

GROUNDING AND BONDING

THE REQUIREMENTS OF THE CONSTRUCTION AND MATERIAL SPECIFICATIONS (C&MS) AND THE TC SERIES OF STANDARD CONSTRUCTION DRAWINGS ARE MODIFIED AS FOLLOWS:

1. ALL METALLIC PARTS CONTAINING ELECTRICAL CONDUCTORS SHALL BE PERMANENTLY JOINED TO FORM AN EFFECTIVE GROUND FAULT CURRENT PATH BACK TO THE GROUNDED CONDUCTOR IN THE POWER SERVICE DISCONNECT SWITCH.
 - A. PROVIDE AN EQUIPMENT GROUNDING CONDUCTOR IN METALLIC CONDUITS (725.04) IN ADDITION TO THE CONDUCTORS SPECIFIED AND BOND THE CONDUIT TO THIS GROUNDING CONDUCTOR.
 - B. WHEN AN EQUIPMENT GROUNDING CONDUCTOR IS REQUIRED IN PLASTIC CONDUIT (725.05), THE INSTALLATION SHALL INCLUDE A SEPARATE EQUIPMENT GROUNDING CONDUCTOR IN ADDITION TO THE CONDUCTORS SPECIFIED.
 - C. METALLIC CONDUIT CARRYING THE LOOP WIRES FROM IN THE PAVEMENT TO THE PULL BOX SPLICE LOCATION WILL ONLY BE BONDED AT THE PULL BOX END, AND WILL NOT CONTAIN AN EQUIPMENT GROUNDING CONDUCTOR.
 - D. IF MULTIPLE CONDUIT RUNS BEGIN AND END AT THE SAME POINTS, ONLY ONE EQUIPMENT GROUNDING CONDUCTOR IS REQUIRED.
 - E. IF AN EQUIPMENT GROUNDING CONDUCTOR IS NEEDED IN CONDUIT BETWEEN SIGNALIZED INTERSECTIONS FOR UNDERGROUND INTERCONNECT CABLE, THE GROUNDING SYSTEM FOR EACH SIGNALIZED INTERSECTION WILL BE SEPARATED ABOUT MIDWAY BETWEEN THE INTERSECTIONS.
 - F. THE MESSENGER WIRE AT SIGNALIZED INTERSECTIONS WILL BE USED AS THE CONDUCTIVE PATH FROM CORNER TO CORNER IF CONDUIT IS NOT PROVIDED UNDER THE ROADWAY. WHEN CONDUIT CONNECTS THE CORNERS OF AN INTERSECTION, AN EQUIPMENT GROUNDING CONDUCTOR SHALL BE USED IN THE CONDUIT.
2. CONDUITS.
 - a. THE 725.04 CONDUIT SHALL HAVE GROUNDING BUSHINGS INSTALLED AT ALL TERMINATION POINTS. THE BUSHING MATERIAL SHALL BE COMPATIBLE WITH GALVANIZED STEEL CONDUIT AND THE GROUNDING LUG MATERIAL SHALL BE COMPATIBLE FOR USE WITH COPPER WIRE. THREADED OR COMPRESSION TYPE BUSHINGS MAY BE USED.
 - b. THE 725.05 CONDUIT SHALL HAVE THE INSIDE AND OUTSIDE DIAMETERS OF THE CONDUIT DEBURRED AT ALL TERMINATION POINTS.
 - c. BOTH ENDS OF METALLIC CONDUIT SHALL BE BONDED TO THE EQUIPMENT GROUNDING CONDUCTOR.
 - d. METALLIC CONDUIT MAY BE BONDED TO METALLIC BOXES THROUGH THE USE OF CONDUIT FITTINGS UL APPROVED FOR THIS TYPE OF CONNECTION, WITH THE BOX BONDED TO THE EQUIPMENT GROUNDING CONDUCTOR.
3. WIRE FOR GROUNDING AND BONDING.
 - a. USE INSULATED, COPPER WIRE FOR THE EQUIPMENT GROUNDING CONDUCTOR. BONDING JUMPERS IN BOXES AND ENCLOSURES MAY BE BARE OR INSULATED COPPER WIRE. WIRE SIZE SHALL BE AS FOLLOWS:
 - i. USE 4 AWG BETWEEN THE POWER SERVICE AND SUPPORTS, POLES, PEDESTALS, CONTROLLER OR FLASHER CABINETS.
 - ii. USE A MINIMUM 8 AWG BETWEEN LOOP DETECTOR PULL BOXES AND THE FIRST CONDUIT THAT REQUIRES A LARGER SIZE AS SPECIFIED IN 3.A.1 ABOVE.
 - iii. USE A MINIMUM 8 AWG BETWEEN THE "PREPARE TO STOP WHEN FLASHING" INSTALLATION (INCLUDING SUPPORT) AND THE FIRST CONDUIT THAT REQUIRES A LARGER SIZE AS SPECIFIED IN 3.A.1 ABOVE.
 - iv. THE INSULATION SHALL BE GREEN OR GREEN WITH YELLOW STRIPE(S). FOR 4 AWG OR LARGER, INSULATION MAY ALSO BE BLACK WITH GREEN TAPE/LABELS INSTALLED AT ALL ACCESS POINTS.
 - b. IN A HIGHWAY LIGHTING SYSTEM, THE EQUIPMENT GROUNDING CONDUCTOR SHALL BE THE SAME WIRE SIZE AS THE DUCT CABLE OR DISTRIBUTION CABLE CIRCUIT CONDUCTORS, WITH THE MINIMUM CONDUCTOR SIZE OF 4 AWG. BONDING JUMPERS WILL BE MINIMUM SIZE 4 AWG.
4. GROUND ROD.
 - a. A 3/4 INCH SCHEDULE 40 PVC CONDUIT WILL BE USED IN FOUNDATIONS AND CONCRETE WALLS FOR THE GROUNDING CONDUCTOR (GROUND WIRE) RACEWAY TO THE GROUND ROD. SHOULD METALLIC CONDUIT BE USED, BOTH ENDS OF THE CONDUIT SHALL BE BONDED TO THE GROUNDING CONDUCTOR.

b. THE TYPICAL GROUNDING CONDUCTOR (GROUND WIRE) SHALL BE 4 AWG INSULATED, COPPER.

GROUNDING AND BONDING (CONT.)

5. THE GREEN CONDUCTOR IN SIGNAL CABLES (CONDUCTOR #4) SHALL NOT BE USED TO SUPPLY POWER TO A SIGNAL INDICATION. IT WILL BE CONNECTED TO THE SIGNAL BODY AS AN EQUIPMENT GROUND IN ALUMINUM HEADS AND IT WILL BE UNUSED IN PLASTIC HEADS. UNUSED CONDUCTORS SHALL BE GROUNDED IN THE CABINET. TYPICAL USE OF CONDUCTORS IS AS FOLLOWS:

COND. NO.	COLOR	VEHICLE SIGNAL	PEDESTRIAN SIGNAL
1	BLACK	GREEN BALL	#1 WALK
2	WHITE	AC NEUTRAL	AC NEUTRAL
3	RED	RED BALL	#1 DW/FDW
4	GREEN	EQUIPMENT GROUND	EQUIPMENT GROUND
5	ORANGE	YELLOW BALL	#2 DW/FDW
6	BLUE	GREEN ARROW	#2 WALK
7	WHITE/BLACK STRIPE	YELLOW ARROW	NOT USED

6. POWER SERVICE AND DISCONNECT SWITCH.
 - a. AT THE POWER SERVICE LOCATION, THE GROUNDING CONDUCTOR (GROUND WIRE) FROM THE DISCONNECT SWITCH NEUTRAL (AC-) BAR TO THE GROUND ROD SHALL BE A CONTINUOUS, UNSPLICED CONDUCTOR. IF SPLICED, IT SHALL BE AN EXOTHERMIC WELD BUTT SPLICE.
 - b. THE SERVICE NEUTRAL (AC-) SHALL ONLY BE CONNECTED TO GROUND AT THE PRIMARY POWER SERVICE DISCONNECT SWITCH.
 - i. NEMA CONTROLLER CABINETS: IF A POWER SERVICE DISCONNECT SWITCH IS LOCATED BEFORE THE CONTROLLER CABINET, THE NEUTRAL (AC-) AND THE GROUNDING BARS IN THE CONTROLLER CABINET SHALL NOT BE CONNECTED TOGETHER AS SHOWN IN NEMA TS-2, FIGURE 5-4.
 - ii. IF SECONDARY DISCONNECT SWITCHES ARE CONNECTED AFTER THE PRIMARY DISCONNECT SWITCH, THE NEUTRAL (AC-) SHALL ONLY BE GROUNDED AT THE PRIMARY SWITCH. EQUIPMENT GROUNDING CONDUCTORS SHALL BE BROUGHT TO THE PRIMARY SWITCH, BUT SHALL BE GROUNDED AT BOTH SECONDARY AND PRIMARY SWITCHES.
7. PAYMENT – ALL MATERIALS AND WORK REQUIRED TO COMPLETE THE EFFECTIVE GROUND FAULT CURRENT PATH SYSTEM ARE INCIDENTAL TO THE CONDUCTORS INSTALLED BY CONTRACT.

ITEM 630 - GROUND MOUNTED SUPPORT, NO. 3, AS PER PLAN

GROUND MOUNTED POST SUPPORTS USED ON THIS PROJECT SHALL BE U-CHANNEL DESIGN AND BE PER CMS 630.06 AND SCD TC-41.20 WITH THE FOLLOWING EXCEPTIONS.

POST SUPPORTS EXPOSED TO TRAFFIC SHALL BE STUBBED AND SPLICED PER THE FOLLOWING PROCEDURE:

- 1) DRIVE 60" LONG STUB TO WITHIN 12" OF GROUND SURFACE.
- 2) BOLT UPPER SIGN POST TO STUB USING QUANTITY OF FOUR 5/16" ALUMINUM BOLTS, STAINLESS STEEL LOCK WASHERS, SS WASHERS, AND SS NUTS WITH A MINIMUM OF 4" CENTER TO CENTER SPACING.
- 3) THE UPPER POST SHALL BE SPLICED BEHIND THE STUB POST TO MINIMIZE THE POSSIBILITY OF VEHICLE SNAGGING DURING A COLLISION.
- 4) CARE SHALL BE EXERCISED TO DRIVE AND ERECT POSTS VERTICALLY PLUMB AND ERECT SIGNS SO THEY ARE LEVEL WHEN VIEWED FROM THE ROADWAY.
- 5) PLACE NO MORE THAN TWO POSTS WITHIN 7' VEHICLE PATH UNLESS LOCATED BEHIND GUARDRAIL. SEE SCD-TC 41.20.
- 6) COST OF SPLICE CONNECTION AND OVERLAP OF POSTS SHALL BE INCIDENTAL TO THE COST OF EACH SIGN SUPPORT.

BASIS OF PAYMENT SHALL BE AT THE UNIT PRICE BID PER FOOT.

ALL GROUND MOUNTED POST SUPPORTS SHALL BE DRIVEN VERTICALLY PLUMB TO A MINIMUM EMBEDMENT DEPTH OF 48 INCHES. IF GROUND CONDITIONS PREVENT DRIVING TO THIS DEPTH, THE SIGN INSTALLATION SHALL BE INSTALLED USING TWO POSTS SIDE BY SIDE TO FORM A DUAL POST INSTALLATION.

WHERE NEW SIGNS ARE TO BE INSTALLED ON EXISTING BEAM SUPPORTS, THE EXISTING SIGN SHALL BE REMOVED WITHOUT DISTURBING THE BEAM SUPPORTS AND THE NEW SIGN INSTALLED IN ITS PLACE ABOVE THE HINGE POINTS. IF THE NEW SIGN IS WIDER, OFFSET IT TO THE RIGHT AS NECESSARY TO MAINTAIN SIDE CLEARANCE, WITH APPROVAL OF THE ENGINEER. IF THE NEW SIGN EXTENDS ABOVE THE EXISTING BEAM SUPPORTS BY MORE THAN SIX INCHES, SIGN BACKING ASSEMBLIES EXTENDING FROM THE TOP OF THE NEW SIGN TO AT LEAST THREE FEET BELOW THE TOP OF THE BEAMS SHALL BE USED AT INTERVALS OF NO MORE THAN ONE AND ONE-HALF FEET FROM THE ENDS AND THREE FEET APART LATERALLY TO SUPPORT THE ADDITIONAL SIGN HEIGHT.

ITEM 204 – SUBGRADE COMPACTION AND PROOF ROLLING

CONSTRUCT THE SUBGRADE AS FOLLOWS AND IN THE FOLLOWING SEQUENCE:

1. SHAPE THE SUBGRADE TO WITHIN 0.2 FEET OF THE PLAN SUBGRADE ELEVATION.
2. EXCAVATE AND REPLACE UNSUITABLE SUBGRADE BEFORE PROOF ROLLING. UNSUITABLE SUBGRADE INCLUDES UNSUITABLE SOIL (A-4B, A-2-5, A-5, A-7-5, AND SOIL WITH A LIQUID LIMIT GREATER THAN 65) AND ANY COAL, SHALE, OR ROCK WHICH NEEDS TO BE REMOVED ACCORDING TO SECTION 204.05 OF THE CONSTRUCTION AND MATERIAL SPECIFICATIONS (C&MS).

IF THERE IS UNSUITABLE SUBGRADE IN A SHALLOW FILL LOCATION, EXCAVATE AND REPLACE THE UNSUITABLE SUBGRADE BEFORE CONSTRUCTING THE SHALLOW FILL AND SHAPING THE SUBGRADE.
3. COMPACT THE SUBGRADE ACCORDING TO C&MS 204.03.
4. THE ENGINEER WILL IDENTIFY THE ACTUAL LIMITS OF EXCAVATION FOR UNSTABLE SUBGRADE BASED ON THE PROOF ROLLING RESULTS AND VISUAL OBSERVATIONS.

PROOF ROLL THE COMPACTED SUBGRADE ACCORDING TO C&MS 204.06.
5. EXCAVATE UNSTABLE SUBGRADE AS DIRECTED BY THE ENGINEER AND STABILIZE BY REPLACING WITH THE SPECIFIED MATERIALS ACCORDING TO C&MS 204.07. EXCAVATIONS WILL EXTEND 18 INCHES BEYOND THE EDGE OF THE SURFACE OF THE PAVEMENT, PAVED SHOULDERS, OR PAVED MEDIANS. PLACE ITEM 204 - GEOTEXTILE FABRIC ON TOP OF THE COMPACTED EXISTING SOIL UNDER THE PROPOSED GRANULAR FILL OVER THE ENTIRE UNDERCUT AREA.
6. PROOF ROLL THE STABILIZED AREAS ACCORDING TO C&MS 204.06 TO VERIFY STABILITY.
7. FINE GRADE THE SUBGRADE TO THE SPECIFIED GRADE

THE QUANTITIES FOR EXCAVATING THE UNSUITABLE SUBGRADE AND UNSTABLE SUBGRADE ARE BOTH PAID UNDER ITEM 204, EXCAVATION OF SUBGRADE.

THE FOLLOWING QUANTITIES ARE CARRIED TO THE GENERAL SUMMARY FOR THE COMPLETION OF THE ABOVE WORK. PAYMENT WILL BE MADE AT THE APPROPRIATE BID PRICE FOR THE ABOVE ITEMS AND WILL INCLUDE ALL MATERIAL, EQUIPMENT, LABOR, AND INCIDENTALS NEEDED TO COMPLETE THIS WORK. FOR ESTIMATING PURPOSES ONLY, AN AREA EQUAL TO 60% OF THE FINISHED PROPOSED PAVEMENT SURFACE WAS USED, WITH AN ASSUMED DEPTH OF CUT OF 12 INCHES. DUE TO A LACK OF GEOTECHNICAL INVESTIGATION, THIS AREA IS NOT DETAILED IN THESE PLANS. THESE ITEMS ARE TO BE USED AS DIRECTED BY THE ENGINEER BASED ON THE RESULTS OF SUBGRADE COMPACTION AND PROOF ROLLING OVER THE ENTIRE PROJECT AREA.

US 30 AND SR 89 INTERSECTION
ITEM 204 - EXCAVATION OF SUBGRADE 1815 CU YD
ITEM 204 - GRANULAR MATERIAL, TYPE B 1815 CU YD
ITEM 204 - GEOTEXTILE FABRIC 5445 SQ YD

THE FOLLOWING QUANTITY IS PROVIDED IN THE ROADWAY SUBSUMMARY TO ADDRESS LOCATIONS REQUIRING PROOF ROLLING OVER THE ENTIRE PROJECT AREA.

US 30 AND SR 89 INTERSECTION
ITEM 204 - PROOF ROLLING 5 HOURS

THE FOLLOWING QUANTITY IS PROVIDED IN THE GENERAL SUMMARY FOR PROOF ROLLING IN THE PROPOSED GRANULAR FILL AREA WHERE UNSUITABLE SUBGRADE WAS REMOVED AND REPLACED AS PER THIS NOTE AS ABOVE:

US 30 AND SR 89 INTERSECTION
ITEM 204 - PROOF ROLLING 3 HOURS

ITEM 625 – LUMINAIRE, CONVENTIONAL, SOLID STATE (LED), IES-III, LED, 3000K, 8500-12900 LUMENS, AS PER PLAN

IN ADDITION TO THE REQUIREMENTS OF ODOT'S CONSTRUCTION AND MATERIAL SPECIFICATIONS AND SUPPLEMENTAL SPECIFICATION 813 & 913, LUMINAIRES FOR CONVENTIONAL LIGHTING UNITS SHALL BE AS FOLLOWS:

LUMINAIRES SHALL BE AMERICAN ELECTRIC AUTOBAHN SERIES (ATBM-PXX-MVOLT-R3-3K-NL-XXX), COPPER LUMARK NAVION SERIES (NAV-AF-C3-D-UNV-T3-XX-7030-1200-AP-XX), GE EVOLVE SERIES (ERL2-0-X-C3-30-X-GRAY-XXX) OR EQUAL APPROVED BY THE ENGINEER.

PAYMENT WILL BE MADE AT THE UNIT BID PRICE FOR EACH C&MS ITEM 625, "LUMINAIRE, CONVENTIONAL, SOLID STATE (LED), IES-III, LED, 3000K, 8500-12900 LUMENS" FOR EACH LUMINAIRE WHICH SHALL BE FULL COMPENSATION FOR ALL LABOR, MATERIALS, AND INCIDENTALS REQUIRED TO COMPLETE THIS ITEM IN A SATISFACTORY AND WORKMANLIKE MANNER.

DESIGN AGENCY



DESIGNER

MAE

REVIEWER

CAD 01/15/21

PROJECT ID

110853


SHEET TOTAL

P.7 44

SHEET NO.	BEGIN REF. NO.	End Ref. No.	Station Range		625	625	625	625	625	625	625	625	625	625	625	625	625	625	625	625	632	633	
			BEGIN	END	CONNECTION, FUSED PULL APART	CONNECTION, UNFUSED PERMANENT	LIGHT POLE, CONVENTIONAL, AT18B40	LIGHT POLE FOUNDATION, 24" X 8' DEEP	NO. 6 AWG 2400 VOLT DISTRIBUTION CABLE	1-1/2" DUCT CABLE WITH THREE NO. 6 AWG 2400 VOLT CABLES	NO. 10 AWG POLE AND BRACKET CABLE	CONDUIT, 3" , 725.04	CONDUIT, JACKED OR DRILLED, 3" , 725.04	LUMINAIRE, CONVENTIONAL, SOLID STATE (LED)	TRENCH	PULL BOX, 725.08, 18"	PULL BOX, 725.08, 24"	GROUND ROD	POWER SERVICE, AS PER PLAN	UNDERGROUND WARNING/MARKING TAPE	ARC FLASH CALCULATIONS AND LABEL	CONDUIT RISER, 2" DIAMETER	CONTROLLER WORK PAD
					EACH	EACH	EACH	EACH	FT	FT	FT	FT	FT	FT	EACH	FT	EACH	EACH	EACH	EACH	EACH	EACH	
	1	2	532+33.22	532+51.22	2		1	1		26	174				1	16			1		16		
	2	3	532+51.22	533+83.00	2		1	1		140	174				1	130			1		130		
	2	4	532+51.22	532+49.16			3		486				152				1						
	5	4	532+16.93	532+49.16	2		1	1		40	174				1	30			1		30		
	4	6	532+49.16	533+66.05			3			124						114		1			114		
	6	7	533+66.05	537+78.02	2		1	1		419	174				1	409			1		409		
	7	8	537+78.02	541+89.04			3			418						408	1				408		
	8	9	541+89.04	542+22.04						49						39					39		
	9	10	542+22.04	542+22.85	2		1	1		16	174				1	6			1		6		
	9	11	542+22.04	542+83.23			3		204				58				1						
	11	12	542+83.23	543+09.76	2	3	1	1		45	174				1	35	1		1		35		
	8	13	541+89.04	541+91.04			3		474				148				1		1				
	13	14	541+91.04	542+06.00			3			30						20	1				20		
	14	15	542+06.00	542+28.24	2		1	1		52	174				1	42			1		42		
	15	16	542+28.24	542+92.24			3		222				64			1							
	16	18	542+92.24	543+20.23					240			30				30			1	1	30	1 1 1	
	16	17	542+92.24	542+92.31	2		1	1		15	174				1	5			1		5		
	16	19	542+92.24	547+32.44			3			465						455		1			455		
	19	20	547+32.44	551+45.02			3			420						410	1				410		
	20	21	551+45.02	552+75.93	2		1	1		139	174				1	129			1		129		
	21	22	552+75.93	552+95.36	2		1	1		27	174				1	17			1		17		
	21	23	552+75.93	552+73.70			3		486				152				1						
	23	24	552+73.70	551+35.00	2		1	1		146	174				1	136			1		136		
	23	25	552+73.70	552+85.33	2	3	1	1		20	174				1	10		1	1		10		
TOTALS CARRIED TO GENERAL SUMMARY:					24	36	12	12	2112	2591	2088	30	574	12	2441	5	7	13	1	2441	1	1	1

LIGHTING SUBSUMMARY

DESIGN AGENCY



DESIGNER
MAE

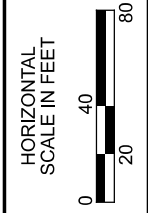
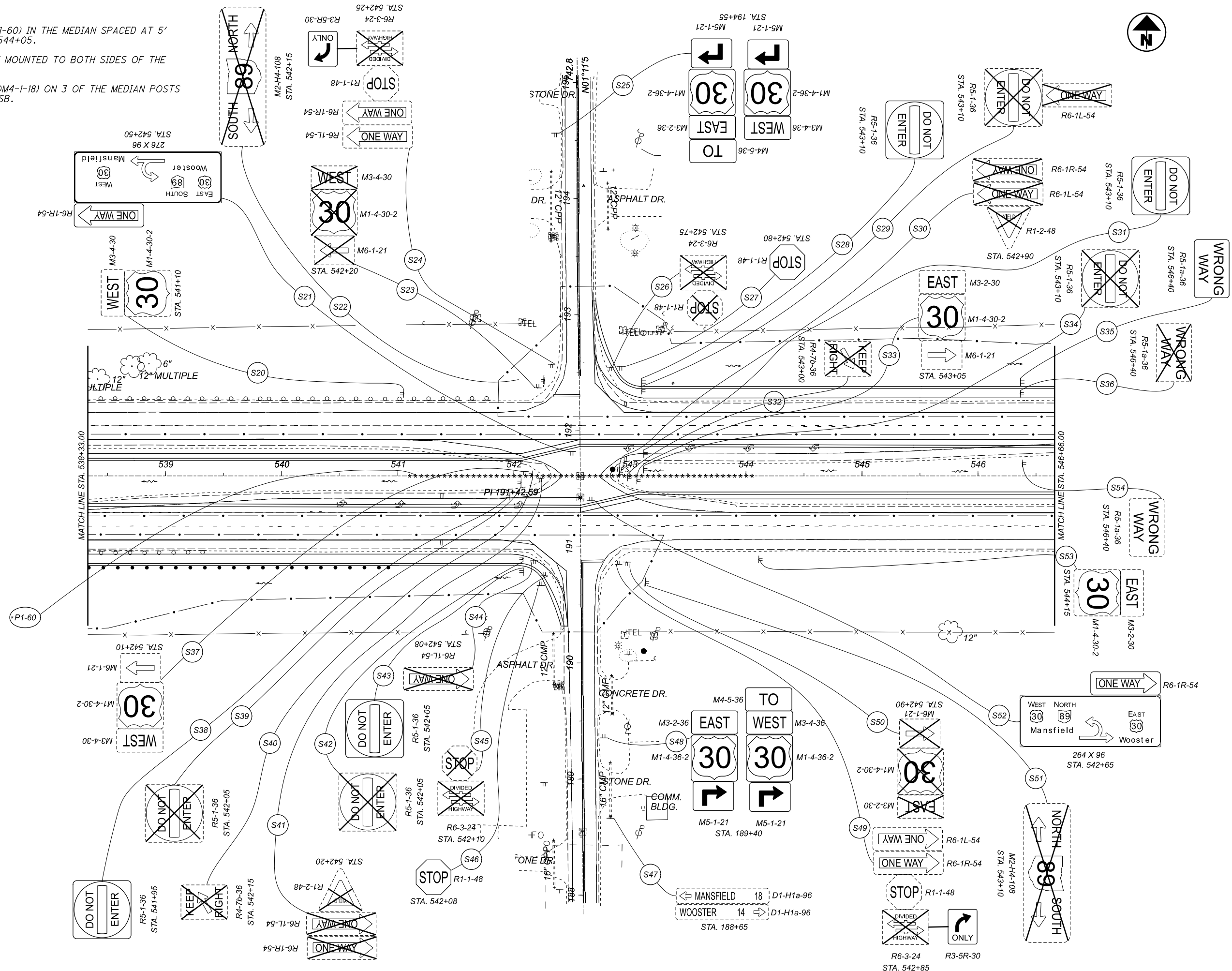
REVIEWER
CAD 01/15/21

PROJECT ID
110853

SHEET TOTAL
P.37 44

NOTES:

- INSTALL 60 NO. 3 POSTS (PI-60) IN THE MEDIAN SPACED AT 5' FROM STA. 541+10 TO STA. 544+05.
- POST REFLECTORS SHALL BE MOUNTED TO BOTH SIDES OF THE MEDIAN POSTS (PI-60).
- INSTALL OBJECT MARKERS (OM4-I-18) ON 3 OF THE MEDIAN POSTS FOR EACH APPROACH, NB & SB.



**SIGNING DETAILS
 US 30 & SR 89**

DESIGN AGENCY



DESIGNER	MAE
REVIEWER	CAD 01/15/21
PROJECT ID	110853
SHEET	TOTAL
P.41	44

