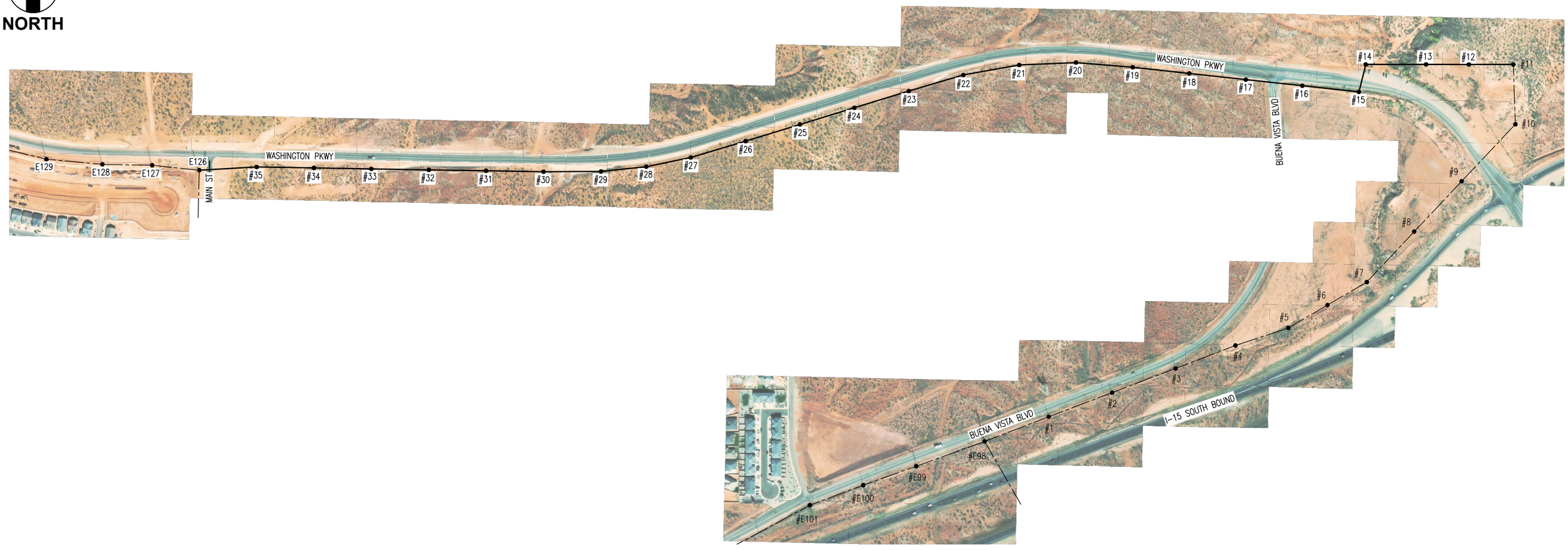
WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP
138KV TRANSMISSION LINE

NORTH



No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/29/24	KAC	ML	90% REVIEW		
A	08/23/24	KAC	ML	60% REVIEW		

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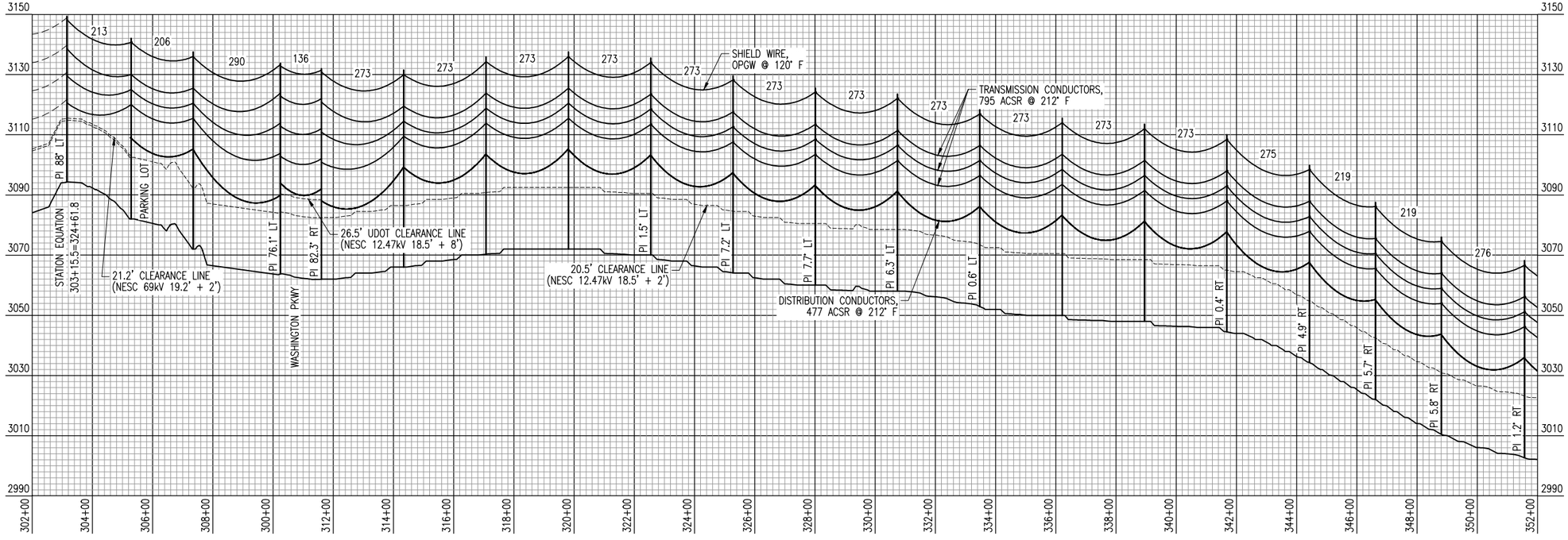
Des By: KAC	Date 08/23/24	
Drawn By: KAC	Date 08/23/24	
Chk'd. By: ML	Date –	
ENGR. ML	Date –	
APPD. –	Date –	
APPD. –	Date –	

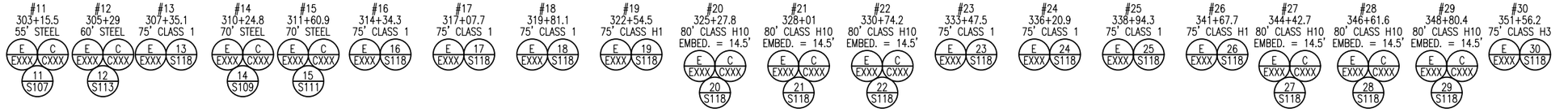
NOT FOR CONSTRUCTION

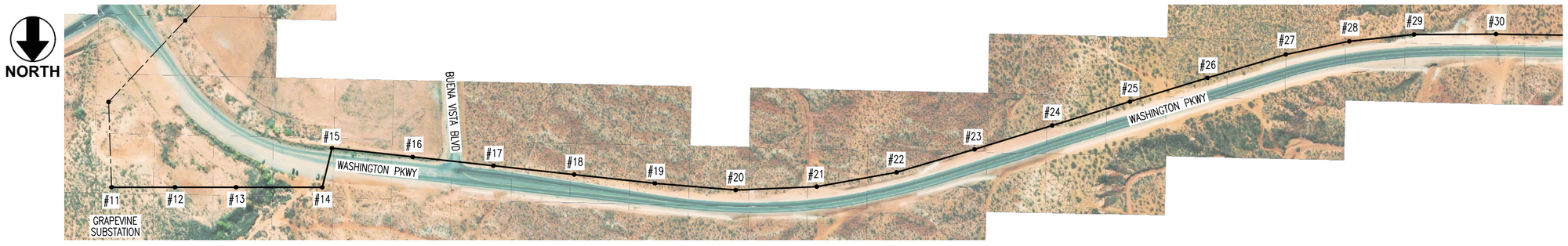
WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP
138KV TRANSMISSION LINE
COVER SHEET

SCALE	DRAWING No.	REVISION
NTS	071-079-E100	B
Project No. 071-079		

PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.03 Elec Drawings\071-079-E100.dwg







CONDUCTOR GOVERNING CONDITIONS

SHIELD WIRE, SX-29/61/512 (DNO-11127) OPGW – 1765 lb. INITIAL TENSION AT NESC MEDIUM
TRANSMISSION WIRE, 795 ACSR "DRAKE" – 6000 lb. INITIAL TENSION AT NESC MEDIUM
DISTRIBUTION WIRE, 477 ACSR "PELICAN" – 20% FINAL TENSION AT 15° F

FEET 0 2 5 10 20 40
SCALE: 1"=20'-0" VERTICAL

FEET 0 20 50 100 200 400
SCALE: 1"=200'-0" HORIZONTAL

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No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/29/24	KAC	ML	90% REVIEW		
A	08/23/24	BDP	ML	60% REVIEW		

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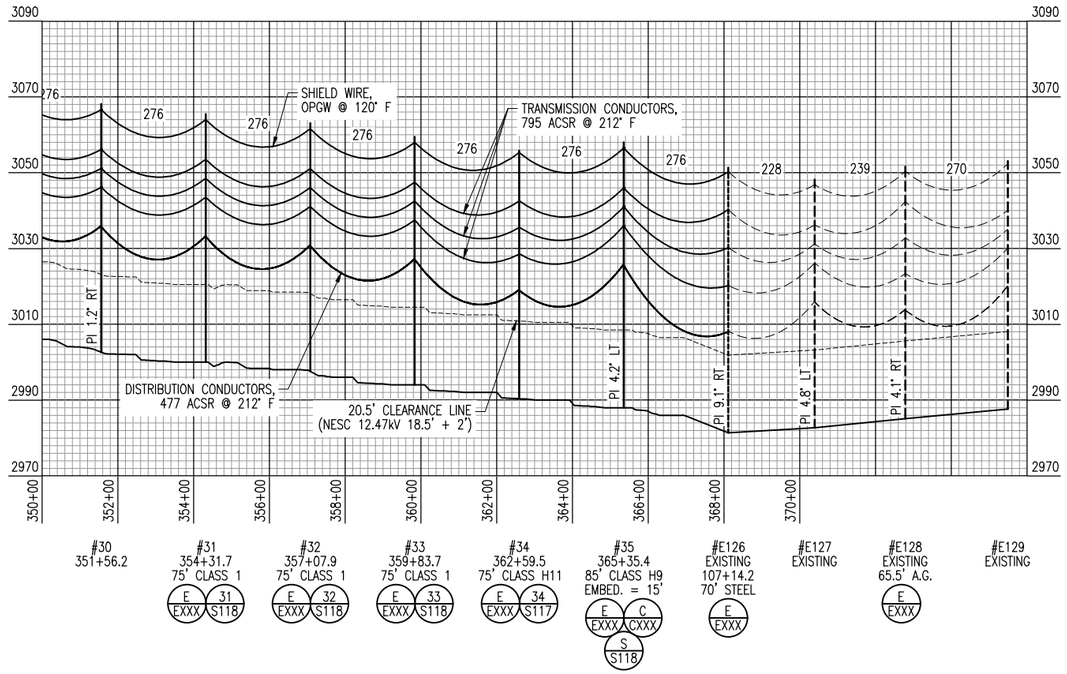
		Date
Des By:	BDP	08/23/24
Drawn By:	BDP	08/23/24
Chk'd. By:	ML	08/23/24
ENGR.	BDP	08/23/24
APPD.	_	_
APPD.	_	_

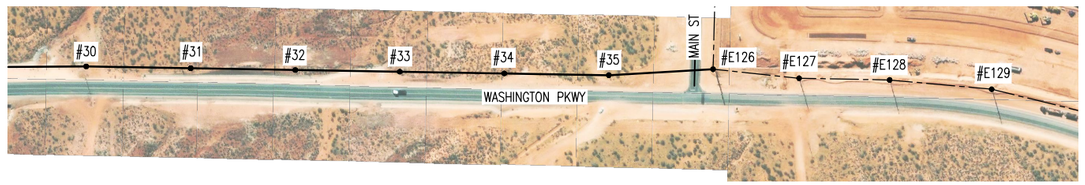
WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP 138KV TRANSMISSION LINE
PLAN & PROFILE – STR #11 TO STR #30

SCALE: NTS
Project No. 071-079
DRAWING No. 071-079-E101
REVISION B

PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.03 Elec Drawings\071-079-E101.dwg



NORTH



CONDUCTOR GOVERNING CONDITIONS

SHIELD WIRE, SX-29/61/512 (DNO-11127) OPGW – 1765 lb. INITIAL TENSION AT NESC MEDIUM
TRANSMISSION WIRE, 795 ACSR "DRAKE" – 6000 lb. INITIAL TENSION AT NESC MEDIUM
DISTRIBUTION WIRE, 477 ACSR "PELICAN" – 20% FINAL TENSION AT 15° F

FEET 0 2 5 10 20 40
SCALE: 1"=20'-0" VERTICAL

FEET 0 20 50 100 200 400
SCALE: 1"=200'-0" HORIZONTAL

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No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/29/24	KAC	ML	90% REVIEW		
A	08/23/24	BDP	ML	60% REVIEW		

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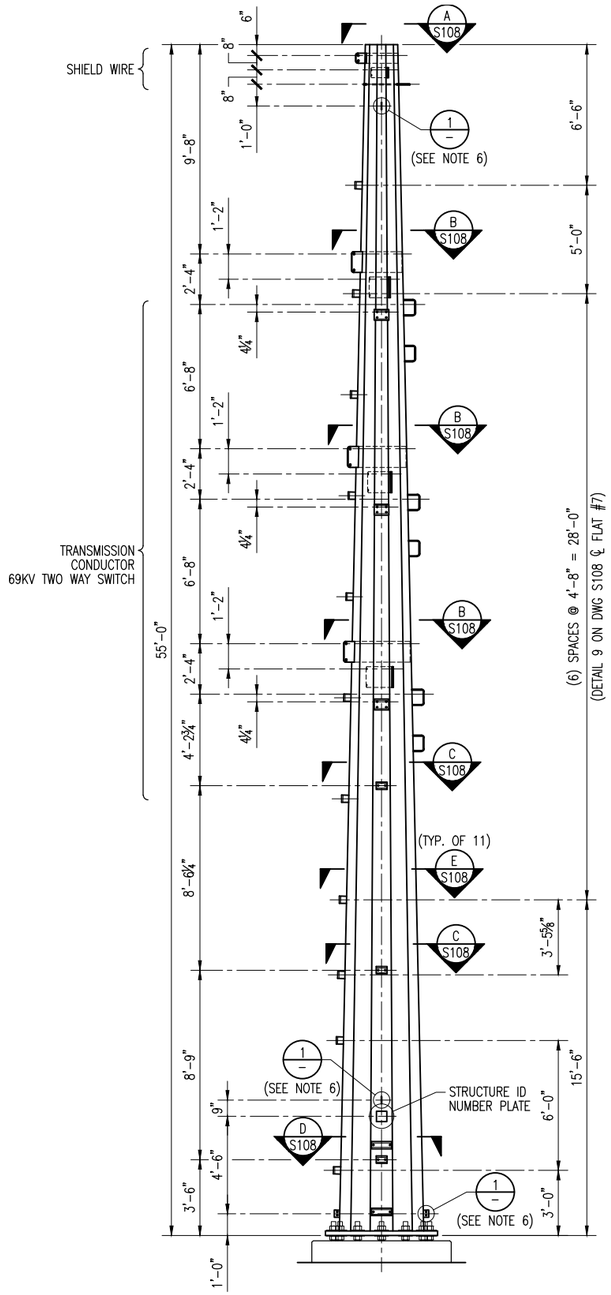
Des By:	BDP	08/23/24
Drawn By:	BDP	08/23/24
Chk'd. By:	ML	08/23/24
ENGR.	BDP	08/23/24
APPD.	_	_
APPD.	_	_

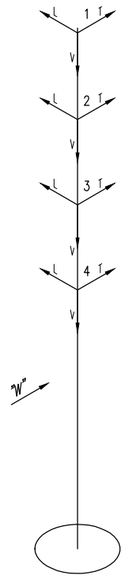
WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP 138KV TRANSMISSION LINE
PLAN & PROFILE – STR #30 TO STR #E129

SCALE: NTS
DRAWING No.: 071-079-E102
REVISION: B
Project No.: 071-079

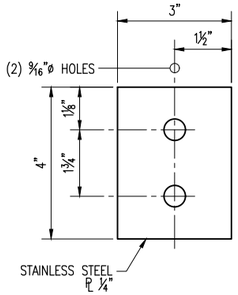
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.03 Elec Drawings\071-079-E102.dwg



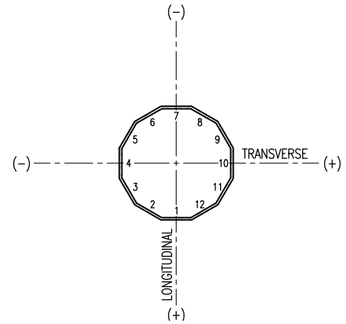
STRUCTURE #11
SCALE: NTS



LOADING DIAGRAM
SCALE: NTS



DETAIL 1 –
SCALE: NTS
GROUND PLATE



ORIENTATION OF AXES
SCALE: NTS

STRUCTURE POINT LOADS

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
1: NESC MEDIUM				
SHIELD WIRE	1	−2.21	1.68	1.08
TRANSMISSION CONDUCTOR	2, 3, 4	−12.05	5.52	1.02
2: HIGH WIND				
SHIELD WIRE	1	−1.72	0.99	0.87
TRANSMISSION CONDUCTOR	2, 3, 4	−6.74	2.98	0.85
3: CAMBER				
SHIELD WIRE	1	−0.63	0.39	0.29
TRANSMISSION CONDUCTOR	2, 3, 4	−3.76	1.63	0.50
4: BROKEN WIRE				
SHIELD WIRE	1	−2.54	1.09	0.37
TRANSMISSION CONDUCTOR	2, 3, 4	−8.53	3.64	0.89
5: STRINGING				
SHIELD WIRE	1	−1.10	0.48	0.18
TRANSMISSION CONDUCTOR	2, 3, 4	−5.08	2.17	4.58

DESIGN APPLICATION

WIRE DATA

SHIELD WIRE: OPGW SX-29/61/512 (DNO-11127)
TRANSMISSION WIRE: 795 kcmil ACSR "DRAKE"

MECHANICAL LOADING CRITERIA

CASE 1: NESC MEDIUM (RULE 250B):
4 psf WIND @ 15°F, 1/4" ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: VERTICAL 1.5, WIND 2.5, TENSION 1.65.

CASE 2: HIGH WIND – 90 MPH (RULE 250C):
19.9 psf @ 60°F, NO ICE ON SHIELD WIRE AND TRANSMISSION CONDUCTORS,
21.2 psf @ 60°F, NO ICE ON STRUCTURE.
OLF: 1.1 – ALL LOADS.

CASE 3: 60°F CAMBER (FINAL TENSION):
NO WIND @ 60°F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.0 – ALL LOADS.

CASE 4: BROKEN WIRE – ALL WIRES AND CONDUCTORS TO SUBSTATION STRUCTURE BROKEN (NESC SPANS AND TENSIONS):
4 psf WIND @ 15°F, 1/4" ICE ON WIRES AND STRUCTURE.
OLF: 1.1 – ALL LOADS.

CASE 5: STRINGING:
2.0 psf @ 60°F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.1 – ALL LOADS

DESIGN DATA

DESIGN TENSIONS (lbs.)

WIRE	NESC			HIGH WIND			CAMBER			STRINGING		
	BACK	AHEAD	SUB	BACK	AHEAD	SUB	BACK	AHEAD	SUB	BACK	AHEAD	SUB
SHIELD WIRE	1765	1765	500	1530	1495	260	710	710	140	770	780	145
TRANSMISSION CONDUCTOR	6000	6000	500	4895	4735	365	3120	3055	205	3585	3595	205

SPAN AND ANGLE DATA

DESCRIPTION	NESC			HIGH WIND			CAMBER			STRINGING		
	BACK	AHEAD	SUB	BACK	AHEAD	SUB	BACK	AHEAD	SUB	BACK	AHEAD	SUB
HORIZONTAL SPAN	145	110	15	145	110	15	145	110	15	145	110	15
VERTICAL SPAN SHIELD	135	190	225	125	255	265	135	180	150	135	185	155
VERTICAL SPAN TRANSMISSION	150	185	−70	150	200	−80	150	165	−40	150	180	−40
LINE ANGLE	67	21	90	67	21	90	67	21	90	67	21	90

GENERAL NOTES

1. THE LOADS IN THE LOADING TABLE ARE ULTIMATE LOADS AND INCLUDE ALL OVERLOAD FACTORS. ALL LOADS IN KIPS EXCEPT WIND "W" IN psf.
2. THE VERTICAL LOADS (V) INCLUDE ONLY DEAD WEIGHT OF THE WIRE AND WEIGHT OF THE INSULATORS. THE DEAD WEIGHT OF THE STRUCTURE SHALL BE CALCULATED BY THE POLE MANUFACTURER AND USED IN THE DESIGN. THE OVERLOAD FACTOR APPLIED TO THE DEAD WEIGHT SHALL BE AS LISTED FOR EACH CASE.
3. FOR STRUCTURAL DESIGN, THE LONGITUDINAL, TRANSVERSE AND VERTICAL LOADS SHALL BE CONSIDERED TO ACT SIMULTANEOUSLY WITH THE WIND AND THE DEAD WEIGHT OF THE STRUCTURE.
4. APPLY STRUCTURE WIND "W" IN THE DIRECTION WHICH PRODUCES THE MAXIMUM STRESS.
5. STRUCTURE SHALL BE DESIGNED TO BE SELF SUPPORTING, GUYS ARE NOT PERMITTED.
6. ATTACH GROUNDING PLATES (DETAIL 1 ON THIS DRAWING) 2'-10" BELOW TOP OF POLE ON FLATS #1 AND #7, 6'-6" ABOVE BASE PLATE ON FLATS #1 AND #7 AND 1'-0" ABOVE BASE PLATE ON FLATS #4 AND #10.
7. CLIMBING LADDER CLIPS (DETAIL 10 ON DRAWING S108) TO BE INSTALLED ON FLAT #5. WORKING LADDER CLIPS TO BE INSTALLED BELOW EACH SHIELD WIRE ATTACHMENT AND BELOW EACH TRANSMISSION CONDUCTOR ATTACHMENT.
8. APPLY SWITCH WEIGHT OF 1000 lbs. AT EACH SWITCH LOCATION. THE CENTER OF GRAVITY FOR THE SWITCH IS 2'-3" FROM FACE OF THE SWITCH BRACKET. THE WIND AREA OF THE SWITCH IS 14 sq. ft. THE OVERLOAD FACTORS APPLIED TO THE SWITCH SHALL BE AS LISTED FOR EACH CASE.
9. FINISH SHALL BE SELF-WEATHERING STEEL (ASTM A871).

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
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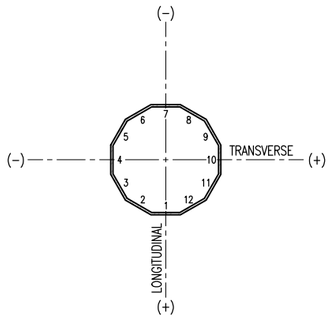
Drawn By:	BDP	Date	08/23/24
Chk'd. By:	KAC	Date	08/23/24
ENGR.	BDP	Date	08/23/24
APPD.	–	Date	–
APPD.	–	Date	–

NOT FOR CONSTRUCTION

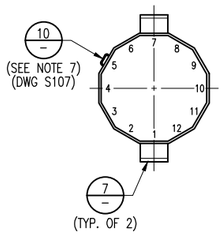
WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP
138KV TRANSMISSION LINE
STRUCTURE #11 – DESIGN DATA

SCALE	DRAWING No.	REVISION
NTS	071-079-S107	B
Project No. 071-079		

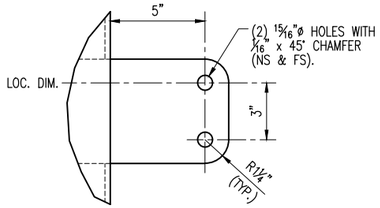
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-079-S107.dwg



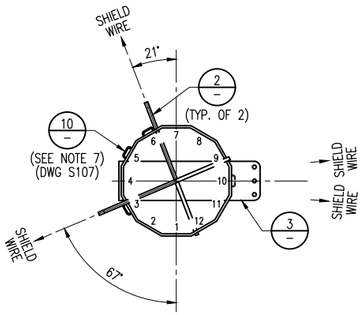
ORIENTATION OF AXES
SCALE: NTS



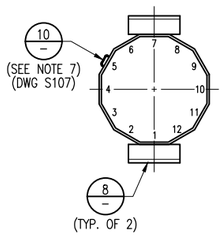
SECTION C/S107
SCALE: NTS
PIPE GUIDE ORIENTATION



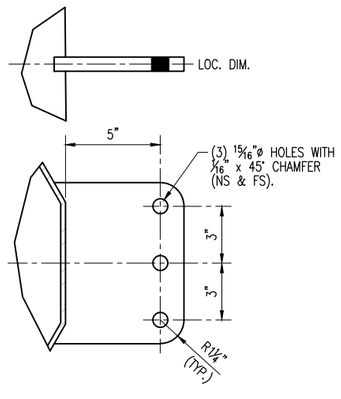
DETAIL 2
SCALE: NTS
SHIELD WIRE DEADEND ATTACHMENT



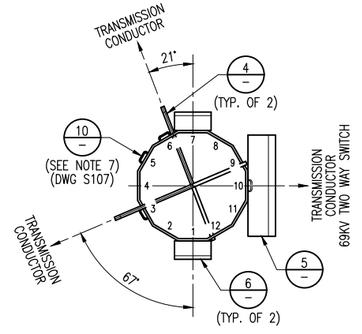
SECTION A/S107
SCALE: NTS
SHIELD WIRE ORIENTATION



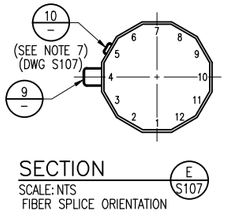
SECTION D/S107
SCALE: NTS
SWITCH OPERATOR ORIENTATION



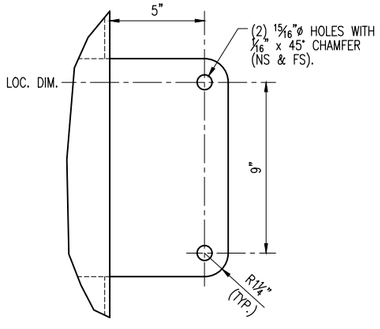
DETAIL 3
SCALE: NTS
(2) SHIELD WIRE DEADEND ATTACHMENT



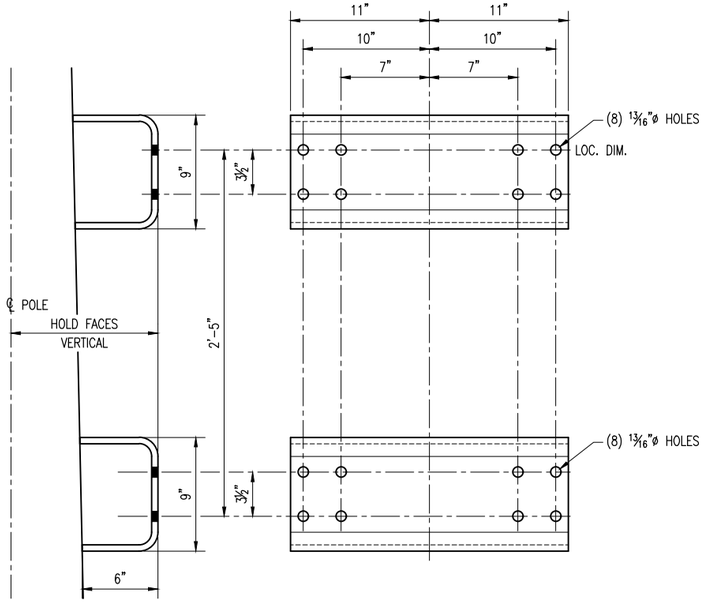
SECTION B/S107
SCALE: NTS
TRANSMISSION ORIENTATION



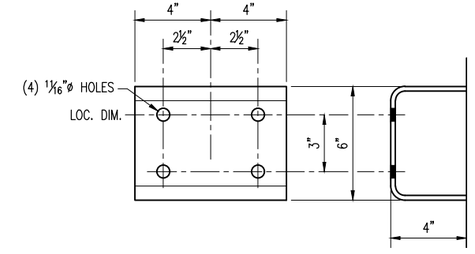
SECTION E/S107
SCALE: NTS
FIBER SPLICE ORIENTATION



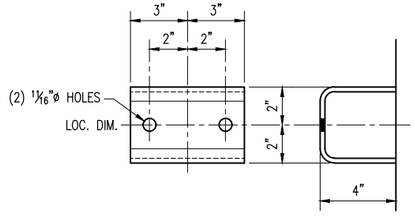
DETAIL 4
SCALE: NTS
TRANSMISSION DEADEND ATTACHMENT



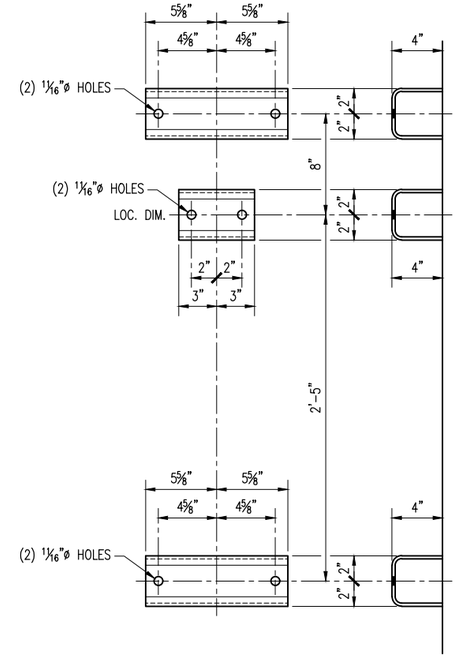
DETAIL 5
SCALE: NTS
SWITCH BRACKET



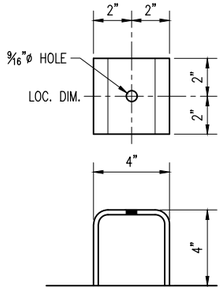
DETAIL 6
SCALE: NTS
THRUST BEARING BRACKET



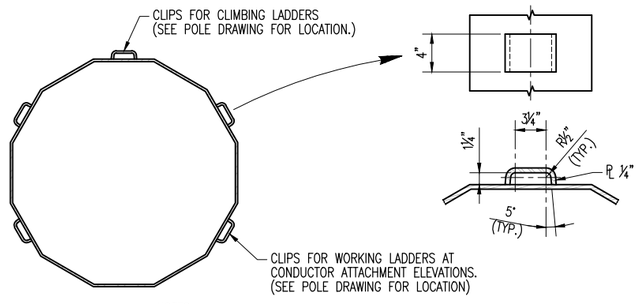
DETAIL 7
SCALE: NTS
PIPE GUIDE BRACKET



DETAIL 8
SCALE: NTS
SWITCH OPERATOR BRACKET



DETAIL 9
SCALE: NTS
FIBER SPLICE BRACKET



NOTES:
1. CLIPS TO BE SPACED AS REQUIRED FOR LADDERS SUPPLIED.
2. LADDER CLIP DETAIL IS FOR McGREGOR LADDERS ONLY.

DETAIL 10
SCALE: NTS
LADDER BRACKET

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/01/24	BDP	ML	60% REVIEW		

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Des By: BDP	Date	03/07/24
Drawn By: BDP	Date	03/07/24
Chk'd. By: ML	Date	03/07/24
ENGR. BDP	Date	03/07/24
APPD. _	Date	_
APPD. _	Date	_

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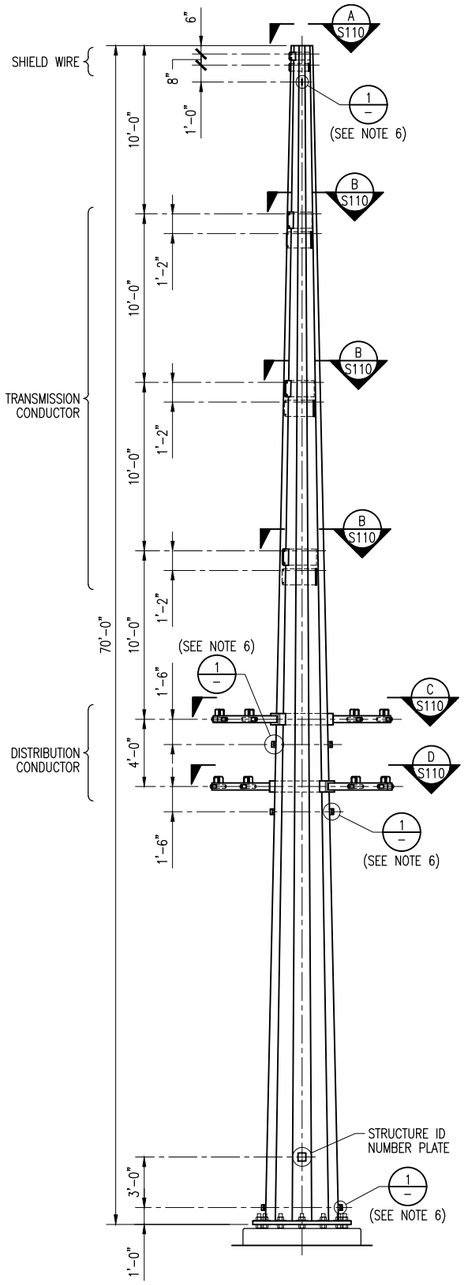
WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP
138KV TRANSMISSION LINE
STRUCTURE #11 – SECTIONS AND DETAILS

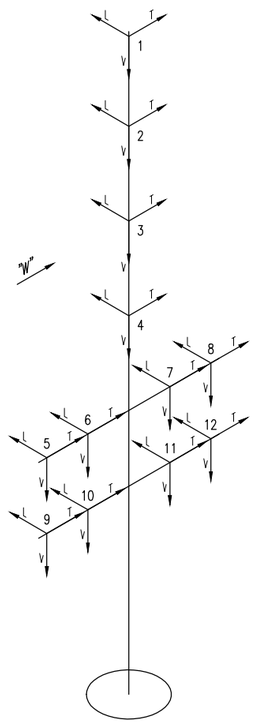
SCALE	DRAWING No.	REVISION
NTS	071-079-S108	B

Project No. 071-079

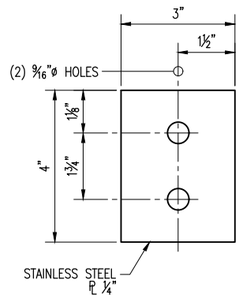
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-079-S108.dwg



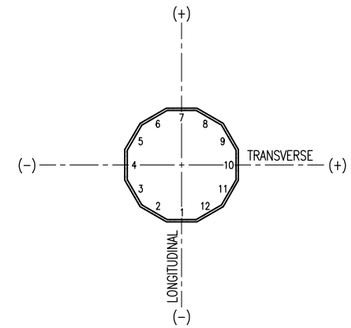
STRUCTURE #14
SCALE: NTS



LOADING DIAGRAM
SCALE: NTS



DETAIL 1
SCALE: NTS
GROUND PLATE



ORIENTATION OF AXES
SCALE: NTS

STRUCTURE POINT LOADS

1: NESC MEDIUM				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−3.75	0.04	0.36
TRANSMISSION CONDUCTOR	2, 3, 4	−12.48	0.06	0.72
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−3.22	3.96	0.27
DISTRIBUTION CONDUCTOR	9, 10, 11, 12	−3.80	−4.56	0.00
2: HIGH WIND				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−2.10	−0.09	0.27
TRANSMISSION CONDUCTOR	2, 3, 4	−6.44	−0.37	0.54
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−1.49	1.71	0.23
DISTRIBUTION CONDUCTOR	9, 10, 11, 12	−2.09	−2.30	−0.15
3: CAMBER				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.88	0.00	0.13
TRANSMISSION CONDUCTOR	2, 3, 4	−3.66	−0.16	0.38
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.60	0.76	0.10
DISTRIBUTION CONDUCTOR	9, 10, 11, 12	−0.83	−1.05	0.06
4: STRINGING				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.54	−0.67	0.94
TRANSMISSION CONDUCTOR	2, 3, 4	−2.46	−3.08	4.14
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.95	1.19	1.64
DISTRIBUTION CONDUCTOR	9, 10, 11, 12	−1.24	−1.54	2.01

DESIGN APPLICATION

WIRE DATA

SHIELD WIRE: OPGW SX-29/61/512 (DNO-11127)
TRANSMISSION WIRE: 795 kcmil ACSR "DRAKE"
DISTRIBUTION WIRE/NEUTRAL WIRE: 477 kcmil ACSR "PELICAN"

MECHANICAL LOADING CRITERIA

CASE 1: NESC MEDIUM (RULE 250B):
4 psf WIND @ 15°F, 1/4" ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: VERTICAL 1.5, WIND 2.5, TENSION 1.65.

CASE 2: HIGH WIND – 90 MPH (RULE 250C):
21.4 psf @ 60°F, NO ICE ON SHIELD WIRE AND TRANSMISSION CONDUCTORS,
20.1 psf @ 60°F, NO ICE ON DISTRIBUTION CONDUCTORS,
21.2 psf @ 60°F, NO ICE ON STRUCTURE.
OLF: 1.1 – ALL LOADS.

CASE 3: 60°F CAMBER (FINAL TENSION):
NO WIND @ 60°F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.0 – ALL LOADS.

CASE 4: STRINGING:
2.0 psf @ 60°F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.1 – ALL LOADS

DESIGN DATA

DESIGN TENSIONS (lbs.)

	NESC		HIGH WIND		CAMBER		STRINGING	
WIRE	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
SHIELD WIRE	1765	1765	1495	1340	710	715	780	845
TRANSMISSION CONDUCTOR	6000	6000	4735	4185	3055	2850	3585	3550
DISTRIBUTION CONDUCTOR	3595	3095	2820	2060	1340	970	1795	1380

SPAN AND ANGLE DATA

	NESC		HIGH WIND		CAMBER		STRINGING	
DESCRIPTION	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
HORIZONTAL SPAN	145	70	145	70	145	70	145	70
VERTICAL SPAN SHIELD	125	90	105	105	130	90	125	95
VERTICAL SPAN TRANSMISSION	65	90	45	95	80	85	70	90
VERTICAL SPAN DISTRIBUTION	−45	110	−145	125	10	95	−40	105
LINE ANGLE	38.25	38.25	38.25	38.25	38.25	38.25	38.25	38.25

GENERAL NOTES

1. THE LOADS IN THE LOADING TABLE ARE ULTIMATE LOADS AND INCLUDE ALL OVERLOAD FACTORS. ALL LOADS IN KIPS EXCEPT WIND "W" IN psf.
2. THE VERTICAL LOADS (V) INCLUDE ONLY DEAD WEIGHT OF THE WIRE AND WEIGHT OF THE INSULATORS. THE DEAD WEIGHT OF THE STRUCTURE SHALL BE CALCULATED BY THE POLE MANUFACTURER AND USED IN THE DESIGN. THE OVERLOAD FACTOR APPLIED TO THE DEAD WEIGHT SHALL BE AS LISTED FOR EACH CASE.
3. FOR STRUCTURAL DESIGN, THE LONGITUDINAL, TRANSVERSE AND VERTICAL LOADS SHALL BE CONSIDERED TO ACT SIMULTANEOUSLY WITH THE WIND AND THE DEAD WEIGHT OF THE STRUCTURE.
4. APPLY STRUCTURE WIND "W" IN THE DIRECTION WHICH PRODUCES THE MAXIMUM STRESS.
5. STRUCTURE SHALL BE DESIGNED TO BE SELF SUPPORTING, GUYS ARE NOT PERMITTED.
6. ATTACH GROUNDING PLATES (DETAIL 1 ON THIS DRAWING) 2'-2" BELOW TOP OF POLE ON FLATS #1 AND #7, 1'-6" BELOW DISTRIBUTION ARMS ON FLATS #4 AND #10 AND 1'-0" ABOVE BASE PLATE ON FLATS #4 AND #10.
7. CLIMBING LADDER CLIPS (DETAIL 6 ON DRAWING S110) TO BE INSTALLED ON FLAT #1 THROUGH THE DISTRIBUTION AND ON FLAT #10 THROUGH THE TRANSMISSION. WORKING LADDER CLIPS TO BE INSTALLED BELOW EACH SHIELD WIRE ATTACHMENT, BELOW EACH TRANSMISSION CONDUCTOR ATTACHMENT AND BELOW EACH DISTRIBUTION ARM.
8. FINISH SHALL BE SELF-WEATHERING STEEL (ASTM A871).

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/23/24	BDP	ML	60% REVIEW		

Washington City
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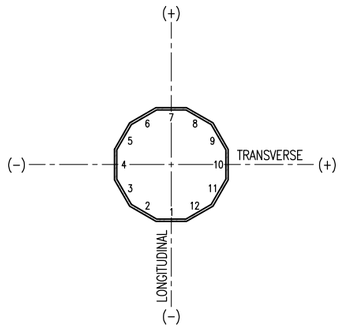
Des By:	BDP	Date	08/23/24
Drawn By:	BDP	Date	08/23/24
Chk'd. By:	KAC	Date	08/23/24
ENGR.	BDP	Date	08/23/24
APPD.	_	Date	_
APPD.	_	Date	_

NOT FOR CONSTRUCTION

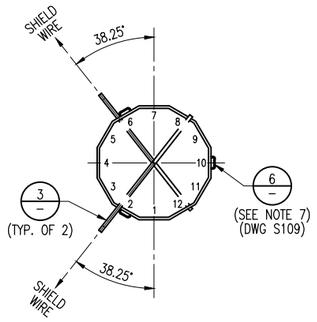
WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP
138KV TRANSMISSION LINE
STRUCTURE #14 – DESIGN DATA

SCALE	DRAWING No.	REVISION
NTS	071-079-S109	B
Project No. 071-079		

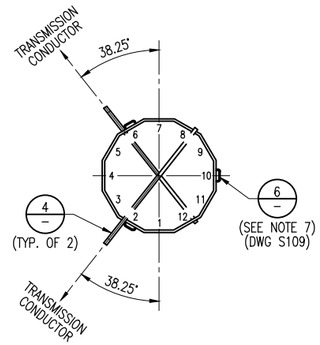
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-079-S109.dwg



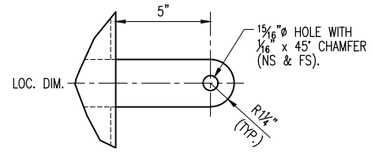
ORIENTATION OF AXES
SCALE: NTS



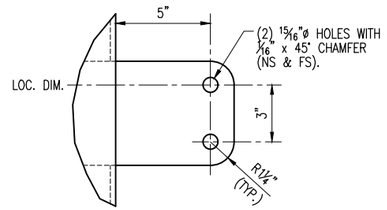
SECTION A S109
SCALE: NTS
SHIELD WIRE ORIENTATION



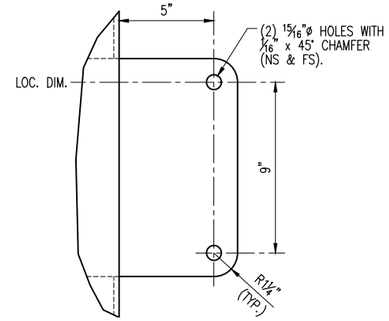
SECTION B S109
SCALE: NTS
TRANSMISSION ORIENTATION



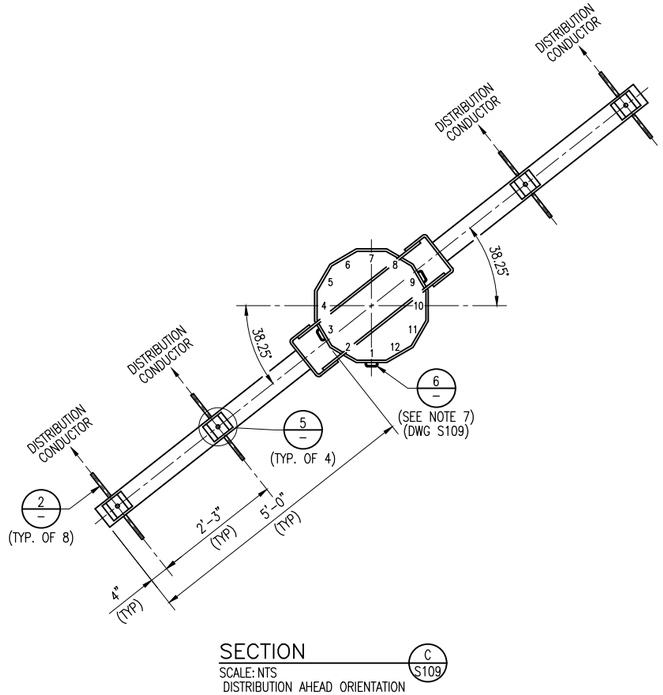
DETAIL 2
SCALE: NTS
DISTRIBUTION DEADEND ATTACHMENT



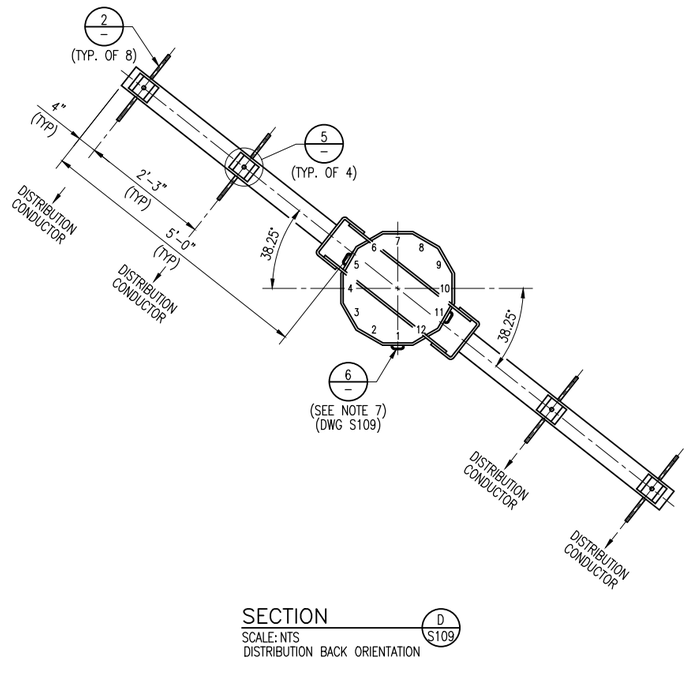
DETAIL 3
SCALE: NTS
SHIELD WIRE DEADEND ATTACHMENT



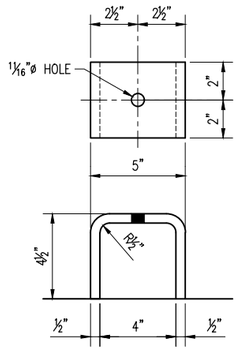
DETAIL 4
SCALE: NTS
TRANSMISSION DEADEND ATTACHMENT



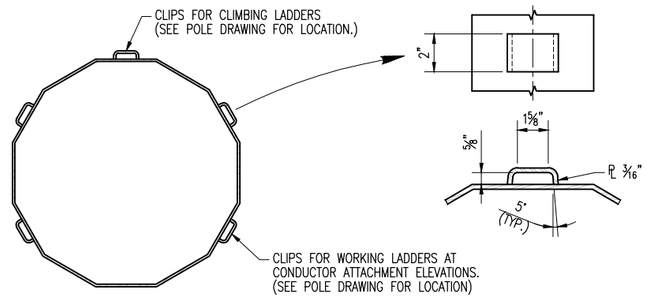
SECTION C S109
SCALE: NTS
DISTRIBUTION AHEAD ORIENTATION



SECTION D S109
SCALE: NTS
DISTRIBUTION BACK ORIENTATION



DETAIL 5
SCALE: NTS
PIN INSULATOR BRACKET



NOTES:
1. CLIPS TO BE SPACED AS REQUIRED FOR LADDERS SUPPLIED.
2. LADDER CLIP DETAIL IS FOR McGREGOR LADDERS ONLY.

DETAIL 6
SCALE: NTS
LADDER BRACKET

No.	DATE	BY	APP	REVISION
B	11/27/24	KAC	ML	90% REVIEW
A	08/01/24	BDP	ML	60% REVIEW

REFERENCE DRAWING

NUMBER

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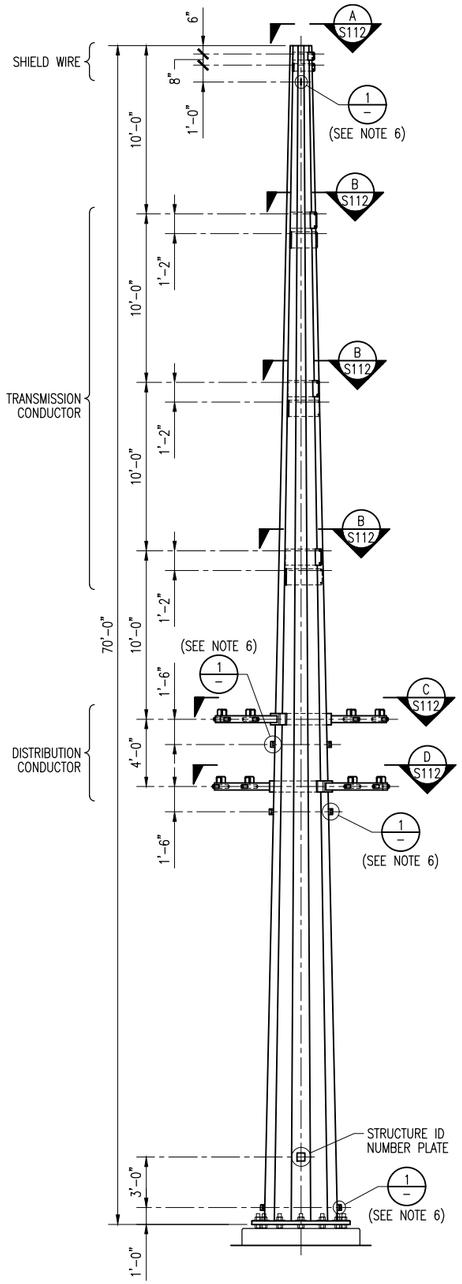
		Date
Des By:	BDP	03/07/24
Drawn By:	BDP	03/07/24
Chk'd. By:	ML	03/07/24
ENGR.	BDP	03/07/24
APPD.	_	_
APPD.	_	_

NOT FOR CONSTRUCTION

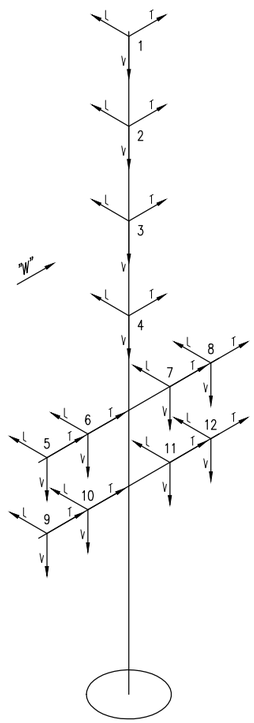
WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP 138KV TRANSMISSION LINE
STRUCTURE #14 – SECTIONS AND DETAILS

SCALE: NTS
Project No. 071-079
DRAWING No. 071-079-S110
REVISION B

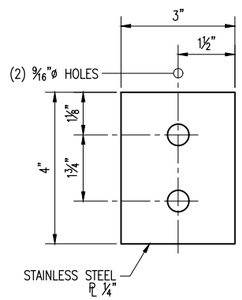
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-079-S110.dwg



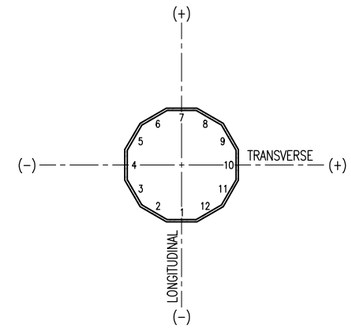
STRUCTURE #15
SCALE: NTS



LOADING DIAGRAM
SCALE: NTS



DETAIL 1
SCALE: NTS
GROUND PLATE



ORIENTATION OF AXES
SCALE: NTS

STRUCTURE POINT LOADS

1: NESC MEDIUM				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	3.97	−0.04	0.33
TRANSMISSION CONDUCTOR	2, 3, 4	13.27	−0.06	0.67
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	3.42	−3.79	0.12
DISTRIBUTION CONDUCTOR	9, 10, 11, 12	4.10	4.44	0.05
2: HIGH WIND				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	2.23	0.10	0.24
TRANSMISSION CONDUCTOR	2, 3, 4	6.90	0.45	0.49
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	1.57	−1.63	0.08
DISTRIBUTION CONDUCTOR	9, 10, 11, 12	2.25	2.25	−0.08
3: CAMBER				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	0.94	0.00	0.12
TRANSMISSION CONDUCTOR	2, 3, 4	3.92	0.19	0.36
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	0.64	−0.73	0.07
DISTRIBUTION CONDUCTOR	9, 10, 11, 12	0.91	1.04	0.07
4: STRINGING				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	0.62	−0.69	0.97
TRANSMISSION CONDUCTOR	2, 3, 4	2.59	−2.93	4.08
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	1.01	−1.13	1.59
DISTRIBUTION CONDUCTOR	9, 10, 11, 12	1.36	1.52	2.08

DESIGN APPLICATION

WIRE DATA

SHIELD WIRE: OPGW SX-29/61/512 (DNO-111127)
TRANSMISSION WIRE: 795 kcmil ACSR "DRAKE"
DISTRIBUTION WIRE/NEUTRAL WIRE: 477 kcmil ACSR "PELICAN"

MECHANICAL LOADING CRITERIA

CASE 1: NESC MEDIUM (RULE 250B):
4 psf WIND @ 15°F, 1/4" ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: VERTICAL 1.5, WIND 2.5, TENSION 1.65.

CASE 2: HIGH WIND – 90 MPH (RULE 250C):
19.9 psf @ 60°F, NO ICE ON SHIELD WIRE AND TRANSMISSION CONDUCTORS,
17.8 psf @ 60°F, NO ICE ON DISTRIBUTION CONDUCTORS,
21.2 psf @ 60°F, NO ICE ON STRUCTURE.
OLF: 1.1 – ALL LOADS.

CASE 3: 60°F CAMBER (FINAL TENSION):
NO WIND @ 60°F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.0 – ALL LOADS.

CASE 4: STRINGING:
2.0 psf @ 60°F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.1 – ALL LOADS

DESIGN DATA

DESIGN TENSIONS (lbs.)

	NESC		HIGH WIND		CAMBER		STRINGING	
WIRE	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
SHIELD WIRE	1765	1765	1340	1520	715	710	845	770
TRANSMISSION CONDUCTOR	6000	6000	4185	4850	2850	3100	3550	3590
DISTRIBUTION CONDUCTOR	3095	3660	2060	2890	970	1380	1380	1850

SPAN AND ANGLE DATA

	NESC		HIGH WIND		CAMBER		STRINGING	
DESCRIPTION	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
HORIZONTAL SPAN	70	140	70	140	70	140	70	140
VERTICAL SPAN SHIELD	45	145	30	150	50	145	45	145
VERTICAL SPAN TRANSMISSION	45	90	45	75	50	100	50	95
VERTICAL SPAN DISTRIBUTION	25	−15	15	−95	45	30	30	−15
LINE ANGLE	41.25	41.25	41.25	41.25	41.25	41.25	41.25	41.25

GENERAL NOTES

1. THE LOADS IN THE LOADING TABLE ARE ULTIMATE LOADS AND INCLUDE ALL OVERLOAD FACTORS. ALL LOADS IN KIPS EXCEPT WIND "W" IN psf.
2. THE VERTICAL LOADS (V) INCLUDE ONLY DEAD WEIGHT OF THE WIRE AND WEIGHT OF THE INSULATORS. THE DEAD WEIGHT OF THE STRUCTURE SHALL BE CALCULATED BY THE POLE MANUFACTURER AND USED IN THE DESIGN. THE OVERLOAD FACTOR APPLIED TO THE DEAD WEIGHT SHALL BE AS LISTED FOR EACH CASE.
3. FOR STRUCTURAL DESIGN, THE LONGITUDINAL, TRANSVERSE AND VERTICAL LOADS SHALL BE CONSIDERED TO ACT SIMULTANEOUSLY WITH THE WIND AND THE DEAD WEIGHT OF THE STRUCTURE.
4. APPLY STRUCTURE WIND "W" IN THE DIRECTION WHICH PRODUCES THE MAXIMUM STRESS.
5. STRUCTURE SHALL BE DESIGNED TO BE SELF SUPPORTING, GUYS ARE NOT PERMITTED.
6. ATTACH GROUNDING PLATES (DETAIL 1 ON THIS DRAWING) 2'-2" BELOW TOP OF POLE ON FLATS #1 AND #7, 1'-6" BELOW DISTRIBUTION ARMS ON FLATS #4 AND #10 AND 1'-0" ABOVE BASE PLATE ON FLATS #4 AND #10.
7. CLIMBING LADDER CLIPS (DETAIL 6 ON DRAWING S112) TO BE INSTALLED ON FLAT #7 THROUGH THE DISTRIBUTION AND ON FLAT #4 THROUGH THE TRANSMISSION. WORKING LADDER CLIPS TO BE INSTALLED BELOW EACH SHIELD WIRE ATTACHMENT, BELOW EACH TRANSMISSION CONDUCTOR ATTACHMENT AND BELOW EACH DISTRIBUTION ARM.
8. FINISH SHALL BE SELF-WEATHERING STEEL (ASTM A871).

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/23/24	BDP	ML	60% REVIEW		

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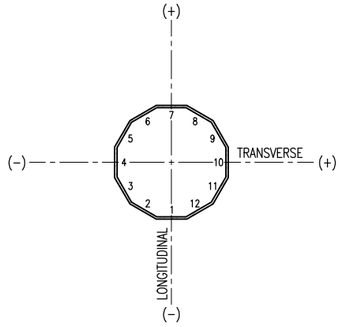
Des By:	BDP	Date	08/23/24
Drawn By:	BDP	Date	08/23/24
Chk'd. By:	KAC	Date	08/23/24
ENGR.	BDP	Date	08/23/24
APPD.	_	Date	_
APPD.	_	Date	_

NOT FOR CONSTRUCTION

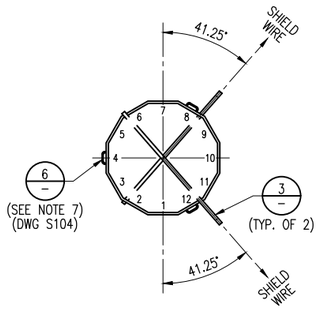
WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP
138KV TRANSMISSION LINE
STRUCTURE #15 – DESIGN DATA

SCALE	DRAWING No.	REVISION
NTS	071-079-S111	B
Project No. 071-079		

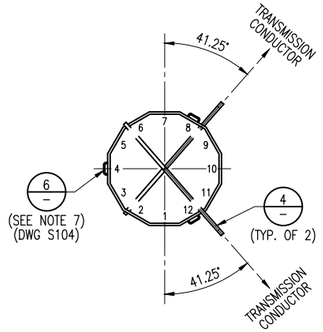
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-079-S111.dwg



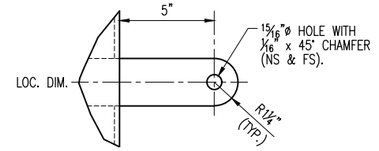
ORIENTATION OF AXES
SCALE: NTS



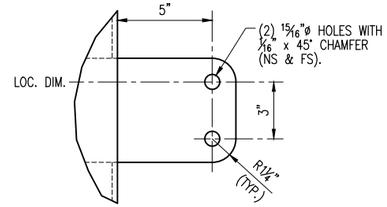
SECTION A S111
SCALE: NTS
SHIELD WIRE ORIENTATION



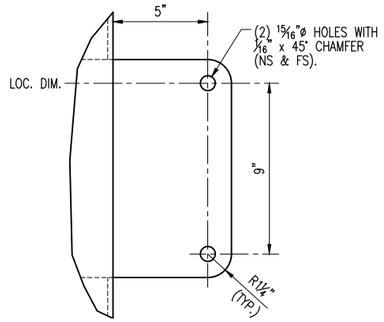
SECTION B S111
SCALE: NTS
TRANSMISSION ORIENTATION



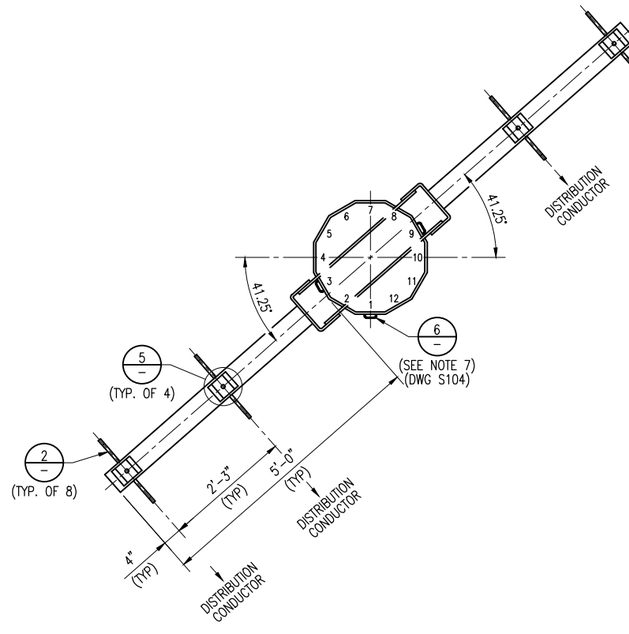
DETAIL 2
SCALE: NTS
DISTRIBUTION DEADEND ATTACHMENT



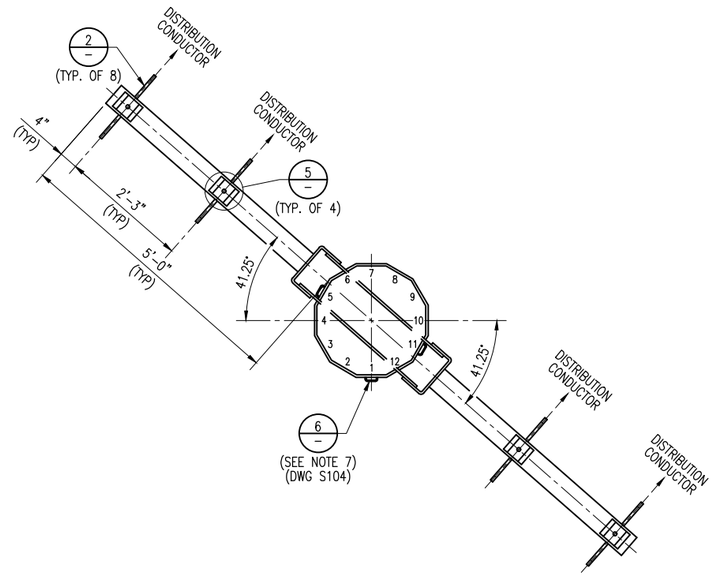
DETAIL 3
SCALE: NTS
SHIELD WIRE DEADEND ATTACHMENT



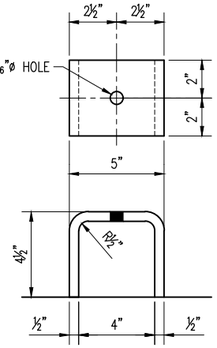
DETAIL 4
SCALE: NTS
TRANSMISSION DEADEND ATTACHMENT



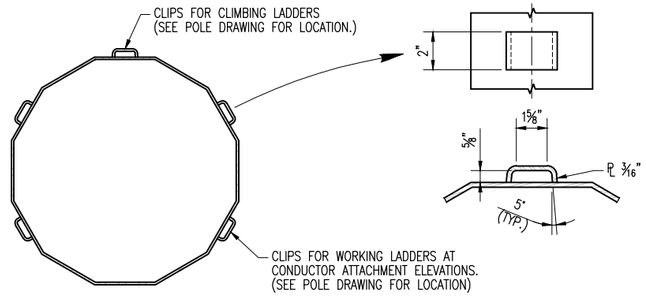
SECTION C S111
SCALE: NTS
DISTRIBUTION BACK ORIENTATION



SECTION D S111
SCALE: NTS
DISTRIBUTION AHEAD ORIENTATION



DETAIL 5
SCALE: NTS
PIN INSULATOR BRACKET



NOTES:
1. CLIPS TO BE SPACED AS REQUIRED FOR LADDERS SUPPLIED.
2. LADDER CLIP DETAIL IS FOR McGREGOR LADDERS ONLY.

DETAIL 6
SCALE: NTS
LADDER BRACKET

NOT FOR CONSTRUCTION

No.	DATE	BY	APP	REVISION
B	11/27/24	KAC	ML	90% REVIEW
A	08/01/24	BDP	ML	60% REVIEW

REFERENCE DRAWING | NUMBER

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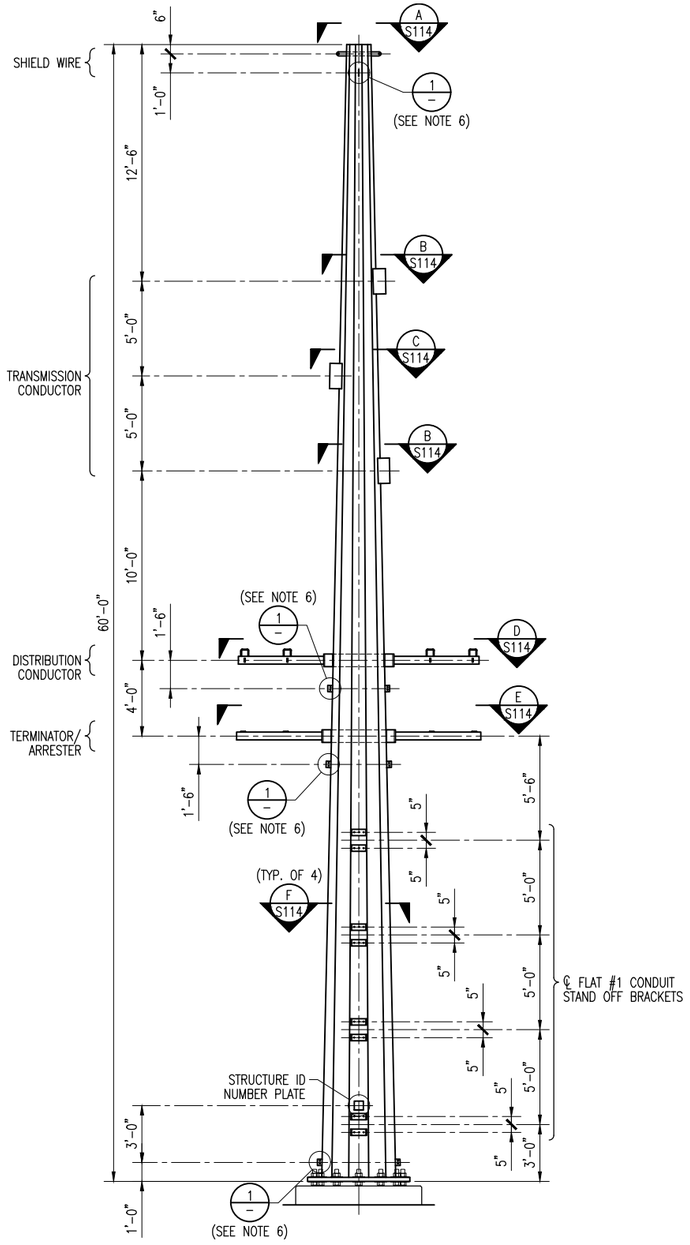
Des By: BDP	Date 03/07/24	
Drawn By: BDP	Date 03/07/24	
Chk'd. By: ML	Date 03/07/24	
ENGR. BDP	Date 03/07/24	
APPD. _	Date _	
APPD. _	Date _	

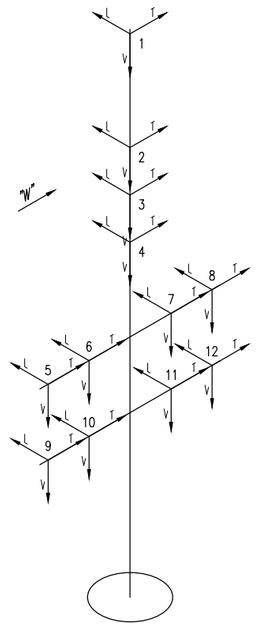
WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP
138KV TRANSMISSION LINE
STRUCTURE #15 – SECTIONS AND DETAILS

SCALE: NTS
Project No. 071-079
DRAWING No. 071-079-S112
REVISION B

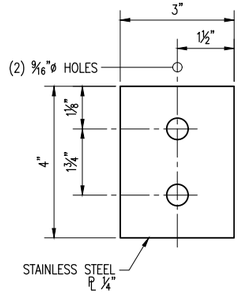
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-079-S112.dwg



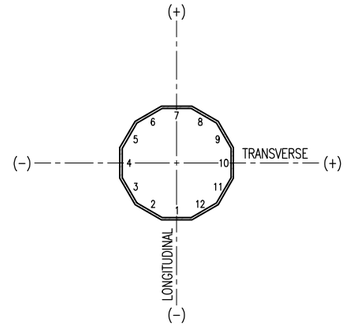
STRUCTURE #10
SCALE: NTS



LOADING DIAGRAM
SCALE: NTS



DETAIL 1 –
SCALE: NTS
GROUND PLATE



ORIENTATION OF AXES
SCALE: NTS

STRUCTURE POINT LOADS

1: NESC MEDIUM				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.28	0.00	0.29
TRANSMISSION CONDUCTOR	2, 3, 4	−0.63	0.00	0.73
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.34	5.93	0.37
TERMINATOR/ARRESTER	9, 10, 11, 12	−0.40	0.38	0.43
2: HIGH WIND				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.27	0.00	0.18
TRANSMISSION CONDUCTOR	2, 3, 4	−0.65	0.00	0.58
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.38	3.10	0.34
TERMINATOR/ARRESTER	9, 10, 11, 12	−0.20	0.17	0.31
3: CAMBER				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.02	0.00	0.09
TRANSMISSION CONDUCTOR	2, 3, 4	−0.11	0.00	0.33
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.02	1.34	0.13
TERMINATOR/ARRESTER	9, 10, 11, 12	−0.15	0.15	0.28
4: STRINGING				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.05	0.00	0.10
TRANSMISSION CONDUCTOR	2, 3, 4	−0.18	0.00	0.37
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.05	1.97	2.13
TERMINATOR/ARRESTER	9, 10, 11, 12	−0.17	0.17	0.31

DESIGN APPLICATION

WIRE DATA

SHIELD WIRE: OPGW SX-29/61/512 (DNO-111127)
TRANSMISSION WIRE: 795 kcmil ACSR "DRAKE"
DISTRIBUTION WIRE/NEUTRAL WIRE: 477 kcmil ACSR "PELICAN"

MECHANICAL LOADING CRITERIA

CASE 1: NESC MEDIUM (RULE 250B):
4 psf WIND @ 15°F, 1/4" ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: VERTICAL 1.5, WIND 2.5, TENSION 1.65.

CASE 2: HIGH WIND – 90 MPH (RULE 250C):
21.4 psf @ 60°F, NO ICE ON SHIELD WIRE AND TRANSMISSION CONDUCTORS,
20.1 psf @ 60°F, NO ICE ON DISTRIBUTION CONDUCTORS,
21.2 psf @ 60°F, NO ICE ON STRUCTURE.
OLF: 1.1 – ALL LOADS.

CASE 3: 60°F CAMBER (FINAL TENSION):
NO WIND @ 60°F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.0 – ALL LOADS.

CASE 4: STRINGING:
2.0 psf @ 60°F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.1 – ALL LOADS

DESIGN DATA

DESIGN TENSIONS (lbs.)

	NESC		HIGH WIND		CAMBER		STRINGING	
WIRE	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
SHIELD WIRE	1765	1765	1495	1495	710	710	780	780
TRANSMISSION CONDUCTOR	6000	6000	4735	4735	3055	3055	3585	3585
DISTRIBUTION CONDUCTOR	0	3595	0	2820	0	1340	0	1795

SPAN AND ANGLE DATA

	NESC		HIGH WIND		CAMBER		STRINGING	
DESCRIPTION	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
HORIZONTAL SPAN	110	105	110	105	110	105	110	105
VERTICAL SPAN SHIELD	30	160	−45	200	40	150	30	155
VERTICAL SPAN TRANSMISSION	35	180	15	200	50	165	40	175
VERTICAL SPAN DISTRIBUTION	0	170	0	205	0	150	0	170
LINE ANGLE	1	1	1	1	1	1	1	1

GENERAL NOTES

1. THE LOADS IN THE LOADING TABLE ARE ULTIMATE LOADS AND INCLUDE ALL OVERLOAD FACTORS. ALL LOADS IN KIPS EXCEPT WIND "W" IN psf.
2. THE VERTICAL LOADS (V) INCLUDE ONLY DEAD WEIGHT OF THE WIRE AND WEIGHT OF THE INSULATORS. THE DEAD WEIGHT OF THE STRUCTURE SHALL BE CALCULATED BY THE POLE MANUFACTURER AND USED IN THE DESIGN. THE OVERLOAD FACTOR APPLIED TO THE DEAD WEIGHT SHALL BE AS LISTED FOR EACH CASE.
3. FOR STRUCTURAL DESIGN, THE LONGITUDINAL, TRANSVERSE AND VERTICAL LOADS SHALL BE CONSIDERED TO ACT SIMULTANEOUSLY WITH THE WIND AND THE DEAD WEIGHT OF THE STRUCTURE.
4. APPLY STRUCTURE WIND "W" IN THE DIRECTION WHICH PRODUCES THE MAXIMUM STRESS.
5. STRUCTURE SHALL BE DESIGNED TO BE SELF SUPPORTING, GUYS ARE NOT PERMITTED.
6. ATTACH GROUNDING PLATES (DETAIL 1 ON THIS DRAWING) 1'-6" BELOW TOP OF POLE ON FLATS #1 AND #7, 1'-6" BELOW DISTRIBUTION ARMS ON FLATS #4 AND #10, 1'-6" BELOW TERMINATOR/ARRESTER ARMS ON FLATS #4 AND #10 AND 1'-0" ABOVE BASE PLATE ON FLATS #4 AND #10.
7. CLIMBING LADDER CLIPS (DETAIL 7 ON DRAWING S114) TO BE INSTALLED ON FLAT #7. WORKING LADDER CLIPS TO BE INSTALLED BELOW EACH SHIELD WIRE ATTACHMENT, BELOW EACH TRANSMISSION CONDUCTOR ATTACHMENT AND BELOW EACH DISTRIBUTION ARM.
8. FINISH SHALL BE SELF-WEATHERING STEEL (ASTM A871).

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/23/24	BDP	ML	60% REVIEW		

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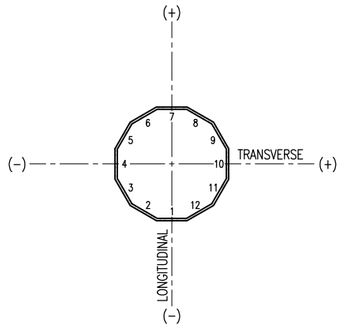
Des By:	BDP	Date	08/23/24
Drawn By:	BDP	Date	08/23/24
Chk'd. By:	KAC	Date	08/23/24
ENGR.	BDP	Date	08/23/24
APPD.	_	Date	_
APPD.	_	Date	_

NOT FOR CONSTRUCTION

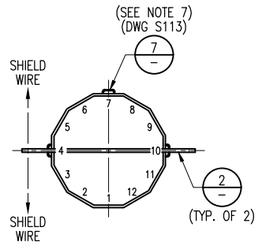
WASHINGTON CITY GRAPEVINE SUBSTATION – PARKWAY TAP 138KV TRANSMISSION LINE STRUCTURE #12 – DESIGN DATA

SCALE	NTS	DRAWING No.	071-079-S113	REVISION
Project No.	071-079			B

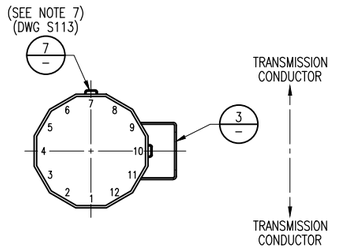
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-079-S113.dwg



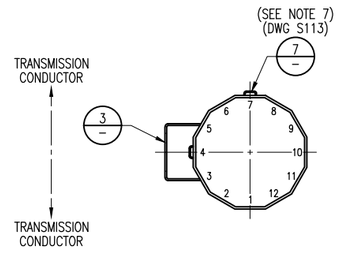
ORIENTATION OF AXES
SCALE: NTS



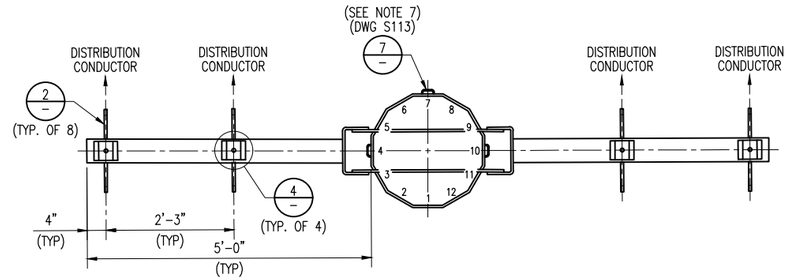
SECTION A S113
SCALE: NTS
SHIELD WIRE ORIENTATION



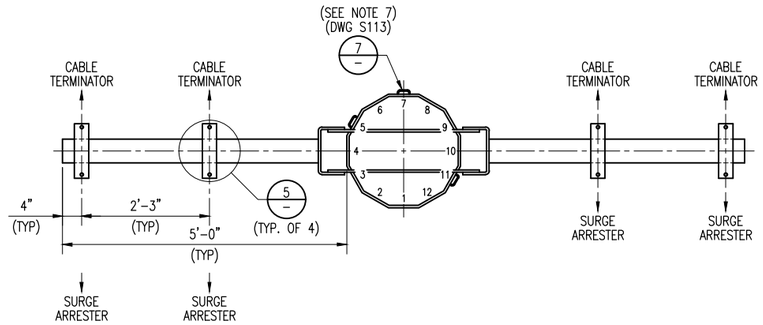
SECTION B S113
SCALE: NTS
TRANSMISSION ORIENTATION



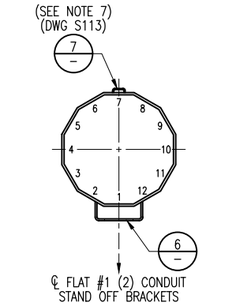
SECTION C S113
SCALE: NTS
TRANSMISSION ORIENTATION



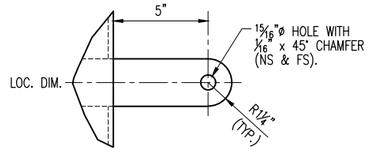
SECTION C S113
SCALE: NTS
DISTRIBUTION ORIENTATION



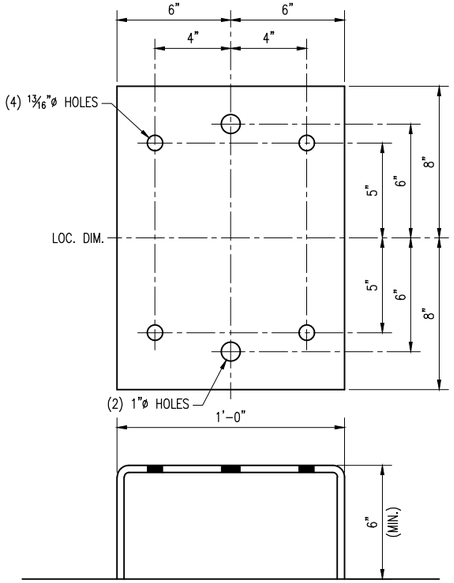
SECTION D S113
SCALE: NTS
TERMINATOR/ARRESTER ORIENTATION



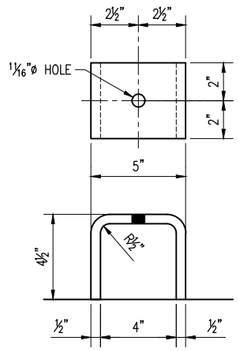
SECTION E S113
SCALE: NTS
CONDUIT STAND-OFF ORIENTATION



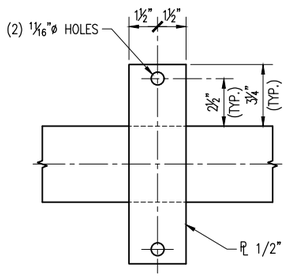
DETAIL 2
SCALE: NTS
DISTRIBUTION DEADEND ATTACHMENT



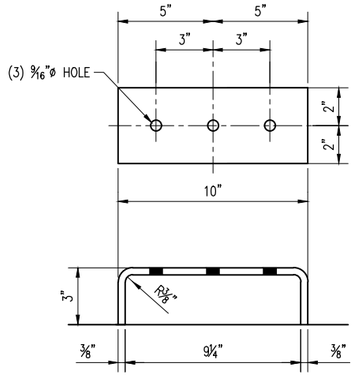
DETAIL 3
SCALE: NTS
POST INSULATOR BRACKET



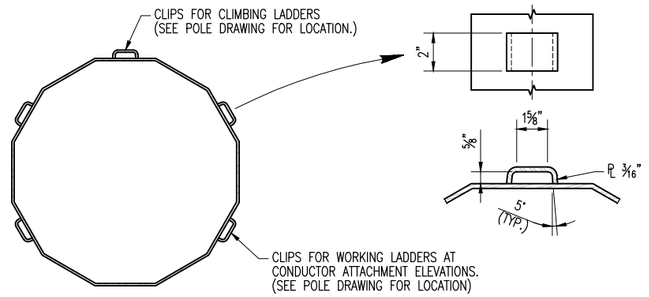
DETAIL 4
SCALE: NTS
PIN INSULATOR BRACKET



DETAIL 5
SCALE: NTS
TERMINATOR/ARRESTER BRACKET



DETAIL 6
SCALE: NTS
CONDUIT STAND OFF BRACKET



NOTES:
1. CLIPS TO BE SPACED AS REQUIRED FOR LADDERS SUPPLIED.
2. LADDER CLIP DETAIL IS FOR McGREGOR LADDERS ONLY.

DETAIL 7
SCALE: NTS
LADDER BRACKET

NOT FOR CONSTRUCTION

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/01/24	BDP	ML	60% REVIEW		

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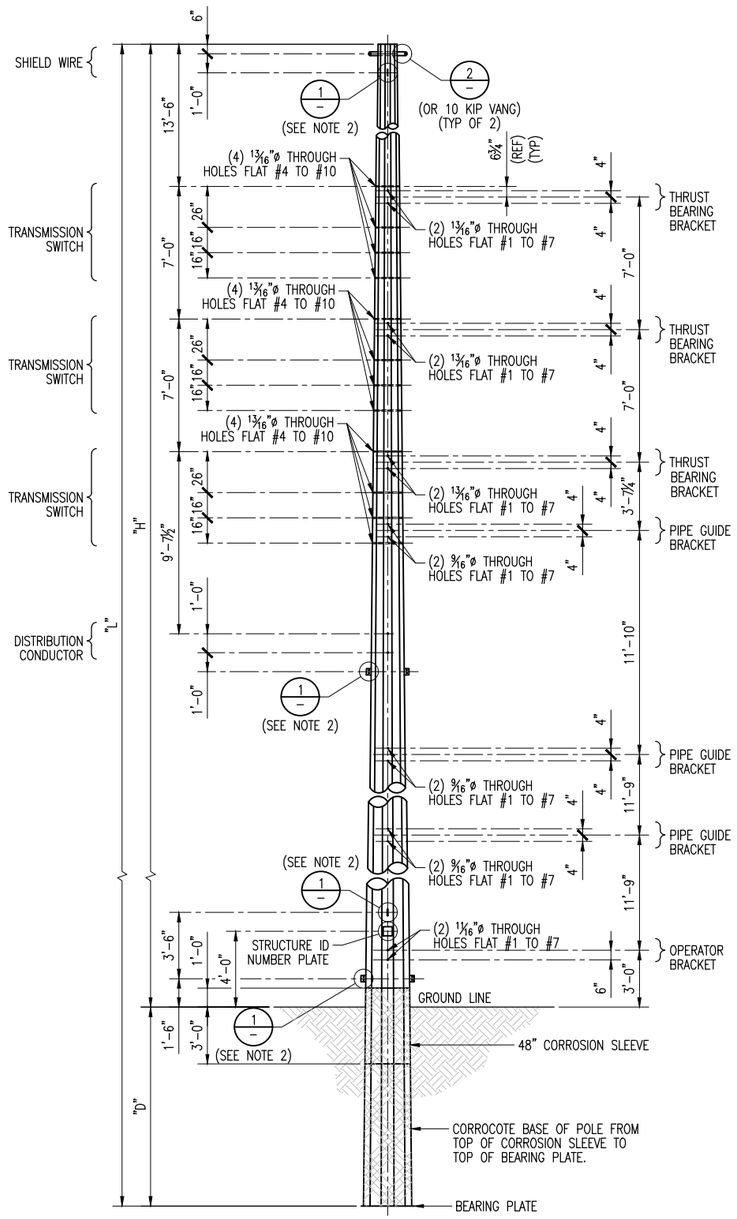
Drawn By:	BDP	Date	03/07/24
Chk'd. By:	ML	Date	03/07/24
ENGR.	BDP	Date	03/07/24
APPD.	_	Date	_
APPD.	_	Date	_

WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP 138KV TRANSMISSION LINE
STRUCTURE #12 – SECTIONS AND DETAILS

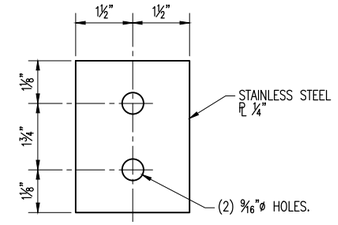
SCALE: NTS
Project No. 071-079
DRAWING No. 071-079-S114
REVISION B

PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-079-S114.dwg



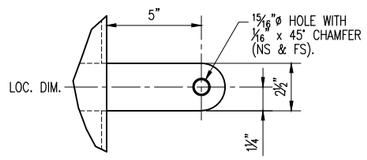
SWITCH STRUCTURE PRE-ENGINEERED POLE

SCALE: NTS



DETAIL 1

SCALE: NTS
GROUNDING PLATE

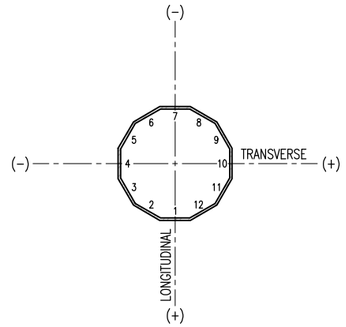


DETAIL 2

SCALE: NTS
SHIELD WIRE SUSPENSION ATTACHMENT

POLE DESIGN DATA (SEE NOTE 1)

DESCRIPTION \ POLE CLASS	75' S-12.0 (H11) (1 REQ'D)	
POLE NUMBER	#34	
NUMBER OF SIDES	12	
TOTAL LENGTH – "L"	75'	
HEIGHT ABOVE GROUND LINE – "H"	65.5'	
EMBEDMENT DEPTH – "D"	9.5'	
TOP DIAMETER	11.93"	
GROUND LINE DIAMETER	26.87"	
BUTT DIAMETER	29.13"	
POLE THICKNESS	0.25"	
POLE TAPER (in/ft)	0.237618	
POLE WEIGHT (lbs)	4596	
GROUND LINE MOMENT CAPACITY (ft-kips)	759	



ORIENTATION OF AXES

SCALE: NTS

DESIGN APPLICATION

WIRE DATA

SHIELD WIRE: OPGW DNO-11127
TRANSMISSION CONDUCTOR: 795 ACSR "DRAKE"
DISTRIBUTION CONDUCTOR: 477 ACSR "PELICAN"

GOVERNING CONDITIONS

SHIELD WIRE:
NESC MEDIUM (1/4" ICE, 4 psf WIND @ 15° F), 1765 lbs. INITIAL TENSION

TRANSMISSION WIRE:
795 ACSR – NESC MEDIUM (1/4" ICE, 4 psf WIND @ 15° F), 6000 lbs. INITIAL TENSION

DISTRIBUTION WIRE:
NO ICE, NO WIND @ 15° F, 20% CONDUCTOR ULTIMATE TENSION, FINAL TENSION

MECHANICAL LOADING CRITERIA

CASE 1: NESC MEDIUM (RULE 250B):
4 psf WIND @ 15°F, 1/4" ICE ON WIRES AND STRUCTURE.
OLF: VERTICAL 1.5, WIND 2.5, TENSION 1.65.

CASE 2: HIGH WIND – 90 MPH (RULE 250C):
21.4 psf WIND @ 60°F, NO ICE ON SHIELD WIRE AND TRANSMISSION WIRES,
21.2 psf WIND @ 60°F, NO ICE ON STRUCTURE.
OLF: 1.1 – ALL LOADS.

DESIGN TENSIONS (lbs.)

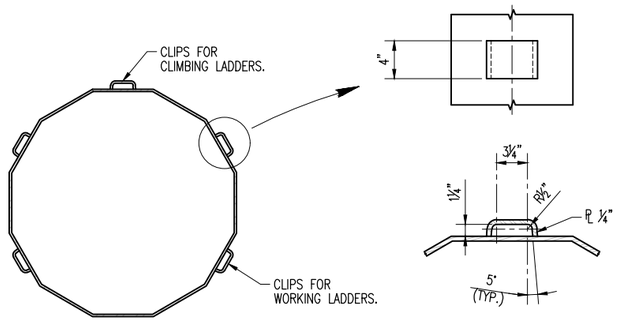
	NESC MEDIUM		HIGH WIND	
WIRE	BACK	AHEAD	BACK	AHEAD
SHIELD WIRE	1765'	1765'	1520	1520
TRANSMISSION	6000'	6000'	4850	4850
DISTRIBUTION	3660'	3660'	2890	2890

SPAN AND ANGLE DATA

	NESC MEDIUM		HIGH WIND	
DESCRIPTION	BACK	AHEAD	BACK	AHEAD
HORIZONTAL SPAN	140'	140'	140'	140'
VERTICAL SPAN SHIELD	120'	130'	100'	120'
VERTICAL SPAN TRANSMISSION	50'	70'	30'	55'
VERTICAL SPAN DISTRIBUTION	35'	55'	-30'	5'
LINE ANGLE	0.1°		0.1°	

GENERAL NOTES

1. VALUES OBTAINED FROM MEYER UTILITY STRUCTURES CATALOG.
2. ATTACH GROUNDING PLATES (DETAIL 1 ON THIS DRAWING) 1'-6" BELOW TOP OF POLE ON FLATS #1 AND #7, 1'-0" BELOW BOTTOM DISTRIBUTION CONDUCTOR HOLE ON FLATS #4 AND #10, 5'-0" ABOVE CORROSION SLEEVE ON FLATS #1 AND #7 AND 6" ABOVE CORROSION SLEEVE ON FLATS #4 AND #10.
3. CLIMBING LADDER CLIPS (DETAIL 3 ON THIS DRAWING) TO BE INSTALLED ON FLAT #7. WORKING LADDER CLIPS TO BE INSTALLED BELOW EACH SHIELD WIRE ATTACHMENT ON FLATS #4 AND #10, BELOW EACH SET OF TRANSMISSION SWITCH HOLES ON FLATS #4 AND #10 AND BELOW DISTRIBUTION CONDUCTOR HOLES ON FLATS #4 AND #10.
4. FINISH SHALL BE SELF WEATHERING STEEL (ASTM A871).
5. CORROCOTE BASE OF POLE FROM TOP OF CORROSION SLEEVE TO TOP OF BEARING PLATE.



NOTES:
1. CLIPS TO BE SPACED AS REQUIRED FOR LADDERS SUPPLIED.
2. LADDER CLIP DETAIL IS FOR McGREGOR LADDERS ONLY.

DETAIL 3

SCALE: NTS
LADDER CLIP DETAIL
(SEE NOTE 2)

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/01/24	BDP	ML	60% REVIEW		

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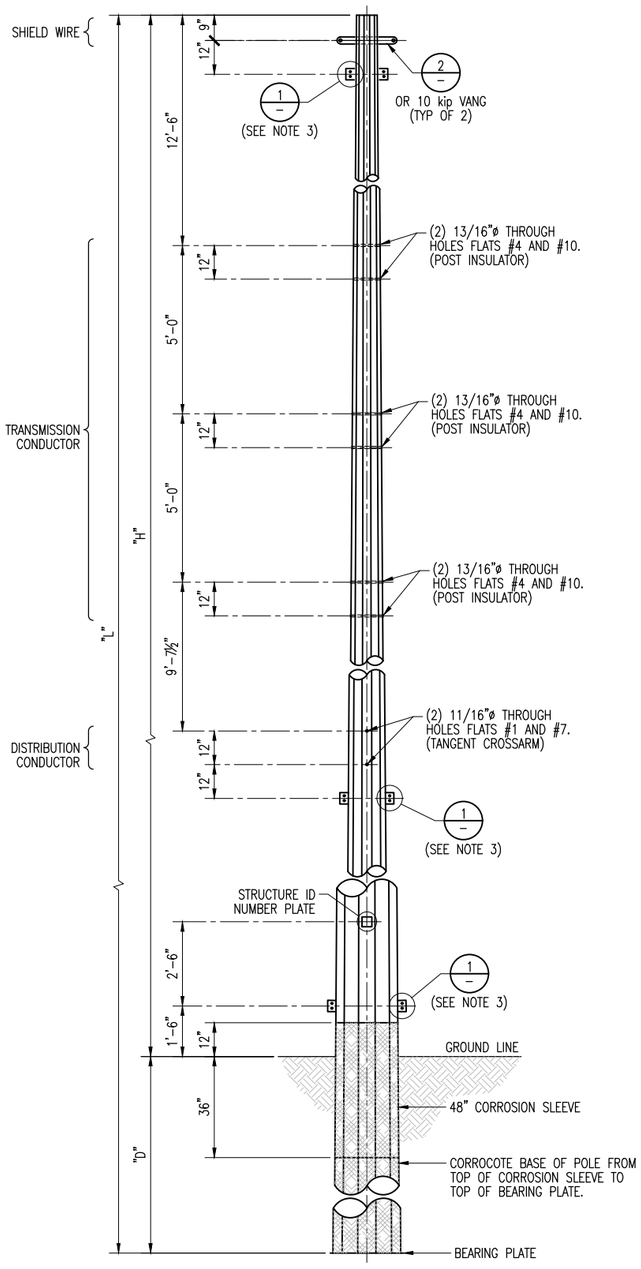
Drawn By:	BDP	Date	03/07/24
Chk'd. By:	ML	Date	03/07/24
ENGR.	BDP	Date	03/07/24
APPD.	_	Date	_
APPD.	_	Date	_

NOT FOR CONSTRUCTION

WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP 138KV TRANSMISSION LINE
PRE-ENGINEERED POLES – DESIGN DATA

SCALE	DRAWING No.	REVISION
NTS	071-079-S117	B
Project No. 071-079		

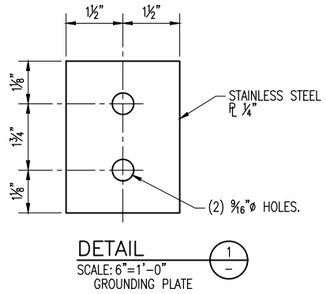
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-079-S117.dwg



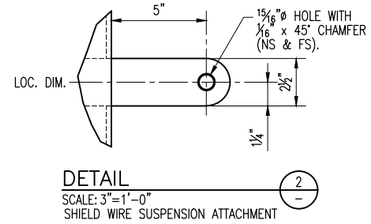
TANGENT STRUCTURE PRE-ENGINEERED POLE
SCALE: NTS

POLE DESIGN DATA (SEE NOTE 1)

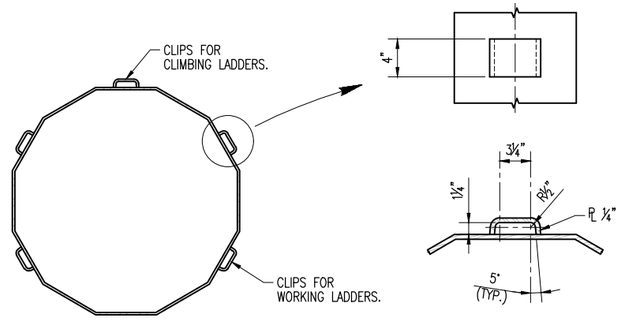
DESCRIPTION / POLE CLASS	75' S-02.9 CLASS 1 (10 REQ'D)	75' S-03.5 (H1) (2 REQ'D)	75' S-04.9 (H3) (1 REQ'D)	80' S-05.7 (H4) (1 REQ'D)	80' S-11.0 (H10) (6 REQ'D)
POLE NUMBER	#13, #16, #17, #18 #23, #24, #25, #31 #32, #33	#19, #26	#30	#35	#20, #21, #22, #27 #28, #29
NUMBER OF SIDES	12	12	12	12	12
TOTAL LENGTH – "L"	75'	75'	75'	85'	80'
HEIGHT ABOVE GROUND LINE – "H"	65.5'	65.5'	65.5'	74.5'	65.5'
EMBEDMENT DEPTH – "D"	9.5'	9.5'	9.5'	10.5'	14.5'
TOP DIAMETER	8.69"	8.69"	8.69"	9.66"	11.5"
GROUND LINE DIAMETER	15.8"	16.86"	19.77"	25.75"	25.75"
BUTT DIAMETER	16.90"	18.12"	21.45"	24.25"	27.9"
POLE THICKNESS	0.1875"	0.1875"	0.1875"	0.1875"	0.25"
POLE TAPER (in/ft)	0.116104	0.132332	0.176764	0.188645	0.226993
POLE WEIGHT (lbs)	2104	2213	2509	3006	4791
GROUND LINE MOMENT CAPACITY (ft-kips)	184	221	307	382	696



DETAIL 1
SCALE: 6"=1'-0"
GROUNDING PLATE

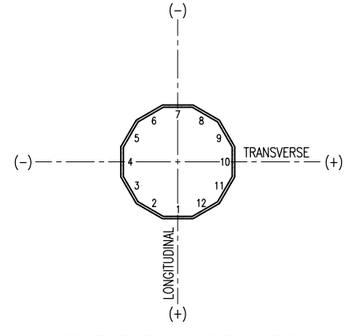


DETAIL 2
SCALE: 3"=1'-0"
SHIELD WIRE SUSPENSION ATTACHMENT



NOTES:
1. CLIPS TO BE SPACED AS REQUIRED FOR LADDERS SUPPLIED.
2. LADDER CLIP DETAIL IS FOR McGREGOR LADDERS ONLY.

DETAIL 3
SCALE: 1/2"=1'-0"
LADDER CLIP DETAIL
(SEE NOTE 2)



ORIENTATION OF AXES
SCALE: NTS

DESIGN APPLICATION

WIRE DATA

SHIELD WIRE: OPGW DNO-11127
TRANSMISSION CONDUCTOR: 795 ACSR "DRAKE"
DISTRIBUTION CONDUCTOR: 477 ACSR "PELICAN"

GOVERNING CONDITIONS

SHIELD WIRE:
NESC MEDIUM (1/4" ICE, 4 psf WIND @ 15° F), 1765 lbs. INITIAL TENSION

TRANSMISSION CONDUCTOR:
795 ACSR – NESC MEDIUM (1/4" ICE, 4 psf WIND @ 15° F), 6000 lbs. INITIAL TENSION

DISTRIBUTION CONDUCTOR:
NO ICE, NO WIND @ 15° F, 20% CONDUCTOR ULTIMATE TENSION, FINAL TENSION

MECHANICAL LOADING CRITERIA

CASE 1: NESC MEDIUM (RULE 250B):
4 psf WIND @ 15°F, 1/4" ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: VERTICAL 1.5, WIND 2.5, TENSION 1.65.

CASE 2: HIGH WIND – 90 MPH (RULE 250C):
21.4 psf WIND @ 60°F, NO ICE ON SHIELD WIRE AND TRANSMISSION CONDUCTORS,
21.2 psf WIND @ 60°F, NO ICE ON STRUCTURE.
OLF: 1.1 – ALL LOADS.

SPAN AND ANGLE DATA – 75' S-02.9 CLASS 1

DESCRIPTION	NESC MEDIUM	HIGH WIND
HORIZONTAL SPAN	275'	275'
VERTICAL SPAN SHIELD	255'	240'
VERTICAL SPAN TRANSMISSION	250'	240'
VERTICAL SPAN DISTRIBUTION	250'	230'
LINE ANGLE	0.6°	0.6°

SPAN AND ANGLE DATA – 75' S-03.5 (H1)

DESCRIPTION	NESC MEDIUM	HIGH WIND
HORIZONTAL SPAN	275'	275'
VERTICAL SPAN SHIELD	310'	335'
VERTICAL SPAN TRANSMISSION	325'	340'
VERTICAL SPAN DISTRIBUTION	325'	355'
LINE ANGLE	1.5°	1.5°

SPAN AND ANGLE DATA – 75' S-04.9 (H3)

DESCRIPTION	NESC MEDIUM	HIGH WIND
HORIZONTAL SPAN	280'	280'
VERTICAL SPAN SHIELD	235'	200'
VERTICAL SPAN TRANSMISSION	210'	195'
VERTICAL SPAN DISTRIBUTION	210'	175'
LINE ANGLE	1.2°	1.2°

SPAN AND ANGLE DATA – 80' S-05.7 (H4)

DESCRIPTION	NESC MEDIUM	HIGH WIND
HORIZONTAL SPAN	275'	275'
VERTICAL SPAN SHIELD	340'	395'
VERTICAL SPAN TRANSMISSION	485'	540'
VERTICAL SPAN DISTRIBUTION	590'	765'
LINE ANGLE	4.2°	4.2°

SPAN AND ANGLE DATA – 80' S-11.0 (H10)

DESCRIPTION	NESC MEDIUM	HIGH WIND
HORIZONTAL SPAN	275'	275'
VERTICAL SPAN SHIELD	260'	240'
VERTICAL SPAN TRANSMISSION	250'	240'
VERTICAL SPAN DISTRIBUTION	250'	235'
LINE ANGLE	7.7°	7.7°

GENERAL NOTES

1. VALUES OBTAINED FROM MEYER UTILITY STRUCTURES CATALOG.
2. ATTACH GROUNDING PLATES (DETAIL 1 ON THIS DRAWING) 1'-6" BELOW TOP OF POLE ON FLATS #1 AND #7, 1'-0" BELOW BOTTOM DISTRIBUTION CONDUCTOR HOLE ON FLATS #4 AND #10 AND 6" ABOVE CORROSION SLEEVE ON FLATS #4 AND #10.
3. CLIMBING LADDER CLIPS (DETAIL 3 ON THIS DRAWING) TO BE INSTALLED ON FLAT #1. WORKING LADDER CLIPS TO BE INSTALLED BELOW EACH SHIELD WIRE ATTACHMENT ON FLATS #4 AND #10, BELOW EACH SET OF TRANSMISSION CONDUCTOR HOLES ON FLATS #4 AND #10 AND BELOW DISTRIBUTION CONDUCTOR HOLES ON FLATS #4 AND #10.
4. FINISH SHALL BE SELF WEATHERING STEEL (ASTM A871).
5. CORROCOTE BASE OF POLE FROM TOP OF CORROSION SLEEVE TO TOP OF BEARING PLATE.

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/01/24	BDP	ML	60% REVIEW		

Washington City
Feels Like Home

ICPE CONSULTING ENGINEERS

Des By:	BDP	Date 03/07/24
Drawn By:	BDP	Date 03/07/24
Chk'd. By:	ML	Date 03/07/24
ENGR.	BDP	Date 03/07/24
APPD.	_	Date _
APPD.	_	Date _

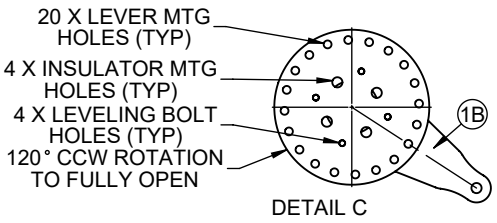
NOT FOR CONSTRUCTION

WASHINGTON CITY
GRAPEVINE SUBSTATION – PARKWAY TAP
138KV TRANSMISSION LINE
PRE-ENGINEERED POLES – DESIGN DATA

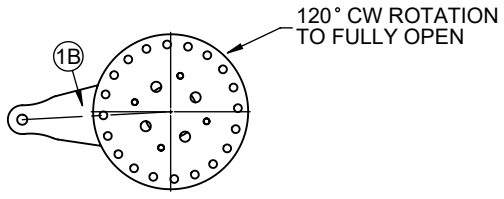
SCALE: NTS | DRAWING No. 071-079-S118 | REVISION B
Project No. 071-079

PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-079-S118.dwg

NOTES:
1. 25,000LBS ULTIMATE LOAD 10,000LBS WORKING LOAD @ ±5° LINE ANGLE TYP 3 PLACES
2. MINIMUM PHASE: 9'-0" WITH & WITHOUT INTERRUPTER
3. PHASE WEIGHT: 600LB WITHOUT INTERRUPTER 930LB WITH INTERRUPTER
4. WIND LOAD AREA: 2,000 SQ IN WITH INTERRUPTER SIDE VIEW
5. FIELD CUT PIPE LENGTHS AS NEEDED.
6. FIELD CUT PIPE GUIDE LOOPS TO FIT
7. SEE SINGLE PHASE DRAWING FOR SWITCH DETAILS

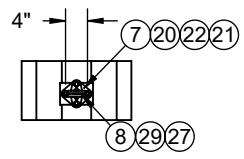


DETAIL C

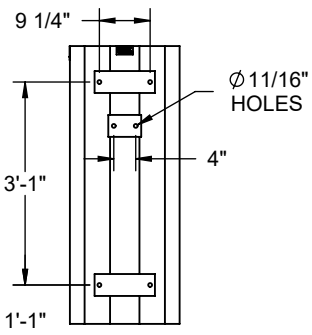


DETAIL B

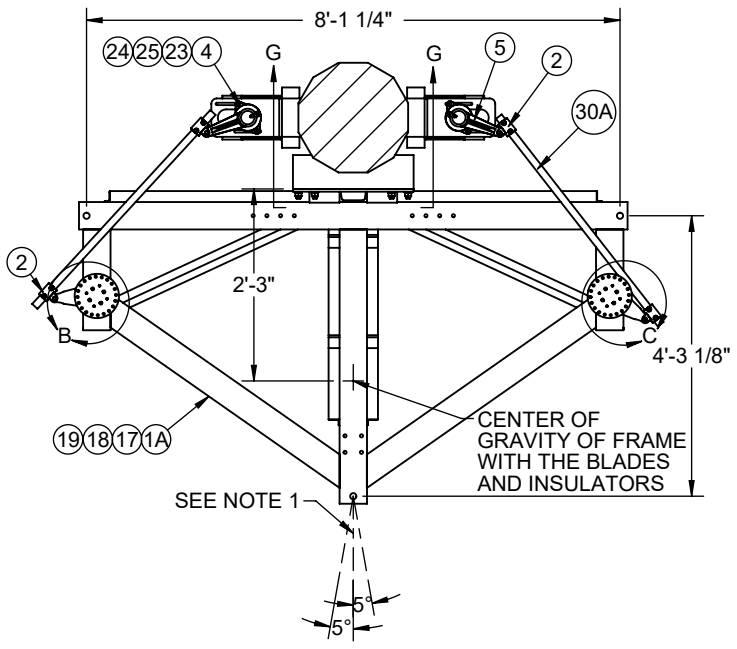
IN/OUT	INSP. 1	INSP. 2	ITEM NO.	QTY (EA.)	SAP PART NUMBER	DESCRIPTION	REFERENCE
			1	1	TU-2TS2	69KV, 1200 AMP SWITCH UNIT (3 PHASE SET)	SK2TS2069XQ00
					SEE ORDER	INSULATOR TR216 (69KV)	
			1A	3	TU-A17563-5	2TSB 69KV FRAME	17563-5
			1B	6	TU-019376X	PIVOT HANDLE	19376
ITEMS SHOWN ABOVE THIS LINE ARE TO BE FACTORY ASSEMBLED							
ITEMS SHOWN BELOW THIS LINE ARE TO BE SHIPPED FOR FIELD ASSEMBLY							
			2	12	TU-A9253	1" CLEVIS ASSY	17540
			3	6	TU-004951SXG	THRUST BEARING BRKT	4951
			4	2	TU-A9247	THRUST BEARING ASSY	14816
			5	6	TU-A19828	PIPE LEVER ASSY	19828
			6	4	TU-001414AAX	PIPE GUIDE	1414
			7	8	TU-003699AXM	PIPE GUIDE MTG BRKT	3699
			8	8	TU-A9258F	PIPE GUIDE ASSY	14715
			9	2	TU-003860AX	OPERATOR MTG BRKT	3860
			10	2	TU-A19653	MANUAL HANDLE LOCKING PLATE ASSEMBLY	19653
			11	1	TU-A9285	OPERATOR HANDLE 36IN 2WAY LESS MTG	N/A
			12	2	TU-008377X	WARNING LABEL STICKER	8377
			13	1	TU-021067X	TS2 POLE LABEL	21067
			14	2	TU-021067-1X	LABEL VOP TS2	21067-1
			15	2	TU-A9277	U-JOINT	3822
			16	6	TU-A9259	2" IPS PIPE COUPLING	22282-1
			17	48	-	HEX BOLT 3/4"-16 x 2 1/4" x 1 3/4" GALV GRADE 2	
			18	48	-	SPRING LOCKWASHER 3/4" GALV	
			19	48	-	HEX NUT 3/4" - 10 GALV	
			20	44	-	HEX BOLT 5/8"-11 x 2 x 1 1/2" GALV GRADE 2	
			21	44	-	SPRING LOCKWASHER 5/8" GALV	
			22	44	-	HEX NUT 5/8" - 11 GALV	
			23	12	-	HEX BOLT 3/8"-16 x 1 3/4" x 1 GALV GRADE 2	
			24	12	-	SPRING LOCKWASHER 3/8" GALV	
			25	12	-	HEX NUT 3/8" - 16 GALV	
			26	4	-	CARRIAGE BOLT 1/2"-13 x 2 x 2 GALV GRADE 2	
			27	20	-	SPRING LOCKWASHER 1/2" GALV	
			28	4	-	HEX NUT 1/2" - 13 GALV	
			29	16	-	HEX BOLT 1/2"-13 x 7/8" x 7/8" GALV GRADE 2	
			30	1	TU-PP10-40-4284	1" SCH 40 PIPE (MULTIPLE LENGTHS)	
ITEMS SHOWN BELOW ARE INCLUDED IN ITEM 30							
			30A	*6*	*TU-RM301319-48*	*1 SCH 40 PIPE @ 4' -0*	
			31	1	TU-PP20-40-5616	2" SCH 40 PIPE (MULTIPLE LENGTHS)	
ITEMS SHOWN BELOW ARE INCLUDED IN ITEM 31							
			31A	*8*	*R50001138*	*2 SCH 40 PIPE @ 21'-0*	



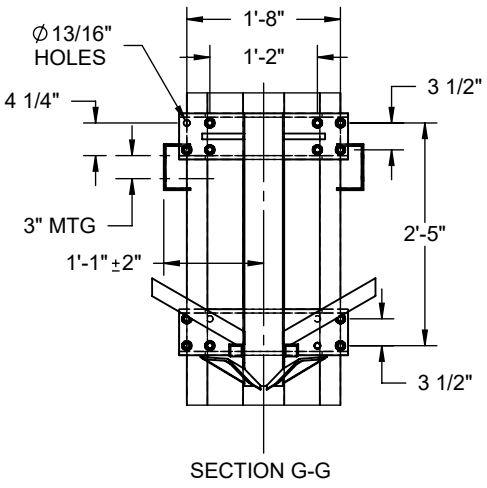
SECTION J-J



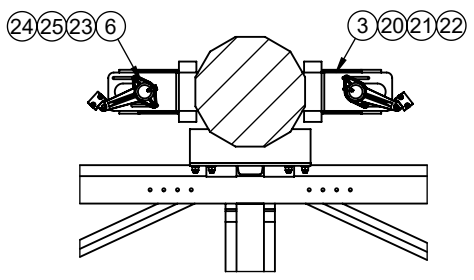
SECTION L-L



SECTION A-A



SECTION G-G



SECTION H-H

REV.	ECN	DESCRIPTION	DATE	BY:	APRV.
C		ADD MTG BRKT HOLE DIMENSIONS	7/31/2019	JDG	-
B	19041106	UPDATE TO CURRENT STANDARDS	2/28/2019	JDG	-
A	-	ADDED 21067 & 21067-1 POLE LABELS	7/13/2018	DWM	BR

REVISIONS

HUBBELL POWER SYSTEMS, INC

HUBBELL POWER SYSTEMS, INC.

	NAME	DATE
DRAWN BY:	DWM	6/4/2018
ENG APPROVED:	LD	6/6/2018

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES

TOLERANCES:
FRACTIONAL ± 1/16"
ANGULAR: ±1°
DRAFT ANGLE: ± 3°
ONE PLACE DECIMAL ± 0.06"
TWO PLACE DECIMAL ± 0.03"
THREE PLACE DECIMAL ± 0.005"
MACHINE SURFACE FINISH 125
UNLESS OTHERWISE NOTED

TURNER ELECTRIC

TITLE:

TU-2TS2
2TS2 69KV 600-2000AMP
CONTROL MECH
ON A MULTISIDED STEEL POLE
BRACKET MOUNT
SWING HANDLE OPERATOR
SPEC FOR 80' POLE AND SMALLER

SIZE	DWG. NO.	REV
B	PS242-FYV9000	C

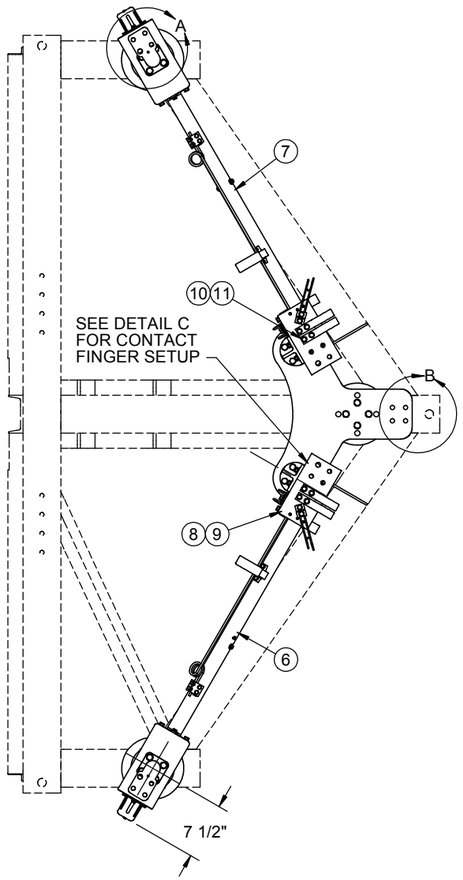
SCALE: NTS | WEIGHT: | SHEET 1 OF 1

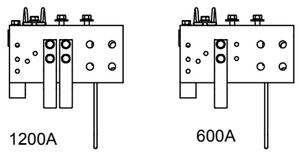
	15kV		23kV		34kV		46kV		69kV	
KV MAX	15.5		27		38		48.3		72.5	
KV BIL	110		150		200		250		350	
FREQ	60		60		60		60		60	
ACCC	D06		D06		D06		D06		D06	
WHIP RATING	24 AMPS		22 AMPS		18 AMPS		16 AMPS		12 AMPS	
ARC HORN RATING	6 AMPS		6 AMPS		6 AMPS		6 AMPS		6 AMPS	
AMPS CONT.	600	1200	600	1200	600	1200	600	1200	600	1200
AMPS SHORT TIME /DURATION	25KA 3 SEC	38KA 3 SEC	25KA 3 SEC	38KA 3 SEC	25KA 3 SEC	38KA 3 SEC	25KA 3 SEC	38KA 3 SEC	25KA 3 SEC	38KA 3 SEC
AMPS PEAK	65KA	99KA	65KA	99KA	65KA	99KA	65KA	99KA	65KA	99KA

TABLE A				
kV	TS2 MECHANISM ASSY	TS2 WHIP ASSY	A	B
15	TU-A21000-R015/L015	TU-21007R-015 / L-015	10"	2'-1"
23	TU-A21000-R023/L023	TU-21007R-023 / L-023	1'-2"	2'-5"
34	TU-A21000-R034/L034	TU-21007R-034 / L-034	1'-6"	2'-9"
46	TU-A21000-R046/L046	TU-21007R-046 / L-046	1'-10"	3'-1"
69	TU-A21000-R069/L069	TU-21007R-069 / L-069	2'-6"	3'-9"

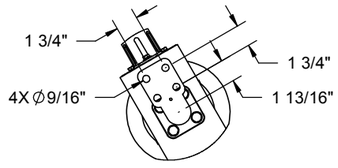
ITEM	PART NUMBER	DESCRIPTION	600AMP QTY. SHIPPED	600AMP QTY. ASSY	1200AMP QTY. SHIPPED	1200AMP QTY. ASSY
1	TU-000109SDXMGM	INSULATOR MOUNTING PEDESTAL	-	3	-	3
2	TU-A19592	3" PIVOT ASSEMBLY	-	6	-	6
3	SEE ORDER	INSULATOR	9	-	9	-
4	TU-A21005-1	TS2 2 WAY CONTACT PLATE	3	-	3	-
5	TU-MP251745X	SWITCH NAME PLATE	1	4	1	4
6	SEE TABLE A	TS2 MECHANISM ASSEMBLY RIGHT	3	-	3	-
7	SEE TABLE A	TS2 MECHANISM ASSEMBLY LEFT	3	-	3	-
8	TU-A21001-2R600	JAW ASSY TS2 600A W/ ARC HORN RH	3	-	-	-
9	TU-A21001-2R1200	JAW ASSY TS2 1200A W/ ARC HORN RH	-	-	3	-
10	TU-A21001-2L600	JAW ASSY TS2 600A W/ ARC HORN LH	3	-	-	-
11	TU-A21001-2L1200	JAW ASSY TS2 1200A W/ ARC HORN LH	-	-	3	-
12	SEE TABLE A	TS2 WHIP ASSEMBLY RHB	-	3	-	3
13	SEE TABLE A	TS2 WHIP ASSEMBLY LHB	-	3	-	3
14	-	-	-	-	-	-
15	-	-	-	-	-	-
16	-	HEX BOLT 1/2"-13 x 1 1/4" x 1 1/4" GALV	* 60	-	* 60	-
17	-	HEX BOLT 1/2"-13 x 1 3/4" x 1 1/4" GALV	-	36	-	36
18	-	HEX NUT 1/2" - 13 GALV	-	36	-	36
19	-	SPRING LOCKWASHER 1/2" GALV	* 72	36	* 72	36
20		HEX BOLT 1/2"-13 x 7/8" x 7/8" GALV	* 12	-	* 12	-

NOTES:
1. ITEMS AND QUANTITIES MARKED WITH AN " * " ARE INCLUDED IN BOLT KIT K-02/INS
2. WHIP SETUP SHOWN ON DRAWINGS 21007R, 21007L

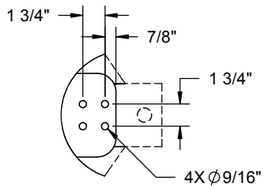




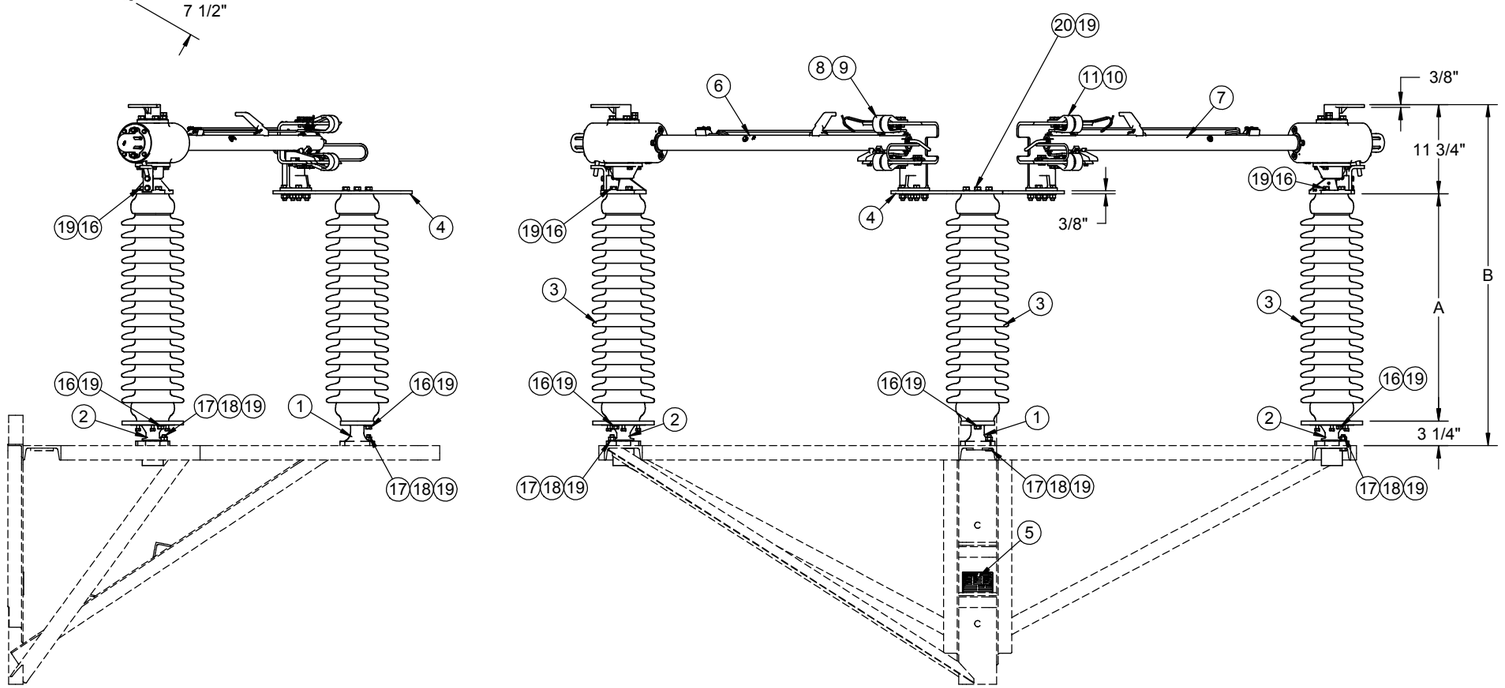
DETAIL C
SCALE 1:12



DETAIL A
SCALE 1 : 12



DETAIL B
SCALE 1 : 12



REV.	ECN	DESCRIPTION	DATE	BY:	APRV:
A	7920	TU-A19592 WAS TU-A9237	12/12/2016	TMB	DAR
-	7739	INITIAL RELEASE	7/13/2016	TMB	DAR

REVISIONS

HUBBELL POWER SYSTEMS, INC

SHIP TO

SO#

PO#

	NAME	DATE
DRAWN BY:	TMB	7/12/16
ENG APPROVED:	DAR	7/12/16

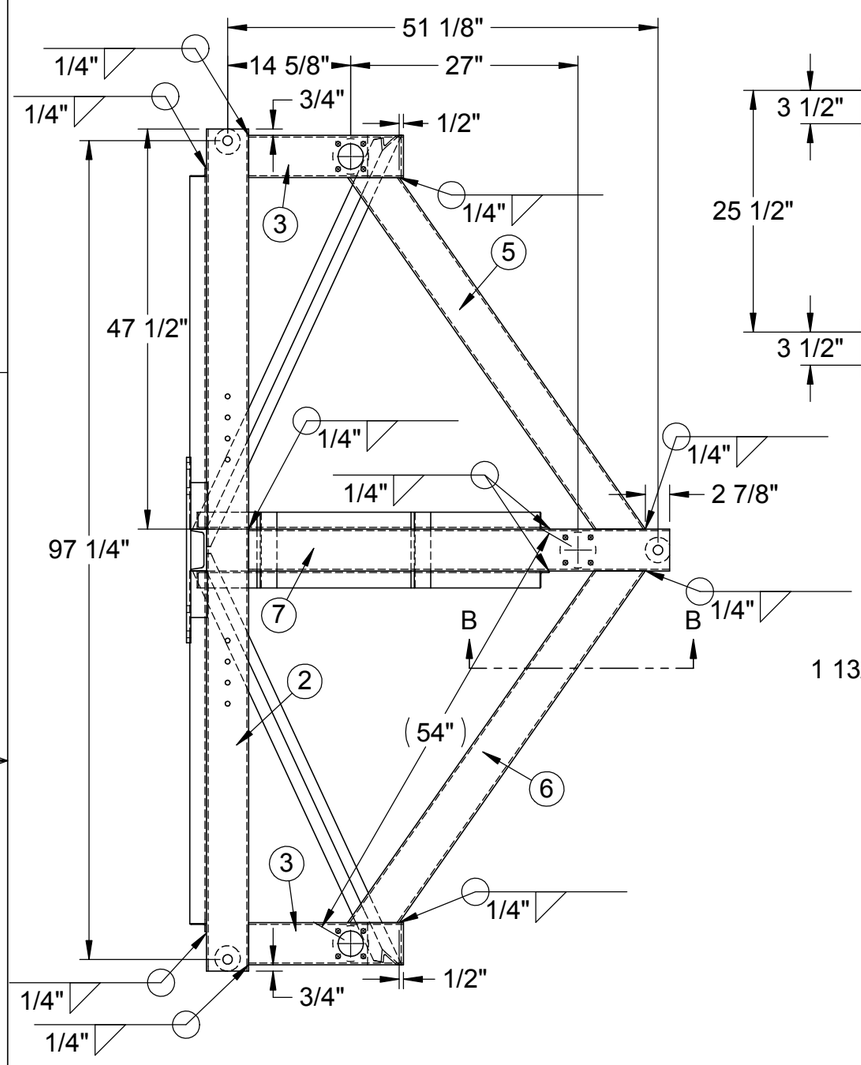
COMMENTS:

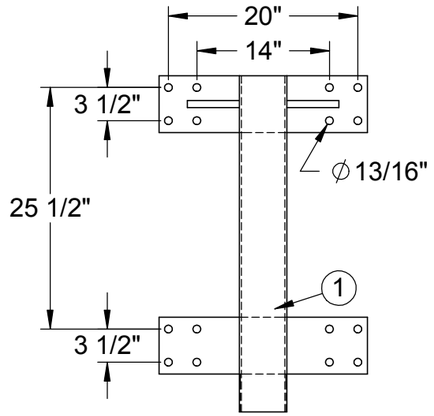
TURNER ELECTRIC

2TS2 15-69KV 600/1200AMP SIDE BREAK SINGLE POLE W/ QUICK WHIP

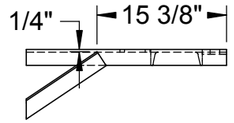
SIZE	DWG. NO.	REV
B	SK2TS2069XQ00	A

SCALE: 1:20 | SHEET 1 OF 1

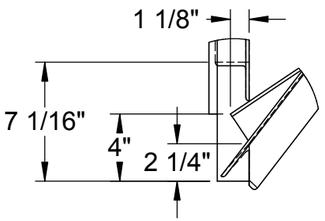




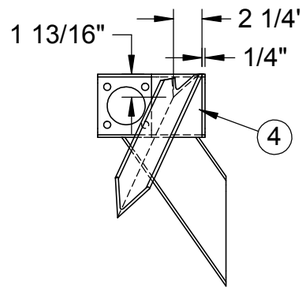
SECTION A-A
SCALE 1 : 16



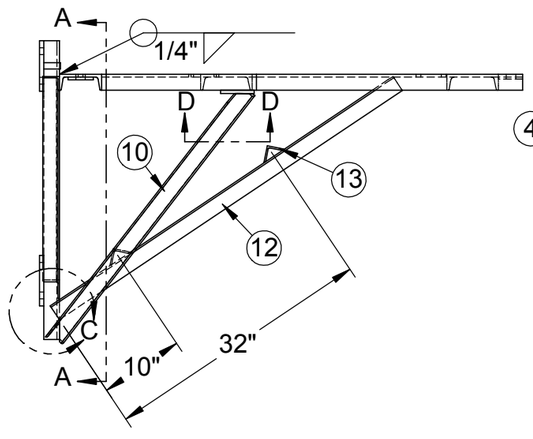
SECTION B-B

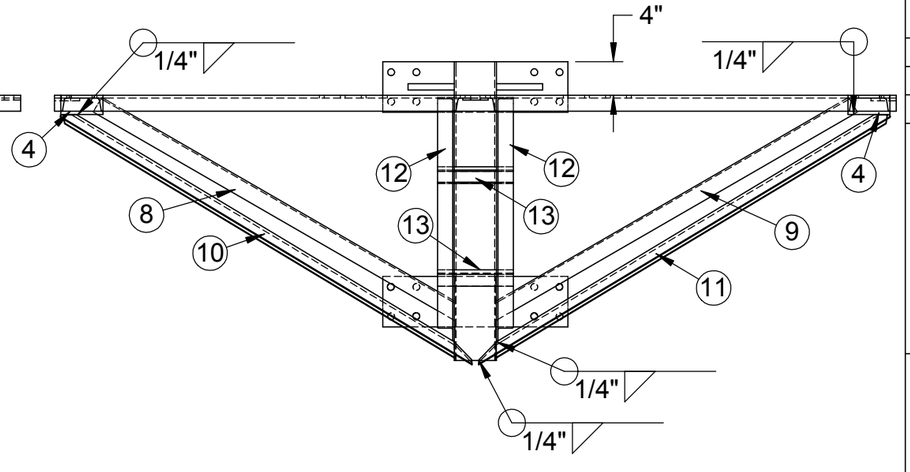


DETAIL C
SCALE 1 : 9

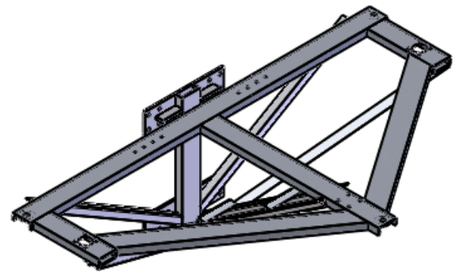


SECTION D-D
SCALE 1 : 12





ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	TU-019944AX	2 WAY FRAME MOUNT STEEL POLE	1
2	TU-017520AX	2D 69KV 2000AMP FRAME BACK	1
3	TU-018794AX	2TSB 69KV 600/2500AMP PIVOT CHANNEL	2
4	TU-021733AX	STRUT MTG PLATE	2
5	TU-018795-1AX	2TSB 69KV SIDE CHANNEL	1
6	TU-018795-2AX	2TSB 69KV SIDE CHANNEL	1
7	TU-017518AX	2D 69KV 2000AMP JAW SUPPORT	1
8	TU-017523-2AX	2D 69KV 2000AMP FRAME BRACE RIGHT	1
9	TU-017523-3AX	2D 69KV 2000AMP FRAME BRACE LEFT	1
10	TU-018796AX	2TSB 69KV STRUT RIGHT	1
11	TU-018796-1AX	2TSB 69KV STRUT LEFT	1
12	TU-017522AX	2D 69KV 2000AMP FRAME BACK STRUT	2
13	TU-000809AX	STURT TIE ANGLE	2



REV.	ECN	DESCRIPTION	DATE	BY:	APRV:
B	8021	ADDED TU-021733AX; UPDATED SHEET FORMAT	3/10/2017	SRL	LD
A	7379	ADDED PART NUMBERS TO BOM	8/28/2015	JCD	LD
-	6178	INITIAL RELEASE	8/30/2012	SRL	LD

REVISIONS

HUBBELL POWER SYSTEMS, INC

HUBBELL POWER SYSTEMS, INC.

	NAME	DATE
DRAWN BY:	SRL	8/30/12
ENG APPROVED.	LD	8/30/12

TURNER ELECTRIC

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES

TOLERANCES:
FRACTIONAL ± 1/16"
ANGULAR: ±1°
DRAFT ANGLE: ± 3°
ONE PLACE DECIMAL ± 0.06"
TWO PLACE DECIMAL ± 0.03"
THREE PLACE DECIMAL ± 0.005"

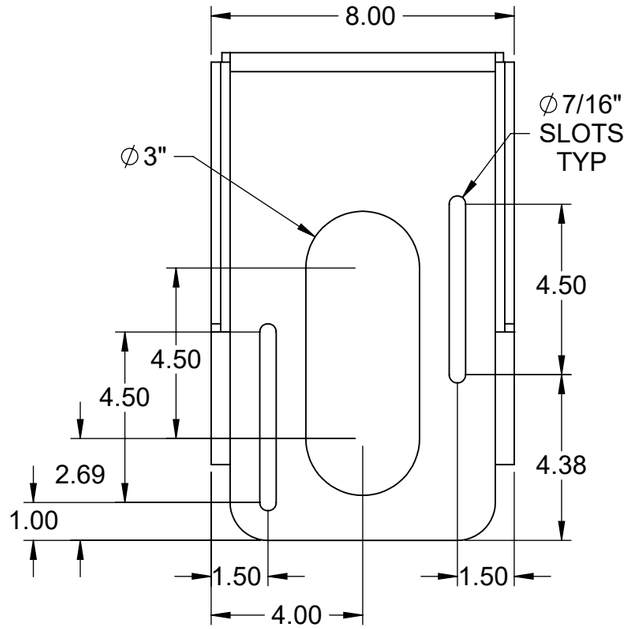
▽ MACHINE SURFACE FINISH 125 UNLESS OTHERWISE NOTED

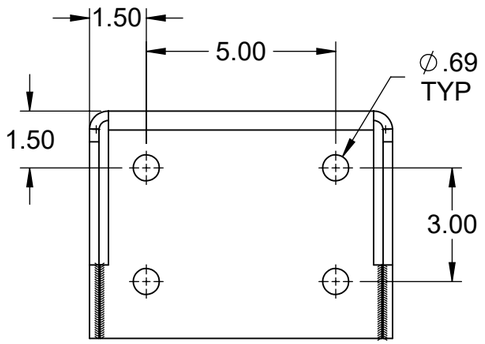
TITLE:

2TSB 69KV FRAME
FOR STEEL POLE
PART# TU-A17563-5

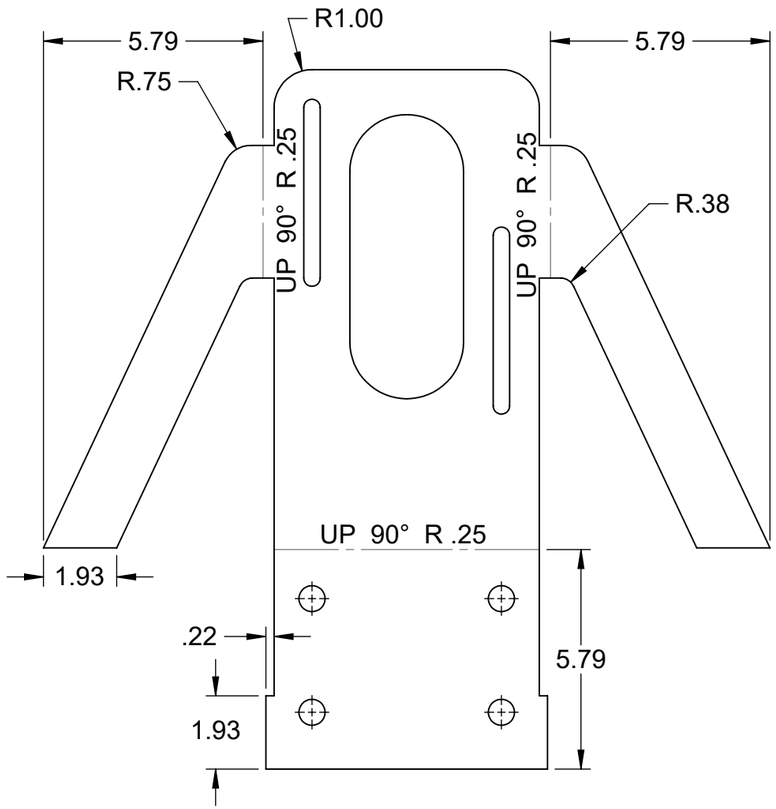
SIZE	DWG. NO.	REV
B	17563-5	B

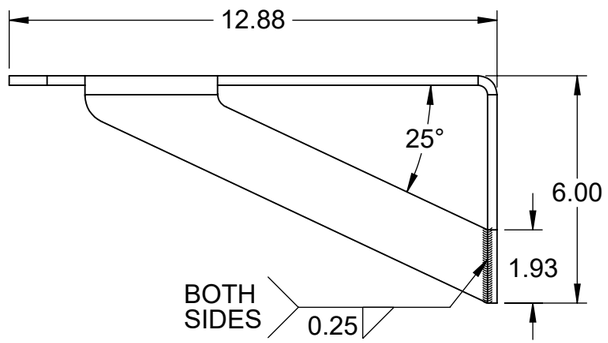
SCALE:1:18 | WEIGHT:121.83 | SHEET 1 OF 1





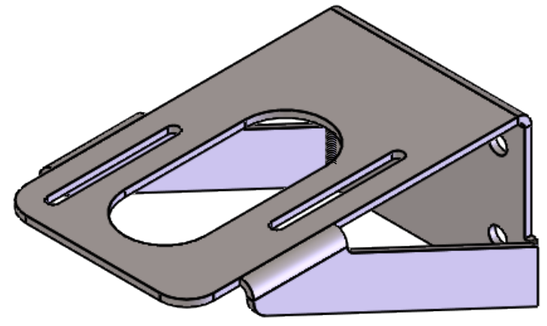
BACK





ITEM NO.	PartNo	DESCRIPTION	QTY
1	PSB1001133	PLATE, STEEL 1/4 (10.21) A36	.977 SQ FT
-			
-	TU-004951SX	FABRICATION	-
-	TU-004951SXG	GALVANIZING	-

NOTES:
1. MATERIAL: A36 STEEL
2. GALVANIZE PER ASTM 123
   THICKNESS: .003 - .005
3. TOTAL CUT PERIMETER: 136.67"
4. TOTAL WELD LENGTH:8"



REV.	ECN	DESCRIPTION	DATE	BY:	APRV:
REVISIONS					
E	ECT08448	CHANGED FROM WELDMENT TO BURN AND BEND	7/6/18	DWM	DAR
D	8200	REDRAWN IN SOLIDWORKS	9/22/17	DWM	LD
C	7285	REMOVED RAW MATERIALS, ADDED PART NUMBERS	7/7/15	-	-
B	1790	012412AXM/-1AXM WAS EDITED	8/24/99	-	-
A	-	INITIAL RELEASE	-	-	-

HUBBELL POWER SYSTEMS, INC.

	NAME	DATE
DRAWN BY:	DWM	7/6/18
ENG APPROVED.	LD	7/6/18

TURNER ELECTRIC

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES

TOLERANCES:
FRACTIONAL ± 1/16"
ANGULAR: ±1°
DRAFT ANGLE: ± 3°
ONE PLACE DECIMAL ± 0.06"
TWO PLACE DECIMAL ± 0.03"
THREE PLACE DECIMAL ± 0.005"

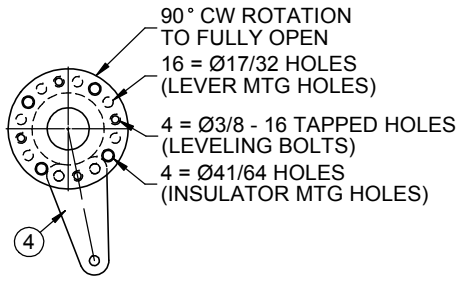
▽ MACHINE SURFACE FINISH 125
UNLESS OTHERWISE NOTED

TITLE:

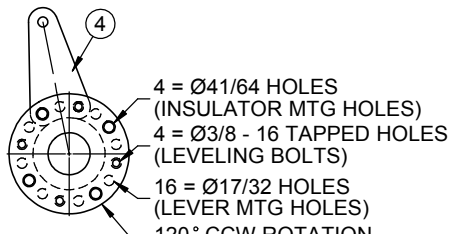
THRUST BEARING BRKT

SIZE	DWG. NO.	REV
B	4951	E

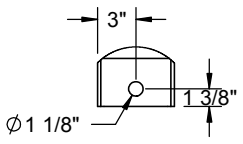
SCALE: 1:4 | WEIGHT: 10.23 | SHEET 1 OF 1



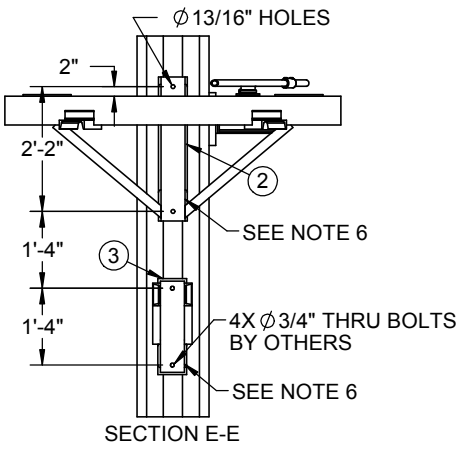
DETAIL B
SCALE 1 : 10



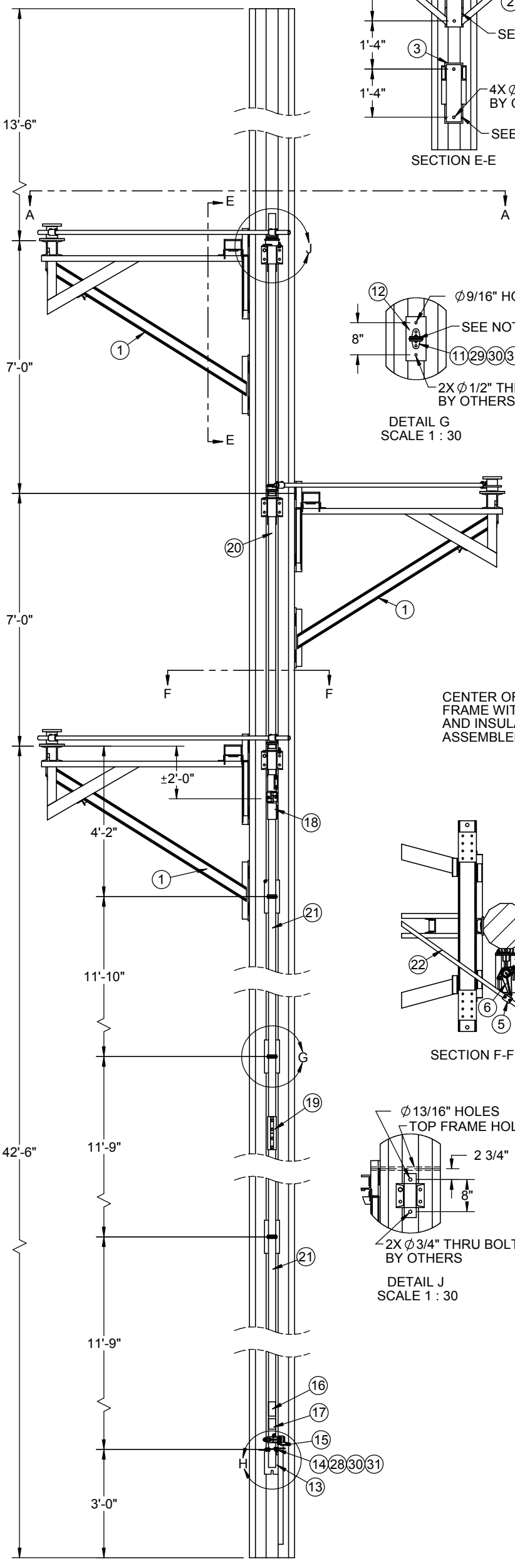
DETAIL C
SCALE 1 : 10



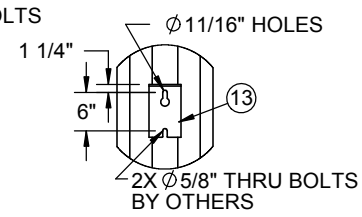
DETAIL D
SCALE 1 : 15



SECTION E-E



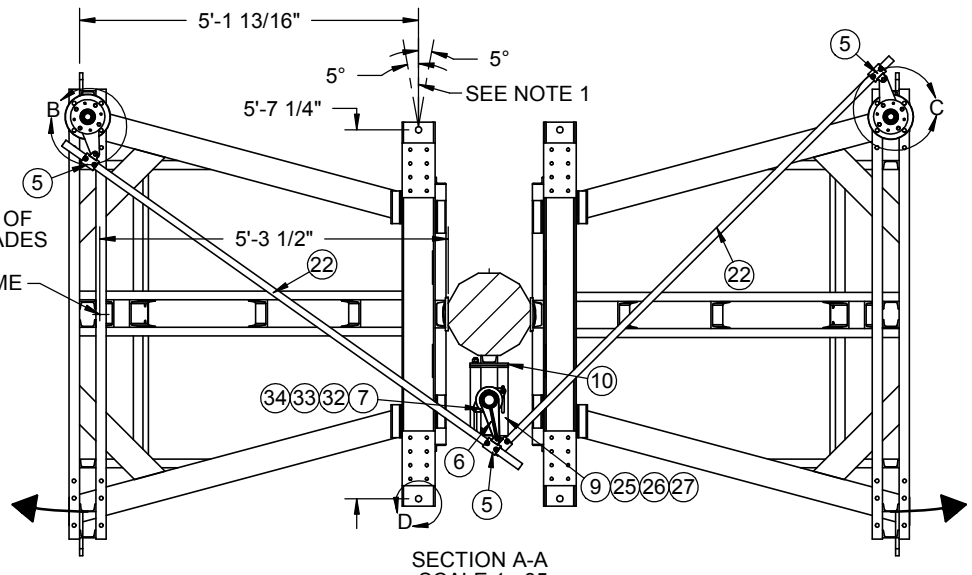
DETAIL G
SCALE 1 : 30



DETAIL H
SCALE 1 : 30

SECTION F-F

DETAIL J
SCALE 1 : 30



SECTION A-A
SCALE 1 : 35

ITEM NO.	PART NUMBER	DESCRIPTION	QTY. SHIPPED	QTY. ASSY
1	TU-A9323	FRAME ASSY 1WAY 138KV	-	3
2	TU-011392SXG	TOP FRAME BRKT	3	-
3	TU-011393SXG	BOTTOM FRAME BRKT	3	-
4	TU-004321AX	PIVOT LEVER	-	3
5	TU-A9253	1" CLEVIS ASSY	6	-
6	TU-A9255	7" LEVER ASSY	3	-
7	TU-A9247	THRUST BEARING ASSY	1	-
8	TU-001414AAX	PIPE GUIDE	2	-
9	TU-A4951	PHG TB MTG BRKT	3	-
10	TU-005737SXG	PHG TB MTG BRKT	3	-
11	TU-A9258F	PIPE GUIDE ASSY	3	-
12	TU-007231AXM	PIPE GUIDE MTG BRKT	3	-
13	TU-003879AX	OPER MTG BRKT	1	-
14	TU-A19653	MANUAL HANDLE LOCKING PLATE ASSEMBLY	1	-
15	TU-A9265	OPERATOR HANDLE 36IN 1 WAY	1	-
16	TU-008377X	WARNING LABEL STICKER	1	-
17	TU-008377-1X	OPERATING PIPE DECAL	1	-
18	TU-A9277	2" U-JOINT ASSY	1	-
19	TU-A9259	2" PIPE COUPLING	1	-
20	TU-RM301390192	2 SCH 80 PIPE @ 16'-0	1	-
21	TU-RM301390	2 SCH 80 PIPE @ 21'-0	2	-
22	TU-RM301320-102	1 SCH 80 PIPE @ 8'-6	3	-
23	-	-	-	-
24	-	-	-	-
25		HEX BOLT 5/8"-11 x 1 3/4" x 1 1/2" GALV GRADE 2	12	-
26	-	HEX NUT 5/8" - 11 GALV	12	-
27	-	SPRING LOCKWASHER 5/8" GALV	12	-
28		CARRIAGE BOLT 1/2"-13 x 2 x 2 GALV GRADE 2	2	-
29		HEX BOLT 1/2"-13 x 1 3/4" x 1 1/4" GALV GRADE 2	6	-
30	-	HEX NUT 1/2" - 13 GALV	8	-
31	-	SPRING LOCKWASHER 1/2" GALV	8	-
32		HEX BOLT 3/8"-16 x 1 1/2" x 1 GALV GRADE 2	6	-
33	-	HEX NUT 3/8" - 16 GALV	6	-
34	-	SPRING LOCKWASHER 3/8" GALV	6	-

NOTES:
1. 25,000LBS ULTIMATE LOAD 10,000LBS WORKING LOAD @ ±5° LINE ANGLE TYP 4 PLACES
2. MINIMUM PHASE:
   9'-0" WITH INTERRUPTER
   6'-6" WITHOUT INTERRUPTER
3. PHASE WEIGHT:
   1,500LB WITHOUT INTERRUPTER
   1,1560LB WITH INTERRUPTER
4. FIELD CUT PIPE LENGTHS AS NEEDED.
5. FIELD CUT PIPE GUIDE LOOPS T FIT
6. TU-011392SXG AND TU-011393SXG TO BE PLACED BETWEEN FRAME AND POLE FACE
7. SEE SINGLE PHASE DRAWING FOR BLADE DETAILS

REV.	DESCRIPTION	DATE	BY:	APRV:

REVISIONS

HUBBELL POWER SYSTEMS, INC.

RITER ENG

SHIP TO WASHINGTON, UT

SO# 112543444-10

PO# 16-441-N

TURNER ELECTRIC

	NAME	DATE
DRAWN BY:	SRL	11/28/16
ENG APPROVED:	LD	11/28/16

COMMENTS:

TU-1CDT
1CDT 138KV 600AMP
CONTROL MECH
ON A LD STEEL POLE

SIZE	DWG. NO.	REV
B	SK161107	-

SCALE: 1:40 | SHEET 1 OF 1

WASHINGTON CITY
MAIN ST. TAP – GRAPEVINE SUBSTATION
138KV TRANSMISSION LINE

NORTH

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/29/24	KAC	ML	90% REVIEW		
A	08/23/24	KAC	ML	60% REVIEW		

Washington City
Feels Like Home

ICPE
CONSULTING ENGINEERS

CONFIDENTIAL

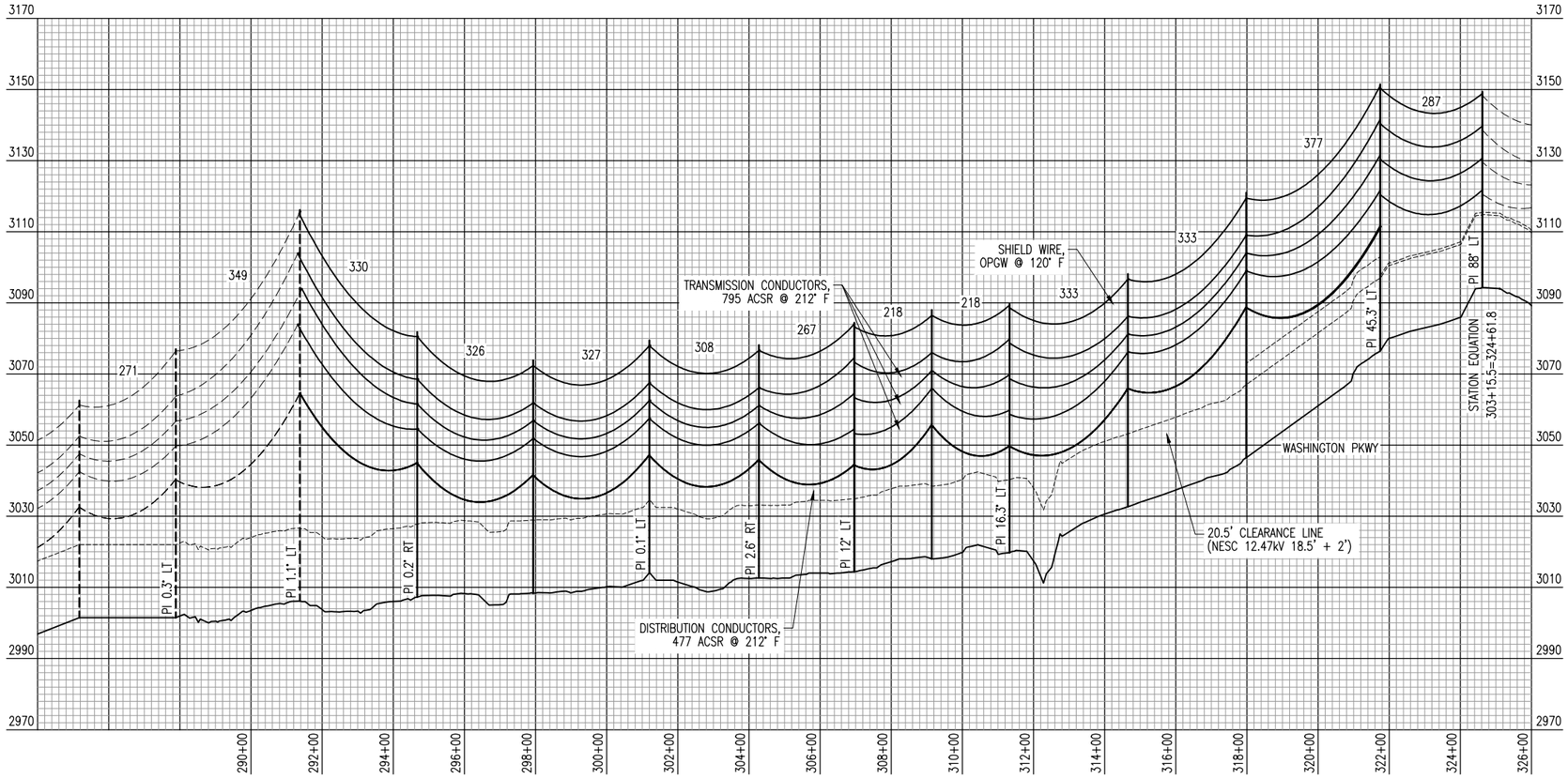
Des By: KAC	Date 08/23/24	
Drawn By: KAC	Date 08/23/24	
Chk'd. By: ML	Date –	
ENGR. ML	Date –	
APPD. –	Date –	
APPD. –	Date –	

NOT FOR CONSTRUCTION

WASHINGTON CITY
MAIN ST. TAP – GRAPEVINE SUBSTATION
138KV TRANSMISSION LINE
COVER SHEET

SCALE	DRAWING No.	REVISION
NTS	071-081-E100	B
Project No. 071-079		

PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.03 Elec Drawings\071-081-E100.dwg



#E100 EXISTING

#E99 EXISTING 74.5° A.G. — E EXXX

#E98 EXISTING 291+37.2 110° STEEL — E EXXX

#1 294+67.4 85° CLASS H11 — E EXXX / 1 S115

#2 297+93.2 75° CLASS H1 — E EXXX / 2 S116

#3 301+19.9 75° CLASS H1 — E EXXX / 3 S116

#4 304+28.2 75° CLASS H4 — E EXXX / 4 S116

#5 306+95.6 70° STEEL — E EXXX / C CXXX / 5 S101

#6 309+14.1 80° CLASS 1 — E EXXX / 6 S116

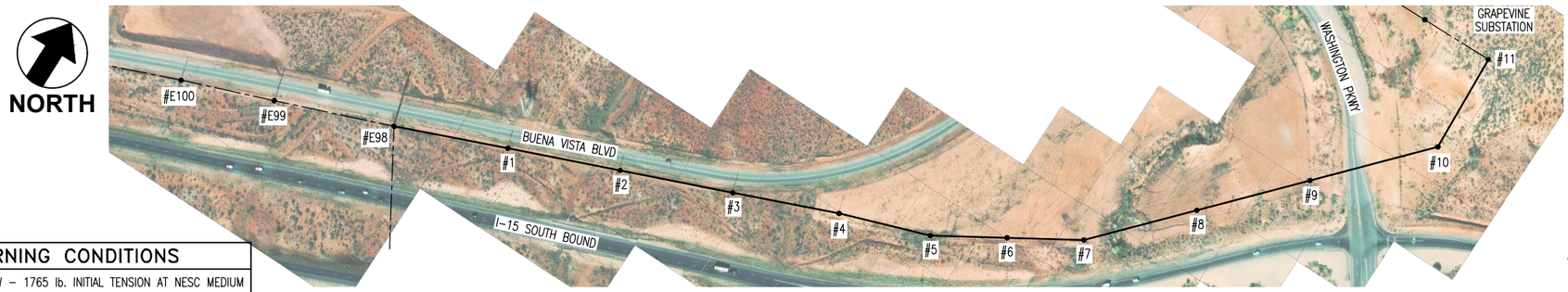
#7 311+32.5 70° STEEL — E EXXX / C CXXX / 7 S103

#8 314+65.2 75° CLASS H1 — E EXXX / 8 S116

#9 317+97.9 85° CLASS H2 — E EXXX / 9 S116

#10 321+74.6 75° STEEL — E EXXX / C CXXX / 10 S105

#11 324+61.8 55° STEEL — E EXXX / C CXXX / 11 S107



FEET 0 2 5 10 20 40 — SCALE: 1"=20'-0" VERTICAL

FEET 0 20 50 100 200 400 — SCALE: 1"=200'-0" HORIZONTAL

CONDUCTOR GOVERNING CONDITIONS

SHIELD WIRE, SX-29/61/512 (DNO-11127) OPGW – 1765 lb. INITIAL TENSION AT NESC MEDIUM
TRANSMISSION WIRE, 795 ACSR "DRAKE" – 6000 lb. INITIAL TENSION AT NESC MEDIUM
DISTRIBUTION WIRE, 477 ACSR "PELICAN" – 20% FINAL TENSION AT 15° F

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/29/24	KAC	ML	90% REVIEW		
A	08/23/24	BDP	ML	60% REVIEW		

Washington City — Feels Like Home

ICPE CONSULTING ENGINEERS

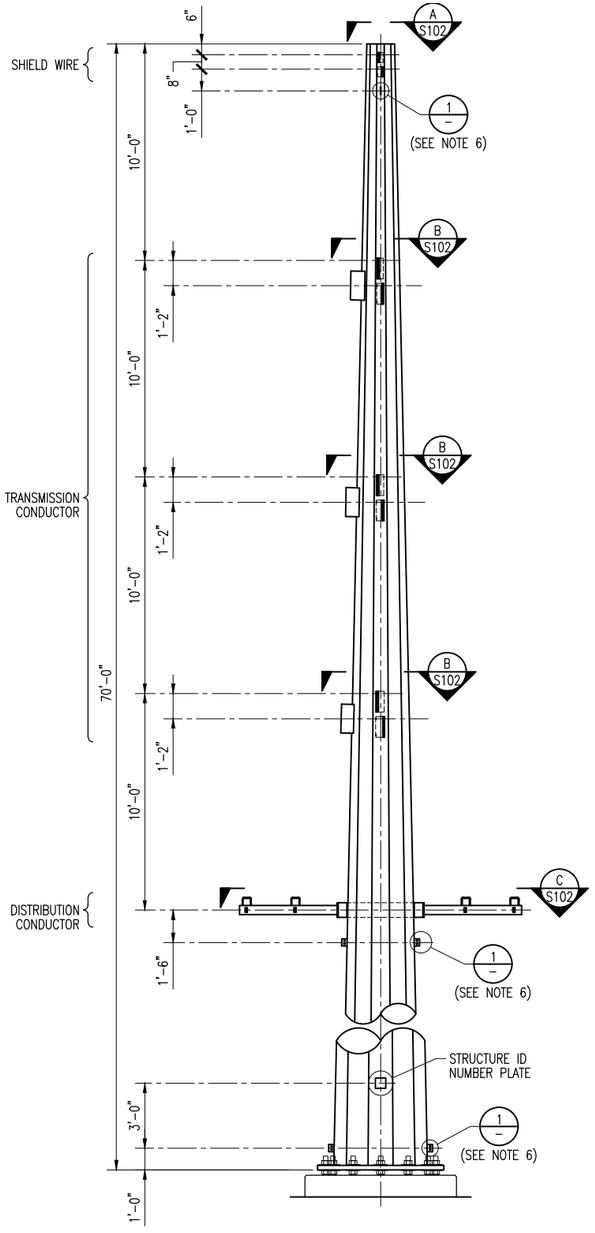
CONFIDENTIAL

		Date
Des By:	BDP	08/23/24
Drawn By:	BDP	08/23/24
Chk'd. By:	ML	08/23/24
ENGR.	BDP	08/23/24
APPD.	_	_
APPD.	_	_

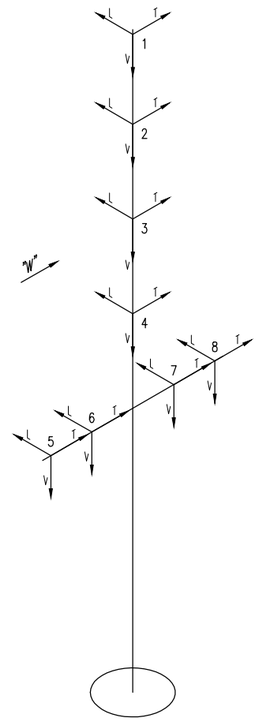
NOT FOR CONSTRUCTION

WASHINGTON CITY
MAIN ST. TAP – GRAPEVINE SUBSTATION 138KV TRANSMISSION LINE
PLAN & PROFILE – STR #E101 TO STR #11

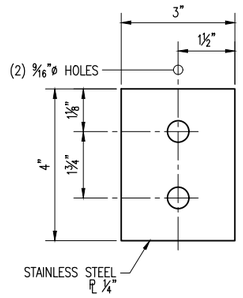
SCALE: NTS
Project No. 071-081
DRAWING No. 071-081-E103
REVISION B



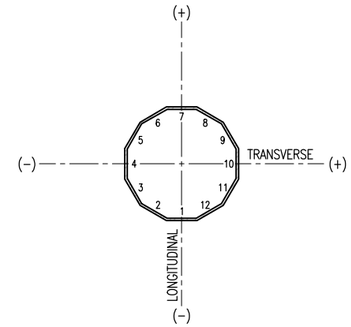
STRUCTURE #5
SCALE: NTS



LOADING DIAGRAM
SCALE: NTS



DETAIL 1
SCALE: NTS
GROUND PLATE



ORIENTATION OF AXES
SCALE: NTS

STRUCTURE POINT LOADS

1: NESC MEDIUM

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.81	0.00	0.50
TRANSMISSION CONDUCTOR	2, 3, 4	−2.40	0.00	0.95
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−1.52	−0.55	0.36

2: HIGH WIND

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.59	−0.09	0.43
TRANSMISSION CONDUCTOR	2, 3, 4	−1.64	−0.40	0.73
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−1.01	−0.54	0.19

3: CAMBER

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.15	0.00	0.16
TRANSMISSION CONDUCTOR	2, 3, 4	−0.64	−0.14	0.46
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.29	−0.23	0.18

4: BROKEN WIRE

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.24	1.93	0.15
TRANSMISSION CONDUCTOR	2	−0.75	6.56	0.23
TRANSMISSION CONDUCTOR	3, 4	−1.52	0.00	0.70
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.96	−0.37	0.26

5: ARM DESIGN

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.45	0.00	0.34
TRANSMISSION CONDUCTOR	2, 3, 4	−1.38	0.00	0.63
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.41	3.45	0.06

6: STRINGING

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.10	−0.83	0.94
TRANSMISSION CONDUCTOR	2, 3, 4	−0.44	−3.94	4.29
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.24	−2.14	2.27

DESIGN APPLICATION

WIRE DATA

SHIELD WIRE: OPGW SX-29/61/512 (DNO-11127)
TRANSMISSION WIRE: 795 kcmil ACSR "DRAKE"
DISTRIBUTION WIRE/NEUTRAL WIRE: 477 kcmil ACSR "PELICAN"

MECHANICAL LOADING CRITERIA

CASE 1: NESC MEDIUM (RULE 250B):
4 psf WIND @ 15'F, 1/4" ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: VERTICAL 1.5, WIND 2.5, TENSION 1.65.

CASE 2: HIGH WIND – 90 MPH (RULE 250C):
21.4 psf @ 60'F, NO ICE ON SHIELD WIRE AND TRANSMISSION CONDUCTORS,
19.3 psf @ 60'F, NO ICE ON DISTRIBUTION CONDUCTORS,
21.2 psf @ 60'F, NO ICE ON STRUCTURE.
OLF: 1.1 – ALL LOADS.

CASE 3: 60'F CAMBER (FINAL TENSION):
NO WIND @ 60'F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.0 – ALL LOADS.

CASE 4: BROKEN WIRE – SHIELD WIRE AND TOP TRANSMISSION CONDUCTOR BACK SPANS BROKEN (NESC SPANS AND TENSIONS):
4 psf WIND @ 15'F, 1/4" ICE ON WIRES AND STRUCTURE.
OLF: 1.1 – ALL LOADS.

CASE 5: ARM DESIGN – ALL BACK SPAN CONDUCTORS ON ARM BROKEN (NESC SPANS AND TENSIONS):
4 psf WIND @ 15'F, 1/4" ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF DISTRIBUTION CONDUCTORS: VERTICAL 1.5, WIND 2.5, TENSION 1.65.
OLF ALL OTHER WIRES AND CONDUCTORS: 1.0 – ALL LOADS.

CASE 6: STRINGING:
2.0 psf @ 60'F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.1 – ALL LOADS

DESIGN DATA

DESIGN TENSIONS (lbs.)

	NESC		HIGH WIND		CAMBER		STRINGING	
WIRE	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
SHIELD WIRE	1765	1765	1565	1480	710	715	760	790
TRANSMISSION CONDUCTOR	6000	6000	5005	4635	3155	3010	3605	3575
DISTRIBUTION CONDUCTOR	3810	3475	3130	2635	1485	1250	1955	1715

SPAN AND ANGLE DATA

	NESC		HIGH WIND		CAMBER		STRINGING	
DESCRIPTION	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
HORIZONTAL SPAN	135	110	135	110	135	110	135	110
VERTICAL SPAN SHIELD	200	125	255	135	190	120	195	125
VERTICAL SPAN TRANSMISSION	180	60	190	45	170	70	175	60
VERTICAL SPAN DISTRIBUTION	115	5	105	−50	120	35	115	10
LINE ANGLE	6	6	6	6	6	6	6	6

GENERAL NOTES

1. THE LOADS IN THE LOADING TABLE ARE ULTIMATE LOADS AND INCLUDE ALL OVERLOAD FACTORS. ALL LOADS IN KIPS EXCEPT WIND "W" IN psf.
2. THE VERTICAL LOADS (V) INCLUDE ONLY DEAD WEIGHT OF THE WIRE AND WEIGHT OF THE INSULATORS. THE DEAD WEIGHT OF THE STRUCTURE SHALL BE CALCULATED BY THE POLE MANUFACTURER AND USED IN THE DESIGN. THE OVERLOAD FACTOR APPLIED TO THE DEAD WEIGHT SHALL BE AS LISTED FOR EACH CASE.
3. FOR STRUCTURAL DESIGN, THE LONGITUDINAL, TRANSVERSE AND VERTICAL LOADS SHALL BE CONSIDERED TO ACT SIMULTANEOUSLY WITH THE WIND AND THE DEAD WEIGHT OF THE STRUCTURE.
4. APPLY STRUCTURE WIND "W" IN THE DIRECTION WHICH PRODUCES THE MAXIMUM STRESS.
5. STRUCTURE SHALL BE DESIGNED TO BE SELF SUPPORTING, GUYS ARE NOT PERMITTED.
6. ATTACH GROUNDING PLATES (DETAIL 1 ON THIS DRAWING) 2'-2" BELOW TOP OF POLE ON FLATS #1 AND #7, 1'-6" BELOW DISTRIBUTION ARMS ON FLATS #4 AND #10 AND 1'-0" ABOVE BASE PLATE ON FLATS #4 AND #10.
7. CLIMBING LADDER CLIPS (DETAIL 7 ON DRAWING S102) TO BE INSTALLED ON FLAT #1 THROUGH THE DISTRIBUTION AND ON FLAT #10 THROUGH THE TRANSMISSION. WORKING LADDER CLIPS TO BE INSTALLED BELOW EACH SHIELD WIRE ATTACHMENT, BELOW EACH TRANSMISSION CONDUCTOR ATTACHMENT AND BELOW EACH DISTRIBUTION ARM.
8. FINISH SHALL BE SELF-WEATHERING STEEL (ASTM A871).

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/23/24	BDP	ML	60% REVIEW		

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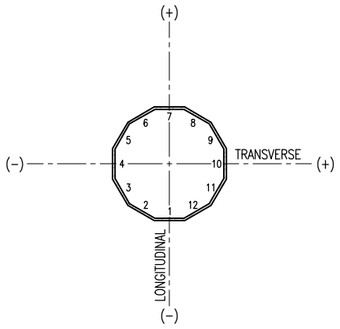
Des By:	BDP	Date	08/23/24
Drawn By:	BDP	Date	08/23/24
Chk'd. By:	KAC	Date	08/23/24
ENGR.	BDP	Date	08/23/24
APPD.	_	Date	_
APPD.	_	Date	_

NOT FOR CONSTRUCTION

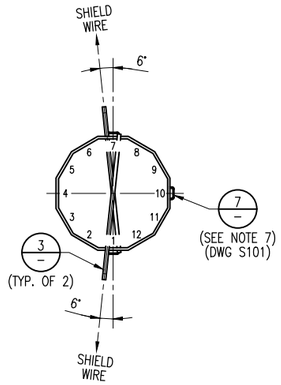
WASHINGTON CITY
MAIN ST. TAP – GRAPEVINE SUBSTATION
138KV TRANSMISSION LINE
STRUCTURE #5 – DESIGN DATA

SCALE: NTS
Project No. 071-079
DRAWING No. 071-081-S101
REVISION B

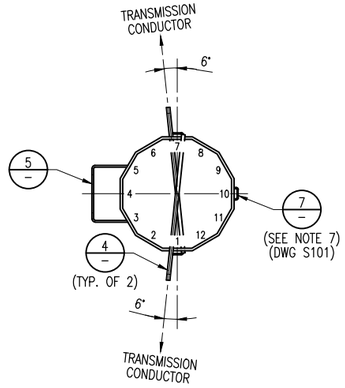
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-081-S101.dwg



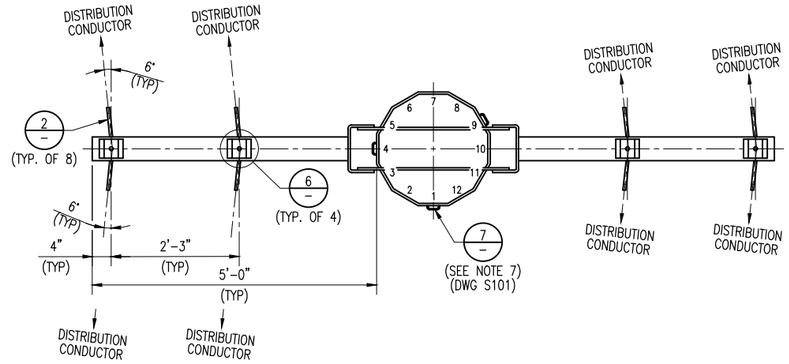
ORIENTATION OF AXES
SCALE: NTS



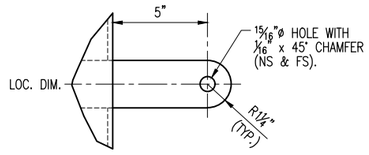
SECTION A S101
SCALE: NTS
SHIELD WIRE ORIENTATION



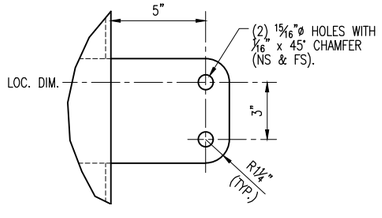
SECTION B S101
SCALE: NTS
TRANSMISSION ORIENTATION



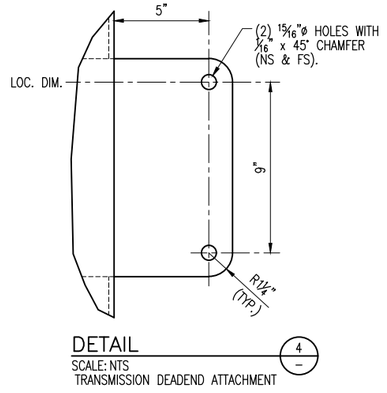
SECTION C S101
SCALE: NTS
DISTRIBUTION ORIENTATION



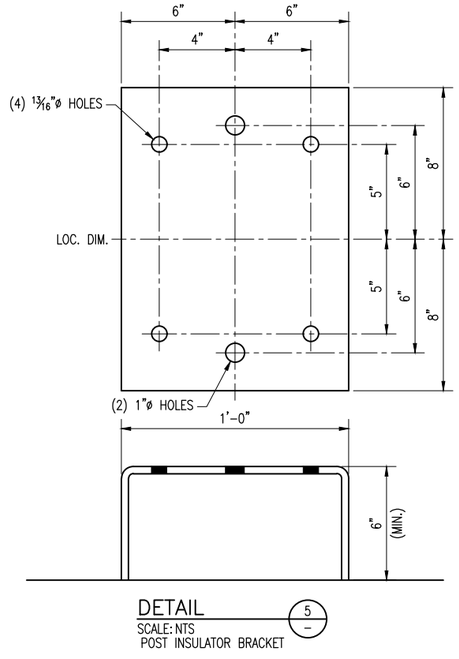
DETAIL 2 –
SCALE: NTS
DISTRIBUTION DEADEND ATTACHMENT



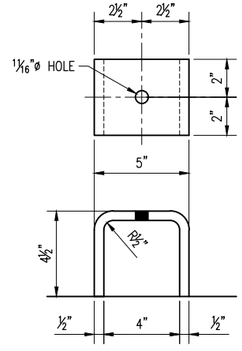
DETAIL 3 –
SCALE: NTS
DEADEND ATTACHMENT TYPE 2



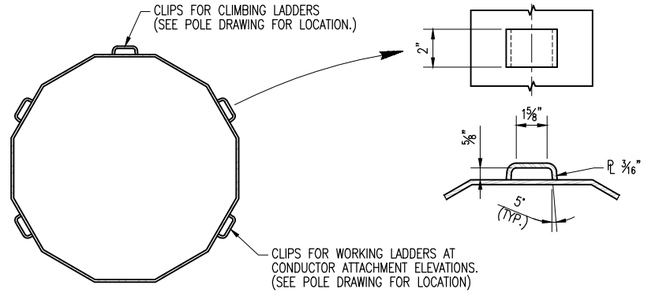
DETAIL 4 –
SCALE: NTS
TRANSMISSION DEADEND ATTACHMENT



DETAIL 5 –
SCALE: NTS
POST INSULATOR BRACKET



DETAIL 6 –
SCALE: NTS
PIN INSULATOR BRACKET



NOTES:
1. CLIPS TO BE SPACED AS REQUIRED FOR LADDERS SUPPLIED.
2. LADDER CLIP DETAIL IS FOR McGREGOR LADDERS ONLY.

DETAIL 7 –
SCALE: NTS
LADDER BRACKET

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/01/24	BDP	ML	60% REVIEW		

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Des By: BDP	Date	03/07/24
Drawn By: BDP	Date	03/07/24
Chk'd. By: ML	Date	03/07/24
ENGR. BDP	Date	03/07/24
APPD. _	Date	_
APPD. _	Date	_

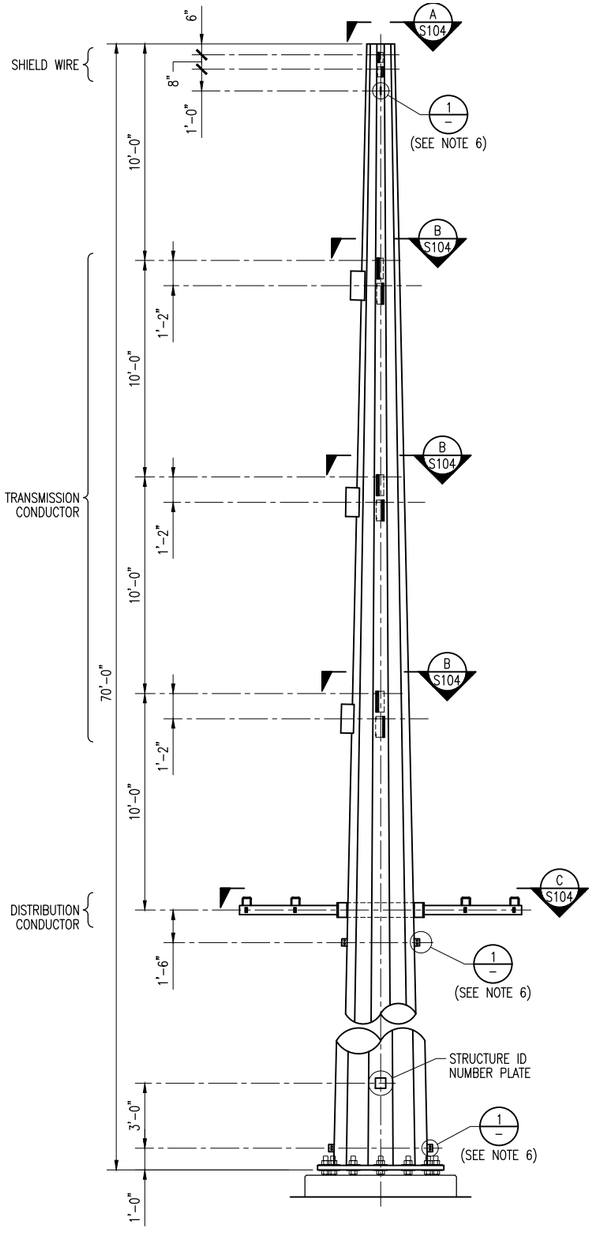
NOT FOR CONSTRUCTION

WASHINGTON CITY
MAIN ST. TAP – GRAPEVINE SUBSTATION
138KV TRANSMISSION LINE
STRUCTURE #5 – SECTIONS AND DETAILS

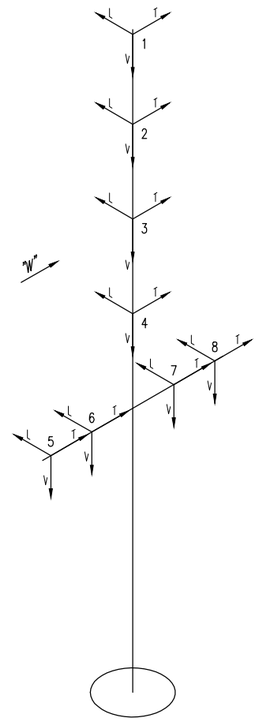
SCALE	DRAWING No.	REVISION
NTS	071-081-S102	B

Project No. 071-079

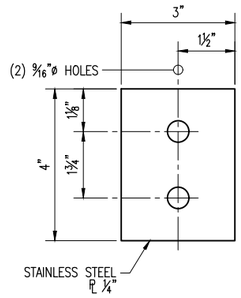
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-081-S102.dwg



STRUCTURE #7
SCALE: NTS



LOADING DIAGRAM
SCALE: NTS



DETAIL 1 –
SCALE: NTS
GROUND PLATE

STRUCTURE POINT LOADS

1: NESC MEDIUM

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−1.07	−0.01	0.47
TRANSMISSION CONDUCTOR	2, 3, 4	−3.21	−0.01	0.84
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−2.05	0.71	0.27

2: HIGH WIND

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.74	0.09	0.36
TRANSMISSION CONDUCTOR	2, 3, 4	−2.10	0.53	0.57
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−1.30	0.66	0.02

3: CAMBER

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.20	0.00	0.16
TRANSMISSION CONDUCTOR	2, 3, 4	−0.89	0.20	0.42
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.40	0.30	0.16

4: BROKEN WIRE

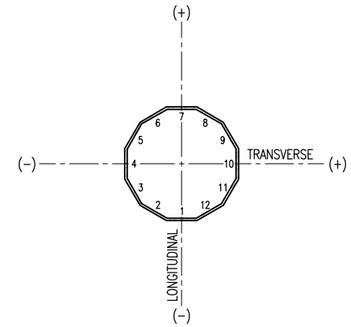
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.34	1.91	0.13
TRANSMISSION CONDUCTOR	2	−1.05	6.52	0.18
TRANSMISSION CONDUCTOR	3, 4	−2.06	−0.01	0.62
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−1.30	0.47	0.20

5: ARM DESIGN

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.60	0.00	0.31
TRANSMISSION CONDUCTOR	2, 3, 4	−1.87	0.00	0.56
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.64	3.86	0.03

6: STRINGING

DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.13	0.82	0.94
TRANSMISSION CONDUCTOR	2, 3, 4	−0.60	3.92	4.14
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.34	2.20	2.26



ORIENTATION OF AXES
SCALE: NTS

DESIGN APPLICATION

WIRE DATA

SHIELD WIRE: OPGW SX-29/61/512 (DNO-111127)
TRANSMISSION WIRE: 795 kcmil ACSR "DRAKE"
DISTRIBUTION WIRE/NEUTRAL WIRE: 477 kcmil ACSR "PELICAN"

MECHANICAL LOADING CRITERIA

CASE 1: NESC MEDIUM (RULE 250B):
4 psf WIND @ 15'F, 1/4" ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: VERTICAL 1.5, WIND 2.5, TENSION 1.65.

CASE 2: HIGH WIND – 90 MPH (RULE 250C):
19.9 psf @ 60'F, NO ICE ON SHIELD WIRE AND TRANSMISSION CONDUCTORS,
17.8 psf @ 60'F, NO ICE ON DISTRIBUTION CONDUCTORS,
21.2 psf @ 60'F, NO ICE ON STRUCTURE.
OLF: 1.1 – ALL LOADS.

CASE 3: 60'F CAMBER (FINAL TENSION):
NO WIND @ 60'F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.0 – ALL LOADS.

CASE 4: BROKEN WIRE – SHIELD WIRE AND TOP TRANSMISSION CONDUCTOR BACK SPANS BROKEN (NESC SPANS AND TENSIONS):
4 psf WIND @ 15'F, 1/4" ICE ON WIRES AND STRUCTURE.
OLF: 1.1 – ALL LOADS.

CASE 5: ARM DESIGN – ALL BACK SPAN CONDUCTORS ON ARM BROKEN (NESC SPANS AND TENSIONS):
4 psf WIND @ 15'F, 1/4" ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF DISTRIBUTION CONDUCTORS: VERTICAL 1.5, WIND 2.5, TENSION 1.65.
OLF ALL OTHER WIRES AND CONDUCTORS: 1.0 – ALL LOADS.

CASE 6: STRINGING:
2.0 psf @ 60'F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.1 – ALL LOADS

DESIGN DATA

DESIGN TENSIONS (lbs.)

WIRE	NESC		HIGH WIND		CAMBER		STRINGING	
	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
SHIELD WIRE	1765	1765	1480	1570	715	710	790	755
TRANSMISSION CONDUCTOR	6000	6000	4635	5140	3010	3210	3575	3610
DISTRIBUTION CONDUCTOR	3475	3915	2635	3255	1250	1550	1715	2020

SPAN AND ANGLE DATA

DESCRIPTION	NESC		HIGH WIND		CAMBER		STRINGING	
	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
HORIZONTAL SPAN	110	170	110	170	110	170	110	170
VERTICAL SPAN SHIELD	190	110	250	60	180	120	185	115
VERTICAL SPAN TRANSMISSION	165	35	175	−15	150	55	160	45
VERTICAL SPAN DISTRIBUTION	90	−20	75	−140	95	25	90	−25
LINE ANGLE	8.25	8.25	8.25	8.25	8.25	8.25	8.25	8.25

GENERAL NOTES

1. THE LOADS IN THE LOADING TABLE ARE ULTIMATE LOADS AND INCLUDE ALL OVERLOAD FACTORS. ALL LOADS IN KIPS EXCEPT WIND "W" IN psf.
2. THE VERTICAL LOADS (V) INCLUDE ONLY DEAD WEIGHT OF THE WIRE AND WEIGHT OF THE INSULATORS. THE DEAD WEIGHT OF THE STRUCTURE SHALL BE CALCULATED BY THE POLE MANUFACTURER AND USED IN THE DESIGN. THE OVERLOAD FACTOR APPLIED TO THE DEAD WEIGHT SHALL BE AS LISTED FOR EACH CASE.
3. FOR STRUCTURAL DESIGN, THE LONGITUDINAL, TRANSVERSE AND VERTICAL LOADS SHALL BE CONSIDERED TO ACT SIMULTANEOUSLY WITH THE WIND AND THE DEAD WEIGHT OF THE STRUCTURE.
4. APPLY STRUCTURE WIND "W" IN THE DIRECTION WHICH PRODUCES THE MAXIMUM STRESS.
5. STRUCTURE SHALL BE DESIGNED TO BE SELF SUPPORTING, GUYS ARE NOT PERMITTED.
6. ATTACH GROUNDING PLATES (DETAIL 1 ON THIS DRAWING) 2'-2" BELOW TOP OF POLE ON FLATS #1 AND #7, 1'-6" BELOW DISTRIBUTION ARMS ON FLATS #4 AND #10 AND 1'-0" ABOVE BASE PLATE ON FLATS #4 AND #10.
7. CLIMBING LADDER CLIPS (DETAIL 7 ON DRAWING S104) TO BE INSTALLED ON FLAT #1 THROUGH THE DISTRIBUTION AND ON FLAT #10 THROUGH THE TRANSMISSION. WORKING LADDER CLIPS TO BE INSTALLED BELOW EACH SHIELD WIRE ATTACHMENT, BELOW EACH TRANSMISSION CONDUCTOR ATTACHMENT AND BELOW EACH DISTRIBUTION ARM.
8. FINISH SHALL BE SELF-WEATHERING STEEL (ASTM A871).

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/23/24	BDP	ML	60% REVIEW		

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Des By:	BDP	Date	08/23/24
Drawn By:	BDP	Date	08/23/24
Chk'd. By:	KAC	Date	08/23/24
ENGR.	BDP	Date	08/23/24
APPD.	–	Date	–
APPD.	–	Date	–

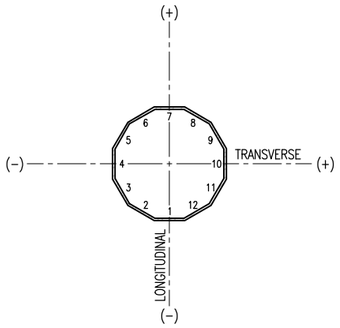
NOT FOR CONSTRUCTION

WASHINGTON CITY
MAIN ST. TAP – GRAPEVINE SUBSTATION
138KV TRANSMISSION LINE
STRUCTURE #7 – DESIGN DATA

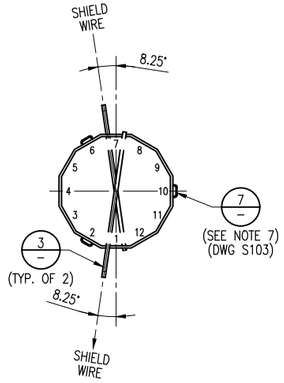
SCALE	DRAWING No.	REVISION
NTS	071-081-S103	B

Project No. 071-079

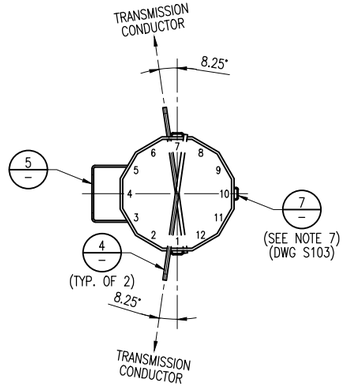
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-081-S103.dwg



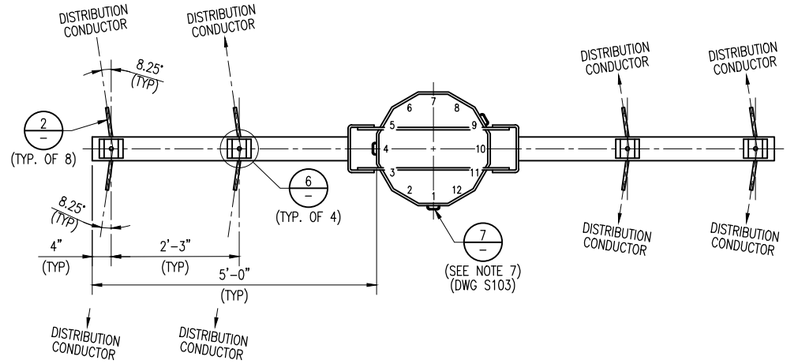
ORIENTATION OF AXES
SCALE: NTS



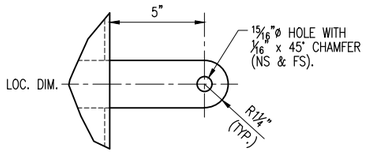
SECTION A S103
SCALE: NTS
SHIELD WIRE ORIENTATION



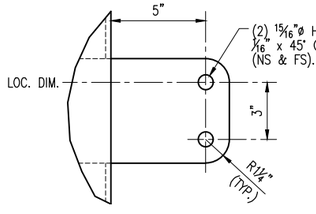
SECTION B S103
SCALE: NTS
TRANSMISSION ORIENTATION



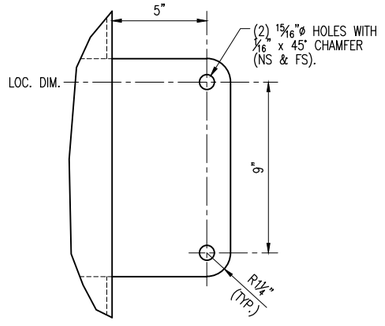
SECTION C S103
SCALE: NTS
DISTRIBUTION ORIENTATION



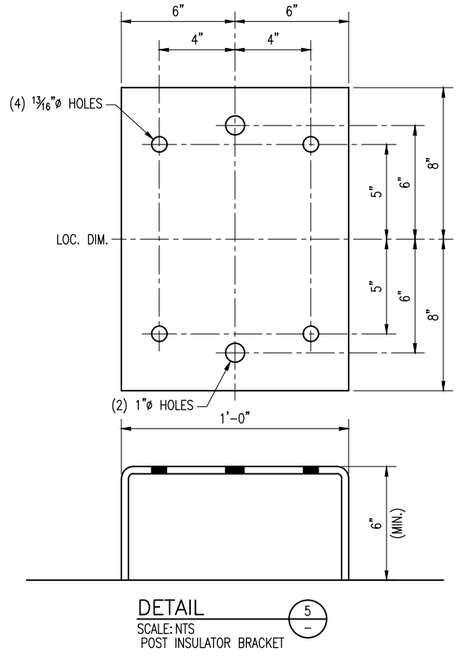
DETAIL 2 –
SCALE: NTS
DISTRIBUTION DEADEND ATTACHMENT



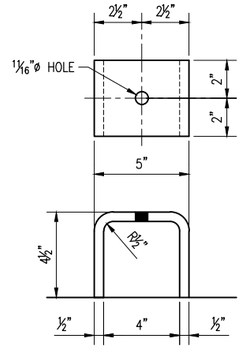
DETAIL 3 –
SCALE: NTS
DEADEND ATTACHMENT TYPE 2



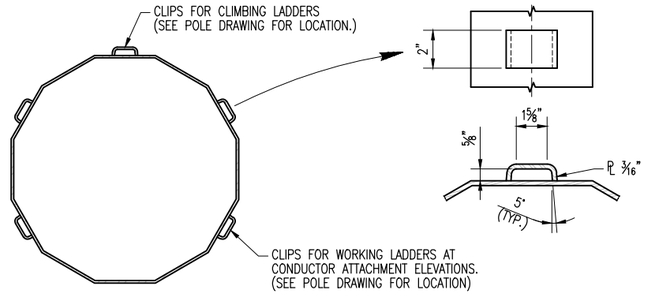
DETAIL 4 –
SCALE: NTS
TRANSMISSION DEADEND ATTACHMENT



DETAIL 5 –
SCALE: NTS
POST INSULATOR BRACKET



DETAIL 6 –
SCALE: NTS
PIN INSULATOR BRACKET



NOTES:
1. CLIPS TO BE SPACED AS REQUIRED FOR LADDERS SUPPLIED.
2. LADDER CLIP DETAIL IS FOR McGREGOR LADDERS ONLY.

DETAIL 7 –
SCALE: NTS
LADDER BRACKET

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/01/24	BDP	ML	60% REVIEW		

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CONFIDENTIAL

Des By: BDP	Date	03/07/24
Drawn By: BDP	Date	03/07/24
Chk'd. By: ML	Date	03/07/24
ENGR. BDP	Date	03/07/24
APPD. _	Date	_
APPD. _	Date	_

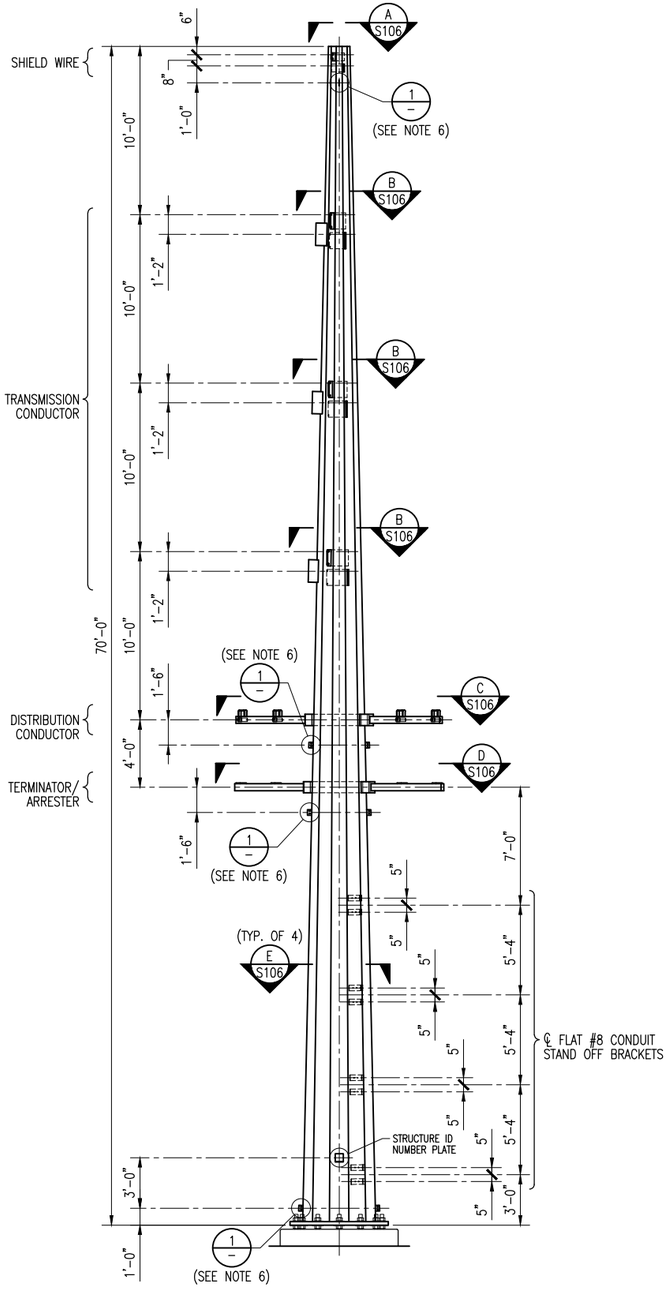
NOT FOR CONSTRUCTION

WASHINGTON CITY
MAIN ST. TAP – –GRAPEVINE SUBSTATION 138KV TRANSMISSION LINE
STRUCTURE #7 – SECTIONS AND DETAILS

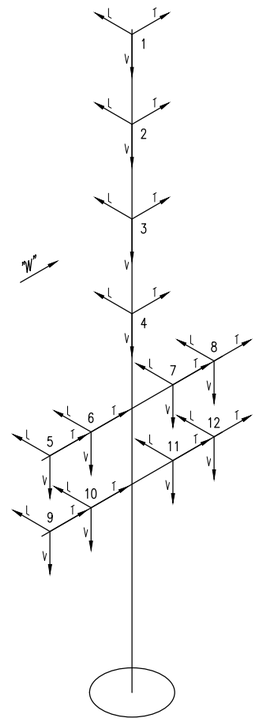
SCALE	DRAWING No.	REVISION
NTS	071-081-S104	B

Project No. 071-079

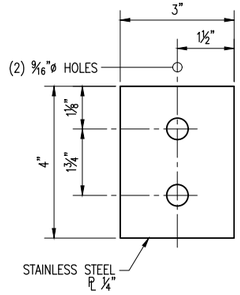
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-081-S104.dwg



STRUCTURE #10
SCALE: NTS



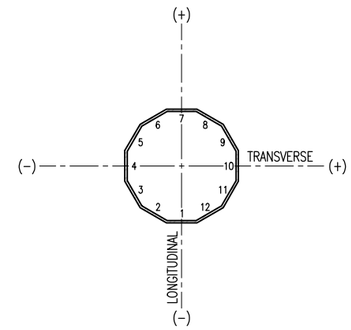
LOADING DIAGRAM
SCALE: NTS



DETAIL 1 –
SCALE: NTS
GROUND PLATE

STRUCTURE POINT LOADS

1: NESC MEDIUM				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−2.51	0.01	0.83
TRANSMISSION CONDUCTOR	2, 3, 4	−8.07	0.02	2.02
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−2.84	−5.94	0.81
TERMINATOR/ARRESTER	9, 10, 11, 12	−0.39	−0.38	0.43
2: HIGH WIND				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−1.61	−0.02	0.82
TRANSMISSION CONDUCTOR	2, 3, 4	−4.89	−0.21	1.79
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−1.79	−3.28	0.83
TERMINATOR/ARRESTER	9, 10, 11, 12	−0.20	−0.18	0.31
3: CAMBER				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.55	0.00	0.24
TRANSMISSION CONDUCTOR	2, 3, 4	−2.45	−0.08	0.84
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.60	−1.43	0.24
TERMINATOR/ARRESTER	9, 10, 11, 12	−0.15	−0.15	0.28
4: BROKEN WIRE				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.80	−1.77	0.22
TRANSMISSION CONDUCTOR	2, 3, 4	−2.66	−6.04	1.00
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−1.81	−3.96	0.59
TERMINATOR/ARRESTER	9, 10, 11, 12	−0.17	−0.17	0.31
5: STRINGING				
DESCRIPTION	POSITION	TRANSVERSE	LONGITUDINAL	VERTICAL
SHIELD WIRE	1	−0.34	−0.76	1.00
TRANSMISSION CONDUCTOR	2, 3, 4	−1.57	−3.65	4.61
DISTRIBUTION CONDUCTOR	5, 6, 7, 8	−0.89	−2.04	2.53
TERMINATOR/ARRESTER	9, 10, 11, 12	−0.17	−0.17	0.31



ORIENTATION OF AXES
SCALE: NTS

DESIGN APPLICATION

WIRE DATA

SHIELD WIRE: OPGW SX−29/61/512 (DNO−111227)
TRANSMISSION WIRE: 795 kcmil ACSR "DRAKE"
DISTRIBUTION WIRE/NEUTRAL WIRE: 477 kcmil ACSR "PELICAN"

MECHANICAL LOADING CRITERIA

CASE 1: NESC MEDIUM (RULE 250B):
4 psf WIND @ 15'F, 1/4" ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: VERTICAL 1.5, WIND 2.5, TENSION 1.65.

CASE 2: HIGH WIND − 90 MPH (RULE 250C):
19.9 psf @ 60'F, NO ICE ON SHIELD WIRE AND TRANSMISSION CONDUCTORS,
17.8 psf @ 60'F, NO ICE ON DISTRIBUTION CONDUCTORS,
21.2 psf @ 60'F, NO ICE ON STRUCTURE.
OLF: 1.1 − ALL LOADS.

CASE 3: 60'F CAMBER (FINAL TENSION):
NO WIND @ 60'F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.0 − ALL LOADS.

CASE 4: BROKEN WIRE − ALL AHEAD WIRE AND CONDUCTOR SPANS BROKEN (NESC SPANS AND TENSIONS):
4 psf WIND @ 15'F, 1/4" ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.1 − ALL LOADS.

CASE 5: STRINGING:
2.0 psf @ 60'F, NO ICE ON WIRES, CONDUCTORS AND STRUCTURE.
OLF: 1.1 − ALL LOADS

DESIGN DATA

DESIGN TENSIONS (lbs.)

	NESC		HIGH WIND		CAMBER		STRINGING	
WIRE	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
SHIELD WIRE	1765	1765	1570	1530	710	710	755	770
TRANSMISSION CONDUCTOR	6000	6000	5140	4895	3210	3120	3610	3595
DISTRIBUTION CONDUCTOR	3915	0	3255	0	1550	0	2020	0

SPAN AND ANGLE DATA

	NESC		HIGH WIND		CAMBER		STRINGING	
DESCRIPTION	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD	BACK	AHEAD
HORIZONTAL SPAN	190	145	190	145	190	145	190	145
VERTICAL SPAN SHIELD	380	195	560	240	355	190	370	195
VERTICAL SPAN TRANSMISSION	445	190	530	200	405	180	430	185
VERTICAL SPAN DISTRIBUTION	420	0	565	0	370	0	425	0
LINE ANGLE	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75

GENERAL NOTES

1. THE LOADS IN THE LOADING TABLE ARE ULTIMATE LOADS AND INCLUDE ALL OVERLOAD FACTORS. ALL LOADS IN KIPS EXCEPT WIND "W" IN psf.
2. THE VERTICAL LOADS (V) INCLUDE ONLY DEAD WEIGHT OF THE WIRE AND WEIGHT OF THE INSULATORS. THE DEAD WEIGHT OF THE STRUCTURE SHALL BE CALCULATED BY THE POLE MANUFACTURER AND USED IN THE DESIGN. THE OVERLOAD FACTOR APPLIED TO THE DEAD WEIGHT SHALL BE AS LISTED FOR EACH CASE.
3. FOR STRUCTURAL DESIGN, THE LONGITUDINAL, TRANSVERSE AND VERTICAL LOADS SHALL BE CONSIDERED TO ACT SIMULTANEOUSLY WITH THE WIND AND THE DEAD WEIGHT OF THE STRUCTURE.
4. APPLY STRUCTURE WIND "W" IN THE DIRECTION WHICH PRODUCES THE MAXIMUM STRESS.
5. STRUCTURE SHALL BE DESIGNED TO BE SELF SUPPORTING, GUYS ARE NOT PERMITTED.
6. ATTACH GROUNDING PLATES (DETAIL 1 ON THIS DRAWING) 2'−2" BELOW TOP OF POLE ON FLATS #1 AND #7, 1'−6" BELOW DISTRIBUTION ARMS ON FLATS #4 AND #10, 1'−6" BELOW TERMINATOR/ARRESTER ARMS ON FLATS #4 AND #10 AND 1'−0" ABOVE BASE PLATE ON FLATS #4 AND #10.
7. CLIMBING LADDER CLIPS (DETAIL 9 ON DRAWING S106) TO BE INSTALLED ON FLAT #2 THROUGH THE DISTRIBUTION AND ON FLAT #10 THROUGH THE TRANSMISSION. WORKING LADDER CLIPS TO BE INSTALLED BELOW EACH SHIELD WIRE ATTACHMENT, BELOW EACH TRANSMISSION CONDUCTOR ATTACHMENT AND BELOW EACH DISTRIBUTION ARM.
8. FINISH SHALL BE SELF−WEATHERING STEEL (ASTM A871).

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
A	08/23/24	BDP	ML	60% REVIEW		

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Des By:	BDP	Date	08/23/24
Drawn By:	BDP	Date	08/23/24
Chk'd. By:	KAC	Date	08/23/24
ENGR.	BDP	Date	08/23/24
APPD.	–	Date	–
APPD.	–	Date	–

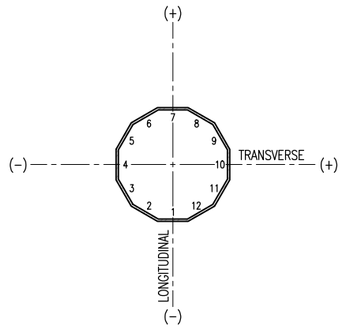
NOT FOR CONSTRUCTION

WASHINGTON CITY
MAIN ST. TAP − −GRAPEVINE SUBSTATION 138KV TRANSMISSION LINE
STRUCTURE #10 − DESIGN DATA

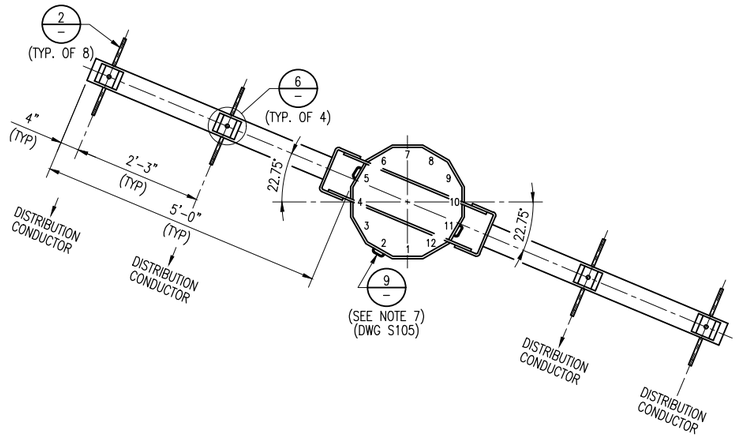
SCALE	DRAWING No.	REVISION
NTS	071−081−S105	A

Project No. 071−079

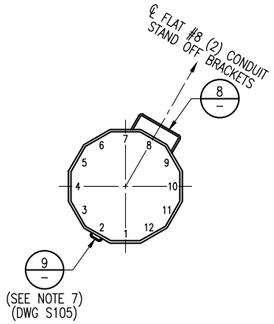
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-081-S105.dwg



ORIENTATION OF AXES
SCALE: NTS



SECTION
SCALE: NTS
DISTRIBUTION ORIENTATION
C / S105



SECTION
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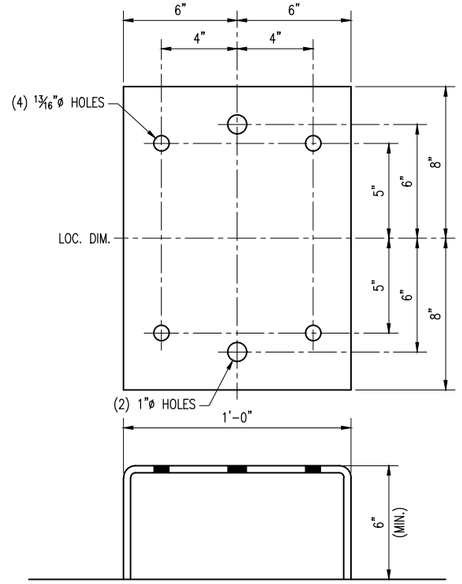
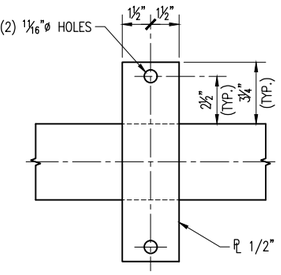
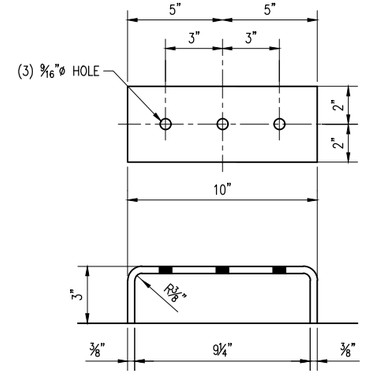
CONDUIT STAND-OFF ORIENTATION
E / S105



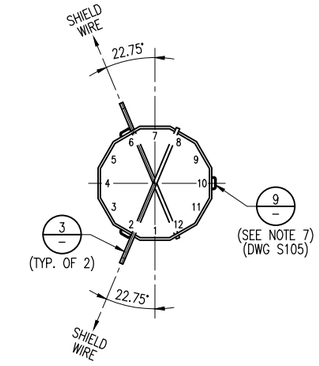
DETAIL
SCALE: NTS
POST INSULATOR BRACKET
5



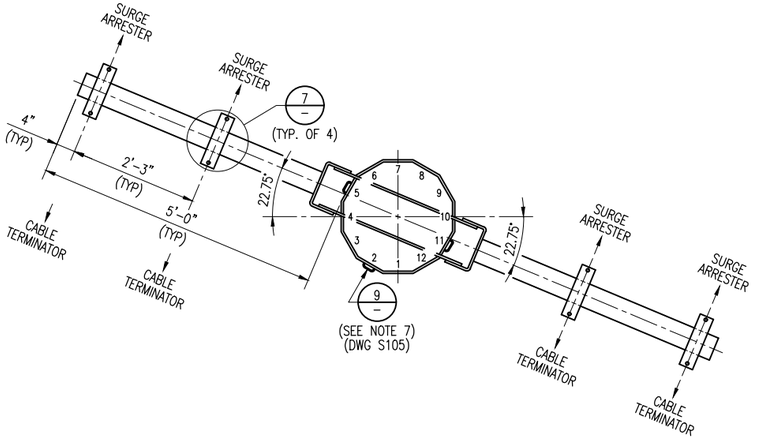
DETAIL
SCALE: NTS
TERMINATOR/ARRESTER BRACKET
7



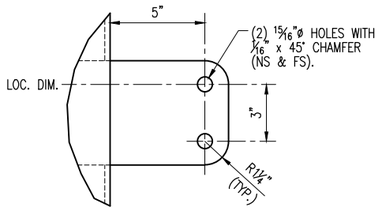
DETAIL
SCALE: NTS
CONDUIT STAND OFF BRACKET
8



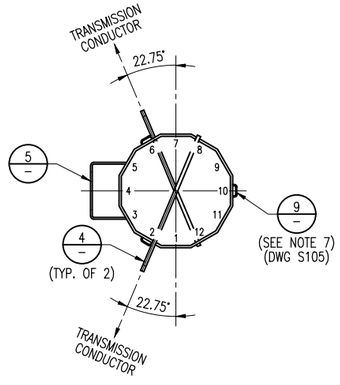
SECTION
SCALE: NTS
SHIELD WIRE ORIENTATION
A / S105



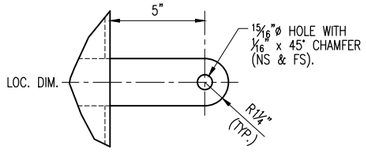
SECTION
SCALE: NTS
TERMINATOR/ARRESTER ORIENTATION
D / S105



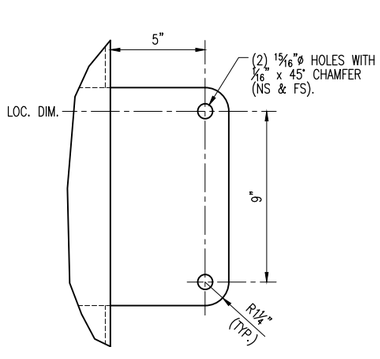
DETAIL
SCALE: NTS
SHIELD WIRE DEADEND ATTACHMENT
3



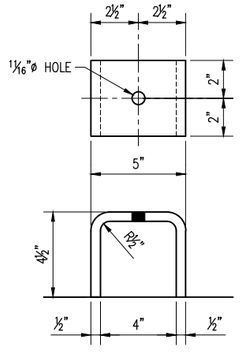
SECTION
SCALE: NTS
TRANSMISSION ORIENTATION
B / S105



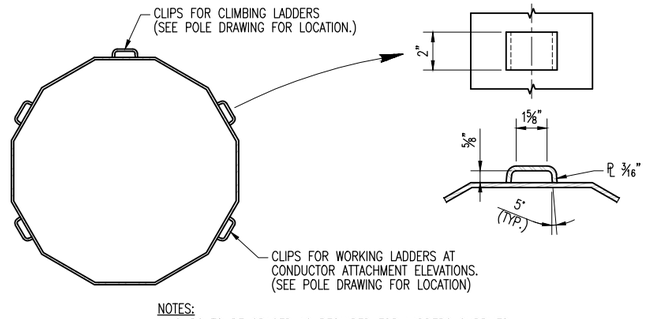
DETAIL
SCALE: NTS
DISTRIBUTION DEADEND ATTACHMENT
2



DETAIL
SCALE: NTS
TRANSMISSION DEADEND ATTACHMENT
4



DETAIL
SCALE: NTS
PIN INSULATOR BRACKET
6



NOTES:
1. CLIPS TO BE SPACED AS REQUIRED FOR LADDERS SUPPLIED.
2. LADDER CLIP DETAIL IS FOR McGREGOR LADDERS ONLY.

DETAIL
SCALE: NTS
LADDER BRACKET
9

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
A	08/01/24	BDP	ML	ISSUED FOR REVIEW		

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Des By:	BDP	Date	03/07/24
Drawn By:	BDP	Date	03/07/24
Chk'd. By:	ML	Date	03/07/24
ENGR.	BDP	Date	03/07/24
APPD.	_	Date	_
APPD.	_	Date	_

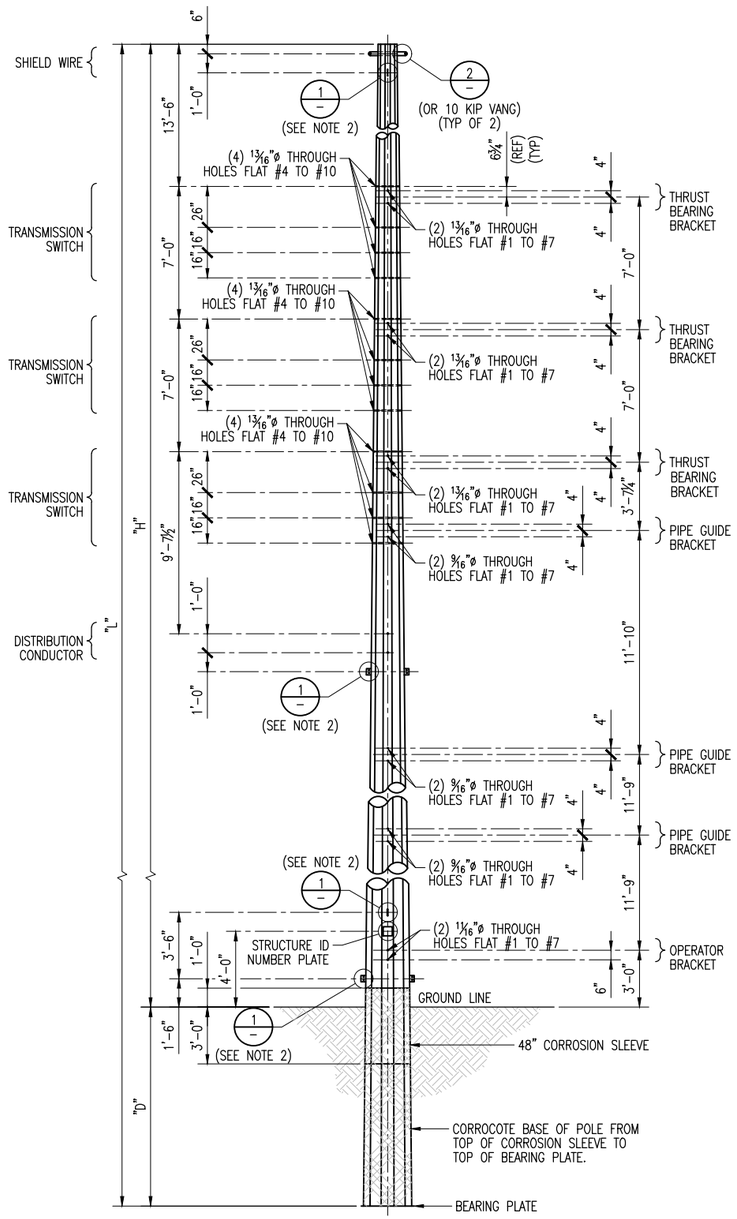
NOT FOR CONSTRUCTION

WASHINGTON CITY
MAIN ST. TAP – GRAPEVINE SUBSTATION 138KV TRANSMISSION LINE
STRUCTURE #10 – SECTIONS AND DETAILS

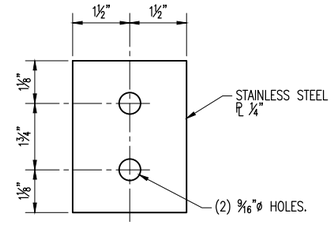
SCALE	DRAWING No.	REVISION
NTS	071-081-S106	A

Project No. 071-079

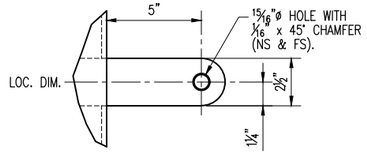
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-081-S106.dwg



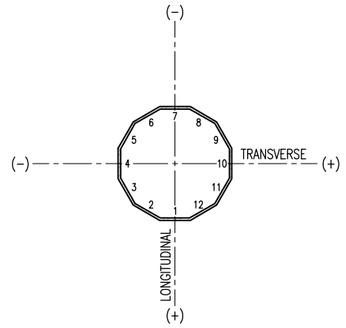
SWITCH STRUCTURE PRE-ENGINEERED POLE
SCALE: NTS



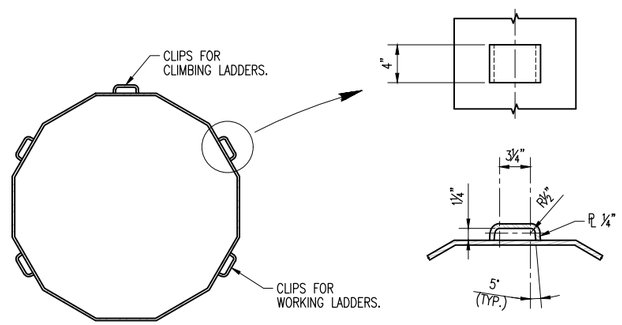
DETAIL 1
SCALE: NTS
GROUNDING PLATE



DETAIL 2
SCALE: NTS
SHIELD WIRE SUSPENSION ATTACHMENT



ORIENTATION OF AXES
SCALE: NTS



NOTES:
1. CLIPS TO BE SPACED AS REQUIRED FOR LADDERS SUPPLIED.
2. LADDER CLIP DETAIL IS FOR McGREGOR LADDERS ONLY.

DETAIL 3
SCALE: NTS
LADDER CLIP DETAIL (SEE NOTE 2)

POLE DESIGN DATA (SEE NOTE 1)

DESCRIPTION \ POLE CLASS	85' S-12.0 (H11) (1 REQ'D)	
POLE NUMBER	#1	
NUMBER OF SIDES	12	
TOTAL LENGTH – "L"	85'	
HEIGHT ABOVE GROUND LINE – "H"	74.5'	
EMBEDMENT DEPTH – "D"	10.5'	
TOP DIAMETER	11.93"	
GROUND LINE DIAMETER	29.02"	
BUTT DIAMETER	31.51"	
POLE THICKNESS	0.25"	
POLE TAPER (in/ft)	0.237618	
POLE WEIGHT (lbs)	5437	
GROUND LINE MOMENT CAPACITY (ft-kips)	866	

DESIGN APPLICATION

WIRE DATA

SHIELD WIRE: OPGW DNO-11127
TRANSMISSION CONDUCTOR: 795 ACSR "DRAKE"
DISTRIBUTION CONDUCTOR: 477 ACSR "PELICAN"

GOVERNING CONDITIONS

SHIELD WIRE:
NESC MEDIUM (1/4" ICE, 4 psf WIND @ 15° F), 1765 lbs. INITIAL TENSION

TRANSMISSION WIRE:
795 ACSR – NESC MEDIUM (1/4" ICE, 4 psf WIND @ 15° F), 6000 lbs. INITIAL TENSION

DISTRIBUTION WIRE:
NO ICE, NO WIND @ 15° F, 20% CONDUCTOR ULTIMATE TENSION, FINAL TENSION

MECHANICAL LOADING CRITERIA

CASE 1: NESC MEDIUM (RULE 250B):
4 psf WIND @ 15°F, 1/4" ICE ON WIRES AND STRUCTURE.
OLF: VERTICAL 1.5, WIND 2.5, TENSION 1.65.

CASE 2: HIGH WIND – 90 MPH (RULE 250C):
21.4 psf WIND @ 60°F, NO ICE ON SHIELD WIRE AND TRANSMISSION WIRES,
21.2 psf WIND @ 60°F, NO ICE ON STRUCTURE.
OLF: 1.1 – ALL LOADS.

DESIGN TENSIONS (lbs.)

WIRE	NESC MEDIUM BACK	NESC MEDIUM AHEAD	HIGH WIND BACK	HIGH WIND AHEAD
SHIELD WIRE	1765'	1765'	1565	1565
TRANSMISSION	6000'	6000'	5190	5005
DISTRIBUTION	3810'	3810'	3130	3130

SPAN AND ANGLE DATA

DESCRIPTION	NESC MEDIUM BACK	NESC MEDIUM AHEAD	HIGH WIND BACK	HIGH WIND AHEAD
HORIZONTAL SPAN	170'	165'	170'	165'
VERTICAL SPAN SHIELD	-75'	220'	-290'	275'
VERTICAL SPAN TRANSMISSION	-175'	215'	-290'	230'
VERTICAL SPAN DISTRIBUTION	-60'	205'	-195'	230'
LINE ANGLE	0.2°		0.2°	

GENERAL NOTES

1. VALUES OBTAINED FROM MEYER UTILITY STRUCTURES CATALOG.
2. ATTACH GROUNDING PLATES (DETAIL 1 ON THIS DRAWING) 1'-6" BELOW TOP OF POLE ON FLATS #1 AND #7, 1'-0" BELOW BOTTOM DISTRIBUTION CONDUCTOR HOLE ON FLATS #4 AND #10, 5'-0" ABOVE CORROSION SLEEVE ON FLATS #1 AND #7 AND 6" ABOVE CORROSION SLEEVE ON FLATS #4 AND #10.
3. CLIMBING LADDER CLIPS (DETAIL 3 ON THIS DRAWING) TO BE INSTALLED ON FLAT #7. WORKING LADDER CLIPS TO BE INSTALLED BELOW EACH SHIELD WIRE ATTACHMENT ON FLATS #4 AND #10, BELOW EACH SET OF TRANSMISSION SWITCH HOLES ON FLATS #4 AND #10 AND BELOW DISTRIBUTION CONDUCTOR HOLES ON FLATS #4 AND #10.
4. FINISH SHALL BE SELF WEATHERING STEEL (ASTM A871).
5. CORROCOTE BASE OF POLE FROM TOP OF CORROSION SLEEVE TO TOP OF BEARING PLATE.

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/01/24	BDP	ML	60% REVIEW		

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CONFIDENTIAL

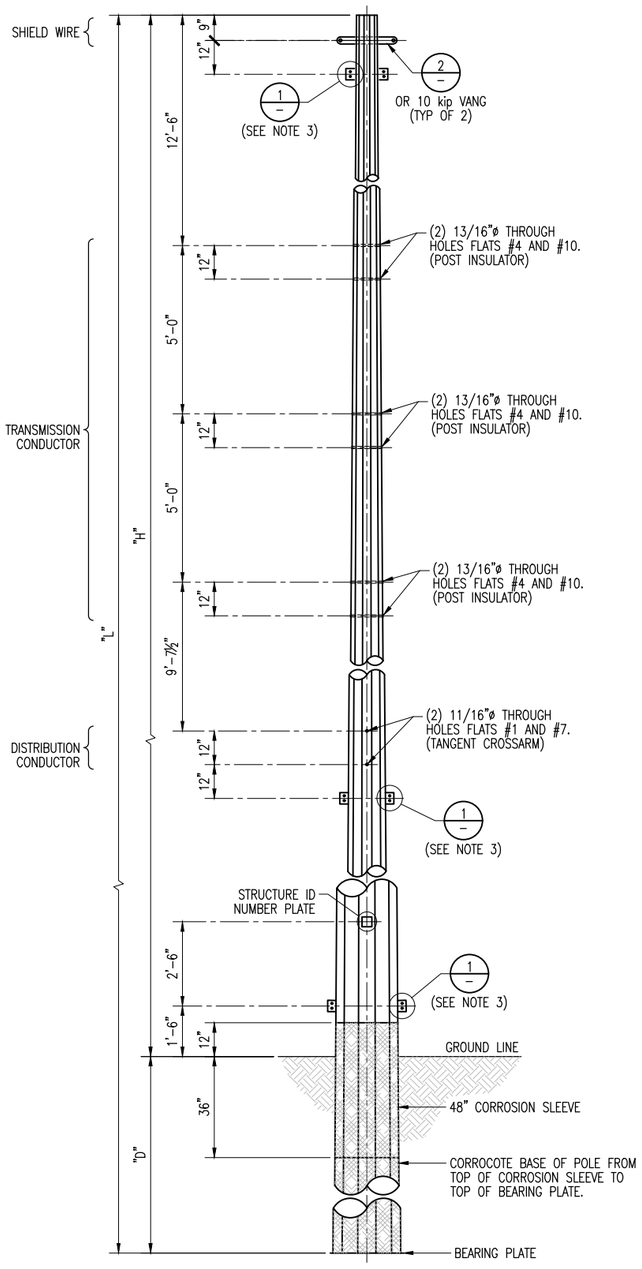
Des By:	BDP	Date	03/07/24
Drawn By:	BDP	Date	03/07/24
Chk'd. By:	ML	Date	03/07/24
ENGR.	BDP	Date	03/07/24
APPD.	_	Date	_
APPD.	_	Date	_

NOT FOR CONSTRUCTION

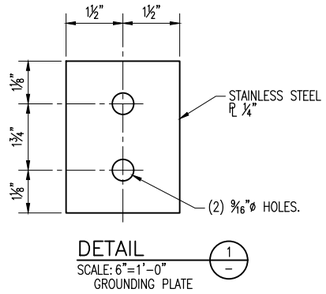
WASHINGTON CITY
MAIN ST. TAP – GRAPEVINE SUBSTATION 138KV TRANSMISSION LINE
PRE-ENGINEERED POLES – DESIGN DATA

SCALE: NTS
Project No. 071-079
DRAWING No. 071-081-S115
REVISION B

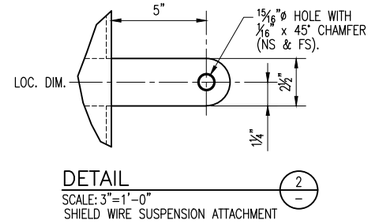
PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-081-S115.dwg



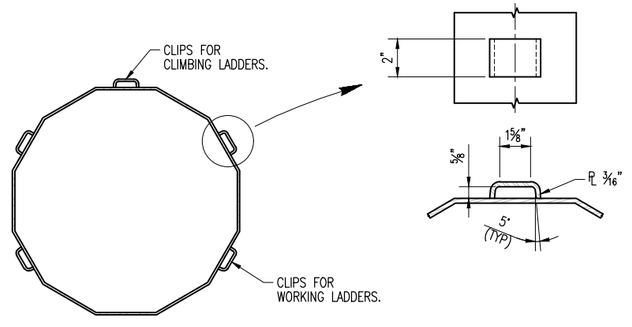
TANGENT STRUCTURE PRE-ENGINEERED POLE
SCALE: NTS



DETAIL 1
SCALE: 6"=1'-0"
GROUNDING PLATE

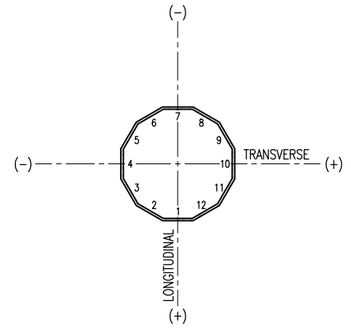


DETAIL 2
SCALE: 3"=1'-0"
SHIELD WIRE SUSPENSION ATTACHMENT



NOTES:
1. CLIPS TO BE SPACED AS REQUIRED FOR LADDERS SUPPLIED.
2. LADDER CLIP DETAIL IS FOR McGREGOR LADDERS ONLY.

DETAIL 3
SCALE: 1/2"=1'-0"
LADDER CLIP DETAIL
(SEE NOTE 2)



ORIENTATION OF AXES
SCALE: NTS

POLE DESIGN DATA (SEE NOTE 1)

DESCRIPTION \ POLE CLASS	80' S-02.9 CLASS 1 (1 REQ'D)	75' S-03.5 (H1) (3 REQ'D)	85' S-04.2 (H2) (1 REQ'D)	75' S-05.7 (H4) (1 REQ'D)
POLE NUMBER	#6	#2, #3, #8	#9	#4
NUMBER OF SIDES	12	12	12	12
TOTAL LENGTH – "L"	80'	75'	85'	75'
HEIGHT ABOVE GROUND LINE – "H"	70'	65.5'	74.5'	65.5'
EMBEDMENT DEPTH – "D"	10'	9.5'	10.5'	9.5'
TOP DIAMETER	8.69"	8.69"	8.69"	9.66"
GROUND LINE DIAMETER	16.32"	16.86"	19.57"	21.52"
BUTT DIAMETER	17.48"	18.12"	21.17"	23.31"
POLE THICKNESS	0.1875"	0.1875"	0.1875"	0.1875"
POLE TAPER (in/ft)	0.116104	0.132332	0.152616	0.188645
POLE WEIGHT (lbs)	2283	2213	2771	2757
GROUND LINE MOMENT CAPACITY (ft-kips)	197	221	299	357

DESIGN APPLICATION

WIRE DATA

SHIELD WIRE: OPGW DNO-11127
TRANSMISSION CONDUCTOR: 795 ACSR "DRAKE"
DISTRIBUTION CONDUCTOR: 477 ACSR "PELICAN"

GOVERNING CONDITIONS

SHIELD WIRE:
NESC MEDIUM (1/4" ICE, 4 psf WIND @ 15° F), 2400 lbs. INITIAL TENSION

TRANSMISSION WIRE:
795 ACSR – NESC MEDIUM (1/4" ICE, 4 psf WIND @ 15° F), 5000 lbs. INITIAL TENSION

DISTRIBUTION WIRE:
NO ICE, NO WIND @ 15° F, 20% CONDUCTOR ULTIMATE TENSION, FINAL TENSION

MECHANICAL LOADING CRITERIA

CASE 1: NESC MEDIUM (RULE 250B):
4 psf WIND @ 15°F, 1/4" ICE ON WIRES AND STRUCTURE.
OLF: VERTICAL 1.5, WIND 2.5, TENSION 1.65.

CASE 2: HIGH WIND – 90 MPH (RULE 250C):
21.4 psf WIND @ 60°F, NO ICE ON SHIELD WIRE AND TRANSMISSION WIRES,
21.2 psf WIND @ 60°F, NO ICE ON STRUCTURE.
OLF: 1.1 – ALL LOADS.

SPAN AND ANGLE DATA – 80' S-02.9 CLASS 1

DESCRIPTION	NESC MEDIUM	HIGH WIND
HORIZONTAL SPAN	230'	230'
VERTICAL SPAN SHIELD	130'	55'
VERTICAL SPAN TRANSMISSION	220'	220'
VERTICAL SPAN DISTRIBUTION	350'	415'
LINE ANGLE	0°	0°

SPAN AND ANGLE DATA – 75' S-03.5 (H1)

DESCRIPTION	NESC MEDIUM	HIGH WIND
HORIZONTAL SPAN	335'	335'
VERTICAL SPAN SHIELD	235'	140'
VERTICAL SPAN TRANSMISSION	230'	195'
VERTICAL SPAN DISTRIBUTION	260'	210'
LINE ANGLE	0°	0°

SPAN AND ANGLE DATA – 85' S-04.2 (H2)

DESCRIPTION	NESC MEDIUM	HIGH WIND
HORIZONTAL SPAN	355'	355'
VERTICAL SPAN SHIELD	325'	290'
VERTICAL SPAN TRANSMISSION	340'	335'
VERTICAL SPAN DISTRIBUTION	390'	410'
LINE ANGLE	0°	0°

SPAN AND ANGLE DATA – 75' S-05.7 (H4)

DESCRIPTION	NESC MEDIUM	HIGH WIND
HORIZONTAL SPAN	290'	290'
VERTICAL SPAN SHIELD	215'	150'
VERTICAL SPAN TRANSMISSION	230'	215'
VERTICAL SPAN DISTRIBUTION	295'	295'
LINE ANGLE	2.6°	2.6°

GENERAL NOTES

1. VALUES OBTAINED FROM MEYER UTILITY STRUCTURES CATALOG.
2. ATTACH GROUNDING PLATES (DETAIL 1 ON THIS DRAWING) 1'-6" BELOW TOP OF POLE ON FLATS #1 AND #7, 1'-0" BELOW BOTTOM DISTRIBUTION CONDUCTOR HOLE ON FLATS #4 AND #10 AND 6" ABOVE CORROSION SLEEVE ON FLATS #4 AND #10.
3. CLIMBING LADDER CLIPS (DETAIL 3 ON THIS DRAWING) TO BE INSTALLED ON FLAT #1. WORKING LADDER CLIPS TO BE INSTALLED BELOW EACH SHIELD WIRE ATTACHMENT ON FLATS #4 AND #10, BELOW EACH SET OF TRANSMISSION CONDUCTOR HOLES ON FLATS #4 AND #10 AND BELOW DISTRIBUTION CONDUCTOR HOLES ON FLATS #4 AND #10.
4. FINISH SHALL BE SELF WEATHERING STEEL (ASTM A871).
5. CORROCOTE BASE OF POLE FROM TOP OF CORROSION SLEEVE TO TOP OF BEARING PLATE.

No.	DATE	BY	APP	REVISION	REFERENCE DRAWING	NUMBER
B	11/27/24	KAC	ML	90% REVIEW		
A	08/01/24	BDP	ML	60% REVIEW		

Washington City
Feels Like Home

ICPE CONSULTING ENGINEERS

Des By: BDP	Date	03/07/24
Drawn By: BDP	Date	03/07/24
Chk'd. By: ML	Date	03/07/24
ENGR. BDP	Date	03/07/24
APPD. _	Date	_
APPD. _	Date	_

NOT FOR CONSTRUCTION

WASHINGTON CITY
MAIN ST. TAP – GRAPEVINE SUBSTATION
138KV TRANSMISSION LINE
PRE-ENGINEERED POLES – DESIGN DATA

SCALE: NTS | DRAWING No. 071-081-S116 | REVISION B
Project No. 071-079

PLOTTED ON 11/27/2024 BY KERRY CARLSON, DRAWING LOCATION: L:_DWGs\WAS071 Washington City\WAS071-079 Transmission Line to Grapevine Sub\201 Drawings\201.02 Structural Drawings\Steel\071-081-S116.dwg

BID DOCUMENTS
WASHINGTON CITY
GRAPEVINE / PARKWAY
TRANSMISSION LINES

PRE-ENGINEERED LIGHT DUTY STEEL POLES
CUSTOM TUBULAR STEEL POLES

November 2024

ICPE
CONSULTING ENGINEERS

Intermountain Consumer
Professional Engineers, Inc.
1145 East South Union Avenue
Midvale, Utah 84047
(801) 255-1111

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PART 1 - NOTICE TO BIDDERS

NOTICE TO BIDDERS:

Proposals (Bids) will be received by Washington City ("Purchaser") until 3:00 p.m. current mountain time (MST) on ***December 31, 2024***, for the (28) twenty-eight Pre-Engineered Light Duty and (7) seven Custom Tubular steel poles for installation in the Purchaser's 69kV Parkway to Grapevine Substation Transmission Line. Bids shall be in accordance with the Bid Documents prepared by ICPE Consulting Engineers, Inc. ("ICPE"), hereinafter referred to as the "Engineer".

Bids shall be submitted by email addressed to:

Tara Pentz
City Recorder
Washington City
111 North 100 East
Washington City, UT 84780
Email: tpentz@washingtoncity.org

The Bids will be opened and evaluated by Washington City.

The purchaser will only enter one contract for the purchase of the (28) twenty-eight Pre-Engineered Light Duty and (7) seven Custom Tubular steel poles to be supplied under these Bid Documents.

The preferred delivery date to the project site is on or before *October 1, 2025***.** If this is not achievable, then please provide the earliest possible delivery.

The Purchaser reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of Washington City.

PART 2 - INSTRUCTIONS TO BIDDERS

A. SCOPE OF CONTRACT:
Bidder shall be fully responsible for all labor, material, and equipment necessary for complete fabrication of the required (28) twenty-nine Pre-Engineered Light Duty and (7) six Custom Tubular steel poles (installed on concrete foundation) for installation in the Purchaser's 69kV Parkway to Grapevine Substation Transmission Line in accordance with applicable Purchase Specification included subsequently in these Bid Documents.

B. SECURING AND COMPLIANCE WITH BID DOCUMENTS:
Bidders shall comply with all conditions stipulated in said Bid Documents.

C. INTERPRETATION AND CORRECTION OF DRAWINGS AND DOCUMENTS:

1. The Bidder shall examine all Bid Documents and fully understand all conditions and matters that can in any way affect the work or cost thereof. Should the Bidder find discrepancies in, or omissions from, the Bid Documents, or should the Bidder be in doubt as to the meaning of the documents, the Bidder should notify the Washington City Engineer as follows:

   Matt Levorsen, PE
   Chief Electrical Engineer
   ICPE Consulting Engineers
   1145 E South Union Ave
   Midvale UT, 84047
   Email: matt.levorsen@icpeinc.com

   to obtain clarification prior to submitting its proposal. Proposals that lack specific details and commitments may be considered unacceptable and rejected.

2. It shall be the Bidder's responsibility to advise the City & Engineer, at least (7) seven days before the time specified for receipt of bids, of conflicting requirements or omissions of information which require clarification. Those questions not resolved by addenda shall be listed in the space provided on the Pricing Schedule, together with statements of the basis upon which the bid is made as affected by each question.

3. The Engineer will promptly clarify the part of the Bid Documents or drawings in question and issue written instructions to all prospective Bidders. Any interpretation of the Bid Documents will be made only by addendum transmitted to each party receiving a set of such documents. Verbal instructions or interpretations will have no validity, regardless of source.

D. PREPARING AND SUBMITTING BIDS:

1. Bids shall be prepared on the Pricing Schedule included with these Bid Documents. Bidders are required to print the completed form to PDF, sign, scan to PDF and return with the spreadsheet.

2. Bids shall bear no marks, erasures, or writing changes, other than those provided or requested.

3. No verbal or telephone bid modifications or cancellations will be considered.

4. Revision or withdrawal of bids shall not be allowed for a period of 30 days after the bid opening date.
5. Bid shall be signed by a Principal of the Bidder duly authorized to sign contracts.
6. Bid proposals shall reflect the cost of all work required by the bidding documents, plus additions, deletions, or modifications required by addenda issued prior to bid opening.
7. All emails shall be clearly marked “Pre-Engineered Light Duty and Custom Tubular Steel Poles – Washington City – 69kV Parkway to Grapevine Substation Transmission Lines”.
8. Bid submittal time and date is as per the Notice to Bidders found in this Bid Document.
9. It is the bidder’s sole responsibility to see that the bid is received at the proper time and place. Any bid received after scheduled bid opening will be considered non-responsive.

E. EXCEPTIONS:

1. Each Bidder shall indicate on the Pricing Schedule any exceptions to the specification and bid documents. If the Bidder takes no exceptions, Bidder shall indicate on the Pricing Schedule that no exceptions are taken. Proposals which do not comply with this requirement will be considered irregular and may be rejected at the discretion of the Purchaser. In case of any exception not described in the bid proposal, the requirements of the specification and bid documents shall govern.
2. If the Bidder takes exception, all such exceptions shall be specific in nature and carefully referenced to the applicable page number, article number, and article title of the specification and bid documents. If the Bidder proposes deletion of specification or bid document language and substitution of revised language, such deletion and substitution shall be carefully presented by typing complete paragraphs or articles of the original specification or bid document language and incorporating the substitute language. Proposed deletions shall be set off by brackets, thus: [delete this language], and proposed substitute language shall be indicated by underlining, thus: substitute this language. Exceptions which are general, which refer to the Bidder's standard terms and conditions, or which refer to the Bidder's descriptive information will not be acceptable. Proposals which do not comply with these requirements for the presentation of exceptions will not be acceptable and may be rejected.
3. If a proposal includes express or implied exceptions that are not listed as required, the requirements of the specifications and documents shall govern. The Bidder shall not alter any part of the specifications and documents in any way, except by stating the exceptions.

F. BID WITHDRAWALS:
Prior to the bid due date, Bidders may withdraw a bid by electronic request.

G. BID DUE DATE:
The bid due date shall be as shown in the Notice to Bidders found elsewhere in these Bid Documents.

H. BID PROPOSAL:

1. Firm prices shall be quoted.
2. The Purchaser reserves the right to waive minor irregularities or minor errors in any proposal if it appears to the Purchaser that such irregularities or errors were made inadvertently. Any such irregularities or errors so waived must be corrected in the

Proposal in which they occur prior to the execution of any contract which may be awarded thereon.

3. All Bidders will be notified of any changes in the Bid Documents in addendum letters. Receipt of addendum letters must be acknowledged in the bid proposal.

I. AWARD OR REJECTION OF BID:
The Purchaser reserves the right to reject any and all bids and to waive any irregularities included therein.

J. ACCEPTANCE OF BID:
No Bidder shall consider themselves under contract until a Letter of Acceptance, bearing an authorized signature(s), is provided by the Purchaser to the Bidder.

PART 3 - GENERAL REQUIREMENTS

A. SCOPE:
The purpose of these General Requirements is to describe the data and other requirements pertaining to the Pre-engineered Light Duty and Custom Tubular Steel Poles (installed on concrete foundation) for installation in the Purchaser's 69kV Parkway to Grapevine Substation Transmission Line. Bids for the Pre-engineered Light Duty and Custom Tubular Steel Poles are being requested.

B. CORRESPONDENCE:
All proposals and other questions regarding the Bid Documents shall be addressed to the Washington City Engineer as follows:

Matt Levorsen, PE
Chief Electrical Engineer
ICPE Consulting Engineers
1145 E South Union Ave
Midvale UT, 84047
Email: matt.levorsen@icpeinc.com

C. BID PROPOSAL:

1. Firm prices shall be quoted. The Bidder's proposal shall not include applicable state sales taxes. Purchaser is tax exempt and will provide proof of exemption upon acceptance of bid proposal. Any price escalation factors employed to establish an invoice price are to be clearly stated and fully explained on the Pricing Schedule.
2. All Bids shall be marked "Pre-Engineered Light Duty and Custom Tubular Steel Poles – Washington City – 69kV Parkway to Grapevine Substation Transmission Lines".
3. The Purchaser reserves the right to accept or reject any or all bids, or any portion thereof.
4. The Purchaser reserves the right to waive minor irregularities or minor errors in any proposal if it appears to the Purchaser that such irregularities or errors were made inadvertently. Any such irregularities or errors so waived must be corrected in the Proposal in which they occur prior to the execution of any contract which may be awarded thereon.
5. All Bidders will be notified of any changes in the Bid Documents by addendum notifications. Receipt of addendum notifications must be acknowledged in the bid proposal.

D. BID EVALUATION:

1. The Purchaser will consider the prices and delivery dates as only two of the many factors making up the total value of the steel poles to be purchased. To properly evaluate other factors, Supplier shall provide the following information in their proposal:
   a. Location of the nearest Field Service Engineer(s) who can provide field service for the proposed Pre-engineered Light Duty and Custom Tubular Steel Poles.
   b. How much (if any) Field Service Engineer's time is included in the quoted price for the steel poles? If not included in the quoted price, the Field Service Engineer cost shall be provided in the space provided in the Pricing Schedule.
2. Other items which will be considered in the bid evaluation are:
   a. The Bidder's past performance in providing steel transmission line structures.
   b. Meeting quoted deliveries.
   c. The Bidder's past ability and willingness to solve problems that have arisen in a complete and satisfactory manner.
   d. The Bidder's deviations from specifications.
   e. Warranties.
   f. Manufacturer's cancellation policy.

E. NOTICE OF ACCEPTANCE:
It is anticipated that a Notice of Acceptance and/or Purchase Order for the galvanized or self-weathering Pre-Engineered Light Duty and Custom Steel Poles Iron Poles will be issued to the successful Bidder(s) within thirty (30) days after the due date for the receipt of the bid proposals. All bids shall remain valid for sixty (60) days.

F. DELIVERY AND SHIPPING:

1. Delivery dates shall be indicated in the Bidders proposal and delivery shall not be later than indicated unless otherwise mutually agreed to by the Owner and Bidder. Washington City desires delivery of the steel poles as soon as possible. The proposed delivery date(s) for the steel poles will be a prime consideration during the bid evaluation. The Date of shipment shall be as promised by the Bidder, based upon prompt receipt of all necessary information. The date of shipment shall be defined as the date the bill of lading is signed by the carrier.
2. Washington City shall be notified 48 hours prior to the arrival of the poles at the delivery site.
3. Any change in the delivery date shall be reported to Washington City immediately by telephone or email, followed by a written confirmation and explanation thereof. The delivery date shall be extended for the period of any reasonable delay due exclusively to causes beyond the control and without the fault of the Seller.
4. Shipping shall be FOB destination located at the Grapevine trail head. Approximate address is N Washington Pkwy and Exit 13. Poles top and bottom pieces for each pole shall be on the same truck. The title to the poles furnished hereunder shall pass to the Purchaser at the destination point.
5. On the same day that any shipment to the purchaser is originated, a transmission, including the following information, shall be forwarded to the Purchaser at the address shown below:
   a. Packing List – Two (2) copies.
   b. Bill of Lading – Original and two (2) copies.

c. Packing list shall also accompany each shipment.

Rick Hansen
Washington City
111 North 100 East
Washington City, UT 84780
Email: rhansen@washingtoncity.org

G. INVOICING:

Rick Hansen
Washington City
111 North 100 East
Washington City, UT 84780
Email: rhansen@washingtoncity.org

H. PAYMENT:
Upon shipment of the steel poles, the Bidder shall submit to the Purchaser a detailed invoice for the steel poles. Purchaser shall make payment to the Seller within 30 days after delivery of the steel poles and the receipt of an invoice.

I. CANCELLATION:
In the event the Purchaser shall be required, or deems it advisable, to suspend or terminate the work being performed pursuant to these Bid Documents, the Purchaser may do so at any time by written notice to the Bidder. In such cases, the Bidder shall take whatever action with respect to work in process as would minimize the Bidder's claim against the Purchaser. The Purchaser would pay the Seller a reasonable suspension or termination charge for all disbursements or expenses which the Seller has incurred or become obligated for prior to the date of notice of cancellation, less the reasonable resale value of the materials which shall have been obtained or ordered to become an integral part of the work and excluding any allowance for anticipated profits on the unperformed portion of the work. Reimbursement portions of this section shall not apply to cancellations caused by design changes by the Bidder not authorized by the Purchaser or by delivery of material beyond the quoted delivery date(s) not authorized by the Purchaser.

J. EXCEPTIONS:
Any exceptions to the Bid Documents shall be clearly stated in the Bidder's proposal. The fact that there are exceptions will not necessarily preclude the selection of the Bidder's proposal. Exceptions will be itemized and considered in the evaluation of the proposal. If no exceptions to the Bid Documents are taken by the Bidder, this shall also be clearly stated in the Bidder's proposal. Alternative offerings will be considered, but they must be clearly indicated as alternatives.

K. WARRANTY:
Manufacturer shall warrant to Purchaser that the materials and/or services to be furnished hereunder are of the highest quality and free from defects in material, workmanship, and title and will be of the kind described in these Bid Documents, the Purchase Specification, and the pertinent Purchase Order. All materials shall be new. The Manufacturer's warranty shall be effective for a minimum period of twelve (12) months after the date of shipment to Purchaser. Terms of Manufacturer's warranty shall be included in the bid proposal and will be a criterion for evaluation of the proposal.

L. STANDARDS:

1. Unless otherwise stated, the latest revisions of the standards of ANSI, NEMA, IEEE, ASTM, NEC, NESC and UL, shall be met in the design, testing, and manufacturing of the

Pre-engineered Light Duty and Custom Tubular Steel Pole(s)/Structure(s) covered by these Bid Documents. In the event a conflict occurs between these codes and the Purchase Specification included subsequently herein, the more stringent requirements shall govern.

2. All materials and devices shall be in accordance with the applicable requirements of the Federal "Occupational Safety and Health Standards."
3. Only new steel pole(s) of recent manufacture shall be furnished.
4. Manufacturer to notify Washington City of proposed schedule.
5. Manufacturer to request "ISSUED FOR FABRICATION" drawings prior to fabrication to meet all submitted delivery date requirements.

M. INSPECTION:

A representative of the Purchaser shall be allowed free access, at all reasonable times, to the Manufacturer's facilities and those of the manufacturer's suppliers for inspection of the Pre-Engineered Light Duty and Custom Tubular Steel Poles, or any of their parts, and to obtain information on the progress of the work. Any work or material found to be defective, or which does not meet the requirements of this Specification may be rejected and shall be replaced by the Manufacturer at its own expense. Such an inspection, however, shall not relieve the Manufacturer of responsibility for the quality and correctness of the work.

APPENDIX A
Pricing Schedule
(see Provided Spreadsheet)

APPENDIX B
Drawings

STEEL POLE DRAWINGS:

Drawing No. S101 - STEEL POLE DESIGN DATA POLE #5 (12° D.E. W/U.B.)

Drawing No. S102 - STEEL POLE DESIGN DATA POLE #5 (12° D.E. W/U.B.) DETAILS

Drawing No. S103 - STEEL POLE DESIGN DATA POLE #7 (16° D.E. W/U.B.)

Drawing No. S104 - STEEL POLE DESIGN DATA POLE #7 (16° D.E. W/U.B.) DETAILS

Drawing No. S105 - STEEL POLE DESIGN DATA POLE #10 (45° D.E. W/U.B.)

Drawing No. S106 - STEEL POLE DESIGN DATA POLE #10 (45° D.E. W/U.B.) DETAILS

Drawing No. S107 - STEEL POLE DESIGN DATA POLE #11 (88° D.E.)

Drawing No. S108 - STEEL POLE DESIGN DATA POLE #11 (88° D.E.) DETAILS

Drawing No. S109 - STEEL POLE DESIGN DATA POLE #14 (76° D.E. W/U.B.)

Drawing No. S110 - STEEL POLE DESIGN DATA POLE #14 (76° D.E. W/U.B.) DETAILS

Drawing No. S111 - STEEL POLE DESIGN DATA POLE #15 (82° D.E. W/U.B.)

Drawing No. S112 - STEEL POLE DESIGN DATA POLE #15 (82° D.E. W/U.B.) DETAILS

Drawing No. S113 - STEEL POLE DESIGN DATA POLE #12 (0° W/U.B.)

Drawing No. S114 - STEEL POLE DESIGN DATA POLE #12 (0° W/U.B.) DETAILS

Drawing No. S115 - PRE-ENGINEERED POLE TANGENT W/U.B. & SWITCH

Drawing No. S116 - PRE-ENGINEERED POLES TANGENT W/U.B.

Drawing No. S117 - PRE-ENGINEERED POLE TANGENT W/U.B. & SWITCH

Drawing No. S118 - PRE-ENGINEERED POLES TANGENT W/U.B.

APPENDIX C
Purchase Specification

PURCHASE SPECIFICATION
TUBULAR STEEL TRANSMISSION LINE STRUCTURES

PART 1 - SCOPE

1.1 This specification outlines minimum requirements for the design, design loadings, material, fabrication, protective coating, and inspection of Pre-engineered (Light Duty) and Custom Tapered Tubular Steel Poles.

1.2 The steel poles and all associated elements (shall be designed and manufactured in the US unless otherwise approved in writing by the Purchaser.

PART 2 - DESIGN

2.1 Stress calculations shall be based upon an elastic analysis. The effects of deflection shall be included in the analysis.

2.2 Allowable stresses in poles and their components shall be in accordance with ANSI/NEMA Standard No. TT1-Tapered Tubular Steel Structures and ASCE's “Design of Steel Transmission Pole Structures”.

2.3 Pole geometry shall be in accordance with information included on the "Steel Pole Drawings.” The base plate is considered as part of the pole and its design shall be in accordance with this specification.

2.4 Anchor bolts are, when required, considered to be part of the pole, and shall be designed and supplied as required. Allowable bond stresses are to be as described in ANSI/NEMA Publication TT1 Tapered Tubular Steel Structures. The compressive strength of the concrete is assumed to be 3000 psi unless otherwise specified. Anchor bolts, number, lengths, and placement (location) shall be determined by the Supplier.

2.5 The allowable shear for anchor bolts will be 0.65 x proof load, where the proof load is calculated from proof stress values given in ASTM. For allowable values for combined shear and tension use ACSE 2.2.7.3.

PART 3 - LOADINGS

3.1 Pole loadings have been specified to fully encompass the requirements of the National Electrical Safety Code as well as any unique climactic or other loading conditions which may be applicable. A one-degree foundation rotation shall be incorporated into the design of Custom Steel Poles requiring reinforced concrete foundations. As a minimum, the following loading conditions shall be considered:

A. NESC Medium.

B. NESC High Wind.

C. NESC Concurrent Ice/Wind.

3.2 Additional loading conditions that may require consideration are:

A. Camber.

B. Broken Conductor.

3.3 Simultaneous Application of Loads: The vertical, transverse, and longitudinal loads previously specified relate to loadings on the wires and structures. The vertical, transverse, and longitudinal load components on the supporting structure should be considered as acting simultaneously.

3.4 Deflection Limits: Pole top deflection shall not exceed three percent of the pole height above ground for the 60° F design load case, unless otherwise specified on the drawings. See Case 3 on drawings for overload factors. All un-guyed angle poles or un-guyed dead-end poles may be precambered to remain plumb when the calculated deflection at the top of pole exceeds this deflection criteria, unless specified otherwise on drawings provided. Structure height shall be the height of the structure from the top of the base plate, or designed ground line, to the top of the structure. If pre-cambering is not required, the supplier shall provide in tabular form the amount of required structure raking to maintain each specified engineered structure as vertically plumb under a final conductor tension loading of 60° F. See Case 3 on drawings for overload factors.

Engineered Tubular Steel Poles (with switch mounting) shall have a pole top deflection shall not exceeding one percent of the pole height above ground at NESC loads (with overload factors) applied, unless otherwise specified on the drawings. Cambering or raking is not allowed on engineered tubular steel poles with switch mounting present.

3.5 The applicable loading requirements are specified in the "Drawings" which are included as part of this specification.

PART 4 - MATERIAL PROPERTIES

4.1 General: All material shall comply with the applicable requirements of ASTM unless otherwise specified.

4.2 Steel Properties: The impact properties in the longitudinal direction of material, which is essential to the strength of the structure, shall be determined in accordance with the Charpy "V" notch test described in ASTM A370 and shall meet the requirements of Table 1, below. The absorbed energy requirements for sub-sized test specimens shall be in accordance with ASTM A370 and A673, Table 1.

TABLE 1

Specified Yield KSI	Plate Thickness or Bar Diameter Inches	Absorbed Energy Ft-lb	Temperature Degrees F
<42	≤½	None	Required
	>½	15	+40
≥42	≤½	15	0
	>½	15	-20

4.3 Heat lot testing shall be used to determine whether the product meets the impact property requirements. Steel used in galvanized structures shall have silicon content less than 0.06% for plates less than 1-1/4" thick; for thicknesses greater than 1-1/4" silicon shall be 0.15 to 0.3%.

4.4 Poles (including embedded sections), Ground Sleeves, Bearing Plates, Arms, Arm Attachment Plates and Conductor Brackets: Material shall conform to the applicable ASTM specification(s) as specified by the Owner. If not specified, any combination of the following structural steels may be used:

A. ASTM A36

B. ASTM A572

C. ASTM A588.

D. ASTM A871.

E. The steel shall conform to the latest revisions of the ASTM specifications and have ASTM minimum yield strength equal to or greater than the value used in the design calculations.

4.5 Base Plate: Materials for the base plate plates of Custom Steel Poles shall conform to ASTM A588, A871, ASTM A633 Gr E, or ASTM A36 (latest revisions). The ASTM yield strength of the material used shall be equal to or greater than values used in the design calculations.

4.6 Corrosion Sleeves: Direct embedded poles shall include a corrosion sleeve. The corrosion sleeve shall be made of the same material as the pole, be 3/16 inch thick, and extend from three feet below the ground line to one foot above the ground line, unless otherwise indicated in the drawings.

4.7 Bearing Plate: Direct embedded poles shall include a bearing plate. The bearing plate shall be made of the same material as the pole, be 3/8 inch thick (minimum), and have a diameter two inches greater than the pole diameter. The bearing plate shall be welded to the bottom of the pole.

4.8 Anchor Bolts and Nuts: Material shall conform to ASTM A615 (72) grade 75 "Standard Specifications for Deformed Billet Steel Bars for Concrete Reinforcement" with an ASTM minimum yield strength equal to or greater than the value used in the design

calculations. The top 24 inches of these bolts shall be galvanized to ASTM A153. Anchor bolt nuts shall meet the impact requirements of Section 4.2. Anchor bolt nuts shall have a proof load equal to or greater than the yield strength of the anchor bolt. Anchor bolts shall be shipped pre-caged.

4.9 Other Bolts and Nuts: Galvanizing shall not be used for bolts having an ultimate strength over 130 KSI. Nuts may be galvanized. Impact tests are not required for heat treated nuts and bolts. The bolts shall be ASTM A307, ASTM A325, ASTM A490, ASTM A449, or ASTM A354.

4.10 Weld Material: The material used for making welds shall be compatible with the parent material, as defined by American Welding Society D1.1 (latest revision) and shall meet the impact requirements of Section 4.2 for the lowest test temperature of the plates being joined.

PART 5 - FABRICATION

5.1 All fabrication shall be completed by skilled workers in accordance with the AISC Code of Standard Practice, NEMA Standard Publication No. TT1 (latest revision) for Tapered Tubular Steel Structures and in accordance with best current practices.

5.2 All fabrication errors, including any detail drawings errors, shall be corrected at the expense of the Manufacturer.

5.3 Transportation expenses, delay-related expenses of the contractor and all expenses for correcting errors shall be the responsibility of the manufacturer. The Manufacturer shall not make corrections on the site, unless approved by the Engineer.

5.4 All structures shall be fabricated from standard rolled and tapered tubular shapes. Care shall be given to insure an aesthetically pleasing structure which fulfills the specified loading requirements.

5.5 Anchor bolts shall have rolled threads with a major diameter as required ±0.015 inches. All anchor bolts shall have a minimum of 12" of threads, be galvanized for the top 12" of the anchor bolt and be supplied with two ASTM A563 heavy hex nuts for each anchor bolt. Anchor bolt assemblies (cages) shall be supplied with steel checking templates (top and bottom) for each foundation. Templates shall designate the bisector of the line angle by means of a V notch or weld bead 1 inch to 2 inches long. (In the case of tangent poles, the mark will be perpendicular to the line direction.) Bracing shall be sufficient to ensure proper bolt alignment at the time of installation of the anchor bolt cages into the foundation. Any misalignment due to insufficient bracing shall be the responsibility of the manufacturer to correct, including but not limited to material replacement, labor, lodging, etc.

5.6 Vangs shall be designed as thru-vangs. The thru-vangs shall, as a minimum, have fillet welds on all sides of the vang on the outside of the pole.

5.7 Fabrication shall be performed in accordance with the latest revision and the provisions of the AISC Manual of Steel Construction and shall be in conformance with

the requirements of ANSI/NEMA Standard No. TT1 (latest revision). Fabrication tolerances are shown in Appendix A of AISC Manual.

5.8 Welding shall be performed by certified operators using procedures in accordance with American Welding Society's Specification D1.1 - Latest Revision and the requirements of ANSI/NEMA Standard No. TT1 (latest revision). Unless otherwise specified, welds will be of the following configuration:

A. Base plate and bearing plate to pole shaft welds (over 3/16" shaft plate thickness): Welds will be 100 percent penetration and fusion.

B. Circumferential welds on the pole shaft: Welds are 100 percent penetration and fusion.

C. Longitudinal welds in female slip joint areas plus 6", and within 6" of tee joints or circumferential welds: Welds are to be 100 percent penetration and fusion.

D. Longitudinal welds other than those covered in C. above: Welds are 80 percent minimum penetration.

E. Arm to Bracket Welds shall be partial penetration groove welds with fillet overlay.

F. Attachment Welds shall be full fusion fillets with partial penetration.

G. Welds for attaching corrosion sleeves to pole shafts shall be continuous filet welds designed to prevent entry and accumulation of water in the area between the inner surface of the corrosion sleeve and the outer surface of the pole shaft. The welds shall be inspected to ensure that they do not include sharp edges or projections that could penetrate through the Corrocote II Classic coating.

H. All other welds shall be a combination of fillet and bevel welds as required by design and shall be indicated on shop fabrication drawings.

I. When holes are drilled through self-weathering steel poles by manufacturers to accommodate the use of through bolts for mounting arms, post insulators, equipment, etc. the through holes shall include sleeves to prevent water from entering the pole through the drilled holes.

PART 6 - FINISHES

6.1 All structure components shall be hot dip galvanized or self-weathering steel in accordance with the Bid Documents and structure drawings. Anchor bolts shall be hot dip galvanized.

A. The top 12" of deformed anchor bolts shall be hot dip galvanized.

B. Galvanizing of anchor bolts shall be performed in accordance with the following specifications; as applicable:

1. ASTM A-123 - Zinc (Hot-Dip Galvanized) coatings on products fabricated from rolled, pressed and forged steel shapes, plates, bars and strips.
2. ASTM A-143 - Safeguarding against embrittlement of hot-dip galvanized structural steel products and procedure for detecting embrittlement.
3. ASTM A-153 - Zinc coating (hot-dip) on iron and steel hardware.
4. ASTM A-376 - Measuring coating thickness by magnetic field or eddy current (electromagnetic) test methods.
5. ASTM A-384 - Safeguarding against warpage and distortion during hot-dip galvanizing of steel assemblies.
6. ASTM A-780 - Repair of damaged hot-dip galvanized coatings.

6.2 Embedded sections of direct embedded poles and their ground sleeves shall be coated with 16 mils of Corrocote II Classic polyurethane or other similar coating approved in writing by the Purchaser. Bearing plates and the bottom five feet of the pole shaft above the bearing plate of direct embedded galvanized steel poles with embedment lengths of 12’ or more shall not be coated, unless otherwise noted in the Bid Document or on the drawings. For all weathering steel poles and galvanized steel poles with embedment depths of less than 12 feet the coating shall extend from five feet above the bearing plate to two feet above the ground line. *The top and bottom edges of the coating shall be feathered to provide a gradual transition between the bare and coated portions of the pole shaft.*

PART 7 - QUALITY CONTROL

7.1 The Manufacturer will be responsible for all quality control. This includes design, drawings, materials, and fabrication. The Manufacturer shall have a quality control manual and it shall be available for review by the Engineer.

7.2 The Owner shall be allowed free access to the Supplier's facilities for inspection of the poles at any time. The Supplier shall monitor the fabrication process in accordance with the requirements of ANSI/NEMA Standard No. TT1 (latest revision).

7.3 Records of all inspections, inspector qualifications, welder certifications, equipment calibrations, and material certifications shall be maintained by the quality assurance department for a minimum of five years.

7.4 The Manufacturer shall provide the Purchaser with the following information, and test and inspection records:

A. Material Certification.

B. Welding Procedures.

C. Welder Certifications.

D. Types of Inspections Performed.

E. Inspector Certification.

F. Results of inspection for compliance with Section 10 of ANSI/NEMA TTI-83.

7.5 Component parts shall be inspected for dimensional compliance to verify conformity with the detailed drawings and established tolerances. Any structure type that is of a unique or complex design, or both, shall be assembled by the Manufacturer prior to shipment.

PART 8 - PACKING AND SHIPPING

8.1 Packing

A. Materials and Procedures: All packing materials shall be suitable for their intended purpose under normal shipping conditions. Selection of load carrying packing material shall consider the abrasion resistance and strength requirements of the particular load.

B. Anchor Bolts: Anchor bolts shall be identified appropriately.

C. Shafts: Due precautions shall be taken when handling and loading tubular steel shaft sections to prevent damage to the sections or their finishes. Shaft sections shall be properly blocked and secured to minimize movement during shipment. Blocks and straps shall be properly padded to minimize abrasion of the shaft finish.

8.2 Shaft sections shall be properly identified so that the sections for each structure can be segregated upon arrival at their destination. If shafts have slip joints, flanged splices or field butt-weld splices which have been pre-fit prior to shipment, the individual sections shall be match-marked so that they can be oriented properly and reassembled in the field. Plate edges of sections that have been prepared for field welding shall be suitably covered and protected during shipment and until they are assembled in the field. Each section of the shaft shall carry its individual identification. Nesting a smaller shaft section within larger diameter tubes is not recommended.

A. Crossarms: Crossarms shall be bundled and packed individually for shipment. They shall be properly identified and marked for attachment to the structure in their correct location.

B. Hardware: All necessary hardware for assembling structures shall be securely packed and marked. The hardware container shall be adequately secured to minimize damage during shipment.

8.3 Shipping: Any shipping damage or shortages shall be reported to the manufacturer and carrier. Arrangements shall be made for inspection of the damaged material prior

to unloading by the carrier and other parties concerned. Unloading shall be carried out with due precautions to protect the structures and their finishes.

PART 9 - ASSEMBLY AND ERECTION

9.1 Anchor Bolts: When required anchor bolts shall be shipped in advance of the structures.

9.2 Shaft Assembly: The Supplier shall specify the type of shaft assembly to be provided.

9.3 Assembly: The poles shall be designed so that assembly of the poles can be performed on the ground. The poles may be assembled and erected as one piece or erected in pieces.

9.4 Erection: The pole shall be capable of being picked up from a single point with a nylon or padded cable choker and swung into position for erection. The balance point shall be identified. After erecting, proper plumbing of the poles, or raking where a dead-end or angle exist, shall be accomplished by adjusting the anchor bolt nuts.

PART 10 - CLIMBING LADDERS

10.1 Each pole shall have ladder clips attached in accordance with the structure drawings.

10.2 The spacing of the clips will be determined based on the style and length of the ladders furnished. Typical ladder length is four feet.

PART 11 - DRAWINGS AND DESIGN CALCULATIONS

11.1 The following drawings and design calculations shall accompany the Bidders proposal:

A. General arrangement drawings showing the overall dimensions and relative locations of all arms and brackets to be attached to the steel structures. The drawings shall also include estimated weights for the structures and attached arms and brackets.

B. Anchor bolt cage drawings showing the overall dimensions, number and size of anchor bolts, and arrangement of the anchor bolt cages for the steel poles. The drawings shall also include estimated weights for the anchor bolt cages (bolts and templates).

C. Preliminary design calculations for the steel structures.

11.2 Within thirty (30) days of the date of the Purchase Order, the Manufacturer shall submit a set of fabrication specifications, erection instructions and drawings to the Engineer for approval. The drawings shall include accurate dimensional information and

fabrication details for the anchor bolt cages and poles, and all arms and brackets to be attached to the pole, as applicable. Three sets of drawings shall be submitted.

11.3 Within 30 days of the date of the Purchase Order, the Manufacturer shall submit a set of final design calculations for the poles to the Engineer for review and approval. The design calculations shall include all data required for design of the augured pier foundations for the poles.

APPENDIX D
ICPE Quality Assurance

QUALITY ASSURANCE REQUIREMENTS
SUMMARY OF TOLERANCE

A. Shafts

1. Shaft Length (one section) ..... ±1"
2. Formed angles ..... 3°
3. Circumference:
   a. Male end ..... +3/32, -15/32"
   b. Female end ..... +11/32, -7/32"
   c. Other ..... +11/32, -7/32"
4. Straightness in shaft ..... 1/8" in 10' (ASTM A-6)
5. Twist of middle sections:
   a. 3 section poles ..... 6°
   b. 4 section poles ..... 3°
6. Location:
   a. Ladder clip groups or steps ..... 1/2"
   b. Ladder clips within a group ..... 1/8"
   c. Other attachments ..... 1/4"
7. Angular Location – all ..... 2° to primary end
8. Baseplate perpendicular to shaft ..... 1/8" per 5'
9. Pole centered on baseplate ..... 1/4"
10. Lifting hole diameter ..... 1/8"
11. Outside spacing of arm mounting vangs ..... +0, -1/8"

B. Base Plates

1. Overall length or width ..... 1/4"
2. Bolt hole diameter ..... 1/16"
3. Bolt hole location ..... 3/32"
4. Drain hole diameter ..... 1/4"
5. Drain hole location ..... 1/4"

C. Anchor Bolts

1. Length ..... +1", -0
2. Threaded length ..... +1", -0
3. Galvanized length ..... +6", -0

D. Arm Assemblies

1. Length ..... 1"
2. Location ..... 1/4"
3. Diameter ..... 1/4"
4. Circumference ..... 9/32"

E. Vangs and Other Attachments

1. Overall length or width ..... 3/32"
2. Holes or slot diameter:
   a. Burned ..... 1/16"
   b. Not burned ..... +1/16, -0"

3. Location ..... 1/16"
4. Angles ..... 2°
5. Vang Straightness
   a. Up to 3/4 thick ..... 1/4"
   b. Over 3/4" thick ..... 1/8"

F. Arm Brackets – Inside spacing between legs ..... +3/16", -1/16"

Pricing Schedule-Steel

Bidder: Date:

The undersigned, in compliance with Instructions to Bidders, having examined the Bid Documents and other related documents and being familiar with all of the conditions affecting the work, does hereby propose to furnish all required galvanized or self-weathering Pre-engineered Light Duty and Custom Tubular Steel Poles for the Washington City – Grapevine Substation Transmission Line in accordance with these Bid Documents as prepared by Intermountain Consumer Professional Engineers, Inc., within the time(s) set forth and at the price(s) stated below. The price(s) shall include all expenses incurred in providing the Pre-engineered Light Duty and Custom Tubular Steel Poles for the Parkway to Grapevine Substation Transmission Line as specified in these Bid Documents.

I/We acknowledge receipt of the following addenda:

Addenda No.	Date Received

POLE NUMBER	SHEET NO.	HEIGHT CLASS	QTY	UNIT	BARE WEIGHT		UNIT PRICE	TOTAL PRICE
					PRE-ENGINEERED LIGHT DUTY OR CUSTOM TUBULAR STEEL POLE(S)	ANCHOR BOLTS		
PRE-ENGINEERED LIGHT DUTY SELF WEATHERING STEEL POLE(S)								
13, 16, 17, 18, 23, 24, 25, 31, 32, 33	S118	75'-C1	10	EA.		-		$ -
2, 3, 8	S116	75'-H1	3	EA.		-		$ -
19, 26	S118	75'-H1	2	EA.		-		$ -
30	S118	75'-H3	1	EA.		-		$ -
4	S116	75'-H4	1	EA.		-		$ -

Pricing Schedule-Steel

34	S117	75'-H11	1	EA.		-		$ -
6	S116	80'-C1	1	EA.		-		$ -
20, 21, 22, 27, 28, 29	S118	80'-H10	6	EA.		-		$ -
9	S116	85'-H2	1	EA.		-		$ -
35	S118	85'-H9	1	EA.		-		$ -
1	S115	85'-H11	1	EA.		-		$ -
PRE-ENGINEERED LIGHT DUTY STEEL POLE QUANTITY:			28	-	-	-	-	-
PRE-ENGINEERED LIGHT DUTY STEEL SUB-TOTAL								$ -

POLE	SHEET NO.	HEIGHT CLASS	QTY	UNIT	BARE WEIGHT		UNIT PRICE	TOTAL PRICE
					CUSTOM TUBULAR STEEL POLE(S)	ANCHOR BOLTS		
CUSTOM TUBULAR STEEL POLES								
5 SELF WEATHERING	S101, S102	CUSTOM 70'	1	EA.				$ -
7 SELF WEATHERING	S103, S104	CUSTOM 70'	1	EA.				$ -
10 SELF WEATHERING	S105, S106	CUSTOM 75'	1	EA.				$ -
11 GALVANIZED	S107, S108	CUSTOM 55'	1	EA.				$ -
12 SELF WEATHERING	S113, S114	CUSTOM 60'	1	EA.				$ -
14 SELF WEATHERING	S109, S110	CUSTOM 70'	1	EA.				$ -
15 SELF WEATHERING	S111, S112	CUSTOM 70'	1	EA.				$ -
CUSTOM TUBULAR STEEL POLE QUANTITY:			7	-	-	-	-	-
CUSTOM TUBULAR STEEL POLES SUB-TOTAL								$ -

TOTAL BID PRICE		$ -
To include all pole elements required (base plate, arms, brackets, vangs etc.) as shown in drawings listed above. Delivery of the (28) Twenty-Eight Pre-Engineered Light Duty and (7) Seven Custom Tubular Steel Pole(s) will be :		weeks ARO

Pricing Schedule-Steel

The bid prices may be evaluated by the following Value Analysis Factors to ensure that the Owner is receiving the best product from a reputable manufacturer with adequate service capabilities. If the bid prices are subject to evaluation, the bid will be awarded based on the evaluated price.

Value Analysis Factors (VAF) (To be completed by Purchaser's/Engineer):

Technical Support	5%
Product Quality and Performance	2%

Substitutions:

The following substitutions of materials and/or equipment are proposed:

Item	Manufacturer and Description	Add/Deduct

Field Service Engineer

Flat Rate Per Day including per diem: $ -

Are field engineering services required for warranty purposes? Yes [ ] No [ ]

Questions or Assumptions:

Pricing Schedule-Steel

I/We agree to provide the Pre-Engineered Light Duty and Custom Tubular Pole(s) for the 69kV Parkway to Grapevine Substation (with the finish chosen by the Purchaser) to Washington City for the lump sum amount stated above. The quantity of Pre-Engineered Light Duty and Custom Tubular Steel Poles to be furnished shall be as shown in the table provided.

SUBMITTED BY:

No Exceptions Taken:		Exceptions Taken: Provide Attachment	

Name

Title

TOTAL BID PRICE	$ -

Company

SEAL

(If by Corporation)

Technical Data to be Furnished With Bid:

The technical information and data required by the Purchase Specification shall be submitted with the bid.
Please print the completed form to PDF, sign, scan to PDF and return with the spreadsheet to Tara Pentz (Purchaser's Washington CIty Recorder)