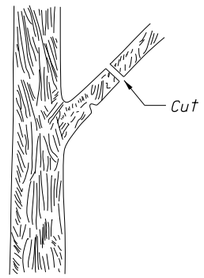


PLAN

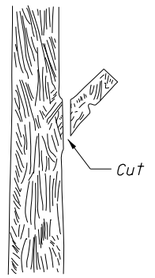
RIPRAP FOR TREE PROTECTION IN CUT



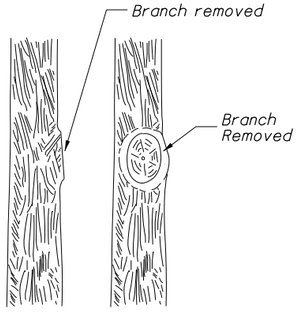
1
Undercut 1/3 of way through to prevent bark from stripping.



2
Remove the limb by making one downward cut leaving a stub.

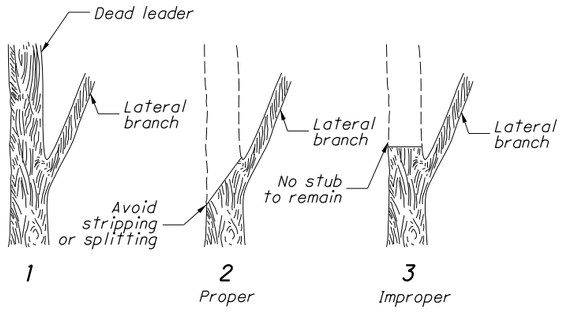


3A
Remove the stub by cutting outside the branch collar.

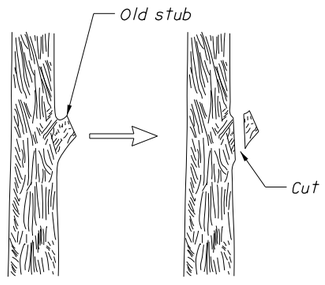


3B
Final cut should not be flush with the trunk, but outside the branch collar.

PROPER REMOVAL OF BRANCHES



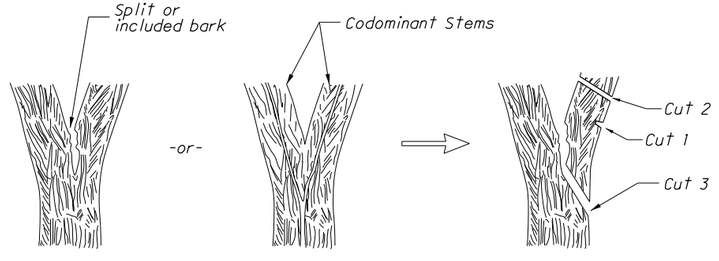
PART OF LEADER OR BRANCH TO BE REMOVED



Remove wire, nails, etc.

Remove the stub by cutting outside the branch collar.

REMOVING STUBS



Remove one stem to create central leader

PROPER CROTCH TREATMENT

PRUNING

THIS DRAWING REPLACES LA-1.1 DATED 7-28-2000.

REVISION DATE	10-15-2010
STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR	Dirk B. Gross
STDS. ENGINEER	M. Bline
ALL METRIC DIMENSIONS (IN BRACKETS [ ]) ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.	

OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

TREE WELLS AND PRUNING

SCD NUMBER **LA-1.1**

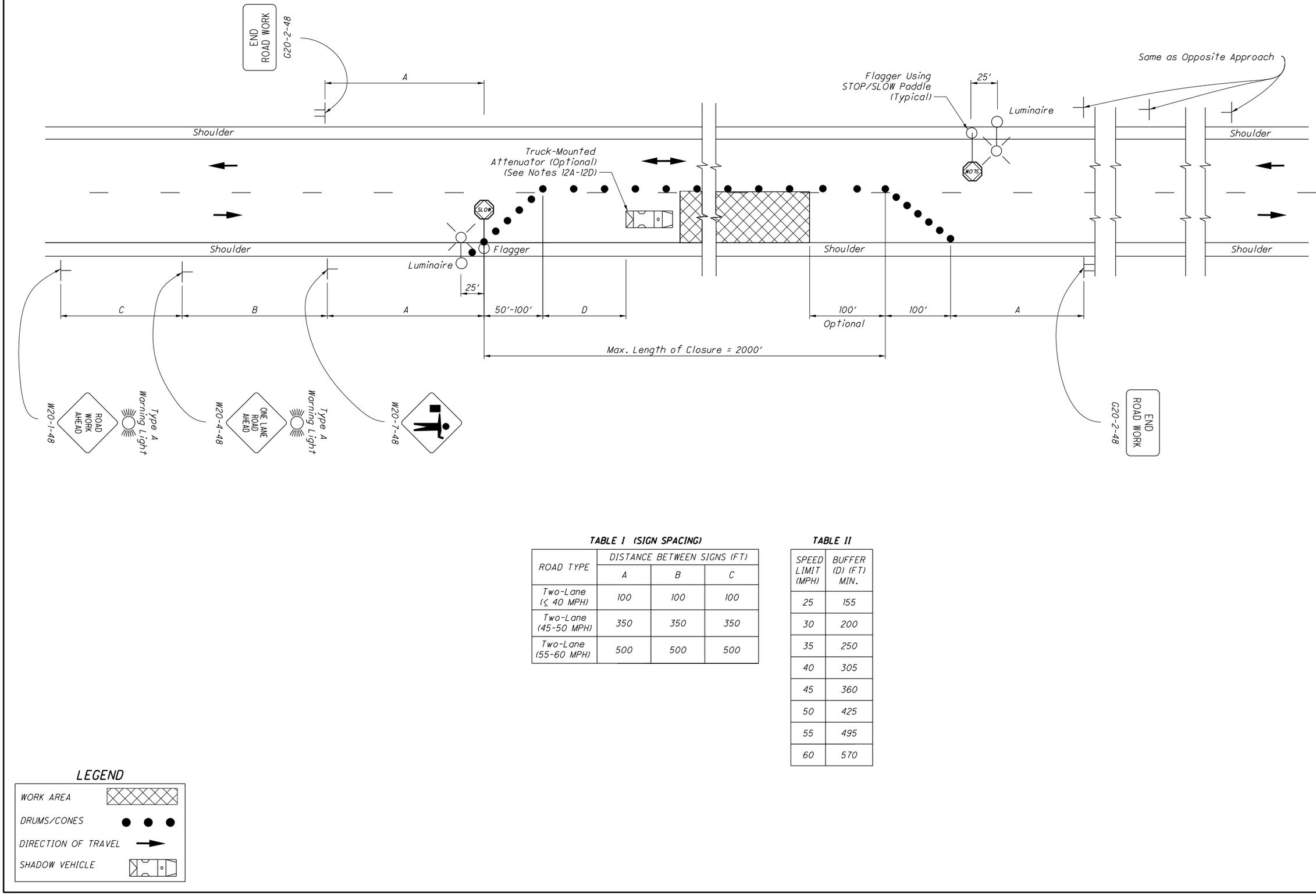


TABLE I (SIGN SPACING)

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
Two-Lane (≤ 40 MPH)	100	100	100
Two-Lane (45-50 MPH)	350	350	350
Two-Lane (55-60 MPH)	500	500	500

TABLE II

SPEED LIMIT (MPH)	BUFFER (D) (FT) MIN.
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570

LEGEND

- WORK AREA
- DRUMS/CONES
- DIRECTION OF TRAVEL
- SHADOW VEHICLE

THIS DRAWING REPLACES MT-97.10 DATED 07-19-2013.

REVISION DATE 07-18-2014

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR Reynaldo Stargell

STDS. ENGINEER Soisson

OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

FLAGGER CLOSING 1 LANE OF A 2-LANE HIGHWAY - STATIONARY OPERATION

SCD NUMBER MT-97.10

NOTES:

FLAGGERS

1. Flaggers, one for each direction, shall be used to control traffic continuously for as long as a one lane operation is in effect. The flaggers shall be able to communicate with each other at all times.

LENGTH OF CLOSURE

2. Several small work areas close together should be combined into one work zone. However, the closure shall not be more than 2000' long unless approved by the Engineer. The minimum length between closures shall be 2000'. Only one side of the road shall be closed in any one work zone.

SIGN LOCATION AND SPACING

3A. The minimum spacing between work zone signs is shown in Table I. Maximum spacing should not be greater than 1.5 times the distances shown in Table I.

3B. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing to existing signs shall be 200' for speeds of 45 mph or less and a minimum of 400' for speeds of 50 mph or greater.

3C. The location of the advance warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.

ADJUSTMENTS FOR SIGHT DISTANCE

4. The location of the flagger station and the advance warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.

BASIC SIGNING

5A. ROAD WORK AHEAD (W20-1) signs shall be provided on entrance ramps or roadways entering the work limits.

5B. END ROAD WORK (G20-2) signs are only required for lane closures of more than 1 day. It is intended that these signs be placed on the mainline, on all exit ramps, and on roadways exiting the work limits.

5C. Overlapping of signing for adjacent projects should be avoided where the messages could be confusing. Any ROAD WORK AHEAD (W20-1) or END ROAD WORK (G20-2) sign which falls within the limits of another traffic control zone shall be omitted or covered during the period when both projects are active.

SIGNING DETAILS

6A. The Advisory Speed (W13-1P) plaque shall be used when specified in the plan.

6B. 36" warning signs may be used when the approach speed limit is 40 mph or less.

FLASHING WARNING LIGHTS

7. Type A flashing warning lights shown on the ROAD WORK AHEAD (W20-1) signs and on the LANE CLOSED AHEAD (W20-5) signs are required whenever a night lane closure is necessary.

DRUMS / CONES

8A. Drum spacing shall be as follows:

a) Spacing along the closure shall be 40' center-to-center.
b) Spacing along the approach taper shall be 10' center-to-center.

8B. Cones may be substituted for drums as follows:

a) Cones used for daytime traffic control shall have a minimum height of 28".
b) Cones used for nighttime traffic control shall have a minimum height of 42".
c) Use of cones at night shall be prohibited along tapers.

8C. Provisions shall be made to stabilize the cones and drums to prevent them from blowing over.

8D. A minimum of two drums shall be used to close the paved shoulder.

(RESERVED FOR FUTURE USE)

9A. (intentionally blank)

AREA ILLUMINATION

10A. Adequate area illumination of each flagger station shall be provided at night. Use of portable flood lighting is acceptable. Luminaires shall be located adjacent to each flagger station.

10B. To ensure the adequacy of floodlight placement and the elimination of glare, the Contractor and the Engineer shall drive through the worksite each night when the lighting is in place. Light placement and shielding shall be adjusted to the satisfaction of the Engineer.

INTERSECTION / DRIVEWAY ACCESS

11. Within the length of closure, provision shall be made to control traffic entering from intersecting streets and major drives as necessary to prevent wrong-way movements and to keep vehicles off of new pavement not ready for traffic. The Contractor shall:

a) Place across the closed lane, either three drums (cones) or barricades, and/or
b) Provide an additional flagger at every public street intersection and major driveway.

Drums (cones) placed across the closed lane shall be located 25' beyond the projected pavement edges of the driveway or cross highway, as shown in Standard Construction Drawings (SCDs MT-97.11 or MT-97.12. For barricades, see SCD MT-101.60.

Existing STOP signs shall be relocated as necessary to assure proper location for the traffic conditions.

The method of control shall be subject to the approval of the Engineer.

SHADOW VEHICLE

12A. The shadow vehicle shall be in place and unoccupied whenever workers are in the work area. This vehicle shall be removed from the pavement whenver workers are not in the work area.

12B. The shadow vehicle shall be equipped with a high-intensity yellow rotating, flashing, oscillating, or strobe light(s).

12C. The vehicle shall be equipped with a truck-mounted attenuator when called for in the plans.

12D. Other protective devices may be used in lieu of the shadow vehicle shown when approved by the Engineer.

CHIP SEAL OPERATIONS

13. For chip seal operations, additional signing shall be incorporated in the advanced warning area.

a) The LOOSE GRAVEL (W8-7) and FRESH TAR (W21-2) signs shall both be used in advance of the chip seal operation.
b) Repeat the LOOSE GRAVEL sign with a 35 mph Advisory Speed (W13-1) plaque every half mile per CMS 422.09.
c) The FRESH TAR and the LOOSE GRAVEL signs shall both be used for signing of side roads intersecting the work area.

THIS DRAWING REPLACES MT-97.10 DATED 07-19-2013.

REVISION DATE 07-18-2014

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR Reynaldo Stargell

STDS. ENGINEER Soisson

OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

FLAGGER CLOSING 1 LANE OF A 2-LANE HIGHWAY - STATIONARY OPERATION

SCD NUMBER MT-97.10

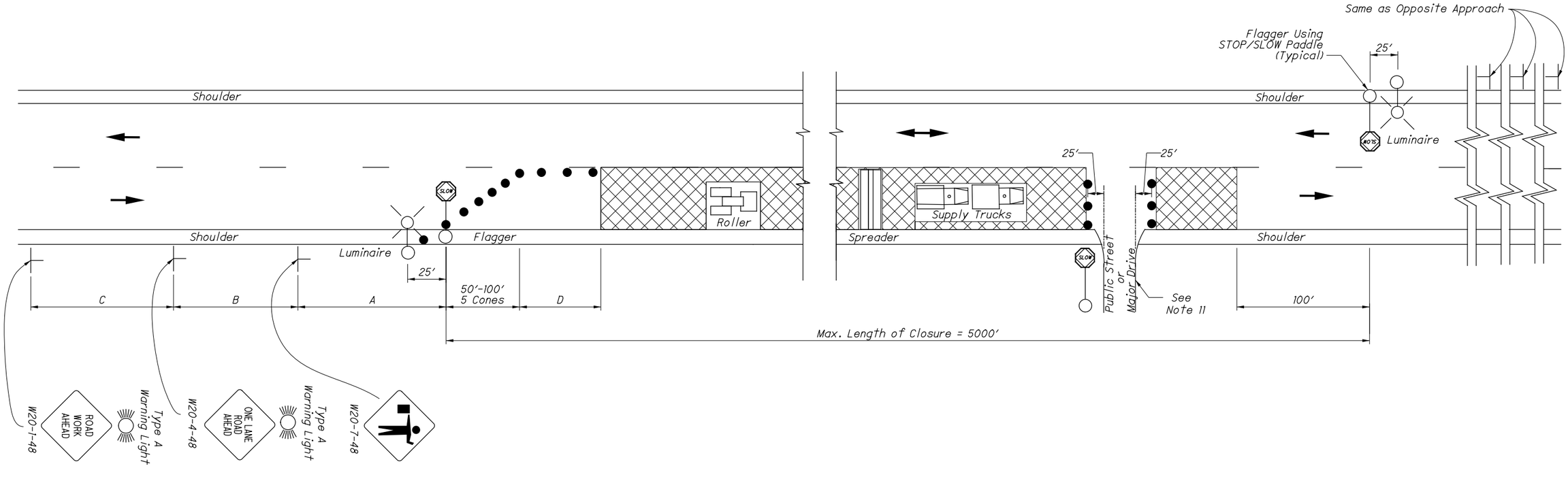


TABLE I (SIGN SPACING)

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT)		
	A	B	C
Two Lane ≤ 40 MPH	100	100	100
Two Lane 45-50 MPH	350	350	350
Two Lane 55-60 MPH	500	500	500

TABLE II

SPEED LIMIT (MPH)	BUFFER (D) (FT) MIN.
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570

LEGEND

WORK AREA

CONES

DIRECTION OF TRAVEL

THIS DRAWING REPLACES MT-97.11 DATED 07-18-2014.

REVISION DATE 01-20-2017

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

STDS. ENGINEER Soisson

OFFICE OF ROADWAY ENGINEERING

FLAGGER CLOSING 1 LANE OF A 2-LANE HIGHWAY FOR PAVING OPERATIONS (NON-FED ONLY)

STANDARD ROADWAY CONSTRUCTION DRAWING

SCD NUMBER **MT-97.11**

NOTES:

FLAGGERS

1. Flaggers, one for each direction, shall be used to control traffic continuously for as long as a one lane operation is in effect. The flaggers shall be able to communicate with each other at all times.

LENGTH OF CLOSURE

2. It is required that the length of closure be kept to a minimum at all times, as directed by the Engineer, with a maximum allowable length of 5000′.

   When the ambient temperature exceeds 80 degrees Fahrenheit the Engineer may increase the maximum allowable length of closure to allow for sufficient cooling of new pavement.

   The Engineer may shorten the maximum allowable length of closure to relieve excessive traffic backups or to improve traffic operation.

SIGN LOCATION AND SPACING

3A. The minimum spacing between work zone signs is shown in Table I. Maximum spacing should not be greater than 1.5 times the distances shown in Table I.

3B. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing to existing signs shall be 200′ for speeds of 45 mph or less and a minimum of 400′ for speeds of 50 mph or greater.

3C. The location of the advance warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.

ADJUSTMENTS FOR SIGHT DISTANCE

4. The location of the flagger station and the advance warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.

BASIC SIGNING

5A. ROAD WORK AHEAD (W20-1) signs shall be provided on entrance ramps or roadways entering the work limits.

5B. END ROAD WORK (G20-2) signs are only required for lane closures of more than 1 day. It is intended that these signs be placed on the mainline, on all exit ramps, and on roadways exiting the work limits.

5C. Overlapping of signing for adjacent projects should be avoided where the messages could be confusing. Any ROAD WORK AHEAD or END ROAD WORK sign which falls within the limits of another traffic control zone shall be omitted or covered during the period when both projects are active.

SIGNING DETAILS

6A. The Advisory Speed (W13-1P) plaque shall be used when specified in the plan.

6B. 36″ warning signs may be used when the approach speed limit is 40 mph or less.

FLASHING WARNING LIGHTS

7. Type A flashing warning lights shown on the ROAD WORK AHEAD (W20-1) signs and on the LANE CLOSED AHEAD (W20-5) signs are required whenever a night lane closure is necessary.

CONES

8A. Cone spacing shall be as follows:

   a) Spacing along the buffer shall be 40′ center-to-center.
   b) Spacing along the approach taper shall be 10′ center-to-center.

8B. Cone sizes shall be as follows:

   a) Cones used for daytime traffic control shall have a minimum height of 28″.
   b) Cones used for nighttime traffic control shall have a minimum height of 42″.

8C. Provisions shall be made to stabilize the cones to prevent them from blowing over.

8D. A minimum of two cones shall be used to close the paved shoulder.

(RESERVED FOR FUTURE USE)

9A. (intentionally blank)

AREA ILLUMINATION

10A. Adequate area illumination of each flagger station shall be provided at night. Use of portable flood lighting is acceptable.

10B. To ensure the adequacy of floodlight placement and the elimination of glare, the Contractor and the Engineer shall drive through the worksite each night when the lighting is in place. Light placement and shielding shall be adjusted to the satisfaction of the Engineer.

INTERSECTION / DRIVEWAY ACCESS

11. Within the length of closure, provision shall be made to control traffic entering from intersecting streets and major drives as necessary to prevent wrong-way movements and to keep vehicles off of new pavement not ready for traffic. The Contractor shall:

   a) Place across the closed lane, either three cones or barricades, and/or
   b) Provide an additional flagger at every public street intersection and major driveway.

   Cones placed across the closed lane shall be located 25′ beyond the projected pavement edges of the driveway or cross highway. For barricades, see Standard Construction Drawing MT-101.60.

   Existing STOP signs shall be relocated as necessary to assure proper location for the traffic conditions.

   The method of control shall be subject to the approval of the Engineer.

CHIP SEAL OPERATION

12. For chip seal operations, additional signing shall be incorporated in accordance with CMS 422.09.

THIS DRAWING REPLACES MT-97.11 DATED 07-18-2014.

REVISION DATE 01-20-2017

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

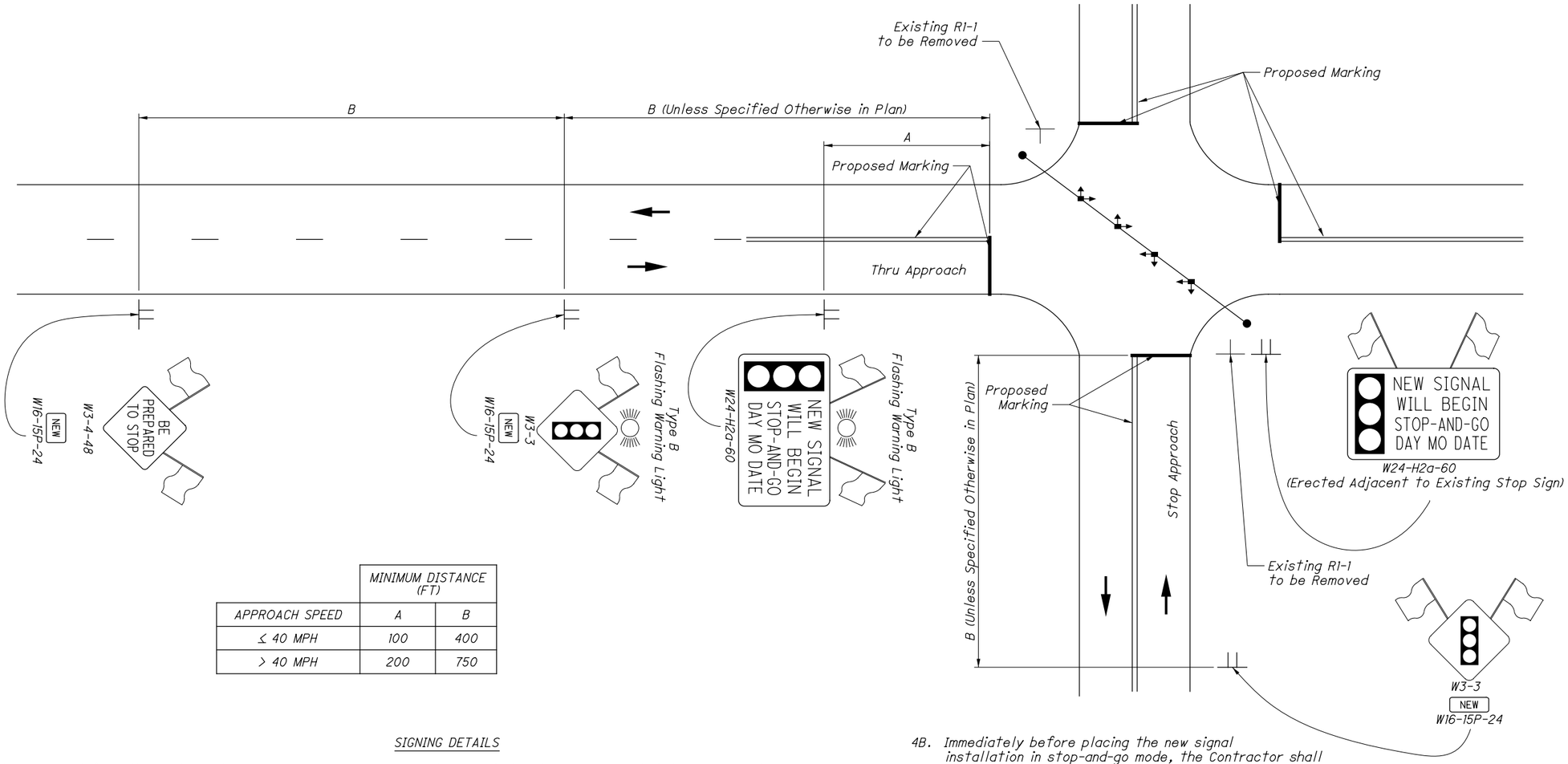
STDS. ENGINEER Soisson

OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

FLAGGER CLOSING 1 LANE OF A 2-LANE HIGHWAY FOR PAVING OPERATIONS (NON-FED ONLY)

SCD NUMBER MT-97.11



	MINIMUM DISTANCE (FT)	
APPROACH SPEED	A	B
≤ 40 MPH	100	400
> 40 MPH	200	750

NOTES:

TRAFFIC SIGNAL

1A. After receiving approval from the Engineer to activate the signal, the Contractor shall notify the Engineer at least 10 days prior to placing the signal in stop-and-go mode to allow the Engineer time to notify local media and law enforcement of the scheduled signal activation.

1B. A permanent new signal or signal upgrade from a flasher shall operate in flash mode for 3 to 5 business days before being placed in a stop-and-go mode for the 10 day burn test, as determined by the Engineer.

1C. The signal shall not be activated to stop-and-go operation on a Friday, Saturday or Sunday, or the day preceding or during a national holiday (New Years, Memorial Day, Independence Day, Labor Day, Thanksgiving, or Christmas), except with written permission from the District Construction Engineer.

SIGNS (GENERAL)

2A. The Contractor shall furnish, install, maintain and remove all signs, warning lights (when required) and flags as shown above, including supports and all necessary mounting hardware.

2B. Type B flashing warning lights shall be installed on the thru approaches as shown above.

2C. Flags shall be erected as shown above. The flags shall be 18" x 18", made of orange vinyl material, and securely fastened to the sign or sign support.

SIGNING DETAILS

3A. The Signal Ahead (W3-3) signs shall be orange unless yellow is specified in the plans. If the sign is orange, the dimensions shall be 48" x 48". If the sign is yellow, the dimensions shall be as specified in the plans.

3B. The NEW (W16-15P) plaque shall be provided below the BE PREPARED TO STOP (W3-4) and Signal Ahead (W3-3) signs along the thru approaches and below the W3-3 signs along the stop approaches.

3C. On multi-lane divided thru approaches, erect signs in median identical to those on the right to create dual installations, including supplemental signs, flags and flashing warning lights.

3D. For multi-way stop approaches, each approach controlled by a STOP sign shall be treated as shown above for the stop approach.

3E. The BE PREPARED TO STOP sign installation (including the W16-15P plaque and flags) on the thru approach shall be omitted when a permanent PREPARE TO STOP WHEN FLASHING (W3-H4a) sign is erected.

SIGNING SCHEDULE

4A. The Contractor shall erect the W24-H2a-60 (with activation day, month, and date, e.g., MON AUG 12) signs equipped with orange flags as shown above on each approach to the intersection at the time the signal is placed in flash mode. See Note 1B.

4B. Immediately before placing the new signal installation in stop-and-go mode, the Contractor shall remove or cover the W24-H2a-60 signs. At the same time, the Contractor shall install or uncover the W3-3 and W3-4 sign assemblies as shown above.

4C. Immediately after placing the new signal installation in stop-and-go mode, the Contractor shall remove or cover the STOP (R1-1) signs.

4D. The Contractor shall remove the flashing warning lights, flags and brackets, the orange W3-3 signs, the W3-4 signs and the W16-15P plaques 21-30 days after the signal is placed in stop-and-go mode.

PAVEMENT MARKING

5. Proposed pavement marking shall be installed as shown in the plans.

REMOVAL OF WORK VEHICLES

6. The Contractor shall remove all work vehicles from the intersection prior to beginning the signal activation process.

PAYMENT

7. Permanent supports and permanent signs (yellow W3-3) and their removal (R1-1) shall be paid for under separate pay items in the plans. Payment for all other labor, equipment and materials necessary to complete this work shall be included in the Lump Sum price bid for CMS 614 Maintaining Traffic.

THIS DRAWING REPLACES MT-120.00 DATED 07-19-2013.

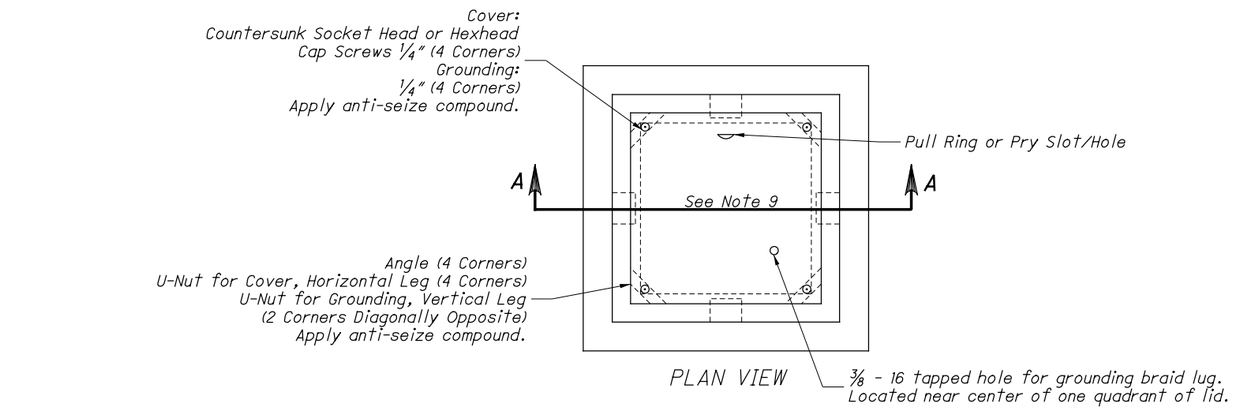
REVISION DATE	STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR	STDS. ENGINEER
01-19-2018	David L. Holstein	Stargell

OFFICE OF ROADWAY ENGINEERING

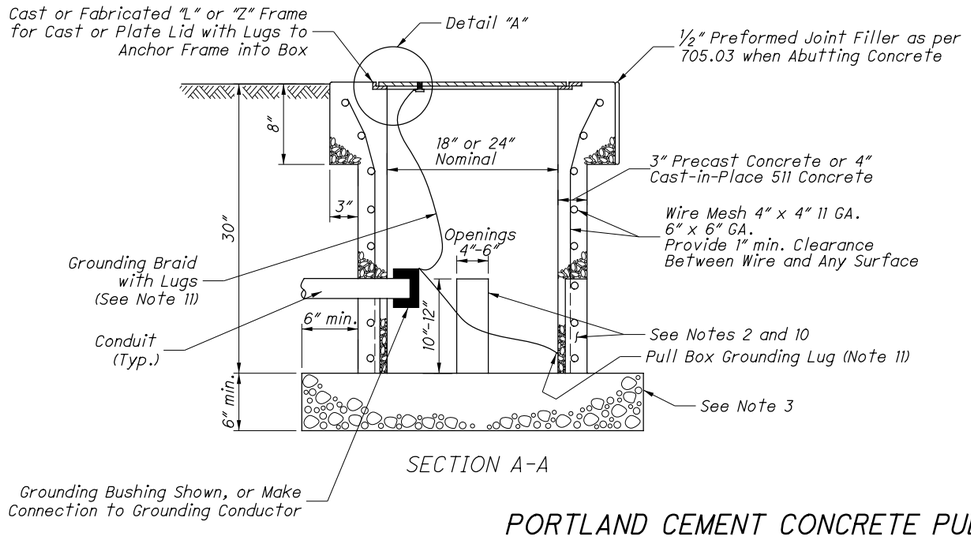
STANDARD ROADWAY CONSTRUCTION DRAWING

NEW SIGNAL ACTIVATION

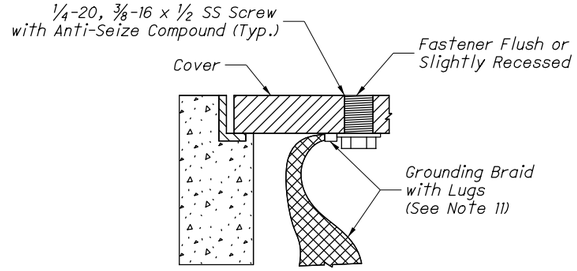
SCD NUMBER **MT-120.00**



PLAN VIEW



SECTION A-A



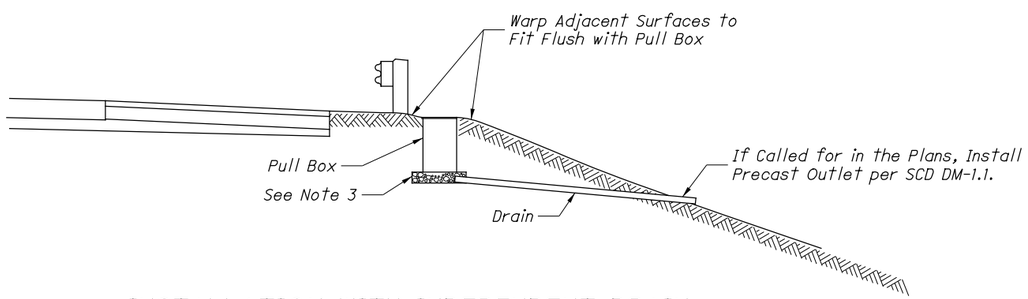
DETAIL "A"

PORTLAND CEMENT CONCRETE PULL BOX (725.08)

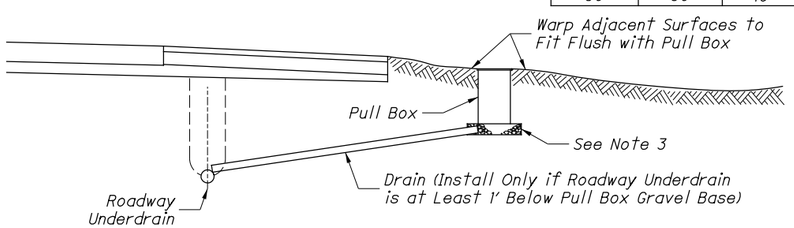
NOTES:

1. Pull boxes shall conform with C&MS 625.11 and 725.07 or 725.08 or 725.06.
2. Conduit openings shall be sealed after conduit installation.
3. Aggregate used for pull boxes shall be No. 7 or 8, at least 6" deep. Cost for aggregate shall be included with the unit price bid for each pull box.
4. Pull box drains in accordance with C&MS 611 shall be installed as directed by the Engineer.
5. A durable label reminding of the need to lubricate the threads of the cover hold down screws with grease or anti-seize compound shall be on the inside of the frame or upper wall.
6. See specifications for cover marking requirements.
7. Portland cement concrete pull box covers shall be cast iron with reinforcing ribs and matching frames by Neenah, Josam or Zurn foundries, or approved equal, or covers may be 1/2" minimum galvanized plate steel.
8. Tapered thickness portland cement concrete pull box walls may be used; however, minimum wall thickness shall be as indicated.
9. Lifting rings or wire pulling rings may be incorporated into precast portland cement concrete pull box walls.
10. Conduit entries for cast-in-place portland cement concrete pull boxes shall be cast as required. Precast portland cement concrete pull boxes may have field core drilled or sawed openings, or may have precast openings or knockouts. Knockouts shall be arranged to avoid compromising the structural integrity of the box.
11. Grounding braid, with lugs, shall be tinned copper, equivalent to #4 AWG. Do not use wire for the lid grounding conductor. Braid shall be bonded to the circuit grounding conductor by an approved (UL-listed) means. Braid length shall allow for complete removal of cover and placement on ground adjacent to the pull box, 48" minimum. Also, ground the pull box lug connection using the braid or #4 AWG green wire. Grounding lug required only on pull boxes constructed with reinforcing steel.
12. Polymer concrete, fiberglass and plastic pull boxes (725.06, 725.07, and 725.12) shall come in the following nominal sizes based on volume. Linear dimensions shall match to +/- 5% and volume by +/- 10%.

SIZE (nominal)	LENGTH (in.)	WIDTH (in.)	DEPTH (in.)
1.5	11	18	12
4	13	24	24
7	17	30	24
18	24	36	36
30	30	48	36



INSTALLATION WITH INDEPENDENT DRAIN



INSTALLATION WITH CONNECTION TO ROADWAY UNDERDRAIN

THIS DRAWING REPLACES HL-30.11 DATED 01-19-2018.

REVISION DATE 07-20-2018

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

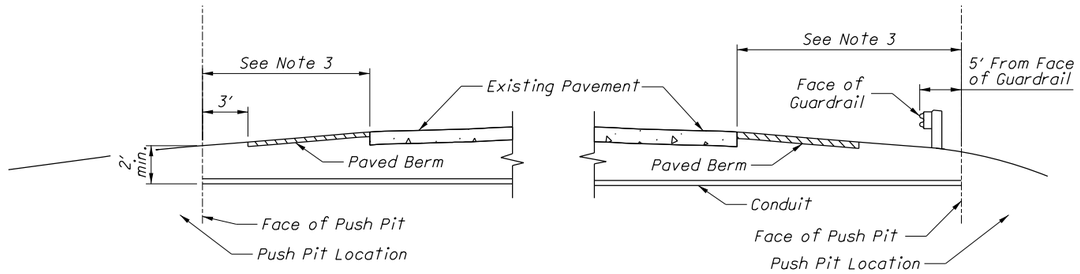
STDS. ENGINEER Duemmel

OFFICE OF ROADWAY ENGINEERING

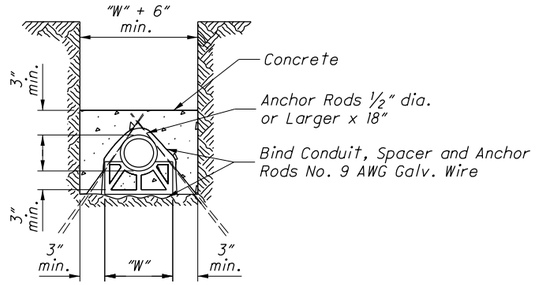
STANDARD ROADWAY CONSTRUCTION DRAWING

PULL BOX DETAILS

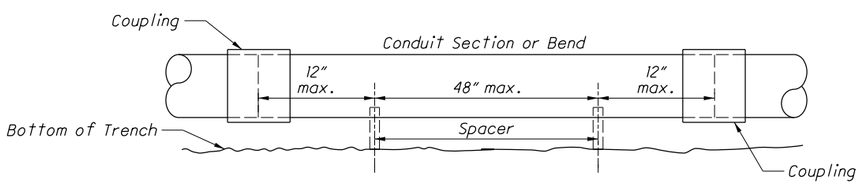
SCD NUMBER HL-30.11



CONDUIT JACKED UNDER PAVEMENT

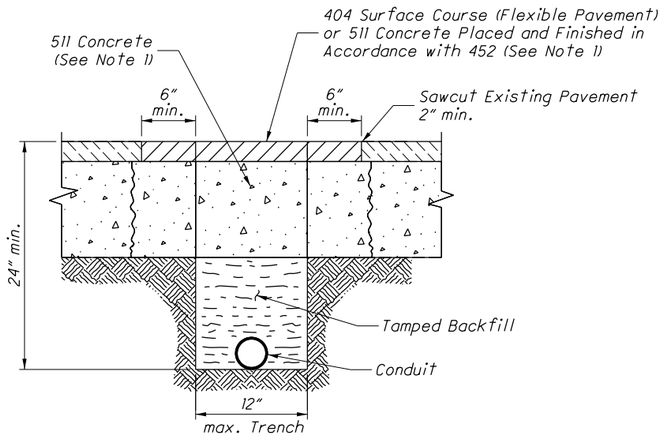


TRENCH SECTION

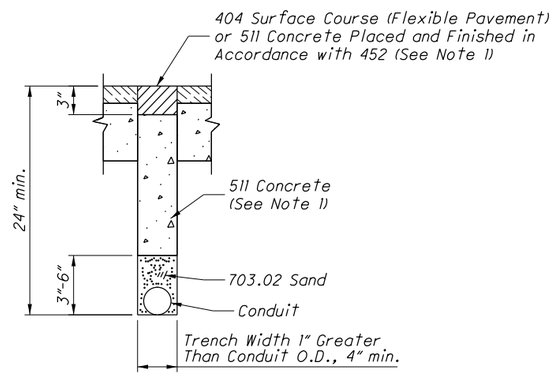


SIDE ELEVATION

CONCRETE ENCASED CONDUIT



"T" TRENCH IN PAVED AREA



NARROW SLIT TYPE TRENCH IN PAVED AREA

NOTES:

1. Replacement of disturbed flexible pavement shall consist of a CMS 511 concrete subcourse with a 404 surface course. Replacement of rigid pavement shall consist of a 511 concrete course with surface finished in accordance with 452.
2. Restore disturbed facilities and surfaces to a condition equal to that existing before the work started.
3. When undermining shoulder areas that do not have paved berms, provide ¾" thick steel surface plates, corrugated pipe sleeves, shoring or other approved means to prevent cave-in.
4. When conduit is jacked or drilled under divided pavements, cable may be installed in a trench through the median area when specified in the plans.

REVISION DATE 01-17-2014

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR Reynaldo Stargell

STDS. ENGINEER Duemmel

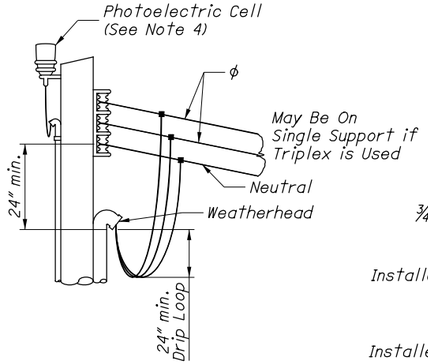
OFFICE OF ROADWAY ENGINEERING

THIS DRAWING REPLACES HL-30.22 DATED 01-18-2013.

STANDARD ROADWAY CONSTRUCTION DRAWING

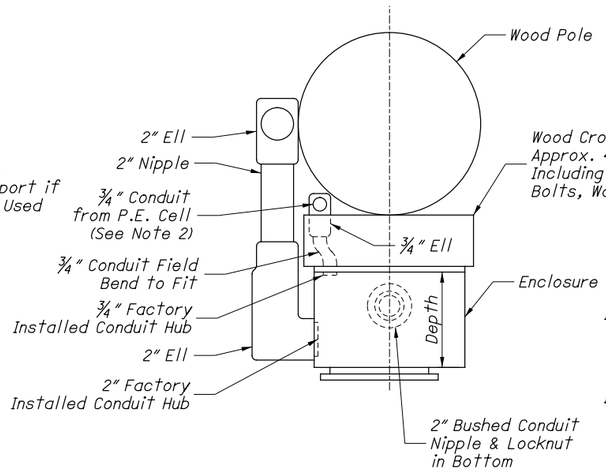
ROADWAY CONDUIT DETAILS II

SCD NUMBER HL-30.22



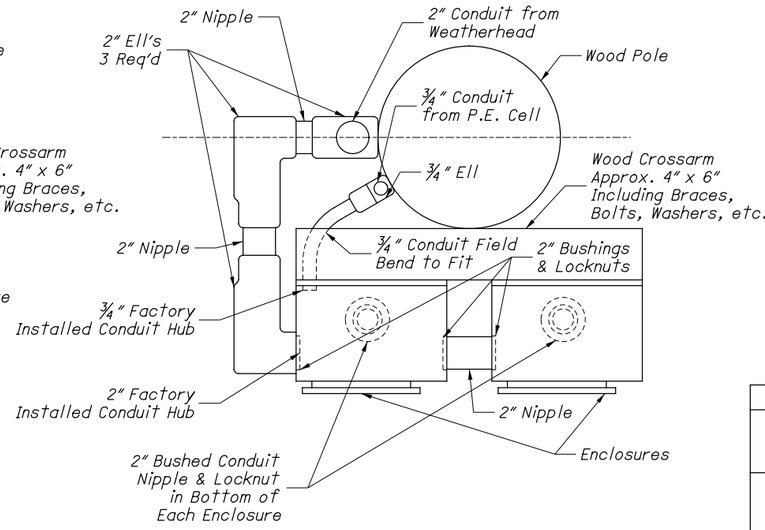
Provide 4' min. Length
of Cable Beyond
Weatherhead

TYPICAL 3-WIRE SERVICE POLE HEAD



PLAN

SINGLE ENCLOSURE



PLAN

DOUBLE ENCLOSURE

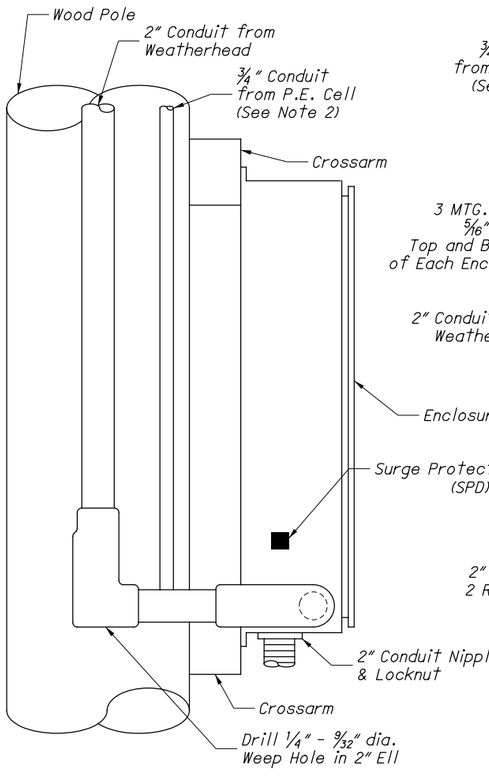
NOTES:

1. All openings in enclosures shall be made by fabricator.
2. The ¾" conduit for control wiring between P.E. cell and contactor enters the back of the enclosure at the bottom.
3. All conduit shall conform to CMS 725.04.
4. If no marking is provided to aim the P.E. cell, face the "window" of the sensing element due north.

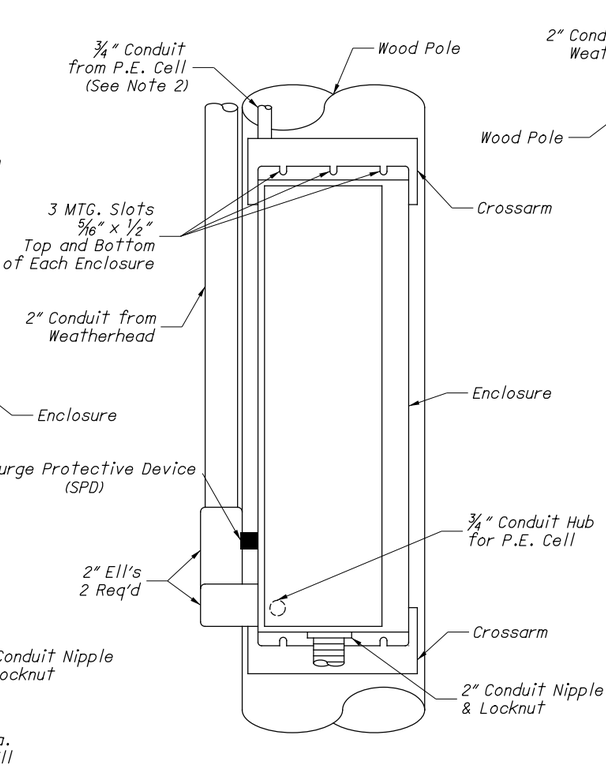
MINIMUM INTERIOR DIMENSIONS OF ENCLOSURE TYPES

TYPE	PRINCIPLE CONTENTS	WIDTH	HEIGHT	DEPTH*
S-60	60 Ampere Fused Switch	10"	18"	6"
S-100	100 Ampere Fused Switch	14"	24"	7"
SC-60	60 Ampere Fused Switch 60 Ampere Contactor	14"	34"	8"
SC-100	100 Ampere Fused Switch 100 Ampere Contactor	18"	38"	8"

* See "PLAN" View of Single Enclosure.
The Interior Depth Dimension Shall Not
Include Any Part of the Enclosure Door Which
May Protrude into the Interior of the Enclosure.

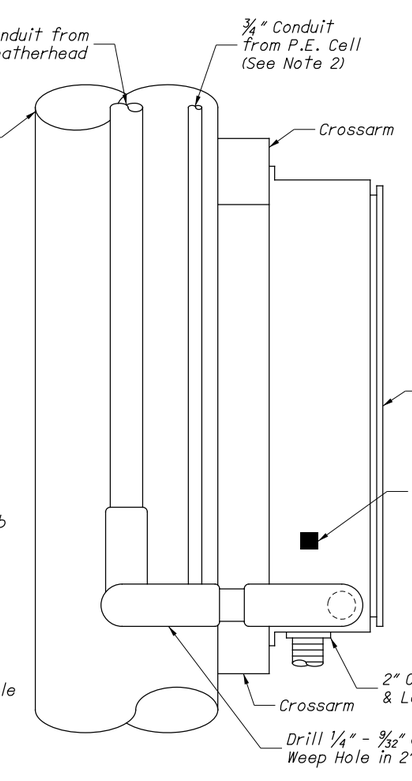


LEFT SIDE VIEW

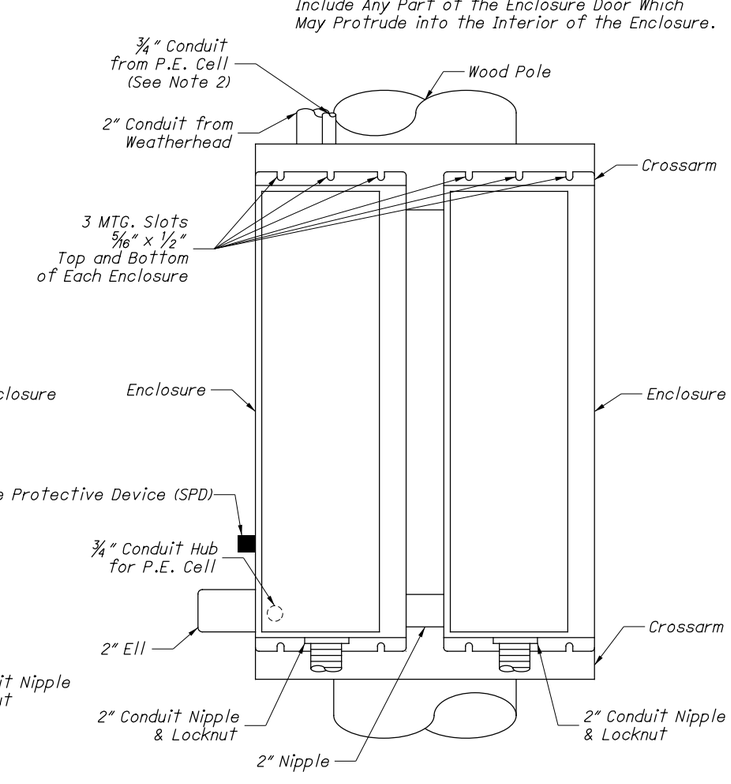


FRONT ELEVATION

SINGLE ENCLOSURE



LEFT SIDE VIEW



FRONT ELEVATION

DOUBLE ENCLOSURE

THIS DRAWING REPLACES HL-40.10 DATED 01-17-2014.

REVISION DATE 01-20-2017

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

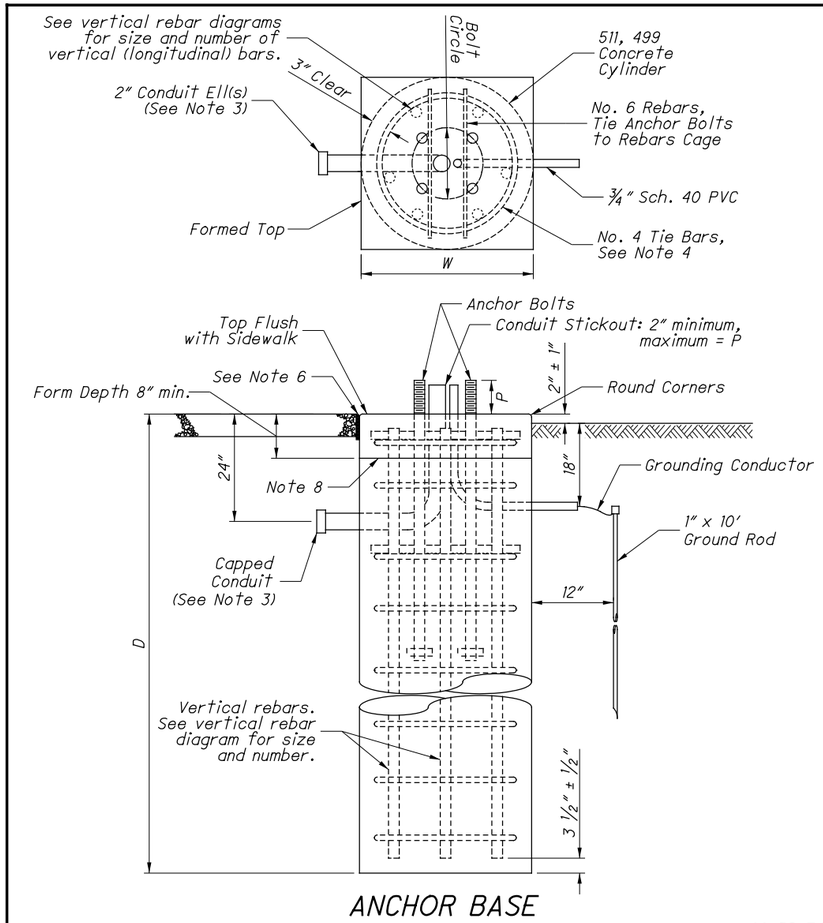
STDS. ENGINEER Duemmel

OFFICE OF ROADWAY ENGINEERING

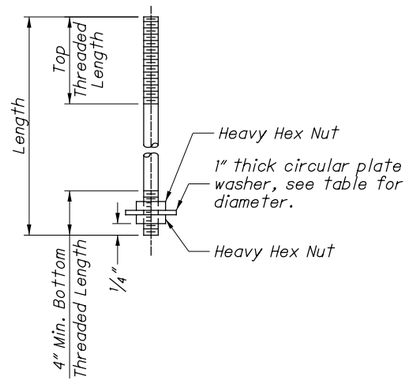
STANDARD ROADWAY CONSTRUCTION DRAWING

POWER SERVICE, POLE MOUNTED

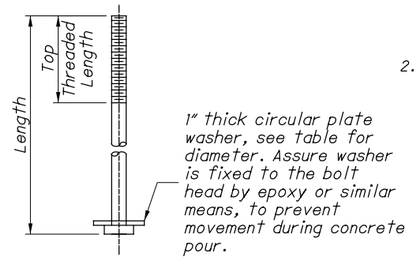
SCD NUMBER HL-40.10



ANCHOR BASE



NUTTED ANCHOR BOLT OPTION



HEADED ANCHOR BOLT OPTION

ALL DIMENSIONS IN INCHES

DIA.	TOP THREAD LENGTH	THREADS PER INCH	PLATE WASHER DIAMETER
1 ¼	8	7	3
1 ½	9	6	3
1 ¾	9	5	4
2	9	4 ½	4
2 ¼	10	4 ½	5
2 ½	10	4	5
3	12	4	6

ANCHOR BOLTS

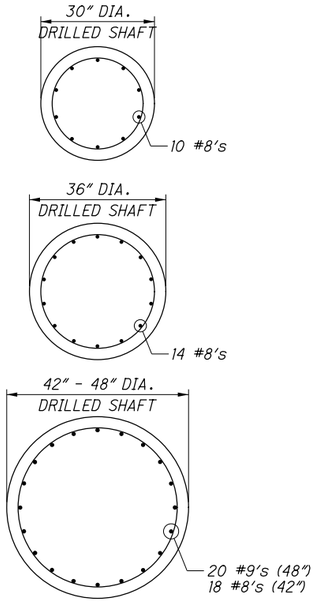
NOTES:

1. A special foundation design will be required when cohesive soil with undrained shear strength of less than 2000 lb/ft² or granular soil with an angle of internal friction less than 30° and a wet density less than 120 lb/ft³ is encountered.
2. Provide all anchor bolts with standard steel hex nuts, leveling nuts, and plain washers. The nuts shall be capable of developing the full strength of the anchor bolts. Anchor bolts shall be Grade 105. Threads shall be UNC-2A, and may be either rolled or cut, and coarse threaded. The embedded end of the anchor bolt shall be headed or threaded with a heavy hex nut. Anchor bolt material may be smooth steel rod that is threaded at the ends or threaded over its entire length. Hex nuts shall be ASTM A563, American Standard heavy hex, Grade DH, with UNC-2B threads. Plate washers shall be A709 Grade 36 or Grade 50. Anchor bolts shall be hot-dip galvanized over their entire length, as per C&MS 711.02, after fabrication and threading. All nuts and plate washers shall be galvanized per C&MS 711.02.
3. Provide a minimum of one capped 2" conduit ell in Standard Construction Drawings (SCDs) TC-81.10 and TC-81.21 foundations for future use. This ell is in addition to any other conduits specified in the plans.
4. Tie spacing, starting from the top of the drilled shaft, shall be 3" between the first two ties and 12" spacing thereafter.
5. All reinforcing steel shall be epoxy coated and comply with and be placed in accordance with CMS 509. Lap all rebar, including the bars, per the Lap Length table in 509. Rebar end hooks not required. Rebar cage shall extend to within 3 ½" ± ½" of top and bottom of foundation.
6. Use ½" preformed joint filler as per C&MS 705.03 between foundations and adjacent paved areas.
7. At locations where the existing slope is 6:1 or greater, the buried depth of foundation shall apply to the low side of the slope. Set the top of the foundation 2" above the existing surface on the high side of the slope. The additional depth of foundation necessary to meet these requirements shall be added to the formed top.
8. In paved areas only, and only with permission of the Engineer, a construction joint may be placed to allow matching of the square, formed top to the finished pavement elevation. The location of this construction joint shall be at the top of the cylindrical portion of the drilled shaft. An ODOT inspector must be present during construction of each permitted joint, to assure adequate construction joint bonding by compliance with C&MS 511.
9. When two foundation diameters (W) are specified, the Contractor may choose between them interchangeably.

ALL DIMENSIONS IN INCHES, UNLESS OTHERWISE NOTED

TC-9.10 TYPE SUPPORTS						TC-9.30 TYPE SUPPORTS					
DESIGN NO.	D (feet)	W	ANCHOR BOLTS SIZE	ANCHOR BOLTS CIRCLE	ANCHOR BOLTS P	DESIGN NO.	D (feet)	W	ANCHOR BOLTS SIZE	ANCHOR BOLTS CIRCLE	ANCHOR BOLTS P
1	8	30	1 ½ x 56	13 ½	6 ¾	1	8	30	1 ½ x 56	13 ½	6 ¾
2	8	30	1 ½ x 56	13 ½	6 ¾	2	8	30	1 ½ x 56	15	6 ¾
3	9	36	1 ¾ x 57	16	7 ¾	3	9	30	1 ½ x 56	16	6 ¾
						4	10	36	1 ¾ x 57	18	7 ¾
						5	9	36	1 ¾ x 57	15	7 ¾
1	8	30	1 ½ x 56	13 ½	6 ¾	6	9	36	1 ¾ x 57	15	7 ¾
2	9	36	1 ¾ x 57	15	7 ¾	7	9	36	1 ¾ x 57	15	7¾
3	10	36	2 x 58	20	8 ½	8	9	36	1 ¾ x 57	16	7 ¾
4	11	36	2 ¼ x 58	22	9	9	10	36	1 ¾ x 57	18	7 ¾
5	11	36	2 ¼ x 58	22	9	10	10	36	1 ¾ x 57	20	7 ¾
						11	10	36	1 ¾ x 57	20	7 ¾
						12	11	36	2 x 58	20	8 ½
						13	15	36	2 x 58	22	8 ½
						14	15	36	2 x 58	22	8 ½

TC-17.10 & 81.10 TYPE SUPPORTS						TC-12.30 TYPE SUPPORTS					
DESIGN NO.	D (feet)	W	ANCHOR BOLTS SIZE	ANCHOR BOLTS CIRCLE	ANCHOR BOLTS P	DESIGN NO.	D (feet)	W	ANCHOR BOLTS SIZE	ANCHOR BOLTS CIRCLE	ANCHOR BOLTS P
1	7	30	1 ¼ x 55	10	5 ¾	1	9	36	1 ¾ x 57	15	7 ¾
2	7	30	1 ½ x 56	12 ½	6 ¾	2	9	36	1 ¾ x 57	15	7 ¾
3	8	30	1 ½ x 56	13 ½	6 ¾	3	11	36	2 x 58	18	8 ½
4	8	36	1 ¾ x 57	15	7 ¾	4	11	36	2 x 58	18	8 ½
5	9	36	1 ¾ x 57	16	7 ¾	5	11	36	2 x 58	22	8 ½
6	9	36	1 ¾ x 57	16	7 ¾	6	11	36	2 x 58	22	8 ½
7	10	36	2 x 58	18	8 ½	7	15	36	2 ½ x 59	23 ½	9 ¾
8	10	36	2 x 58	20	8 ½	8	15	36	2 ½ x 59	23 ½	9 ¾
9	10	36	2 x 58	22	8 ½	9	15	36	2 ½ x 59	23 ½	9 ¾
10	11	36	2 ¼ x 58	22	9	10	17	42 or 48	2 ½ x 59	25 ½	9 ¾
11	11	36	2 ¼ x 58	22	9	11	17	42 or 48	2 ½ x 59	25 ½	9 ¾
12	12	36	2 ½ x 59	23 ½	9 ¾	12	18	42 or 48	3 x 61	25 ½	11 ¼
13	16	42 or 48	3 x 61	26	11 ¾						
14	16	48	3 x 61	34	11 ¾						



VERTICAL REBAR

THIS DRAWING REPLACES TC-21.20 DATED 01-19-2018.

REVISION DATE 07-20-2018

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

STDS. ENGINEER Duemmel

OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

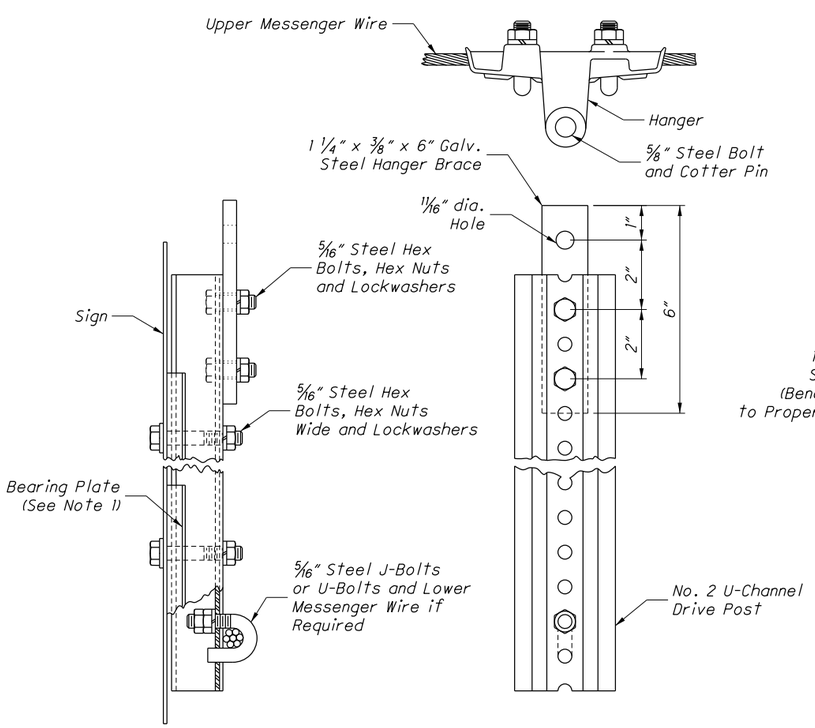
FOUNDATIONS

SCD NUMBER TC-21.20

1 / 1

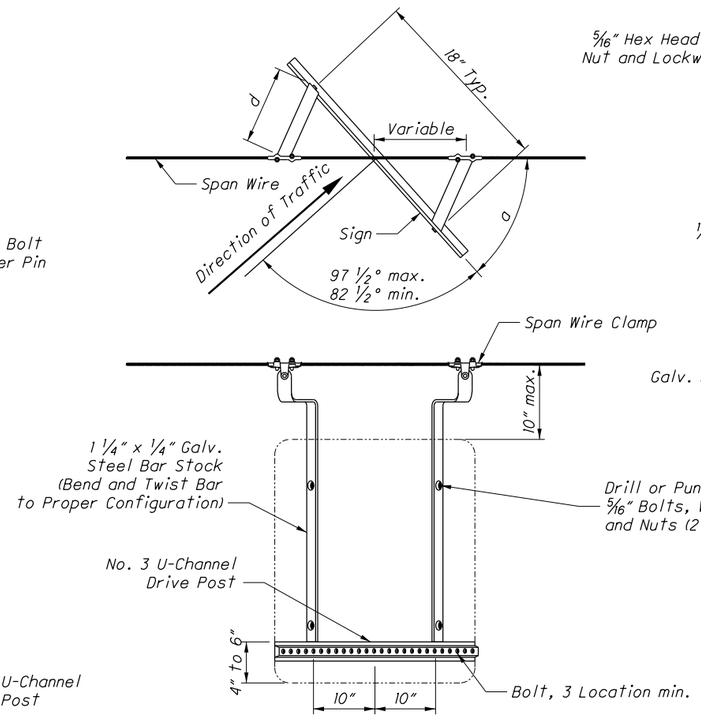
NOTES:

1. Use bearing plates conforming to details on Standard Construction Drawing TC-41.20.



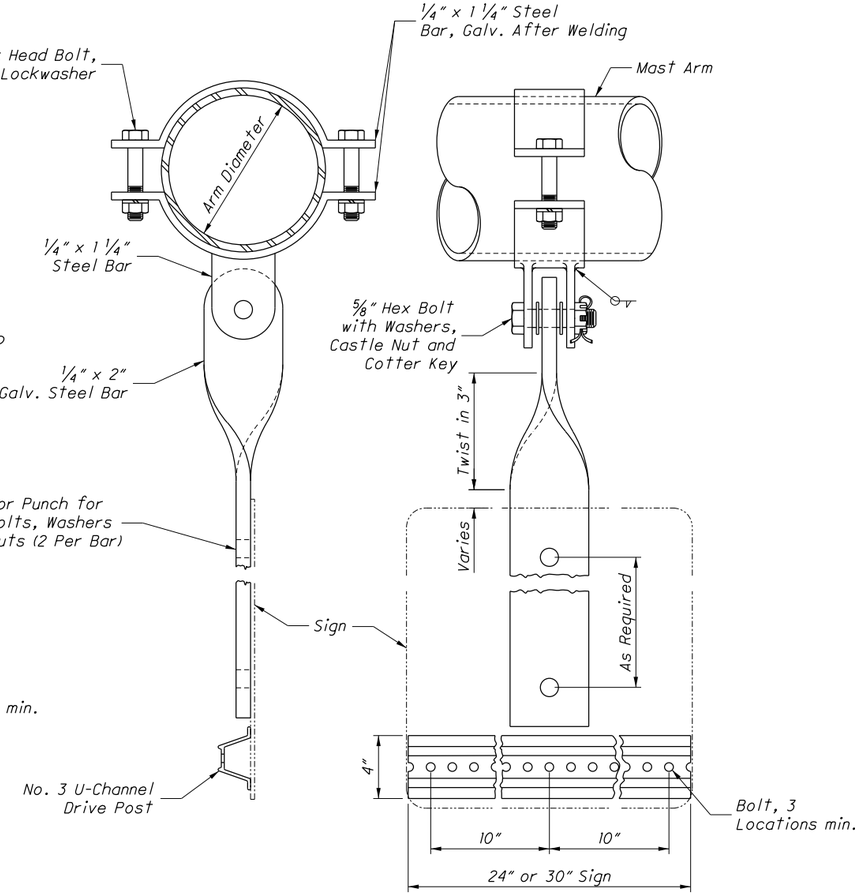
2 Required per Sign

SIGN HANGER ASSEMBLY, SPAN WIRE TYPE 1



α	d (in)
0°	0
15°	2.4
30°	4.7
45°	6.9
60°	9

SIGN HANGER ASSEMBLY, SPAN WIRE TYPE 2



SIGN HANGER ASSEMBLY, MAST ARM

THIS DRAWING REPLACES TC-41.41 DATED 01-21-2011.

REVISION DATE 10-18-2013

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR James Young

STDS. ENGINEER H. Suter

OFFICE OF ROADWAY ENGINEERING

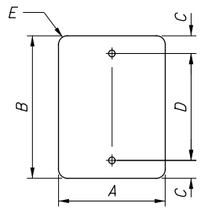
STANDARD ROADWAY CONSTRUCTION DRAWING

SPECIAL SIGN ATTACHMENTS

SCD NUMBER TC-41.41

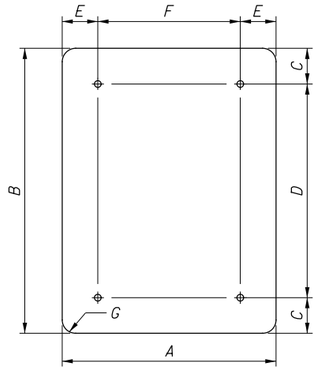
NOTES:

1. All bolt holes shall be ⅜" in diameter and may be drilled or punched to finished size.
2. Dimensions between bolt holes shall be to tolerance of ± 1/32".
3. For back-to-back mounting of STOP (R1-1) and DO NOT ENTER (R5-1) sign, follow details shown on Standard Construction Drawing TC-41.50.



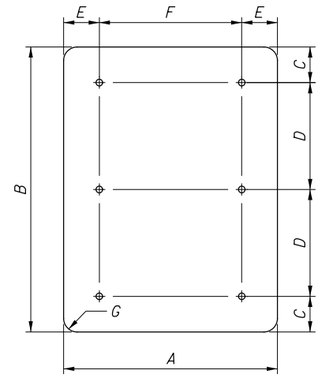
V-REC-1-2

A	B	C	D	E	THICKNESS	AREA (FT²)
6	54	9	36	1.5	0.080	2.25
9	12	1.5	9	1.5	0.080	0.75
10	12	1.5	10	1.5	0.080	0.83
12	15	1.5	12	1.5	0.080	1.25
12	16	1.5	13	1.5	0.080	1.33
12	18	1.5	15	1.5	0.080	1.50
12	24	3	18	1.5	0.080	2.00
12	30	3	24	1.5	0.080	2.50
12	36	3	30	1.5	0.080	3.00
12	48	6	36	1.5	0.080	4.00
12	60	6	48	1.5	0.080	5.00
14	48	6	36	1.5	0.080	4.67
18	24	3	18	1.5	0.080	3.00
18	60	6	48	1.5	0.100	7.50
24	30	3	24	1.5	0.080	5.00
24	36	3	30	1.5	0.080	6.00
24	38	3	32	1.5	0.080	6.33
24	42	6	30	1.5	0.080	7.00
24	48	6	36	1.5	0.100	8.00
30	36	3	30	1.875	0.080	7.50
30	42	6	30	1.875	0.080	8.75
30	48	6	36	1.875	0.100	10.00
30	60	6	48	1.875	0.100	12.50



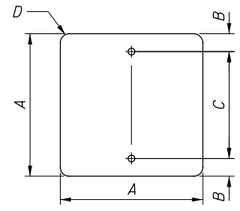
V-REC-2-4

A	B	C	D	E	F	G	THICKNESS	AREA (FT²)
36	42	6	30	6	24	2.25	0.080	10.50
36	48	6	36	6	24	2.25	0.100	12.00
36	54	6	42	6	24	2.25	0.100	13.50
36	60	6	48	6	24	2.25	0.100	15.00
36	72	12	48	6	24	2.25	0.100	18.00
36	75	13.5	48	6	24	2.25	0.100	18.75
42	60	6	48	9	24	2.25	0.100	17.50
48	60	6	48	9	30	3	0.100	20.00



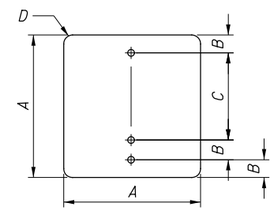
V-REC-2-6

A	B	C	D	E	F	G	THICKNESS	AREA (FT²)
48	72	6	30	9	30	3	0.100	24.00
48	76	8	30	9	30	3	0.100	25.33
48	84	12	30	9	30	3	0.100	28.00
48	96	12	36	9	30	3	0.100	32.00



SQ-1-2

A	B	C	D	THICKNESS	AREA (FT²)
6	1.0	4	1.0	0.080	0.25
9	1.0	7	1.0	0.080	0.56
12	1.5	9	1.5	0.080	1.00
15	1.5	12	1.5	0.080	1.56
16	1.5	13	1.5	0.080	1.78
18	3	12	1.5	0.080	2.25
24	3	18	1.5	0.080	4.00
30	3	24	1.875	0.080	6.25
36	3	30	2.25	0.080	9.00



SQ-1-3 (MAINTENANCE MARKER)

A	B	C	D	THICKNESS	AREA (FT²)
12	1	9	1.5	0.08	1

Shape — No. Bolts Required

V-REC-2-4

No. Supports Required

THIS DRAWING REPLACES TC-52.20 DATED 01-19-2018.

REVISION DATE 07-20-2018

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

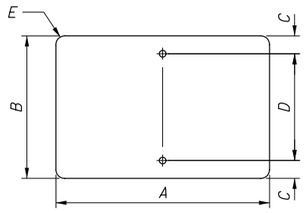
STDS. ENGINEER Soisson

OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

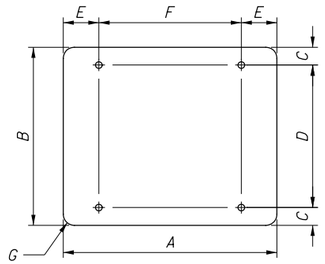
SIGN BLANK DETAILS II

SCD NUMBER TC-52.20



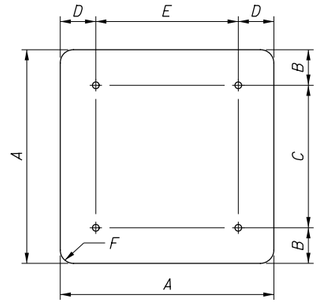
H-REC-1-2

A	B	C	D	E	THICKNESS	AREA (FT^2)
12	4	1	2	1.5	0.080	0.33
12	6	1	4	1.5	0.080	0.50
12	6.5	1	4.5	1.5	0.080	0.54
12	9	1.5	6	1.5	0.080	0.75
15	8	1.5	5	1.5	0.080	0.83
15	12	1.5	9	1.5	0.080	1.25
18	6	1	4	1.5	0.080	0.75
18	9	1.5	6	1.5	0.080	1.12
18	12	1.5	9	1.5	0.080	1.50
20	15	1.5	12	1.5	0.080	2.08
20	18	3	12	1.5	0.080	2.50
21	15	1.5	12	1.5	0.080	2.19
24	6	1	4	1.5	0.080	1.00
24	8	1.5	5	1.5	0.080	1.33
24	9	1.5	6	1.5	0.080	1.50
24	10	1.5	7	1.5	0.080	1.67
24	12	1.5	9	1.5	0.080	2.00
24	18	3	12	1.5	0.080	3.00
30	8	1.5	5	1.5	0.080	1.67
30	9	1.5	6	1.5	0.080	1.88
30	12	1.5	9	1.5	0.080	2.50
30	15	1.5	12	1.5	0.080	3.12
30	16	1.5	13	1.5	0.080	3.33
30	18	3	12	1.5	0.080	3.75
30	21	3	15	1.5	0.080	4.38
30	24	3	18	1.5	0.080	5.00
36	6	1	4	1.5	0.080	1.50
36	8	1.5	5	1.5	0.080	2.00
36	9	1.5	6	1.5	0.080	2.25
36	12	1.5	9	1.5	0.080	3.00
36	14	1.5	11	1.5	0.080	3.50
36	15	1.5	12	1.5	0.080	3.75
36	18	3	12	1.5	0.080	4.50
36	20	3	14	1.5	0.080	5.00
36	24	3	18	1.5	0.080	6.00
36	30	3	24	1.875	0.080	7.50
37.5	30	3	24	1.875	0.080	7.81
48	8	1.5	5	1.5	0.125	2.67
48	10	1.5	7	1.5	0.125	3.33
48	12	1.5	9	1.5	0.125	4.00
48	14	1.5	11	1.5	0.125	4.67
48	16	1.5	13	1.5	0.125	5.33
48	18	3	12	1.5	0.125	6.00



H-REC-2-4

A	B	C	D	E	F	G	THICKNESS	AREA (FT^2)
40	20	3	14	6	28	1.5	0.080	5.56
42	24	3	18	9	24	1.5	0.080	7.00
42	30	3	24	9	24	1.875	0.080	8.75
42	36	6	24	9	24	2.25	0.080	10.50
45	36	6	24	9	27	2.25	0.080	11.25
48	8	1.5	5	9	30	1.5	0.125	2.66
48	10	1.5	7	9	30	1.5	0.125	3.33
48	12	1.5	9	9	30	1.5	0.125	4.00
48	14	1.5	11	9	30	1.5	0.125	4.66
48	16	1.5	13	9	30	1.5	0.125	5.33
48	18	3	12	9	30	1.5	0.125	6.00
48	20	3	14	9	30	1.5	0.100	6.67
48	24	3	18	9	30	1.5	0.100	8.00
48	30	3	24	9	30	1.875	0.100	10.00
48	36	6	24	9	30	2.25	0.100	12.00
48	42	6	30	9	30	2.25	0.100	14.00
54	18	3	12	9	36	1.5	0.100	6.75
54	30	3	24	9	36	1.875	0.100	11.25
54	36	6	24	9	36	2.25	0.100	13.50
60	12	1.5	9	12	36	1.5	0.100	5.00
60	18	3	12	12	36	1.5	0.100	7.50
60	24	3	18	12	36	1.5	0.100	10.00
60	30	3	24	12	36	1.875	0.100	12.50
60	36	6	24	12	36	2.25	0.100	15.00
60	48	6	36	12	36	3	0.100	20.00
66	24	3	18	12	42	1.5	0.100	11.00
66	36	6	24	12	42	2.25	0.100	16.50
72	12	1.5	9	12	48	1.5	0.125	6.00
72	15	1.5	12	12	48	1.5	0.125	7.50
72	18	3	12	12	48	1.5	0.125	9.00
72	24	3	18	12	48	1.5	0.100	12.00
72	30	3	24	12	48	1.875	0.100	15.00
72	36	6	24	12	48	2.25	0.100	18.00
72	48	6	36	12	48	3	0.100	24.00
78	24	3	18	12	54	1.5	0.125	13.00
96	24	3	18	12	72	1.5	0.125	16.00



SQ-2-4

A	B	C	D	E	F	THICKNESS	AREA (FT^2)
36	6	24	6	24	2.25	0.080	9.00
42	6	30	9	24	2.25	0.080	12.25
48	6	36	9	30	3	0.100	16.00

NOTES:

1. All bolt holes shall be ⅜" in diameter and may be drilled or punched to finished size.
2. Dimensions between bolt holes shall be to tolerance of ± 1/32".
3. For back-to-back mounting of STOP (R1-1) and DO NOT ENTER (R5-1) sign, follow details shown on Standard Construction Drawing TC-41.50.

Shape — No. Bolts Required

H-REC-2-4

No. Supports Required

THIS DRAWING REPLACES TC-52.20 DATED 01-19-2018.

REVISION DATE 07-20-2018

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

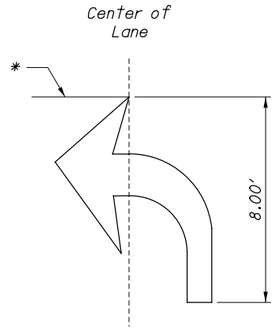
STDS. ENGINEER Soisson

OFFICE OF ROADWAY ENGINEERING

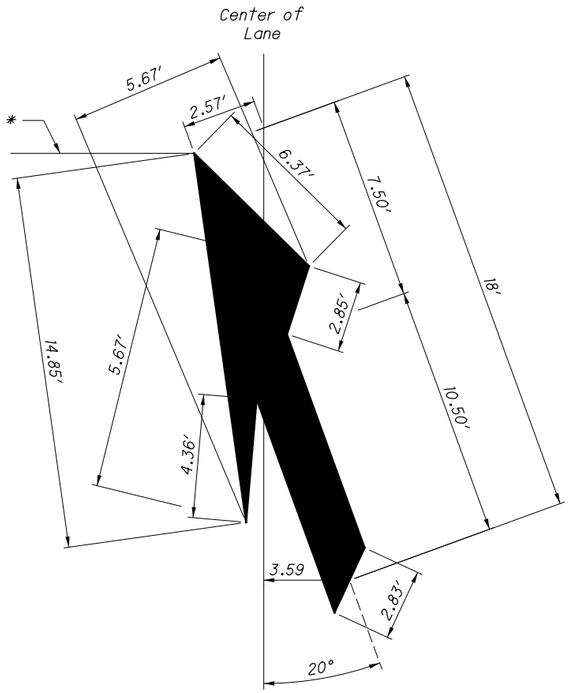
STANDARD ROADWAY CONSTRUCTION DRAWING

SIGN BLANK DETAILS II

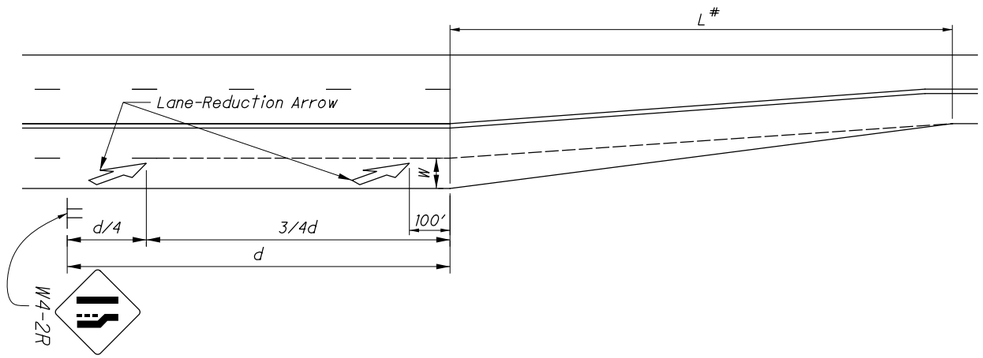
SCD NUMBER TC-52.20



TURN ARROW
(Right Arrow Opposite)



LANE-REDUCTION ARROW (RIGHT)
(For Left Lane, Use Mirror Image)

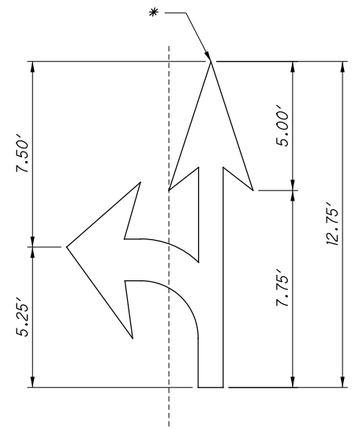


Speed (S) (MPH)	Lane Width (W) (FT)	Taper Length (L) # (FT)	Advance Warning Distance (d) (FT)
25	12	125	325
30	12	180	460
35	12	245	565
40	12	320	670
45	12	540	775
50	12	600	885
55	12	660	990
60	12	720	1100
65	12	780	1200
70	12	840	1250

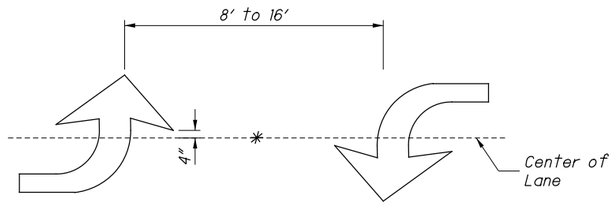
Taper Length (L) shown is for 12 foot lane width (W). Use formula for other lane widths.

S - Posted, 85th-percentile or statutory speed, in MPH
W - Lane width or offset, in feet
L - Taper length in feet for Speed < 45 MPH = $WS^2/60$
L - Taper length in feet for Speed ≥ 45 MPH = WS
d - Advance Warning Distance, in feet

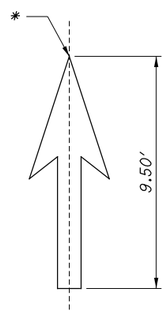
LANE-REDUCTION ARROW MARKING DETAIL
(See Note 8)



TURN AND THROUGH ARROW
(Three-Headed Directional Arrows Can be Achieved by the Combination of Turn Arrows.)



TWO-WAY LEFT-TURN ARROWS
(See Note 6)

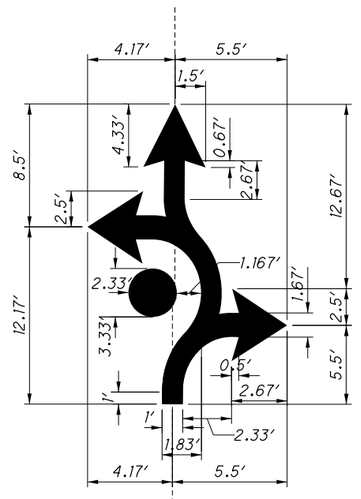


THROUGH ARROW

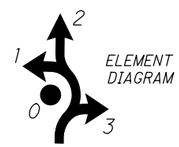
TABLE 1 - LANE-USE ARROWS

ARROW TYPE	SIZE (FT)	AREA (SQ FT)
Turn Arrow	8.00	17
Through Arrow	9.50	13
Turn and Through Arrow	12.75	28
Lane-Reduction Arrow	18.00	46

* - Indicates Station Reference Point



FISH-HOOK ARROW (ROUNDABOUTS)



OVERALL DIMENSIONS		
ELEMENTS INCLUDED	OVERALL WIDTH	OVERALL HEIGHT
1	6.5'	14.67'
1 & 2	6.5'	20.67'
1 & 3	9.67'	14.67'
1, 2 & 3	9.67'	20.67'
0 & 2*	4.5'	20.67'
0, 2 & 3*	7.67'	20.67'
2	3.833'	20.67'
2 & 3	7.0'	20.67'
3	6.0'	8.0'

* THE DOT (ELEMENT 0) IS ONLY USED IN SYMBOLS FOR THE LEFTMOST LANE.

THIS DRAWING REPLACES TC-71.10 DATED 01-20-2017.

REVISION DATE 01-19-2018

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

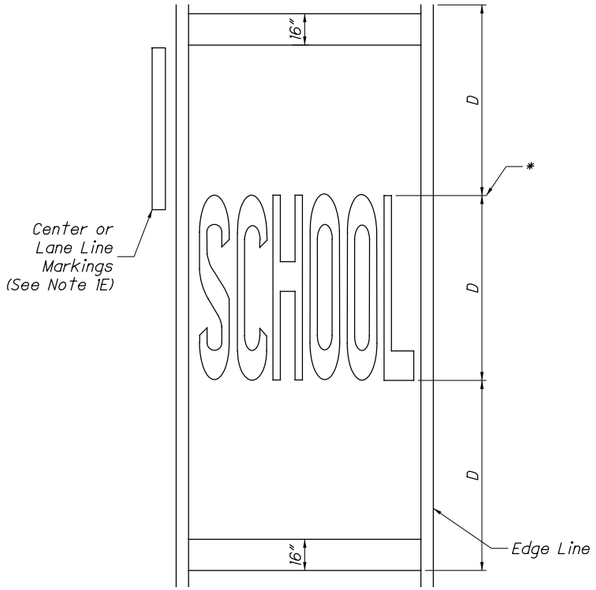
STDS. ENGINEER P. Singh

OFFICE OF ROADWAY ENGINEERING

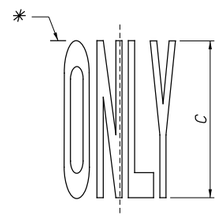
STANDARD ROADWAY CONSTRUCTION DRAWING

WORD AND SYMBOL PAVEMENT MARKINGS

SCD NUMBER TC-71.10



SCHOOL WORD MARKING
(See Note 1)



ONLY WORD MARKING
(See Note 4)

TABLE 3 - WORDS (SQ FT)

WORD	HEIGHT (C, D)		
	URBAN 6′	RURAL 8′	MULTI-LANE 10′
ONLY (C)	17	23	N/A
SCHOOL (D)	27	37	90

TABLE 4 - LANE USE MARKINGS

ROADWAY TYPE	DIMENSIONS (FT)		
	A (MIN.)	B	C
RURAL	30	88	8
URBAN	10	66	6

(See Note 5)

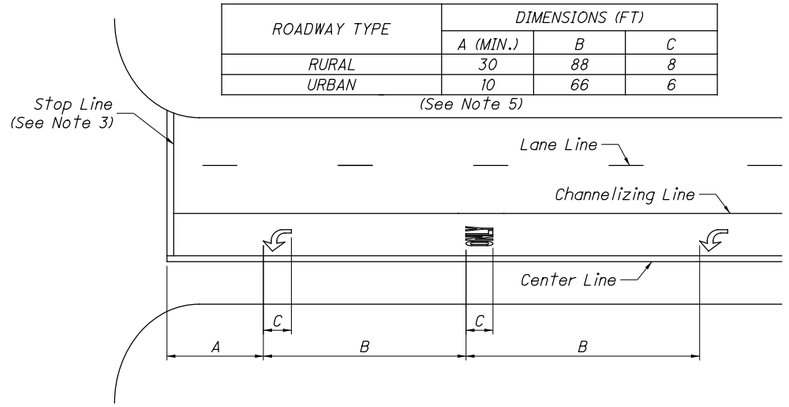
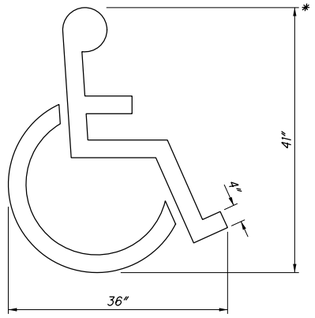
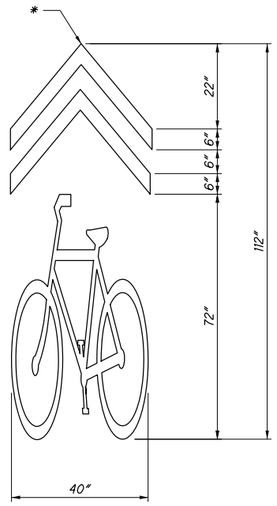


TABLE 2 - HANDICAP, BIKE & CHEVRON MARKINGS

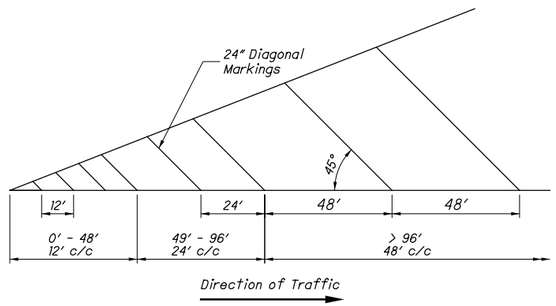
SYMBOL	HEIGHT (IN)	WIDTH (IN)	AREA (SQ FT)
HANDICAP	41	36	2.7
BIKE	72	40	16
CHEVRON	40	40	3.3 (.83 x 4)



HANDICAP SYMBOL MARKING

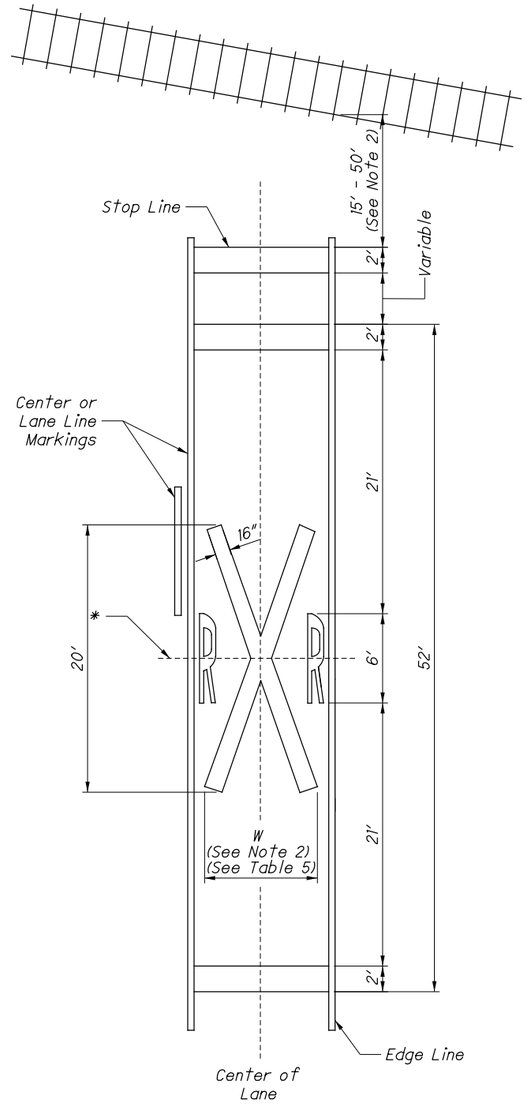


SHARED LANE MARKING
(See Note 7)



TYPICAL SPACING DETAIL FOR 24" DIAGONAL MARKINGS
(Chevron Markings, Including a Spacing Table, are Shown on SCD TC-72.20.)

* - Indicates Station Reference Point



RAILROAD SYMBOL MARKING
(See Note 2)

TABLE 5 - R X R SYMBOL

W, R X R	WIDTH (W) (FT)	8	9	10	11	12
	AREA (SQ FT)	67	68	70	71	72

THIS DRAWING REPLACES TC-71.10 DATED 01-20-2017.

REVISION DATE 01-19-2018

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

STDS. ENGINEER P. Singh

OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

WORD AND SYMBOL PAVEMENT MARKINGS

SCD NUMBER TC-71.10

NOTES:

SCHOOL Marking

1A. The SCHOOL markings shall be installed on all paved approaches in advance of all School Zones.

1B. The SCHOOL markings should be placed at least 100′ in advance of the School Zone. The preferred placement of the SCHOOL marking is adjacent to the School Zone Advance sign.

1C. On two-way, two-lane highways the following shall apply:

1.) When the approach lane to the School Zone is 11′ or more in width -

a.) The SCHOOL word marking and transverse lines shall be contained in, and centered in, the lane.

b.) The character height shall be 6′ for urban areas and 8′ for rural areas.

2.) When the approach lane to the School Zone is less than 11′ in width -

a.) One installation of the SCHOOL word marking and transverse lines shall extend across both lanes of traffic.
b.) The characters shall be 10′ in height.

1D. On multi-lane approaches the following shall apply -

1.) When the approach lanes to the School Zone are 11′ or more in width -

a.) The SCHOOL word marking and transverse lines shall be contained in, and centered in, each lane.
b.) The character height shall be 6′ for urban areas and 8′ for rural areas.

2.) When the approach lanes to the School Zone are less than 11′ in width -

a.) One installation of the SCHOOL word marking shall extend to the width of two approach lanes.
b.) Transverse lines shall extend across all approach lanes of traffic.
c.) The characters shall be 10′ in height.

1E. Center or lane lines shall not pass through the SCHOOL word marking.

1F. 6′ and 8′ high SCHOOL word marking shall be marked with 4″ strokes.

10′ high SCHOOL word marking shall be marked with 8″ strokes.

1G. The area of the transverse lines varies with the width of the pavement; therefore, the area must be added to the value in Table 3 (sheet 2).

Railroad Crossing Markings

2A. On multi-lane approaches, markings shall be as follows -

a.) The RXR symbol shall be placed in each approach lane.
b.) Transverse lines used with the railroad symbols shall extend across all appraoch lanes.

2B. The railroad symbol should be located so that the Railroad Advance Warning (W10-1) sign is within the two transverse boundary lines of the railroad symbol.

2C. The stop line shall be located for best sight distance between 15′ - 50′ of the near edge of the tracks.

2D. The stop line shall be approximately 8′ from a gate (if present).

2E. Width (W) of the "X" will vary according to the lane width.

2F. The height of the "R" shall be 6′.

2G. The area of the transverse lines and stop lines varies with the width of the pavement; therefore the area must be added to the value in Table 5 (sheet 2).

Stop Line Marking

3A. Except as specified in Notes 3B and 3C, the stop line should be placed as follows:

a.) The stop line should be placed where cross-corner vision is maximum.
b.) In no case shall the stop line be placed more than 30′ or less than 4′ from the nearest edge of the intersecting roadway.
c.) For normal intersections the maximum distance should be 10′.

3B. If a marked crosswalk is present the stop line should be placed 4′ in advance of, and parallel to, the nearest crosswalk line.

3C. For signalized intersections the stop line should be placed at a minimum distance of 40′ from the nearest signal head.

ONLY Word Marking

4A. The ONLY word marking is optional.

4B. Where used, the spacing between ONLY and arrow markings should be based on Table 4 (sheet 2).

4C. When lane-use arrow markings are used and the ONLY marking is not, an additional lane-use arrow should be used in its place to retain the spacing as shown in Table 4 (sheet 2).

Lane-Use Arrow Markings

5A. Lane-use arrow markings are optional except where a through traffic lane(s) approaching an intersection becomes a mandatory turn lane(s).

5B. Where used, the spacing between markings should be based on Table 4 (sheet 2). However, based on the turn lane length, the spacing between the markings may be adjusted.

Two-Way Left-Turn Only (TWLTO) Arrows

6A. Arrow sets should be longitudinally spaced at intervals of:

a.) 500′ - 1000′ for speeds less than or equal to 40 mph,
b.) 1000′ - 1500′ for speeds over 40 mph

6B. In addition, an arrow set should be placed:

a.) 100′ - 200′ from the near edge of an intersecting roadway, or
b.) Inside both ends of TWLTO lanes.

Shared Lane Marking

7A. When chevron markings are used, its area must be added to the value of the bike symbol markings (see Table 2 on sheet 1).

7B. When used, the shared lane marking should be placed immediately after an intersection and spaced at intervals not greater than 250′ thereafter.

Lane-Reduction Arrow Markings

8A. Lane-reduction arrow markings should be placed where a lane reduction transition occurs on a roadway as follows:

a.) Lane-reduction arrow markings may be placed for speeds of less than 45 mph, if determined to be appropriate based on engineering judgement.
b.) Lane-reduction arrow markings should be placed for speeds of 45 mph or over.
c.) Lane-reduction arrow markings may be placed in long acceleration lanes.
d.) Where lane-reduction arrows are used, they should be placed as follows:

i.) First lane-reduction arrow 100′ in advance of the 'Begin Taper' point.
ii.) Second lane-reduction arrow placed at the 3/4d point.

THIS DRAWING REPLACES TC-71.10 DATED 01-20-2017.

REVISION DATE 01-19-2018

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

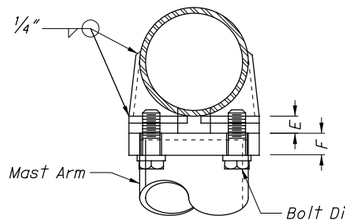
STDS. ENGINEER P. Singh

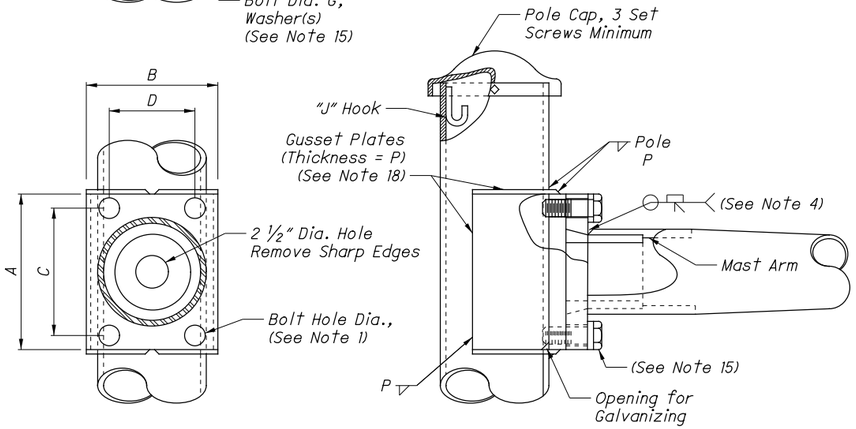
OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

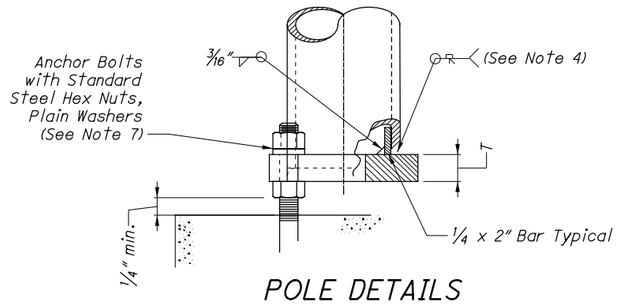
WORD AND SYMBOL PAVEMENT MARKINGS

SCD NUMBER TC-71.10

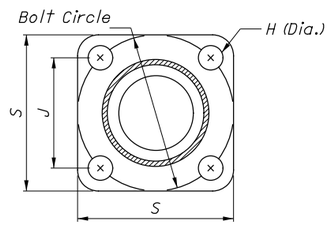




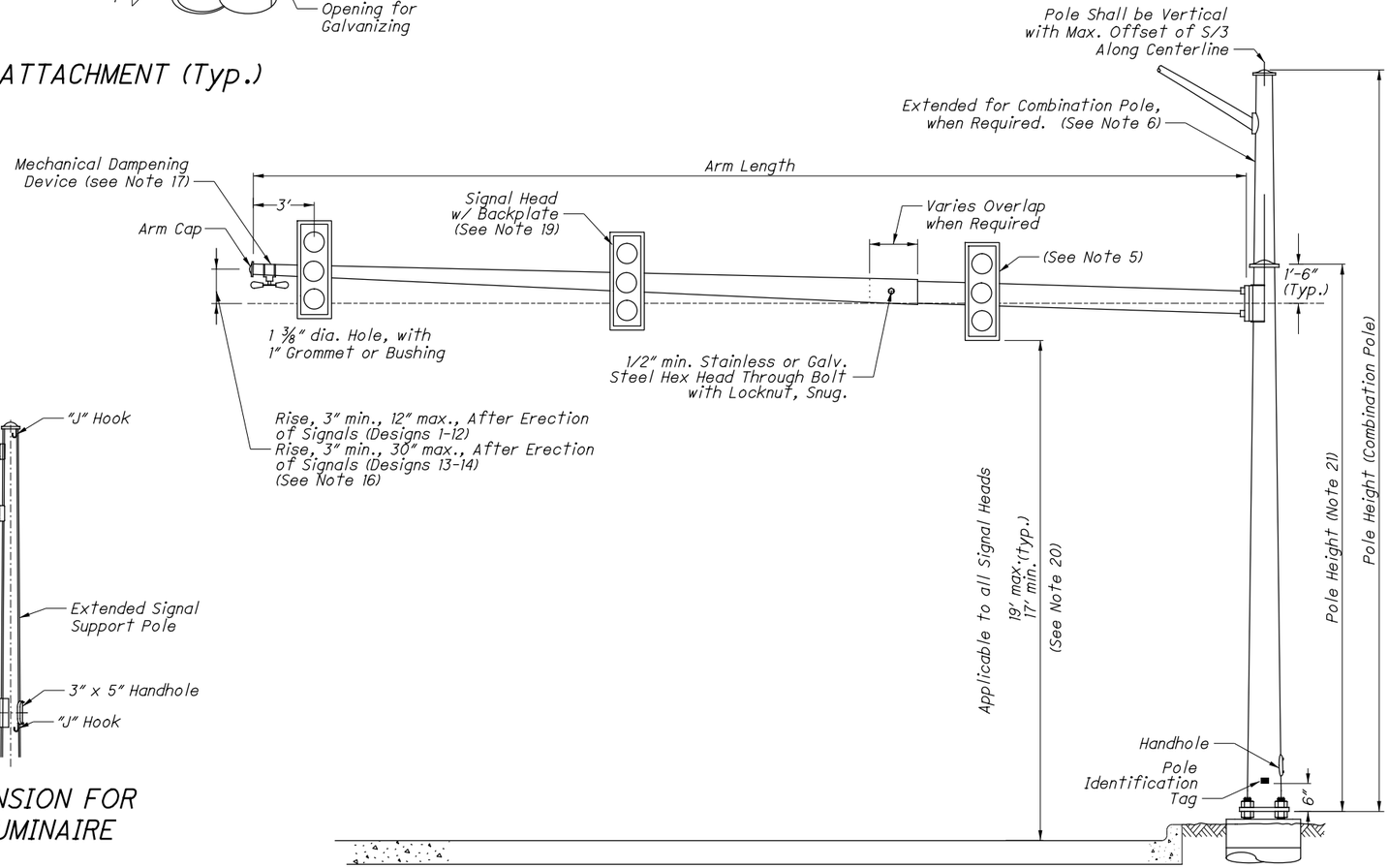
ARM ATTACHMENT (Typ.)

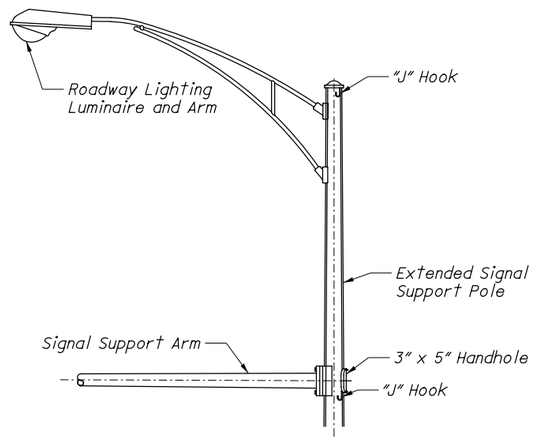


POLE DETAILS



BASE PLATE





POLE EXTENSION FOR LIGHTING LUMINAIRE

NOTES:

1. Arm plate hole diameter shall be bolt diameter plus 1/8". Pole plate tapped hole shall have threads with 75% (min.) full profile height. Threads may be retapped after galvanizing.
2. For sign mounting details, see Standard Construction Drawings (SCDs) TC-16.21 and TC-41.41.
3. For foundation details, see SCD TC-21.20.
4. The arm attachment plate shall be welded using a full penetration weld. The pole attachment to the base plate shall be welded using a full penetration weld.
5. For signal attachment details, see SCD TC-85.20. All signal heads shall be installed with the center of the entire head centered on the arm, +/- 6".
6. For modification of pole to support roadway lighting, see SCD HL-10.12.
7. A minimum of one bolt thread shall remain above the anchor nut.
8. All unused couplings shall be provided with a removable galvanized cast iron plug.
9. For pole and base plate dimensions, see Sheet 2.
10. The wire entrance part of the signal head may be oriented in any direction to keep the cable drip loop from rubbing on the signal head. The signal head shall hang level and plumb.
11. For construction details and location of handholes, see SCD TC-22.10.
12. The design loads were calculated as the equivalent amount of signal area that could be carried at the end of the arm.
13. The design loads were developed without applying galloping fatigue loads. Also, the stress requirements of Note b, Table 11-2 in the AASHTO code were not applied.
14. These structures should be inspected for excessive wind induced deflection in the vertical direction. If found, a damping plate should be placed on the arm.
15. Connection bolts shall be ASTM A325 for diameters 1.5" and smaller. Larger bolts shall be ASTM A449. Designs 1 through 12 shall use ASTM F436 flat washers. Design 13 shall use ASTM F959 DTI washers. Design 14 shall use ASTM F2437 Type 2 Grade 5 DTI washers. If necessary, I.D. of DTI washers shall be ground or reamed to properly fit over attachment bolts. Provide proper DTI feeler gage to Engineer. An F436 washer shall be used directly under the head of the bolt with all DTI washers. Assure that the flat washer does not spin during bolt tightening with DTI washer.
16. Negative arm end slope is acceptable to achieve rise requirement.
17. An approved mechanical damping device shall be installed as close as possible to the end of the arm. Required on arms over 59' in length. Install on arms 59' or less if directed by the plans or the Engineer. Flat plate dampers shall only be used for new construction if directed by the plans or the Engineer.
18. Ring-stiffened wrap-around horizontal plates are permitted as an alternative shown to the horizontal plates shown.

(cont. - see sheet 2)

REVISION DATE 07-20-2018

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

STDS. ENGINEER Duemmel

OFFICE OF ROADWAY ENGINEERING

THIS DRAWING REPLACES TC-81.21 DATED 07-15-2016.

STANDARD ROADWAY CONSTRUCTION DRAWING

SINGLE ARM OVERHEAD SIGNAL SUPPORT

SCD NUMBER TC-81.21

NOTES:

19. All backplates shall have louvers and 2" fluorescent yellow reflective border. Border shall not be applied over louvers. Louvers should be oriented to scoop air from the front side and oriented with the openings facing alternate directions by groups, as shown. Louver open area shall be at least 8 percent of the total backplate area.

20. 17' min. clearance to bottom of backplate. 19' is the maximum clearance height. However, clearances above this threshold can be accepted upon approval of the project engineer only if clearance heights conform to the requirements set forth in the Ohio Manual of Uniform Traffic Control Devices.

21. Actual pole height shall be calculated based off the critical pavement and foundation elevations, as outlined in Traffic Engineering Manual section 440.

ALL DIMENSIONS ARE IN INCHES, UNLESS OTHERWISE NOTED.
(NOTE B)

DESIGN NO.	MAXIMUM DESIGN AREA SQ. FT. (NOTE A)	DESIGN DISTANCE FROM CL (FT.)	POLE		ARM			TWO PIECE ARM		ARM ATTACHMENT								ANCHOR BASE				
			WALL THICK	SIZE	WALL THICK	SIZE	MAX LENGTH	WALL THICK	SIZE	A	B	C	D	E	F	G	P	BOLT CIRCLE	S	J	T	H
1	26	24.5	.179	10 x 6.78 x (*)	.179	7 x 3.50	25'			14.50	12	10.50	8	1.25	1.25	1.25	0.25	13.50	14.13	9.56	1.50	1.75
2	25	31.5	.179	11 x 7.78 x (*)	.179	8 x 3.52	32'			14.50	12	10.50	8	1.25	1.50	1.25	0.25	15	15.63	10.63	1.50	1.75
3	25	37.5	.179	12 x 8.78 x (*)	.179	9 x 3.68	38'			14.50	12	10.50	8	1.25	1.50	1.25	0.25	16	17	11.31	1.50	1.75
4	42	37.5	.239	13 x 9.78 x (*)	.239	10.32 x 5.00	38'			16.50	14.50	12.50	9.50	1.50	2	1.25	0.25	18	18.50	12.75	2	2.13
11	40	44.5	.239	14 x 10.78 x (*)			45'	.239	11 x 8.62 x 17' +	16.50	14.50	12.50	9.50	1.50	2	1.25	0.31	20	20.50	14.13	2	2.13
								.179	9.19 x 5.10 x 29' - 3"													
12	42	47.5	.299	14 x 10.78 x (*)			48'	.299	11 x 8.62 x 17' +	16.50	14.50	12.50	9.50	1.75	2	1.50	0.31	20	20.50	14.13	2	2.38
								.179	9.19 x 4.68 x 32' - 3"													
13	40	59.5	.299	16 x 12.78 x (*)			60'	.299	13 x 8.80 x 30' +	19.50	16.50	15	12	1.50	2	1.50	0.31	22	23	15.56	2	2.38
								.239	9.62 x 5.14 x 32'													
14	38	69.5	.299	17 x 13.78 x (*)			70'	.3125	14 x 9.1 x 35' +	19.50	16.50	15	12	2.00	2	2.00	0.38	22	23	15.56	2	2.38
								.239	9.9 x 4.42 x 37'													

NOTES:

A. Maximum design area is based on 90 MPH design wind speed with a pressure of 25 PSF.

B. These designs use full penetration welds at the arm and base plate connections.

THIS DRAWING REPLACES TC-81.21 DATED 07-15-2016.

REVISION DATE 07-20-2018

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

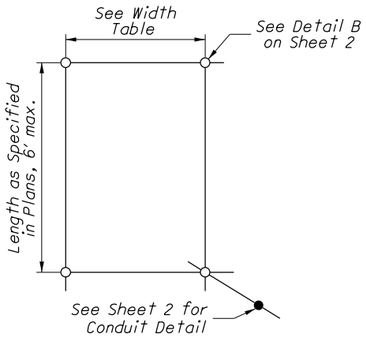
STDS. ENGINEER Duemmel

OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

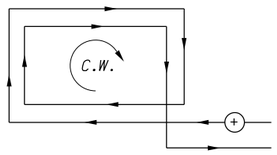
SINGLE ARM OVERHEAD SIGNAL SUPPORT

SCD NUMBER TC-81.21



SAW CUT LAYOUT

RECTANGULAR LOOP CONSTRUCTION	
LOOP PERIMETER	NUMBER OF TURNS
LESS THAN 40'	4
40' TO 160'	3
OVER 160'	2



WINDING PATTERN

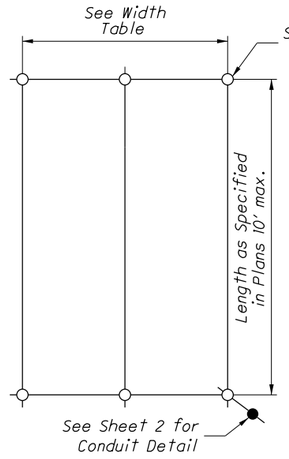
See Above Table for Number of Turns

RECTANGULAR DETECTOR LOOP DETAILS

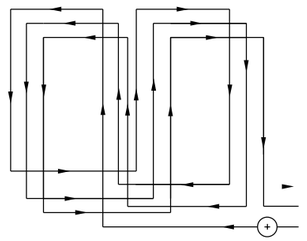
1. Rectangular detector loops shall not be used at the stop line or for dilemma zone detector.

WIDTH TABLE			
LANE WIDTH	RECTANGULAR AND POWERHEAD	QUADRUPOLE	ANGULAR DESIGN
11' AND LARGER	6' WIDTH	6' WIDTH	A= 4.5'
LESS THAN 11'	5' WIDTH	6' WIDTH	A= 4.0'

All loops shall be tested with standard ODOT motorcycle and bicycle targets.



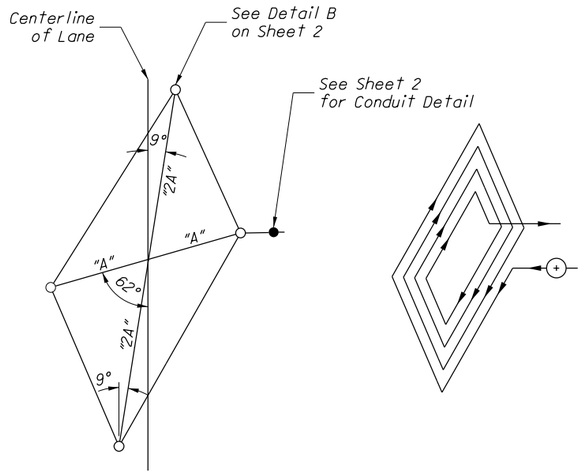
SAW CUT LAYOUT



WINDING PATTERN

Number of Turns is 3-6-3

FIGURE 8 (QUADRUPOLE) LOOP DETAILS



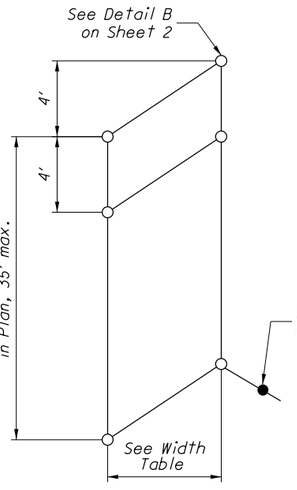
SAW CUT LAYOUT

WINDING PATTERN

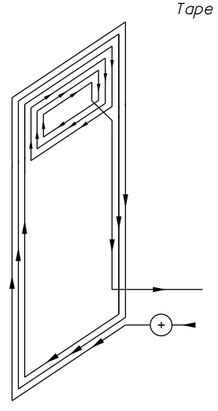
Number of Turns is 4.
See Width Table for Dimension "A"

ANGULAR DESIGN DETECTION (A.D.D.) LOOP DETAIL

1. There shall be one A.D.D. loop per travel lane.



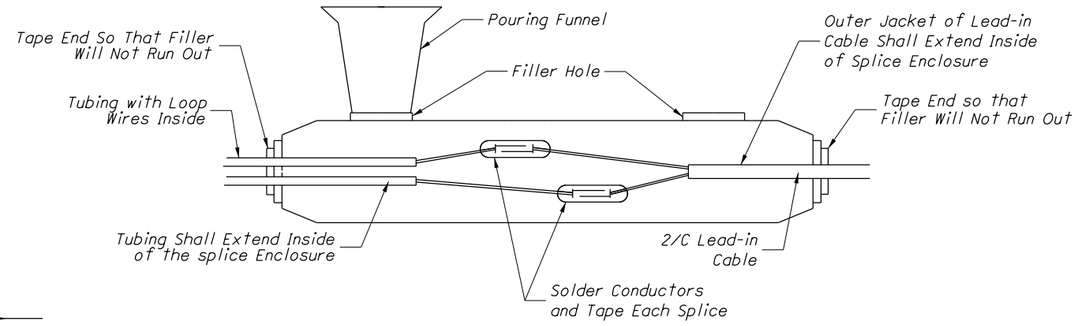
SAW CUT LAYOUT



WINDING PATTERN

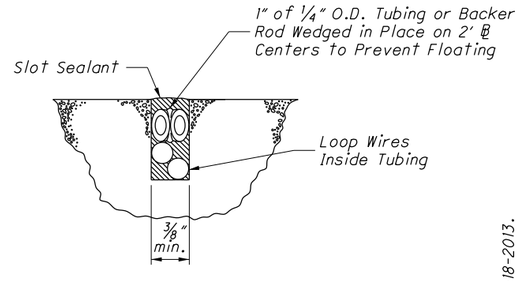
Number of Turns is 3 + 3

POWERHEAD DETECTOR LOOP DETAILS



1. Loop detectors wire to lead-in cable splices within the encapsulated splice enclosure shall be soldered.
2. If a pullbox is not specified in the plans, the waterproof splice enclosure shall be located in the first entered pole or pedestal, except if the controller cabinet is mounted on that pole or pedestal, in which case the loop wires shall be routed directly into the cabinet.
3. The enclosure shall not contain visible air bubbles (voids) greater than ¼".

SPLICE ENCLOSURE DETAIL



1. Minimum saw slot depth: Asphalt 4"
   Concrete 2"
   Maximum saw slot depth: Concrete 2 1/2 "
2. Loop detector wire in tubing shall be as specified in CMS Table 732.19-1.
3. Loop detector sealant shall be a prequalified product in accordance with Supplement 1048.
4. Saw slots and probe holes shall be thoroughly cleaned and dried prior to installation of sealant.
5. Wire installations in new asphalt may be sawed and embedded with sealant in sub-surface course with subsequent covering by the surface course, subject to approval of the Engineer.

SLOT DETAIL

THIS DRAWING REPLACES TC-82.10 DATED 10-18-2013.

REVISION DATE 07-17-2015

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

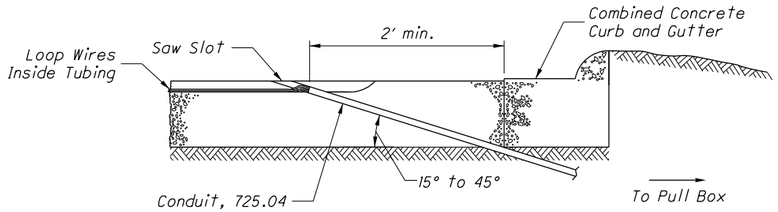
STDS. ENGINEER Duemmel

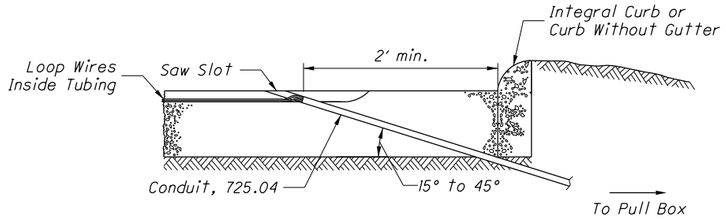
OFFICE OF ROADWAY ENGINEERING

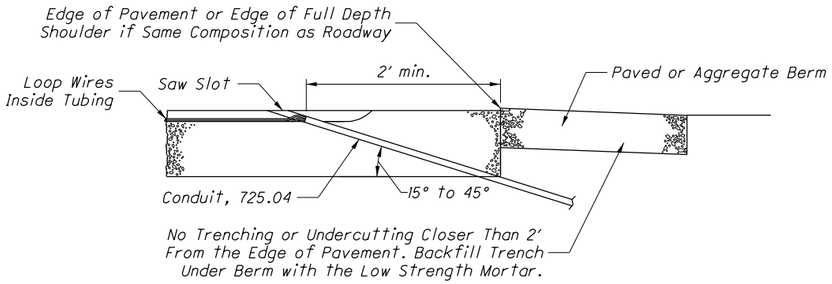
STANDARD ROADWAY CONSTRUCTION DRAWING

VEHICLE DETECTOR INSTALLATION DETAILS

SCD NUMBER TC-82.10



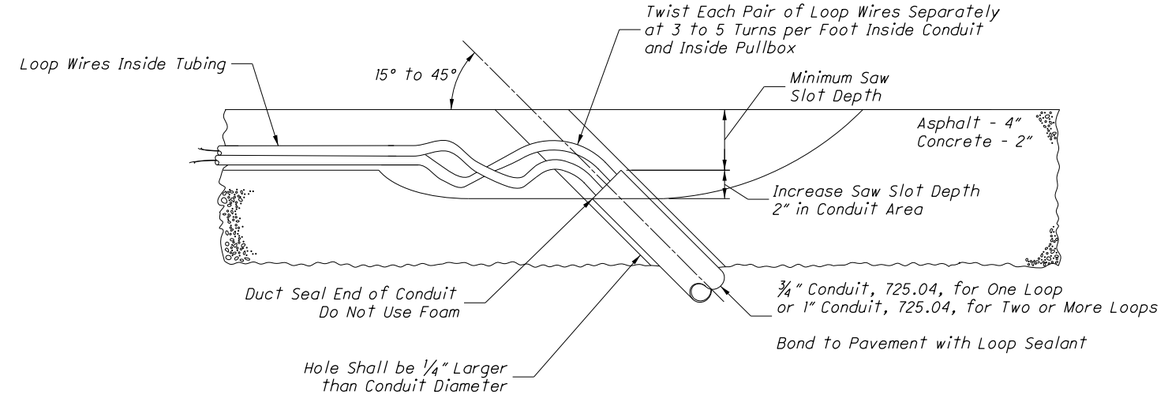




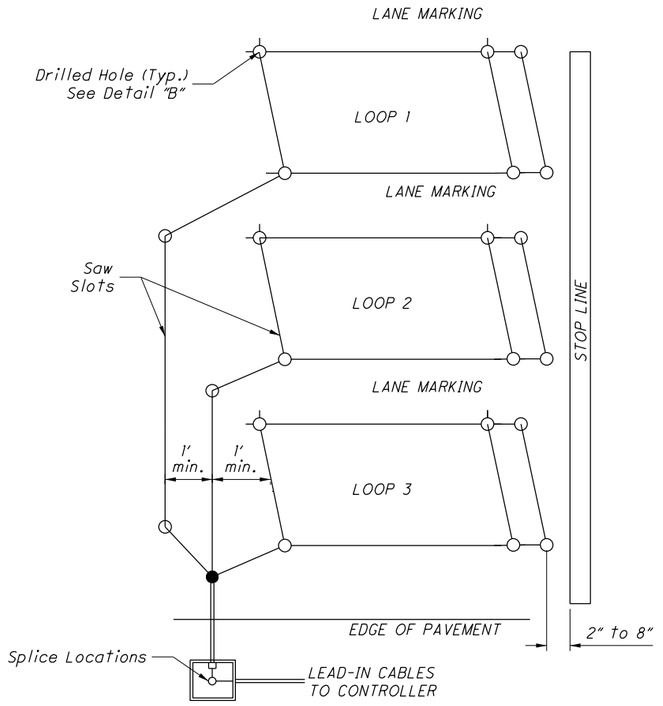
1. The drilled hole shall be located as shown above and within the full depth pavement. It shall not be drilled or cut through the paved berm, curb or curb and gutter section.

2. In areas of poor pavement condition, the saw slot depth shall be increased to insure adequate wire embedment. All field adjustments shall be subject to the approval of the Engineer.

TYPICAL DRILLED HOLE LOCATIONS



CONDUIT DRILLED HOLE DETAIL



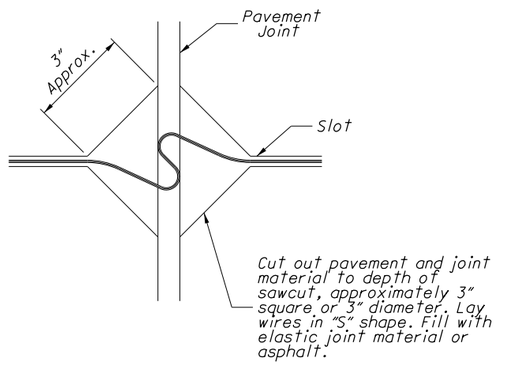
1. Only one set of loop wires shall be run in a saw slot over to the conduit hole location.

2. All adjacent saw slots shall have a minimum distance of 1' between them. No saw slot shall be located within 1' of a longitudinal or transverse joint in P.C.C. pavements if the slot is parallel to the joint.

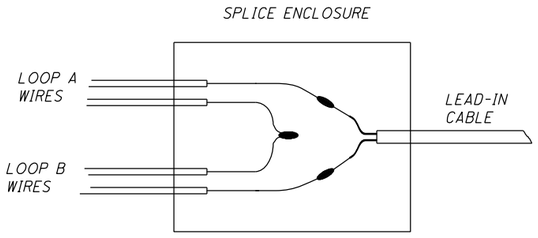
3. Stop line detector loops shall each be on a separate detector unit channel to enhance motorcycle detection.

4. Loops shall be centered in lane.

MULTIPLE LOOP LAYOUT



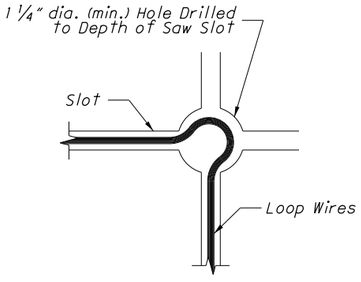
JOINT CROSSING DETAIL IN P.C.C. PAVEMENTS



1. Where multiple loops use a single lead-in cable, series connections shall be used.

2. A maximum of 2 loops (3 wire splices) shall be used in any encapsulated splice kit.

SERIES CONNECTIONS



DETAIL "B"

THIS DRAWING REPLACES TC-82.10 DATED 10-18-2013.

REVISION DATE 07-17-2015

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

STDS. ENGINEER Duemmel

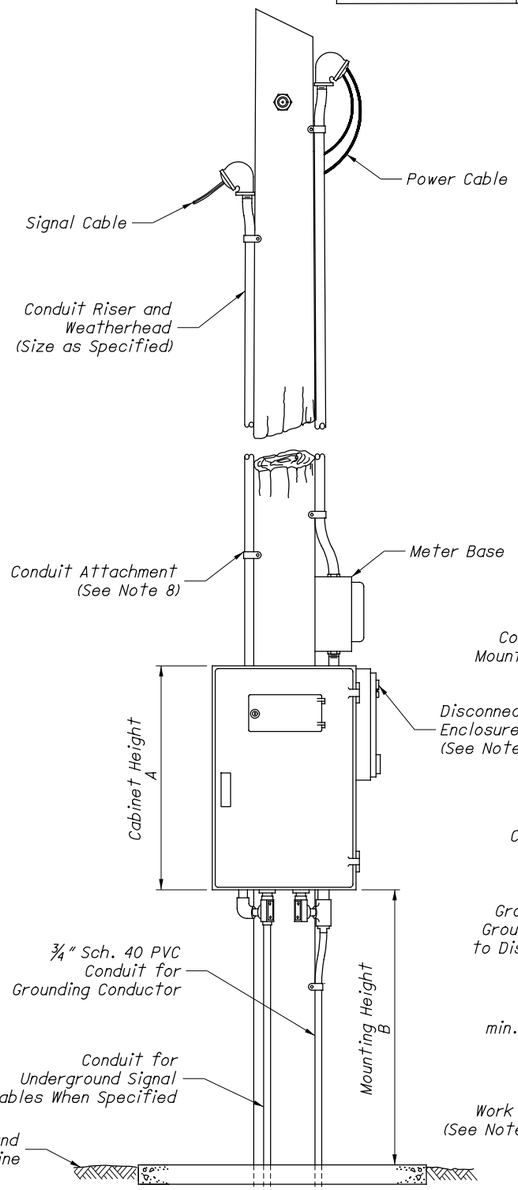
OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

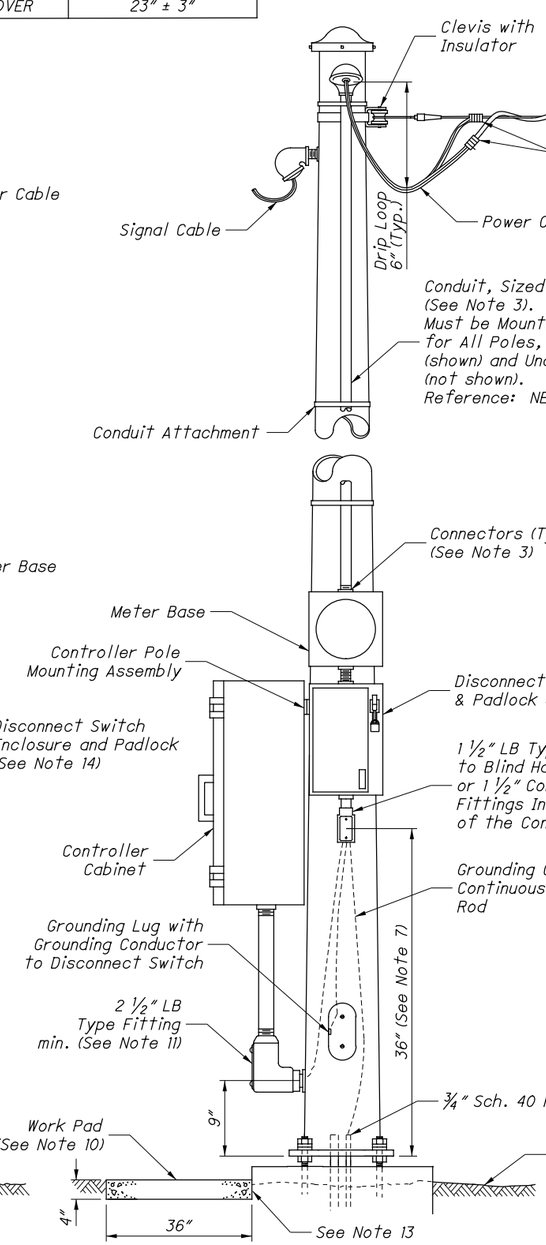
VEHICLE DETECTOR INSTALLATION DETAILS

SCD NUMBER TC-82.10

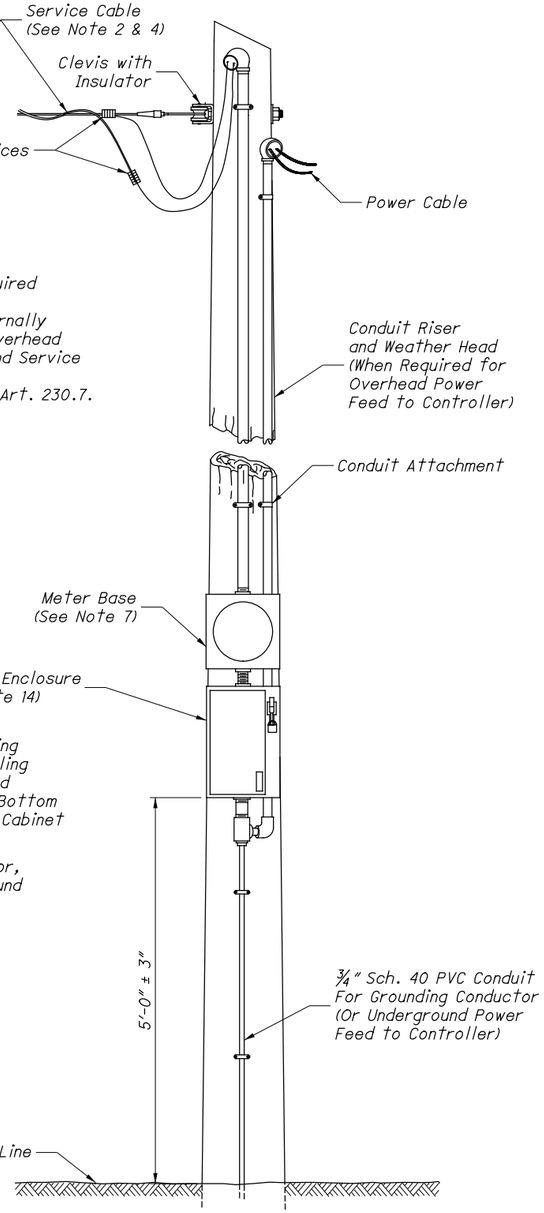
CABINET HEIGHT (A)	MOUNTING HEIGHT (B)
LESS THAN 36″	30″ ± 3″
36″ AND OVER	23″ ± 3″



POWER SERVICE AND CONTROLLER MOUNTING ON WOOD POLES



POWER SERVICE AND CONTROLLER MOUNTING ON NEW STEEL POLES, STANDARD OR DECORATIVE
(See Note 6)



POWER SERVICE

NOTES:

1. All conduit fitting entries for controllers and power service equipment in proposed steel poles shall be attached by a bling half coupling welded into the pole prior to galvanizing.
2. Service cable attachment on wood poles shall be by a ⅝″ thru-bolt and clevis; on steel poles by a banded clevis.
3. If both the meter and disconnect switch are not required on a steel pole, the power cable shall enter the controller through a conduit riser, external to the pole. For underground power service, install meter base and disconnect on an adjacent pedestal (SCD TC-83.20) or strut frame (SCD HL-40.20), as directed in the plans.
4. The service cable and cable splices to the power cable for the incoming power supply shall be installed by the power supplying agency unless otherwise specified. The pole attachment hardware shall be furnished and installed by the Contractor.
5. Orientation of the cabinet, meter and disconnect switch enclosure shall be arranged to minimize exposure to the street side and also minimize encroachment on sidewalks, unless otherwise shown on the plans.
6. Power and controller service for metal poles shall be similar to that shown for the wood pole with the exception of the attachment hardware.
7. The top of the meter base shall not exceed 6′ above the ground. The mounting height of the LB type fitting may be decreased in order to accomodate a larger meter base.
8. Conduit attachment shall be by means of two hole conduit straps with a maximum spacing of 5′. Minimum fastener requirements are as follows:
   wood poles - ¼″ x 3″ long lag screws No. 14 x 3″ long round head screws, or 20d spikes
   steel poles - ¼″ screws, self tapping or with drilled and tapped hole, in lieu of conduit clamps, ¾″ wide passivated stainless steel banding may be used on steel poles.
9. Conduit connections at the top and bottom of the disconnect switch enclosure and meter base shall be watertight and shall use the hubs listed on the enclosure and meter base U.L. labels. Conduit shall be bent to allow the conduit to enter straight into the enclosure or meter base, and to provide space for the weatherhead when the riser is pulled tight against the pole.
10. A 48″ x 36″ x 4″ work pad shall be located below each pole-mounted controller cabinet unless located in an otherwise paved area. When required, this item shall be paid for under item 633, controller work pads. In level areas, the top of the pad shall be 1″ above the ground line. In steeply sloped areas, the pad's location shall be adjusted to provide access and drainage while complying with the required controller cabinet mounting height.
11. The horizontal orientation of the handhole relative to the 2 1/2″ blind half coupling for the controller shall be as required by the plans except they shall not be closer than 90°. Install LB fitting before erecting pole.
12. When conduit risers are required to be attached to utility company wood poles, and the utility company's policy requires non-metallic conduit, the conduit risers shall conform with NEMA Standards publication No. TC-2 for PVC conduit type EPC-40.
13. 1/2″ preformed joint filler as per CMS 705.05 shall be used between foundations and adjacent paved areas.
14. Provide a separate disconnect and conduits for intersection lighting. Do not route lighting circuits through controller cabinet.

THIS DRAWING REPLACES TC-83.10 DATED 07-15-2016.

REVISION DATE 01-19-2018

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

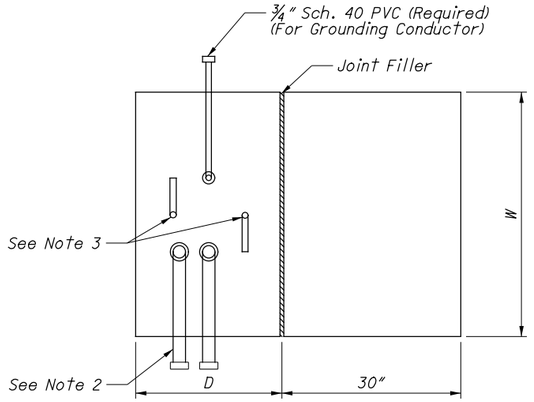
STDS. ENGINEER Duemmel

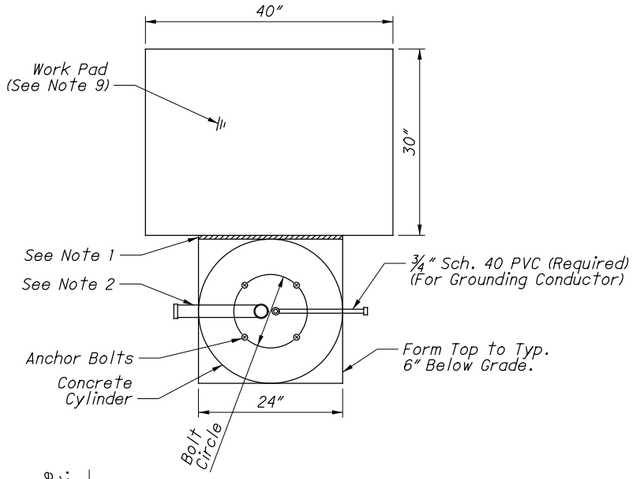
OFFICE OF ROADWAY ENGINEERING

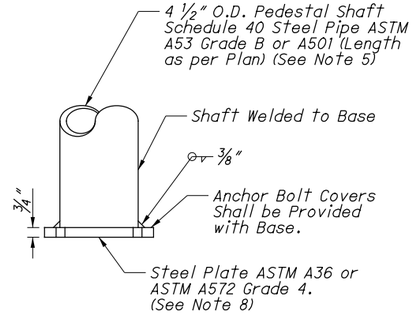
STANDARD ROADWAY CONSTRUCTION DRAWING

POLE MOUNTINGS FOR CONTROLLERS AND POWER SERVICE

SCD NUMBER TC-83.10







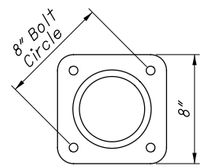
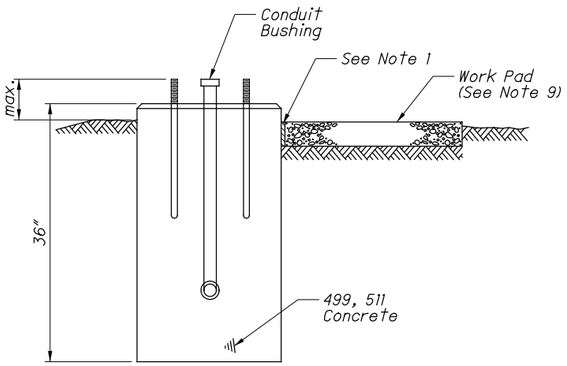
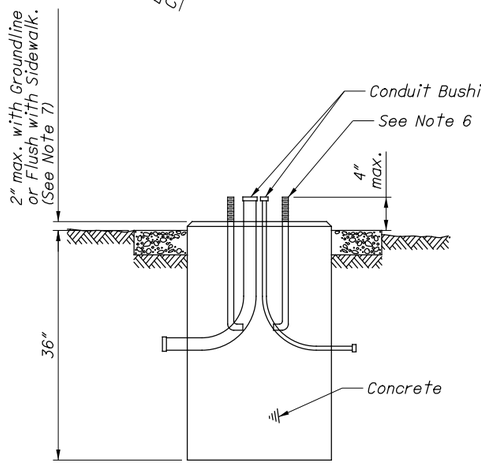


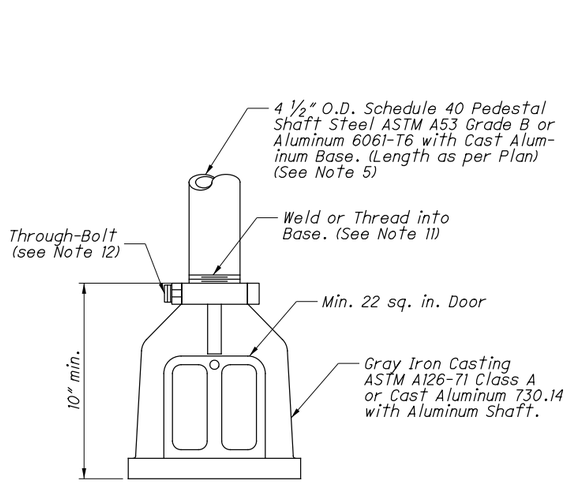
PLATE PEDESTAL BASE





FOUNDATION CONCRETE	WORK PAD
0.42 C.Y.	0.96 S.Y.

PEDESTAL FOUNDATION

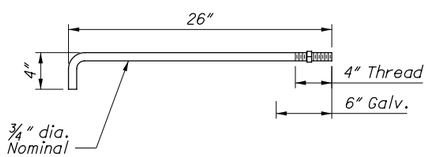


TS-1:

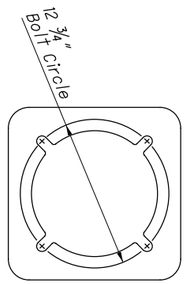
TYPE	W (IN)	D (IN)	FOUNDATION CONCRETE	WORK PAD
M36	40	24	0.82 C.Y.	0.96 S.Y.
P44	50	36	1.54 C.Y.	1.24 S.Y.

TS-2:

SIZE	W (IN)	D (IN)	FOUNDATION CONCRETE	WORK PAD
7	50	36	1.54 C.Y.	1.24 S.Y.



PEDESTAL ANCHOR BOLT
ASTM A307 STEEL



TRANSFORMER TYPE
PEDESTAL BASE

NOTES:

1. ½" preformed joint filler as per CMS 705.03 shall be used between foundations and adjacent paved areas.
2. For cabinets, 4" minimum, 2 required. For pedestals, as shown in the plans.
3. The size, number and location of anchor bolts shall be in accordance with the manufacturer's recommendations.
4. All pedestals shall be provided with a method of securely attaching a 4 AWG insulated copper grounding conductor to the pedestal or anchor bolt. No cables or connections shall be external to the pedestal.
5. The pedestal shaft length as shown in the plans includes the pedestal base height for either base design. The maximum Equivalent Physical Area (EPA) of pedestal-mounted signal devices shall be 8 square feet (3-section head with backplate) at a bottom mounting height of 12' or less. Larger devices should be mounted on HL-10.13 bases and poles.
6. The pedestal base shall set on the foundation top without grouting, preformed fillers or leveling nuts under the base. Steel shims may be used under the base for leveling the installation.
7. The foundation area of contact with the pedestal base shall be level. If adjacent paved areas slope, the remainder of the foundation top shall be beveled to meet the adjacent elevations.
8. A cast steel anchor base of equivalent strength may be used in lieu of the base plate.
9. A 4" thick work pad shall be provided unless in an otherwise paved area. When required, this item shall be paid for under Item 633 Controller Work Pad. In level areas the top of the pad shall be 1" above the ground line. In steeply sloped areas the pad's location shall be adjusted to provide access and drainage.
10. Ground mounted controller cabinets shall be sealed to the foundation with a flexible weatherproof clear, silicone caulking compound.
11. Threaded shaft connections into transformer-type pedestal bases shall resist rotation through the use of mechanical fasteners. A galvanized or stainless steel through-bolt shall be used with a minimum diameter of ¼" and utilizing nylock or deformed-thread nuts.
12. Alternate to through-bolt: provide a deep collar on top of transformer base with three set screws of stainless steel that engage the shaft above the threads after the shaft is threaded into the base.

THIS DRAWING REPLACES TC-83.20 DATED 07-15-2016.

REVISION DATE 07-21-2017

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

STDS. ENGINEER Duemmel

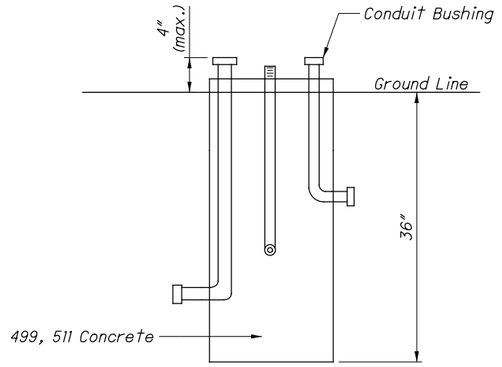
OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

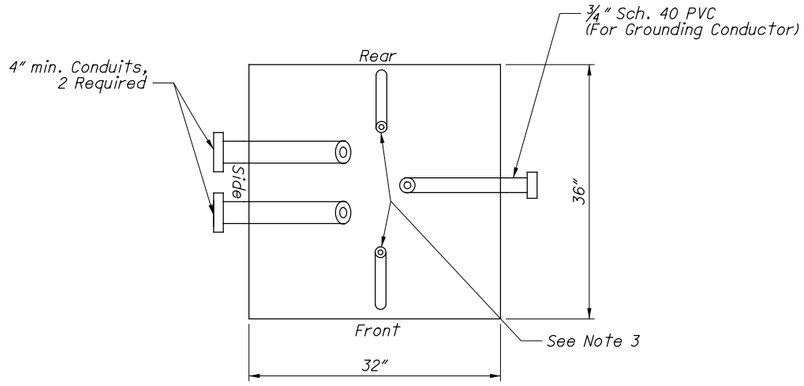
CABINET FOUNDATIONS AND PEDESTALS

SCD NUMBER TC-83.20

332/336 CABINET FOUNDATION



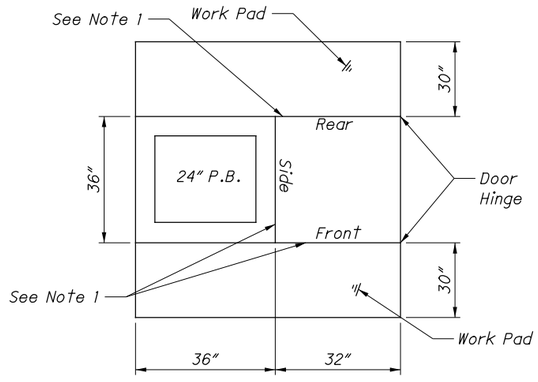
ELEVATION VIEW



PLAN VIEW

332/336 CONTROLLER WORK PAD

(See Note 9)



PLAN VIEW

NOTE: Pullbox Shall be Placed
on Opposite Side of Door Hinge

THIS DRAWING REPLACES TC-83.20 DATED 07-15-2016.

REVISION DATE 07-21-2017

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR
David L. Holstein

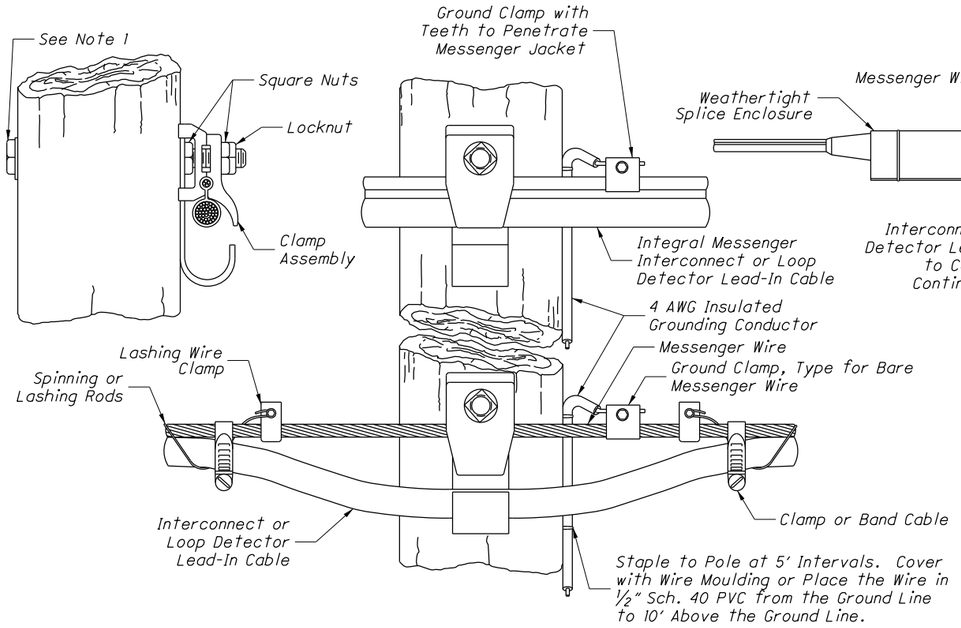
STDS. ENGINEER
Duemmel

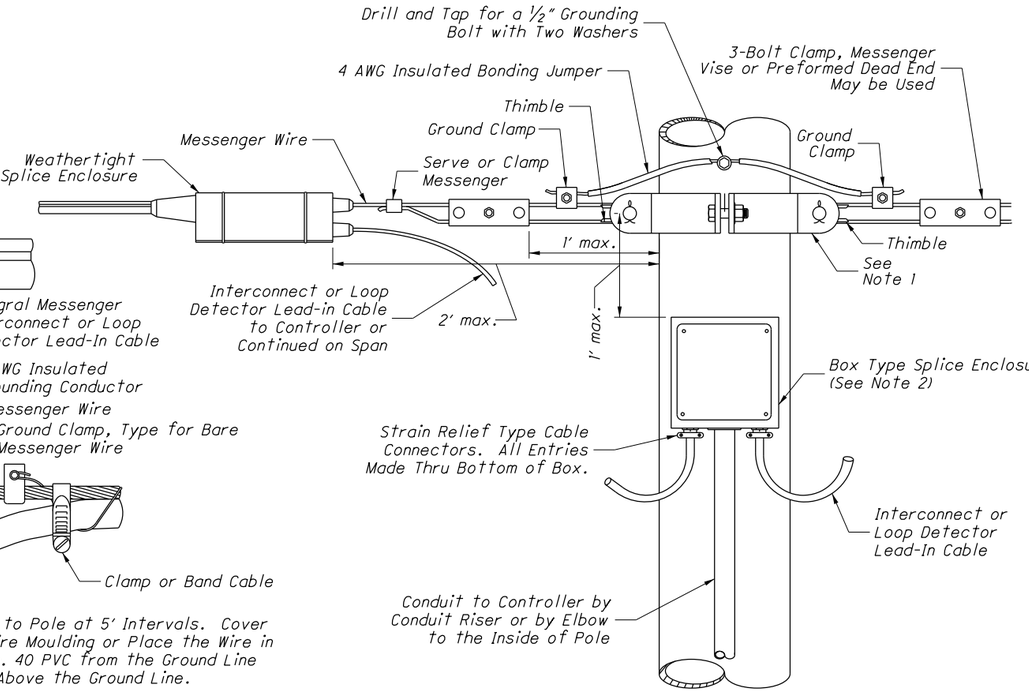
OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

CABINET FOUNDATIONS AND PEDESTALS

SCD NUMBER
TC-83.20

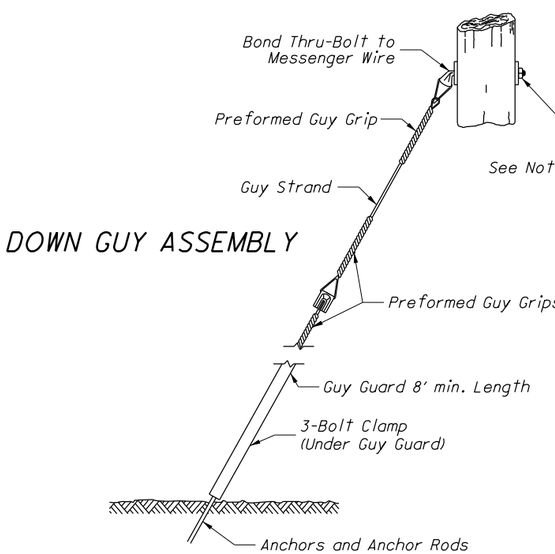




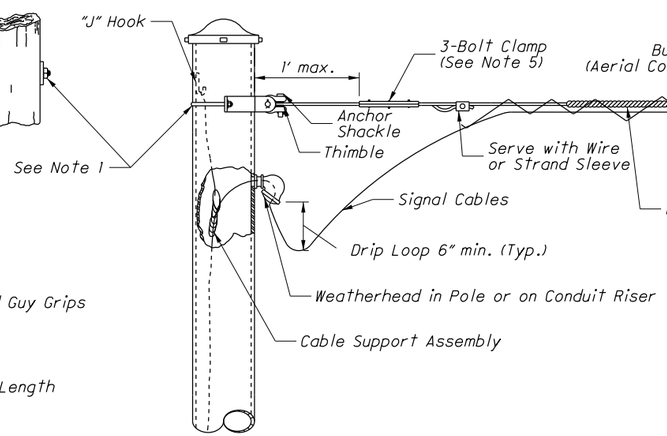
INTERCONNECT & LOOP DETECTOR LEAD-IN ATTACHMENT DETAIL

NOTES:

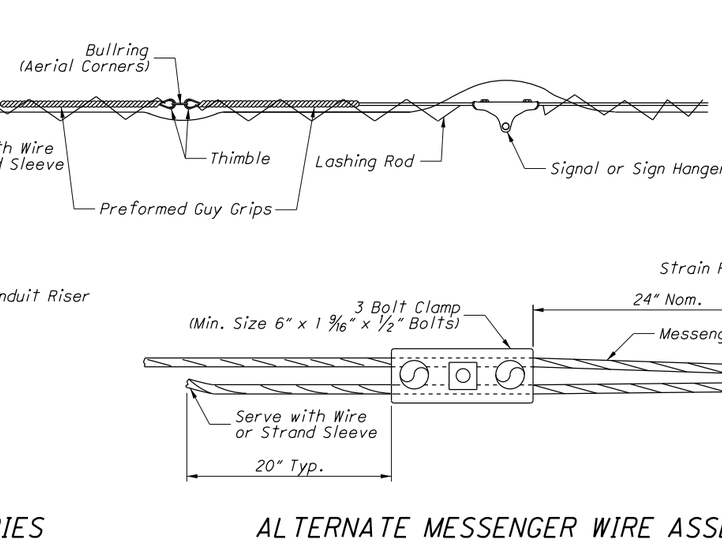
1. Messenger wire pole attachment shall be by a pole clamp on steel poles and be a ⅝" thru-bolt (or thimble-eye bolt) with washers on wood poles.
2. The pole mounted type splice enclosure may be used as an alternative splice method unless otherwise specified in the plans. Pole attachment shall be by means of passivated stainless steel banding or tapped screws on steel poles and lag screws on wood poles. The box shall be gasketed and weathertight, and hot dipped galvanized if constructed of steel. Minimum box requirements shall be 8" x 8" x 4" with 12 terminal connections (20 amp).
3. The interconnect or loop detector lead-in cable shall have a sag between 3% and 5% or match existing utility lines.
4. The interconnect or loop detector lead-in messenger wire shall be grounded at the first and last poles in a cable run and at intervals not to exceed 1200'. When attached to wood poles, the messenger wire shall be grounded by bonding to an existing ground rod. The messenger wire shall be bonded to grounded steel poles by use of a ½" bolt drilled and tapped into the pole.
5. The minimum 3-bolt size clamp shall be 6" long with ½" diameter bolts. Preformed guy grips shall not be used to attach the messenger wire to the signal poles. Their use is limited to bullring attachments.
6. The alternate messenger wire attachment shall only be allowed on round, tapered steel strain poles and must be specified in the construction plans for use. Alternate wire attachment shall not be used for tether wire attachment.

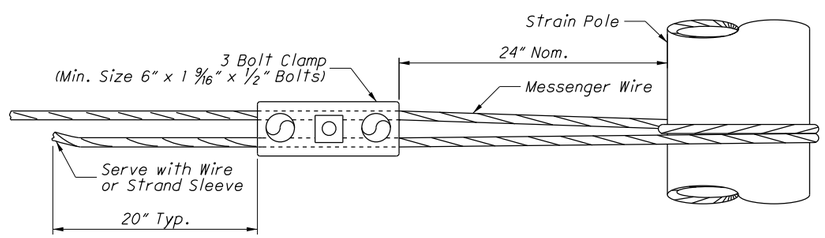


DOWN GUY ASSEMBLY



MESSENGER WIRE WITH ACCESSORIES





ALTERNATE MESSENGER WIRE ASSEMBLY

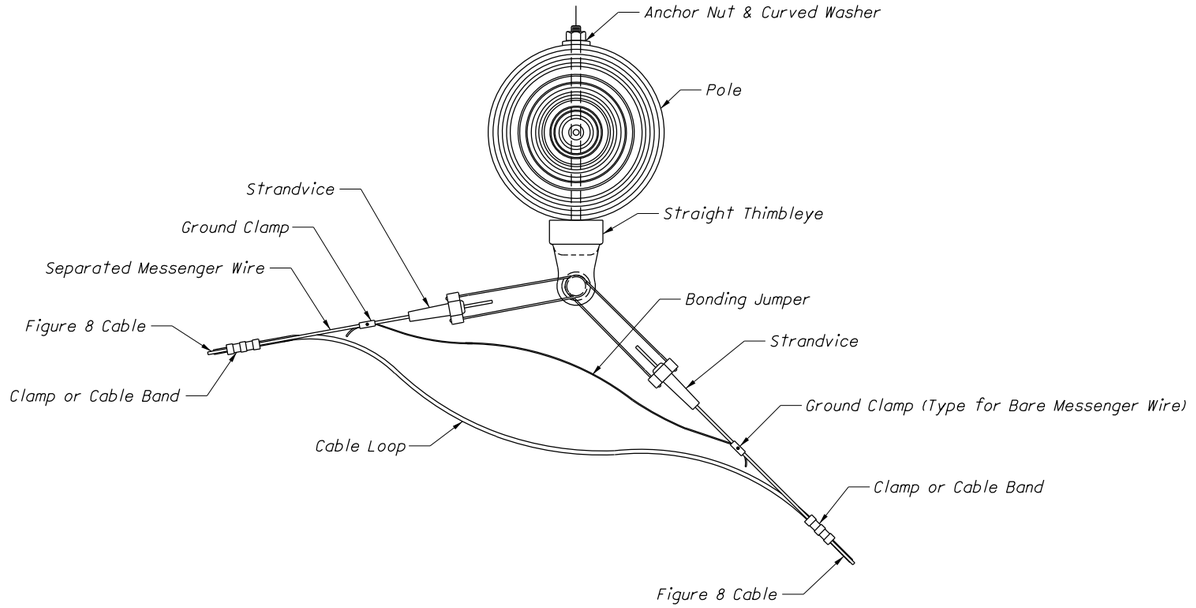
THIS DRAWING REPLACES TC-84.20 DATED 01-21-2011.

REVISION DATE	STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR	STDS. ENGINEER	OFFICE OF ROADWAY ENGINEERING
10-18-2013	James Young	Duemmel	

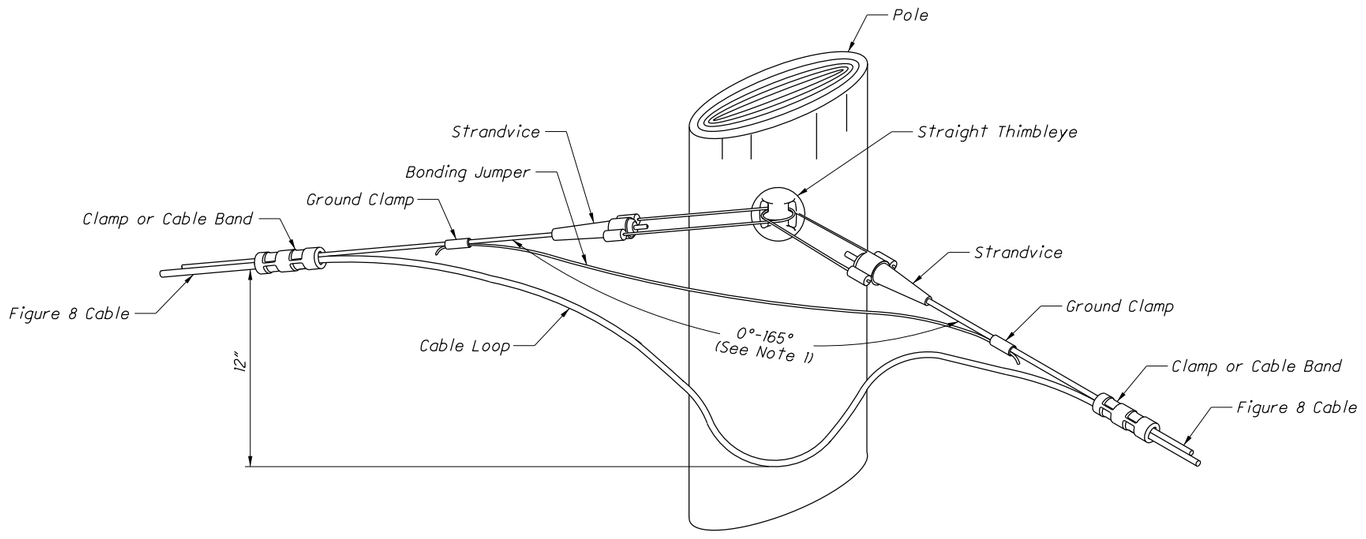
STANDARD ROADWAY CONSTRUCTION DRAWING

MESSENGER WIRE DETAILS I

SCD NUMBER **TC-84.20**



TOP VIEW



FRONT VIEW

NOTES:

1. For angles of 166° through 180° use interconnect attachment details shown on Standard Construction Drawing (SCD) TC-84.20. Messenger wire pole attachment shall be by a pole clamp on steel poles and by a ⅝" thru-bolt or thimbleye bolt with curved washers on wood poles.
2. The interconnect or loop detector lead-in messenger wire shall be electrically grounded at the first and last poles in a cable run and at intervals not to exceed 1200'. When attached to wood poles, the messenger wire shall be grounded by bonding to existing ground wire or connection to a ground rod. The messenger wire shall be bonded to grounded steel poles by use of a ½" bolt, drilled and tapped into the pole.
3. The interconnect or loop detector lead-in cable shall have a sag between 3% and 5% or match the existing utility lines.
4. Grounding of poles shall be as shown on SCD TC-84.20.

REVISION DATE 10-18-2013

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR James Young

STDS. ENGINEER Duemmel

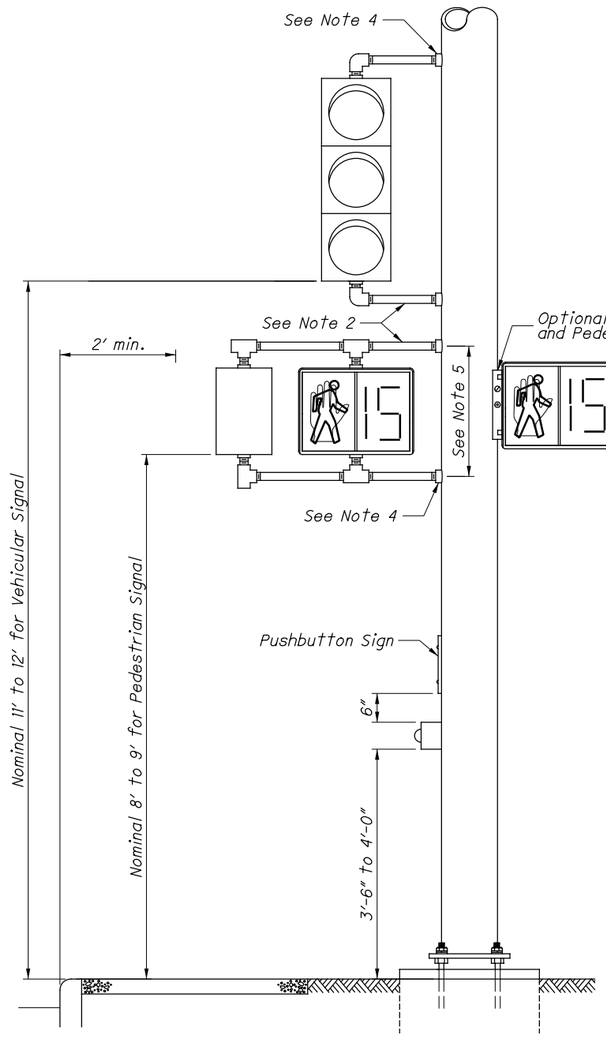
OFFICE OF ROADWAY ENGINEERING

THIS DRAWING REPLACES TC-84.21 DATED 01-19-2007.

STANDARD ROADWAY CONSTRUCTION DRAWING

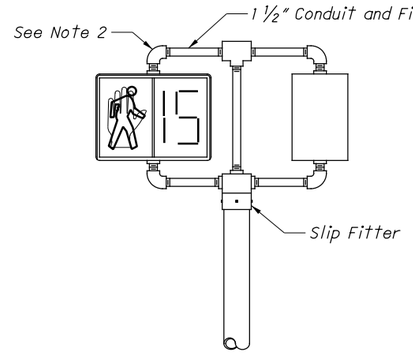
MESSENGER WIRE DETAILS II

SCD NUMBER TC-84.21

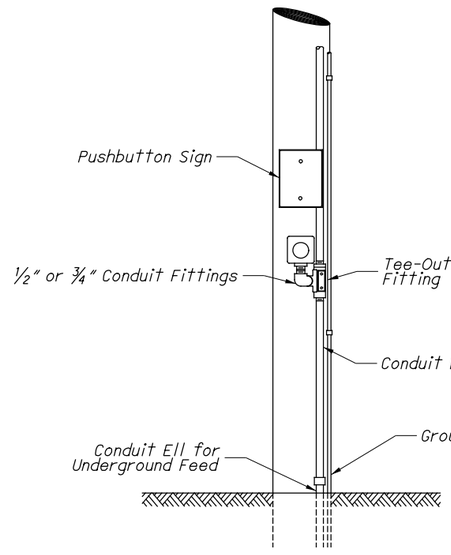


STEEL POLE DETAIL

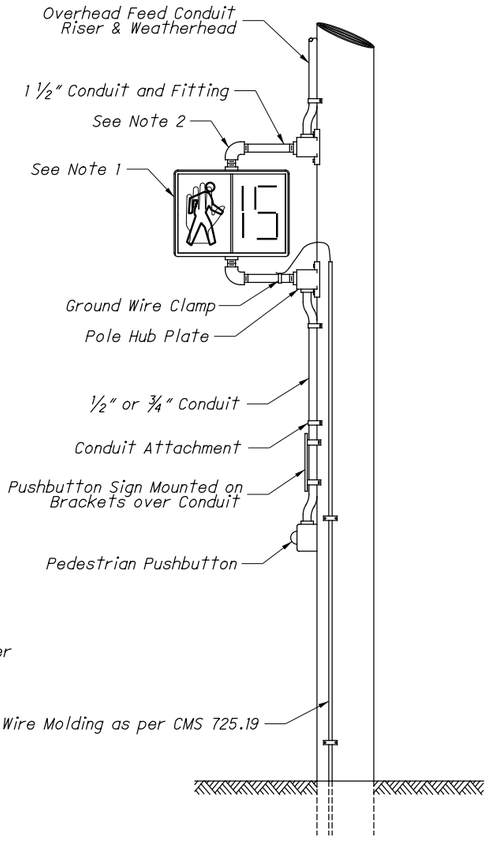
(See Note 3)



PEDESTAL MOUNTED SIGNAL HEAD



UNDERGROUND FEED



OVERHEAD FEED

WOOD POLE DETAIL

NOTES:

1. Vehicular signal heads shall utilize mounting brackets similar to those shown for pedestrian signal heads.

2. Signal head conduit brackets and conduit fittings shall be galvanized and painted (except pole clamps or bands) to match the body of the signal head.

3. For embedded steel poles, external conduit shall be similar to that shown in wood pole detail. External grounding will not be required unless specifically noted on the plans.

4. The signal head bracket arms shall be attached to steel poles by one of the following methods:

   a. 1 ½" blind half coupling welded into the pole prior to galvanizing.

   b. Bracket arm hub plates attached to the pole as per note 7.

   c. Pole clamp with threaded hub.

   Field installation of the wiring holes for signal heads and pushbuttons will be permitted provided that the holes are drilled or hole sawn. No torch cutting or field welding will be permitted. Cut surfaces shall be filled smooth and covered with two coats of zinc rich paint. Grommets or wiring guides shall be installed in the holes.

5. Vertical spacing between bracket fittings shall be determined by the Contractor, and shall be the dimension from centerline to centerline of the bracket arms necessary to accommodate the vertical height of the signal head plus not more than 10".

6. The following minimum size fasteners shall be used for the attachment of the indicated hardware to wood poles:

   a. CONDUIT BRACKET ARM HUB PLATES: ½" dia. x 3" long lag screws (two screws per hub plate).

   b. CONDUIT STRAPS (Two hole): ¼" x 3" long lag screws, #14 x 3" long round head wood screws, or 20d spikes.

   c. PUSHBUTTON SIGN: with brackets - ⅜" x 3" long lag screws (two per bracket); without brackets - ⅜" x 3" long lag screws with 7/16" I.D. x 1" O.D. flat washer between the sign and pole (two per sign).

   d. PUSHBUTTON: #14 x 3" long round head wood screws or ¼" x 3" long lag screws (two per pushbutton).

7. The following minimum size fasteners shall be used for the attachment of the indicated hardware to steel poles:

   a. CONDUIT BRACKET ARM HUB PLATES: ½" dia. screw or ¾" wide passivated stainless steel band (two fasteners or bands per hub plate).

   b. CONDUIT: Two hole conduit straps with ¼" dia. screws or ¾" wide passivated stainless steel bands.

   c. PUSHBUTTON SIGN: ⅜" dia. screws (two per sign).

   d. PUSHBUTTON: ¼" dia. screws (two per pushbutton).

   The screws shall utilize a drilled and tapped hole or be the self-tapping type.

THIS DRAWING REPLACES TC-85.10 DATED 07-15-2016.

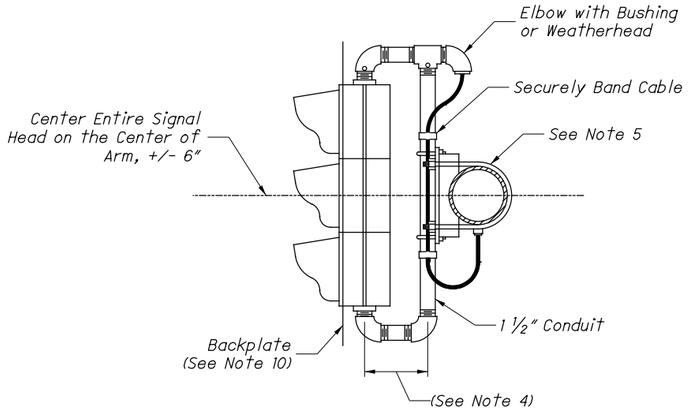
REVISION DATE	STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR	STDS. ENGINEER	OFFICE OF ROADWAY ENGINEERING
07-21-2017	David L. Holstein	Duemmel	

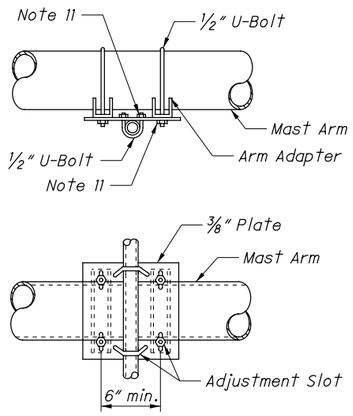
STANDARD ROADWAY CONSTRUCTION DRAWING

POLE MOUNTINGS FOR SIGNAL HEADS

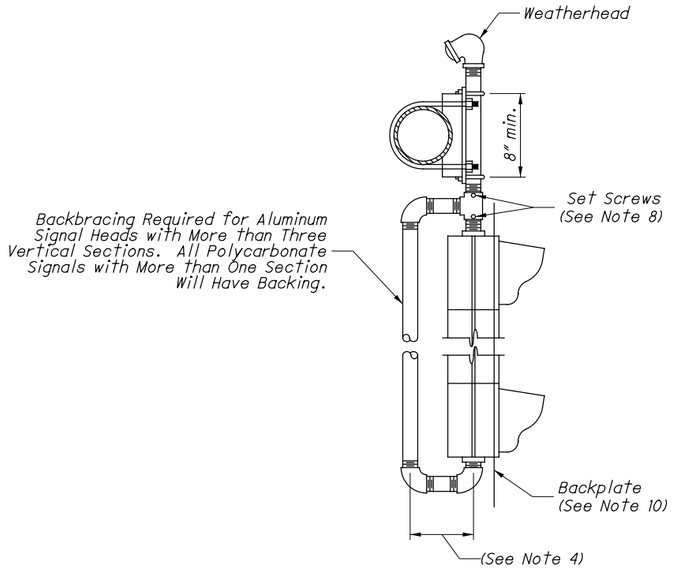
SCD NUMBER **TC-85.10**

RIGID SIGNAL HEAD MOUNTING FOR MAST ARMS





SIGNAL HEAD SUSPENSION



NOTES:

1. Signal head conduit brackets and conduit fittings shall be galvanized. On span wire mounted signals, they shall be painted to match the body of the signal head. On mast arm mounted signals, they shall not be painted unless specified in the plans.
2. All signal head assemblies shall be installed in a plumb position and perpendicular to the approach lane.
3. The mast arm clamp shall have a minimum strength at yield to support a 200 pound dead load and 90 mph design wind.
4. A minimum of 17" is required for optically programmed signal heads and a minimum of 6" for standard signal heads.
5. Alternate rigid signal head mounting devices (e.g. "Astro-Brac") for mast arms may be approved by the Engineer upon demonstration that they provide adequate rigidity, equal range of adjustment and can be tightened sufficiently to prevent movement and loosening under vibration.
6. All signal heads shall be installed with their lowest part (including backbracing and backplates) with a clearance above pavement elevation at the center of the roadway of 17' minimum, 19' maximum. It is intended that this clearance be obtained without the use of drop pipes, but rather by the careful selection of foundation heights, attachment heights, arm rise, and other factors during the installation. If the installation cannot be adjusted to the proper clearance the Contractor shall advise the Engineer of all signals which exceed the maximum. The Engineer will, in consultation with the maintaining agency, direct the use of drop pipes or waive the maximum clearance requirement for each head.
7. Cable entrance openings on disconnect hangers shall rigidly clamp cable to prevent movement of the cable within the enclosure.
8. Signal head rotation shall be prevented by the use of serrated rings, set screws, or other positive devices incorporated in the signal housing and at critical locations in the supporting hardware.
9. All conductors shall have adequate clearance between hangers, thimbles, bullrings, etc. in order to avoid damage from rubbing.
10. All backplates shall have a 2" fluorescent yellow reflective border.
11. Use nylon locking or deformed thread nuts.

THIS DRAWING REPLACES TC-85.20 DATED 01-15-2016.

REVISION DATE 07-20-2018

STATE OF OHIO DEPARTMENT OF TRANSPORTATION ADMINISTRATOR David L. Holstein

STDS. ENGINEER Duemmel

OFFICE OF ROADWAY ENGINEERING

STANDARD ROADWAY CONSTRUCTION DRAWING

OVERHEAD SIGNAL ATTACHMENT MAST ARM

SCD NUMBER TC-85.20

SUPPLEMENTAL SPECIFICATIONS

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
SUPPLEMENTAL SPECIFICATION 800
REVISIONS TO THE 2016 CONSTRUCTION & MATERIAL SPECIFICATIONS

DATED 07-20-2018

101.02

On page 6, **Add** the following abbreviation to the list**:**

DCE District Construction Engineer

On page 8, **Add** the following abbreviation to the list:

TAP Traffic Authorized Product

101.03

On page 10, **Replace** the definition with the following:

Contract Documents. The Contract Documents include the Invitation for Bids, Addenda, Proposal, contract form and required bonds, Specifications, Supplemental Specifications, Special Provisions, general and detailed plans, Plan notes, standard construction drawings identified in the Plans, notice to contractor, Change Orders, Supplemental Agreements, Extra Work Contracts, "Accepted" and "Accepted as Noted" Working Drawings, and any other document designated by the Department as a Contract Document, all of which constitute one instrument.

On page 11, **Add** the following definition after the definition of **Engineer**:

Engineered Drawings. A type of Working Drawing that requires the practice of engineering as defined in ORC 4733.01(E). Examples of Engineered Drawings include: Excavation Bracing Plans, Demolition Plans, Erection Plans, Falsework Plans, Cofferdam Plans, Causeway Plans, Jacking and Temporary Support Plans, Plans for Heavy Equipment on Structures, Plans for structures for Maintaining Traffic, and Corrective Work Plans.

On page 13, **Replace** the definition with the following:

Shop Drawings. Drawings accepted by the Contractor and submitted to the Department that describe portions of the Work fabricated off site that are incorporated permanently with the project. Department acceptance is not required.

On page 14, **Replace** the definition with the following:

Working Drawings. Contractor submitted drawings for work, not otherwise defined in the Bid Documents, and require Department acceptance. Examples of Working Drawings include: Engineered Drawings, installation plans, certified drawings, and any other supplementary plans or similar data that the Contractor is required to submit for acceptance.

102.01

On page 15, **Add** the following paragraph after the second paragraph:

The Department will perform contractor performance evaluations for each contractor and subcontractor on every ODOT-let construction project. Evaluations shall be well documented, objective, and performed in a timely manner, in accordance with Supplement 1131. The contractor's average scores for the previous calendar year will be used in the calculation of the contractor's bidding capacity. The contractor has the right to appeal an evaluation.

104.02.D

On page 22, **Replace** the first sentence with the following:

The Engineer may increase or decrease quantities and alter the Work as necessary to complete the Project.

104.02.D

On page 23, **Replace** item number 3 in the first paragraph with:

3. the total of all such adjustments for all Contract Items is more than $400.

104.02.D

On page 23, **Replace** Table 104.02-2 with the following table:

TABLE 104.02-2

% Decrease	Factor	% Decrease	Factor
25	1.08	67	1.51
26 to 27	1.09	68	1.53
28 to 29	1.10	69	1.56
30 to 31	1.11	70	1.58
32 to 33	1.12	71	1.61
34 to 35	1.13	72	1.64
36	1.14	73	1.68
37 to 38	1.15	74	1.71
39	1.16	75	1.75
40 to 41	1.17	76	1.79
42	1.18	77	1.84
43	1.19	78	1.89
44 to 45	1.20	79	1.94
46	1.21	80 and over	2.00
47	1.22		
48	1.23		
49	1.24		
50	1.25		
51	1.26		
52	1.27		
53	1.28		
54	1.29		
55	1.31		
56	1.32		
57	1.33		
58	1.35		
59	1.36		
60	1.38		
61	1.39		
62	1.41		
63	1.43		
64	1.44		
65	1.46		
66	1.49		

104.02.D

On page 24, **Delete** the first paragraph "A quantity…" through the end of TABLE 104.02-3. The last paragraph in the section will remain.

105.02

On page 26, **Replace** the last paragraph of the subsection with the following:

"Accepted" and "Accepted as Noted" Working Drawings are Contract Documents as defined in 101.03. The Department's acceptance will not relieve the Contractor of responsibility to complete the Work according to the Contract nor relieve a signatory engineer's responsibility as defined by OAC 4733-23. Include the cost of furnishing Working Drawings in the cost of the Work they cover.

105.16

On page 32, **Delete** the last sentence of the first paragraph beginning with "The cost of work…"

105.16

On page 32, **Add** the following paragraph after the last paragraph of the section:

The cost of work described herein is incidental to the Contract, unless included under another item of work.

106.09

On page 36, **Delete** section E:

On page 36, **Change Section F to Section E:**

E. Proof of Domestic Origin. Furnish documentation to the Engineer showing the domestic origin of all steel and iron products covered by this section, before they are incorporated into the Work. Products without a traceable domestic origin will be treated as a non-domestic product.

106.11

On page 37, **Add** the following section:

106.11 Maritime Transportation. On federal-aid projects, ensure that project-specific materials or equipment transported by ocean vessel are in compliance with 46 CFR 381 and the Cargo Preference Act. Transport at least 50% of any equipment or materials on privately owned United States-flag commercial vessels, if available.

107.21

On page 49, **Replace** the first paragraph in the section with:

107.21 Prompt Payment. In accordance with ORC 4113.61, make payment to each subcontractor and supplier within 10 Calendar Days after receipt of payment from the Department for Work performed or materials delivered or incorporated into the Project, provided that the pay estimate prepared by the Engineer includes Work performed or materials delivered or incorporated into the public improvement by the subcontractor or supplier. Contractors are prohibited from holding retainage from bonded subcontractors. For unbonded subcontractors, promptly release any retainage held, as set forth in any subcontractor or supplier agreement, within 10 days of department's acceptance of the work involving the subcontractor or supplier from whom retainage has been held. For the sole

purpose of establishing a time frame for the release of the subcontractor or supplier retainage, acceptance of subcontractor or supplier work will occur when the subcontractor or supplier has complied with the requirements of 109.12.A and B. No subcontract provision shall permit the Contractor to delay subcontractor's retainage payments until the Project's final payment.

107.22

On page 49, **Add** the following section:

107.22 Unmanned Aircraft Systems. If the project requires or anticipates the use of Unmanned Aircraft Systems within ODOT Right of Way, the Contractor will follow proper risk assessment and federal regulations in accordance with Supplement 1132.

108.02

On page 50, **Replace** the second sentence in the sixth paragraph with:

At or before the meeting, submit the initial progress schedule to the DCE. Prepare the schedule according to 108.03.

On page 53, **Replace** the fourth paragraph with:

2. Step 2 (District Dispute Resolution Committee). Each District will establish a District Dispute Resolution Committee (DDRC) which will be responsible for hearing and deciding disputes at the Step 2 level. The DDRC will consist of the District Deputy Director, District Construction Engineer and the Capital Program Administrator or designees (other than the project personnel involved in the dispute).

On page 53, **Replace** the fifth paragraph with:

Within seven (7) calendar days of receipt of the Step 1 decision, either abandon the dispute or submit a written request for a Step 2 meeting to the District Construction Engineer (DCE). The DCE will assign the dispute a dispute number. Within fourteen (14) calendar days of submitting the request for a Step 2 meeting, submit three (3) complete copies of the Dispute Documentation to the DCE as follows:

On page 54, **Replace** the sixth paragraph with:

a) Director's Claims Board Hearing. The Director's Claims Board (the "Board") will consist of the Deputy Director of the Division of Construction Management, Deputy Director of Engineering and a District Capital Program Administrator from a district not involved in the claim, or their designees. A representative from the Division of Chief Legal Counsel and Division of Opportunity, Diversity, and Inclusion may be present to observe the hearing. The Director or designee will be responsible for deciding claims.

On page 56, **Add** the following paragraph after the sixth paragraph:

Prior to any ADR meeting, certify the claim in writing and under oath using the following certification:

"I, (Name and Title of an Officer of the Contractor) certify that this claim is made in good faith, that all supporting data is accurate and complete to the best of my knowledge and belief, and that the claim amount accurately reflects the contract amendment for which (Contractor Company name) believes the Department is liable."

On page 56, **Add** the following sentence to the seventh paragraph:

However, interest will not be paid on the amount of any agreed settlement unless specifically itemized and included in the total settlement prior to agreement.

108.07

On Page 64, **Replace** Table 108.07-1 with the following:

TABLE 108.07-1 SCHEDULE OF LIQUIDATED DAMAGES

Original Contract Amount (Total Amount of the Bid)		Amount of Liquidated Damages to be Deducted for Each Calendar Day of Overrun in Time
From More Than	To and Including	
$0.00	$500,000	$400
$500,000	$2,000,000	$600
$2,000,000	$10,000,000	$900
$10,000,000	$50,000,000	$1,500
Over $50,000,000		$3,200

109.05.C.4

On Page 74, **Replace** the second paragraph with:

The Department will pay for use of Contractor-owned equipment the Engineer approves for force account Work at established rates. The Department will pay the rates, as modified in 109.05.C.4.b, given in the Equipment Watch Cost Recovery (formerly Rental Rate Blue Book), by EquipmentWatch, a division of Penton Business Media, Inc.

109.12.B.

On page 88, **Add** the following sentence after the first sentence in the paragraph:
For project involving multiple public agencies, the Final Inspector will receive and compile punch lists from all agencies that have authority to provide one prior to issuing the Department's punch list.

202.03

On page 93, **Add** the following sentence to the end of the second paragraph:

Remove any existing welded form hangers, welded attachments two inches or longer measured parallel to the long axis of the top flange of steel beams or girders, and welded attachments that interfere with the placement of welded shear connectors.

202.04

On page 93, **Replace** the first paragraph with the following:

Pipe Removal. Remove and reuse, store, or dispose of pipe, or culvert, including headwalls, as specified in the Contract Documents.

202.04

On page 94, **Replace** the first full paragraph with the following:

Seal openings left in walls of manholes or catch basins that are to remain in place.

203.04

On page 101, **Replace** the second sentence of the fifth paragraph of 203.04 with the following:

The area is considered to contain hazardous waste or material and must be handled according to the *Construction Administration Manual of Procedures*, Item 202 Removal of Structures and Obstructions, Section- Regulated Waste Requirements, Regulated Wastes Found During Construction.

205.04.A.

On page 116, **Replace** the second sentence of the first paragraph with the following:

The percentage is based on a dry density for soil of 115 pounds per cubic foot (1840 kg/m^3):

205.04.A.

On page 116, **Replace** Table 205.04-1 with the following:

Chemical	Spreading Rate
Cement	5 %
Lime	5 %

205.04.B.

On page 116, **Replace** the second sentence of the first paragraph with the following:

If necessary, add water to bring the mixed material to between 2 and 4 percent above optimum moisture content for cement, and to at least 3 percent above optimum moisture content for lime.

205.07

On page 117, **Add** the following paragraph after the first paragraph:

The Department will not apply the quantity underrun adjustment factors in Table 104.02-2 to the bid unit prices for Cement and Lime.

206.05.A.

On page 118, **Replace** the second sentence of the second paragraph with the following:

The percentage is based on a dry density for soil of 115 pounds per cubic foot (1840 kg/m^3):

206.05.A.

On page 118, **Replace** Table 206.05-1 with the following:

Chemical	Spreading Rate
Cement	5 %
Lime	5 %

206.05.B.1.

On page 119, **Replace** the first sentence of the fourth paragraph with the following:

After the initial mixing, remix the soil and introduce water through the mixer to bring the mixed material to between 2 and 4 percent above optimum moisture.

206.05.D

On page 120, **Replace** the first sentence of the first paragraph with the following:

By the end of each day's operation, cover the stabilized work area's surface with curing coat for curing the chemically stabilized subgrade.

206.05.D

On page 120, **Replace** the second sentence of the second paragraph with the following:

If the surface starts to dry out, indicated by turning white, or the curing coat is delayed, apply water for temporary curing until the curing coat can be applied.

206.08

On page 121, **Add** the following paragraph after the first paragraph:

The Department will not apply the quantity underrun adjustment factors in Table 104.02-2 to the bid unit prices for Cement and Lime.

255.05

On page 145, **Replace** the entire section with the following:

255.05 Placing Dowels and Tiebars. Drill dowel and tiebar holes using hydraulic, electric, or pneumatic percussion drills without spalling or damaging the existing concrete. Provide drills capable of independent adjustment of each drill shaft in the horizontal and vertical direction. When drilling dowels, use a device capable of drilling a minimum of three holes at a time. For patches 10 feet (3 m) or greater in length, provide tie bars or wiggle bolts of the size and spaced as shown on the standard construction drawings along the longitudinal joint(s). Blow all drilled holes clean with oil-free compressed air. Maintain holes dry and frost free before grouting the dowels or tiebars. Pneumatically inject grout starting at the rear of the drilled holes and drawing a bead of material towards the front. Inject a sufficient amount of grout to fill all voids around the dowels and tiebars. Use a grout retention disc with a radius slot as shown in the standard drawings to retain the grout within the drilled holes. Place the grout retention disc on the dowels and tiebars at the end to be inserted in the hole. Insert dowels and tiebars in the holes and rotate the dowels and tiebars approximately one full revolution. Ensure a small amount of grout extrudes through the radius slot in the grout retention disc when the dowels and tiebars are installed. Hold dowel bars in proper alignment until the grout has hardened.

255.10

On page 148, **Replace** the third paragraph with the following:

The Department will not pay for additional work to repair damage caused by pavement sawing, pavement drilling or pavement removal.

302.04

On page 161, **Replace** the entire subsection with the following:

302.04 Spreading and Finishing. Ensure that the compacted depth of any one layer is a minimum of 4 inches (100 mm) and a maximum of 7.75 inches (190 mm). If the plan thickness is 7.0-7.75 inches (178 mm – 190 mm) and District Testing confirms the JMF and mixture production has 95% passing the 1.50 inch (37.5 mm) sieve, the 302 may be placed in two lifts if requested by the Contractor. One lift of plan thickness will be required if top size aggregate dragging occurs. Ensure that the temperature of the mixture when delivered to the paver is a minimum of 250 °F (120 °C). Ensure the temperature of the mixture is sufficient for the roller coverage to be effective in compacting the mixture.

304.03

On page 162, **Replace** the first paragraph with the following:

304.03 Before Spreading. Sample the material stockpile, according to ASTM D75, to determine the initial moisture content to be used for compaction. Create the moisture-density curve according to AASHTO T 99, Method C, to determine the optimum moisture content.. For projects when the total volume of material is less than 1000 cubic yards (765 m^3), the optimum moisture content may be obtained from a moisture-density curve that was performed on the material within 1 year prior to the date of placement. Submit moisture-density test results to the Engineer.

401.04

On page 171, **Replace** the last paragraph with the following:

Process and use RAP by one of the following two methods. Note on the JMF submittal RAP page which of Method 1 or Method 2 methods described below apply to the RAP. When using RAS without RAP apply the virgin binder requirements of Table 401.04-2 Method 2. Use PG64-28 virgin binder in all 442 intermediate courses regardless of the percentage of RAP used. If greater than 25 percent RAP is used in a JMF submittal use PG58-28 or PG64-28 virgin binder. If 26-30 percent RAP is used in the JMF submittal, the Contractor may submit a 3000 gram RAP sample along with a blend chart, according to Level 3 Mix Design procedures, to determine the grade of virgin asphalt binder to use. When using both 15 percent or greater RAP and 3 percent RAS in an intermediate or base course use PG58-28 or PG64-28. ODOT may request RAP and/or RAS samples or binder properties at any time.

401.04.A

On page 172, in Table 401.04-1, **Replace** the Comments for 442 Polymer Surface Course with the following:

Polymerized binder is virgin. (For non-polymer virgin binder allow 20% max RAP.)

401.04.B

On page 173, in Table 401.04-2, **Replace** the Comments for 442 Polymer Surface Course with the following:

Polymerized binder is virgin. (For non-polymer virgin binder allow 25% max RAP.)

401.04.C

On page 173, **Add** the following sentence to the end of the first paragraph:

C. RAS Processing and Usage. Include RAS in a JMF submittal according to the Standard RAP/RAS Limits Table 401.04-1 or Extended RAP/RAS Limits Table 401.04-2 unless specified differently in the applicable mix specification. When using RAS without RAP apply the virgin binder requirements of Table 401.04-2 Method 2.

401.11

On page 176, **Add** the following sentence to the end of the last paragraph:

Completely discharge the mixture into the spreading equipment and within 90 minutes of loading.

401.15

On page 181, **Replace** the last paragraph with the following:

When the total project includes more than one continuous lane mile (including bridges) of surface course paving in combination with night paving, and no pay item for anti-segregation equipment, provide anti-segregation equipment according to 401.12, for only the surface course. No additional payment will be made for this anti-segregation equipment.

403.06.C

On page 192, **Replace** the last sentence of the first paragraph with the following:

The Department will use its VA test result, the Contractor result of the split, as well as the most recent previous day (or night) Contractor quality control and/or sublot test in the comparison for the Department VA testing.

403.06.C

On page 193**, Replace** Note [2] of Table 403.06-1, with the following:

[2] District VA mix test deviation from most recent previous day (or night) QC and/or lot test.

403.06.C

On page 193, in TABLE 403.06-1, **Replace** the MSG Comparison of 0.025 for 446 with 0.010.

403.06.E

On page 194, **Replace** the first paragraph with the following:

E. Contractor Tests not Verified. If the Department MSG VA test shows the MSG comparison tolerance in Table 403.06-1 is not met, a single Department tested MSG for that day and every prior production day back to when the Department MSG VA last met the tolerance will be used for each 446 Day/Lot density determination. The Contractor may request a review with the Department occasionally for the purpose of determining the cause of a comparison problem. Department decisions upon review are final. If a Contractor is requesting a review of every occurrence of lack of comparison and the Department test is always found correct, the Department may deny that Contractor further reviews. For all other mixes, if the Department VA test does not verify the accompanying Contractor tests within the verification tolerances, then the Monitoring Team will investigate.

403.06.F

On page 195, **Replace** the first paragraph with the following:

F. Contractor Removal, Restoration. For 446 MSG, for a given Contractor facility, if in a series of 15 or more Contractor/ Department MSG comparison tests (VA, Monitoring tests) the Contractor MSG is lower than the Department MSG by more than 0.002 and occurs a minimum of 65 percent of the time the facility will be removed from Department MSG Verification Acceptance and operate under 403.07. (At a minimum, a report will be issued annually of the Contractor/ Department MSG comparison status of each facility for this determination. This frequency may be increased.)

For all other mixes, if repeated problems with poor comparison of tests are not the District's fault; or poor comparison of Contractor tests to the JMF; or with plant operation, input materials, or any of the other requirements of Department specifications occur in a single project or successive projects, the District will request an opinion from the QCQC before notifying the Contractor of removal from Department VA. The District will immediately notify the Contractor of the removal with a follow up letter from District Testing. Once notified, acceptance of asphalt mixtures is by Unconditional Acceptance. Restoration of the VA procedures may occur on a future project with a District recommendation to the QCQC based on consistent improved plant operation and mix control, a review of the Contractor problems and resolutions, and a review of the QCP by the QCQC.

403.07.A

On page 195, **Add** the following sentence to the end of the first paragraph:

This requirement does not apply to 446 MSG as outlined below.

403.07.B

On page 196, **Add** the following paragraph after the first paragraph:

For 446 MSG, the Department will test a single daily MSG for each corresponding 446 Day/Lot density determination from the facility. The facility can be returned to Department MSG VA when the 65 percent criteria (see 403.06 F) is not exceeded in a series of 30 comparison tests.

421 MICROSURFACING On page 207, **Replace** the entire Item 421 with the following:

ITEM 421 MICROSURFACING

421.01 Description. This work consists of constructing a cold laid polymer modified emulsified asphalt pavement course to fill ruts or provide a leveling and/or surface course for existing pavements. Warrant the microsurfacing for two years.

421.02 Materials. Use a polymer modified emulsified asphalt binder (Binder) consisting of the following:

Use a quick-traffic CSS-1hM modified emulsified asphalt (Binder) meeting the requirements in Table 421.02-1. Use only Binder certified according to Supplement 1032. Do not use port addition of the polymer to the emulsified asphalt. Provide to the Engineer certified test data and a statement from the Binder supplier with each load of Binder that the Binder is the same base asphalt binder, polymer, polymer percentage as formulated and used in the mix design. Include the percent residue on the Bill of Lading.

Ensure the Binder meets the following and specification limits will be producible for at least 30 days from sample date:

TABLE 421.02-1	
Tests on emulsion, AASHTO T 59, unless otherwise designated:	CSS-1hM [1]
Viscosity, Saybolt Furol at 77 °F (25 °C) (SFS)	20 to 100
Storage Stability Tests, 24-hr (% difference), max.	1
Particle Charge Test	Positive
Sieve Tests (%) (Distilled Water), max.	0.10
Distillation to 177 °C, Residue % solids, min.[2]	62
Tests on distillation residue:	
Penetration, 25 °C, 100 g, 5 sec (dmm) AASHTO T 49	40 to 90
Ductility, 25 °C, 5 cm/min, (cm), min. AASHTO T 51	40
Solubility in trichloroethylene, (%), min. AASHTO T 44 [3]	97.5
Elastic Recovery, 10 °C, 20 cm (%), min. AASHTO T 301 [4]	50
Softening Point, Ring & Ball (°C), min. AASHTO T 53	60

[1] Pre-blend only: Use a minimum of 3.0% SBR solids based on weight of the asphalt binder. Use Natural SBR latex modifier or synthetic SBR latex modifier conforming to 702.14. Use only one type of latex. Mill or blend the SBR Emulsion into the emulsified solution prior to the emulsification process.

[2] See Supplement 1013. For natural latex, use the Oven Evaporation method in AASHTO T 59 in place of distillation and use this residue for further testing.

[3] On the base asphalt only. Solubility in N-Propyl Bromide (ASTM D7553) can be used in place of trichloroethylene.

[4] Straight molds. Hold at test temperature for 90 minutes. Place in ductilometer and elongate 20 cm at 5 cm/min. Hold for 5 minutes and cut. After 1 hour retract the broken ends to touch and measure the elongation (X) in centimeters to the nearest 0.01 cm. Use the following formula to calculate the elastic recovery: Percent Recovery = ((20-X)/20) x 100. Report results to nearest 0.1%.

Conform to 703.01 and 703.05 for aggregate, except as follows:

TABLE 421.02-2	
Percent by weight of fractured pieces	100
Sand Equivalence (AASHTO T176)	55 minimum

Conform to Table 421.02-3 Gradation A for the aggregate for surface courses, Gradation B for the aggregate for rut fill courses, and Gradation A or B for the aggregate for leveling courses. Stockpile tolerance will be based on target gradation stated in the mix design but will not exceed design gradation band for No. 200 sieve.

TABLE 421.02-3				
Sieve Size		Total Percent Passing		
		A	B	Stockpile Tolerance
3/8 inch	(9.50 mm)	100	100	
No. 4	(4.75 mm)	85 to 100	70 to 90	± 5.0%
No. 8	(2.36 mm)	50 to 80	45 to 70	± 5.0%
No. 16	(1.18 mm)	40 to 65	28 to 50	± 5.0%
No. 30	(600 µm)	25 to 45	19 to 34	± 5.0%
No. 50	(300 µm)	13 to 25	12 to 25	± 4.0%
No. 100	(150 µm)	–	7 to 18	± 3.0%
No. 200	(75 µm)	5 to 15	5 to 18	± 2.0%

Screen the aggregate for oversize material prior to use using a 3/8 inch (9.5 mm) screen size. When a blend of aggregates is to be used to meet gradation A or B, proportion the aggregates in a separate stockpile and blend to a uniform consistency prior to screening. Screen the aggregate to complete the blending process and to remove any oversize material prior to use. If oversize material becomes present in the mixture, screen the aggregate directly into material support units.

For mineral filler, use Portland cement conforming to ASTM C 150, Type I. Adjustments in the quantity of mineral filler added to the mixture are permitted to improve mixture consistency, mix time, or set time. Do not exceed ± 0.5% from the mix design during placement.

Use water conforming to 499.02. Add water to the mixture to control mixture consistency only and not to control mix time.

Use mix set additives as stated in the mix design to control the mixture's mix and set time. If mix set additives are used during production of mixture, include as part of the mix design. Ensure additives are compatible with the other components of the mix.

421.03 Proportioning. Develop a mix design to comply with the mix design criteria and submit to OMM on approved forms, at least two weeks prior to the start of calibration, for preliminary JMF approval. OMM may require additional time prior for preliminary approval to perform tests on lab materials to ensure mix compliance. OMM will notify the Contractor if additional time for testing is required. Final JMF approval will be granted upon successful placement in the field. OMM may require the Contractor to design and submit for a new JMF for lack of mix compliance or lack of field performance.

Submit the mix design and proposed materials to OMM. Include a minimum of 11 pounds (5,000 g) of each aggregate, one quart (1 L) sample of Binder, 3.5 ounces (100 g) of mineral filler, and one pint (0.5 L) of additive, if used, and a complete mix design packet prepared by an AASHTO-accredited laboratory in Pavement Preservation. Prepare the mix design by designing the mixture using the minimum, mid-point, and maximum residual binder content for gradations A or B and present all test data for all tests specified in Table 421.03-1. Determine the residual binder content and present related proportioning of total water (includes moisture in aggregate), mineral filler, and additive with tolerances for each in the final designed mixture. Verify during the mix design the compatibility of the aggregate, Binder, mineral filler, and other additives. Produce the mix design using the same materials that will be used on the project. Approved JMF's expire on December 31st.

A. Ensure that the mix design:

1. Has aggregate (including blended aggregates) meeting the gradation specified.

2. Has residual asphalt by dry weight of aggregate of 7.0 to 8.5 percent for leveling and surface courses, and 6.5 to 8.0 percent for rut fill courses.

3. Has a mineral filler content of 0.3 to 2.5 percent by dry weight of aggregate and a tolerance of not greater than ± 0.5 percent of the mix design within the required minimum and maximum.

4. Verify the mix times and wet cohesion requirements based on specific minimum and maximum percent mineral filler, total water, and additive.

5. Has a total water content with a tolerance not greater than ± 1.5 percent.

6. Has a total non-diluted additive content with a tolerance not greater than ± 0.2 percent. Verify that the additive dilution rate with water specified in the mix design is consistent with the paving machine being used.

7. Meets the specified properties of the following International Slurry Seal Association (ISSA) tests:

TABLE 421.03-1		
ISSA Test No.	**Description**	**Specification**
TB-139	Wet Cohesion	
	30 minutes min. (set time)	12 kg-cm min.
	60 minutes min. (traffic)	20 kg-cm min or near spin
TB-114	Wet Stripping	90 percent min.
TB-100	Wet Track Abrasion Loss 1-hour soak 6 day soak	 450 g/m² max. 650 g/m² max.
TB-144	Saturated Abrasion Compatibility	2 g loss max.
TB-113	Mix Time @ 77 °F (25 °C)	Controllable to 120 seconds
	Mix Time @ 104 °F (40 °C)	Controllable to 60 seconds
TB-147	Lateral Displacement (For Leveling and Rut Fill courses only)	5%, max.
TB-109	Excess Asphalt by LWT Sand Adhesion	538 g/m² max.

Check the ISSA TB-139 (set time) and ISSA TB-113 (mix time) tests at the highest temperature expected during construction. For the ISSA TB-113 test at 104 °F (40 °C), preheat all ingredients and containers.

B. Report the following in the mix design (all percentages are based on the dry weight of the aggregate):

1. Source and location of each individual material. Provide percentage of each aggregate source if multiple aggregate sources are used.

2. Aggregate gradation, washed and dry (dry for field QC). Provide aggregate gradation of each source and final combined if multiple sources are used.

3 . Sand equivalence of the aggregate.

4. Percentage of mineral filler and tolerance.

5. Percentage of total water and tolerance and acceptable pH range.

6. Percentage and Type of mix set additives (if required) and tolerance.

7. Percentage of Binder and residual asphalt content in the mixture.

8. Quantitative effects of moisture content on the unit weight of the aggregate per AASHTO T 19.

421.04 Quality Control Program (QCP). Create and implement a Quality Control Program (QCP) for each construction season. The QCP will cover processes conducted to provide a microsurface mixture at the project site that is uniform in composition, conforms to the specification requirements and project mix design, and that when placed is free of any defects (lack of mixing, inconsistent texture, inconsistent profile, excessive overlap at joints, streaking, drag marks, roughness, raveling, rutting, holes, and debris, etc.) within the Contractor's control at project completion. Submit a hard copy of the proposed QCP to OMM for review and acceptance. Submit by February 28 or a minimum of five (5) weeks before calibration.

Submit a hard copy and a digital copy (if available) of the QCP acceptance letter and accepted QCP to District Testing a minimum of two weeks prior to calibration. Keep copies of the letter and the QCP with each Contractor's Quality Control Manager and provide a copy of both to the Engineer. Digital copies of the QCP and letter in pdf format are allowed with the following requirements: The file icon must be appropriately labeled and be on the computer desktop. The QCP must contain page numbering and a Table

of Contents inside the front cover locating all sections by page number and out of date QCPs must be removed from the computer desktop.

Failure to comply with the approved QCP may result in work stoppage and adversely affect the Contractor's Prequalification rating.

The QCP is a reflection of a Contractor's sincerity and ability in producing a quality product. Development of this program beyond the minimum requirements specified below is encouraged.

Include in the program:

A. The assignment of quality control responsibilities. Quality control includes all efforts required to achieve a product meeting specifications. List individuals as required below and note their designated responsibilities to meet QCP requirements. Provide a Quality Control Manager who is a company employee who is routinely and usually at the paving site during placement of any microsurfacing. Provide a list designating technician responsibilities and expected actions. Ensure only trained personnel handle and test samples at all times. Define who is responsible at the project site and specific methods for ensuring mixing equipment, haul vehicles, etc. meet requirements.

B. Means for annual training of company and consultant technicians and their supervisors in ethical conduct according to company expectations. Document how and when training is given, what the expectations are, how expectations are communicated, and list all personnel trained. Describe the QC Manager's and technician supervisor's responsibilities and methods in ensuring ethical conduct is maintained throughout the year.

C. Provisions to meet the Department mix specifications.

D. Procedures for extra testing (e.g., job start, responses to poor test results or field mix problems, aggregate stock testing, moistures) and any other testing necessary to control materials not already defined in these Specifications.

E. Methods to maintain all worksheets, including all handwritten records, and other test and sample records from the project for the duration of the contract or five years, whichever is longer. Define the test record process. Define company records retention requirements. Provide copies of all test reports and forms used in the quality control process.

F. Procedures for calibration and documentation for all testing equipment. Procedures for calibration record storage. Procedure to supply documentation records of testing equipment calibration at the request of the engineer.

G. Method of performing mixing equipment calibrations including scales to be used, yield checks, and documentation for each project.

H. Procedure for random sampling to be used at the project and documentation method. Procedures for sample taking, tracking, handling, and documentation method for all samples taken at the project paving site.

I. Procedure for ensuring that every Contractor employee involved in the testing of aggregates and microsurfacing mix and operation of the mixing equipment has read the QCP and has on site access to all applicable Department specifications, proposals, policies, and the current approved JMF.

J. Procedure for ensuring binder Bills of Lading with BOL load number, binder source and grade, and binder percent residue are reviewed against running mix designs and record of review listing the above information be kept with the QC Manager for the duration of the project. Means to meet the handling and storage requirements of the Binder and tack coat suppliers.

K. Means to meet placed mixture uniformity and hauling/trucking requirements.

L. Define the roles and responsibilities of the QC Manager.

M. Signature of the Quality Control Manager and, if different, the person in authority to enforce all operations covered by the QCP as outlined in this subsection.

421.05 Weather Limitations. Apply the mixture only when it is not raining, pavement has no standing water, and the existing pavement surface and atmospheric temperature is a minimum of 45 °F (7 °C) and rising and there is no forecast of an atmospheric temperature below 32 °F (0 °C) within 24 hours from the time the mixture is applied. Between September 30 and May 1, do not apply the mixture if the existing pavement surface temperature is less than 50 °F (10 °C).

421.06 Mixing Equipment. Produce the mixture in a self-propelled, front feed, continuous loading mixing machine equipped with a conveyer belt aggregate delivery system and an interconnected positive displacement, water jacketed asphalt emulsion gear pump to accurately proportion aggregate and asphalt emulsion or a variable displacement computerized rate control to accurately proportion aggregate and asphalt emulsion. Locate the mineral filler feed so the proper amount of mineral filler is dropped on the aggregate before discharge into the pugmill. Provide a spray bar to completely prewet the aggregate dropping into the pugmill with additive and water before introduction of asphalt emulsion. Ensure that the twin-shaft, multi-blade pugmill is a continuous flow type and minimum of 49 inches (1.25 m) long. Ensure that the blade size and side clearances meet the equipment manufacturer's recommendations. Introduce the emulsion within the first one-third of the mixer length to ensure proper mixing of all materials before exit from the pugmill.

Equip the machine with opposite side driving stations to allow full control of the machine from either side. Equip the mixer with a remote forward speed control at the back mixing platform so the operator controlling the mixture placement can control forward speed and level of mixture in the spreader or rut box. Provide material control devices that are readily accessible and positioned so the amount of each material used can be determined at any time.

Equip the mixing machine with a water pressure system and nozzle type spray bar to provide a water spray ahead of and outside the spreader box when required. Apply water at a rate that will dampen the surface, but will not create free flowing water ahead of the spreader box.

The Contractor may use truck-mounted batch machines with a conveyer belt aggregate delivery system and without the front feed, continuous loading feature on projects of less than 15,500 square yards (13,000 m^2), on spot repairs, on projects with multiple routes where every route is less than 15,500 square yards (13,000 m^2), or where specified in the plans.

421.07 Equipment Calibration. Before mix production, calibrate the mixing equipment to the approved JMF in the presence of the Engineer according to Supplement 1040. Verify that the project calibration is not affected by any previous calibrations and scale factors by removing or resetting prior to starting a new calibration. Generate documentation for the Engineer, including individual calibrations of each material at various settings. Perform a calibration for each JMF used on the project. Following calibration, do not make any further calibration adjustments to the mixing equipment without the Engineer's approval. The Engineer may require additional calibrations following any equipment break down related to the aggregate delivery belt, asphalt emulsion gear pump, or mixture performance issues.

Submit the approved mix design information and JMF(s) to the Engineer and District Testing at least 48 hours prior to start of calibration.

421.08 Spreading Equipment. If a leveling or surface course is specified, apply the mixture by means of a conventional spreader box attached to the mixer.

If a rut fill course is specified, apply the mixture with a 5 to 6 foot (1.5 m to 1.8 m) width V-shaped rut filling spreader box attached to the mixer. Equip the rut filling spreader box with a steel strike-off.

If a leveling course is specified, apply the mixture with a spreader box equipped with a steel or rubber strike-off that is designed to fill wheel path ruts. A secondary strike-off may be used to reduce roughness of the leveling course but will not remove mixture in wheel path ruts or affect desired cross section.

Equip the spreader box with paddles or augers mounted on an adjustable shaft to continually agitate and distribute the materials throughout the box. Ensure that the equipment provides sufficient turbulence to prevent the mix from setting in the rut fill or spreader box or causing excessive side build-up or lumps. To prevent loss of the mixture from the spreader box, attach flexible seals, front and rear, in contact with the road. Operate the spreading equipment in such a manner as to prevent the loss of the mixture on superelevated curves.

For surface courses, attach a secondary strike-off to the spreader and adjust as required to provide a uniform mixture texture.

The Contractor may use burlap drags or other drags, if necessary, to obtain the desired finish. Replace drags having excessive build-up.

421.09 Surface Preparation. Before applying the mixture, thoroughly clean the surface.

Remove raised pavement markers according to 621.08, when specified.

Remove all existing pavement markings, except 740.02 (traffic paint), using an abrasion method conforming to 641.10.

Seal visible joints and cracks longer than 2 feet (600 mm) in length and any joint or crack greater than 1/4 inch (6 mm) in width no matter the length using Item 423 TYPE II OR TYPE III SEALANT ONLY. Apply crack sealant material at a width of 2 to 4 inches (50 to 100 mm) and at a thickness of not less than 1/16 inch (2 mm) and not greater than 3/16 inch (5 mm).

Apply a tack coat to the existing pavement surface conforming to ITEM 407 CSS-1H OR 421.02 CSS-1HM, consisting of a minimum of 15% asphalt residue achieved by diluting with water. Apply the tack coat at a rate of 0.06 to 0.12 gallons per square yard (0.25 to 0.45 L/m^2) that provides uniform coverage without excess run-off and allow tack to break before releasing to construction traffic. Adjust application rate of tack coat based on surface texture and porosity. Apply the tack coat only to areas that will be covered by the microsurface during the same day. Do not apply tack coat on top of a leveling course prior to placing the surface course.

Protect drainage structures, monument boxes, water valve, etc. during material application.

421.10 Test Strip. Construct a continuous 1000-foot (300 m) long by lane width test strip for each approved JMF(s) for the project. The test strip will demonstrate the mix and set time of the material and ability to perform under full traffic. If handwork will be performed on the project, include handwork in the test strip. Construct the test strip at the same time of day or night the full production will be applied. Perform a yield check to ensure the proper spread rate, surface quality requirements and compliance with JMF components are met. Submit results to the Engineer.

The Engineer will evaluate the completed test strip and yield check report after a minimum of 12 hours under traffic, to determine if the mix design and application is acceptable. The Contractor may begin full production after the Engineer accepts the test strip.

If the microsurfacing is being applied between May 1 and October 15, the Department may waive the test strip if the Contractor has constructed a Department accepted test strip during the same time frame with the same materials and JMF(s) and with no documented project performance issues. Provide documentation (Project Number, District, Route, Test Strip Date, Engineer, etc.) and history from the previous test strip(s) and calibration(s) to the Engineer.

421.11 Application. Apply the microsurface mixture to the prepared surface in a manner to fill cracks, shallow potholes, and minor surface irregularities and achieve a uniform textured surface without causing streaking, drag marks, skips, lumps or tears. Carry a sufficient amount of material at all times in all parts of the spreader box to ensure complete and uniform coverage. Avoid overloading of the spreader box. Do not allow lumping, balling, or unmixed aggregate in the spreader box.

When specified, place leveling courses to cover the entire pavement area as specified. Place the leveling course in a manner to maintain or improve the ride quality of the existing pavement. Provide a completed leveling course with no drag marks or tears greater than 1/2 inch (13 mm) wide, 1/4 inch (6 mm) deep, or 12 inches (25 mm) in length. Provide a completed leveling course free of flushing, bleeding, or added roughness. The completed leveling course may exhibit minor raveling upon opening to traffic but will not exhibit any continued raveling after the first four hours of traffic.

When specified, apply rut fill courses in widths from 5 to 6 feet (1.5 to 1.8 m) for each wheel path. Apply enough material to fill the wheel paths without excess crowning (overfilling). An excess crown is defined as 1/8 inch (3 mm) after 24 hours of traffic compaction. If rut depth exceeds 1.0 inches (25 mm), apply rut fill course in multiple courses. Provide a smooth, neat seam where two rut fill passes meet. Take care to restore the designed profile of the pavement cross-section. After compaction by traffic, ensure the completed rut fill does not result in deviations in excess of 1/4 inch (6 mm) as measured across each wheel path using a 6 foot (1.8 m) straight edge. Do not place microsurfacing surface course material until wheel path deviations in excess of 1/4 inch (6 mm) are corrected. Place the rut fill course in a manner to maintain or improve the ride quality of the existing pavement. Provide a completed rut fill course with no drag marks or tears greater than 1/2 inch (13 mm) wide, 1/4 inch (6 mm) deep, or 12 inches (25 mm) in length. Provide a completed rut fill course free of flushing, bleeding, or added roughness. The completed rut fill course may exhibit minor raveling upon opening to traffic but will not exhibit any continued raveling after the first four hours of traffic.

If a leveling course and a surface course are specified, apply the microsurface mixture at a minimum of 14 pounds per square yard (7.6 kg/m^2) of dry aggregate weight for the leveling course and 18 ± 1 pounds per square yard (9.8 ± 0.5 kg/m^2) of dry aggregate weight for the surface course. Apply the two courses at a minimum combined rate of 32 pounds per square yard (17.4 kg/m^2) of dry aggregate weight.

If a surface course is specified and it is not placed on a microsurfacing leveling course, apply the microsurface mixture at a rate of 22 ± 0.5 pounds per square yard (11.9 ± 0.3 kg/m^2) of dry aggregate weight. Apply the mixture in a manner to produce a uniform surface texture across the entire paving pass.

For leveling and surface courses, provide a smooth, feathered, neat seam of 1 to 3 inches (25 to 75 mm) where two passes meet at the pavement centerline and at edge of shoulder. In variable width pavement sections minimize overlap and feather overlapping pass on to the completed surface. Construct overlaps such that cross slope drainage is maintained. Immediately remove excess material from the ends of each run.

Construct surface courses at a width to cover the outside edges of rut fill and leveling courses. Construct seams at or near edge of lane but do not construct seams in wheel paths. Maintain straight edge lines along curbs and shoulders. Do not allow runoff in these areas. Ensure that lines at intersections are straight.

Use squeegees and lutes using similar material as the secondary strike-off to spread the mixture in areas inaccessible to the spreader box and areas requiring hand spreading. The Contractor may adjust the mix set additive to provide a slower setting time if hand spreading is needed. Do not adjust the water content to adjust the setting time. If hand spreading, pour the mixture in a small windrow along one edge of the surface to be covered and spread it uniformly by a hand squeegee or lute. Provide uniform appearance of the entire surface area regardless of the means used to spread material.

Ensure that the microsurfacing cures at a rate that will permit traffic on the pavement within one hour after application without damaging the pavement surface. However, should the Contractor experience a curing condition that does not allow the opening to traffic within one hour, work out an arrangement agreeable to the Engineer before releasing traffic on the pavement.

If the final surface course is not uniform in texture, free of streaks, drag marks, lumps or tears, stop applying the mixture and take steps to correct the problem. Do not resume work until the Engineer is satisfied the problem has been corrected.

421.12 Quality Control.

A. General. Use the methods described in this section to control the quality of the mixture and application, and to measure compliance. If any test results or measures of compliance exceed any of the identified quality control tolerances or specification requirements, stop placement and immediately notify the Engineer and District Testing. Identify the cause of exceeding any of the identified quality control tolerances and document in detail the corrective action necessary to bring the deficiency into compliance. Implement the corrective action and resume work and immediately perform a test or measure to confirm corrective action has resolved the deficiency. If upon resuming work the tolerances are exceeded, stop the work. Present a revised corrective action plan to, and obtain the Engineer's approval before resuming work. Upon resuming work, immediately perform a test or measure to confirm corrective action has resolved the deficiency.

The Department can obtain samples of materials at any time. Aggregate samples can be taken from sources, on-hand stockpiles, or from the mixing equipment. Work can be stopped and materials and JMF can be rejected on the basis of poor Department test results. If the Department reports non-compliance on any material test, the Department will compare results with the Contractors Quality Control Manager. The Engineer will determine if the tests or compliance measurement has been satisfactory corrected.

Prior to starting placement, verify the pH of the water to be used is within the acceptable range on the JMF. Verify again if source of water changes.

Perform a minimum of four yield checks daily with one occurring within the first 1,000 linear feet (300 linear meter) of continuous placement and the last occurring in the last 1,000 linear feet (300 linear meter). Perform at least one yield check for each course applied. For cross-overs, driveways, and any other irregular areas, determine yield checks by a means acceptable to the Engineer. Ensure yield checks are a minimum of 500 linear feet (150 linear meter) for continuous loading mixing machines or one full-loaded truck-mounted machine. Ensure yield checks meet and include documentation of compliance for sections 421.03, 421.05, 421.09, 421.11, and 421.13.

B. Binder. Within one hour of the start of production obtain and label a Binder sample from supply tanker and diluted tack coat sample from the distributor truck and give the samples to the Engineer the same day. Provide and sample the Binder and diluted tack coat in one quart (1 L) plastic containers with plastic screw tops. Label and retain one sample per each additional day for the Department. Take more samples when requested by the Engineer.

Visually inspect Binder in supply tanker(s) to ensure uniform material with no separation or contamination. Verify temperature of Binder and tack coat. Monitor and verify proportioning of asphalt emulsion and water into distributor and proper mixing before use or sampling. Perform a minimum of one Binder and tack coat cook-off each production day to determine the residue content of the Binder and tack coat and verify compliance.

C. Aggregate. Ensure the aggregate stockpile gradation does not vary by more than the stockpile tolerance in Table 421.02-3 compared to the approved JMF and does not exceed the design gradation band for No. 200 (75 µm) sieve. Ensure the percent passing does not change from the high end to the low end of the range for any two consecutive sieves.

Verify the blending and screening of aggregates at the stockpile site and sample the blended and screened aggregate for QC testing.

Stockpile a minimum of 10 percent of the project aggregate or 200 tons (180 metric tons) of aggregate whichever is less at a staging area. Obtain three (3) aggregate samples from the stockpile and perform gradation testing on each sample according to AASHTO T 2, AASHTO T 248, Supplement 1004 (AASHTO T 11 where required), and moisture content per AASHTO T 255. Use dry gradations for determining the No. 200 (75 µm) sieve. Determine the percent passing for each sieve size listed in Table 421.02-3. Calculate the average of each sieve for all three tests. Ensure the average value for each sieve is within the requirements of Table 421.02-3. Do not begin production if not in compliance with gradation band and stockpile tolerance.

At a minimum test one sample taken from the stockpile randomly during each production day. Include additional testing when directed to sample and test by the Engineer. The Contractor may perform an additional aggregate test to verify results if first test is not in compliance with stockpile tolerance. Report and track all test results and monitoring trending of the aggregate gradation within the stockpile.

Reject aggregate that does not meet the stockpile tolerance in Table 421.02-3 compared to the approved JMF. Do not exceed the design gradation band for No. 200 sieve.

For data collection by the Department, if requested by the Engineer, obtain a mix sample randomly during the day by dragging a tube sampler across material under the mixer but before the spreader box as it moves forward. Obtain a 10 pound (4,535 gram) minimum mix sample, put in a suitable plastic container, and provide to the Engineer.

D. Mixture Application. Ensure the Quality Control Manager and trained technicians perform and use the methods described in this section to control quality and measure compliance.

1. Supervise the mixing machine calibration, test strip application, and verify compliance before production begins.

2. Establish with the mix operator restrictive operating limits for use of total mixture water, additive, and mineral filler subject to weather conditions and course applied.

3. Maintain all calibration records and compare calibration results for each project through construction season.

4. Direct all material input settings required to produce mix design compliance.

5. Verify mixture meets required mix time, set time and mix consistency.

6. Perform an aggregate moisture test at the start of each production day.

7. Communicate and direct any desired adjustments with the Binder supplier (asphalt emulsion) for mix and set time properties.

8. Evaluate roadway for determination of planned application rates and maintain direct communication with Department personnel, application personnel, and Engineer on all compliance issues.

9. Verify and document that all cracks greater than 1/4 inch (6 mm) in width and all cracks longer than two feet (50 mm) have been filled and that the crack sealant is in compliance with thickness requirements.

10. Monitor roadway during application for proper surface cleaning.

11. Monitor application of tack coat for proper coverage and document application rate.

12. Monitor mixture placement for consistency, uniformity of thickness across paving pass, and use of water spray bars.

13. Monitor mixture application rate and finishing methods to ensure uniform surface.

14. Monitor cross section compliance subject to course type specified.

15. Monitor set properties for opening to traffic and durability under traffic.

16. Monitor daily production reports for compliance with mix design tolerances.

17. Maintain each material usage by ticket weight and verify consistency to mixing machine calibrated use.

18. Direct adjustments of material settings and mixture subject to material test results and field performance.

19. Monitor haul trucks, mixing machine, and allied equipment for oil drippings, aggregate spillage and other factors that may affect the adherence or performance of the applied mixture.

E. Documentation. Provide the Engineer a daily report no later than the next calendar day (excluding Sundays) with the following:

1. A printout from the mixing machine showing the total pounds of aggregate, emulsion, and cement as well any other materials capable of being printed used for the day as part of the daily production report.

2. Project number, county, and route.

3. Date, air temperature, pavement temperature, and humidity.

4. Binder temperature, percent residue, and pounds per gallon (grams per liter)

5. Production report with course(s) applied, lane(s) completed, location of work, daily summary of each material used, application rate for each course and lane and total area per course.

6. Yield checks on application rate and compliance with application placement requirements (four per day, minimum).

7. Gradation and moisture content (one random sample during the day and any other samples when directed by the Engineer).

8. Total gallons (L) of tack cost used and residual asphalt content.

9. Quality Control Tests and Reports.

10. Contractor representative's signature.

Provide a Bill of Lading for Binder and aggregate as requested or at project completion.

421.13 Acceptance. Maintain continuous control of the Binder to dry aggregate proportioning to conform to the approved JMF(s) within a tolerance of ± 1.5 gallons per ton (±6.4 L/metric ton). Control the spread rate to not less than the specified quantity of aggregate per square yard (square meter) on a dry weight basis.

The Engineer will base acceptance of the binder-to-dry aggregate proportion and spread rate on the Engineer's summary of quantities used each day. The Engineer will approve and accept a day's application of microsurfacing provided:

A. The Engineer's summary indicates conformance with the above control requirements for proportioning and spread rate and

B. The course(s) applied are in compliance with the application requirements of this specification and

C. The pavement cracks are sealed prior to placement of the microsurface and

D. The Quality Control requirements are met and

E. The pavement is uniform in composition and texture, free from excessive scratch marks, tears, rippling and other surface irregularities (segregation, raveling, rutting, holes, debris, etc.), longitudinal joints and lane edges coincide with any lane lines and edge lines and transverse joints are uniform, neat and provide a smooth transition.

The spread rate requirement does not apply to rut fill courses if the Contractor filled the wheel paths according to this specification.

421.14 Performance Review. Perform remedial actions for any defect exceeding the threshold levels in Table 421.14-1 for a period of two years from the date of substantial work complete as documented on the Department's Form C-85. Contact the Department to schedule a final performance review at least 60 days prior to the end performance review period. The Department will review the pavement before the end of the two-year performance review period to determine if remedial action is required. The Department will issue the results in writing to the Contractor upon completion of the performance review.

Remedial Actions. Perform Remedial Actions by October 15th of the same year as the review. If the Department determines that immediate repairs are necessary, due to a potential hazard to the traveling public, the Department will notify the Contractor and establish a date that all repairs are to be finished.

Provide construction traffic control when performing any work required or allowed by this specification in accordance with current Department policy and the Ohio Manual of Uniform Traffic Control Devices. Obtain Department approval for the time the work will be performed.

Provide approved materials, equipment, and labor to perform Remedial Actions at no additional cost to the Department. Prior to performing a Remedial Action, submit a Remedial Action plan to the DCE for approval. State in the plan when and how the Remedial Action will be performed; what material will be used; and how traffic will be controlled. Warrant Remedial Action work for the remainder of the warranty period.

Use only microsurfacing for permanent repair and resurfacing areas. Perform temporary repairs using material approved by the DCE. Replace temporary repairs with a permanent repair as soon as weather permits.

Replace pavement markings or raised pavement markers (RPM) removed, obliterated, or damaged while performing a Remedial Action with equivalent approved pavement markings or RPM products at no cost to the Department.

The Contractor is not responsible for pavement damage beyond the Contractor's control (i.e., car fire, oil spill, structural issues etc.).

TABLE 421.14-1

Defect Type	**Threshold Level [6] (allowable distress levels)**
Non-uniform texture [1]	300 square feet (28 m^2)
Surface Loss [2]	20 square feet (1.8 m^2)
Raveling [3]	300 square feet (28 m^2)
Rutting [4] [5]	0.25 inch (6.5 mm) continuous in any Segment.
Notes:	
(1) Texture inconsistencies in either the transverse and or longitudinal direction.	
(2) Loss of surface by traffic wear, debonding, or delamination.	
(3) "Moderate" level raveling as defined in the Strategic Highway Research Program (SHRP) "Distress Identification Manual for the Long-Term Pavement Performance Project" (SHRP-P-338).	
(4) Measure the wheel path with a 4 foot (1.2 m) straight edge.	
(5) Only applies during the first 120 days of Warranty or after any Warranty work.	
(6) Based on 1000 foot (300 m) lane Segment. The beginning of a Segment is the beginning of any distress type.	

If any 1000 foot (300 meter) lane segment has repairs or defects greater than 5 percent of the area, resurface with a full lane width of microsurfacing meeting the requirements of this specification.

421.15 Method of Measurement. The Department will measure Microsurfacing, Surface Course and Microsurfacing, Leveling Course by the number of square yards (square meters), complete and accepted in place. The Department will base the width of the pavement course on the width shown on the plans, specified in this specification, or directed by the Engineer. The Department will measure the length along the centerline of each roadway or ramp.

The Department will measure the number of raised pavement markers removed.

The Department will measure Microsurfacing, Rut Fill Course by the number of tons (metric tons) of dry aggregate used, complete and accepted in place. The Department will base the weight of the dry aggregate used on the calibrated unit weight as reported from the aggregate delivery belt.

421.16 Basis of Payment. The cost of tack coat and Item 423 Crack Sealing is incidental to microsurfacing.

The Department will pay for removal of existing pavement markings according to 421.08 under Items 643, 644, 645, 646, 647, and 648 as specified. The Department will pay for removal of existing raised pavement markers according to Item 621 Raised Pavement Markers Removed.

The Department will pay for the construction of accepted test strips at the individual bid prices for the courses constructed.

The Department will pay for accepted quantities at the contract prices as follows:

Item	Unit	Description
421	Square Yard (Square Meter)	Microsurfacing, Surface Course
421	Square Yard (Square Meter)	Microsurfacing, Leveling Course
421	Ton (Metric Ton)	Microsurfacing, Rut Fill Course

422.06

On page 218, **Replace** the third and fourth paragraph of section 422.06 with the following:

Remove the raised pavement markers according to 621.08.

422.09

On page 220, **Replace** the last paragraph with the following:

Before opening to traffic, post the roadway with "Loose Gravel/Fresh Tar" signs and a "35 mph" speed plaque mounted below the sign. Ensure that signs conform to Item 614. Place these signs in the advance warning area and just beyond each intersecting road throughout the length of the activity area. Remove the signs as directed by the Engineer.

422.13

On page 224, **Replace** the last paragraph of section 422.13 with the following:

The Department will measure the number of raised pavement markers removed.

422.14

On page 224, **Replace** the third and fourth paragraph of section 422.14 with the following:

The Department will pay for removal of existing raised pavement markers according to Item 621 Raised Pavement Markers Removed.

441.02

On page 231, **Replace** the fifth and sixth paragraphs with the following:

If the F/A ratio using total asphalt binder content is greater than 1.0 recalculate it using the effective asphalt binder content. Calculate the effective asphalt binder content according to the Asphalt Institute

Manual Series No. 2. The value (calculated to the nearest percentage point) of the Fifty to Thirty (F-T) value, is the percent of total aggregate retained between the No. 50 (300 μm) and No. 30 (600 μm) sieves, minus the percent of total aggregate retained between the No. 30 (600 μm) and No. 16 (1.18 mm) sieves.

Use a PG 64-22 asphalt binder for a Type 1 Intermediate course unless RAP and/or RAS used according to 401.04 require a virgin binder grade change. Use a PG 64-22 asphalt binder for a Type 2 intermediate course unless RAP and/or RAS used according to 401.04 require a virgin binder grade change. Use a PG 64-22 asphalt binder and Type 1 surface gradation for asphalt concrete for driveways and under guardrails.

441.05

On page 234, **Replace** the first paragraph with the following:

441.05 JMF Field Adjustments. During the first three days of production the Contractor may adjust the JMF gradation within the below limits without a redesign of the mixture. For projects with less than 3 days of production, give District Testing written notice of any JMF gradation adjustments within 1 workday following the last day of production. Limit adjustments of the JMF to conform to actual production, without a redesign of the mixture, to ±3 percent passing each of the 1/2 inch (12.5 mm), No. 4 (4.75 mm), and No. 8 (2.36 mm) sieves and ±1 percent passing the No. 200 (75μm) sieve. Do not exceed the limits in Table 441.02-1 and Table 442.02-2 in the adjusted JMF. The adjustment on the 1/2 inch (12.5 mm) sieve applies only to Type 2 mixes. Determine the need for any JMF gradation adjustments in the time specified. Should no adjustments be made, the Department will base acceptance on conformance to the original JMF. After the time period specified, the Department will allow no further adjustment of the JMF.

441.10

On page 238, **Replace** TABLE 441.10-1**,** with the following:

TABLE 441.10-1

Mix Characteristic	Out of Specification Limits[5]
Asphalt Binder Content[1]	-0.3% to 0.3%
1/2 inch (12.5 mm) sieve[1]	-6.0% to 6.0%
No. 4 (4.75 mm) sieve[1]	-5.0% to 5.0%
No. 8 (2.36 mm) sieve[1]	-4.0% to 4.0%
No. 200 (75 μm) sieve[1]	-2.0% to 2.0%
Air Voids[2]	2.5% to 4.5%
Air Voids[3]	3.0% to 5.0%
MSG[4]	-0.012 to 0.012
[1] deviation from the JMF [2] for Design Air Voids of 3.5% [3] for Design Air Voids of 4.0% [4] deviation from the MTD [5]unless otherwise restricted by mix type specification	

442.02

On page 240, **Replace** the first paragraph with the following:

442.02 Type A Mix Design. Design the mixture composition for a Type A mix according to 441.02 and the most recent Asphalt Institute Manual Series No. 2 (MS-2) for design procedures and material properties except as modified by this subsection. Include in the JMF submittal the standard

Department cover and summary page; all printouts from the gyratory compactor (all gyratory points not necessary); and analysis covering the required mix properties. Unless otherwise directed submit one compacted gyratory sample and loose mix for compaction of another sample, in addition to a 5-pound (2000 g) loose sample, for each JMF.

442.02

On page 241, **Replace** the second paragraph**,** with the following:

The restricted zone does not apply. Use control points according to MS-2, except as specified in Table 442.02-2.

442.02

On page 241, **Replace** the TABLE 442.02-2**,** with the following:

TABLE 442.02-2 AGGREGATE GRADATION REQUIREMENTS

Sieve Size		9.5 mm mix	12.5 mm mix	19 mm mix
		Total Percent Passing		
1 1/2 inch	(3.75 mm)	–	–	100
3/4 inch	(19 mm)	–	100	85 to 100
1/2 inch	(12.5 mm)	100	95 to 100	90 max
3/8 inch	(9.5 mm)	90 to 100	96 max	–
No. 4	(4.75 mm)	70 max	52 to 60[1]	–
No. 8	(2.36 mm)	34 to 52	34 to 45	28 to 45
No. 200	(75 µm)	2 to 8	2 to 8	2 to 6
[1] For the No. 4 sieve do not exceed 63 in production.				

442.02

On page 241, **Replace** the TABLE 442.02-3**,** with the following:

TABLE 442.02-3 VMA CRITERIA

Mix	VMA (percent minimum)
9.5 mm	15.0
12.5 mm	14.0
19.0 mm	13.0

442.05

On page 242, **Add** the following paragraph after the first paragraph:

For 12.5mm mixes ensure the percent passing the No. 4 sieve does not exceed 63 in production. If two tests in a row or any two tests in two days (QC and/or 448 sublot) exceed 63 stop production and notify District Testing.

442.05

On page 242, **Delete** the last three sentences of the third paragraph. “For 12.5mm mixes … are made.”

451.04.A

On page 254, **Replace** the first sentence of the third paragraph with the following:

Finish small areas, irregular areas, and areas that are inaccessible to finishing equipment using other methods as approved by the Engineer.

451.09.B

On page 259, **Replace** Table 451.09-1 DOWEL SIZE with the following:

TABLE 451.09-1 DOWEL SIZE

Thickness of Pavement	Diameter of Solid Dowel	Tubular Dowel	
		Outside Diameter	Wall Thickness
Less than 8 1/2 inches (215 mm)	1 inch (25 mm)	-	-
8 1/2 to 10 inches (215 to 255 mm)	1 1/4 inches (32 mm)	1 5/16 inches (33 mm), or 1 3/8 inches (35 mm)	0.120 inches (3 mm)
Over 10 inches (255 mm)	1 1/2 inches (38 mm)	1 5/8 inches (41 mm)	0.120 inches (3 mm)

451.09.B

On page 259, **Add** the following paragraph immediately after Table 451.09-1 DOWEL SIZE:

Ensure each end of tubular dowel is fitted with a snug fitting plug style insert cap that does not exceed the outside diameter of the tubular dowel, to prohibit any intrusion of concrete or other materials.

455.03.A.1.a

On page 277, **Replace** the first sentence with the following:

A lot consists of concrete of the same JMF.

499.02

On page 286, **Add** the following to the first paragraph:

Carbonate Micro-Fines …….....701.14

499.03

On page 286, **Replace** the third sentence of the first paragraph with the following:

The design air for concrete with 1 inch nominal maximum size aggregate is 7 percent.

499.03

On page 287, in Table 499.03-1 **Replace** the table columns heading with:

Quantities per Cubic Yard Provide Concrete with 7±2% Air Content

499.03

On page 287, in Table 499.03-1 **Replace** footnote 2 with the following:

[2] Cementitious Content includes cement, pozzolan, and carbonate micro-fines materials, denoted as Cm.

499.03

On page 287, **Replace** Table 499.03-2 with the following:

TABLE 499.03-2 POZZOLAN AND CARBONATE MICRO-FINES MATERIALS	
MATERIAL	**MAXIMUM CONTENT (%)**
Fly Ash	25
GGBFS	30
Micro-Silica	10
Carbonate Micro-Fines [1]	20
When using multiple pozzolan and carbonate micro-fines materials, do not exceed the individual maximum contents above for each material. A combination of pozzolan and micro-fines materials may not exceed 50% of the total cementitious content by weight.	
[1] Not for use in QC 2 or QC 3 concrete.	

499.06

On page 291, **Replace** Table 499.06-1 with the following:

TABLE 499.06-1 CONCRETE BATCHING TOLERANCES

Material	Batching Tolerance (%)
Cement	±1.0
Pozzolan	±1.0
Carbonate Micro-Fines	±1.0
Aggregates	±2.0
Water[1]	±1.0
Chemical Admixtures	±3.0

[1]Measured by weight or volume

499.07

On page 292, **Replace** Table 499.07-1 with the following:

TABLE 499.07-1 EVERY BATCH TICKET	
Name of ready-mix batch plant	
Batch plant No.	
Batch plant location	
Serial number of ticket	
Date	
Truck number	
Class of concrete	
JMF Number	
Batch time	
Batch size	yd^3 (m^3)
Actual weights of cementitious material:	
Cement	lb (kg)
Fly ash	lb (kg)
GGBFS	lb (kg)
Microsilica	lb (kg)
Carbonate Micro-Fines	lb (kg)
Other	lb (kg)
Actual weights of aggregates:	
Coarse	lb (kg)
Intermediate	lb (kg)
Fine	lb (kg)
Other	lb (kg)
Actual weight of water	lb (kg)
Actual volume of admixtures:	
Air-entrainer	fl oz (mL)
Superplasticizer	fl oz (mL)
Water-reducer	fl oz (mL)
Retarder	fl oz (mL)
Other	fl oz (mL)
Aggregate moisture contents:	
Coarse aggregate	%
Intermediate aggregate	%
Fine aggregate	%
Water-cementitious ratio, leaving the plant	

499.07

On page 293, **Replace** Table 499.07-2 with the following:

TABLE 499.07-2 FIRST TICKET EACH DAY, EACH JMF

Cementitious Materials:	Source:	Grade or Type:
Cement		
Fly ash		
GGBFS		
Microsilica		
Carbonate Micro-Fines		
Other		
Admixtures	Brand:	Type:
Air-entrainer		
Retarder		
Superplasticizer		
Water-reducer		
Other		

500

On page 294, **Replace** the title of subsection 501.05 with:

501.05 Submittal of Engineered Drawings

501

Add the following section into the heading:

501.07 Welded Attachments

501.04.A.

On page 294, **Replace** the first paragraph with the following:

Submit shop drawings to the OMM and the District Office of Planning and Engineering before the start of fabrication on Item 513, UF Level or at least 3 days before the pre-fabrication meeting, per 513.07 or 515.07 as follows:

501.04.B.

On page 295, **Revise** the second paragraph to the following:

Submit two copies of the shop drawings to the Engineer and one copy to the District Office of Planning and Engineering with the materials delivered to the project. Do not incorporate material into the work until after submitting the drawings. Department approval of these shop drawings is not required.

501.04.C.

On page 295, **Revise** the second paragraph to the following:

Shop drawings shall be neatly and accurately drawn on 11 x 17 inch or 22 × 34-inch (280 x 432 mm or 559 × 864 mm) sheets. Submit the shop drawings electronically in pdf format.

On page 296, **Delete** the last paragraph in the subsection, beginning with "After all fabrication…".

501.05

On page 296, **Revise** the second paragraph to:

Perform daily inspections to ensure the work governed by the Engineered Drawing is functioning as designed. Report malfunctioning work to the Engineer immediately.

501.05

On page 296, **Replace** the title of subsection 501.05 with:

501.05 Submittial of Engineered Drawings.

501.05.A

On page 296, **Revise** the fourth paragraph as follows:

A. Projects with Railroad Involvement. Prepare and provide Engineered Drawings listed in this section as follows:

Have competent individuals prepare, check and initial each Engineered Drawing. The preparer and checker shall be different individuals. Provide, on the cover sheet or submittal letter, the first name, last name and initials of each preparer and checker performing work on the Engineered Drawings. Have an Ohio Registered Engineer sign, seal, and date the cover sheet or submittal letter according to ORC 4733 and OAC 4733-35. If multiple preparers or multiple checkers created the drawing, then the cover sheet or submittal letter shall clearly indicate the portions for which each person is responsible.

Submit Engineered Drawings to all involved railway companies at least 50 days before planned construction begins. Obtain acceptance from all involved railroad companies. Furnish the Engineer copies of all correspondence with the railroad, documentation of railroad acceptance and the Engineered Drawings accepted by the railroad.

Schedule an Engineered Drawing meeting to be held 7 days, or less ~~at the discretion of the Engineer,~~ after submitting railroad accepted drawings to the Engineer. The signatory Engineer responsible for the Engineered Drawing design, the Superintendent, the Engineer and the Inspector may participate in the meeting in person, via conference call or via video conference. The Engineer ~~may~~ will invite the responsible designer of the Plans for assistance. The purpose of the meeting shall be to review the drawings; resolve all issues to the Engineer's satisfaction and ensure all parties are in agreement with the work to commence. At the conclusion of the meeting, the Engineer will provide a written response to the submittal in accordance with C&MS 105.02. Do not begin work until the Engineer's acceptance has been received.

Perform all work in accordance with the ODOT accepted Engineered Drawings. Immediately cease all operations that deviate from the ODOT accepted Engineered Drawings. If a deviation is necessary, prepare revised Engineered Drawings as noted above and furnish the Engineer a copy of revised Engineered Drawings including documentation of acceptance from all involved railroad companies. Schedule an Engineered Drawing meeting as noted above to be held 24 hours, or less at the discretion of the Engineer, after submitting the revised railroad accepted drawings. At the conclusion of the meeting, the Engineer will provide a written response to the submittal in accordance with C&MS 105.02. Do not begin work until the Engineer's acceptance has been received.

The Department will consider delays resulting from Engineered Drawing deviations as non-excusable in accordance with 108.06.E.

This section applies to Engineered Drawings for the following:

1. Bracing adjacent to the railroad tracks. Perform work according to 501.05.B.1.

2. Demolition of structures over or within 14 feet of railroad tracks. Perform work according to 501.05.B.2.
3. Erection of structural members over or within 14 feet of railroad tracks. Perform work according to 501.05.B.4.

501.05.B

On page 296, **Revise** the third paragraph as follows:

B. Projects without Railroad Involvement. Prepare and provide Engineered Drawings listed in this section as follows:

Have competent individuals prepare, check and initial each Engineered Drawing. The preparer and checker shall be different individuals. Provide, on the cover sheet or submittal letter, the first name, last name and initials of each preparer and checker performing work on the Engineered Drawings. Have an Ohio Registered Engineer prepare, sign, seal and date the cover sheet or submittal letter according to ORC 4733 and OAC 4733-35. If multiple preparers or multiple checkers created the drawing, then the cover sheet or submittal letter shall clearly indicated the portions for which each person is responsible.

Schedule an Engineered Drawing meeting to be held 7 days, or less ~~at the discretion of the Engineer,~~ after submitting drawings to the Engineer. The signatory Engineer responsible for the design, the Superintendent, the Engineer and the Inspector will participate in the meeting in person, via conference call or via video conference. The Engineer ~~may~~ will invite the designer of the contract Plans for assistance. The purpose of the meeting shall be to review the drawings; resolve all issues to the Engineer's satisfaction and ensure all parties are in agreement with the work to commence. At the conclusion of the meeting, the Engineer will provide a written response to the submittal in accordance with C&MS 105.02. Do not begin work until the Engineer's acceptance has been received.

Perform all work in accordance with the accepted Engineered Drawings. Immediately cease all operations that deviate from the accepted Engineered Drawings. If a deviation is necessary, prepare revised Engineered Drawings as noted above and furnish the Engineer a copy of revised Engineered Drawings. Schedule an Engineered Drawing meeting as noted above to be held 24 hours, or less at the discretion of the Engineer, after submitting the revised drawings. At the conclusion of the meeting, the Engineer will provide a written response to the submittal in accordance with C&MS 105.02. Do not begin work until the Engineer's acceptance has been received.

The Department will consider delays resulting from Engineered Drawings deviations as non-excusable in accordance with 108.06.E.

This section applies to Engineered Drawings for the following:

1. Cofferdams and Excavation Bracing. If a complete design is not provided in the plans, provide Engineered Drawings for excavations when the edge line of a roadway used to maintain traffic is located within a distance of one-half times the excavation height or for excavations that expose any side of an excavation to a height exceeding eight feet.

The Contractor may construct the design(s) shown on the plans without an Engineered Drawing submittal or prepare an alternate design. Submit Engineered Drawings for all alternate Cofferdam and Excavation Bracing designs. Perform all Work as specified below:

a. Locate Cofferdams and Excavation Bracing according to the contract, if shown.
b. Maintain temporary horizontal and vertical clearances according to the contract.
c. Include the effects of AASHTO live, dead and temporary construction load surcharges as necessary.

d. Design Cofferdams and Excavation Bracing to support the sides and bottom of an excavation for all phases of work in accordance with the latest *AASHTO Guide Design Specifications for Bridge Temporary Works*, Section 4 and the latest edition of either the AASHTO LRFD Bridge Design Specifications or the AASHTO Standard Specifications for Highway Bridges.

2. Demolition of Bridges or portions of Bridges in which the work endangers the public welfare, or life, health or property. Perform all Work as specified below:

a. Provide temporary devices or structures necessary to protect traffic during all demolition activities. Provide traffic protection when demolition is located less than 12' horizontally from active traffic on structures of less than 25' vertical clearance. Increase the 12' minimum horizontal distance 1 foot for each 2 feet of additional height greater than 25'.

b. Never lift the portions of structure being removed over active traffic. Before releasing traffic make the remaining structure stable.

c. Design traffic protection devices or structures when over live traffic, for a minimum load of 50 pounds per square foot plus the weight of equipment, debris and any other load to be carried. Include any portion of the deck that cantilevers beyond the fascia beams or girders.

d. In lieu of temporary devices or structures required in "a." above, provide a vertical barrier. Design the vertical barrier with rigid or flexible materials specifically designed for demolition containment. Extend the enclosure up to the bottom of the deck and down to the ground. Maintain all materials free of tears, cuts and holes.

e. Maintain temporary horizontal and vertical clearances according to the contract.

f. Locate structural members to be reused before performing any removal operations.

g. Do not damage structural members being reused during any removal operation.

h. Perform Work so that all members are stable during all operation and loading conditions.

i. Provide the method and sequence of the removal operations. Include the type and location of equipment to be used during the demolition.

j. Perform Work according to 501.05.B.6.

3. Falsework for cast-in-place concrete slab bridges. Perform all work according to 508 and as specified below:

a. Provide a camber table to account for the deflection of the falsework loaded with its self weight and the weight of wet concrete. Also include in the table, the specified camber to compensate for slab deflection after the falsework is released.

b. Maintain temporary horizontal and vertical clearances according to the contract.

c. As a minimum design falsework over waterways for a five year flood or with 75 percent of the effective waterway opening of the proposed structure. The Contractor is responsible

for any damages caused by upstream flooding due to insufficient temporary structure size or the accumulation of debris or sediment in the channel.

d. Support falsework foundations located within the ten year flood limits on rock, shale or piles driven to a minimum depth of 15 feet, and to sufficient penetration to carry superimposed loads or until refusal on rock.

e. The incorporation of structural steel shapes, used as temporary support members, into a finished concrete slab superstructure is prohibited.

f. Design falsework in accordance with the latest AASHTO Guide Design Specifications for Bridge Temporary Works, Section 2.

4. Erection of steel or precast concrete structural members as specified below:

a. Never lift structural members over active traffic. Before releasing traffic make structural members stable.

b. Supply any temporary supports or braces necessary to maintain structural stability and prevent lateral movement until completion of all construction activities.

c. Perform Work according to 501.05.B.6, 513 or 515.

d. Do not field weld temporary members to permanent steel members.

e. Maintain temporary horizontal and vertical clearances according to the contract.

f. Provide drawings with at least the following information:

(1) Site Plan of the work area showing permanent support structures (piers and abutments); roads; railroad tracks; waterways; overhead and underground utilities; and other information pertinent to erection.

(2) Erection sequence for all members, noting any temporary support conditions, such as holding crane positions, temporary supports, falsework etc. Member reference marks, when reflected on the erection plans, should be the same used on the shop drawings.

(3) Primary member delivery location and orientation.

(4) Maintenance of Traffic during erection operations.

(5) Location of each crane for each primary member pick, showing radius and crane support (barges, mats, etc.).

(6) Capacity chart for each lifting equipment configuration and boom length used in the work.

(7) Center of gravity locations for primary member.

(8) Rigging weights, capacity and arrangement for primary member picks.

(9) Lifting weight of primary member picks, including all rigging and pre-attached elements.

(10) Details of any temporary lifting devices to be bolted or welded to permanent members, including method and time (shop or field) of attachment; capacity; and method, time, and responsibility for removal.

(11) Blocking details for bridge bearings.

5. Jacking and support of existing structures as specified below:

a. Support the structure on temporary supports and brace as necessary to maintain structural stability and prevent lateral movement until completion of the permanent supports. Do not rely on jacks lifting system alone,(e.g. hydraulic system), to support the structure except during the actual jacking operation. Remove all temporary supports upon completion of the jacking procedure.

b. Maintain a maximum differential jacking height of 1/4 inch between any adjacent beam lines.

c. Maintain a maximum differential jacking height of 1 inch between any adjacent abutments or piers.

d. Place jacks and any load plates at least 2 inches from the edges of any concrete substructure seats.

e. Do not field weld temporary members to permanent steel members.

f. Maintain temporary horizontal and vertical clearances according to the contract.

6. When the total load applied to a structure during construction, (new or structure being rehabilitated), exceeds 75 percent of the legal limit, (The Legal Limit is 80,000 lbs. or percentage thereof if posted), the load effects on the structure shall be analyzed based on the operating level calculated by the Load Factor Rating Method as given in the *AASHTO Manual for Bridge Evaluation*.

7. Structures for maintaining traffic in accordance with Item 502.

a. For structures located over or within 14 feet of railroad tracks, submit plans in accordance with 501.05.A.

b. Perform Work according to 501.05.B.6.

501.05.C

On page 300, **Revise** the subsection to:

C. Corrective Work. Unless otherwise noted, before performing corrective work on structure items, 507,511,513,515,516,517 and 524, prepare a Corrective Work Plan (CWP). Submit three copies of the CWP to the Engineer for acceptance 30 days, or less at the discretion of the Engineer before construction begins. Have an Ohio Registered Engineer prepare, sign, seal and date each CWP. Obtain Department acceptance before beginning corrective work.

Perform all Work in accordance with the accepted CWP. Immediately cease all operations that deviated from the accepted CWP. If a deviation is necessary, furnish the Engineer three copies of a revised CWP. The revised CWP shall be signed, sealed and dated by an Ohio Registered Engineer. Obtain Department acceptance of revised CWP prior to performing corrective work.

Perform all corrective work, including the preparation of the CWP and revisions at no expense to the Department. The Contractor shall reimburse the Department for all CWP review costs of the Designer of Record. The Department will consider delays resulting from all corrective work as non-excusable in accordance with 108.06E.

501.05.D

On page 300 **Delete** entire subsection.

501.07

On page 301, **Add** the following Section:

501.07 Welded Attachments. Prepare and provide a detailed request showing weld size, length, type and location for welding permanent or temporary attachments to main structural members not shown or permitted by contract. Submit request to the Office of Structural Engineering at least 20 days before construction begins. Obtain acceptance before performing work. Perform work according to 513.

503.03

On page 303, **Replace** the first sentence with:

This item includes the preparation of an Engineered Drawing according to 501.05, and the construction, maintenance, and subsequent removal of all cofferdams and excavation bracing.

507.04

On page 313, **Replace** the tenth full paragraph with:

Do not use a follower unless approved by the Office of Geotechnical Engineering. If the Office of Geotechnical Engineering does approve the use of a follower, account for the increased energy loss when determining the required driving criteria.

507.06

On Page 314, **Replace** the section in its entirety with the following:

507.06 Cast-in-Place Reinforced Concrete Piles. Provide cast-in-place reinforced concrete piles with a plain cylindrical casing conforming to 711.03. Measure the pile diameter to the outside diameter of the casing.

Ensure that the pile casings are watertight after being driven. If furnished, shoes or points shall not project more than 1/4 inch (6 mm) outside the vertical surface of the casing.

The nominal pile wall thickness, t, is the greater of either 0.250 inches (6.66 mm) or the thickness determined using the following formula:

t (inches) =	R (lb) / 900,000		t (mm) =	R (N) / 157,606

Where:

R = Ultimate bearing value in pounds (newtons)

For cast-in-place piles containing reinforcing steel, place reinforcing steel as stated in the second and third paragraph of 524.09 and place concrete according to 524.11.

After installation, cover the tops of driven casings until the concrete is placed. Before placing concrete, remove accumulated water or other foreign matter in a driven casing. Place concrete for cast-in-place piles using methods that prevent voids, however, do not vibrate the concrete.

508.02

On page 318, **Replace** the eighth paragraph with the following:

Remove falsework only after the concrete conforms to 511.14 and before final acceptance of the structure. Cut off or pull falsework piling. Cut off piles to at least the slope line, riprap line, or stream bed.

508.02

On page 318, **Replace** the thirteenth paragraph with the following:

For continuous concrete slab or beam superstructures, do not place concrete on a span until the falsework and forms are complete for the adjacent spans. Do not release or remove falsework from a span until the concrete in adjacent spans has been placed a sufficient length of time to meet all requirements for the removal of falsework as set forth in 511.14. Inserts cast into prestressed members for the purposes of falsework support shall be galvanized according to 711.02 and shall be shown in the shop drawings according to 515.06.

508.03

On page 319, **Revise** the first paragraph to the following:

Construct substantial, unyielding, and mortar tight forms, designed to produce a finished concrete conforming to the proper dimensions and contours. Make forms for exposed surfaces of approved material requiring a minimum number of joints or of dressed lumber of uniform thickness using form liner approved by the Engineer. Use forms and form liners to reduce the joints showing on the finished surface to a minimum. Arrange joints to coincide with rustication grooves shown on the plans. Properly brace or tie forms together using form ties that do not allow metal within 2 inches (50 mm) of an exposed surface of the finished structure after the forms are removed. For ties in the region of exposed surfaces, use an approved insert. Remove all forms and do not allow material, except reinforcing supports specified in 509.08, to remain in the concrete.

508.05

On page 319, **Revise** the last sentence to:

The Department will not pay for dynamic load testing as required in 508.02 to determine blow count if piles are not driven to rock.

509.04

On page 321**, Replace** the last five sentences with the following**:**

Install reinforcing steel with the following clearances from the concrete surface:

A. 2 1/2 inches [-0 inch, +0.5 inch] (65 mm [-0 mm, +13 mm]) to the top of sidewalks.

B. 3 inches [-0 inch] (75 mm [-0 mm]) at the faces of footings placed against rock or earth.

C. 1 1/2 inches [-0 inch, +0.25 inch] (38 mm [-0 mm, +6 mm]) to the bottom of a cast-in-place deck slab.
D. 2 1/2 inches [-0.25 inch, +0.75 inch] (65 mm [-6 mm, +19 mm]) between the reinforcing steel and the top surfaces of cast-in-place concrete deck slabs.
E. 2 inches [-0 inch, +0.5 inch] (50 mm [-0 mm, +13 mm]) at all other surfaces.

509.07

On page 322, **Replace** the second paragraph with:

Mechanical connectors shall be capable of developing 125 percent of the yield strength of the connected bars. For threaded connections, do not reduce the nominal area of the bars shown in the plans without increasing the grade of the reinforcing bar shown in the plans. The total slip of the bar within the splice sleeve of the connector after loading in tension to 30.0 ksi (207 MPa) and relaxing to 3.0 ksi (21 MPa) shall not exceed the following measured displacements between gage points clear of the splice sleeve:

511.07

On page 330, **Revise** TABLE 511.07-1 as follows:

TABLE 511.07-1
PLACEMENT TOLERANCES

Deviation from plumb for exposed surfaces	± ¾ inch (19 mm)
Vertical alignment (Deviation from a line parallel to the grade line)	± ½ inch in 20 feet (13 mm in 6 m) Max. ±1 inch (25 mm)
Longitudinal alignment (Deviation from a line parallel to the centerline or baseline)	±½ inch in 20 feet (13 mm in 6 m) Max. ±1 inch (25 mm)
Width dimensions of walls for exposed surfaces	±½ inch (13 mm)
Bridge Slab thickness	±¼ inch (6 mm)
Elevations of beam seats	±1/8 inch (3 mm)
Slope, Vertical Deviation from Plane	±0.2%
Slope, Horizontal Deviation from Plane	±0.4%

511.07

On page 330, **Replace** the second paragraph with the following:

When placing superstructure and approach slab concrete assure the ambient air temperature is 85 °F (30 °C) or less and not predicted to go above 85 °F (30 °C) during the concrete placement; and evaporation rates, determined according to Figure 1 in ACI 308, do not exceed 0.1 lbs/ft^2/hour (0.5 kg/m^2/hour).

511.07

On page 330, **Replace** the fourth paragraph with the following:

Figure 1 does not apply to substructure items and formed parapets. Figure 1 applies to slip-formed parapets and approach slabs.

511.08

On page 333, **Revise** TABLE 511.08-1 as follows:

TABLE 511.08-1
SLIPFORMED BRIDGE RAILING TOLERANCES

Reinforcing steel cover	-1/2 inch, +1/2 inch (-13 mm, +13 mm)
Top width dimension	-0, +1/4 inch (+6 mm)
Bottom width dimension	-0, +1/2 inch (+13 mm)
Surface flatness	1/4 inch in 10 feet (6 mm in 3 m)
Vertical alignment (Deviation from a line parallel to the grade line)	1/2 inch in 20 feet (13 mm in 6 m) Max. ±1 inch (25 mm)

511.14

On page 336, **Delete** footnote [3] in table 511.14-1A

511.14

On page 337, **Delete** footnote [3] in table 511.14-1B

511.14

On page 337, in the **Revise** the second paragraph to:

If the air temperature surrounding the concrete is maintained between 32 and 50 °F (0 and 10 °C), and if the provisions of 511.12 do not apply, maintain the concrete above 32 °F (0 °C) for 7 days or until a successful strength test conforming to Table 511.14-1A, except this time shall not be less than 5 days.

511.19

On page 341, **Replace** the title of the section with:

511.19 Joints, Cracks, Scaling and Spalls.

511.19.E

On page 342, **Replace E.** with:

E. Cracks discovered in the deck of the top and bottom surfaces before opening the deck to traffic, that are 10 mils or 0.010 inches (0.254 mm) or less in width. For deck cracking on the top and bottom

surface area, on more than 20% of the surface area, or that is 10 mils or 0.010 inches (0.254 mm) or more in width, or deck scaling that is greater than 0.250 inches (6.25 mm) deep, or on more than 20% of the deck surface area, or deck spalling on more than one area, or an area greater than 32 square yards (26.76 square meters), an investigation will be performed by OMM and proceed according to 108.02 to resolve the issue.

512.03.F

On page 349, **Replace** the second paragraph with the following:

If the concrete surface had curing compound applied, acid test the surface after blasting to see if the curing compound was removed. Perform the acid test for every 500 square feet (47 square meters). Use a 30%, by weight, solution of hydrochloric acid. Apply 4 to 5 drops to the concrete surface. If foaming/fizzing occurs the curing compound is removed. Rinse the tested location with an ammonia solution to neutralize the concrete area tested (1 cup ammonia to 5 gallons water).

512.03.G.2.f

On page 350, **Replace** "f." with the following:

f. Tint clear non-epoxy sealers with a vanishing dye that will not damage the concrete.

512.03.G.2.g

On page 351, **Replace** "g." with the following:

g. Do not apply sealer if the ambient temperature is below 40 °F (5 °C) or will fall below 32 °F (0 °C) within 12 hours after application.

512.03.G.2.h

On page 351, **Delete** subsection "h."

512.04.B

On page 352, **Revise** the second sentence to:

Sweep, abrasive blast, then with the use of a manual or power broom sweep and blow with compressed air so that the surfaces to which the sealer is to be applied is dry and free of dust and dirt.

512.04.C

On page 353, **Revise** the third paragraph to:

Before using the material submit to OMM copies of the manufacturer's certified test data showing that the material complies with the requirements of this specification. The test data shall be developed by an independent approved testing laboratory, and shall include the brand name of the material, name of manufacturer, number of the lot tested and date of manufacture. When the material has been approved by OMM, further testing by the manufacturer will not be required unless the formulation or manufacturing process has been changed, in which case new certified test results will be required. The manufacturer shall certify that the formulation is the same as that for which data has been submitted. The state reserves the right to sample and test delivered lots for compliance.

512.05.F

On page 355, **Revise** the first paragraph to:

Only allow traffic on deck after the treated area does not track. If there is any unreacted material on the surface after application(s), flush with fresh water, as recommended by the manufacturer. Contain all waste according to 107.19.

512.06.C

On page 356, **Revise** the last sentence to:

Broadcast sand over the entire sealed area of the bridge deck by mechanical means to effect a uniform coverage of 1 to 2 pounds per square yards (0.54kg/m² to 1.08 kg/m²).

512.08.G

On page 359, **Replace G.** in its entirety with the following:

G. Type 2 Membrane Waterproofing. This type of waterproofing consists of a rubberized asphalt and peel-and-stick waterproofing membrane 711.25. Follow manufacturer's written recommendations for application of this product, which shall be provided to the project. After installing the primer coat, if required, remove the membrane's release liner and place the adhesive side on the prepared concrete surface. Lay the membrane smooth and free of wrinkles. Lap joints in membranes by at least 1 inch (25 mm). Store membrane materials indoors at temperatures not to exceed 120 °F (49 °C).

For precast concrete three- and four-sided structures, install Type 2 membrane on the exterior vertical and exterior top horizontal surfaces.

513.25.B

On page 377, **Revise** the fifth paragraph to:

If a test section contains unacceptable defects, test 5-foot (1.5 m) segments on both sides of the test section, or, if less than 5-foot (1.5 m) segments are on both sides of the test section, test the full length of the weld. Retest welds requiring repair after repairs are complete.

514.02

On page 381 **Revise** the first sentence of the third paragraph to:

For caulking, use a single pack moisture cured polyurethane based material, which will not shrink, or sag capable of filling voids up to 1 inch (25 mm) wide.

514.04.A

On page 382, **Replace** the second paragraph with the following:

Each quality control specialist must be, at a minimum, either a NACE (National Association of Corrosion Engineers) coating inspector Level 1-certified, or a SSPC (The Society for Protective Coatings) protective coating specialist, or a SSPC protective coating inspector Level 1, or a SSPC bridge coating inspector Level 1,or formally trained or retrained by, at a minimum, a NACE coating inspector Level 1 certified, or a SSPC protective coating specialist, or a SSPC protective coatings inspector Level 1, or a SSPC bridge coating inspector Level 1. The training shall be adequate to ensure that the quality control specialist is able to use all the testing equipment and understands the requirements of this specification. Provide a copy of the NACE or SSPC certification or a copy of the trainer's NACE or SSPC certification and a letter or certificate signed and dated by the trainer to the

Office of Construction Administration. Ensure that the NACE or SSPC certification is current or retrain the quality control specialist every five years in accordance with the above requirements.

514. 05

On page 385, **Replace** the first paragraph with:

Testing Equipment. For the project duration, provide the Engineer or inspectors with the test equipment listed below for the type of work at each work site with ongoing work. With the exception of the recording thermometer, the fabricator shall provide its quality control specialists with the test equipment listed below. The Contractor and fabricator shall maintain all testing equipment in good working order, and provide documentation or certification of calibration from the manufacturer. If the Contractor or Fabricator and the Engineer's inspector are using different test equipment, the Contractor or Fabricator and the Engineer's inspector will perform side-by-side testing and compare results. If the difference between the Department's and Contractor's or Fabricator's tests results, such as blast profile, dry film thickness, temperature, dew point and relative humidity, are greater than 1%, the Contractor or Fabricator and the Engineer will determine the reason for the differences and make necessary adjustments.

514. 05.B

On page 386, **Replace B** with:

B. One Spring micrometer and extra-coarse replica tape or comparable electronic surface profile gauge for the measurement of abrasive blast profile depth within ±0.2 mils on the project at all times.

514.13.D

On page 392**, Replace** the second and third paragraphs with the following:

Collect all debris from blasting operations, equipment, or filters, and all debris that fell to the ground. Store the debris in steel containers/drums with lids that are locked at the end of each workday. Store the debris in these locked drums while in the storage location and when hauled from the storage location to the disposal site. The storage location shall be at the bridge site unless, the Engineer and Contractor agree on an alternate storage location. Secure the storage location by surrounding the site with a 5 foot (1.5 m) high dumpster or a 5 foot (1.5 m) high chain link fence fabric supported by traffic sign drive posts 10 feet (3 m) apart. Drive the traffic signposts into the ground at least 2 feet (0.6 m) deep. Secure the dumpster or fencing with padlocks at the end of each day. The location of centralized cleaning stations for recyclable steel shall also be agreed by the Engineer and the Contractor.

Test and evaluate the debris for disposal. Obtain the services of a testing laboratory to obtain directly from the project site and evaluate a composite representative sample of the abrasive blasting debris for each bridge site. The person taking the sample must be an employee of the testing laboratory.

514.17.A

On page 395, **Revise** the first paragraph to:

A. General. Paint all structural steel, scuppers, expansion joints except top surface, steel railing, exposed steel piling, drain troughs, and other areas as shown on the plans. Paint galvanized or metalized surfaces if shown on the plans. Unless otherwise shown on the plans or specified below, apply paint to provide the specified coating thickness by brush and spray methods. Apply primer and

intermediate paint per 708.01 and 708.02 to cover all visible steel surfaces. If gaps or crevices remain between adjacent coated steel surfaces after applying the intermediate coat, caulk according to 514.19. If brush and spray are not practical to paint places of difficult access, the Contractor may use daubers, small diameter rollers, or sheepskins.

514.17.E

On page 398, **Revise** the section as follows:

E. Brush Application. Apply the paint to produce a smooth coat. To ensure coverage, apply wet stripe coats using brushes, daubers, small diameter rollers or sheepskins to all edges, outside corners, crevices, welds, rivets, bolts, nuts and washers in addition to the spray application of each individual coating Apply stripe coat of organic zinc primer either before or after spray application of primer. Apply stripe coats of intermediate and finish coats before spray application of the respective coats. Apply additional paint as necessary to produce the required coating thickness.

514.17.G

On page 399, in Section **G.**, **Replace** bullet 2. with:

2. Perform Adhesion Testing according to ASTM D 4541, Type 4. Meet or exceed 400 psi adhesion between coats or between the paint system and the substrate, or 400 psi cohesion within paint coats.

514.19

On page 400, **Revise** the paragraph to:

After the intermediate coat cures and before applying the finish coat, caulk gaps or crevices up to 1/2 inch (13 mm) wide. Follow the manufacturer's recommendations for curing before applying the finish coat.

515.03

On page 406, **Revise** the first paragraph of this section to:

There are three levels of fabricator qualification. OMM will classify each fabricator at the highest level of fabrication it is qualified to perform.

515.11.A

On page 409, **Add** the following paragraph after the first paragraph:

Immediately prior to final stressing, obtain the temperature correction factor for prestressing strands using a thermometer that has been calibrated against a NIST-traceable thermometer. Define the frequency, location, and thermometer in the Quality Control Plan.

515.13

On page 409, **Replace** the section with the following:

515.13 Inspection Facilities. The fabricator shall provide the inspector office accommodations conforming to the following requirements:

A. Minimum dedicated floor area of 120 square feet (11 m^2).

B. Minimum ceiling height of 7 feet (2.1 m).

C. Adequate working and storage facilities, work space, lighting, electrical outlets, lockable files or cabinets with key.

D. Heating and cooling capable of maintaining an ambient air temperature between 68 °F (20 °C) and 80 °F (27 °C).

E. Secure internet access.

515.14

On page 410, **Revise** the first paragraph with the following:

Use metal forms capable of producing members within the tolerances shown on the plans. Forms made of material other than metal may be used for bulkheads and voids and may be used for a single project for prestressed members requiring non-standard forms. Ensure that the surfaces of the forms in contact with the concrete are smooth and the joints between panels are tight. The soffit form shall have a plane surface at right angles to the vertical axis of the members and have the two bottom edges beveled 3/4 inch (19 mm) with a triangular strip built into the forms. Increase the length of the forms for elastic shortening and normal concrete shrinkage, and design the forms to accommodate this movement.

515.15.D

On page 411 **Replace** the 5th and 6th paragraphs of the section with the following Table:

Sample and test the concrete for prestressed concrete members as specified below:

TEST SPECIMEN REQUIREMENTS

Cubic Yards per Bed	**Sampling Frequency**	**Number of Cylinders Required**
Less than or equal to 30 cubic yards	First and last load per bed	Minimum of 4
30 to 60 cubic yards	First and last load per bed plus one random sample.	Minimum of 6
Greater than 60 cubic yards	First and last load per bed plus 2 random samples.	Minimum of 8

515.17

On page 414, **Revise** TABLE BEAM DIMENSIONAL TOLERANCES as follows:

BEAM DIMENSIONAL TOLERANCES

Description	**Box Beam**	**I Beam**

Length of beam	±1/8" per 10 ft (1 mm/m) max ±3/4" (19 mm)	±1/8" per 10 ft (1 mm/m) max ±1" (25 mm)
Depth of beam	±1/4" (6 mm)	-1/4" (6 mm) +1/2" (13 mm)
Depth of I beam flange including fillets	N/A	±1/4" (6 mm)
Beam (box)/Flange (I) Width	±1/4" (6 mm)	-1/4" (6 mm) +3/8" (10 mm)
Flange Thickness excluding fillets		
a) Top	-0 +1/2" (13 mm)	±1/4" (6 mm)
b) Bottom	-1/8" (3 mm) +1/2" (13 mm)	±1/4" (6 mm)
Width Web	N/A	-1/4" (6 mm) +3/8" (10 mm)
Width beam walls	-1/4" (6 mm) +3/8" (10 mm)	N/A
Width of Void	±1/2" (13 mm)	N/A
Height of Void	±1/2" (13 mm)	N/A
Box Beam Diaphragm spacing	±2" (50 mm)	N/A
Deviation from True Vertical	±1/8" (3 mm)	1/8" per ft (8 mm per m)
Deviation from Skew Angle	±1/2" (13 mm)	±1/2" (13 mm)

515.17

On page 414, **Revise** TABLE REINFORCING STEEL TOLERANCES as follows:

REINFORCING STEEL TOLERANCES

Description	**Box Beam**	**I Beam**
Clear cover	-0 +1/4" (6 mm)	-0 +1/4" (6 mm)
Splice lengths	-1 1/2" (38 mm)	-1 1/2" (38 mm)
Stirrup spacing in anchorage zone	±1/4" (6 mm)	±1/4" (6 mm)
Stirrup spacing outside anchorage zone	±1" (25 mm)	±1" (25 mm)
Stirrup extension above top flange	-1/2" (13 mm) +1/4" (6 mm)	0 +1” (25 mm)
Reinforcement extension beyond beam end	-3/4” (18 mm) +0	-3/4” (18 mm) +0

515.22

On page 416, **Revise** the first two paragraphs of the section to:

Payment for prestressed concrete beams include all inserts, sleeves, fittings, reinforcing steel fully or partially encased in the members, threaded rods, embedded inserts, embedded bearing sole plates, temporary bracing, fixed anchor dowels, and all transverse tie rods necessary to complete this work. The Department will consider all costs associated with all structural steel, including bolts, nuts, washers and plate washers for steel intermediate diaphragms, as well as concrete and reinforcing steel for cast-in-place concrete intermediate diaphragms as incidental to the intermediate diaphragms.

The Department will pay for expansion joint end diaphragms, semi-integral diaphragms, pier diaphragms, bearing load plates, bearing pads, and other expansion materials, separately.

516.07

On page 419, **Revise** the fifth paragraph to:

Set elastomeric bearing pads directly on the concrete surface. If the beams seats are sealed with an epoxy or non-epoxy sealer prior to setting the bearings, do not apply sealer to the concrete surfaces under the proposed bearing locations. If these locations are sealed, or membrane cured, remove the sealer or membrane cure to the satisfaction of the Engineer before setting the bearings. Perform this removal at no expense to the Department.

517.02

On page 421, **Revise** the first sentence to:

Fabricate railing according to Item 513.

518.05

On page 424**, Add** the following sentence to the end of the first paragraph:

Place porous backfill in loose lifts not to exceed 12 inches. Run a plate compactor or tamper over the top of each lift for consolidation of approximately 85% of original layer thickness. If placed in loose lifts greater than 12 inches, flood the porous backfill at the appropriate moisture content for consolidation of approximately 85% of original layer thickness.

519.06

On page 426, **Revise** the second paragraph to:

Remove the forms within 24 hours after placing the concrete, and finish all exposed surfaces by rubbing to match the surrounding concrete. Apply membrane curing according to 511.14, Method B, immediately after rubbing the surface.

522.03

On page 432, **Revise** the last sentence of this section to:

Backfill according to the requirements for Item 611.

526.05

On page 443, **Replace** the section with the following:

526.05 Finishing and Curing. Mechanically screed, at a vibration frequency of 1500 to 5000 pulses per minute, the concrete surface to the proper elevation in one complete pass with a minimum of hand finishing. Cure approach slabs according to 511.14.A. Seal joints and cracks according to 511.19. If the approach slab is to serve as a base for an asphalt concrete wearing course, texture the

approach slab according to Item 305. If the approach slab is to serve as a wearing surface, test the surface according to 451.13, and diamond groove the surface according to 511.17.

Open approach slabs to traffic according to Table 511.14-1A or Table 511.14-1B.

601.02

On page 445, **Replace** the last paragraph with the following:

Ensure tied concrete block mats and articulating concrete block revetment systems are held together by galvanized steel wire, HDPE mesh, or stainless steel wire.

601.04.A

On page 445, **Replace** the name of section A. with the following:

A. Type A – Provide Flat Stones or Broken Concrete

601.04.A

On page 445, **Delete** the following paragraph from the end of section A.:

Approved manufacturers are on file with the Office of Materials Management. For approval, manufacturers will submit product information to the Office of Hydraulic Engineering.

601.04.B

On page 445, **Replace** the name of section **B.** with the following:

B. Type B – Provide Articulating Concrete Block Revetment System

601.04.B

On page 445, **Replace** the first sentence of the section with the following:

Ensure articulating concrete block revetment conform to 712.13.

601.04.C

On page 445, **Replace** the name of section **C.** with the following:

C. Type C – Construct Concrete Riprap Using Cloth or Burlap Bags

601.04.D

On page 446, **Replace** the name of section **D.** with the following:

D. Type D – Construct a 6-inch (150 mm) Reinforced Concrete Slab

601.11

On page 448, **Delete** the last paragraph of the section:

~~Approved manufacturers are on file with the laboratory. For approval, manufacturers will submit product information to the Office of Hydraulic Engineering.~~

601.12

On page 448, **Delete** the last two sentences of the section:

~~Tied Concrete Block Mats are approved by the Office of Hydraulics Engineering. Furnish products according to the Departments Qualified Products List (QPL).~~

601.13

On page 448, **Delete** the last two sentences of the section:

~~Articulating Concrete Block Revetment Systems are approved by the Office of Hydraulic Engineering. Furnish products according to the Departments Qualified Products List (QPL).~~

601.15

On page 449, under the Unit listed for Articulating Concrete Block Revetment System, Type_____, **Replace** the Cubic Yard (Cubic Meter) measurement with Square Yard (Square Meter).

602.03.D

On page 450, **Replace** the first paragraph with the following:

D. Precast structures for half height headwalls are for circular conduits up to a maximum of 78 inches (1980mm) and elliptical and pipe arch conduits up to a maximum 78 inches (1980 mm) round equivalent. The shop drawings are kept on file at the certified precast facility per Supplemental 1073. Construct elliptical and pipe arch half height headwalls from templates of the actual conduit being supplied to the project to ensure the opening is outside diameter plus one inch. Ensure the precast structures and their shop drawings conform to the following additional requirements:

602.03.E

On page 451, **Replace** the first paragraph of section **E.** with the following:

Precast structures for wing walls and headwalls for use with Items 706.05, 706.051, 706.052, and 706.053. Do not use precast footings. The Contractor may provide precast wingwalls or headwalls in lieu of cast-in place walls using the following criteria:

606.02

On Page 459, **Add** the following paragraph after the last paragraph in the section:

MGS barrier may be constructed using round wooden posts of 6' length until March 2019. After that date, round wooden posts shall be 69" in length. Prior to March 2019, posts may be trimmed or may extend above the blockout.

602.02 Materials

On page 450, **Replace** the second line with the following:

Concrete, Class QC1……..499 and 511

606.04

On page 459, **Replace** the sixth paragraph with the following:

Repair galvanized surfaces that have been abraded such that the base metal is exposed, including threaded portions of all fittings and fasteners, and cut ends of bolts as specified by ASTM A 780 except the Department will not allow aerosol spray applications of paints containing zinc dust.

610.02

On page 471, **Revise** the Title of the section and the first sentence as follows:

610.02 Approval by the Department. Submit to the Department for acceptance, 30 days before the work is to begin, shop drawings of the units to be furnished.

610.04.A

On page 472, after 4th paragraph, **Add** the sentence:

All openings to be filled with nonshrink mortar per 705.22 including all lifting device voids

611.02.A

On page 475, **Add** the following material:

Glass-fiber-reinforced polymer mortar pipe…….707.75

611.02.A

On page 475, **Replace** the references "707.05 or 707.07" with the following:

707.05 Type B or 707.07 Type B

611.02.A

On page 475, **Add** the following materials after "Corrugated steel box culverts":

Polymer Precoated, Galvanized Steel Conduits with precoated galvanized smooth interior liner..…707.18

Aluminum coated Steel Conduits with precoated galvanized smooth steel interior liner…..707.19

Galvanized Coated Steel Conduits with precoated galvanized smooth steel interior liner…707.20

611.02.B

On page 475, **Delete** the following material:

~~Mortar lined corrugated steel pipe…..707.11~~

611.02.B

On page 475, in section 611.02 B., **Add** the following materials after "Bituminous lined corrugated steel pipe":

Polymer Precoated, Galvanized Steel Conduits with precoated galvanized smooth interior liner..…707.18

Aluminum coated Steel Conduits with precoated galvanized smooth steel interior liner…..707.19

Galvanized Coated Steel Conduits with precoated galvanized smooth steel interior liner…707.20

611.02.B

On page 476, **Add** the following material:

Glass-fiber-reinforced polymer mortar pipe…….707.75

611.02.B

On page 475, **Remove** the following material:

ABS sewer pipe…….707.52

611.02.C

On page 476, **Add** the following material:

Glass-fiber-reinforced polymer mortar pipe…….707.75

611.02.C

On page 476, **Remove** the following material:

ABS sewer pipe…….707.52

611.02.C

On page 476, **Delete** the following material:

~~Mortar lined corrugated steel pipe…..707.11~~

611.02.C

On page 476, **Add** the following materials after "Bituminous lined corrugated steel pipe":

Polymer Precoated, Galvanized Steel Conduits with precoated galvanized smooth interior liner..…707.18

Aluminum coated Steel Conduits with precoated galvanized smooth steel interior liner…..707.19

Galvanized Coated Steel Conduits with precoated galvanized smooth steel interior liner…707.20

611.02.E

On page 477, **Remove** the following material:

ABS sewer pipe…….707.52

611.02.H

On page 478, **Replace** the entire section with the following:

H. For bedding and backfill, furnish materials conforming to:

Bedding…….613, 703.11

Structural Backfill.....613, 703.11

Final Backfill:

Granular Structural Backfill.....703.11

Natural Soils .....703.16.A[1]

Granular Embankment Materials.....703.16.B[1]

Granular Embankment Material Types A, B, C and D…..

…….703.16.C[1]

Coarse aggregate…… Table 703.01-1

Fine aggregate.....703.02.A, 703.03, or 703.05.A

304.....703.17.A

410, 411, and 617……703.18.A[1]

Low Strength Mortar Backfill (LSM).....613

[1] Use any type of material defined as suitable materials for embankment construction except for steel slag, PCS and RAP.

611.02.I

On page 478, **Replace** "Class QC5, QC Misc" with "Class QC 1".

611.02.J

On page 478, **Replace** "Class QC1" with "Class QC5, QC Misc".

611.03

On page 479, in the definition for Bedding Material, **Delete** the following sentences:

~~It is placed or shaped to fit the bell and spigot and typically placed or shaped to fit the conduit. The bedding material may also extend up and around the sides of the conduit or drainage structure.~~

611.03

On page 479, in the definition for **Plastic Conduit**, **Delete** the following reference:

~~707.31~~

611.03

On page 480, in the definition for **Structural Backfill**, **Add** the following sentence at the end of the paragraph:

For drainage structures, material used to fill the trench from the top of Bedding Material to subgrade in pavement or topsoil in vegetated areas.

611.03

On pages 479, **Add** the following after the definition for "Conduit":

Conduit Rise. The distance of the greatest vertical opening of the conduit. For round conduits, the conduit rise equals the conduit diameter.

611.04.A

On page 480, in the first sentence of the first paragraph, **Delete** the following reference:

~~706.13~~

611.04.B

On page 482, **Add** the following to the end of the first full paragraph:

Ensure the conduit structural design is performed in accordance to AASHTO LRFD Bridge Design Specifications. Have an Ohio Registered Engineer sign and seal the calculations.

611.06

On page 484, **Add** the following sentences to the end of the second paragraph:

Conduit Manufactures may approve materials listed in 611.02 for Final Backfill for use as Bedding and Structural Backfill for Type F conduits on slopes 3:1 or greater. Conduit Manufacturers may approve materials listed in 611.02 for Final Backfill for use as Structural Backfill for conduit Types D and E and drainage structures not located in pavement. Identify the use of Final Backfill materials proposed for Bedding and Structural Backfill in the Installation Plan and cross-section details.

611.08

On pages 486, **Add** the following paragraph after the third paragraph:

Provide a concrete masonry collar per SCD D.M.-1.1 when joining conduits of different materials.

611.11

On page 490, **Replace** the third paragraph with the following:

Reinforce the paving with 2 x 2-W0.9 x W0.9 galvanized welded wire fabric or epoxy coated reinforcing steel meeting the material requirements of 509.02. Provide galvanized wire fabric or epoxy coated reinforcing steel with a width 4 inches (100 mm) less than the finished paving. Provide support beneath the mesh where necessary using galvanized support chairs or #4 epoxy coated reinforcing steel. Securely fasten the mesh to the conduit near each edge and at the center of the mesh at points not more than 4 feet (1.2 m) apart along the flow line of the culvert. Securely fasten the epoxy coated reinforcing steel to the conduit at each end and along the length of the steel not more than 4 feet (1.2 m) apart. Repair any damage to the galvanizing or other coating material caused by placement or by tack welding. Use wire brushing and zinc rich paint to make the repairs.

611.12

On page 491, **Replace** the last sentence of the second full paragraph with the following:

Furnish the video recording in a digital, reproducible format on one of the following media types: Portable hard drive, flash drive or as determined appropriate by the Engineer. Provide the video files with a naming format consistent with the Installation Plan references or as determine acceptable by the Engineer.

611.12.B.

On pages 493, **Replace** Table 611.12.B with the following:

Table 611.12.B

Conduit Type	Measurement Equipment	Type of Measurement
Rigid conduit and 707.11, mortar lined corrugated steel pipe, 748.06, steel casing pipe	Crawler mounted camera according to 902.01with crack measuring capabilities according to 902.02 C	Joint gaps Crack widths
Plastic conduit, 707.12, corrugated steel spiral rib conduit, 707.24, corrugated aluminum spiral rib conduit, 748.01, ductile iron pipe, and Circular corrugated metal conduit not listed below	Crawler mounted camera with laser profiler according to 902.02 A, B, and C or Mandrel according to 902.03 and Crawler mounted camera according to 902.01 with crack measuring capabilities according to 902.02 C	Joint gaps Crack widths Deflection
The following types of corrugated metal conduit: 707.04, precoated, galvanized steel culverts 707.05 and 707.07, bituminous coated corrugated steel pipe with paved invert, 707.13 and 707.14, bituminous lined corrugated steel pipe	Crawler mounted camera with laser profiler according to 902.02 A, B, and C	Joint gaps Crack widths Deflection

611.13

On pages 494, **Replace** Table 611.13 with the following:

TABLE 611.13

Metal Conduit	Evaluate if infiltration is observed. Evaluate all racking, buckling or denting. Evaluate all vertical sags or misalignments exceeding 0.1 ft. Repair vertical sags or misalignments of 0.25 ft and greater. Evaluate the overall vertical alignment of the conduit recorded in CA-P-1. Evaluate if the joint gap exceeds the Manufacturer's tolerance*. Repair or replace conduit if the joint gap exceeds the Manufacturers tolerance*. Repair all damage to coatings. Repair or replace conduit if the Performance Inspection per 611.12 indicates a deflection > 7.5%. Replace conduit if the Performance Inspection per 611.12 indicates a deflection > 12%
Rigid Conduit	Evaluate if infiltration is observed. Evaluate if joint gap exceeds the Manufacture's tolerance*. Evaluate all vertical sags or misalignments exceeding 0.1 ft. Repair vertical sags or misalignments of 0.25 ft and greater. Evaluate the overall vertical alignment of the conduit recorded in CA-P-1. Repair or replace conduit if the joint gap exceeds the Manufacturers tolerance*. Repair or replace conduit if cracks > 0.10 inch. Repair or replace conduit if spalls or slabbing are observed.
Plastic Conduit	Evaluate if infiltration is observed. Evaluate all racking, bulging or buckling. Evaluate if joint gap exceeds the Manufacturers tolerance*. Evaluate all vertical sags or misalignments exceeding 0.1 ft. Repair vertical sags or misalignments of 0.25 ft and greater. Evaluate the overall vertical alignment of the conduit recorded in CA-P-1. Evaluate all cracks. Repair or replace conduit if the joint gap exceeds the Manufacturer's tolerance*. Repair or replace conduit if Performance Inspection per 611.12 indicates a deflection > 7.5%. Replace conduit if the Performance Inspection per 611.12 indicates a deflection > 12%

* Note: The tolerance is defined as the maximum joint gap listed in the Installation Plan.

614.03

On page 501, **Add** the following paragraphs after the first paragraph:

Ensure all individuals contracted by, secured by, directed by or employed by the contractor whom are involved in the development, design, implementation, operation, inspection and enforcement of work zone related transportation management and traffic control have been trained appropriate to the job decisions each individual is required to make. Repeat training in intervals of no more than 5 years to reflect changing practices.

Designate a trained person at the project level that has the primary responsibility and sufficient authority for implementing and maintaining the Transportation Management Plan (TMP) and other safety and mobility aspects of the project. For information and requirements regarding TMPs and related components see ODOT Traffic Management in Work Zones Policy (21-008(P)) and Standard Procedure (123-001(SP)). Maintain a 24-hr contact for the designated trained person and provide this contact information to the Engineer at the preconstruction conference. The designated trained person shall be present on site for, and involved with, each temporary traffic control set up/take down and each phase change. For projects with a Worksite Traffic Supervisor (WTS) the designated trained person shall be the WTS.

614.03

On Page 501, **Replace** the second paragraph with the following:

Furnish cones, drums, portable sign supports, Type 3 barricades, portable changeable message signs, arrow boards, and impact attenuators that are pre-qualified according to the Department's Approved List.

614.03

On Page 502, **Replace** the second paragraph with the following:

Furnish orange drums with reboundable reflective sheeting complying with the requirements of 730.191 and in conformance with the OMUTCD. Drums of colors other than orange shall not be permitted on the project. Ensure that owner identification markings on construction drums are no more than 1 inch (25 mm) in character height and are located at least 2 inches (50 mm) below the reflectorized bands or on the top or bottom horizontal surfaces of the drum. Ballast the drums according to the manufacturer's recommendations.

614.03

On Page 502, **Add** the following sentence after the first sentence of the third paragraph:

Traffic cones of colors other than highly visible orange shall not be permitted on the project.

614.03

On Page 502, **Add** the following paragraph after the fourth paragraph:

Furnish object markers that are a minimum size of 6 x 12 inches and that consists of reflective sheeting adhered to an aluminum or plastic plate.

614.03

On Page 503, **Delete** the third paragraph:

Furnish object markers that are a minimum size of 6 x 12 inches and that consists of reflective sheeting adhered to an aluminum or plastic plate.

614.035

On Page 503, **Replace** the subsection title and first sentence with the following:

Storage of Equipment, Vehicle and Material on Highway Rights of Way.

614.04.A

On Page 504, **Replace** the paragraph with the following:

A. Erect a NO EDGE LINES sign in advance of any section of roadway lacking OMUTCD standard edge line markings. Ensure these signs are in place before opening the roadway to traffic. Erect these signs on each entrance ramp, 25 to 200 feet beyond the far shoulder or curb line of intersecting through roads to warn entering or turning traffic of the conditions, and at least once every 2 miles (3 km) along the roadway. Remove these signs when they no longer apply.

614.11.B.1

On page 507, **Replace** TABLE 614.11-1 **and** TABLE 614.11-1M with the following

TABLE 614.11-1

	Line Width (inch)				
	4	6	8	12	24
Type of Pavement Marking	**Gallon per Mile of Line**				
Solid Line	22	33	44	66	132
10-foot Dashed Line	5.5	8.25	--	--	--
4-foot Dashed Line	2.2	3.3	--	--	--
Dotted Line	7.3	10.95	--	--	--
Arrows, Symbols, and Words	1.4 gallons per 100 square feet				
Glass Beads: 740.09, Type A	15 pounds per 100 square feet				

TABLE 614.11-1M

	Line Width (mm)				
	100	150	200	300	600
Type of Pavement Marking	**Liter per Kilometer of Line**				
Solid Line	52	78	105	157	314
3.0 m Dashed Line	13	19.5	--	--	--
1.2 m Dashed Line	5.2	7.8	--	--	--
Dotted Line	17.3	25.95	--	--	--
Arrows, Symbols, and Words	0.6 liters per square meter				
Glass Beads: 740.09, Type A	7.3 kg per square meter				

614.11.B.2

On page 507, **Replace** TABLE 614.11-2 with the following:

TABLE 614.11-2

	Line Width (inch)				
	4	6	8	12	24
Type of Pavement Marking	**Gallon per Mile of Line**				
Solid Line	12	18	24	36	72
10-foot Dashed Line	3	4.5	--	--	--
Dotted Line	4	6	--	--	--
Arrows, Symbols, and Words	0.75 gallons per 100 square feet				
Glass Beads: 740.09, Type A	7.5 pounds per 100 square feet				

614.11.B.2

On page 508, **Replace** TABLE 614.11-2M with the following:

TABLE 614.11-2M

	Line Width (mm)				
	100	150	200	300	600
Type of Pavement Marking	**Liter per Kilometer of Line**				
Solid Line	28	42	56	84	168
3.0 m Dashed Line	7	10.5	--	--	--
Dotted Line	9.4	14.1	--	--	--
Arrows, Symbols, and Words	0.3 liters per square meter				
Glass Beads: 740.09, Type A	3.7 kg per square meter				

614.11.F.1.a

On page 508, **Replace "a."** with the following:

a. Edge Lines. Class I edge lines shall match existing edge line in width, 4 or 6 inches (100 or 150 mm).

614.11.F.1.b

On page 508, **Replace "b."** with the following:

b. Lane Lines. Class I lane lines shall match existing lane line in width, 4 or 6 inches (100 or 150 mm).

614.11.F.1.c

On page 508, **Replace "c."** with the following:

c. Channelizing Lines. Class I channelizing lines shall match existing channelizing line in width, 8 or 12 inches (200 or 300 mm).

614.11.F.2.b

On page 509, **Replace "b."** with the following

b. Lane Lines. Class II lane lines shall be white and shall match existing lane lines in width, 4 or 6 inches (100 or 150 mm), by a minimum of 4 feet (1.2 m) long dashes spaced at a maximum of 40 feet (12.0 m) intervals. Class II Lane Line Markings must be marked with Class I or Class III Markings or final markings within 14 calendar days according to 614.11. H. 3.

614.11.F.2.c

On page 509, **Replace "c."** with the following

c. Gore Markings. Class II gore markings are continuous, white 24-inch (600 mm) wide lines in a chevron crosshatched pattern placed within the theoretical gore of an exit ramp or diverging roadways. Class II Gore Markings must be marked with Class I or Class III Markings or final markings within 14 calendar days according to 614.11.H.3.

614.11.F.3

On page 509, **Replace** the section with the following:

3. Class III Markings (Full Pattern, Low Rate). Use Class III Markings on surface courses that are expected to receive thermoplastic, spray thermoplastic or epoxy final markings within 30 days. Class III Markings use a lower application rate which reduces the surface preparation needed prior to application of thermoplastic, spray thermoplastic or epoxy final markings. If Class III Markings have been applied and weather conditions are expected to prevent thermoplastic, spray thermoplastic or epoxy final markings application for 30 days or more, re-apply Class III Markings (if thermoplastic, spray thermoplastic or epoxy final markings application is expected to occur within 30 days) or apply Class I Markings as necessary to carry the project through the season or over the winter.

Apply Class III work zone markings to the standard dimensions as defined in Item 641 except as follows:

a. Edge Lines. Class III edge lines shall match existing edge line in width, 4 or 6 inches (100 or 150 mm).

b. Lane Lines. Class III lane lines shall match existing lane line in width, 4 or 6 inches (100 or 150 mm).

c. Channelizing Lines. Class III channelizing lines shall match the existing channelizing line in width, 8 or 12 inches (200 or 300 mm).

614.11.G.1.a

On page 509, **Replace** the section with the following:

a. Removal Methods. Remove the markings so that less than 5% of the line remains visible. Repair damage to the pavement that results in the removal of more than 1/8 inch of pavement thickness.

Use sand, shot, or water blasting to remove markings on all asphalt or concrete pavement surfaces.

Use only sand, shot, or water blasting for removal of all pavement markings in preparation for placing Item 422 Chip Seal or Item 421 Microsurfacing.

A grinder may only be used to remove markings on temporary pavement or pavement that will be covered or removed prior to project completion (e.g., intermediate asphalt course). When a grinder drum is mounted to a skid steer loader, the drum must be able to accommodate a minimum of 150 teeth.

614.16

On page 517, **Revise** the section as follows:

Item	Unit	Description
614	Lump Sum	Maintaining Traffic
614	Lump Sum	Detour Signing
614	Each	Replacement Drum
614	Each	Replacement Sign
614	Each	Object Marker, ___ - Way
614	Each, Mile, Foot (Kilometer, Meter)	Work Zone Pavement Markings
614	Each	Work Zone Raised Pavement Marker
614	Sign Month	Portable Changeable Message Sign
614	Each	Work Zone Speed Limit Sign
614	Each	Work Zone Marking Sign
614	Hour	Law Enforcement Officer with Patrol Car
614	Each	Barrier Reflector
614	Each	Work Zone Crossover Lighting System
614	Each	Work Zone Impact Attenuator
614	Mile (Kilometer)	Work Zone Lane Line, Class ___, ___*, ___**
614	Mile (Kilometer)	Work Zone Center Line, Class ___, ___**
614	Foot (Meter)	Work Zone Channelizing Line, Class ____, ___*, ___**
614	Mile (Kilometer)	Work Zone Edgeline, Class ____, ___*, ___**
614	Foot (Meter)	Work Zone Gore Marking, Class II, ___**
614	Foot (Meter)	Work Zone Stop Line, Class I, ___**
614	Foot (Meter)	Work Zone Arrow, Class I, ___**
614	Foot (Meter)	Work Zone Crosswalk Line, Class I, ___**

614	Foot (Meter)	Work Zone Dotted Line, Class I, ___**
614	Cubic Yard (Cubic Meter)	Asphalt Concrete for Maintaining Traffic

* Width of marking (4" or 6" for Lane Lines and Edgelines; 8" or 12" for Channelizing Lines).
** Type material (642 paint; 740.06, Type I or Type II; or left blank to allow any of the three.)

615.05

On page 518, **Add** the following paragraph after the third paragraph:

Provide aggregate shoulders, when specified, conforming to Item 411 for the full thickness of the pavement section placed.

615.09

On page 520, **Replace** the first paragraph with the following:

Method of Measurement. The Department will measure the quantity of Pavement by the number of square yards (square meters) of pavement surface (including paved and aggregate shoulders) placed, maintained, and removed as directed, measured complete in place.

625

On page 539, **Replace** the heading with the following:

625.06 Shop Drawings

625.06

On page 540, **Replace** the heading with the following:

625.06 Shop Drawings

625.12

On page 543, **Add** the following paragraph after the third paragraph:

Use watertight hubs for all conduit penetrations of outdoor electrical enclosures. Do not make such penetrations using locknuts onto threaded conduit ends.

625.13

On page 544, **Add** the following to the end of the 4th sentence in the third paragraph:
"or in chemically stabilized subgrade".

625.14

On page 545, in the second full paragraph **Replace** "5 percent" with "20 percent".

625.15

On Page 545, **Add** the following paragraphs after the third paragraph:

Construct the lighting electrical system to provide selective coordination of overcurrent devices per NEC 240.12(1). Overload indications per NEC 240.12(2) are allowed but not required as part of a standard ODOT lighting control system. Provide to the Engineer:

A) individual catalog sheets and device time-current curves and/or tables and

B) combined graphical overlays that document acceptable installed overcurrent device coordination.

Provide this documentation for all installed overcurrent devices, including the service disconnect fuses, the lighting control center branch circuit breakers, and tower circuit breakers/ pole fuses (if present). Tabular data, if used, shall include the following time points as a minimum: 0.01, 0.02, 0.05, 0.1, 0.2, 0.5,1, 10, 100, and 300 seconds and additional points as needed to clearly show the overcurrent device operating characteristics. Include minimum melt time and maximum clearing time for fuses; include minimum and maximum clearing time for circuit breakers. Provide documentation of the utility-installed transformer ANSI fuse link type (e.g., K or T) and fuse rating (if available). Provide documentation of the utility-installed power service size (in kVA).

Provide to the Engineer a compiled list or catalog sheets showing the Short-Circuit Current Rating (SCCR) of all fuses and fuse holders, circuit breakers, switches and contactors, pursuant of the requirements in NEC Article 110.10.

625.15

On page 546, **Add** the following paragraph to the end of the section:

Install a padlock per 631.06 on all external actuators. Coordinate with power company on installation of a second padlock conforming to their specifications. Install a dual padlock bar.

626.04

On page 554**, Replace** the third paragraph with the following paragraphs:

Install guardrail blockout reflectors on top of the blockout or on the side of the blockout away from traffic. Install guardrail blockout reflectors on the top or side of the blockout nearest the edge of pavement. Install the guardrail blockout reflector so that the reflective surface is above the guardrail.

For guardrail blockout reflectors that are installed on top of the blockout, angle the reflective face approximately 5 degrees towards the nearest travel lane.

626.04

On Page 554, **Delete** the eighth paragraph in its entirety.

626.04

On page 554, **Add** the following after the ninth paragraph:

Use one-way and bi-directional barrier reflectors in accordance with the following guidelines:

BARRIER REFLECTORS COLOR & DIRECTION	One-Way Reflector		Bi-Directional Reflector	
	Left Edge	Right Edge	Left Edge	Right Edge
Two-Lane, Two-Way			NA	W/W
Interchange Ramp			Y/R**	W/R
Multilane Undivided			NA	W/W
Multilane Divided				
Multilane Divided with median barrier*		W	Y/Y	
Multilane Divided without median barrier	NA	W		

* concrete wall, guardrail or cable rail
** if median concrete wall is present

626.04

On page 555, **Replace** the Mounting Location table with the following:

Mounting Location	
Concrete barrier, retaining walls, bridge rail or bridge parapets	
Type 1	Barrier Reflector
Guardrail	
Type 2	Corrosion Resistant Metal Guardrail Blockout Reflector
Type 3	Acrylic or Polycarbonate Plastic Guardrail Blockout Reflector
Type 4	Spring Loaded Guardrail Blockout Reflector
Type 5	L-Type Guardrail Blockout Reflector

626.06

On page 555, **Replace** the entire section with the following:

626.06 Basis of Payment. The Department will pay for accepted quantities at the contract prices as follows:

Item	Unit	Description
626	Each	Barrier Reflector, Type ____ , (One-Way or Bi-Directional)

630

On page 555, **Replace** the heading with the following:

630.03 Shop Drawings

630.03

On page 556, **Replace** the section with the following:

630.03 Shop Drawings. Furnish shop drawings according to 625.06. Submit sign support shop drawings that cover all design types such as ground mounted, rigid overhead, span wire mounted, and overpass structure mounted supports. On the drawings, show overall height, sign clearance above foundation, span length, sign locations, sign overall heights and widths, and glare shield height and location, if applicable.

630.04

On page 557, **Replace** the second paragraph with the following:

Use sign designs according to the OMUTCD and the Sign Designs and Markings Manual. For projects sold before July 14, 2016 use Clearview font or the Standard Alphabets for Traffic Control Devices for positive contrast legends on freeway and expressway guide signs and on all other guide signs when permitted in the Sign Designs and Markings Manual. For projects sold on or after July 14, 2016, use the Standard Alphabets for Traffic Control Devices for positive contrast legends on all guide signs. Do not revise overall sign sizes from what is shown in the plans. The edge space between the border and the text may be adjusted from what is normally used to achieve the sign widths shown. Do not use Clearview font for projects sold on or after July 14, 2016. For negative contrast legends, use the Standard Alphabets for Traffic Control Devices. Use capital legends and upper/lower case legends

in accordance with the Sign Designs and Markings Manual. When either is permitted in the Sign Designs and Markings Manual, use upper/lower case legends.

631.02

On page 567, **Replace** the second paragraph with the following:

Furnish shop drawings according to 625.06

632

On page 572, **Replace** the heading with the following:

632.04 Shop Drawings

632.04

On page 573, **Replace** the section with the following:

632.04 Shop Drawings. Furnish shop drawings according to 625.06

632.09

On page 575, **Replace** the section with the following:

632.09 Pedestrian Pushbutton. Properly orient and install pushbuttons on poles or pedestals. Service pushbuttons mounted on steel poles by wiring inside the poles. Furnish 3/4-inch (19 mm) diameter holes through the back of the housing and the pole wall, install a rubber grommet, and route wiring through until no external wiring is visible. Plug any unused conduit attachment holes. Attach the housing by machine or self-tapping screws in the housing back wall. Service pushbutton mounted on wooden poles through conduit. Furnish flat sheet pedestrian pushbutton signs in accordance with 630.04.

632.29

On page 583, **Add** the following to the end of the fourth paragraph:

For combination strain poles, the luminaire bracket arm will be a separate item. For combination signal supports, the luminaire bracket arm will be a separate item.

633

On page 585, **Replace** the heading with the following:

633.04 Shop Drawings

633.04

On page 586, **Replace** the section with the following:

632.04 Shop Drawings. Furnish shop drawings according to 625.06

633.08

On Page 588, **Replace** the first sentence in the sixth paragraph with the following:

Provide a riser with each ground mounted cabinet unless it is a NEMA Size 7 cabinet.

633.14

On Page 589, **Replace** the section with the following:

633.14 Centrally Controlled Arterial Traffic Signal System. Install this construction item on signal systems with a minimum of fifty (50) networked signalized intersections in jurisdictions who employ dedicated engineering and/or traffic signal operations staff. Install, test, and operate the station, consisting of computer equipment, communications equipment, and central control software, in one or more locations in the maintaining agency's facilities as shown in the plans. The maintaining agency shall furnish communications at these stations.

633.19

On page 590, **Replace** the fourth sentence of the third paragraph with the following:

The Department will measure Cabinet, Type ___, Furnish Only by the number of each complete prewired cabinet, and will include pole mounting hardware, riser and anchor bolts, but will exclude installation, controller unit, and detector units.

633.19

On page 591, **Replace**, the first paragraph with the following:

The Department will measure Centrally Controlled Arterial Traffic Signal System by the number of each location shown on the plans, and will include all equipment, testing, and software.

633.20

On page 591, **Add** the following item to the pay item table:

633 Each Centrally Controlled Arterial Traffic Signal System

On page 591, **Delete** the following item from the pay item table,

633 Each Remote Monitoring Station

638.02

On page 593, in section **638.02 Materials, Pipe, joints and fittings, Add** the following material:

Glass-fiber-reinforced polymer mortar pipe and fittings……..……..748.04

641.02

On page 603, **Delete** the second paragraph in its entirety.

641.02

On page 603, **Replace** the third paragraph with the following:

Any materials delivered without a TE-24 when applicable and applied without Laboratory preapproval shall be removed. Laboratory tested materials not meeting specifications shall be removed from the project site.

641.02

On page 603, **Replace** in the fourth paragraph the following:

MSDS with SDS

641.08.A

On page 606, **Replace** the paragraph with the following:

A. Edge Lines. Place edge lines as continuous stripes using the width specified. Locate the center of the stripe 6 inches (150 mm) from the edge of pavement. Ensure that the right edge line is applied to the left of the right edge of pavement. Ensure that the left edge line is applied to the right of the left edge of pavement.

648.05

On page 628, **Replace** the fifth complete paragraph with the following:

If the deficiency of spray thermoplastic marking material or glass beads is 20 percent or more, the Department will consider the work unsatisfactory. In addition, the Engineer will consider as unsatisfactory materials applied outside the temperature or application requirements in 648.05 without written approval of the Engineer. Replace or reapply spray thermoplastic markings and glass beads in all sections determined to be unsatisfactory as determined by the Engineer.

659.07

On page 640, **Replace** the second to last sentence of the last paragraph with the following:

Sow seeds within 15 months of the testing date.

659.09

On page 642, in TABLE 659.09-1 GRASS AND WILDFLOWER SEED MIXES, **Add** the following in the Class 2 Roadside Mixture seed mix section:

2	Roadside Mixture			
	Kentucky Bluegrass (Poa pratensis)	1.5		7.32
	Kentucky 31 Fescue (Festuca arundinacea var. KY 31 or Fawn Tall Fescue)	2		9.76
	Perennial Ryegrass (Lolium perenne)	1.5		7.32

659.09

On page 644, in TABLE 659.09-1, **Delete** the following seed type in the Class 7 seed mix for Temporary Erosion Control Mixture:

~~Fawn Tall Fescue (Festuca arundinacea) 3.0 lb/1000 ft^2 and 14.64 kg/1000 m^2~~

700.00

On page 686, in TABLE "Minimum Requirements for Sampling Materials", Section 731.10, **Replace** "QPL" with "TAP" in the third column.

On page 686, in TABLE "Minimum Requirements for Sampling Materials", Section 732.04C, **Replace** "QPL" with "TAP" in the third column.

On page 686, in TABLE "Minimum Requirements for Sampling Materials", Section 732.07A, **Replace** "QPL" with "TAP" in the third column.

On page 686, in TABLE "Minimum Requirements for Sampling Materials", Section 732.07B, **Replace** "QPL" with "TAP" in the third column.

On page 688, in TABLE "Minimum Requirements for Sampling Materials", Section 732.08, **Replace** "QPL" with "TAP" in the third column.

On page 688, in TABLE "Minimum Requirements for Sampling Materials", Section 733.03A, **Replace** "QPL" with "TAP" in the third column.

On page 688, in TABLE "Minimum Requirements for Sampling Materials", Section 733.03B, **Replace** "QPL" with "TAP" in the third column.

On page 688, in TABLE "Minimum Requirements for Sampling Materials", Section 733.03C, **Replace** "QPL" with "TAP" in the third column.

On page 688, in TABLE "Minimum Requirements for Sampling Materials", Section 733.03E, **Replace** "QPL" with "TAP" in the third column.

On page 688, in TABLE "Minimum Requirements for Sampling Materials", Section 733.09, **Replace** "QPL" with "TAP" in the third column.

On page 688, in TABLE "Minimum Requirements for Sampling Materials", Section 733.09C, **Replace** "QPL" with "TAP" in the third column.

701.00

On page 690, **Replace** the heading with the following:

701 CEMENTITIOUS MATERIALS AND CARBONATE MICRO-FINES

701.00

On page 690, **Replace** the first paragraph with the following:

701.00 Acceptance. Provide cements meeting 701.01, 701.02, 701.04, 701.05, 701.07 and 701.09 and certified according to Supplement 1028; fly ash meeting 701.13 and certified according to Supplement 1026; ground, granulated blast furnace slag meeting 701.11 and certified according to Supplement 1034; and micro silica meeting 701.10 and certified according to Supplement 1045; carbonate micro-fines meeting 701.14 and certified according to Supplement 1016, without prior sampling, testing and approval by the Department. Lists for certified cement, fly ash, GGBFS and micro silica sources are maintained by the Laboratory.

701.14

On page 691, **Add** the following:

701.14 Carbonate Micro-Fines for use in Portland Cement Concrete. Provide carbonate micro-fines (CMF) according to ASTM C1797, except modify Type C according to the properties shown in Table 701.14-1 below:

TABLE 701.14-1 CHEMICAL AND PHYSICAL REQUIREMENTS

Parameter	**Type C**
$MgCO_3$, %	≥43
Sum of $CaCO_3$ + Mg CO_3, % by mass	≥ 98
Methylene blue value (mg/g)	≤ 3
Particle size distribution,	minimum % passing
850 µm (No. 20) sieve	100
300 µm (No. 50) sieve	80-100
150 µm (No. 100) sieve	
75 µm (No. 200) sieve	10-90

45 µm (No. 325) sieve	5-70

702.01

On page 693, in subsection 5.3, **Replace** the last sentence with the following:

Limit approved previously used materials to 5.0 percent by PG Binder weight maximum and provide a written certification to OMM stating the exact percent used, the source, and any brand or trade names. Approved previously used materials are only allowed to be used to produce PG 58-28 and PG 64-28 and suppliers must get recertified per Supplement 1032 for these PG grades.

702.01

On page 694, **Replace** Table 702.01-1 with the following:

Table 702.01-1

Material Requirements for PG Modified Binder

Test / Requirement	SBR Polymer		Pre Blended Binder				Note
Final PG Binder Grade	70-22M (a, b)	64-28 (b)	64-28 (a)	70-22M (a,k)	76-22M (a,k)	88-22M (a,l,m)	c
Actual Pass Temperatures	Report						i
RTFO Mass Change, percent max	0.75						d
Phase Angle, max	78		78		74		d
Elastic Recovery, min			65		75	90	e, d
Toughness, in. lb	125	105					f, d
Tenacity, in lb.	70	80					f, d
Elongation, in. min	20	20					f, d
Ductility, in. min	28	28					j, d
Separation, F max	10						g, d
Homogeneity			None Visible				h, d

a. Pre-blended Binder. Use a base neat asphalt binder that is a -22 grade for 70-22M and 76-22M. Use a base neat asphalt binder that is a -28 grade for 64-28. 64-28 can be neat, PPA modified or modified with SB, SBS or Elvaloy. 64-28 PPA only modified does not have to meet the phase angle or elastic recovery requirements. Ensure SB, SBS or Elvaloy modified 64-28 meets all requirements listed.

b. Post-blended Binder made from neat Supplement 1032 certified or preapproved standard PG Binder grade and SBR solids amount equal to or above 3.5 percent by weight of total binder to achieve the PG Binder grade. Ensure all listed properties are met.

c. Without Direct Tension, graded with actual pass temperatures

d. PG Modified Binder

e. AASHTO T301, 10cm @ 77 ºF (25 ºC), hold 5 min. before cutting, on RTFO material for SB, SBS, and Elvaloy. Note elongation after one hour to the nearest 0.01 cm and report elastic recovery to nearest 0.1%.

f. ASTM D 5801, 50cm/min @ 77 ºF (25 ºC)

g. Condition samples according to ASTM D 7173. Conduct softening point difference of top and bottom of tube per AASHTO T53. Compatibility of polymer and neat binder is sole responsibility of supplier. Formulate PG Modified Binder to retain dispersion for 3 days minimum.

h. Heat a minimum 400 gram sample at 350 ºF (177 ºC) for 2.5-3 hours. Pour entire sample over a hot No. 50 (300 µm) sieve at 340 ºF (171 ºC). Look for retained polymer lumps.

i. Actual high and low temperature achieved by PG Modified Binder beyond required grade, but will not grade out to the next standard PG Binder grade for low temperature.

j. AASHTO T51, @ 39 ºF (4 ºC), 1 cm/min

k. SB, SBS, Elvaloy or Supplemental Specification 887 GTR

l. SB, SBS, Elvaloy

m. The requirements of 3.0 Pa*s maximum for the rotational viscosity for 88-22M may be waived at the discretion of the Department if the supplier warrants that the asphalt binder can be adequately pumped, mixed, and compacted at or below the temperature requirements in Table 702.00-1. Do not exceed 10.0 Pa*s rotational viscosity using the #27 spindle at time of shipment.

702.08

On page 697, **Replace** the last paragraph with the following:

Provide Certified Test Data to the Engineer for each shipment of material.

703.17

On page 717, **Replace** the first paragraph with the following:

703.17 Aggregate Materials for 304. Furnish aggregate that is CCS, crushed gravel, crushed ACBFS, or steel slag.

705.03

On page 723, **Revise** the section as follows:

Furnish preformed fillers according to either AASHTO M 153 or AASHTO M 213, with the following modification:

5.7 For materials manufactured as described in 4.1.1 and 4.1.2, ensure that the producer certifies to the Engineer that the asphalt content is at least 35 percent by weight of the filler.

Or furnish semi-rigid closed-cell polypropylene foam preformed fillers according to the following:

1.	Water Absorption	< 1.0%	ASTM D 545 or AASHTO T 42
2.	Compression Recovery	> 80%	ASTM D 545 or AASHTO T 42
3.	Extrusion	< 0.1 inch	ASTM D 545 or AASHTO T 42
4.	Density	> 3.5 lb/cu.ft.	ASTM D 545 or AASHTO T 42

5. Heat Resistance 392 F +/- 5F ASTM D 5249

Furnish materials according to the Department's (QPL).

705.03

On page 723, **Replace** the entire section with the following:

705.03 Preformed Fillers. Furnish preformed fillers according to either AASHTO M 153 or AASHTO M 213, with the following modification:

5.7 For materials manufactured as described in 4.1.1 and 4.1.2, ensure that the producer certifies to the Engineer that the asphalt content is at least 35 percent by weight of the filler.

Or furnish semi-rigid closed-cell polypropylene foam preformed fillers according to ASTM D 8139.

Furnish materials according to the Department's (QPL).

705.24.A

On page 730, **Revise** the subsection as follows:

A. Scaling Resistance - Treated concrete, abraded by sufficient wire brushing to break any film remaining on the surface after drying, will pass ASTM C 672, Scaling Resistance test with a rating of 2- "Slight to Moderate Scaling" after 50 cycles (non-air entrained concrete) as compared to a rating of 5-"Severe Scaling" on untreated concrete.

706.05

On page 746, **Add** the section after section 6.2.2:

6.2.4.9 Provide Carbonate Micro-Fines according to 701.14 and Table 499.03-2.

706.051

On page 748, **Add** the section after section 6.2.2:

6.2.4.9 Provide Carbonate Micro-Fines according to 701.14 and Table 499.03-2.

706.051

On page 749, **Replace** section 9.1 with the following:

9.1 Ensure that the aggregate, cement, and water are manufactured in conformance with 499.06, and 499.07.

Ensure that the temperature requirements of 511.08 and 511.15 are met.

Ensure that the proportion of cementitious and carbonate micro-fines material is not less than 564 pounds per cubic yard (335 kg/m^3) of concrete.

If used, add the corrosion inhibitor as an aqueous solution. Consider the water in the solution as mixing water for the purpose of determining the w/c ratio of concrete.

706.051

On page 750, **Delete** section 10.3.3.2.

706.052

On page 752, **Add** the following after section 6.2.2:

6.2.4.9 Provide carbonate micro-fines according to 701.14 and Table 499.03-2.

706.052

On page 753, **Replace** section 9.1 with the following:

9.1 Ensure that the aggregate, cement, and water are manufactured according to 499.06, and 499.07.

Ensure that the temperature requirements of 511.08 and 511.15 are met.

Ensure that the proportion of cementitious and carbonate micro-fines material is not less than 564 pounds per cubic yard (335 kg/m^3) of concrete.

If used, add the corrosion inhibitor as an aqueous solution. Consider the water in the solution as mixing water for the purpose of determining the water-cement ratio of concrete.

706.052

On page 754, **Delete** section 9.2.3.

706.052

On page 754, **Delete** section 10.3.3.2.

706.053

On page 756, **Replace** section 6.2.2 with the following:

6.2.2 Provide fly ash conforming to 701.13.

706.053

On page 756, **Add** the following after the section 6.2.2:

6.2.4.9 Provide carbonate micro-fines according to 701.14 and Table 499.03-2.

706.053

On page 757 Replace section 9.1 with the following:

9.1 Ensure that the aggregate, cement, and water are manufactured according to 499.06, and 499.07.

Ensure that the temperature requirements of 511.08 and 511.15 are met.

Ensure that the proportion of cementitious and carbonate micro-fines material is not less than 564 pounds per cubic yard (335 kg/m^3) of concrete.

If used, add the corrosion inhibitor as an aqueous solution. Consider the water in the solution as mixing water for the purpose of determining the water-cement ratio of concrete.

706.053

On page 758, **Delete** section 9.2.3.

706.13

On page 762, **Replace** the last paragraph with the following:

Ensure structures that have a span of 10 feet or greater and are located under the traveled way, including the treated shoulder width, are designed in accordance with the AASHTO LRFD Bridge Design Specifications. Have competent individuals prepare and check the shop drawings. Provide a cover sheet containing the preparer(s) and checker(s): First Name, Last Name, Initials and Content Responsibility. Preparer(s) and checker(s) shall initial each sheet for their content responsibility. The preparer(s) and checker(s) shall not be the same individual. Have an Ohio Registered Engineer review, approve, sign, seal and date the shop drawing cover sheet or submittal letter according to ORC 4733 and OAC 4733-35.

707.11

On page 767, **Delete** the entire section.

707.52

On page 778, **Delete** section **707.52. ABS Sewer Pipe**.

707.62

On page 778, **Replace** the term "storm sewer pipe" with the term "drainage pipe".

707.75

On page 778, **Add** the following new section after section **707.70 Welded and Seamless Steel Pipe.:**

707.75 Glass-Fiber-Reinforced Polymer Mortar Pipe. Provide Glass-fiber-reinforced polymer mortar pipe and fittings for non-pressure applications according to ASTM D 3262 and for pressure applications according to ASTM D 3754 with the following modifications:

4.1 Provide a minimum pipe stiffness of 18 psi.

7.2 Furnish certified test data as defined in 101.03 to the Engineer.

708.02.B.1

On page 780, **Revise** the Pot life section of the Physical Requirements table as follows:

Pot life. Follow the paint manufacturers recommendations for applying the coating within the pot life specified with no evidence of gellation. The coating will be in a free-flowing condition and easily sprayed.

708.02.C.1.d

On page 780, **Revise** the Pot life section as follows:

d. Pot life. Follow the paint manufacturers recommendations for applying the coating within the pot life specified with no evidence of gellation. The coating will be in a free-flowing condition and easily sprayed.

708.02.C.1.e

On page 781, **Revise** the Curing time section as follows:

e. Curing time.

(1) Set-to-touch, ASTM D 1640. 4 hours, maximum at 77 °F (25 °C).

(2) Dry-to-recoat, ASTM D 1640. 24 hours, maximum at 77 °F (25 °C).

708.02.D.1.d

On page 781, **Revise** the Pot life section as follows:

d. Pot life. Follow the paint manufacturers recommendations for applying the coating within the pot life specified with no evidence of gellation. The coating will be in a free-flowing condition and easily sprayed.

708.02.D

On page 782, in the second paragraph, **Revise** the second paragraph as follows:

Prepare three panels for each of the specified tests according to ASTM D 609, except provide a minimum thickness of 1/8 inch (3 mm) and use ASTM A 36/A 36M hot rolled steel. Blast clean the surface to equal, as nearly as is practical, the standard Sa 2 1/2 of ASTM D 2200 (Steel Structures Painting Council SSPC-SP10 meets this requirement). Ensure that the surface has a nominal height of profile of 1 to 3.5 mils (25 to 88 μm) verified by using appropriate replica tape. Coat and cure the panels according to the manufacturer's printed instructions. Provide a dry film coating thickness for the system to be tested as follows:

709.07

On page 784, **Add** the new section 709.07 as follows:

709.07 Electric- Resistance-Welded Carbon and Alloy Steel Mechanical Tubing. Provide grade 60 carbon steel round tubing with a minimum 60 ksi (414 MPa) yield strength according to ASTM A 513/A 513M, with the following modifications:

14.1 Galvanize both the interior and exterior of the tubing with a minimum thickness of 0.30 oz/ft² (91.5 g/m^2) zinc. If welded tubing is used, re-metallize the outside weld with zinc.

Furnish certified material according to Supplement 1068.

711.02

On page 793, **Replace** the second paragraph with the following:

Coat ASTM F3125 fasteners according to 711.09. Furnish all other bolts, nuts, washers, and similar threaded fasteners that are galvanized according to ASTM A 153 or ASTM F F2329. These items may be mechanically zinc coated according to ASTM B 695, Class 50.

711.03

On page 793, **Replace** the section with the following:

711.03 Steel for Piling. Furnish steel for H-piling conforming to ASTM A 572 Grade 50 / A 572M Grade 345. Furnish steel for sheet piling according to ASTM A 328/A 328M. Furnish steel for cast-in-place reinforced concrete piles conforming to ASTM A 252, Grade 2 or 3.

711.09

On page 795, **Replace** the section in its entirety with the following:

711.09 High-Strength Steel Bolts, Nuts, and Washers. Furnish high-strength steel bolts, nuts, and washers according to ASTM F3125 Grade A325 (A325M) with the following modification:

If necessary for approval, obtain samples from material delivered to the project site or at other locations designated by the Laboratory.

Furnish bolts for steel use in bare unpainted applications according to ASTM F3125 Grade A325 (A325M), Type 3.

Use zinc coated bolts to fasten steel that has received an inorganic zinc prime coat according to 514.

Furnish high-strength steel bolts, nuts, and washers that also meet the requirements of Supplement 1080.

Provide samples to the Laboratory for acceptance.

711.10

On page 795, **Replace** the first sentence with the following:

711.10 Machine Bolts. Furnish bolts according to ASTM F1554 with the following modification:

712.02

On pages 801, **Delete** the second sentence of the section:

~~Furnish materials according to the Department's QPL.~~

712.03

On page 801, **Replace** the second paragraph of the section with the following:

4 Total Chlorides (NaCl, $CaCl_2$, and $MgCl_2$ as NaCl based on dry weight) not less than 95 percent.

712.04.B.

On page 801, **Replace** the second paragraph with following:

4.2.1. *Particle size of Quick Lime* – Quick lime shall all pass the 3/8-inch (9.5 mm) sieve and at least 90 percent shall pass the No. 4 (4.74 mm) sieve.

712.06.A

On page 802, **Replace** the last two sentences in the section with:

Ensure that the treatment of structural timber, lumber, piling, posts, and braces conform to the current AWPA standards or AASHTO M-133, and this subsection.

712.06.B

On page 802, **Replace** the section with:

B. Materials. Furnish timber preservatives according to AASHTO M 133 and current AWPA standards.

712.06.H

On page 802, **Add** the following section after section **G**

H. Sawn Wood Sign Posts. A sawn wood post must adhere to AASHTO M 168: Wood Products standards, and be the allowable grade and species for the sizes shown in the following table:

Nominal post size[a]	Allowable grade and species
4 by 4 inches	No. 1 structural light framing Douglas fir, free of heart center
	No. 1 structural light framing Hem-Fir, free of heart center
	No. 1 structural light framing Southern Yellow pine
4 by 6 inches	No. 2 structural joists and planks Douglas fir, free of heart center
	No. 1 structural joists and planks Hem-Fir, free of heart center
	No. 1 structural joists and planks Southern Yellow pine
Greater than 4 by 6 inches	No. 1 posts and timbers, also known as No. 1 structural Douglas fir, free of heart center
	Select structural Hem-Fir, free of heart center
	No. 1 timbers Southern Yellow pine

[a]Sizes shown are nominal dressed sizes

The sweep must not exceed .08 foot in 10 feet.

Sawn wood sign posts must be graded per the following:

Southern Pine Inspection Bureau (SPIB) Standard Grading Rules
Western Wood Products Association (WWPA) Standard Grading Rules
West Coast Lumber Inspection Bureau (WCLIB) Standard Grading Rules

Posts must be treated per current AASHTO M 133: Preservatives and Pressure Treatment Processes for Timber standards.

Douglas fir and Hem-Fir posts must be incised prior to treatment.

Inspection shall be in accordance with AWPA M2.

Quality control shall be in accordance with AWPA M3.

Care of the posts shall be in accordance with AWPA M4.

725.08.A.

On page 812, **Add** the following sentence to the end of the first paragraph,

Equip the pull box with a stainless steel electrical grounding stud, 1/4-20 UNC thread, with 1/2-inch minimum stickout, located in the lower third of an interior wall.

725.11.B

On Page 814, **Delete** the following from the specification:

Furnish metal halide lamps that are first line, high quality lamps having heat resistant clear glass envelopes with a quartz arc tube interior with horizontal initial lumens and approximate hours of life not less than the values shown in TABLE 725.11-3.

TABLE 725.11-3

ANSI	WATTS	Horizontal Lumens Initial	Economic Life Hours
M57	175	14,000	4,000
M58	250	18,000	4,000
M59	400	32,000	10,000
M47	1,000	95,000	7,500

Furnish metal halide lamps that produce a minimum of 65 percent of the initial lumen output at the end of economic life.

Furnish low pressure sodium lamps that are first line, high quality lamps having heat resistant clear glass envelopes with a quartz arc tube interior with horizontal initial lumens and approximate hours of life not less than the values shown in TABLE 725.11-4.

TABLE 725.11-4

WATTS	Lumens Initial	Economic Life Hours
35	4,000	16,000
55	8,000	16,000
90	13,500	16,000
135	22,500	16,000
180	33,000	16,000

725.11.F

On page 817, **Replace** the third complete paragraph with the following:

For mounting on concrete, use adhesive-grip anchors designed to be set into a drilled hole half-filled with material meeting 705.20, with a minimum hole depth of 1-3/4 inches.

725.16

On Page 819, **Replace** the first paragraph with the following:

Ensure that each ground rod is one piece, at least ¾ inch in diameter and 10 feet in length with a driving point on the lower end. If other than circular cross section, assure the periphery of the rod is 4.7 inches or more. Ensure that the rod is of solid construction and is 100% stainless steel and UL listed. 1 inch by 10 feet galvanized rods may be installed through 12/31/2018. After that date, only ground rods meeting the material specifications above will be accepted.

725.19.F

On page 820, **Replace** the first and second paragraphs with the following:

F. Switchgear Enclosure. Ensure that components are mounted on a removable back panel of 14 gage or heavier stainless steel rather than directly on the back wall of the enclosure and that the back panel mountings do not penetrate the walls of the enclosure. Provide a welded grounding stud on the enclosure interior.

Ensure that a neutral terminal bar of adequate ampere rating and with holes in number and of size to terminate each conductor separately is provided in each enclosure where neutral conductors are to be terminated. Ensure that an equipment grounding conductor terminal bar of adequate ampere rating and with holes in number and of size to terminate each conductor separately is provided in each enclosure where grounding conductors are to be terminated. When there is no code or utility company

prohibition, a combination neutral and equipment grounding conductor bar may be furnished. Attach the grounding electrode conductor to the grounding stud. Provide a bonding jumper from the equipment grounding bar to the grounding stud.

725.19.H

On page 821, **Replace** the first paragraph with the following:

H. Customer Service Pole. Furnish a wood pole that complies with Supplement 1072. Ensure that the pole and any cross arms or pole key is Southern Pine or Western Red Cedar, full length, pressure treated in compliance with specifications of the American Wood Protection Association or AASHTO M-133. Ensure that the pole is 35 feet (10.5 m) minimum in length and Class 4 or heavier and conforming to ANSI 05.1 Specifications and Dimensions for wood poles. Ensure that the pole is reasonably straight without pronounced sweep or short crooks.

725.19.I

On page 821, **Add** the following section after section H:

I. Circuit Breakers. Ensure that circuit breaker assemblies for lighting control circuits are 100% rated for continuous (over 3 hours) operation by the manufacturer and labeled so, with a pre-defined minimum enclosure size, and housed in an enclosure sufficient to achieve the 100% rating.

725.21.A

On page 824, in the third full paragraph after the words "aluminum door", **Add** the following:

, bolted, or (if specified)

725.21.B.9

On page 828, **Delete** the phrase: "at least 2 inches (50mm) beyond the threads."

726.01

On page 828, **Replace** the entire section with the following:

726.01 Barrier Reflectors. Furnish concrete barrier, retaining wall, bridge parapet, bridge rail or guardrail blockout reflector body housings of the following Type:

Type 1, Barrier Reflector. Furnish concrete barrier, retaining wall, bridge parapet, or bridge rail reflector body housings that are made of acrylic or polycarbonate plastic. Ensure that the minimum reflective surface area of the reflector is 7 square inches (4400 mm^2).

Furnish white reflectors that reflect the following minimum candela of light at the indicated observation angles for each 1 foot-candle (10.76 lx) of incident light at the indicated entrance angles. Furnish amber reflectors that reflect at least 60 percent of these values.

MINIMUM SPECIFIC INTENSITY, CD/10.76 LX

	Observation Angle	
Entrance angle	**0.2°**	**2.0°**
-4°	62	0.25
15°	52	0.18

The entrance angle is measured in the horizontal plane between the direction of incident light and normal to the face of the reflector. The observation angle is measured in the vertical plane between the observer's line of sight and the direction of light incident to the reflector face.

Type 2, Barrier Reflector. Furnish corrosion resistant metal guardrail blockout reflectors that are a minimum size of 4.5 × 10 × 0.125 inches (112.5 × 250 × 3.1 mm) with 1/4" (6 mm) predrilled mounting holes. One or both sides shall be covered with a minimum 4.5 × 5 inches (112.5 × 125 mm) of Type G, H or J reflective sheeting.

Type 3, Barrier Reflector. Furnish acrylic or polycarbonate plastic guardrail blockout reflector housings with 1/4" (6 mm) predrilled mounting holes. Products shall be structurally reinforced to withstand the force of thrown plowed snow. New products will be tested by the Department for a minimum of one winter season before approval. One or both sides shall be covered with a minimum 4.5 × 5 inches (112.5 × 125 mm) of Type G, H or J reflective sheeting.

Type 4, Barrier Reflector. Furnish spring loaded guardrail blockout reflector (reflector plate, holding arm and holding plate) made of plastic with UV protection.

The reflector plate shall have a minimum size of 5.33 x 6.33 x 0.150 inches. One or both sides of the reflector plate shall be covered with a minimum 5.0 x 6.0 inches of Type G, H or J reflective sheeting.

The total height of the Spring Loaded Guardrail Blockout Reflector shall be 26.00 inches, which includes the reflector plate, holding arm and holding plate.

The holding plate shall have 2 predrilled holes for 5/11x 1 1/14 inch long leg screw.

The spring shall be made of 0.135 phos-music wire conform to ASTM-A228-07 standard specification requirements.

Type 5, Barrier Reflector. Furnish L-type guardrail blockout reflector 6.50"x11.38" (reflective and mounting plate) made of durable, flexible high density polyethylene (HDPE) plastic with UV protection.

The reflective plate shall have a minimum size of 6.50"x4.25" inches. One or both side of the reflective plate shall be covered with a minimum of 26.0 square inches Type G, H or J reflective sheeting.

The mounting plate shall have two (2) 1/2" (12.7 mm) predrilled mounting holes.

Furnish materials according to the Department's QPL.

730.01

On page 829, **Replace** the section with the following:

730.01 Steel Tube and Pipe. Furnish steel tube and pipe according to ASTM A 53, Grade B, ASTM A 500 Grade B**,** or ASTM A 501, except provide tubing for truss and end frame diagonals according to 711.01.

730.017

On page 830, **Replace** the section with the following:

730.017 Wooden Box Beams. Furnish wooden box beams fabricated from 1/10 or 1/8 inch (2.54 or 3.18 mm) thick laminated veneers with the grain oriented parallel to the length of the finished beam and the veneers glued together in a continuous process with lap or scarf joints connecting successive veneers in each layer staggered throughout the thickness of the beam. A 45 degree miter shall be used for the corner joints. The adhesive used shall be a phenol-formaldehyde which conforms to ASTM D 2559. The beams shall be pressure treated with a preservative meeting AWPA Standard U1, Commodity Specification F: Composite Materials.

730.19

On page 832, **Replace** the first paragraph of 730.19 with the following:

Furnish Type G reflective sheeting of microprismatic construction according to Supplement 1049, and according to ASTM D 4956, Type IV, including supplemental requirement S1. Do not furnish material of glass bead construction.

731.06

On page 834, **Replace** the second paragraph with the following:

Ensure that the manufacturer of LED beacons is listed on the Department's TAP for LED signal lamps.

731.07

On page 835, **Replace** the first paragraph with the following:

Ensure that the manufacturer of LED beacons is listed on the Department's TAP for LED signal lamps.

731.08

On page 835, **Add** the following sentence to the end of the first paragraph,

Conduit must be labelled clearly as Sunlight Resistant, meeting the requirements of NEC Art. 300 and 350.

731.10

On page 835, **Replace** the second paragraph with the following:

Furnish materials according to the Department's TAP.

732.04

On page 840, **Replace** the fourth paragraph with the following:

Furnish materials according to the Department's TAP.

732.06

On page 842, **Replace** the second Paragraph with the following:

Ensure that the design of the pushbutton and its associated contacts and housing are sturdy and resistant to mechanical shocks and abuse. Ensure that a concentrated force of 50 pounds (225 N) applied to the button or any exposed portion does not damage the unit or misadjusts the contacts. Furnish a housing with a curved back surface for mounting on poles of various diameters. Integrate the curved surface with the housing or supply an adapter with a flat back type housing. Attach the cover assembly to the housing by stainless steel machine screws, resulting in a weatherproof and shockproof assembly. Furnish a hole threaded for a 1/2-inch (13 mm) pipe in the housing for conduit attachment purposes. Furnish housing with manufacturer applied external surfaces of yellow Color 13655, FEDERAL STANDARD 595 , unless specified otherwise in the Plans.

732.06

On page 842, **Remove** the fourth Paragraph in its entirety.

732.07

On page 843, **Replace** the last sentence of the section with the following:

Furnish materials according to the Department's TAP.

732.08

On page 843, **Replace** the third paragraph with the following:

Furnish materials according to the Department's TAP.

732.11

On page 844, **Replace** the sixth paragraph with the following:

Use steel anchor bolts conforming to ASTM F1554, Grade 105 and galvanized according to 711.02. Ensure that ends have a steel plate as shown on the plans.

732.19

On page 848, **Revise** Table 732.19-1 CABLE AND WIRE as follows:

Cable or Wire	Number of Conductors	Wire Gage	Specification or type	Conductor Type	Notes
Signal Cable	As specified	As specified	IMSA 19-1 IMSA 20-1	Copper, color coded, stranded	
~~Interconnect cable~~	~~As specified~~	~~As specified~~	~~IMSA 19-1~~ ~~IMSA 20-1~~	~~Copper, color coded, stranded~~	
	~~Twisted pairs as specified~~	~~As specified~~	~~RUS PE-39~~ ~~IMSA 19-2~~ ~~IMSA 20-2~~	~~Copper, color coded, solid~~	
~~Interconnect cable, integral, messenger type~~	~~As specified~~	~~As specified~~	~~IMSA 19-3~~ ~~IMSA 20-3~~	~~Copper, color coded, stranded~~	
	~~Twisted pairs as specified~~	~~As specified~~	~~IMSA 19-4~~ ~~IMSA 20-4~~	~~Copper, color coded, solid~~	~~[2]~~
Loop detector wire	Single conductor	14 AWG	IMSA 51-5	Copper, stranded	
Loop detector lead-in cable	Two conductor	14 AWG	IMSA 50-2	Copper, twisted pair, stranded, shielded	
Power cable	Two conductor	As specified	UL: RHH/RHW/ USE or HHW, cross linked polyethylene with an insulation thickness of 0.045 inch (1.14 mm) (min.)	Copper, stranded	[3]
Service cable	Two conductor (duplex)	As specified		Aluminum,[1] twisted, stranded	
Ground Wire	Single conductor		UL: RHH/RHW/USE or XHHW, cross linked polyethylene	Copper, stranded	[4]

Loop detector leadin cable, direct burial	As specified	12 or 14 AWG, or as specified	IMSA 19-6 IMSA 20-6	Copper, stranded	
Loop detector leadin cable, Integral messenger type	As specified	12 or 14 AWG, or as specified	IMSA 19-4 IMSA 20-4	Copper, stranded	

732.21

On page 847, in the first paragraph, second sentence, **Delete** the phrase "(or circuit breaker)"

733.02.C

Page 851 **Replace** the second paragraph with the following

Furnish materials according to the Department's TAP.

733.02.D

Page 851 **Replace** the second paragraph with the following

Furnish materials according to the Department's TAP.

733.03.A.1

Page 855 **Replace** the ninth paragraph with the following

Furnish materials according to the Department's TAP.

733.03.A.2

Page 861 **Replace** the second paragraph with the following

Furnish TS-1 cabinets according to the Department's TAP.

733.03.B

Page 863 **Replace** the first paragraph with the following

Furnish TS-2 cabinet according to the Department's TAP.

733.02.C.4.a

Page 864 **Replace** the last sentence of the section with the following

Furnish loop detector sensors according to the Department's TAP.

733.03.E

Page 875 **Replace** the last sentence of the section with the following

Furnish 336L cabinet materials according to the Department's TAP.

733.09

Page 882 **Replace** the last sentence of the section with the following

Furnish materials according to the Department's TAP.

733.10

On page 882, **Add** the following section after the last paragraph on the page:

733.10 Centrally Controlled Arterial Traffic Signal System. Furnish materials according to the Department's Traffic Authorized Products (TAP) List.

740.02

On page 883, **Replace** the fifth paragraph with the following:

Ensure that Type 1 and Type 1A conforms to the following requirements:

740.05

On page 887, **Delete** the following sentence from the sixth paragraph:

Use Materials certified according to Supplement 1089.

740.08

On page 889, **Replace** the second paragraph with the following:

Prequalify materials according to Supplement 1047. Furnish materials according to the Departments' Approved List.

740.09.D

On page 890, **Replace** the third paragraph with the following:

Ensure that the glass beads have the following gradation when tested according to Supplement 1008.

748.04

On page 893, **Add** the following new section after section **748.03 Polyethylene (PE) Service Branches and Fittings.**:

748.04 Glass-Fiber-Reinforced Polymer Mortar Pipe (RPMP), Joints, and Fittings. Furnish RPMP conforming to ASTM D 3517 or AWWA C 950. Design of underground and above ground glass-fiber-reinforced polymer mortar pipe and fittings shall meet design requirements of AWWA M 45: Fiberglass Pipe Design Manual.

Furnish double-bell push-on type fiberglass joints conforming to ASTM D 4161 and with a rubber gasket conforming to ASTM F 477. Furnish restrained joints and fittings conforming to ASTM D 3517 or AWWA C 950.

Provide a minimum pipe stiffness of 18 psi.

Furnish certified test data as defined in 101.03 to the Engineer.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 804
FIBER OPTIC CABLE AND COMPONENTS

January 20, 2017

804.01 Description. This work consists of furnishing and installing fiber optic cable and components. This specification describes the requirements for communication system cables, splicing, associated interface devices, and power cables.

804.02 General. Furnish new materials and equipment, being of first quality, of latest design and completely free of defects in material and poor workmanship.

All materials, cables, fiber and hardware shall be of the same type and manufacturer to assure uniformity, interchangeability of components, single responsibility and most satisfactory service.

Permanently attach to each major component, the manufacturer's name, the type or style, model number and serial number on a weatherproof decal or tag.

All fibers in the cable shall be usable fibers and shall be free of surface imperfections, material and inclusions in order to meet or exceed one hundred percent (100%) of the optical, mechanical, and environmental requirements contained in this specification.

Applicable Documents

All work described in this section shall meet or exceed the applicable provisions of the following industry documents:

A. U.S Department of Agriculture, Rural Electrification Administration Specification for Totally Filled Optical Fiber Cable, PE-90
B. EIA/TIA-455-a, Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components
C. EIA/TIA-455-25a, Repeated Impact Testing Of Fiber Optic Cables and Cable Assemblies
D. EIA-455-28b, Method for Measuring Dynamic Tensile Strength of Optical Fibers
E. EIA-455-33a, Fiber Optic Cable Tensile Loading and Bending Test
F. EIA-455-34, Interconnection Device Insertion Loss Test
G. EIA-455-41, Compressive Loading Resistance of Fiber Optic Cables
H. EIA/TIA-455-81a, Compound Flow (Drip) Test for Filled Fiber Optic Cable
I. EIA/TIA-455-82b, Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable
J. EIA-455-89a, Fiber Optic Cable Jacket Elongation and Tensile Strength
K. EIA-455-95, Absolute Optical Power Test for Optical Fibers and Cables
L. EIA-455-104, Fiber Optic Cable Cyclic Flexing Test
M. EIA/TIA-598, Color Coding of Fiber Optic Cables
N. EIA/ANSI-472 Generic Requirement for Optical Fiber and Optical Fiber Cables
O. ANSI/ICEA S-87-640
P. ANSI/TIA/EIA-526-7: OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

804.03 Materials. Furnish materials conforming to: 904.01 and as listed on the QPL. Provide all materials required for the installation and splicing of the specified communications cables, power cables, and associated interface devices. All materials, cables, fiber and hardware shall be commercially-available items.

804.04 Manufacturer Warranties. Provide a three (3) year manufacturer's warranty to all items contained in this specification with the exception of fiber optic cable, which shall be warranted by the manufacturer for a period of one (1) year. This one (1) year transferrable warranty shall cover the cable against significant degradation of the fiber caused by cable defects incurred either during the manufacturing or installation process.

804.05 Fiber Optic Cable. Fiber optic cable shall be loose tube, single-mode dielectric cable. In instances where new fiber optic cable is being spliced to existing fiber optic cable, match the existing type of fiber optic cable, unless it does not meet the following specifications:

1. ITU-T G.652 (Categories A, B, C and D)
2. IEC Specification 60793-2-50 Type B1.3
3. TIA/EIA 492-CAAB
4. Telecordia GR-20

Provide written manufacturer certification that the offered cable complies with all optical, electrical and mechanical requirements set forth in this and all referenced specifications.

Any deviation of the offered cable from the requirements set forth herein shall be conspicuously noted by colored highlights and/or callout bubbles in the submitted material documentation.

Ensure all cables are free of material or manufacturing defects and dimensional non-uniformity that would:

1. Interfere with the cable installation using acceptable installation practices.
2. Degrade the transmission performance and environmental resistance after installation.
3. Inhibit proper connection to interfacing elements.
4. Otherwise yield an inferior or inoperative installation.

Certain mechanical requirements such as central anti-buckling members and other items necessary to comply with the maximum bend requirements in 904.01 may be omitted, if approved by the Engineer.

A. Cable Wraps

Furnish and install cable wraps (markers) on the fiber optic cable installed in each pull box (median and round).

Provide wraps that:

1. Are 4 inches long "snap on type", UV stabilized, and solid color throughout.
2. The wording shall include no advertising logo or message.

Provide wraps with color and text as follows:

1. For ODOT cable: yellow background with black print text "ODOT fiber optic cable – ITS 614-387-4113".

Include the fiber count of the appropriate fiber that the cable wraps is placed upon.

B. Cable Installation

Exercise extreme caution when ordering optical fiber cable in order to ensure that no additional splicing, beyond that indicated in the plans, is required.

If it is believed that additional splices are required, immediately bring this matter to the attention of the Engineer for resolution.

Certification is required by the cable manufacturer to perform installation with the cable manufacturers recommended procedures including, but not limited to the following:

1. Proper attachment to the cable strength elements for pulling during installation.
2. Cable tensile limitations and the tension monitoring procedures.
3. Cable bending radius limitations.

Submit documentation to the Engineer showing that one of the following certifications is held at the time of the contract letting date:

Building Industry Consulting Service International (BICSI) - All fiber installers must be Installer 2, Optical Fiber certified and at least one installer shall be BICSI Technician certified and the Technician shall oversee all fiber optic cable operations.

Electronics Technician Association (ETA) - All fiber installers must be FOI certified and at least one installer shall be FOT-OSP certified and all fiber optic cable operations shall be overseen by the FOT-OSP Technician.

Fiber Optic Association (FOA) - All fiber installers must be CFOT certified and at least one installer shall be CFOS certified and the CFOS shall oversee all fiber projects.

Present certification to the Engineer prior to installing any cable.

Comply with the cable manufacturer's specifications at all times.

To accommodate long continuous installation lengths, bi-directional pulling of the optical fiber cable is permissible. Implement as follows:

1. From the midpoint of a pull station, pull the fiber optic cable into the conduit from the shipping reel in accordance with the manufacturer's specifications.
2. When this portion of the pull is complete, remove the remainder of the cable from the reel to make the inside end available for pulling in the opposite direction.
3. This is accomplished by hand pulling the cable from the reel and laying it into large "figure eight" loops on the ground. The purpose of the figure eight pattern is to avoid cable tangling and kinking.
4. Lay the figure eight loops carefully one upon the other (to prevent subsequent tangling) and in a protected area.
5. Make available for installation the inside reel end of the cable.
6. Should it be necessary to set up a winch at an intermediate manhole or pull box, pull the required length of cable to that point and bring out of the manhole and coil into a figure eight.
7. The figure eight is then turned over to gain access to the free cable end. This can then be reinserted into the duct system for installation into the next section.

Ensure that the minimum bending radius of the optical fiber cable is not compromised when preparing this stored cable slack.

Involve the placement of optical fiber cables in an inner duct during installation. Ensure that inner ducts are secured to prevent movement during the cable installation process.

Do not pull the sheath termination hardware on the optical fiber cables over any sheave blocks.

Do not exceed 100 feet per minute of pulling speed when power equipment is used to install optical fiber cabling.

Do not exceed the pulling tension and bending radii limitation for optical fiber cables under any circumstances.

Use large diameter wheels, pulling sheaves, and cable guides to maintain the appropriate bending radius.

Provide tension monitoring at all times during the pulling operation by using commercial dynamometers, load cell instruments, or shearing pins.

B.1. Air-blown/Pushable Fiber-optic Cable and Micro-duct Installation. Follow all manufacturer recommended procedures when performing installation of air-blown fiber. Have a manufacturer representative present for the installation of the first 2 complete runs of both the micro-duct pathway and air-blown fiber optic cable from pull-box to pull-box.

All micro-duct pathway shall consist of complete runs between pull-boxes with no pathway splices occurring in between.

Account for thermal expansion and contraction when installing pathway.

Micro-duct pathways may be installed by plowed-trench method, open-trench method, saw-cut in pavement, or by horizontally-directional boring method.

Perform BB and pressure testing per manufacturer recommendation on all micro-ducts following complete installation and in the presence of the ODOT Engineer or their representative and a manufacturer representative.

B.2. Slack Installation. Proper storage of slack cable, both long term and short term, will be required.

Do not leave slack cable lying free on the ground or floor of a building except during the actual pulling process.

Neatly coil the cable, adhering to the bend radius requirements, on racks or bays, as directed by the Engineer.

Submit certified shop drawings of the materials and installation of the anchored mounting channels to be installed in pull boxes and aerial hardware according to 625.06.

Include the cost for the fiber optic cable used in the slack installation (both aerial and underground) and mounting hardware. This shall be paid per location per cable.

B.2.A. Underground Slack Installation. In underground installations, coil 150 feet of fiber slack in each 48" or 32" pullbox. Direction will be provided by the Engineer should the Contractor believe that this amount of slack is not capable of being stored.

B.2.B. Aerial Slack Installation. Where slack installation is designated, but a splice enclosure is not designated, provide a 100 feet in-line aerial mounted slack cable installation.

Where an aerial splice enclosure is shown, provide 50 feet of aerial mounted slack for each cable entering the splice enclosure.

Where the fiber cable is being brought aerially into an underground installation, provide 40 feet of slack for each cable run entering the designated pull box.

804.06 Fan-Out Kit. Only four (4) drop cable fibers are required for the full duplex daisy-chain fiber optic communication design; the remaining fibers are typically unused spares.

Fan out and apply connectors to all unused drop cable fibers and insert them into the termination panel. Color coded, Pre-connectorized, pre-tested pigtails may also be used.

Connectors attached to fibers from the fan-out kit shall be incidental to the fan-out kit.

804.07 Drop Cable. Drop cables are used to connect the fiber trunk cable to termination point.

Leave unused drop cable fibers for future use.

Place spare drop cable fibers at the splice enclosure end inside of the enclosure with sufficient excess to provide two service loops.

Insert spare drop cable fibers at the device end into the fan-out kit, connectorized and inserted in the termination panel.

Provide drop cables routed down through a pole from aerial interconnect with strain relief (cable support assembly).

Cost of the cable support assembly shall be incidental to the bid item price of the drop cable.

Provide a minimum of 15 feet (4.5 meters) slack drop cable in each device cabinet or termination panel location.

Coil slack drop cable and bind to the cabinet or wall via tie wrap or other approved means.

Any means of securing the slack cable shall NOT apply stress to the drop cable.

Loosely wrap tie wraps around the cable.

804.08 Fiber Optic Patch Cord. Equip patch cords for connections to/from fan-out kits and/or fiber termination panels with approved connectors on both ends of the patch cord.

The optical connectors on the other end of these patch cords shall be compatible with the connectors furnished on the optical device transmit and receive cards.

Patch cords shall be of a length that minimizes the amount of slack that needs to be stored in the cabinet.

804.09 Fiber Termination Panel. Provide a termination panel in a place that provides the most room for making connections, minimizes fiber bending, and does not subject fibers to interference from door openings or routine maintenance operations inside the cabinet space.

House in the termination panel all fiber optic pigtails, fiber optic connectors, fiber optic patch cords, and splice trays.

Mount termination panels in a location in ground mounted cabinets such that the bottom of the panel is 36” from the top of the cabinet riser or 48” from ground level.

All fiber optic pigtails, fiber optic connectors, fiber optic patch cords, splice trays, and pigtail fusion splices shall be incidental to the unit cost of the fiber optic termination panel.

Provide three meter patch cords of the appropriate fiber type and fiber connectors in a quantity that is half of the number of fiber optic connectors available on the termination panel, or as directed by the engineer.

A. NEMA Cabinet

Attach termination panel to the inside wall of the cabinet.

B. Caltrans Signal Cabinet (332, 336)

Utilize standard 19-inch rack mount panels for the termination panel.

C. Caltrans (334) or AASHTO/ITE/NEMA ITS Cabinet

Utilize standard 19-inch rack mount panels for the termination panel.

Provide a minimum of five 12-strand Splice Trays place in the fiber termination panel.

Splice trays shall be incidental to the cost of the termination panel.

Splice trays shall be of the type that allows up to 12 splices. The buffer tubes of each fiber shall enter at opposite ends of the splice tray and shall have separate coils of fiber at opposite ends of the tray.

Install splice trays in the following manner:

The splice trays have areas on each end for coiled fiber.

Coil the entering fiber buffer tube at one end and coil the exiting fiber buffer tube at the opposite end.

Secure the splice, with splice protector in the holder, located in the center of the splice tray.

Secure all splice trays in a separate 19 inch rack mount housing from the fiber optic connectors, so as to limit the amount of clutter located in the termination panel housing.

Make available enough fiber optic cable slack to allow each splice tray to be set flat on the ground outside of the cabinet, during any needed future fiber optic maintenance/repairs.

Install all fiber optic cable, buffer tubes, pigtails, patch cords, and splice trays in a neat and orderly fashion and secured to eliminate any interference with the removal, replacement, operation, and maintenance of all other items located in the cabinet.

Perform all permanent splicing based on Fiber Termination Drawings found in plan set.

Provide an emergency restoration kit with each fiber termination panel to perform temporary splices. This kit shall include all necessary materials to perform a minimum of 5 mechanical splices. Tools, such as cleavers, strippers, etc., shall be provided by the owning agency. Each mechanical splice kit shall be capable of achieving not more than 0.5dB loss at any wavelength and contain LC/SC/ST type connectors. This kit shall be incidental to each termination panel. The emergency restoration kit shall be of the same manufacturer as the cable being installed.

804.10 Fusion Splicing. Ensure that all permanent optical splices are of the core alignment fusion type method.

Splice only at locations identified in the plans or approved by the Engineer.

The splicing of fibers shall be between fibers of identical color contained in fiber buffer tubes of identical color (splice through in-kind fibers inside of in-kind buffer tubes), or as specified in the plans.

Ensure all splicing equipment is in good working order, properly calibrated, and meets all industry standards and safety regulations.

Accomplish cable preparation, closure installation, and splicing in accordance with accepted and approved industry standards.

Upon completion of the splicing operation, deposit all waste material in suitable containers, removed from the job site, and disposed of in an environmentally acceptable manner.

No individual splice loss measured in a single direction shall exceed 0.05 dB.

804.11 Fiber Optic Connectors. In the event that particular components proposed in the system are not compatible or cannot fit within the cabinets with the proposed type connectors, detail a plan to use other connectors for the Engineer's approval.

Include in the plan the type of connector, except for the pigtails connecting to the components requiring different connectors, and new proposed cabinet layout.

The contractor shall be compensated for any change in materials and any labor involved.

Optical fiber connectors shall satisfy all of the interface parameters of equipment components as may be defined by the transmission equipment specifications.

Pigtails shall have sufficient length to extend from the fiber splice closure to the termination panel, allowing for routing, securing, and slack.

The connector shall be pre-terminated on the fiber cable or pigtail and core-aligned fusion spliced to the fiber trunk cable.

No-epoxy, no-polish quick mount single-mode UPC connectors shall be provided.

804.12 Splice Enclosure. Use a ring cut methodology at splice locations, as described below.

Cut back trunk cable jacketing at a sufficient distance to allow unused trunk fiber tubes to be stored uncut/unopened with two service loops inside the enclosure.

Open the trunk cable tube that contains the interconnect fibers to expose the inner fibers.

The remaining trunk cable fibers in the opened tube shall remain uncut and stored in the splice tray with a minimum of two service loops.

The only trunk cable fibers that are to be cut are the trunk cable fibers being spliced into the drop cable.

Cost for the splices shall be incidental to the fiber optic cable being spliced. If all fiber optic cable is existing, then splices will be itemized separately.

If the contractor must cut the cable at the splice enclosure location, the additional splices for through fibers shall be included in the cost of the splice enclosure.

804.13 Fiber Optic Media Converter. Equip traffic signal controllers and/or cabinets and ITS cabinets with media converters.

Install and activate each media converter in the controller housing or cabinet.

804.14 Testing. All testing listed below shall be incidental to the cost of the fiber optic cable and shall be completed and approved, prior to acceptance of the fiber optic cable by the Engineer.

A. Optical Fiber Cable Factory and Reel Testing. Obtain a factory test data sheets for each reel of optical fiber cable delivered.

The tests shall be performed by the factory at 1550 nm and shall include directional Optical Time Domain Reflectometer (OTDR) traces and test data for each fiber in the cable.

Test each fiber on the reel at 1550 nm prior to installation to ensure no damage occurs to the fiber in transit and that the length of cable is correct.

Provide these two test results to the Engineer prior to installation as part of final acceptance of the section of cable for payment.

Attenuation test all cabled optical fibers > 1000 meters in length. Provide the attenuation of each fiber with each cable reel.

Supply the Engineer with the factory, and pre-installation test results documenting that the cables meet all relevant EIA specifications.

Single-mode fibers utilized in the cables specified herein shall be subjected to and successfully pass a tensile proof stress test equivalent to 100 kpsi (0.70 gN/m^2) for 1.0 second.

Fibers shall contain no factory splices.

B. Post-Installation Testing. Test all continuous fiber with a light source utilizing procedures as stated in ANSI/TIA/EIA-526-7: MEASUREMENT OF OPTICAL POWER LOSS OF INSTALLED SINGLE-MODE FIBER CABLE PLANT - OFSTP-7.

Testing procedures shall utilize – one jumper reference.

Perform bidirectional testing of optical fibers.

Coordinate with the Engineer for specific locations for the testing.

Provide the Engineer written notification a minimum 14 calendar days before testing the fiber optic cable.

Do not begin testing until written authorization and fiber locations and test points have been received from the Engineer.

Perform tests as described below:

1. Test all single mode fiber cables at both 1310 nm and 1550 nm after installation.
   Fibers will be considered acceptable if the Optical Time Domain Reflectometer (OTDR) trace for that fiber shows an end to end loss of less than xx dB + yy (0.05) dB + zz (0.2) dB (where yy is the number of splices (a number to be provided by the Engineer), zz is the number of connector pairs and xx is calculated using the following formula: xx = distance x fiber attenuation/unit distance at the required wavelength).
   In addition, no splice may show a loss of greater than 0.05 dB and no connector pairs may show a loss of greater than 0.2 dB, regardless of the total accumulated end-to-end loss.
   Perform any additional tests required by the ANSI/TIA/EIA standard and include in the written test report.
2. Test each fiber strand from both ends of the fiber utilizing an OTDR at the wavelengths specified above.
   Overall, the OTDR test results shall be made up of the wavelength of the conducted test, the link length, attenuation, cable identification, and the locations of the near end, the far end and each splice point or points of discontinuity.
   Electronic format results for each fiber strand shall be submitted as part of the final documentation, prior to acceptance.
   Submit to the Engineer all test results in electronic format provided by the manufacturer of the test equipment used by the contractor to perform the tests.
   Those results must be provided such that they can be viewable without the use of special software or additional equipment, unless the software or equipment is also delivered to the Engineer.
   If software is provided, a separate pdf document showing all fiber test results must be submitted to be placed in the project file.
   Any software or equipment so delivered will become the permanent property of the maintaining agency and will not be returned.

3. If the cable fails to meet the above requirements, it shall be replaced by the Contractor at the Contractor's expense.

   Test results shall include a record of wavelength, fiber type, fiber and bundle number, test equipment and model number, date reference setup, and operator (crew members).

   In the event that test results are not satisfactory, make adjustments, replacements, and changes as necessary and then repeat the test or tests that disclosed faulty or defective material, equipment, or installation method. Additional tests shall be performed as the Engineer deems necessary.

   Tests related to connected equipment of others shall be done only with the permission and presence of the Contractor involved. Perform only that testing required to prove that the fiber connections are correct.

804.15 Packaging and Shipping. Package the completed cable for shipment on wooden reels.

Wrap the cable and reel in a water resistant covering.

Securely fasten each end of the cable to the reel to prevent the cable from coming loose during transit.

At least six feet of cable length on each end of the cable shall be accessible for testing.

Seal both ends of the cable to prevent the ingress of moisture.

Provide on each cable reel a durable weatherproof label or tag showing the manufacturer's name, the cable type, and the actual length of cable on the reel, the Contractor's name, the contract number, and the reel number.

Include a shipping record in a weatherproof envelope showing the above information and also include the date of manufacture, cable characteristics (size, attenuation, etc.), cable identification number and any other pertinent information.

The minimum diameter of the reel shall be at least thirty times the diameter of the cable.

The optical fiber cable shall be in one continuous length per reel with no factory splices in the fiber.

Each reel shall be marked to indicate the direction the reel shall be rolled to prevent loosening of the cable.

Installation procedures and technical support information shall be furnished at the time of delivery.

804.16 Fiber Optic Training. Provide both formal classroom and "in-field" operations and maintenance training for up to twenty (20) designated personnel on the fiber optic cable system and its components. Coordinate all training at a mutually agreed upon time and location. All training material generated for each course shall contain "hand-outs" for each attendee. These hand-outs shall serve not only as subject guidance, but as quick-reference material for future use. Deliver all course material, in reproducible form, to the Engineer immediately following course completion. Provide two (2) DVD copies of the training program.

Submit for Engineer's approval at least two (2) weeks prior to the proposed starting date, the schedule for such training.

A. Classroom Training. Train personnel to install, splice, and test fiber optic cable. This training shall be a minimum of 32 hours. The 32 hours of fiber optic training shall be a four (4) day course taught by personnel from the manufacturer of the fiber optic cable. Topics in the course shall include: safety, theory, fiber types, cable placement

techniques, fiber optic sheath removal, hardware types, fault location with an Optical Time Domain Reflectometer (OTDR), Dense Wave Division Multiplexing (DWDM), splicing and termination methods and applications, theory and principles of splicing, fusion splicing, mechanical splicing, cable preparation procedures for installing optical connectors, installing connectors, mocking up a typical traffic control system, cable system testing and documentation, attenuation test procedures, and overall cable system maintenance. This course shall include lectures, demonstrations, and hands-on experience with the equipment. Students shall be given hand-outs to use as guides for field applications.

B. Field Training. Provide field training. This training shall consist of the following as a minimum: eight (8) hours of fiber optic communications plant trouble shooting including fault location using an optical power meter/light source and using an Optical Time Domain Reflectometer (OTDR) cable tester, four (4) hours of field splicing (which shall include re-enterable rotary mechanical splicing (for emergency temporary repair) and fusion splicing techniques), and four (4) hours of training on the installation, maintenance, and replacement of fiber interconnect centers.

C. Course Outline and Workbooks. For both types of training, four (4) copies of all proposed training material shall be submitted for approval, which shall include course curriculums, draft manuals, and resumes of instructors. Make submittals to the Engineer at least four (4) weeks prior to the scheduled starting date. For the classroom training, provide for each participant a course workbook, which shall be provided in loose-leaf format in a three (3) ring binder.

804.17 Method of Measurement. The Department will measure Fiber Optic Cable by the number of feet, excluding slack, and will include the costs for equipment, fusion splices, labor and miscellaneous materials.

The Department will measure Fiber Optic Cable, Airblown / Pushable by the number of feet, excluding slack, and will include the costs for equipment, fusion splices, labor and miscellaneous materials.

The Department will measure Micro-duct Pathway by the number of feet and will include the costs for equipment, splices, labor and miscellaneous materials.

The Department will measure Fan-Out Kit by the number of each, and will include all costs for material, equipment, tools and labor to provide and install the fan-out kit.

The Department will measure Drop Cable by the number of each, and will include all costs for material, equipment, tools and labor to provide and install the drop cable.

The Department will measure Fiber Optic Patch Cord by the number of each, and will include supplying and installing connectors on all ends of the patch cord.

The Department will measure Fiber Termination Panel by the number of each, and will include all materials, MTP Module, splice trays, pre-terminated MTP cables, patch cables, emergency restoration kit, tools and labor to provide and install a termination panel.

The Department will measure Fusion Splice by the number of each, and will include all costs for equipment, material and labor to provide a permanent fused splice including splice protection.

The Department will measure Fiber Optic Connector by the number of each.

The Department will measure Splice Enclosure by the number of each, and will include fusion splices and aerial or pull box wall mounting brackets as required.

The Department will measure Slack Installation by the number of each, and will include all materials, equipment and labor to provide a slack installation.

The Department will measure Fiber Optic Media Converter by the number of each.

The Department will measure Fiber Optic Fusion Splicer by the number of each.

The Department will measure Fiber Optic Optical Time Domain Reflectometer (OTDR) by the number of each.

The Department will measure Fiber Optic Cleaver by the number of each.

The Department will measure Fiber Optic Power Meter by the number of each.

The Department will measure Fiber Optic Visual Fault Locator by the number of each.

The Department will measure Fiber Optic Training by the number of each.

804.18 Basis of Payment. The Department will pay for accepted quantities at the contract prices as follows:

Item	**Unit**	**Description**
804	Foot	Fiber Optic Cable, _____ Fiber
804	Foot	Fiber Optic Cable, Airblown / Pushable, _____Fiber
804	Foot	Micro-duct Pathway, _____ Cell Pathway
804	Each	Fan-Out Kit, _____ Fiber
804	Foot	Drop Cable, _____ Fiber
804	Each	Fiber Optic Patch Cord, _____ Fiber
804	Each	Fiber Termination Panel, _____ Fiber
804	Each	Fusion Splice
804	Each	Fiber Optic Connector
804	Each	Splice Enclosure
804	Each	Slack Installation
804	Each	Fiber Optic Media Converter
804	Each	Fiber Optic Fusion Splicer
804	Each	Fiber Optic, Optical Time Domain Reflectometer (OTDR)
804	Each	Fiber Optic Cleaver
804	Each	Fiber Optic Power Meter
804	Each	Fiber Optic Visual Fault Locator
804	Each	Fiber Optic Training

Designer Note: This specification shall be used for any project that contains Intelligent Transportation System (ITS) Devices and Components.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 809
INTELLIGENT TRANSPORTATION SYSTEM (ITS) DEVICES AND COMPONENTS

January 19, 2018

809.01 Description

This work consists of furnishing and installing ITS Equipment, including Freeway Management System (FMS) and Traffic Signal System (TSS) assemblies and components. This specification describes the requirements for the multiple types of equipment used for ITS, including Closed-Circuit Television (CCTV) Cameras and Poles, Dynamic Message Signs (DMS), Highway Advisory Radio (HAR) Equipment, ITS Cabinets, Traffic Signal items, Ramp Metering, Vehicle Detectors, Variable Speed Limit (VSL) Signs, and Wrong Way Detection, as well as software licenses, controllers, cable, testing, and warranty for each device.

809.02 General

All materials and equipment furnished shall be new, of first quality, of latest design and be completely free of defects in material and poor workmanship.

Each major component shall have the manufacturer's name, type or style, model number and serial number on a weatherproof decal or tag permanently attached to the equipment.

Install all materials per the manufacturer's recommendations.

809.03 Approved Products

Provide products listed on the Traffic Authorized Products (TAP) List as shown on the ODOT Materials Management website for all ITS installations involving all items listed in this supplemental specification.

809.04 Submittals

Deliver submittals to the Engineer and the ODOT Office of Traffic Operations. All submittals shall contain the vendor part number being submitted for use on the project. Any submittal not specifically listed as a Traffic Authorized Product at the time of bid shall not be considered for use on the project. Materials shall be certified by the Contractor that this specification has been met.

809.05 CCTV IP-Camera Systems

Furnish and install the following products as listed on the TAP. All CCTV assembly components will be provided and warranted by a single vendor, to provide an end-to-end manufacturer responsibility.

Furnish all tools, equipment, materials, supplies, and manufactured articles, and perform all operations and equipment integration necessary to provide a complete, fully operational IP-camera site as depicted herein, within the plan set, and/or in the Contract.

Provide the Department with a written inventory by location including serial numbers of items received and the condition in which they were received. Once received, the equipment becomes the Contractor's responsibility.

All items will be installed in accordance with the manufacturer's instructions or as directed by the Department.

<u>IP-CAMERA TESTING PROVISIONS</u>

Provide one (1) complete IP-CCTV unit including software to ODOT for testing of firmware in advance of installation. Do not order additional IP-camera units until ODOT has tested the first unit and determined the firmware acceptable.

Testing process will include IP-camera cable testing and IP-camera local control testing.

Notify the Department at least fourteen working days prior to installation of the IP-camera assembly so that the Department, or his representative(s), can be present to establish the appropriate settings for the pan-and-tilt stops.

Notify the Department at least fourteen working days in advance of the proposed date that the contractor will perform the IP-camera cable test and the **IP-Camera Local Control Test.**

IP-CAMERA CABLE TESTING PROVISIONS

Furnish all equipment, appliances, and labor necessary to test the installed IP-camera cable between the IP-camera assembly and the network communication device. Before any connections are made**:**

- Verify exterior IP-camera CAT-6 STP cable is outdoor NEC rated and is compliant to Telecommunications Industry Association (TIA). International Organization for Standards ISO/IEC) creates and maintains standards for telecommunication cabling.
- Perform a cable analysis to ANSI/TIA-568-C.2 standards of category 6 cabling and continuity test on the IP-camera cable, which must not exhibit any discontinuities, such as openings, shorts, crimps, or defects;
- Replace any cable that fails to meet these parameters, or if any testing reveals defects in the cable, and retest new cable as specified above.
- Furnish all test equipment.

IP-CAMERA LOCAL CONTROL TESTING

Perform the following local field operational tests at the IP-camera assembly field site in accordance with the test plans. After the IP-camera assembly, including the camera hardware, power supply, and connecting cables, has been installed:

- Verify that physical construction has been completed as detailed herein, within the plan set, and/or in the Contract;
- Verify the quality and tightness of ground and surge protector connections;
- Verify the power supply voltages and output meet the specifications
- Connect devices to the power source;
- Verify installation of specified cables and connections between the IP-camera, PTU, and IP camera control receiver; Verify presence of BNC compression fitting on coaxial camera cables.
- Connect to IP-camera through a laptop Ethernet connection and establish communication with IP-camera via TCP/IP-HTTP protocols.
- Set the IP-camera address;
- Verify the presence of industry compliant video image i.e. H.264 with local or remote laptop/computer. Exercise the pan, tilt, zoom, focus, iris opening, and manual iris control selection, and the operation, low pressure alarm (if present), preset positioning, and power on/off functions;
- Observe the video picture on a laptop/computer and local camera control unit; Demonstrate IP-camera sensitivity at low light levels to meet the provisions;
- Demonstrate the pan/tilt speed and extent of movement to meet the provisions;
- Verify proper voltage of all the power supplies.

VENDOR AND MANUAL PROVISIONS

Provide a training and maintenance manual for the IP-camera assembly and the CCTV networks, including detailed provisions and information regarding the following CCTV system components.

Weight and dimensions;
Resolution;
Sensitivity;
Power consumption;
Optical zoom range;
Digital zoom range;
Zoom and focus presets;
Pan/tilt presets;
Ethernet connection;
Security;
Supported network protocols;
Video Compression;
Frame Rate;
Number of video streams and stream outputs;
IP-Camera control interface as required by recommended Standard
10/100 Base-T RJ-45 Ethernet, etc.;
Operating temperature and relative humidity; and General maintenance procedures

Provide documentation detailing the technical and operational aspects of the completed system. This will include device manuals, system diagrams, cabling diagrams, any and all field engineering notes specific to each installed IP-camera assembly, and any other documentation as required by the Department.

A. CCTV IP-Camera System, Dome-Type

B. CCTV IP-Camera System, Tunnel / Wall

C. CCTV IP-Camera System, Portable

Where multiple systems are to be provided, deploy systems on a staggered schedule so that the systems do not require recharging at the same time.

Provide video up to 15 frames per second continuously.

All units shall be in working condition and shall be capable of streaming video over an IP cellular connection (ODOT provided) so that ODOT specified areas of the project can be monitored by the ODOT project engineer. The ODOT project engineer shall be the sole determining party for the placement of these cameras and may request the Contractor to change camera locations as needed depending on the phasing of the project. Operate and maintain the portable camera units for the duration of the project.

All cameras shall be capable of being viewed simultaneously and provide PTZ control of selected camera through the use of ODOT ITS Camera Control Software. (A test camera shall be required to ensure functionality with ODOT ITS Camera Control Software.)

There will be no additional compensation provided to supply an alternate system.

D. CCTV IP-Camera – Local Camera Control Unit

This item shall be incidental to item 809.05.A CCTV IP-Camera System, Dome-Type and 809.05.B CCTV IP-Camera System, Tunnel / Wall.

809.06 CCTV Concrete Poles and Lowering Units

Furnish and install the following products as listed on the TAP. This will include furnishing and installing a water penetration preventer in the lower junction box of the lowering unit.

The Manufacturer will supply training for the Contractor on the installation, operation, and safety of the poles and lowering devices. The manufacturer will furnish the Engineer documentation certifying that the specified electrical Contractor personnel have been trained on the installation, operation, and safety features of the lowering device. These personnel shall be the only ones authorized by ODOT to work on the camera pole and lowering system for the duration of the project and any warranty period.

A. CCTV Concrete Pole with Lowering Unit

The height of the pole shall be 50 or 70 feet above ground level with a minimum of 10 foot embedment depth as specified by the plans, plan drawings, and by the soil samples with manufactures recommendation. If the specific pole embedment depths were not provided by the designer, the contractor shall be required to obtain their own soil samples, or obtain soil samples from ODOT's records. These samples shall then be sent to the pole manufacture to get the proper embedment depths using the appropriate backfill material. This embedment depth will need to be signed/stamped by a geotechnical Professional Engineer (represented by the manufacturer or contractor/consultant).

B. CCTV Lowering Unit

Remove an existing CCTV lowering unit, and furnish and install a new closed circuit television lowering unit on top of an existing pole, up to 100 feet tall.

Field verify the existing pole top adapter size to ensure that it is compatible with the new CCTV lowering unit. Include in the bid price any modifications or replacement pole top adapters for the lowering unit replacement. Position camera tenon arms as directed by the engineer.

809.07 Dynamic Message Sign Equipment

Furnish and install the following products as listed on the TAP.

Provide one (1) complete DMS unit including software to ODOT for testing of firmware in advance of installation. Do not order additional DMS units until ODOT has tested the first unit and determined the firmware acceptable. All ground-mounted cabinets shall be powered from the load center located in the DMS housing, unless approved otherwise by the ODOT ITS Engineer. As required by the material specification, for the TAP, two outdoor-rated CAT5e cables shall be

installed between the ground mounted ITS cabinet and the DMS housing, in addition to the fiber optic cable.

A. Dynamic Message Sign (DMS) – Full-Size Walk-In

B. Dynamic Message Sign (DMS) – Front-Access

C. Destination Dynamic Message Sign (DDMS) – Freeway

Provide the balance of materials and services needed to properly earth ground the DDMS. All earth grounding shall conform to the National Electrical Code. Refer to Standard Construction Drawing ITS-40.10.

D. Destination Dynamic Message Sign (DDMS) – Arterial

Provide the balance of materials and services needed to properly earth ground the DDMS. All earth grounding shall conform to the National Electrical Code. Refer to Standard Construction Drawing ITS-40.10.

809.08 Highway Advisory Radio Equipment

Furnish and install the following products as listed on the TAP.

A. Highway Advisory Radio (HAR) Assembly

Install the equipment on a wood pole, as specified by the plans. Refer to Standard Construction Drawing ITS-20.10.

Provide all services to prepare a FCC license application package for the Highway Advisory Radio system in accordance with FCC Rules & Regulations Part/Section 90.242. Furnish all tools, equipment, materials, supplies, and manufactured hardware, and perform all operations and equipment integration necessary to provide a complete, fully operational HAR system as shown in the plans. Install all HAR equipment according to the manufacturer's recommendations or as directed by the Engineer.

Perform the following tests on the HAR, after all equipment has been installed and initial adjustment is complete at the field site.

<u>Ground Plane Resistivity</u>

Conduct ground plane resistivity measurements to verify efficiency desired. The testing shall utilize an earth resistance meter and be conducted in accordance with IEEE Standard 3-point fall of potential method.

Provide all test equipment, take and document resistivity measurements on the grounding system. Provide all documentation to ODOT prior to final acceptance of the installation.

<u>Transmitter</u>

Perform field measurements to verify compliance with Title 47 CFR Part 90.242.

Tune the HAR with the impedance matching network of the coupling unit by adjusting the stainless steel tip of the antenna. The HAR shall be considered tuned when the system's voltage standing wave ratio (VSWR) is at the lowest possible value as directed by the Engineer.

Record and transmit a test message with the output power level of the transmitter set at approximate 10 W or lower. Adjust modulation between 85 to 95 percent as specified by the FCC for the standard AM broadcast band.

Make actual on-the-air field strength measurements. Select a sufficient number of points in order to determine the distance at which the attenuated field of 2 mV/m exists, as measured with a calibrated standard field strength meter. This may be done in 5 to 8 radial directions facilitating a plot of a 2 mV/m at a distance of 1.5 km from the HAR antenna. If the measured field exceeds 2 mV/m at a distance of 1.5 km, decrease the transmitter output power accordingly and if the measured field is less than 2 mV/m at the same distance then the power may be increased as directed by the Engineer.

Submit a written report of all measurements to the Engineer for approval. Include a map, with scale, showing a 2 mV/m contour based on the actual on-the-air field strength measurements. Tabulate the VSWR percent modulation and transmitter output power measurements.

System Tests

Conduct approved HAR system tests on at least one HAR system, including the operations center, and one transmitter.

Perform, at a minimum, all remote control functions. Test the AM Radio to be able to hear the live audio broadcast from the operations center. Perform testing of the live audio broadcast with the cabinet door closed, to simulate a normal field condition. Complete ODOT provided test procedure documentation and turn over to the Engineer for review, as a basis for rejection or acceptance. If the system test fails because of any subsystem component, correct that component or substitute another in its place, then repeat the test. If a component has been modified as a result of a system test failure, prepare a report and deliver it to the Engineer prior to retesting.

B. Highway Advisory Radio (HAR) Flashing Beacon System

Supply the serial number, ESN and all modem information necessary to establish service to the modem by location. Refer to Standard Construction Drawing ITS-20.10.

809.09 ITS Cabinets

Furnish and install the following products as listed on the TAP. Install work pads per ODOT CMS 633.11. The work pads shall be incidental to the price of the cabinet.

A. ITS Cabinet – Ground-Mounted

There shall be a total of 4 conduits entering the foundation. This includes two 4-inch Schedule 40 multi-cell conduits to be connected to the 32-inch communications “TRAFFIC” pull-box, one 2-inch Schedule 40 conduit to be connected to the 18-inch power “ELECTRIC” pull-box, and one 3/4-inch galvanized steel conduit to service the ground rod. The cost of these

conduits shall be incidental to the cost of the ITS cabinet. Refer to Standard Construction Drawing ITS-10.11.

B. ITS Cabinet – Pole-Mounted

Refer to Standard Construction Drawing ITS-11.11.

C. ITS Cabinet – Power Distribution Cabinet (PDC)

There shall be a total of 4 conduits entering the foundation. This includes three 2-inch Schedule 40 conduits to be connected to the 18-inch power "ELECTRIC" pull-box, and one 3/4-inch galvanized steel conduit to service the ground rod. The cost of these conduits shall be incidental to the cost of the ITS cabinet.

D. ITS Cabinet – Ramp Meter

There shall be a total of 4 conduits entering the foundation. This includes two 4-inch Schedule 40 multi-cell conduits to be connected to the 32-inch communications "TRAFFIC" pull-box, one 2-inch Schedule 40 conduit to be connected to the 18-inch power "ELECTRIC" pull-box, and one 3/4-inch galvanized steel conduit to service the ground rod. The cost of these conduits shall be incidental to the cost of the ITS cabinet. Refer to Standard Construction Drawing ITS-76.10.

809.10 Traffic Signal Equipment

Furnish and install the following products as listed on the TAP.

A. Closed Loop Arterial Traffic Signal System

B. Centrally Controlled Arterial Traffic Signal System

C. Highway Rail/Traffic Signal Pre-emption

D. Traffic Signal System with Emergency Vehicle Pre-emption

E. Traffic Signal System with Transit Priority

F. Adaptive Traffic Signal Control System

G. High Resolution ATC Controller Unit

H. ATC V5.2b Controller

809.11 Ramp Metering

Furnish and install the following products as listed on the TAP.

A. Ramp Meter System (RMS)

Include the following items in the system:

- Those items specified on Standard Construction Drawing ITS-76.10.

- ITS Cabinet-Ramp Meter, including foundation, as specified in Supplemental Specification 809.09.D
    - There shall be a total of 4 conduits entering the foundation. This includes two 4-inch Schedule 40 multi-cell conduits to be connected to the 32-inch communications "TRAFFIC" pull-box, one 2-inch Schedule 40 conduit to be connected to the 18-inch power "ELECTRIC" pull-box, and one 3/4-inch galvanized steel conduit to service the ground rod. The cost of these conduits shall be incidental to the cost of the ITS cabinet.
- Controller including software as listed on the TAP
- Cabinet work pads conforming to ODOT Construction and Material Specification 633.11. The work pads shall be incidental to the price of the cabinet.

Testing and Certification

1. Test all loops installed for continuity and insulation as per 632.28. Furnish a copy of the test records to the ODOT Engineer. Any loops which test open or less than the specification allows to ground, shall be re-cut at the Contractor's expense.

2. Ramp Meter Testing, Local and Remote Operation.

Test each ramp meter system installed under this project, including all hardware and software components, warning sign, and loop detectors, for operational completeness. Perform testing in the presence of an ODOT ITS Engineer and/or his/her designated representative. Testing shall consist of Pre-Test Check-Out and a Ramp Meter Sixty-day Performance Test.

State, to the Engineer, in writing, that the ramp meter is complete and ready for local testing. Within five (5) days upon receiving this notification the Engineer shall begin the Pre-test Check-out.

a. Pre-test Check-out

The ODOT ITS Engineer and/or his/her representative shall thoroughly exercise the system, using a test or procedure that would demonstrate the capabilities of each component. Individually check all hardware, software, and performance functions, including the maintenance and trouble-shooting software, for compliance with the specifications.

Any portion of the project which does not meet these specifications shall be corrected by the Contractor and rechecked by the ODOT ITS Engineer. Demonstrate that the field equipment can meet the requirements as specified in this document.

b. Ramp Meter Sixty-day (60) Performance Test – Local Control.

Following successful completion of the Pre-test Check-out, and the correction, repair and/or replacement of identified deficiencies, the Contractor shall demonstrate that the system satisfies the specified operational requirements as an integrated unit by operating the system continuously for sixty (**60)** consecutive days without major malfunction or failure.

Notify the Engineer fourteen (14) days prior, in writing that the Ramp Meter Sixty-day (60) Performance Test will begin on a date and time mutually acceptable to all parties.

During the Ramp Meter Sixty-day (60) Performance Test the ODOT ITS Engineer shall exercise the system **and** document the performance of all specified features. The Ramp Meter Sixty-day Performance Test may be suspended or terminated by the Engineer or the Contractor.

Suspension is defined as halting the test progress, the Contractor taking necessary corrective action, and the test being resumed from the point of suspension. Termination is defined as halting the test. In the event of termination, take necessary corrective action, and restart the test from the beginning. Any corrective action shall be by mutual agreement between the Contractor and the Engineer.

The Ramp Meter Sixty-day (60) Performance Test may be suspended for the following reasons, including but not limited to:

- Failure or interference due to conditions beyond the control of the Contractor, such as vandalism, traffic accidents, power failures, and similar occurrences.
- Communications noise from an outside source.
- Failure of any support or diagnostic equipment necessary to successfully test the system.
- Failure of any communications hub.
- A hardware failure of the computer or associated critical peripheral equipment, or a computer software error, which causes the system to crash or behave erratically.

The Ramp Meter Sixty-day (60) Performance Test may be terminated for the following reasons, including but not limited to:

- Failure of any hardware or performance item to meet these specifications.
- Communications noise from an outside source.
- Failure of software to change timing patterns or go from metering to non-metering in the local mode of operation.
- Failure of the warning sign to operate properly, except for lamp outages.
- Intermittent or catastrophic failure of any ramp meter loop detectors.
- Failure of any electronic component in the ramp meter cabinet.
- The appearance of any problem, which, in the opinion of ODOT or its representative, has a significant effect upon the reliability, safety, or operation of the system.

Each ramp meter system will be tested for proper operation from the ODOT ITS Lab, 1606 West Broad St., Columbus, Ohio.

B. Ramp Meter Training

Supply an 8 hour classroom and hands-on training session for maintenance personnel in the operation and maintenance of all field equipment. The personnel shall be designated from the Department.

Provide all maintenance and local operations training prior to any equipment being made operational in the field.

Provide training by personnel thoroughly familiar with the equipment operation.

This may be the Contractor's personnel (if certified by manufacturer), equipment manufacturer representatives, or a combination of the two.

Submit to and receive approval from the ODOT ITS Engineer, a complete course outline and summary of the experience and qualifications of the instructional personnel Engineer prior to the start of training.

Training sessions may be combined and/or shortened with the agreement of the ITS Engineer and the Contractor.

Furnish recommended test equipment, literature, and drawings for the classes.

At the conclusion of classes all items furnished, which are not currently owned by Department, shall be turned over to the ITS Engineer.

Conduct training at ODOT Central Office.

The training shall, when possible, make use of and be centered on test equipment presently owned by the owner agencies.

The Contractor is responsible for determining the test equipment available and recommending any needed equipment not currently owned at each of the various maintaining agencies

Limit class size to fifteen (15) persons to afford maximum individual experience.

Digitally record (Video and Audio) all training class time (indoors or outdoors) on standard format.

Turn over the media to the ITS Engineer following the training.

809.12 Vehicle Detection

Provide a representative from manufacturer to direct on the exact placement of the radar unit in reference to distance and height from traveled lane. Provide at no additional cost, any power adapters needed to sufficiently power the detector. The manufacturer's qualified technical representative shall be on site during installation and testing and shall provide onsite training on the setup, operation and maintenance of the unit.

All connectors, plugs, and wiring needed to make the detection system fully operational shall be incidental to each detection type. Fully Operational shall include wiring to pole or ground-mounted ITS cabinet for contact closure pairs, RS485 communication, and radar assembly power and manufacturer detector cards to cover each lane.

Upon completion of the equipment installation at a roadside site, a Stand Alone Site Acceptance Test shall be conducted by the Contractor at the site according to the manufacturer’s recommended testing procedure. The Contractor shall provide a seven-calendar day notice to the Engineer requesting permission to conduct a site acceptance test on a specific workday. No more than two acceptance tests shall be scheduled in any given four-hour period per day, unless specifically authorized by Department. At the discretion of the Engineer, the Engineer or a designated representative may witness the Stand Alone Site Acceptance Test. Arrange, at no additional expense to the Department, the attendance of a qualified technical representative of the equipment manufacturer to attend each test until ten percent (10%) or a minimum of two (2) sites of that particular type are approved, whichever is greater. All raw data must be placed in a form suitable for analysis. The Stand Alone Site Acceptance Test Plan is required to be developed to ensure a 95% confidence.

Furnish and install the following products as listed on the TAP.

A. Side-Fired Radar Detector

The following shall be incidental to this item:

- Outdoor rated Ethernet CAT5E communication cable, per 809.13B, from the NEMA 3R for installations where the ITS cabinet is within 250 feet of the radar pole.
- NEMA 3R cabinet mounted on the radar pole with surge suppression. Refer to Standard Construction Drawing ITS-60.10.

B. Advance Radar Detection

Mount unit in a forward-fire or side-fire position, looking at either approaching or departing traffic this unit shall only detect vehicles in one direction of travel. Mount unit directly to a pole or mast arm, as recommended by the manufacturer. Provide cable(s) as required and recommended by the manufacturer. Power shall be provided from the traffic signal cabinet and plugged into filtered (LOOK AT WIRING DIAGRAM) power. Provide one (1) unit per approach.

The following shall be incidental to this item:

- A serial to Ethernet communications module and Ethernet cable (minimum length – 7 feet).
- Power Supply and Communications modules – secured to a single panel that can be mounted to the interior of the traffic cabinet. Include in the panel, modular-plug style connections for up to four (4) sensor cables. Additional sensors may be hard-wired to the communication modules, as necessary.

C. Stop-Bar Radar Detection

Mount unit in a forward-fire or side-fire position, looking at either approaching or departing traffic this unit shall only detect vehicles in one direction of travel. Mount unit directly to a pole or mast arm, as recommended by the manufacturer. Provide cable(s) as required and recommended by the manufacturer. Power shall be provided from the traffic signal cabinet and plugged into filtered (LOOK AT WIRING DIAGRAM) power. Provide one (1) unit per approach.

The following shall be incidental to this item:

- A serial to Ethernet communications module and Ethernet cable (minimum length – 7 feet).
- Power Supply and Communications modules – secured to a single panel that can be mounted to the interior of the traffic cabinet. Panel shall include modular-plug style connections for up to four (4) sensor cables. Additional sensors may be hard-wired to the communication modules, as necessary.

809.13 Communication

Furnish and install the following products as listed on the TAP.

A. High-Speed Ethernet Radio

In addition to radio, provide Power-over-Ethernet (PoE) injector meeting all requirements of the radio manufacturer, including power, temperature, and humidity. PoE injector must have grounding prong or ability to be easily grounded.

Provide all required cabling with the radios. This shall include a run of Ethernet Cable, Outdoor-Rated from the cabinet to the radio unit itself as well as a Category 5e (or greater) patch cable for network connection inside of cabinet.

If necessary and/or the radio does not contain an integrated antenna, provide a manufacturer recommended antenna (appropriate gain and beam pattern) to achieve communication at the plan specified distance. Antenna shall be considered part of unit and warranty shall apply as well.

Provide all mounting brackets, cabling, conduits and accessories in order to establish a fully functioning unit, installed in place.

B. Ethernet Cable, Outdoor-Rated

The Contractor shall furnish and install a Category 5e or greater outdoor-rated Ethernet cable that meets the following minimum specifications:

- Footage Markings: Every 3 feet
- Armor: Helically Applied 12mm Aluminum with inner jacket
- Conductor Insulation: Polyolefin
- Jacket: UV and Abrasion Resistant Polyethylene
- Conductors: 24 AWG solid bare annealed copper
- Cable Diameter: Maximum 0.35 inches
- Flooding Compound: Waterproof Gel
- Minimum Bend Radius: 1.0 Inch
- Maximum Pulling Force: 25 pounds
- Shielded
- Temperature Rating
    - Installation: -30 to +60 C
    - Operation: -45 to +80 C
- Color Code
    - Pair 1: Blue-White/Blue
    - Pair 2: Orange-White/Orange
    - Pair 3: Green-White/Green
    - Pair 4: Brown-White/Brown

Install cable as shown in the plans, or as directed by the Engineer, leaving 10 feet of slack in each pull box. The cable shall be terminated with RJ-45 connectors and be wired per TIA/EIA 568-B.

809.14 ITS Device Downtime

The following specifies the duration allowed for outages of communication systems and/or power systems for ITS devices located throughout the State of Ohio. The contractor shall be required to abide by these maximum downtimes and shall have adequate means to ensure that any necessary temporary lines/devices are installed prior to the removal/de-energizing of any cable to the specified device. The ODOT Office of Traffic Operations requires notification of any outage

a minimum of 7 workings days in advance so that any additional work on ODOT's part may be coordinated. Email notification to CEN.ITS.Lab@dot.state.oh.us. The ODOT Engineer in consultation with the Office of Traffic Operations shall be the sole determining party in deeming if a circumstance is unusual and shall be granted additional downtime. Perform all work on the weekend, unless it has been determined otherwise by ODOT Traffic Operations.

A. Dynamic Message Signs (DMS):

DMS shall be limited to a maximum downtime of 8 hours. At a minimum, power shall be restored within the maximum allotted downtime. When relocating DMS, the downtime shall be limited to a maximum downtime of 48 hours.

Disincentive: $400/day or $17/hour – beginning after the allowable downtime

B. CCTV Cameras:

CCTV Cameras shall be limited to a downtime of 72 hours. Make arrangements when having to relocate these devices so that the new infrastructure is in place before taking the existing site equipment offline.

Disincentive: $400/day or $17/hour – beginning after the allowable downtime

C. Highway Advisory Radios (HAR):

HAR shall be limited to a maximum downtime of 8 hours. These devices shall be maintained in the approximate area of the existing location prior to the start of construction. If necessary the HAR may be moved temporarily to the construction project office, if located nearby. When located at the construction project office it shall be reinstalled and reconnected to the ODOT network at the project office within the maximum downtime period.

Disincentive: $400/day or $17/hour – beginning after the allowable downtime

D. Vehicle Detector Stations (VDS) / Radar Vehicle Detectors (RVD):

VDS and RVD shall not be limited to a maximum downtime. However, the contractor shall not perform any action that results in the loss of communication/power to two or more VDS/RVD in succession. Those RVD's that are part of a queue warning station do not apply to this item and the contractor is directed to the queue warning station section of this note.

E. Highway Advisory Radio Flashing Beacon Systems (HAR-FBS):

HAR-FBS shall not be limited to a maximum downtime. The purpose of these systems is to notify the motoring traffic of the radio station that broadcasts traffic data and alert motorists of traffic alerts through the use of flashing beacons. If these devices are disturbed during construction, they shall be returned to the approximate original location and in the same condition in which they were removed.

F. Queue Warning Stations

Due to the function of these devices, the maximum downtime shall be limited to 8 hours. These devices are comprised of multiple radar vehicle detectors and changeable message signs. Due to the interoperability of all devices related to the system, any one of these items being down equals the entire system being down.

Disincentive: $400/day or $17/hour – beginning after the allowable downtime

G. Fiber Optic Cable

All fiber optic cable shall be limited to a 24 hour maximum downtime, except the 24 strand single-mode fiber optic cable located in the District 6 Region along I-71 (downtown to the North Outerbelt), which shall be limited to a maximum downtime of 12 hours. All temporary fiber optic cable shall be installed and ready for splicing prior to any existing fiber optic cables on the project being severed.

Provide a temporary fiber optic cable having the exact same fiber count and buffer tube orientation as the existing, so as not to confuse any maintenance activities that may occur during the construction project. All fibers of the temporary cable shall be core-aligned fusion spliced to the like fiber (buffer-tube to buffer-tube, color to color) regardless of their active status.

Disincentive: $400/hour– beginning after the allowable downtime

809.15 Warranty

Guarantee equipment furnished under this specification to perform to the manufacturer's published specifications.

Warrant equipment for a minimum of five (5) years from time of original project completion date, at the time of bid, against manufacturer’s defects and/or failure in design, materials, or workmanship

Ensure that each device has one permanent, weatherproof label indicating vendor, date of shipment, and warranty end date. For clarification, the warranty end date is 5 years past the original date of project completion. Any item missing this label shall be considered incomplete and will not receive payment until label is attached. The label shall be attached in a location as to avoid direct contact with the outdoor environment.

Unless otherwise specified in the invitation for bids, warranty coverage will become effective on the original project completion date of the project by the Department.

The manufacturer(s) will assign to the Department all manufacturer's normal warranties or guarantees, on all such electronic, electrical and mechanical equipment, materials, technical data, and products furnished for and installed on the project. An electronic copy of the warranty or guarantee, as well as a hard copy of each warranty or guarantee (compiled into a three ring binder), shall be furnished to ODOT.

Defective equipment will be repaired or replaced, at the manufacturer's option, during the warranty period at no cost to the Department.

Have personnel on site to make the site operational within ten (10) business days upon notification from the Department. If additional parts are required to repair in the correct manner as installed, an additional twenty (20) business days may be given to receive the parts and completely resolve the issue in the correct manner. If the problem is not resolved due to negligence in response from the Contractor after thirty (30) days, the Department reserves the right to back-charge the Contractor in order to internally fix or hire a 3rd party Contractor to make necessary repairs. If the Contractor is having issues obtaining parts, a written letter from the part manufacturer, on the manufacturer’s letter head stating estimated lead time on the parts will be an acceptable method for the Contractor to obtain a time extension for the complete repair of the unit.

This warranty responsibility to the Department may be transferred to the manufacturer if written documentation is provided and accepted by the Department.

Provide written documentation of warranty provisions to the Department. Include in this the agreement for warranty of items, project number and description, date of final acceptance of project, and warranty end date.

809.16 GPS Coordinates / As-Built Plans

Prior to the final acceptance of the project, the contractor shall provide as-built plans of the entire ITS portion of the project to the ODOT ITS Engineer in the following formats: DGN files, PDF file, and one (1) half-size plan hard copy. All hard copies shall be submitted in separate 3-ring binders, noting the contents on the outside of the binder. Included with the pdf and hard copy versions of this documentation, the contractor shall provide actual field data of all sites. This data shall include the following:

- GPS coordinates, within 3 feet accuracy, of all pull boxes, poles, cabinets, and power services with coordinating device id number. (Device id # shall be noted on the plans or provided by the ODOT ITS Engineer prior to the collection of the data).
- Meter numbers and utility provider of all power services with their service locations.

809.17 Utility Locates During Construction

The ITS Infrastructure is not listed as a member of OUPS at this time. All requests for locates shall be coordinated through the Office of Traffic Operations, ITS Field Operations Section. The contractor shall submit requests to CEN.ITS.LAB@DOT.OHIO.GOV. The ITS shall be marked once by ODOT personnel or an ODOT representative and the contractor shall take care to note where the infrastructure is located. After this initial marking has occurred, it shall be the responsibility of the contractor to perform any remarking of the ITS infrastructure when needed. Any damage to the ITS infrastructure, as a result of project activities shall be repaired immediately (See ITS Device Downtimes Section) and at the cost of the contractor.

809.18 Ground Mounted Variable Speed Limit Sign Equipment

Information for the Variable Speed Limit Sign Equipment will be added here.

809.19 Wrong Way Detection System

This item of work shall consist of furnishing and installing a complete wrong way detection system. The system shall detect the presence of vehicles traveling in the wrong direction on an exit ramp. When a vehicle traveling in the wrong direction is detected, white LED warning lights in the sign system shall be activated, a camera shall record the event, and after a second detector confirms that the vehicle continued to travel in the wrong direction, electronic notification shall be sent.

All elements of the wrong way system shall be provided as a complete system by a single vendor/manufacturer.

All elements of the wrong way detection system shall be considered incidental to this item of work unless separately itemized. The following list represents an outline of components to be included with the system. Items not specifically listed below, but required to provide for a fully functioning wrong way detection system shall also be included:

- Doppler vehicle dual direction detector units.
  - number of units furnished per site shall be as required to meet the functionality requirements of the system and detect all wrong way vehicles.
  - detection hardware shall be powered by 120vac.

- ultra-low powered k-band doppler radar units with programmable outputs.
- shall be capable of detecting incoming or outgoing targets traveling between 5 and 100 mph.
- shall be sealed from water intrusion.
- shall include self-testing, status LED lights and self-protection from reverse polarity.
- shall utilize rs232 serial communication for programming.

- (1)-conformation camera.
  - wide angle hdtv 720p outdoor rated with cross-link analysis.
  - shall have programmable event based logic that integrates with the wrong way logic controller.
  - ip66 rated, nema 4x
  - provide for a minimum of one input and one output.
  - provide for adjustable image settings.
  - use a ¼" progressive scan rgb cmos
- (1)-cellular modem
  - with 2 years of monitoring service. The system shall include system monitoring, notifications, and updates via a cellular service, hosted/provided by the manufacture for a period of 2 years following the original project completion date.
  - 4g lte cellular gateway with integral five port 10/100 ethernet switch with external omni-direction antenna.
  - include integral rs232 port.
  - shall be capable of over the air firmware updated and remote management.
  - shall be capable of ipsec vpn
- (4)-wireless radio communication units. Radio control shall operate on a 900 mhz frequency hopping spread spectrum network, wi-fi or approved equal. Radios shall integrate communication of sign control circuit to activate signs. The radio shall be synchronized so all of the remote indications will turn on within 120 msec of each other and remain synchronized through-out the duration of the flashing cycle.
- Loop detector monitoring card
  - number of cards furnished shall be sufficient to accommodate the proposed loop detection needs.
  - shall work with standard nema/170/2070 card racks.
  - shall utilize tia232 serial communication for programming.
  - shall include self-testing and LED status lights.
  - provide for a minimum of 4 frequency settings.
- (1) - wrong way logic controller with integrated test functions.
  - shall analyze inputs from multiple sensors and cameras.
  - provide for programmable outputs.
  - shall contain drive relays
  - shall include LED status lights and on-site testing.
  - provide for micro – usb interface
- (1) - programmable sign controller
  - provide for a minimum of two inputs and outputs
  - programmable including flash pattern, duration and LED intensity.
  - integrate with wireless radios.
  - include real time clock with on-board battery.

- provide for data logging.
- provide for rs232 serial interface

- Pole mounted control cabinet(s), with control equipment.
- (2) - wrong way signs r5-1a (48"x36"), 120v ac/solar powered, LED, perimeter blinking.
- (4) - wrong way signs r5-1a (42"x30"'), sign flat sheet.
- (2) - do not enter signs r5-1 (48"'x48"), 120vac/solar powered, LED edge lit.
- Solar panels mounted to an aluminum plate and bracket at an angle of 45 degrees- 60 degrees to provide maximum output.
- Batteries for LED signs with written two year full replacement warranty.
- The system shall operate under the following conditions:
  - shall comply with part 15 of fcc.
  - shall operate from -4 degrees f to 122 degrees f.
  - programmable from a windows based pc
- (8)-hours of onsite training.

All LED, perimeter edge lit blinking signs shall be wirelessly controlled and synchronized via the use of wireless radios. Each sign shall be a complete assembly, consisting of but not limited to, signage, sign mounting hardware, indications and electrical components (wiring, solid-state circuit boards, etc.). Each sign shall be supplied with all required hardware to install assembly. All exposed hardware shall be anti-vandal. Assure all signs meets the requirements of ODOT CMS 630. The control circuit shall be sealed watertight to eliminate dirt contamination and allow for safe handling in all weather conditions.

See solar powered LED sign requirements and electrical requirements for solar-powered devices for additional requirements.

Solar powered LED sign shall meet the requirements of TEM 242-9

Solar requirements
See "general electrical requirements for solar-powered devices".

Required documentation
Each sign unit shall be provided with the following documentation either in hard copy or as a pdf.
1. One schematic diagram shall be provided for the sign unit along with any necessary installation instructions.
2. The LED manufacturers name, brand, and model number.

Warranty
1. The LED enhanced signal ahead sign unit shall be repaired or replaced by the manufacturer if it exhibits a failure due to workmanship or material defects within 2 years of field operation.
2. The manufacturer shall provide a written warranty against defects in materials, workmanship, and luminous intensity for the LED enhanced sign unit for a period of 2 years after installation. A replacement LED enhanced sign unit shall be provided within 10 days after receipt of failed unit at no cost, except the cost of shipping the failed unit.

Electrical requirements for solar-powered devices

- run requirements of this device shall include 4 hours per day for 14 days under autonomy operation.
- utilize environmentally-sealed, high-efficiency LED light sources for this solar-powered application.
- house the solar power supply controller and battery in one or two stainless steel or aluminum enclosures with a minimum nema 3 or 3x rating.
- if the exterior size of the enclosure necessary to meet the requirements below is less than 1000 cubic inches, a single polymer enclosure rated nema 4 and listed as sunlight-resistant may be installed, with approval of the engineer.
- seal enclosure conduit entries to prevent insect and/or rodent entry.
- provide metal enclosures with an exterior of bare or powder-coated aluminum, or stainless steel.
- provide a locking enclosure using 2 locks per padlock per CMS 631.06.
- separate the control electronics and battery, if contained within a single enclosure, to prevent damage to the control electronics if the battery envelope is compromised. Control equipment shall be located in a nema 4x enclosure.
- provide sealed gel-cell or agm (absorbed glass mat) lead-acid batteries for all installations with instantaneous load requirements of 4 watts or above, regardless of duty cycle. For installations with instantaneous load requirements of less than 4 watts, rechargeable nicd, li-ion, or nimh batteries may be used instead of agm or gel-cell, if approved by the engineer.
- provide signed copies from the solar panel and/or controller manufacturer of all calculations used to size the solar panel and batteries.
- include in these calculations the insolation value used and its reference source, the solar panel efficiency, charger/controller efficiency, inverter efficiency, proposed LED lamp and/or equipment load, and a figure representing anticipated miscellaneous losses.
- show calculations documenting a reserve capacity of two weeks operation under continuous worst-case (minimum) insolation figures (usually december) for the proposed geographic location, using a panel elevation angle appropriate to the site, at a sustained temperature of 25 degrees fahrenheit (-4 degrees celsius).
- deliver a copy of the calculations to the engineer and another copy to the office of roadway engineering for approval.
- provide documentation showing that the solar panel manufacturer tested the panel according to iec61215 or equivalent approved standard.
- provide documentation showing that solar panel mounting is rated for 90 mph design wind and designed to resist vandalism.
- ensure nec grounding and bonding requirements are met if voltages over 50v ac or dc are present.

809.20 Method of Measurement

The Department will measure CCTV IP-Camera System, Dome-Type by the number of each, and will include the costs for equipment, Local Camera Control Unit, labor, and miscellaneous materials.

The Department will measure CCTV IP-Camera System, Type HD – Tunnel/Wall by the number of each, and will include the costs for equipment, Local Camera Control Unit, labor, and miscellaneous materials.

The Department will measure CCTV IP-Camera System, Portable by the number of days it is functioning, and will include the costs for equipment, labor, miscellaneous materials, and maintenance.

The Department will measure CCTV Concrete Pole with Lowering Unit by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure CCTV Lowering Unit by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Dynamic Message Sign (DMS) – Full-Size Walk-In by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Dynamic Message Sign (DMS) – Front-Access by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Destination Dynamic Message Sign (DDMS) – Freeway by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Destination Dynamic Message Sign (DDMS) – Arterial by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Highway Advisory Radio (HAR) Assembly by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Highway Advisory Radio (HAR) Flashing Beacon System by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure ITS Cabinet – Ground-Mounted by the number of each, and will include the costs for equipment, labor, work pad, conduits, and miscellaneous materials.

The Department will measure ITS Cabinet – Pole-Mounted by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure ITS Cabinet – Power Distribution Cabinet (PDC) by the number of each, and will include the costs for equipment, labor, work pad, conduits, and miscellaneous materials.

The Department will measure ITS Cabinet – Ramp Meter by the number of each, and will include the costs for equipment, labor, work pad, conduits, and miscellaneous materials.

The Department will measure Closed Loop Arterial Traffic Signal System by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Centrally Controlled Arterial Traffic Signal System by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Highway Rail/Traffic Signal Pre-emption by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Traffic Signal System with Emergency Vehicle Pre-emption by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Traffic Signal System with Transit Priority by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Adaptive Traffic Signal Control System by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure High Resolution ATC Controller Unit by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure ATC V5.2b Controller by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Ramp Meter System by the number of each, and will include the costs for equipment, labor, work pad, conduits, and ramp meter cabinet and miscellaneous materials.

The Department will measure Ramp Meter Training by the number of each, and will include the costs for travel, accommodations, training equipment, and training as defined in these specifications.

The Department will measure Side-Fired Radar Detector by the number of each, and will include the costs for equipment, wiring, cabling, NEMA cabinet, labor, and miscellaneous materials.

The Department will measure Advance Detection by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Stop-Bar Detection by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Stop-Bar & Advance Detection by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure High-Speed Ethernet Radio by the number of each, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Ethernet Cable, Outdoor-Rated by the number of feet, and will include the costs for equipment, labor, and miscellaneous materials.

The Department will measure Wrong Way Detection System complete in place, including all materials, testing, labor and software for a fully functional system.

809.21 Basis of Payment

The Department will pay for accepted quantities at the contract prices as follows:

Item	Unit	Description
809	Each	CCTV IP-Camera System, Dome-Type
809	Each	CCTV IP-Camera System, Type HD, Wall/Tunnel
809	Day	CCTV IP-Camera System, Portable
809	Each	CCTV Concrete Pole with Lowering Unit, ____Feet
809	Each	CCTV Lowering Unit
809	Each	Dynamic Message Sign (DMS) – Full-Size Walk-In
809	Each	Dynamic Message Sign (DMS) – Front-Access
809	Each	Destination Dynamic Message Sign (DDMS) – Freeway
809	Each	Destination Dynamic Message Sign (DDMS) – Arterial
809	Each	Highway Advisory Radio (HAR) Assembly
809	Each	Highway Advisory Radio (HAR) Flashing Beacon System
809	Each	ITS Cabinet – Ground-Mounted
809	Each	ITS Cabinet – Pole-Mounted
809	Each	ITS Cabinet – Power Distribution Cabinet (PDC)
809	Each	ITS Cabinet – Ramp Meter
809	Each	Closed Loop Arterial Traffic Signal System

809	Each	Centrally Controlled Arterial Traffic Signal System
809	Each	Highway Rail/Traffic Signal Pre-emption
809	Each	Traffic Signal System with Emergency Vehicle Pre-emption
809	Each	Traffic Signal System with Transit Priority
809	Each	Adaptive Traffic Signal Control System
809	Each	High Resolution ATC Controller Unit
809	Each	ATC V5.2b Controller
809	Each	Ramp Meter Station
809	Each	Ramp Meter Training
809	Each	Side-Fired Radar Detector
809	Each	Advance Detection
809	Each	Stop-Bar Detection
809	Each	Stop-Bar & Advance Detection
809	Each	High-Speed Ethernet Radio
809	Feet	Ethernet Cable, Outdoor-Rated
809	Each	Wrong Way Detection System

Designer Note:
This specification shall be used for any project that contains INTELLIGENT TRANSPORTATION SYSTEM (ITS) DEVICES AND COMPONENTS.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 816
VIDEO DETECTION SYSTEM

July 20, 2018

816.01 Description. This work consists of furnishing and installing video detection equipment complete and ready for service.

816.02 Materials. The video detection system shall consist of power supply, hard-wired video cameras, all necessary video and power cabling with end connectors, mounting brackets, surge protection as recommended by the manufacturer, video detection processors/extension modules capable of processing the number of camera and phase combination video sources shown on the project plans. Provide sufficient number of cameras to process vehicle presence, passage and system detection zones as shown on the project plans.

Furnish materials from the Department's Qualified Products List (QPL) conforming to the following:

Video Detection System……907

816.03 Documentation and Testing. All product documentation shall be written in the English language. Provide one bound copy and one PDF version of the user's manual.

Perform functional tests and 10-day performance test according to 632.28.

816.04 Installation Requirements. Run all cables serving the cameras unspliced between the camera and controller cabinet, with ten feet of slack provided in the controller cabinet.

816.05 Training. Furnish two days of training in the operation, setup and maintenance of the video detection system installed as part of the Contract. Furnish all handouts, manuals and product information. For the training, use the same models of equipment furnished for the project. The maintaining agency shall furnish the facilities in which the training will take place.

Furnish all media and test equipment needed to present the training.

Coordinate video detection training with the Engineer a minimum of 30 days in advance of proposed date of training.

816.06 Method of Measurement. The Department will measure Video Detection System by each intersection shown on the plans, in place, complete and ready for service and will include all materials, testing, labor and software.

The Department will measure Training on a lump sum basis, and will include providing the instruction materials, instructor travel expenses and test or media equipment for presenting the training material.

816.07 Basis of Payment. The Department will pay for accepted quantities at the contract prices as follows:

Item	Unit	Description
816	Each	Video Detection System
816	Lump	Training for Video Detection System

Designer Notes:

This item provides video imaging-based stop bar detection of vehicles at signalized intersections with rigid signal supports (mast arms).

This is a detection item and not suitable for traffic surveillance.
ODOT discourages the use video detection at its traffic signals, preferring instead stop bar and advance radar detection.
See TEM 420-5.2, 420-5.3 and the Signal Design Reference Pack (SDRP) for additional information on the limitations of video detection.
Despite application limitations, video detection is suitable for non-invasive detection (requires no pavement sawing and roadside trenching, etc.) in certain situations such as:

1. Bridge decks where inductive loop detectors are not practical.
2. Urban areas with complicated or crowded roadside infrastructure such as streetscapes.
3. Private "developer" signals (e.g., parking lots) where poor pavement maintenance by the private property owner makes inductive loop operation unreliable.
4. Areas of heavy truck traffic where pavement is subject to deformations such as shoving and rutting that damages inductive loops.
5. Signals located in areas where significant roadway construction is anticipated that would destroy loops if installed.
6. Temporary signals.
7. Work zone signals (e.g., private driveways).

Designers should note that radar detection is also suitable for the above situations and is generally preferred.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 904
FIBER OPTIC CABLE AND COMPONENTS

July 15, 2016

904.01 Fiber Optic Cable. Furnish loose-tube, single-mode, step-index dielectric cable, manufactured in the United States.

Cable shall be 8.1-8.3/125 um loose buffer, single-mode, step index optical fiber cable containing glass of type, Corning SMF-28e, AFL SR-15e, or approved equal, and that meets the following specifications:

1. ITU-T G.652 (Categories A, B, C and D)
2. IEC Specification 60793-2-50 Type B1.3
3. TIA/EIA 492-CAAB
4. Telecordia GR-20

All cables shall be free of material or manufacturing defects and dimensional non-uniformity that would:

Interfere with the cable installation using accepted cable installation practices.
Degrade the transmission performance and environmental resistance after installation.
Inhibit proper connection to interfacing elements.
Otherwise yield an inferior product.

A. Mechanical and Performance Requirements. The cable shall be a rugged <u>all dielectric</u> outdoor cable containing color coded buffer tubes with 12 single mode color-coded fibers per-buffer tube, dual window (1310 nm and 1550 nm) fibers with UV acrylate coating in color coded,

gel-free, loose buffer tubes with the maximum outer diameter as shown in the chart below based on cable strand count.

Fiber Count	Maximum Outside Diameter (Inches)
6	0.45
12	0.45
24	0.45
48	0.45
72	0.45
144	0.65
288	0.75

Strand the loose buffer tubes around an all-dielectric center strength element using a reverse oscillation lay, wrapped by water blocking core separator or functional equivalent.

The maximum allowable attenuation of the fiber is .35 dB/km for 1310 nm and .25 dB/km for 1550 nm.

Each buffer tube shall contain a water blocking element for water-blocking protection.

No water blocking yarns are permitted to avoid accidentally cutting fibers.

The water blocking elements shall be non-nutritive to fungus, electrically non-conductive, and homogeneous; it shall also be free from dirt or foreign matter.

This water blocking element will preclude the need for other water-blocking material; the buffer-tube shall be gel-free.

Apply water swellable tape longitudinally around the outside of the stranded tubes/fillers.

The water swellable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous.

It shall also be free from dirt and foreign matter.

The cable manufacturer shall be TL 9000 registered.

The optical fiber cable shall withstand water penetration when tested with a one-meter static head or equivalent continuous pressure applied at one end of a one-meter length of filled cable for one hour.

No water shall leak through the open cable end.

Perform testing in accordance with EIA-455-82B.

B. Outer Jacket. Cables shall be all dielectric cable (with no armoring) and shall be jacketed (sheathed) with medium density polyethylene as defined by ASTM D1248, Type II, Class C, Category 4 and Grades J4, E7 and E8.

If the project plans require armored cable, the cable shall have two jackets, one molded to the outside of the armor and one that floats freely within the armor and contains the buffer tubes and other fiber optic cable construction components as required.

Apply jacketing material directly over the tensile strength members to provide mechanical protection, and to serve as the primary moisture barrier.

Design cable sheath to meet or exceed the tensile criteria defined in EIA-455-89a.

Each jacketed fiber shall have a tensile strength in excess of 50 lbs.

The polyethylene shall contain carbon black to provide ultra-violet light protection, and it shall not promote the growth of fungus.

Ensure the jacket or sheath is free of any holes, splits, or blisters.

The cable jacket shall contain no metal elements and shall be of a consistent thickness.

The cable shall contain at least one ripcord under the sheath for easy sheath removal.

C. Crush Resistance. The non-armored optical fiber cables shall withstand a compressive load of 220 N/cm applied uniformly over the length of the cable.

The average increase in attenuation for the fibers shall be ≤ 0.10 dB at 1550 nm for a cable subjected to this load.

The cable shall not exhibit any measurable increase in attenuation after load removal.

Testing shall be in accordance with EIA-455-41, "compressive loading resistance of fiber optic cable," except that the load shall be applied at the rate of 3 mm to 20 mm per minute and maintained for 10 minutes.

Submit the manufacturer's certification for approval.

D. Cyclic Flexing. The cable shall be capable of withstanding 25 cycles of mechanical flexing at a rate of 30 ± 1 cycles/minute.

The average increase in attenuation for the fibers shall be ≤ 0.10dB at 1550 nm at the completion of the test.

Outer cable jacket cracking or splitting observed under 10x magnification shall constitute failure.

Conduct the test in accordance with EIA-455-104, except that the sheave diameter shall be a maximum diameter of 20 times the cable outer diameter (O.D.).

Test the cable in accordance with test conditions I and III of EIA-455-104.

The cable shall withstand 25 impact cycles.

The average increase in attenuation for the fibers shall be ≤ 0.20dB at 1550 nm (single-mode).

The cable jacket shall not exhibit evidence of cracking or splitting. The test shall be conducted in accordance with EIA/TIA-455-25A.

Submit the manufacturer's certification for approval.

E. Tensile Strength. Provide tensile strength by high tensile strength aramid yarns and fiberglass, which shall be helically stranded evenly around the cable core.

The cable shall withstand a tensile load of 2700 Newtons (N) [600 lbs.] without exhibiting an average increase in attenuation of greater than 0.10dB.

Conduct test in accordance with EIA-455-33A, using a maximum mandrel and sheave diameter of 560 mm.

Apply load for one hour in test condition II of EIA-455-33A.

The optical fiber cable shall withstand a maximum pulling tension of 2700N (600 lbs.) during installation (short term) with no damage and 845N (190 lbs.) installed (long term).

Submit the manufacturer's certification for approval.

F. Temperature. The shipping, storage, installation, and operating temperature range of the cable shall meet or exceed -20 °F to +155 °F (-29 °C to +60°C).

G. Loose Buffer. Contain single-mode fibers in a loose buffer tube.

The configuration shall be dimensionally sized to minimize local stresses and microbend losses.

Buffer tubes shall be 2.5mm in outer diameter.

The optical fiber cable shall be an approved product of the U.S. Department of Agriculture, Rural Electrification Administration in accordance with the requirements of REA-PE-90, or as otherwise indicated, and shall conform to EIA/TIA-598.

Each optical fiber shall consist of a doped silica core surrounded by a concentric silica cladding.

Buffer tubes shall be polypropylene.

Include fillers in the cable core to lend symmetry to the cable cross section where needed.

The central anti-buckling member shall consist of a glass reinforced plastic rod; the purpose of the central member is to prevent buckling of the cable.

H. Colors. All optical fibers shall be identifiable by standard color codes as defined in EIA/TIA-598. Each fiber shall be distinguishable, as determined by the maintaining agency, from others by means of color coding and shall conform to the following EIA/TIA sequence of colors:

1. Blue	7. Red
2. Orange	8. Black
3. Green	9. Yellow
4. Brown	10. Violet
5. Slate	11. Rose
6. White	12. Aqua

The colors shall be in accordance with the Munsell color shades.

The fiber coloring shall be an ultraviolet (UV) curable ink which is applied to the outside of the optical fiber protective coating layer and shall not be an integral component of the coating layer itself in order to produce more distinguishable colored fiber.

Buffer tubes containing fibers shall also be color-coded with distinct and recognizable colors according to the following sequence of colors:

1. Blue	13. Blue with black tracer
2. Orange	14. Orange with black tracer
3. Green	15. Green with black tracer
4. Brown	16. Brown with black tracer
5. Slate	17. Slate with black tracer
6. White	18. White with black tracer
7. Red	19. Red with black tracer
8. Black	20. Black with white tracer or black with yellow tracer
9. Yellow	21. Yellow with black tracer
10. Violet	22. Violet with black tracer
11. Rose	23. Rose with black tracer
12. Aqua	24. Aqua with black tracer

The color formulation shall be compatible with the fiber coating and be heat stable.

Color formulation shall not fade or smear or be susceptible to migration and it shall not affect the transmission characteristics of the optical fibers and shall not cause fibers to stick together.

I. Cable Marking. The fiber optic cable outer jacket shall be capable of being marked by the vendor, on a project-by-project basis, with manufacturer's name, the year of manufacture, the words "optical fiber cable", fiber count, type of fiber, the name of the cable owner (e.g., "ODOT I.T.S."), Project ID number ("PID # xxxxx") and sequential linear foot markings.

Repeat the markings every 3 feet.

The actual length of the cable shall be within -0/+1% of the length marking.

The marking shall be in a contrasting color to the cable jacket.

The marking shall be 2.5 mm in height and must be permanent weatherproof and shall not wear off during the installation in the underground conduit system.

J. Quality Assurance Provision. The fiber optic cable shall meet or exceed the requirements of this specification when measured in accordance with the methods of the individual requirements or the following methods as defined in EIA-455-A:

1. Fiber dimensions
2. Attenuation
3. Numerical aperture
4. Fiber proof test
5. Crush resistance
6. Cable bending
7. Tensile load
8. Impact resistance
9. Attenuation vs. Temperature

904.02 Air-Blown/Pushable Fiber Optic Cable. Furnish bend-insensitive G.657.A1 or G.657.A2, single-mode, step-index dielectric cable, manufactured in the United States.

Cable shall be 8.1-8.3/125 um single-mode, bend-insensitive optical fiber cable containing glass of type, Corning SMF-28e, AFL SR-15e, or approved equal, and that meets the following specifications:

ITU-T G.652 (Categories A, B, C and D)
IEC Specification 60793-2-50 Type B1.3
TIA/EIA 492-CAAB
Telecordia GR-20

All cables shall be free of material or manufacturing defects and dimensional non-uniformity that would:

Interfere with the cable installation using manufacturer recommended cable installation methods.

Degrade the transmission performance and environmental resistance after installation.
Inhibit proper connection to interfacing elements.
Otherwise yield an inferior product.

A. Mechanical and Performance Requirements. The cable shall be a rugged all dielectric outdoor cable containing color coded buffer tubes / binders with 12 single mode color-coded fibers per binder, dual window (1310 nm and 1550 nm) fibers with UV acrylate coating in color coded, buffer tubes or binders with the maximum outer diameter as shown in the chart below based on cable strand count.

Fiber Count	Maximum Outside Diameter (Inches)
6	0.125
12	0.3
24	0.3
48	0.3
72	0.3
144	0.33
288	0..41
432	0.5

The buffer tubes / binders shall be stranded around an all-dielectric center strength element using a reverse oscillation lay, wrapped by water blocking core separator or functional equivalent.

The maximum allowable attenuation of the fiber is .35 dB/km for 1310 nm and .25 dB/km for 1550 nm.

No water blocking yarns are permitted to avoid accidentally cutting fibers.

The water blocking elements shall be non-nutritive to fungus, electrically non-conductive, and homogeneous; it shall also be free from dirt or foreign matter.

This water blocking element will preclude the need for other water-blocking material.

The cables shall include GR-20 compliant water-blocked cable core and buffer tubes / binders.

The cable components shall be non-nutritive to fungus, electrically non-conductive, and homogenous.

It shall also be free from dirt and foreign matter.

The cable manufacturer shall be TL 9000 registered.

The optical fiber cable shall withstand water penetration when tested with a one-meter static head or equivalent continuous pressure applied at one end of a one-meter length of filled cable for one hour.

No water shall leak through the open cable end.

Perform testing in accordance with EIA-455-82B.

B. Outer Jacket. Cables shall be all dielectric cable (with no armoring) and shall be jacketed (sheathed) with Polybutylene Terephthalate or High-Density PolyEthylene.

Jacketing material shall be applied directly over the tensile strength members to provide mechanical protection, and to serve as the primary moisture barrier.

This cable sheath shall be designed to meet or exceed the tensile criteria defined in EIA-455-89a.

Each jacketed fiber shall have a tensile strength in excess of 50 lbs.

The jacketing shall contain carbon black to provide ultra-violet light protection, and it shall not promote the growth of fungus.

The jacket or sheath shall be free of any holes, splits, or blisters.

The cable jacket shall contain no metal elements and shall be of a consistent thickness.

The cable shall contain at least one ripcord under the sheath for easy sheath removal.

C. Crush Resistance. The non-armored optical fiber cables shall withstand a compressive load of 220 N/cm applied uniformly over the length of the cable.

The average increase in attenuation for the fibers shall be ≤ 0.10 dB at 1550 nm for a cable subjected to this load.

The cable shall not exhibit any measurable increase in attenuation after load removal.

Perform testing in accordance with EIA-455-41, "compressive loading resistance of fiber optic cable," except that the load shall be applied at the rate of 3 mm to 20 mm per minute and maintained for 10 minutes.

Submit the manufacturer's certification for approval.

D. Cyclic Flexing. The cable shall be capable of withstanding 25 cycles of mechanical flexing at a rate of 30 ± 1 cycles/minute.

The average increase in attenuation for the fibers shall be ≤ 0.10dB at 1550 nm at the completion of the test.

Outer cable jacket cracking or splitting observed under 10x magnification shall constitute failure.

Conduct the test in accordance with EIA-455-104, except that the sheave diameter shall be a maximum diameter of 20 times the cable outer diameter (O.D.).

Test the cable in accordance with test conditions I and III of EIA-455-104.

The cable shall withstand 25 impact cycles.

The average increase in attenuation for the fibers shall be ≤ 0.20dB at 1550 nm (single-mode).

The cable jacket shall not exhibit evidence of cracking or splitting. The test shall be conducted in accordance with EIA/TIA-455-25A.

Submit the manufacturer's certification for approval.

E. Tensile Strength. Tensile strength shall be provided by high tensile strength aramid yarns and fiberglass, which shall be helically stranded evenly around the cable core.

The cable shall withstand a tensile load of 1334 Newtons (N) [300 lbs.] without exhibiting an average increase in attenuation of greater than 0.10dB.

Apply the load for one hour in test condition II of EIA-455-33A.

The optical fiber cable shall withstand a maximum pulling tension of 1334N (300 lbs.) during installation (short term) with no damage and 400N (90 lbs.) installed (long term).

Submit the manufacturer's certification for approval.

F. Temperature. The shipping, storage, installation, and operating temperature range of the cable shall meet or exceed 14 °F to +158 °F (-10°C to +70°C).

G. Bend-Insensitive. Single-mode fibers shall be contained in color-coded binders.

The configuration shall be dimensionally sized to minimize local stresses and microbend losses.

The optical fiber cable shall be an approved product of the U.S. Department of Agriculture, Rural Electrification Administration in accordance with the requirements of REA-PE-90, or as otherwise indicated, and shall conform to EIA/TIA-598.

Each optical fiber shall consist of a doped silica core surrounded by a concentric silica cladding.

The central anti-buckling member shall consist of a glass reinforced plastic rod; the purpose of the central member is to prevent buckling of the cable.

H. Colors. All optical fibers shall be identifiable by standard color codes as defined in EIA/TIA-598. Each fiber shall be distinguishable, as determined by the maintaining agency, from others by means of color coding and shall conform to the following EIA/TIA sequence of colors:

1. Blue	7. Red
2. Orange	8. Black
3. Green	9. Yellow
4. Brown	10. Violet
5. Slate	11. Rose
6. White	12. Aqua

The colors shall be in accordance with the Munsell color shades.

The fiber coloring shall be an ultraviolet (UV) curable ink which is applied to the outside of the optical fiber protective coating layer and shall not be an integral component of the coating layer itself in order to produce more distinguishable colored fiber.

Buffer tubes containing fibers shall also be color-coded with distinct and recognizable colors according to the following sequence of colors:

1. Blue	13. Blue with black tracer
2. Orange	14. Orange with black tracer
3. Green	15. Green with black tracer
4. Brown	16. Brown with black tracer
5. Slate	17. Slate with black tracer
6. White	18. White with black tracer
7. Red	19. Red with black tracer
8. Black	20. Black with white tracer or black with yellow tracer
9. Yellow	21. Yellow with black tracer
10. Violet	22. Violet with black tracer
11. Rose	23. Rose with black tracer
12. Aqua	24. Aqua with black tracer

The color formulation shall be compatible with the fiber coating and be heat stable.

Color formulation shall not fade or smear or be susceptible to migration and it shall not affect the transmission characteristics of the optical fibers and shall not cause fibers to stick together.

I. Cable Marking. The fiber optic cable outer jacket shall be capable of being marked by the vendor, on a project-by-project basis, with manufacturer's name, the year of manufacture, the words "optical fiber cable", fiber count, type of fiber, the name of the cable owner (e.g., "ODOT I.T.S."), Project ID number ("PID # xxxxx") and sequential linear foot markings.

The markings shall be repeated every 3 feet.

The actual length of the cable shall be within -0/+1% of the length marking.

The marking shall be in a contrasting color to the cable jacket.

The marking shall be 2.5 mm in height and must be permanent weatherproof and shall not wear off during the installation in the underground conduit system.

J. Quality Assurance Provision. Fiber optic cable shall meet or exceed the requirements of this specification when measured in accordance with the methods of the individual requirements or the following methods as defined in EIA-455-A:

1. Fiber dimensions
2. Attenuation
3. Numerical aperture
4. Fiber proof test
5. Crush resistance
6. Cable bending
7. Tensile load
8. Impact resistance
9. Attenuation vs. Temperature

904.03 Micro-Duct Pathway. Furnish and install a micro-duct pathway for the purpose of installing air-blown / pushable fiber optic cable.

All components of the pathway shall be constructed of clean virgin high density polyethylene (HDPE) conforming to ASTM D3350-98a, Type III, Category 5, Class B or C and Grade P-34 per ASTM D1248-84 or equivalent.

The pathways may consist of multiple micro-ducts within a single jacketed duct.

All micro-duct oversheathing shall be orange in color and shall include a locate wire.

The locate wire shall be installed in the pathway and shall not be permitted to be located within a micro-duct.

All micro-ducts and oversheathing are to be flexible, lightweight, durable, corrosion resistant, non-conductive and easy to install. Micro-ducts and oversheath shall be constructed of polymeric materials. All micro-ducts are to be smooth on the outside, micro-ribbed on the inside, and have a co-extruded permanent lubrication layer. All oversheathing shall be smooth.

Provide a silicone lubricated co-extruded permanent layer of uniform thickness, containing active or polymeric materials which provide a permanent low friction boundary layer between the micro-duct and cable for a minimum service life of 15 years for the micro-duct. All micro-duct included in the pathway shall be equipped with silicone super slick permanent liner.

All micro-duct and oversheath shall be free from holes, blisters, inclusions, cracks, or other imperfections, which would affect the performance or serviceability

The micro-duct and oversheath shall be homogenous throughout and free from dimensional non-conformities as much as possible within the manufacturing process.

Micro-Duct Specifications:

Micro-Duct Size	12.7/10	22/16
Outside Diameter	12.7mm	21.3mm
Wall thickness	1.05-1.4mm	1.3-1.4mm
Inside Diameter	10mm ± 0.3	15.5 mm

The micro-duct pathway shall contain micro-ducts dissimilar in color and be provided in the following configurations:

A. 7-Cell Pathway
This pathway shall consist of 7 micro-ducts in a single oversheathed pathway and shall be sized as follows:
7 micro-ducts sized at 22 mm OD and 16 mm ID

B. 4-Cell Pathway
This pathway shall consist of 4 micro-ducts in a single oversheathed pathway and shall be sized as follows:
4 micro-ducts sized at 22 mm OD and 16 mm ID

C. 2-Cell Pathway
This pathway shall consist of 2 micro-ducts in a single oversheathed pathway and shall be sized as follows:
2 micro-ducts sized at 12.7 mm OD and 10 mm ID

D. 1-Cell Pathway
This pathway shall consist of 1 micro-duct in a single oversheathed pathway and shall be sized as follows:
1 micro-ducts sized at 22 mm OD and 16 mm ID

904.04 Reserved for Future Use

904.05 Fan-Out Kit. Furnish a 900um fan-out kit assembly of size twelve fiber capacity.

Minimum length shall be 24 inches. It shall be outdoor-rated for operation with a minimum operating temperature range of -40 °F to +149 °F (-30 °C to +65°C).

Each assembly shall contain a Fan-Out Top, Fan-Out Bottom, Fan-Out Tubing, epoxy, syringe, and insert.

904.06 Drop Cable. All drop cable shall meet the requirements of 904.01, except for 904.01.I, Cable Marking.

All Drop Cable shall be marked by the vendor with the manufacturer's name, year of manufacture, the words "Optical Fiber Cable" or similar, fiber count, type of fiber, and sequential linear foot marking.

Repeat markings every 3 feet.

The actual length of the cable shall be within +/-1% of the length marking.

The marking shall be in contrasting color to the cable jacket, minimum 2.5mm in height, permanent and weatherproof, and shall not wear off during installation in the underground conduit system.

904.07 Fiber Optic Patch Cord. The optical patch cords furnished shall consist of a single fiber jacketed cable equipped with optical connectors at each end.

Each patch cable shall have a unique identification label on each end.

Mark labels in indelible ink and do not crimp, kink or otherwise harm the patch cable.

Equip patch cords for connection between two Fiber Distribution Panels (FDPs) with approved connectors on each end.

The sheath shall be flame retardant and coded NFR in accordance with the national electric code.

The patch cord jacket shall be resistant to ultraviolet radiation.

Optical fiber connectors shall satisfy the interface parameters of the equipment components as defined by the transceiver equipment specifications.

All connectors shall be of Type UPC or APC.

SPC-type connectors are not permitted.

904.08 Fiber Termination Panel. Fiber Termination Panels shall include all materials as described in the respective specifications for NEMA Cabinet types and Caltrans (332,334,336) Cabinet or AASHTO/ITE/NEMA ITS Cabinet types.

A. NEMA Cabinet Type. Fiber termination panels shall house and protect the connectors on each pigtail.

Securely insert the optical connectors on each pigtail in a connector panel that is manufactured to be mated with the LC (UPC) connector type.

The connector panel shall be made by the housing manufacturer and be designed for the specified housing.

Maximum optical loss across the connection shall be 0.25dB.

The fiber optic cable shall be of a sufficient length that will allow the cable to be pulled from the cabinet through conduit to adjacent overhead or underground splice enclosures and fusion spliced to the trunk fiber optic cables as depicted in the communications splicing diagrams, leaving 75 feet of slack at the splice enclosure and 15 feet of slack in the cabinet.

The termination panel shall use LC connectors for the equipment side and specified connectors shall be core-aligned fusion spliced or factory pre-connectorized to the fiber optic drop cable that leads to the splice enclosure.

The fiber termination panel shall be compact, rugged and shelf mountable to ensure secure mounting within existing NEMA controller cabinets and shall be IP-65 rated.

24-fiber termination panels shall mount neatly in the cabinet space as defined by the Traffic Engineer.

48-fiber termination panels may consist of two side-by-side 24-fiber termination panels.

Panel shall be manufactured by Corning, Gatorpatch, AFL, or approved equal.

B. Caltrans (332,334,336) Cabinet or AASHTO/ITE/NEMA ITS Cabinet Type. The fiber termination panel enclosure shall consist of a self-contained metal enclosure including LC style fiber optic connectors and MTP modules (as specified below).

Pre-terminate outdoor rated fiber optic cable to the proper MTP connector (pinned or non-pinned).

In cases where the fiber optic cable has more than 48 strands of fiber the MTP pre-terminated cable shall be of a sufficient length as shown on the plans that will allow the cable to be pulled from the cabinet through conduit to adjacent overhead or underground splice enclosures and fusion spliced to the trunk fiber optic cables as depicted in the communications splicing diagrams, leaving 75 feet of slack at the splice enclosure and 15 feet of slack in the cabinet.

In cases where the fiber optic cable has 48 strands or less the MTP pre-terminated cable shall be 12 feet in length and shall splice into the trunk cable utilizing splice trays in the cabinet. Store splice trays neatly in the termination panel, while allowing easy removal for troubleshooting purposes.

All connector terminations shall be ceramic UPC connectors.

Dimensions of patch panels shall mount inside a standard EIA 19-inch rack.

Patch Panel Enclosures shall be equipped with a locking mechanism for front and back of patch panel assembly to prevent unauthorized access.

Patch Panels shall include MTP modules capable of housing 12-24 fiber optic LC-type connectors. The modules shall interface with the cabinet equipment via LC connectors and the fiber optic trunk cable via MTP connectors. The fiber optic cable shall be secured in a manner that no strain is presented to the MTP connector.

MTP Modules, connectors, patch cables, pre-terminated fiber cables and fusion splices shall be incidental to the fiber termination panel.

904.09 Fiber Optic Connectors. All optical fiber termination components shall meet or exceed the applicable provisions of EIA/TIA-455-A.

All optical fiber connectors shall be of industry standard and of type for single-mode optical fiber and shall meet or exceed the applicable provisions of EIA/TIA-455-2b, EIA/TIA-455-5a, and EIA-455-34. All connectors shall be compliant with industry standard ANSI/TIA/EIA-568B.3. The connector shall comply with TIA/EIA fiber optic connector intermateability standard (FOCIS) document, TIA/EIA-604-3.

Single-mode pigtails shall be provided with factory pre-connectorized single-mode connectors. Connectors shall have a maximum loss of 0.5 dB through each mated pair of single-mode fibers. Each connector shall be capable of 100 repeated matings with maximum increase in splice loss limited to 0.2 dB per connector.

Single mode fiber optic pigtails shall be provided.

Optical fiber cable used for pigtails shall be of the tight buffered type protected by aramid fibers.

The pigtail jacket shall be resistant to ultraviolet radiation.

Connector reflectance shall be measured at the factory to be = -40 dB for super physical contact (SPC), -55 dB for ultra physical contact (UPC), and -60 dB for angle polished contact (APC).

Strain-relief boot color shall be white for SPC, blue for UPC, and green for APC.

Manufacturer shall be ISO 9001 and TL 9000 registered.

All connectors shall be LC-type UPC.

SPC-type connectors are not permitted.

904.10 Splice Enclosure. The splice enclosure shall be weatherproof, corrosion resistant, rodent proof, re-enterable, and crush resistant.

The splice enclosure shall be of clam-shell design with upper and lower pieces that are tightened down and sealed using screws / bolts.

The splice enclosure shall easily fit into a 32 inch pull box along with loops of slack cable in box (approximately 100 ft.). The splice enclosure shall be a complete kit including all components and hardware for installation.

The splice enclosure shall be suitable for application in the temperature range of -40 °C to +70 °C.

The splice enclosure shall provide space, allowing entry of fiber optic cable without exceeding the minimum bend radius of the cable.

The enclosure shall have provisions for cable and pigtail strain-relief, and shall be equipped with strain-relief hardware.

The splice enclosure shall be designed to permit selective fiber splicing (looping a backbone cable in and out while only cutting into the desired fibers).

The size of the enclosure shall allow all the fibers of the largest optical fiber trunk cable to be fusion spliced to a second cable of the same size, plus additional pigtails.

The splice enclosure shall allow splicing of all fibers up to the maximum number.

904.11 Fiber Optic Media Converter. Operating temperature range shall be -20 °F to +155 °F (-29 °C to +68 °C).

Electrical power for freestanding units shall be provided by NEMA 5-15 compatible plug and/or Class 2 switching power supply with a minimum cord length of 6 feet.

Established and documented MTBF shall be 100,000 hours, minimum.

A. Fiber Optic to Ethernet Media Converter. Converter shall provide RJ-45 interface compatible with 100BaseT-TX: Cat. 5, EIA/TIA-568 100-Ohm UTP cable.

B. Fiber Optic to RS-232 Media Converter. Converter shall provide a RS232 Asynchronous communications channel using a 9-pin D-sub or RJ-45 connector using industry-standard pin configuration or a plug-in module connection to a controller unit.

The FO Module shall be one of the following, per project operational requirements:

1. A free-standing, shelf-mounted enclosed unit.
2. A plug-in module compatible with an ODOT-approved Caltrans or NEMA controller unit, and approved in writing by the manufacturer of the controller.

904.12 Fiber Optic Fusion Splicer. The Fiber Optic Fusion Splicer shall be one of the following types:

1. AFL FSM-70S
2. FITEL S178A version 2
3. SUMITOMO T-55
4. SUMITOMO TYPE-71C+
5. Or Approved Equal, that meets the following minimum specifications as determined by the ODOT Department of Traffic Operations:
   Splicing Method – Core Alignment
   Applicable Fibers – SM, MM, DS, NZ-DS
   Cladding Diameter – 80-125 um
   Splice loss estimation using Core Alignment

Camera Axis – X and Y
Typical Splicing time of Single-Mode Fiber less than or equal to 13 seconds
Operating Temperature – (-10 to +50 C)
Color LCD Monitor
High wind velocity protection
Average Splice Loss (dB) – 0.02 SM, 0.01 MM, 0.04 DS
Internal Battery w/ AC adapter– capable of performing minimum of 100 splices on full charge
Ability to download splice data to PC via USB
Internal Splice Data Storage = 2,000 splice results
Maximum Dimension (inches) – 8 x 9.5 x 6
If available, hard carrying case

904.13 Fiber Optic Optical Time Domain Reflectometer (OTDR). The Fiber Optic OTDR shall be one of the following types and shall include adapters for FC, ST, SC, and LC type connectors:

1. AFL M310-25K-01-HC2
2. FLUKE OFP-100-QI
3. Or Approved Equal, that meets the following minimum specifications as determined by the ODOT Department of Traffic Operations:
   Shall have a Built-in Optical Power Meter
   Shall have a Built-in Visual Fault Locator
   Internal Memory storage – 500 traces
   Color Display
   Multi-mode and Single-mode fiber testing capability
   Ability to download splice data to PC via USB
   Rugged Construction
   If available, hard carrying case
   Operating Temperature – (-10 to +45 C)
   Li-Ion Battery w/ AC adapter
   Digital Fiber Scope for video inspection that is compatible with the UPC and APC types of connectors.
   Maximum Dimension (inches) – 11 x 5.5 x 3

904.14 Fiber Optic Cleaver. The Fiber Optic Cleaver shall be one of the following types:

1. AFL CT-30A
2. CORNING FBC-012
3. SUMITOMO FC-7
4. Or Approved Equal, that meets the following minimum specifications as determined by the ODOT Department of Traffic Operations:
   Fiber Blade Life – 24,000
   Fiber scrap collection-free with use of integrated scrap container
   If available, hard carrying case

904.15 Fiber Optic Power Meter. The Fiber Optic Power Meter shall include dual optical light sources (LED / LASER) and shall be one of the following types:

1. AFL OPM4
2. EXFO ELS-50 (235BL & 12C) and EPM-53
3. FLUKE FTK1450
5. Or Approved Equal, that meets the following minimum specifications as determined by the ODOT Department of Traffic Operations:
    Calibration Wavelengths (nm) – 850, 1300, 1310, and 1550
    Include SC, ST, and LC adapters
    Measurement range – (+6 TO -50 dBm)
    Accuracy – ±0.25 dB
    Resolution – 0.01 dB
    Measurement Units –dBm, W
    Power – AA Batteries
    Operating Temperature – (-10 to +50 C)
    Maximum Dimensions (inches) – 7.5 x 4 x 2.5
    If available, hard carrying case

904.16 Fiber Optic Visual Fault Locator. The Fiber Optic Visual Fault Locator shall be one of the following types:

1. AFL VF12-01-0900PR
2. CORNING VFL350
3. FLUKE VisiFault with NF380 adapter
4. Or Approved Equal, that meets the following minimum specifications as determined by the ODOT Department of Traffic Operations:
    Emitter Type – Laser Class II
    Wavelength – 650 nm ± 20 nm
    Maximum Output Power – 1.3 mW (into single-mode fiber)
    Modulation – 2-3 Hz or CW selectable
    Operating Temperature – (-10 to 40 C)
    Maximum Dimensions (inches) – 7 x 2.5 x 1.5
    Power – AA or AAA Batteries
    Connection Ferrule Diameter – 2.5 mm and 1.25 mm
    Compatible Fiber Optic Connectors – SC, LC, and ST
    If available, hard carrying case

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 907
VIDEO DETECTION SYSTEM

January 20, 2012

Provide a 60-month warranty or the manufacturer's standard warranty, whichever is greater, for the following equipment:

1. Camera Heads
2. Combined Camera Head/Processor Units
3. Processors
4. Rack Mount Cards
5. Hubs
6. Portable Interface Devices

Ensure that the warranty period begins on the date of shipment to the project. Ensure that each system has a permanent label or stamp indicating the date of shipment.

The warranty to include technical support which shall be available from the supplier, at no cost, via telephone within 4 hours of the time a call is made, from factory-certified personnel or factory certified installers.

The warranty is to include updates to the video detection processor firmware and application software which shall be available from the manufacturer without charge.

A. Functional Capabilities. Provide camera systems able to transmit video signals up to 1,000 feet.

Furnished video detection system configuration shall utilize video processors with 1 or more video inputs and 1 video output, responding to specific site applications, camera locations and detection zones shown on the project plans.

B. Interface. Provide video inputs that accept signals from an external video source. Provide an interface connector located on the front of the video processing unit.

Provide an indication of the presence of the video signal. The indicator shall assert upon valid video synchronization and turn off when the presence of a valid video signal is removed.

Provide one video output per processor module. The video output shall have the capability to show text and graphical overlays to aid in system setup. The overlays shall display real-time actuation of detection zones upon vehicle detection or presence. Control of the overlays and video switching shall also be provided. The video output interface connector shall be BNC, RCA, VGA, or DVI type.

Provide a communications port on the front panel. The port shall use a DB9 or RJ45 type connector. The communications interface shall allow the user to remotely configure the system and/or to extract calculated vehicle/roadway information.

Furnish interface software. The interface protocol shall support multi-drop or point-to multipoint communications. Each video detection system shall have the capability to be individually IP addressable either built in or with third party video server units.

Provide open collector outputs meeting NEMA TS2 requirements. The open collector output will be used for vehicle detection indicators as well as discrete outputs for alarm conditions.

Provide LED status indicators on the front panel. The LEDs shall illuminate when an output is asserted. Provide one output LED for each output.

Provide a dedicated mouse compatible port on the front panel of the video processing unit. The mouse port shall be used as part of the system setup and configuration. Provide a compatible mouse with each video detection system.

C. Functionality. Detection zones shall be programmed via an on-board menu displayed on a video monitor and a pointing device connected to the video detection processor. The menu shall facilitate placement of detection zones and setting of zone parameters or to view system parameters.

The video detection processor shall detect vehicles in real time as they travel across each detection zone and provide indication on the video display.

The video detection processor shall default to a safe condition, such as minimum recall, fixed recall or a constant call on each active detection channel, in the event of unacceptable interference with the video signal or low visibility conditions.

A user-selected output shall be active during the low-visibility condition that can be used to modify the controller operation if connected to the appropriate controller input modifier(s). The system shall automatically revert to normal detection mode when the low-visibility condition no longer exists.

A minimum of 24 detection zones per camera input shall be possible, and each detection zone shall be capable of being sized to suit the site and the desired vehicle detection region/type.

The video detection processor's memory shall be non-volatile to prevent data loss during power outages.

The video detection processor shall maintain normal operation of existing detection zones when one zone is being added or modified. The video detection processor shall output a constant call on any detector channel corresponding to a zone being modified and shall resume normal operation upon completion.

The video detection processor shall output minimum recall, fixed recall or constant call for each enabled detector output channel if a loss of video signal occurs. The recall behavior shall be user selectable for each output. The video detection processor shall output a constant call during the background “learning” period.

Detection zone outputs shall be configurable to allow the selection of presence, pulse, extend, and delay outputs. Timing parameters of pulse, extend, and delay outputs shall be user definable between 0.1 to 25.0 seconds.

Up to six detection zones per camera view shall have the capability to count the number of vehicles detected, measure classification and speed. The data values shall be internally stored within the processor module for later retrieval through the communication port. The data collection interval shall be user

definable in periods of 5, 15, 30, or 60 minutes or by intersection cycle. Real-time data shall be retrieved by the PC-based software provided with the system.

Cameras shall be completely compatible with the video detection processor and shall be certified by the manufacturer to ensure proper system operation.

The camera shall use a color CCD sensing element with resolution of no less than 470 lines horizontal and 400 lines vertical.

The camera shall include mechanisms to compensate for changing of lighting by using an electronic shutter and/or auto-iris lens.

The camera shall include a motorized variable focal length lens with factory preset focus that requires no field adjustment. If zooming of the camera lens to suit the site geometry by means of a portable interface device is required, the portable interface shall be provided. The horizontal field of view shall be adjustable from 10 to 45 degrees minimum.

The camera electronics shall include automatic gain control (AGC) to produce a satisfactory image at night.

The camera shall be housed in a weather-tight sealed enclosure. The housing shall be field rotatable to allow proper alignment between the camera and the traveled road surface.

The camera enclosure shall be equipped with a sunshield. The sunshield shall include a provision for water diversion to prevent water from flowing in the camera's field of view.

The camera enclosure shall include a thermostatically controlled heater to assure proper operation of the lens shutter at low temperatures and prevent moisture condensation on the optical faceplate of the enclosure.

When mounted outdoors in the enclosure, the camera shall operate satisfactorily in a temperature range from -30°F to +140°F (-34 °C to +60 °C) and a humidity range from 0% RH to 100% RH.

The camera enclosure shall be equipped with weather-tight connections for all cables.

The cable provided shall be as recommended by the manufacturer for optimal video detection performance. The cable shall be either multi-paired jacketed cable or coaxial cable. Coaxial cable can be used between the camera and the video detection processor in the traffic signal controller cabinet and shall be as recommended by the manufacturer, or a Department approved 75 ohm precision video cable with 20 AWG solid bare copper conductor (9.9 ohms/M), RG-59, U-Type, solid polyethylene insulating dielectric, 98% (min) tinned copper double-braided shield and light blue polyethylene jacket previously proven to provide successful operation with the video detection system.

For coaxial cable, the signal attenuation shall not exceed 0.78 dB per 100 feet (30 m) at 10 MHz.

Coaxial cable shall be suitable for installation in conduit and in exposed sunlight environment. 75-ohm BNC plug connectors shall be used at both the camera and cabinet ends. The coaxial cable, BNC connector, and crimping tool recommended by the manufacturer of the video detection system shall be used and installed per the manufacturer's recommended instructions to ensure proper connection.

Multi-paired jacketed cable shall include a minimum of four individually paired No. 19 AWG communication cables with an overall shield. Pairs shall not be individually shielded. Paired cable and power cables may be installed under the same outer jacket.

Power cable, if required, shall be rated for 90°C, 300 volt, 16 AWG, stranded, three conductor cable with a nominal outside diameter of approximately 0.330 inches (8 mm). Conductor insulation color code shall be black, white and green. Outside jacket shall be black.

Camera power cable shall be suitable for installation in conduit and in exposed sunlight environment, and UL listed.

The power and video cable may be installed under the same outer jacket.

Provide surge protection devices for all new or added video detection devices as recommended by the manufacturer. Coaxial cable shall be protected with an inline or panel mounted surge suppressor as recommended by the manufacturer, or approved equal. Surge suppressor shall be installed and grounded per video detection manufacturer's recommendations.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 916

COATING OF LIGHT SUPPORTS, SIGNAL SUPPORTS, AND OTHER SIMILAR ITEMS OVER HOT-DIP GALVANIZED STEEL OR ALUMINUM

January 19, 2018

916.01 Description. This Specification applies to a manufacturer-supplied protective wet or dry coat system on new light supports, signal supports, light and signal components, installation fasteners, and other similar items defined in the plans and specifications. If neither coating system is specified in the Plans, then either coating system (wet or dry) may be used, provided it meets the performance requirements of this Specification and is supplied by a Certified Supplier per ODOT Supplement 1091, 1093 or 1094.

Provide a coating system over steel substrate consisting of an initial coat of hot dip galvanizing and one or more subsequent coats by a Dry (powder coat) or Wet (paint) process applied to the hot dip galvanizing. Provide aluminum substrates similarly coated but without the underlying galvanization.

Provide the color of the finished coating system noted in the Construction Item description supplemental information and specified by Federal color number. **Reference Standards**

AAMA 2604-10 *Voluntary Specification, Performance Requirements, and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels*

ASTM B 117 *Standard Practice for Operating Salt Spray (Fog) Apparatus*

ASTM D 522 *Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings*

ASTM D 523 *Standard Test Method for Specular Gloss*

ASTM D 714 *Standard Test Method for Evaluating Degree of Blistering of Paints*

ASTM D 1654 *Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments*

ASTM D 2244 *Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally-Measured Color Coordinates*

ASTM D 2794 *Standard Test for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)*

ASTM D 3359 *Standard Test Methods for Measuring Adhesion by Tape Test*

ASTM D 3363 *Standard Test Method for Film Hardness by Pencil Test*

ASTM D 6386 *Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product Hardware Surfaces for Painting*

ASTM D 7803 *Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product Hardware Surfaces for Powder Coating*

ASTM G 154 *Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials*

SSPC-PA-2 *Procedure for Determining Conformance to Dry Coating Thickness Requirements*

916.02 Materials. Assure the hot-dip galvanized coating on steel supports and other steel items conform to the requirements of 711.02. Assure galvanized surface preparation conform to ASTM D 6386 (wet process) or ASTM D7803 (dry process). Assure aluminum substrates are ground, chemically etched, sanded, shot blasted or prepared by another manufacturer-approved method prior to coating

Before starting either of the coating processes, submit certified independent test data to the Engineer for the proposed coating materials. Assure the test data shows the proposed coating process meets or exceeds all required material and performance requirements. Also produce and provide a test sample (Drawdown Card, minimum size 3 inches by 5 inches) to the Engineer of the proposed coating system, in the required color, on a substrate identical to that proposed in the Plans. If more than one substrate material is used on the structure, then provide a sample for each.

916.03.A. Dry Process (Powder Coat). Assure the powder is triglycidyl isocyanurate (TGIC) or TGIC-free beta hydroxyalkylamide (HAA), and that the finished coating system meets the performance criteria listed in Table A. Assure the product proceeds promptly to the powder coating process within the same facility where the poles and arms are manufactured, or to a manufacturerapproved third-party facility that conforms to this Specification. Assure the finished coating system meets the performance criteria listed in Table A.

916.03.B. Wet Process Provide a wet paint process using one or more coats, with a urethane or polyaspartic finish coat. Assure the finished coating system meets the performance criteria listed in Table A.

916.04 Performance Requirements.

Table A			
REQUIREMENT STATEMENT	SPECIFICATION OR TEST PROCEDURE	MINIMUM VALUE REQUIRED **(Dry Process)**	MINIMUM VALUE REQUIRED **(Wet Process)**
Gloss Retention	ASTM G154 (UVA-340 Lamp, Cycle 1), ASTM D 523 or D4141 (Procedure A)	Min. 2500 hours, 60% of initial gloss retained (60º)	Min. 2500 hours, 60% of initial gloss retained (60º)
Color Retention	ASTM G154 (UVA-340 Lamp, Cycle 1) or D4141 (Procedure A) and ASTM D 2244	After 3000 hours, Less than 6 ΔE units	After 3000 hours, Less than 6 ΔE units
Salt spray	ASTM B 117, ASTM D1654, D714	After 3000 hours – No loss of bond, No rusting or scribe blistering beyond 1/8" from center of scribe on bare (not galvanized) steel, Few or No face blisters.	After 3000 hours – No loss of bond, No scribe blistering beyond 1/8" from center of scribe, white corrosion products in scribe line only, Few or No face blisters.
Direct impact	ASTM D 2794	80 in./lb (9.0 m/kg)	120 in./lb (9.0 m/kg)
Reverse impact	ASTM D 2794	80 in./lb (9.0 m/kg)	120 in./lb (9.0 m/kg)
Pencil hardness (scratch/gouge)	ASTM D 3363	H-2H	2H
Elongation (Mandrel test):	ASTM D 522	1/8 inch (3.2m mm)	1/8 inch (3.2mm)
Minimum adhesion	ASTM D 3359	5A and/or 5B, specify tape used	5A and/or 5B, specify tape used
Thickness	SSPC-PA-2	5.0 mils (steel), 2.0 mils (aluminum) minimum (includes all process tolerances)	4.0 mils minimum (includes all process tolerances)
Durability (Aluminum substrates only)	AAMA 2604-10	Super Durable	Not Applicable

916.05 Warranty. Provide a written warranty statement from the manufacturer of the finished support(s), arm(s) and other item(s). Include the contract number, ODOT PID, and location of the project in the warranty statement. Assure in writing that the warranty period begins upon the date of delivery of the support to the project. Provide a warranty period five (5) years or more.

Designer Notes:

These specifications are intended to be incidental to an As-Per-Plan version of established ODOT Standard Construction Items such as signal strain poles, signal supports, signal pedestals, and light poles. This Supplemental Specification should be referenced on the Title Page as well as in the As-Per-Plan Note.

It is not recommended to apply any secondary coating to light *Towers* over the standard hot-dip galvanizing because of wear from the lowering device rollers. Light *Poles* may be coated.

For signal strain poles and signal supports at ODOT-maintained installations, only Black (FEDSTD-595b 17038) should be specified.