BUILDER'S COPY
THESE PLANS & SPECIFICATIONS MUST BE KEPT ON THE JOB SITE FOR USE BY THE INSPECTORS WHEN MAKING INSPECTIONS

EDGEMONT
COL01184

at&t

CELL SITE RF MODIFICATIONS
MRUTH059922
FA#:10093889 CROWN CASTLE BU:855801
SELF-SUPPORT

PLAN REVIEW & PERMITS
PLANS REVIEWED FOR CODE COMPLIANCE
APPROVED ☒
APPROVED SUBJECT TO REDLINES ☒
BY: Thomas Larson DATE:11/04/2024
SUBJECT TO FIELD INSPECTION

REDLINED
10/31/2024

ZONING REVIEW
APPROVED
By: LM
Date: 10/29/2024

PROJECT DESCRIPTION

AT&T WIRELESS PROPOSES TO MODIFY AN EXISTING WIRELESS INSTALLATION. THE SCOPE WILL CONSIST OF THE FOLLOWING:

SELF-SUPPORT WORK:
- REMOVE (9) PANEL ANTENNAS
- REMOVE (18) REMOTE RADIO HEADS (RRHS)
- REMOVE (6) TMAs
- INSTALL (3) AIR 6419 B77D ANTENNAS
- INSTALL (3) AIR 6419 B77G ANTENNAS
- INSTALL (3) PANEL ANTENNAS
- INSTALL (12) REMOTE RADIO UNITS (RRUs)
- INSTALL (6) BACK TO BACK RRH MOUNTS

GROUND WORK:
- REMOVE (2) FSM4 UNITS
- REMOVE (6) DIPLEXERS
- REMOVE (6) CONVERTERS
- INSTALL (1) ERICSSON BASE BAND UNIT IN EXISTING FIF RACK
- INSTALL (10) CONVERTERS IN EXISTING DC POWER PLANT
- INSTALL (1) CONVERSION KIT IN EXISTING DC POWER PLANT
- INSTALL (1) SHELF IN EXISTING DC POWER PLANT
- INSTALL (4) 170AH BATTERIES IN EXISTING BATTERY RACK

ENGINEERING

2021 INTERNATIONAL BUILDING CODE OR LATEST ADOPTED EDITION
2023 NATIONAL ELECTRIC CODE OR LATEST ADOPTED EDITION
TIA/EIA-222-H OR LATEST EDITION

SITE INFORMATION

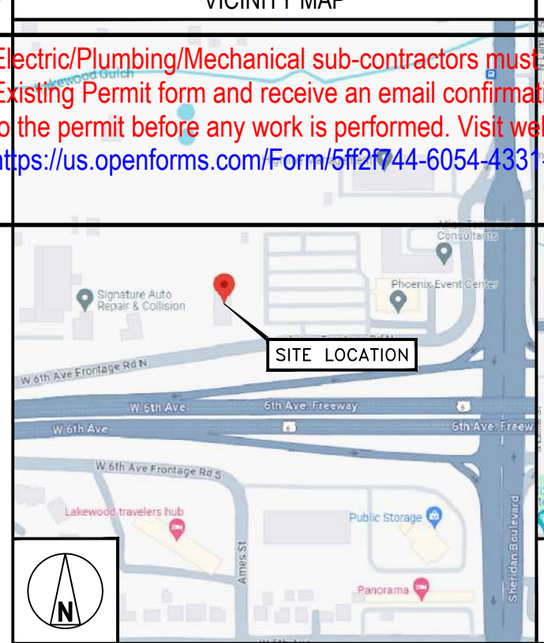
PROPERTY OWNER:	FIFTY STATES PROPERTIES LLC
ADDRESS:	5787 W 300 JAMESTOWN, IN 46147
SITE ADDRESS:	5351 WEST 6TH AVENUE LAKEWOOD, CO 80214
FA:	10093889
SELF-SUPPORT OWNER:	CROWN CASTLE
CELL SITE RF MODIFICATION PACE#:	MRUTH059922
COUNTY:	JEFFERSON
LATITUDE (NAD83): LONGITUDE (NAD83):	39.72720806 -105.056489
GROUND ELEVATION:	5333' AMSL
ZONING JURISDICTION:	CITY OF LAKEWOOD
ZONING DISTRICT:	NA
PARCEL NUMBER:	49-014-00-015
OCCUPANCY GROUP:	U
CONSTRUCTION TYPE:	V-B
POWER COMPANY:	XCEL ENERGY
TELEPHONE COMPANY:	CENTURYLINK
SITE ACQUISITION MANAGER:	KEVIN THOMPSON (952) 896-0859
CONSTRUCTION MANAGER:	JOHN RUTKOWITZ (303) 264-0523
RF ENGINEER:	SHAD RYDALCH (208) 371-0011

CONTACT INFORMATION

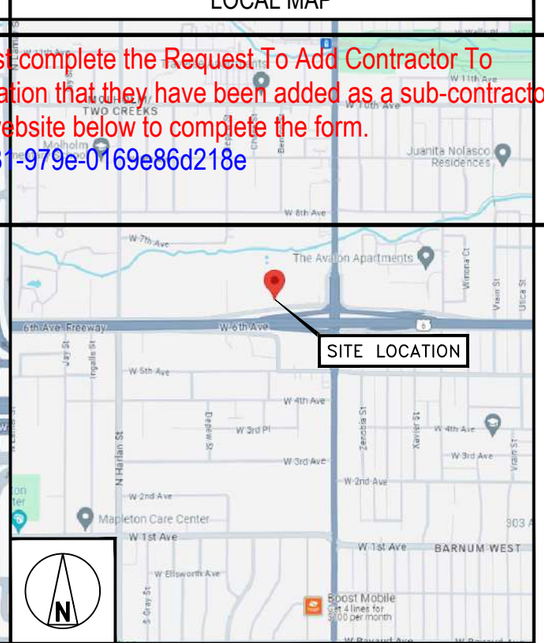
ENGINEER:	BLACK & VEATCH CORPORATION 4600 SOUTH SYRACUSE STREET, SUITE 800 DENVER, CO 80237
CONTACT:	CAMERON LOUCKS
PHONE:	(303) 264-0581

Electric/Plumbing/Mechanical sub-contractors must complete the Request To Add Contractor To Existing Permit form and receive an email confirmation that they have been added as a sub-contractor to the permit before any work is performed. Visit website below to complete the form.
https://us.openforms.com/Form/5ff2f744-6054-4331-979e-0169e86d218e

VICINITY MAP



LOCAL MAP



NO SCALE

DRIVING DIRECTIONS

DIRECTIONS FROM AT&T OFFICE

GET ON I-25 N FROM INVERNESS DR W, CONTINUE ON I-25 N TO DENVER. TAKE THE CO-95/SHERIDAN BLVD EXIT FROM US-6 W/W 6TH AVE, TAKE W 6TH AVE FRONTAGE RD N TO YOUR DESTINATION IN LAKEWOOD, MERGE WITH CO-95 N/SHERIDAN BLVD, TURN LEFT ONTO W 6TH AVE FRONTAGE RD N, TURN RIGHT, TURN LEFT, SITE WILL BE ON THE LEFT.

GENERAL NOTES

THE FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION. A TECHNICIAN WILL VISIT THE SITE AS REQUIRED FOR ROUTINE MAINTENANCE. THE PROJECT WILL NOT RESULT IN ANY SIGNIFICANT DISTURBANCE OR EFFECT ON DRAINAGE. NO SANITARY SEWER SERVICE, POTABLE WATER, OR TRASH DISPOSAL IS REQUIRED AND NO COMMERCIAL SIGNAGE IS PROPOSED.

DRAWING INDEX

SHEET NO.	SHEET TITLE
T-1	TITLE SHEET
C-1	SITE PLAN
C-1.1	ENLARGED SITE PLAN
C-2	EQUIPMENT LAYOUT
C-3	ELEVATION
C-4	ANTENNA SCHEDULE & LAYOUTS
C-5	EQUIPMENT DETAILS
C-6	EQUIPMENT DETAILS
E-1	ELECTRICAL DC ONE-LINE DIAGRAM
G-1	GROUNDING ONE-LINE DIAGRAM
G-2	GROUNDING DETAILS
GN-1	LEGEND & ABBREVIATIONS
GN-2	GENERAL CONSTRUCTION NOTES
GN-3	GENERAL SITE WORK & DRAINAGE NOTES
GN-4	GENERAL CONCRETE WORK NOTES
GN-5	GENERAL STRUCTURAL STEEL NOTES
GN-6	GENERAL ELECTRICAL NOTES
GN-7	BATTERY SAFETY NOTES

11"x17" PLOT WILL BE HALF SCALE UNLESS OTHERWISE NOTED

CONTRACTOR SHALL VERIFY ALL PLANS, EXISTING DIMENSIONS, AND CONDITIONS ON THE JOB SITE, AND SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK.

UNDERGROUND SERVICE ALERT
UTILITY NOTIFICATION CENTER OF COLORADO
(800) 922-1987
WWW.UNCC.ORG
3 WORKING DAYS UTILITY NOTIFICATION PRIOR TO CONSTRUCTION

at&t
188 INVERNESS DRIVE WEST
SUITE 400
ENGLEWOOD, CO 80112

BLACK & VEATCH
4600 SOUTH SYRACUSE STREET
SUITE 800
DENVER, COLORADO 80237

PROJECT/PHASE NO:	129551/1207
DRAWN BY:	PDJ
CHECKED BY:	JMH
RFDS:	___

REV	DATE	DESCRIPTION
0	04/24/24	ISSUED FOR CONSTRUCTION

COLORADO LICENSED
JASON T. KAHRS
52811
PROFESSIONAL ENGINEER
04/24/2024

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT.

EDGEMONT
COL01184
5351 WEST 6TH AVENUE
LAKEWOOD, CO 80214
CELL SITE RF MODIFICATIONS

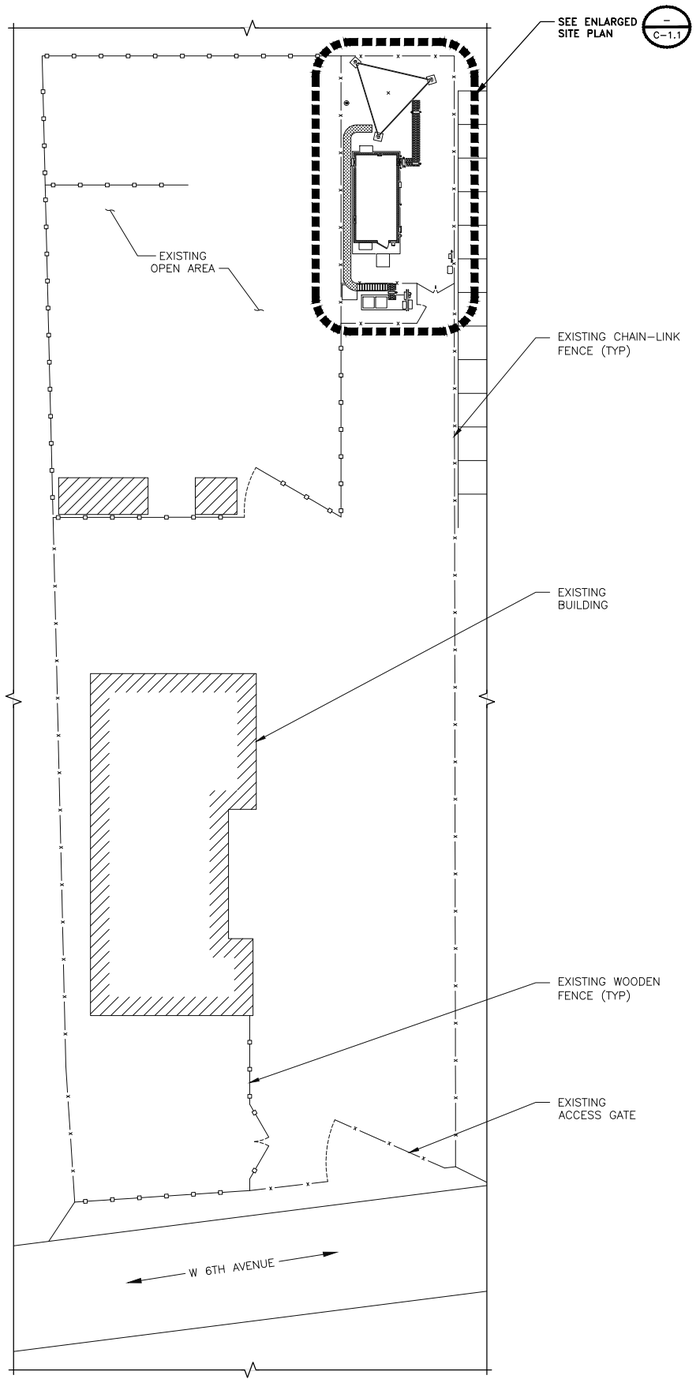
SHEET TITLE
TITLE SHEET

SHEET NUMBER
T-1

PERMIT NO:
TELE24-00035

NOTES

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS.
2. ANTENNAS AND MOUNTS OMITTED FOR CLARITY.



SITE PLAN

20' 10' 0 20' 40'
1"=20'

1

at&t

188 INVERNESS DRIVE WEST
SUITE 400
ENGLEWOOD, CO 80112

BLACK & VEATCH

4600 SOUTH SYRACUSE STREET
SUITE 800
DENVER, COLORADO 80237

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EDGEMONT
COL01184
5351 WEST 6TH AVENUE
LAKEWOOD, CO 80214
CELL SITE RF MODIFICATIONS

SHEET TITLE
SITE PLAN

SHEET NUMBER
C-1

PERMIT NO:
TELE24-00035

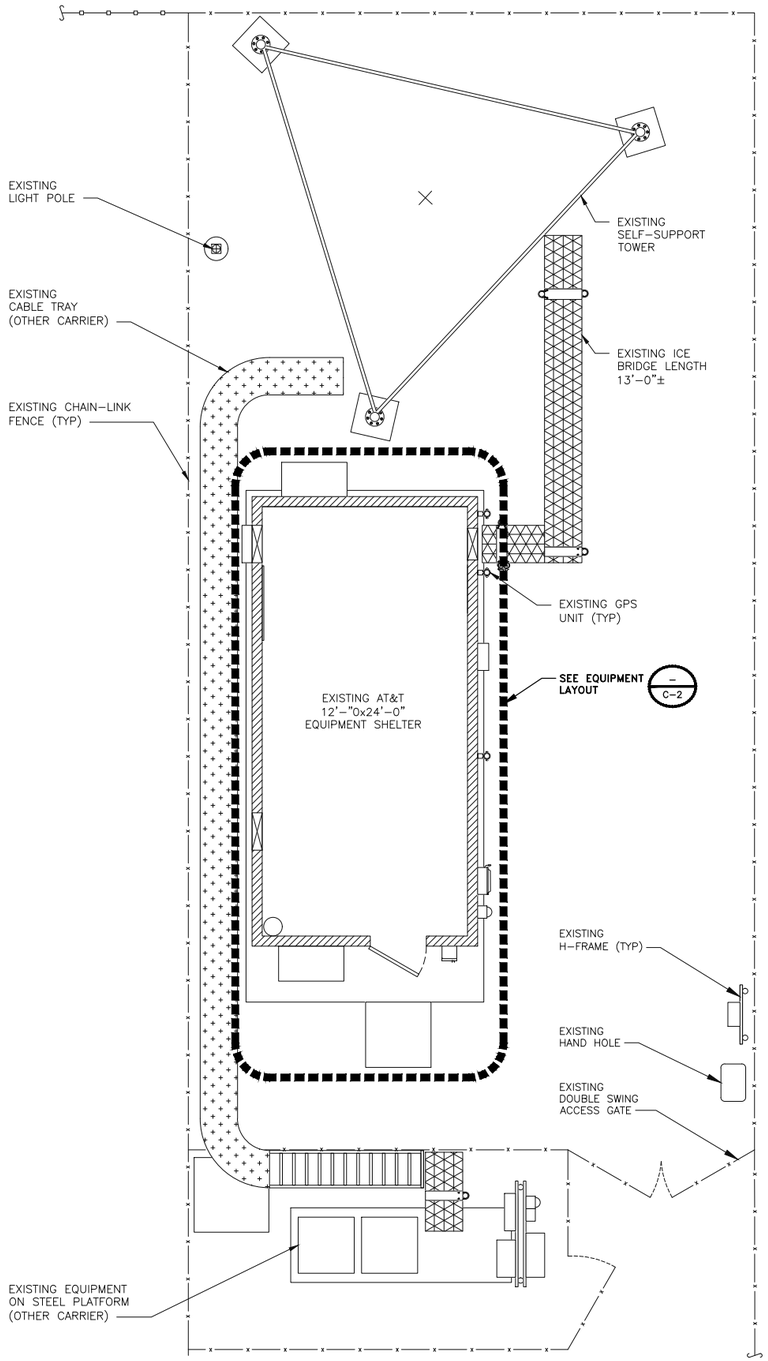
COAX & CABLE INFORMATION

- (5) EXISTING 1 5/8" COAX CABLES
- (4) EXISTING 1 1/4" COAX CABLES
- (7) EXISTING 7/8" COAX CABLES
- (6) EXISTING #8 AWG DC POWER TRUNKS
- (3) EXISTING 18-PAIR FIBER TRUNKS

ROUTED ON EXISTING SELF-SUPPORT

NOTES

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS.
2. ANTENNAS AND MOUNTS OMITTED FOR CLARITY.



N

SITE PLAN

4' 2' 0 4' 8'
1/4"=1'-0"

1

at&t
188 INVERNESS DRIVE WEST
SUITE 400
ENGLEWOOD, CO 80112

BLACK & VEATCH
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DENVER, COLORADO 80237

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5351 WEST 6TH AVENUE
LAKEWOOD, CO 80214
CELL SITE RF MODIFICATIONS

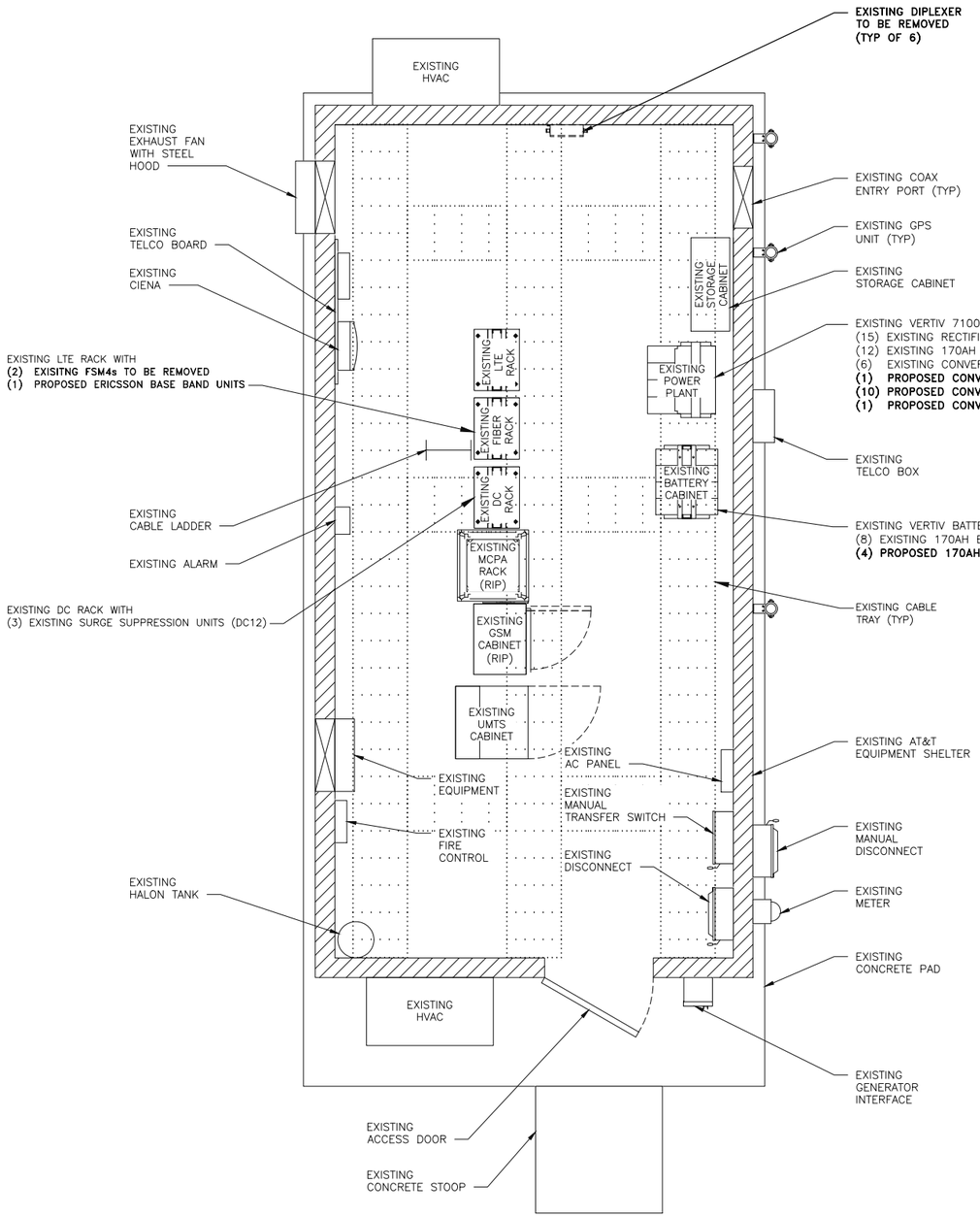
SHEET TITLE
ENLARGED SITE PLAN

SHEET NUMBER
C-1.1

PERMIT NO:
TELE24-00035

NOTES

1. ALL EXISTING EQUIPMENT TO REMAIN UNLESS NOTED OTHERWISE.
2. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS.
3. IFC 608 & IMC 502.4 CODE ANALYSIS & BATTERY COMPLIANCE INFORMATION SHOWN ON SHEET GN-7.
4. THERE WILL BE A TOTAL OF 50.16 GALLONS OF ELECTROLYTE WITH THE 4 PROPOSED LEAD-ACID BATTERIES THAT ARE BEING ADDED.
5. ON-SITE BATTERY SPILL CLEAN-UP KIT SHALL BE CAPABLE OF NEUTRALIZING A MINIMUM OF 1.5 GALLONS.
6. TOTAL ELECTROLYTE IS 50.16 GAL. WHICH IS LESS THAN 50 GAL. REQUIRED TO MEET IFC COMPLIANCE STANDARD.



FINAL EQUIPMENT LAYOUT

12" 6" 0 1' 2' 3' 4' 5'
1/2"=1'-0"

1

at&t
188 INVERNESS DRIVE WEST
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ENGLEWOOD, CO 80112

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DENVER, COLORADO 80237

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5351 WEST 6TH AVENUE
LAKEWOOD, CO 80214
CELL SITE RF MODIFICATIONS

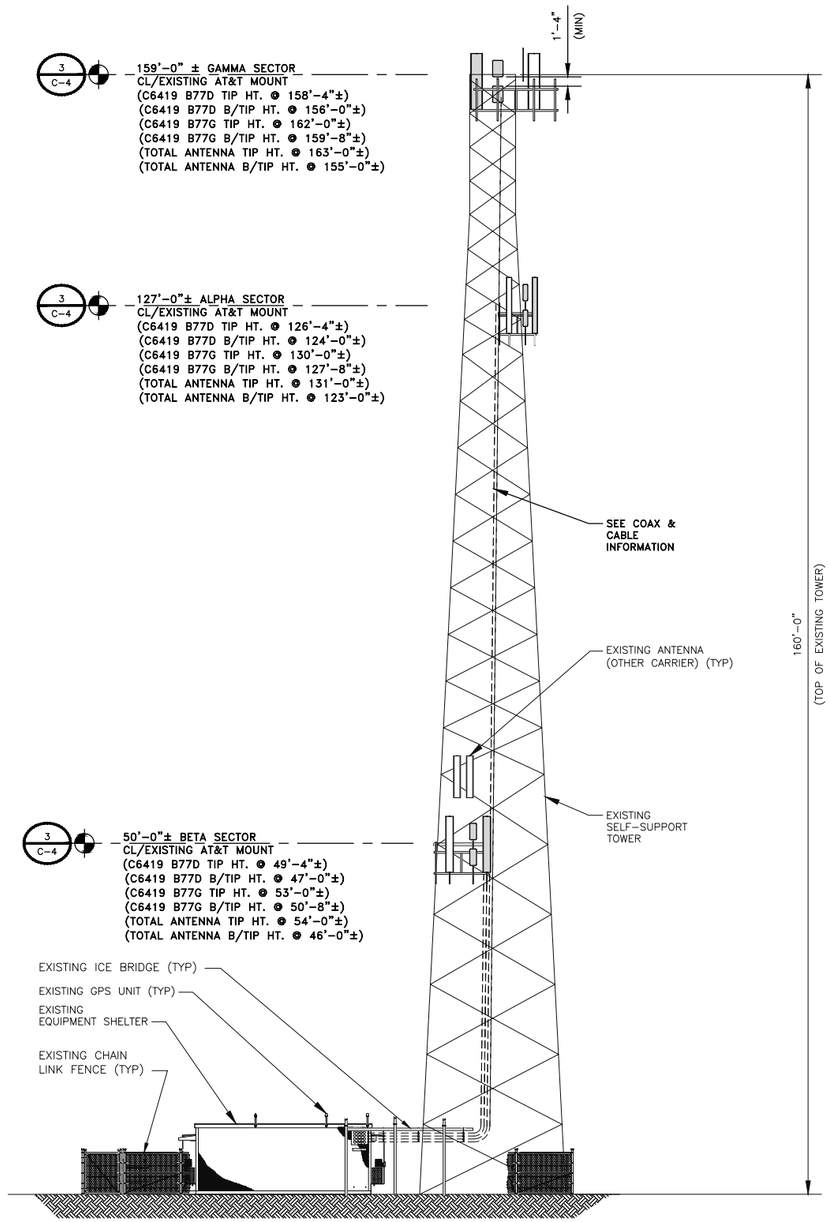
SHEET TITLE
EQUIPMENT LAYOUT

SHEET NUMBER
C-2

PERMIT NO:
TELE24-00035

NOTES

1. THE EXISTING SELF-SUPPORT IS CURRENTLY BEING ANALYZED BY OTHERS TO DETERMINE ITS STRUCTURAL CAPACITY TO CARRY THE PROPOSED NEW COAX & ANTENNAS. THESE DRAWINGS HAVE BEEN CREATED BASED ON THE ASSUMPTION THAT THE STRUCTURAL ANALYSIS WILL SHOW THAT THE SELF-SUPPORT HAS SUFFICIENT CAPACITY TO SUPPORT THE PROPOSED NEW LOADS. INSTALLATION OF THE COAX & ANTENNAS SHALL NOT COMMENCE UNTIL AN APPROVED STRUCTURAL ANALYSIS HAS BEEN RECEIVED BY THE OWNER OR AT&T, & HAS BEEN REVIEWED BY BLACK & VEATCH.
2. MOUNT MODIFICATIONS REQUIRED @ RAD 127' & 50'; SEE BLACK & VEATCH DESIGN DATED APRIL 17, 2024. PLEASE REFERENCE SHEETS S-1. NO PROPOSED LTE WORK SHALL COMMENCE ON THIS STRUCTURE UNTIL AFTER MOUNT MODIFICATIONS HAVE BEEN COMPLETED AND PROPERLY INSPECTED.
3. THE PASSING ANTENNA MOUNT ANALYSIS FOR THE EXISTING MOUNT AT RAD 159'. THIS SITE WAS COMPLETED BY BLACK & VEATCH ON MARCH 13, 2024 CONFORMING TO TIA-222-H. ACCORDING TO THE BLACK & VEATCH MOUNT ANALYSIS, THE MOUNT HAS SUFFICIENT CAPACITY.



COAX & CABLE INFORMATION

- (5) EXISTING 1 5/8" COAX CABLES
- (4) EXISTING 1 1/4" COAX CABLES
- (7) EXISTING 7/8" COAX CABLES
- (6) EXISTING #8 AWG DC POWER TRUNKS
- (3) EXISTING 18-PAIR FIBER TRUNKS

ROUTED ON EXISTING SELF-SUPPORT

FINAL EAST ELEVATION

12' 8' 4' 0 10' 20'
3/32"=1'-0"

1

at&t
188 INVERNESS DRIVE WEST
SUITE 400
ENGLEWOOD, CO 80112

BLACK & VEATCH
4600 SOUTH SYRACUSE STREET
SUITE 800
DENVER, COLORADO 80237

PROJECT/PHASE NO:	129551/1207
DRAWN BY:	PDJ
CHECKED BY:	JMH
RFDS:	___

REV	DATE	DESCRIPTION
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COLORADO LICENSED
JASON T. KAHNS
52811
PROFESSIONAL ENGINEER
04/24/2024

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EDGEMONT
COL01184
5351 WEST 6TH AVENUE
LAKEWOOD, CO 80214
CELL SITE RF MODIFICATIONS

SHEET TITLE
ELEVATION

SHEET NUMBER
C-3

PERMIT NO:
TELE24-00035

COAX & CABLE INFORMATION

- (5) EXISTING 1 5/8" COAX CABLES
- (4) EXISTING 1 1/4" COAX CABLES
- (7) EXISTING 7/8" COAX CABLES
- (6) EXISTING #8 AWG DC POWER TRUNKS
- (3) EXISTING 18-PAIR FIBER TRUNKS

ROUTED ON EXISTING SELF-SUPPORT

SECTOR	TECH.		ANTENNA MODEL		AZIMUTH		RAD CENTER		RRH/RRU MODEL & RELATED EQUIPMENT	
	EXIST.	FINAL	EXIST.	FINAL	EXIST.	FINAL	EXIST.	FINAL	EXIST.	FINAL
A1	UMTS	**LTE**	*7750	**NNH4-65C-R6-V3**	35°	**35°**	129'-0"	**127'-0"**	*(2) LGP17501	**4490 B5/B12A 4415 B30** WCS-IMFQ-AMT
A2	LTE	**LTE**	*RV4PX310R-V2	**6149 B77D+6149 B77G STACKED**	35°	**35°**	127'-0"	**127'-0"**	*B25 RRH4X30-4R *RRH4X25-WCS-4R WCS-IMFQ-AMT	**INTEGRATED WITHIN: ERICSSON 6419D INTEGRATED WITHIN: ERICSSON 6419G**
A3	LTE	LTE	NNH4-65C-R6-V3	NNH4-65C-R6-V3	35°	35°	127'-0"	127'-0"	*B25 RRH4X30-4R *4T4R B5 160W AHCA	**4890 B25/B66 4478 B14**
A4	LTE	–	*NNH4-65C-R6	–	35°	–	127'-0"	–	*4T4R B25/66 320W AHFIB *4T4R B12/14 320W AHLBA	–
B1	UMTS	**LTE**	*7750	**NNH4-65C-R6-V3**	150°	**150°**	51'-0"	**50'-0"**	*(2) LGP17501	**4490 B5/B12A 4415 B30** WCS-IMFQ-AMT
B2	LTE	**LTE**	*RV4PX310R-V2	**6149 B77D+6149 B77G STACKED**	150°	**150°**	49'-0"	**50'-0"**	*B25 RRH4X30-4R *RRH4X25-WCS-4R WCS-IMFQ-AMT	**INTEGRATED WITHIN: ERICSSON 6419D INTEGRATED WITHIN: ERICSSON 6419G**
B3	LTE	LTE	NNH4-65C-R6-V3	NNH4-65C-R6-V3	150°	150°	49'-0"	50'-0"	*B25 RRH4X30-4R *4T4R B5 160W AHCA	**4890 B25/B66 4478 B14**
B4	LTE	–	*NNH4-65C-R6	–	150°	–	49'-0"	–	*4T4R B25/66 320W AHFIB *4T4R B12/14 320W AHLBA	–
C1	UMTS	**LTE**	*7750	**NNH4-65C-R6-V3**	265°	**265°**	162'-0"	**159'-0"**	*(2) LGP17501	**4490 B5/B12A 4415 B30**
C2	LTE	**LTE**	*RV4PX310R-V2	**6149 B77D+6149 B77G STACKED**	265°	**265°**	160'-0"	**159'-0"**	*B25 RRH4X30-4R *RRH4X25-WCS-4R	**INTEGRATED WITHIN: ERICSSON 6419D INTEGRATED WITHIN: ERICSSON 6419G**
C3	LTE	LTE	NNH4-65C-R6-V3	NNH4-65C-R6-V3	265°	265°	160'-0"	159'-0"	*B25 RRH4X30-4R *4T4R B5 160W AHCA	**4890 B25/B66 4478 B14**
C4	LTE	–	*NNH4-65C-R6	–	265°	–	160'-0"	–	*4T4R B25/66 320W AHFIB *4T4R B12/14 320W AHLBA	–

*TO BE REMOVED

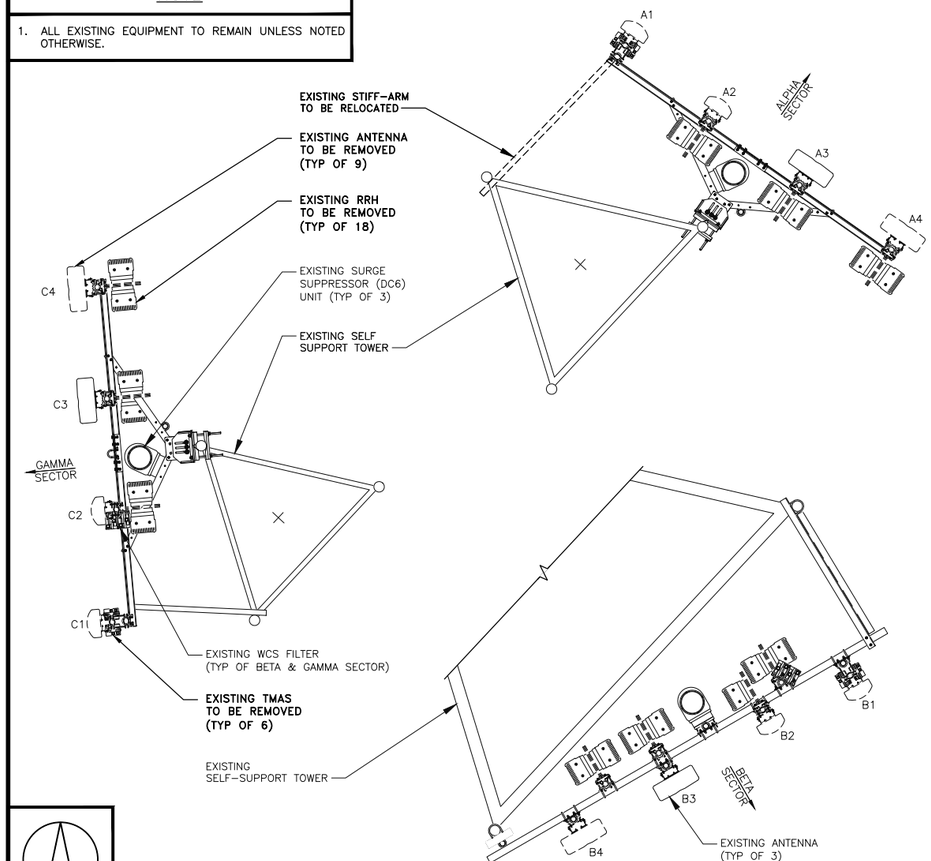
ANTENNA SCHEDULE

NO SCALE

1

NOTE

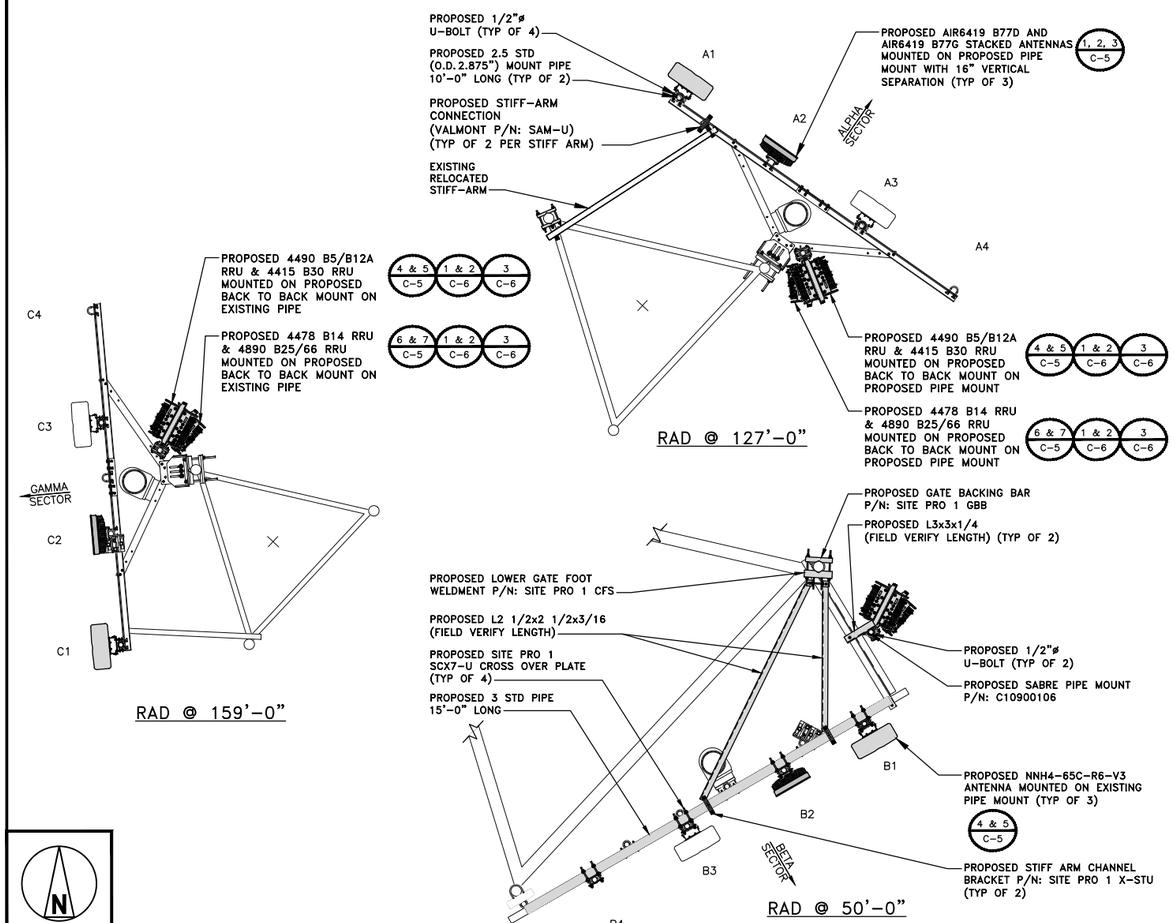
1. ALL EXISTING EQUIPMENT TO REMAIN UNLESS NOTED OTHERWISE.



EXISTING ANTENNA LAYOUT

12" 6"0 1' 2' 3' 4' 5' 6' 7'
3/8"=1'-0"

2



PROPOSED ANTENNA LAYOUT

12" 6"0 1' 2' 3' 4' 5' 6' 7'
3/8"=1'-0"

3

at&t

188 INVERNESS DRIVE WEST
SUITE 400
ENGLEWOOD, CO 80112

BLACK & VEATCH

4600 SOUTH SYRACUSE STREET
SUITE 800
DENVER, COLORADO 80237

PROJECT/PHASE NO: 129551/1207
DRAWN BY: PDJ
CHECKED BY: JMH
RFDS: ___

REV	DATE	DESCRIPTION
0	04/24/24	ISSUED FOR CONSTRUCTION

COLORADO LICENSED
JASON T. KAHRS
52811
PROFESSIONAL ENGINEER
04/24/2024

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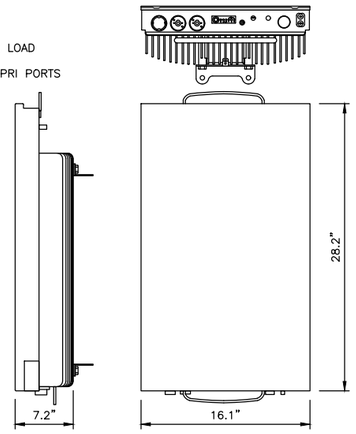
SHEET TITLE
ANTENNA SCHEDULE & LAYOUTS

SHEET NUMBER
C-4

PERMIT NO:
TELE24-00035

ERICSSON AIR 6419 B77D

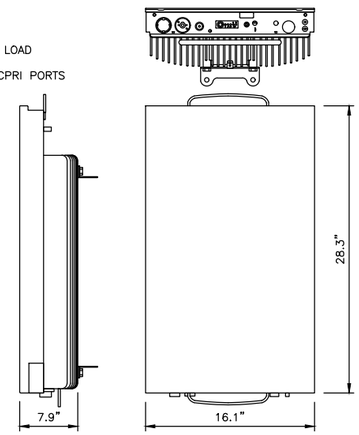
DIMENSIONS, WxDxH: 16.1"x7.2"x28.2"
(mm) 409x183x717mm
POWER CONSUMPTION: 1135 WATTS @ 100% LOAD
TOTAL WEIGHT: 63 lbs
PORTS: 3 x 10/25 GBPS eCPRI PORTS



PROPOSED ANTENNA SPECIFICATIONS | NO SCALE | 1

ERICSSON AIR 6419 B77G

DIMENSIONS, WxDxH: 16.1"x7.9"x28.3"
(mm) 409x201x719mm
POWER CONSUMPTION: 1200 WATTS @ MAX LOAD
TOTAL WEIGHT: 66.1 lbs
PORTS: 2 x 10/25 GBPS eCPRI PORTS



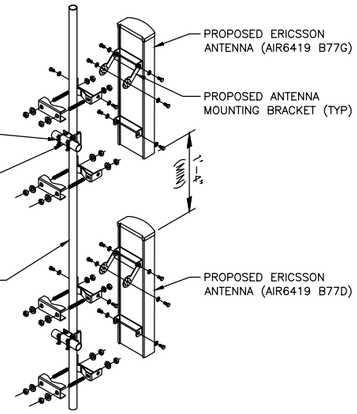
PROPOSED ANTENNA SPECIFICATIONS | NO SCALE | 2

CROSSOVER PLATES
–ROUND MEMBER HORIZONTAL FACE PIPES SHALL USE SITEPRO1# SCX7–U (OR APPROVED EQUIVALENT)
–SQUARE MEMBER HORIZONTAL FACE PIPES SHALL USE SITEPRO1# STCX45–K (OR APPROVED EQUIVALENT)
–(1) PER HORIZONTAL PIPE

HORIZONTAL FACE PIPE –TYP. TOP & BOTTOM

ANTENNA MOUNTING PIPE FOR STACKED AIR6419 ANTENNAS SHALL BE P2.5 STD (2–7/8" O.D.) SABRE# C10900802 / ANT.46141 (OR APPROVED EQUIVALENT)

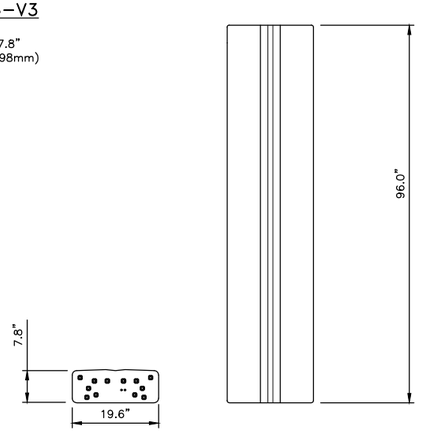
CROSSOVER PLATE NOTE:
FOR MOUNT REPLACEMENTS, IF CROSSOVER PLATES OF EQUIVALENT SIZE ARE SUPPLIED WITH THE, THOSE CROSSOVER PLATES SHALL BE USED



ANTENNA PIPE MOUNTING DETAIL | NO SCALE | 3

COMMSCOPE NNH4–65C–R6–V3

DIMENSIONS HxWxD: 96.0"x19.6"x7.8" (2438x498x198mm)
WEIGHT: 102.1lbs



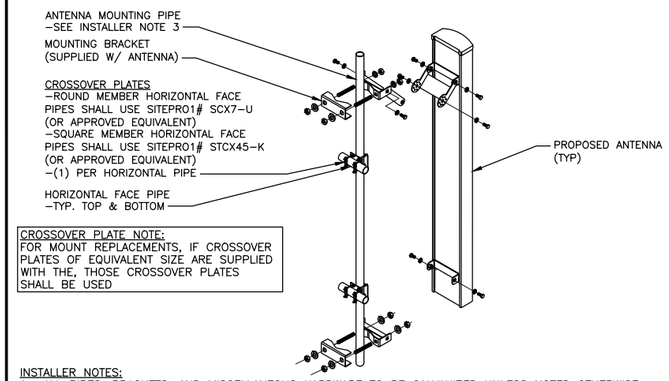
PROPOSED ANTENNA SPECIFICATIONS | NO SCALE | 4

ANTENNA MOUNTING PIPE –SEE INSTALLER NOTE 3
MOUNTING BRACKET (SUPPLIED W/ ANTENNA)

CROSSOVER PLATES
–ROUND MEMBER HORIZONTAL FACE PIPES SHALL USE SITEPRO1# SCX7–U (OR APPROVED EQUIVALENT)
–SQUARE MEMBER HORIZONTAL FACE PIPES SHALL USE SITEPRO1# STCX45–K (OR APPROVED EQUIVALENT)
–(1) PER HORIZONTAL PIPE

HORIZONTAL FACE PIPE –TYP. TOP & BOTTOM

CROSSOVER PLATE NOTE:
FOR MOUNT REPLACEMENTS, IF CROSSOVER PLATES OF EQUIVALENT SIZE ARE SUPPLIED WITH THE, THOSE CROSSOVER PLATES SHALL BE USED

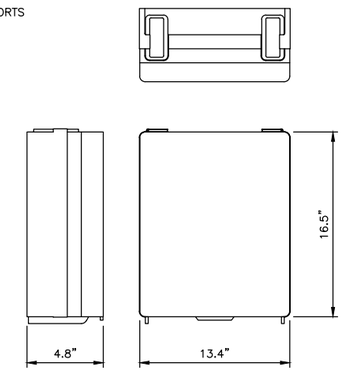


INSTALLER NOTES:
1. ALL PIPES, BRACKETS, AND MISCELLANEOUS HARDWARE TO BE GALVANIZED UNLESS NOTED OTHERWISE
2. REFER TO ANTENNA MANUFACTURER INSTALLATION MANUAL FOR ASSEMBLY AND BOLT TORQUE SPECS.
3. ANY NEW MOUNT PIPES PROPOSED FOR PASSIVE ANTENNAS. INCLUDING NEW MOUNTS OR MOUNT REPLACEMENTS. SHALL BE P2.5 STD (2–7/8" O.D.) SABRE# C10900802 / ANT 46141 (OR APPROVED EQUIVALENT) PASSIVE ANTENNA MOUNT PIPES FOR EXISTING MOUNTS MAY REMAIN. UNLESS OTHERWISE NOTED IN MOUNT ANALYSIS

ANTENNA MOUNTING DETAIL | NO SCALE | 5

ERICSSON RADIO 4415 B30

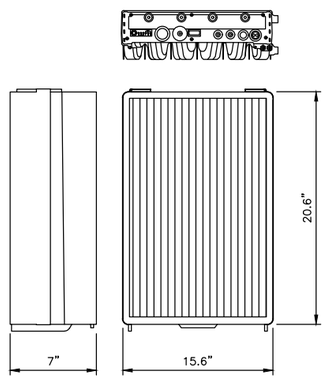
DIMENSIONS, WxDxH: 13.4"x4.8"x16.5"
(mm) 342x123x420mm
POWER CONSUMPTION: 670W
TOTAL WEIGHT: 47 lbs
PORTS: 4 x 4.3–10 (f) GBPS eCPRI PORTS



RRU SPECIFICATIONS | NO SCALE | 6

ERICSSON RADIO 4490 B5/12A

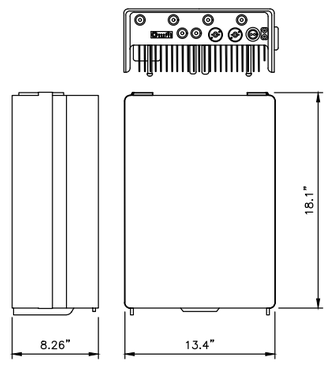
DIMENSIONS, HxWxD: 20.6"x15.6"x7"
(mm) 524x397x178mm
POWER CONSUMPTION: 480W
TOTAL WEIGHT: 65 lbs



RRU SPECIFICATIONS | NO SCALE | 7

ERICSSON RADIO 4478 B14

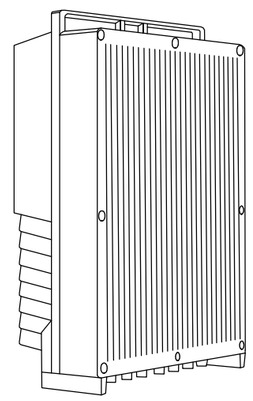
DIMENSIONS, WxDxH: 13.4"x8.26"x18.1"
(mm) 342x210x460mm
POWER CONSUMPTION: 650W
TOTAL WEIGHT: 59.4 lbs



RRU SPECIFICATIONS | NO SCALE | 8

ERICSSON RADIO 4890 B25/66

DIMENSIONS, HxWxD: 17.5"x15.1"x6.9"
(mm) 444x384x176mm
POWER CONSUMPTION: 480 WATTS
TOTAL WEIGHT: 68 lbs



RRU SPECIFICATIONS | NO SCALE | 9

at&t
188 INVERNESS DRIVE WEST
SUITE 400
ENGLEWOOD, CO 80112

BLACK & VEATCH
4600 SOUTH SYRACUSE STREET
SUITE 800
DENVER, COLORADO 80237

PROJECT/PHASE NO:	129551/1207
DRAWN BY:	PDJ
CHECKED BY:	JMH
RFDS:	___

REV	DATE	DESCRIPTION
0	04/24/24	ISSUED FOR CONSTRUCTION

COLORADO LICENSED
JASON T. KAHRS
52811
PROFESSIONAL ENGINEER
04/24/2024

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LAKEWOOD, CO 80214
CELL SITE RF MODIFICATIONS

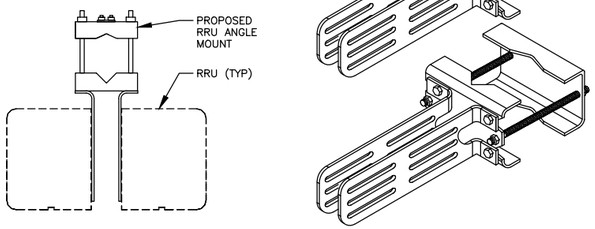
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EQUIPMENT DETAILS

SHEET NUMBER
C-5

PERMIT NO:
TELE24-00035

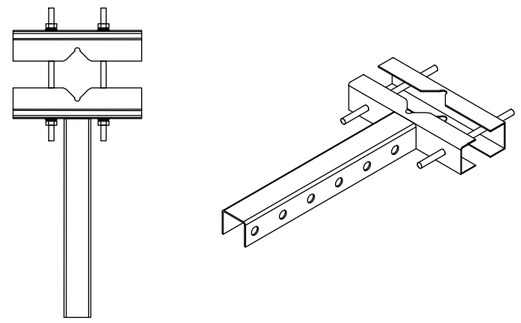
COMMSCOPE RR-FA2 RRU MOUNT W/ 86067769-001 RRU BRACKET

TOTAL WEIGHT (UNFINISHED): 35.88 lbs
ROUND LEGS: 1/2" DIA. TO 5.6" DIA.
60 DEGREE ANGLE LEGS: 1" DIA. TO 6.0" DIA.
90 DEGREE ANGLE LEGS: 1" DIA. TO 4.5" DIA.

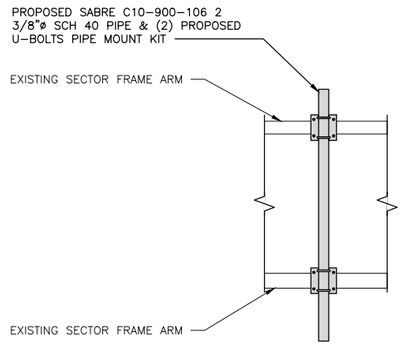


DUAL RRU MOUNTING DETAIL | NO SCALE | 1

TALLEY CABLE SUPPORT BRACKET P/N SS-TB2550



RRH CABLE SUPPORT BRACKET DETAIL | NO SCALE | 2



*NOTE:
1. CONTRACTOR TO VERIFY CONNECTION OF MAST PIPE TO FRAME.
2. ALL DRILLED SURFACES SHALL BE REPAIRED WITH A MINIMUM OF TWO COATS OF ZRC GALVILITE COLD GALVANIZING COMPOUND PER ASTM A780 AND MANUFACTURER'S RECOMMENDATIONS.
3. EXISTING BOLT HOLES IN THE EXISTING MEMBERS SHALL NOT BE REUSED UNLESS NEW BOLT HOLE TO EXISTING BOLT HOLE SPACING MEETS AISC MINIMUM BOLT SPACING REQUIREMENTS. FOR 1/2" U-BOLTS, SPACING SHOULD BE NO LESS THAN 1-1/2" FOR 5/8" U-BOLTS, SPACING SHOULD BE NO LESS THAN 1-7/8".

MAST PIPE CONNECTION DETAIL | NO SCALE | 3

NOT USED | NO SCALE | 4

NOT USED | NO SCALE | 5

NOT USED | NO SCALE | 6

NOT USED | NO SCALE | 7

NOT USED | NO SCALE | 8

NOT USED | NO SCALE | 9

at&t
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ENGLEWOOD, CO 80112

BLACK & VEATCH
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DENVER, COLORADO 80237

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RFDS: ___

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EQUIPMENT DETAILS

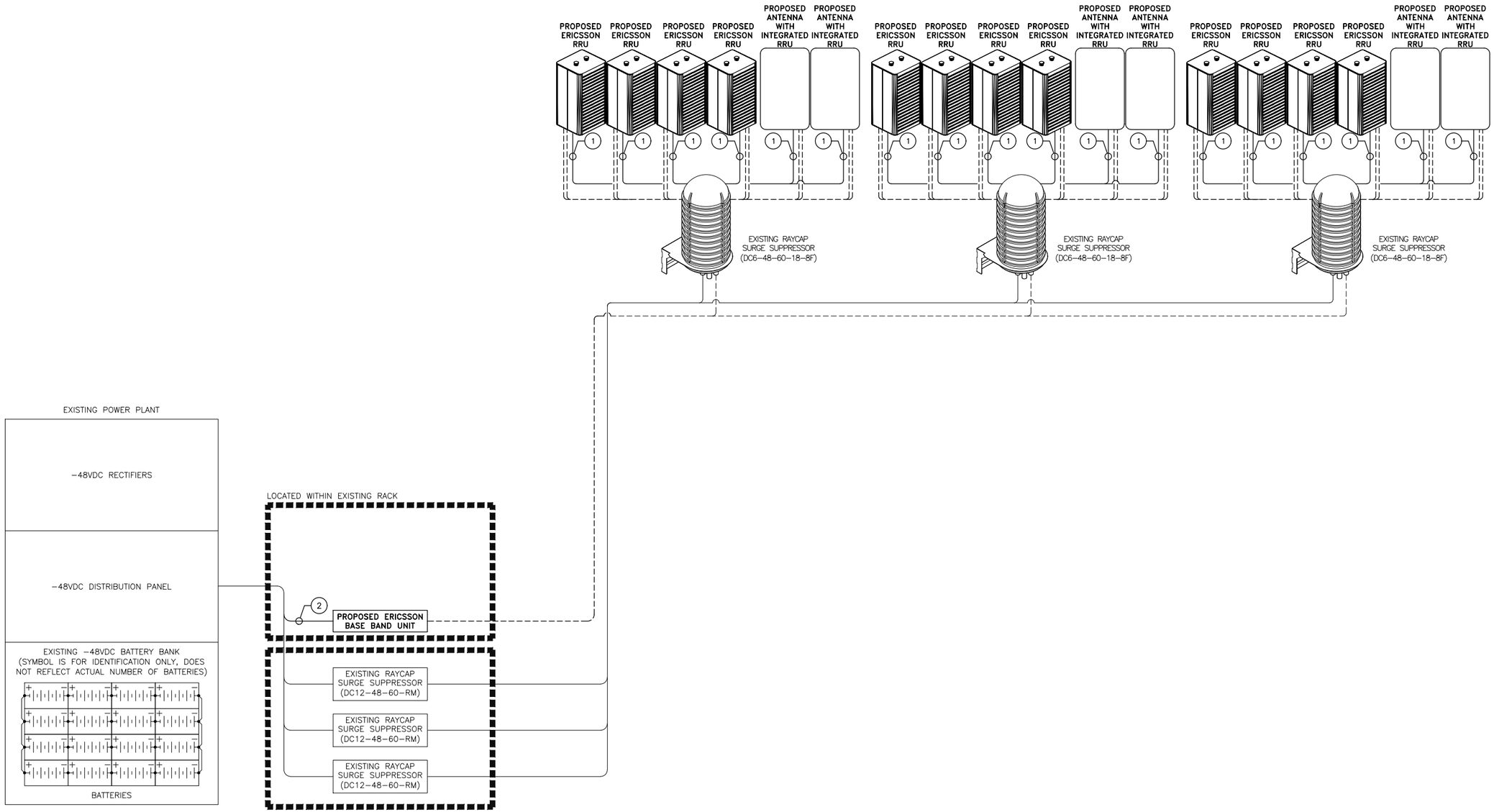
SHEET NUMBER
C-6

PERMIT NO:
TELE24-00035

DC CIRCUIT SCHEDULE			
NO.	FROM	TO	CONFIGURATION
(1)	EXISTING RAYCAP SURGE SUPPRESSOR DC6-48-60-18-8F	PROPOSED REMOTE RADIO UNIT (RRU)	(1) 2-#8 THHN/THWN/VW-1 TYPE TC-ER DC CABLE
(2)	EXISTING -48VDC DISTRIBUTION PANEL	PROPOSED ERICSSON BASE BAND UNIT	(2) 1-#12 TELCOFLEX III DC CABLE

NOTES

1. DC POWER WIRING SHALL BE COLOR CODED AT EACH END FOR IDENTIFYING +24V AND -48V CONDUCTORS. RED MARKINGS SHALL IDENTIFY +24V AND BLUE MARKINGS SHALL IDENTIFY -48V. REFER TO ATT-002-290-701.
2. NON-LTE DC POWER WIRING SIZE 14 AWG TO 10 AWG SHALL BE TELCOFLEX III. DC POWER WIRING 8 AWG AND LARGER SHALL BE TELCOFLEX IV.
3. LTE POWER WIRING SHALL BE IN ACCORDANCE WITH ATT-002-290-531.
4. DC ELECTRICAL DEMAND FOR THE PROPOSED ADDITIONS WERE INCLUDED IN AC LOAD CALCULATIONS.
5. CONNECT ALL PROPOSED ERICSSON RRU SECOND CPRI TO SURGE SUPPRESSOR FOR FUTURE USE.
6. CONTRACTOR TO RECONNECT ALL EXISTING EQUIPMENT TO PROPOSED POWER PLANT.



ELECTRICAL DC ONE-LINE DIAGRAM

NO SCALE

at&t

188 INVERNESS DRIVE WEST
SUITE 400
ENGLEWOOD, CO 80112

BLACK & VEATCH

4600 SOUTH SYRACUSE STREET
SUITE 800
DENVER, COLORADO 80237

PROJECT/PHASE NO:	129551/1207
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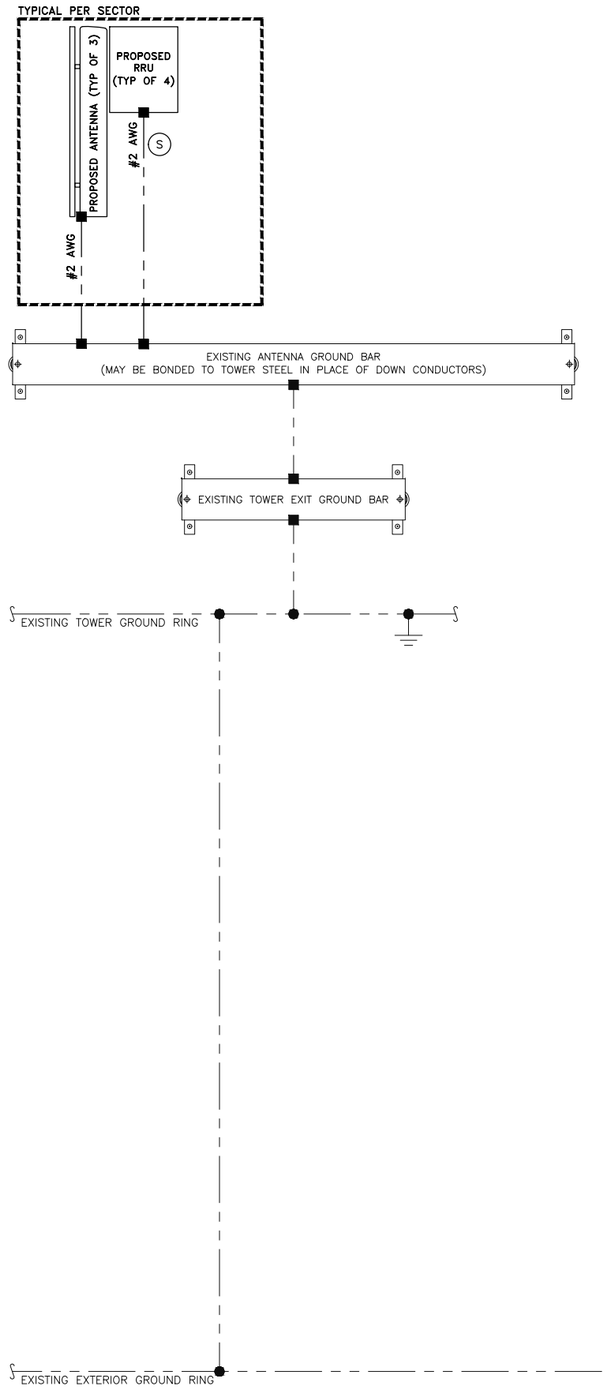
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COL01184
5351 WEST 6TH AVENUE
LAKEWOOD, CO 80214
CELL SITE RF MODIFICATIONS

SHEET TITLE
ELECTRICAL DC ONE-LINE DIAGRAM

SHEET NUMBER
E-1

PERMIT NO:
TELE24-00035



GROUNDING ONE-LINE DIAGRAM

NO SCALE

- EXOTHERMIC CONNECTION
- MECHANICAL CONNECTION
- GROUND ROD
- TEST GROUND ROD WITH INSPECTION SLEEVE

LEGEND

1. GROUNDING IS SHOWN DIAGRAMMATICALLY ONLY.
2. CONTRACTOR SHALL GROUND ALL EQUIPMENT AS A COMPLETE SYSTEM. GROUNDING SHALL BE IN COMPLIANCE WITH NEC SECTION 250 AND AT&T GROUNDING AND BONDING REQUIREMENTS (ATT-TP-76416) AND MANUFACTURER'S SPECIFICATIONS.
3. ALL GROUND CONDUCTORS SHALL BE COPPER; NO ALUMINUM CONDUCTORS SHALL BE USED.

NOTES

(A) EXTERIOR GROUND RING: #2 AWG SOLID COPPER, BURIED AT A DEPTH OF AT LEAST 30 INCHES BELOW GRADE, OR 6 INCHES BELOW THE FROST LINE AND APPROXIMATELY 24 INCHES FROM THE EXTERIOR WALL OR FOOTING. (ATT-TP-76416 2.2.3.5 / 7.5.1)

(B) TOWER GROUND RING: THE GROUND RING SYSTEM SHALL BE INSTALLED AROUND AN ANTENNA TOWER'S LEGS, AND/OR GUY ANCHORS. WHERE SEPARATE SYSTEMS HAVE BEEN PROVIDED FOR THE TOWER AND THE BUILDING, AT LEAST TWO BONDS SHALL BE MADE BETWEEN THE TOWER RING GROUND SYSTEM AND THE BUILDING RING GROUND SYSTEM USING MINIMUM #2 AWG SOLID COPPER CONDUCTORS. (ATT-TP-76416 / 7.5.1)

(C) INTERIOR GROUND RING: #2 AWG STRANDED GREEN INSULATED COPPER CONDUCTOR EXTENDED AROUND THE PERIMETER OF THE EQUIPMENT AREA. ALL NON-TELECOMMUNICATIONS RELATED METALLIC OBJECTS FOUND WITHIN A SITE SHALL BE GROUNDED TO THE INTERIOR GROUND RING WITH #6 AWG STRANDED GREEN INSULATED CONDUCTOR. (ATT-TP-76416 / 7.6.4)

(D) BOND TO INTERIOR GROUND RING: #2 AWG SOLID TINNED COPPER WIRE PRIMARY BONDS SHALL BE PROVIDED AT LEAST AT FOUR POINTS ON THE INTERIOR GROUND RING, LOCATED AT THE CORNERS OF THE BUILDING. (ATT-TP-76416 7.5.2.2)

(E) GROUND ROD: UL LISTED COPPER CLAD STEEL. MINIMUM 5/8" DIAMETER BY EIGHT FEET LONG. GROUND RODS SHALL BE INSTALLED WITH INSPECTION SLEEVES. GROUND RODS SHALL BE DRIVEN TO THE DEPTH OF GROUND RING CONDUCTOR. (ATT-TP-76416)

(F) CELL REFERENCE GROUND BAR: POINT OF GROUND REFERENCE FOR ALL COMMUNICATIONS EQUIPMENT FRAMES. ALL BONDS ARE MADE WITH #2 AWG UNLESS NOTED OTHERWISE STRANDED GREEN INSULATED COPPER CONDUCTORS. BOND TO GROUND RING WITH (2) #2 SOLID TINNED COPPER CONDUCTORS. (ATT-TP-76416 / 7.6.7)

(G) HATCH PLATE GROUND BAR: BOND TO THE INTERIOR GROUND RING WITH TWO #2 AWG STRANDED GREEN INSULATED COPPER CONDUCTORS. WHEN A HATCH-PLATE AND A CELL REFERENCE GROUND BAR ARE BOTH PRESENT, THE CRGB MUST BE CONNECTED TO THE HATCH-PLATE AND TO THE INTERIOR GROUND RING USING (2) TWO #2 AWG STRANDED GREEN INSULATED COPPER CONDUCTORS EACH.

(H) EXTERIOR CABLE ENTRY PORT GROUND BARS: LOCATED AT THE ENTRANCE TO THE CELL SITE BUILDING. BOND TO GROUND RING WITH A #2 AWG SOLID TINNED COPPER CONDUCTORS WITH AN EXOTHERMIC WELD AND INSPECTION SLEEVE. (ATT-TP-76416 / 7.6.7.2)

(J) TOWER EXIT GROUND BAR: #2 AWG SOLID TINNED COPPER BOND TO THE TOWER GROUND RING. (ATT-TP-76416 / 7.4.2.6)

(K) TELCO GROUND BAR: BOND TO BOTH CELL REFERENCE GROUND BAR AND EXTERIOR GROUND RING. (ATT-TP-76416 / 7.6.8)

(L) FRAME BONDING: THE BONDING POINT FOR TELECOM EQUIPMENT FRAMES SHALL BE THE GROUND BUS THAT IS NOT ISOLATED FROM THE EQUIPMENTS METAL FRAMEWORK. BOND THE FRAME GROUND TO THE "I" SECTION OF THE CELL REFERENCE GROUND BAR OR SUPPLEMENTARY CONDUCTOR. (ATT-TP-76416 6.5.3 AND 7.8)

(M) INTERIOR UNIT BONDS: METAL FRAMES, CABINETS AND INDIVIDUAL METALLIC UNITS LOCATED WITH THE AREA OF THE INTERIOR GROUND RING REQUIRE A #6 AWG STRANDED GREEN INSULATED COPPER BOND TO THE INTERIOR GROUND RING. (ATT-TP-76416 / 7.12.3.1)

(N) FENCE AND GATE GROUNDING: METAL FENCES WITHIN 7 FEET OF THE EXTERIOR GROUND RING OR OBJECTS BONDED TO THE EXTERIOR GROUND RING SHALL BE BONDED TO THE GROUND RING WITH A #2 AWG SOLID TINNED COPPER CONDUCTOR AT AN INTERVAL NOT EXCEEDING 25 FEET. BONDS SHALL BE MADE AT EACH GATE POST AND ACROSS GATE OPENINGS. (ATT-TP-76416 / 7.12.2.2)

(P) EXTERIOR UNIT BONDS: METALLIC OBJECTS, EXTERNAL TO OR MOUNTED TO THE BUILDING, SHALL BE BONDED TO THE EXTERIOR GROUND RING. (ATT-TP-76416 7.12.2)

(Q) ICE BRIDGE SUPPORTS: EACH ICE BRIDGE LEG SHALL BE BONDED TO THE GROUND RING WITH #2 AWG BARE TINNED COPPER CONDUCTOR. PROVIDE EXOTHERMIC WELDS AT BOTH THE ICE BRIDGE LEG AND BURIED GROUND RING. (ATT-TP-76416 / 7.4.2.6)

(R) DURING ALL DC POWER SYSTEM CHANGES INCLUDING DC SYSTEM CHANGE OUTS, RECTIFIER REPLACEMENTS OR ADDITIONS, BREAKER DISTRIBUTION CHANGES, BATTERY ADDITIONS, BATTERY REPLACEMENTS AND INSTALLATIONS OR CHANGES TO DC CONVERTER SYSTEMS IT SHALL BE REQUIRED THAT SERVICE CONTRACTORS VERIFY ALL DC POWER SYSTEMS ARE EQUIPPED WITH A MASTER DC SYSTEM RETURN GROUND CONDUCTOR FROM THE DC POWER SYSTEM COMMON RETURN BUS DIRECTLY CONNECTED TO THE CELL SITE REFERENCE GROUND BAR (CRGB) PER TP76300 SECTION H 6 AND TP76416 FIGURE 7-11 REQUIREMENTS.

(S) OUTDOOR GROUNDING CONDUCTORS: GROUNDING CONDUCTORS INSTALLED OUTDOORS AND RUN ENTIRELY ABOVE GRADE SHALL BE TINNED STRANDED COPPER AND BE SUNLIGHT RESISTANT.

GROUNDING KEY NOTES

at&t
188 INVERNESS DRIVE WEST
SUITE 400
ENGLEWOOD, CO 80112

BLACK & VEATCH
4600 SOUTH SYRACUSE STREET
SUITE 800
DENVER, COLORADO 80237

PROJECT/PHASE NO: 129551/1207
DRAWN BY: PDJ
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REV	DATE	DESCRIPTION
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COLORADO LICENSED
JASON T. KAHRS
52811
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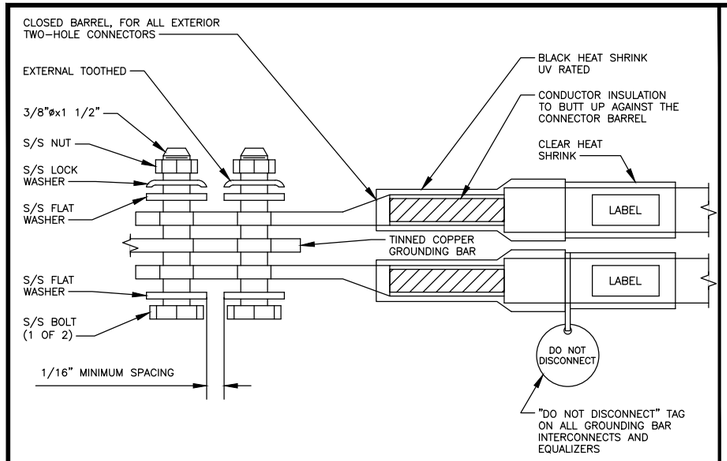
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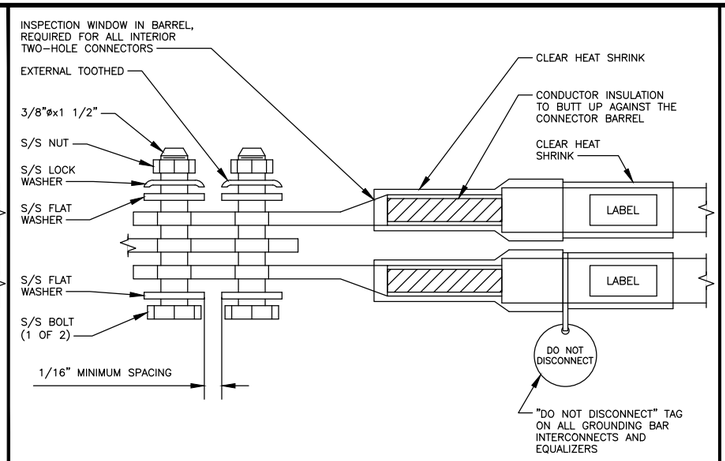
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GROUNDING ONE-LINE DIAGRAM

SHEET NUMBER
G-1

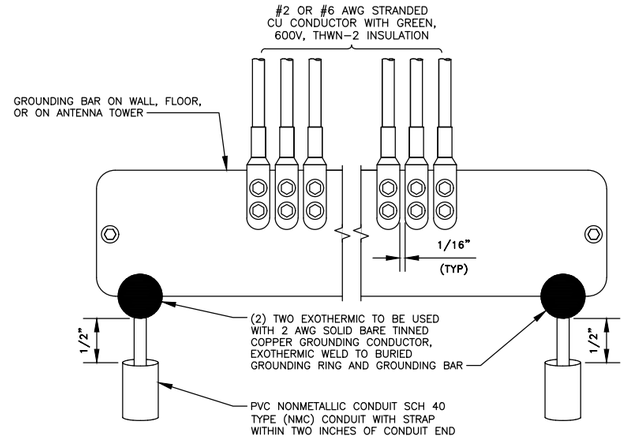
PERMIT NO:
TELE24-00035



INTERIOR TWO HOLE LUG | NO SCALE | 1



EXTERIOR TWO HOLE LUG | NO SCALE | 2



INSTALLATION OF GROUNDING CONDUCTOR TO GROUNDING BAR | NO SCALE | 3

NEWTON INSTRUMENT COMPANY, INC. BUTNER, NC			
NO	REQUIRED	PART NUMBER	DESCRIPTION
1	1	1/4"X4"X30"	SOLID GROUND BAR
2	2	A-6056	WALL MOUNTING BRACKET
3	2	3061-4	INSULATORS
4	4	3012-1	5/8"-11X1" H.H.C.S.
5	4	3015-8	5/8" LOCKWASHER

EACH GROUND CONDUCTOR TERMINATING ON ANY GROUND BAR SHALL HAVE AN IDENTIFICATION TAG ATTACHED AT EACH END THAT WILL IDENTIFY ITS ORIGIN AND DESTINATION

SECTION "P" – SURGE PROTECTORS
(EC) CABLE ENTRY PORTS (HATCH PLATES) (#2)
(EC) TELCO GROUND BAR (#2)
(EC) COMMERCIAL POWER COMMON NEUTRAL/GROUND BOND (#2)
(AT&T) CELL SITE +24V POWER SUPPLY RETURN BAR (#2)
(AT&T) CELL SITE -48V POWER SUPPLY RETURN BAR (#2)
(EC) GENERATOR FRAMEWORK (IF AVAILABLE) (#2)
(AT&T) RECTIFIER FRAMES
(AT&T) ANTENNA SUPPRESSION

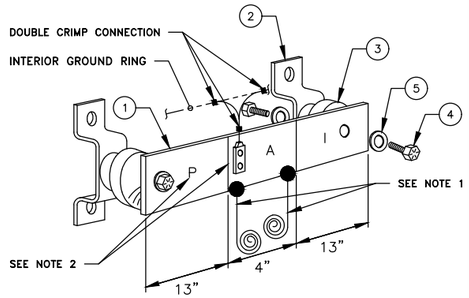
SECTION "A" – SURGE ABSORBERS
(EC) INTERIOR GROUND RING (#2)
(EC) EXTERNAL EARTH GROUND FIELD (BURIED GROUND RING) (#2)
(EC) METALLIC COLD WATER PIPE (IF AVAILABLE) (#2)
(EC) BUILDING STEEL (IF AVAILABLE) (#2)

SECTION "I" – ISOLATED GROUNDING ZONE
(AT&T) ALL CELL SITE COMMUNICATIONS EQUIPMENT FRAMES

(MGB) REFERENCE GROUNDING BAR | NO SCALE | 4

DETAIL NOTES

1. EXOTHERMICALLY WELD #2 AWG BARE TINNED SOLID COPPER CONDUCTOR TO GROUND BAR. ROUTE CONDUCTOR TO BURIED GROUND RING AND PROVIDE PARALLEL EXOTHERMIC WELD.
2. EC SHALL PERMANENTLY MARK THE LINES BETWEEN EACH SECTION AND LABEL EACH SECTION ("P", "A", "I") WITH 1" HIGH LETTERS.
3. GROUND BAR SHALL BE ENGRAVED PER AT&T SPECIFICATIONS TO PREVENT THEFT.



NOTES | NO SCALE | 5

1. ALL MAIN CABLES WILL BE GROUNDED W/ COAXIAL CABLE GROUND KITS AT:
   A. THE ANTENNA LEVEL.
   B. MID LEVEL IF TOWER IS OVER 200'.
   C. BASE OF TOWER PRIOR TO TURNING HORIZONTAL
   D. OUTSIDE THE EQUIPMENT SHELTER AT ENTRY PORT.
   E. INSIDE THE EQUIPMENT SHELTER AT THE ENTRY PORT.
2. ALL PROPOSED GROUND BAR DOWNLEADS ARE TO BE CADWELDED TO THE EXISTING ADJACENT GROUND BAR DOWNLEADS A MINIMUM DISTANCE OF FOUR FEET BELOW GROUND BAR.
3. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ANTENNA AND COAX CONFIGURATION, MAKE AND MODELS PRIOR TO INSTALLATION.
4. DO NOT ALLOW THE COPPER CONDUCTOR TO TOUCH THE GALVANIZED GUY WIRE AT THE CONNECTION POINT OR AT ANY OTHER POINT. NO EXOTHERMICALLY WELDED CONNECTION SHALL BE MADE TO THE GUY WIRE.
5. SUBCONTRACTOR SHALL GROUND ALL EQUIPMENT INCLUDING ANTENNAS, RET MOTORS, TMA'S, COAX CABLES, AND RET CONTROL CABLES AS A COMPLETE SYSTEM. GROUNDING SHALL BE EXECUTED BY QUALIFIED PERSONEL IN COMPLIANCE WITH MANUFACTURER'S SPECIFICATIONS AND RECOMMENDATIONS.
6. DO NOT INSTALL CABLE GROUNDING KIT AT A BEND AND ALWAYS DIRECT GROUNDING CONDUCTOR DOWN TO GROUNDING BAR.
7. GROUNDING KIT SHALL BE TYPE AND PART NUMBER AS SUPPLIED OR RECOMMENDED BY CABLE MANUFACTURER.
8. WEATHERPROOFING SHALL BE TYPE AND PART NUMBER AS SUPPLIED OR RECOMMENDED BY CABLE MANUFACTURER.
9. ALL EXTERIOR HEAT SHRINK OR HEAT SHRINK EXPOSED TO U/V LIGHT SHALL BE BLACK. ALL INTERIOR HEAT SHRINK SHALL BE CLEAR.
10. NUMBER OF GROUNDING BARS MAY VARY DEPENDING ON THE TYPE OF TOWER, ANTENNA LOCATION, AND CONNECTION ORIENTATION. THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING ADDITIONAL GROUNDING BAR AS REQUIRED, PROVIDING 50% SPARE CONNECTION POINTS.
11. PROVIDE GROUNDING KIT 6" BEFORE TURN TRANSITION FROM TOWER TO ICE BRIDGE.

NOT USED | NO SCALE | 6

NOT USED | NO SCALE | 7

NOT USED | NO SCALE | 8

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COLORADO LICENSED
JASON T. KAHRS
52811
PROFESSIONAL ENGINEER
04/24/2024

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EDGEMONT
COL01184
5351 WEST 6TH AVENUE
LAKEWOOD, CO 80214
CELL SITE RF MODIFICATIONS

SHEET TITLE
GROUNDING DETAILS

SHEET NUMBER
G-2

PERMIT NO:
TELE24-00035

LEGEND

EXOTHERMIC CONNECTION

MECHANICAL CONNECTION

CHEMICAL ELECTROLYTIC GROUNDING SYSTEM

TEST CHEMICAL ELECTROLYTIC GROUNDING SYSTEM

EXOTHERMIC WITH INSPECTION SLEEVE

GROUNDING BAR

GROUND ROD

TEST GROUND ROD WITH INSPECTION SLEEVE

SINGLE POLE SWITCH

DUPLEX RECEPTACLE

DUPLEX GFCI RECEPTACLE

FLUORESCENT LIGHTING FIXTURE
(2) TWO LAMPS 48–T8

SMOKE DETECTION (DC)

EMERGENCY LIGHTING (DC)

SECURITY LIGHT W/PHOTOCELL LITHONIA ALXW
LED–1–25A400/51K–SR4–120–PE–DDBTXD

CHAIN LINK FENCE

WOOD/WROUGHT IRON FENCE

WALL STRUCTURE

LEASE AREA

PROPERTY LINE (PL)

SETBACKS

ICE BRIDGE

CABLE TRAY

WATER LINE

UNDERGROUND POWER

UNDERGROUND TELCO

OVERHEAD POWER

OVERHEAD TELCO

UNDERGROUND TELCO/POWER

ABOVE GROUND POWER

ABOVE GROUND TELCO

ABOVE GROUND TELCO/POWER

WORKPOINT

SECTION REFERENCE

DETAIL REFERENCE

ABBREVIATIONS

AB	ANCHOR BOLT
ABV	ABOVE
AC	ALTERNATING CURRENT
ADDL	ADDITIONAL
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AGL	ABOVE GROUND LEVEL
AIC	AMPERAGE INTERRUPTION CAPACITY
ALUM	ALUMINUM
ALT	ALTERNATE
ANT	ANTENNA
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
BATT	BATTERY
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BM	BEAM
BTC	BARE TINNED COPPER CONDUCTOR
BOF	BOTTOM OF FOOTING
CAB	CABINET
CANT	CANTILEVERED
CHG	CHARGING
CLG	CEILING
CLR	CLEAR
COL	COLUMN
COMM	COMMON
CONC	CONCRETE
CONSTR	CONSTRUCTION
DBL	DOUBLE
DC	DIRECT CURRENT
DEPT	DEPARTMENT
DF	DOUGLAS FIR
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DWG	DRAWING
DWL	DOWEL
EA	EACH
EC	ELECTRICAL CONDUCTOR
EL.	ELEVATION
ELEC	ELECTRICAL
EMT	ELECTRICAL METALLIC TUBING
ENG	ENGINEER
EQ	EQUAL
EXP	EXPANSION
EXT	EXTERIOR
EW	EACH WAY
FAB	FABRICATION
FF	FINISH FLOOR
FG	FINISH GRADE
FIF	FACILITY INTERFACE FRAME
FIN	FINISH(ED)
FLR	FLOOR
FDN	FOUNDATION
FOC	FACE OF CONCRETE
FOM	FACE OF MASONRY
FOS	FACE OF STUD
FOW	FACE OF WALL
FS	FINISH SURFACE
FT	FOOT
FTG	FOOTING
GA	GAUGE
GEN	GENERATOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GLB	GLUE LAMINATED BEAM
GLV	GALVANIZED
GPS	GLOBAL POSITIONING SYSTEM
GND	GROUND
GSM	GLOBAL SYSTEM FOR MOBILE
HDG	HOT DIPPED GALVANIZED
HDR	HEADER
HGR	HANGER
HVAC	HEAT/VENTILATION/AIR CONDITIONING
HT	HEIGHT
IGR	INTERIOR GROUND RING
IN	INCH
INT	INTERIOR
LB(S)	POUND(S)
LF	LINEAR FEET
LTE	LONG TERM EVOLUTION
MAS	MASONRY
MAX	MAXIMUM
MB	MACHINE BOLT
MECH	MECHANICAL
MFR	MANUFACTURER
MGB	MASTER GROUND BAR
MIN	MINIMUM
MISC	MISCELLANEOUS
MTL	METAL
MTS	MANUAL TRANSFER SWITCH
MW	MICROWAVE
NEC	NATIONAL ELECTRIC CODE
NM	NEWTON METERS
NO.	NUMBER
#	NUMBER
NTS	NOT TO SCALE
OC	ON–CENTER
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OPNG	OPENING
P/C	PRECAST CONCRETE
PCS	PERSONAL COMMUNICATION SERVICES
PCU	PRIMARY CONTROL UNIT
PRC	PRIMARY RADIO CABINET
PP	POLARIZING PRESERVING
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	PRESSURE TREATED
PWR	POWER CABINET
QTY	QUANTITY
RAD	RADIUS
RECT	RECTIFIER
REF	REFERENCE
REINF	REINFORCEMENT
REQ'D	REQUIRED
RET	REMOTE ELECTRIC TILT
RF	RADIO FREQUENCY
RMC	RIGID METALLIC CONDUIT
RRH	REMOTE RADIO HEAD
RRU	REMOTE RADIO UNIT
RWY	RACEWAY
SCH	SCHEDULE
SHT	SHEET
SIAD	SMART INTEGRATED ACCESS DEVICE
SIM	SIMILAR
SPEC	SPECIFICATION
SQ	SQUARE
SS	STAINLESS STEEL
STD	STANDARD
STL	STEEL
TEMP	TEMPORARY
THK	THICKNESS
TMA	TOWER MOUNTED AMPLIFIER
TN	TOE NAIL
TOA	TOP OF ANTENNA
TOC	TOP OF CURB
TOF	TOP OF FOUNDATION
TOP	TOP OF PLATE (PARAPET)
TOS	TOP OF STEEL
TOW	TOP OF WALL
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
TYP	TYPICAL
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORY
UNO	UNLESS NOTED OTHERWISE
UMTS	UNIVERSAL MOBILE TELECOMMUNICATIONS SYSTEM
UPS	UNITERRUPTIBLE POWER SYSTEM (DC POWER PLANT)
VIF	VERIFIED IN FIELD
W	WIDE
W/	WITH
WD	WOOD
WP	WEATHERPROOF
WT	WEIGHT

at&t

188 INVERNESS DRIVE WEST
SUITE 400
ENGLEWOOD, CO 80112

BLACK & VEATCH

4600 SOUTH SYRACUSE STREET
SUITE 800
DENVER, COLORADO 80237

PROJECT/PHASE NO:	129551/1207
DRAWN BY:	PDJ
CHECKED BY:	JMH
RFDS:	___

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LEGEND & ABBREVIATIONS

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GENERAL CONSTRUCTION NOTES

GENERAL CONSTRUCTION

1. FOR THE PURPOSE OF CONSTRUCTION DRAWINGS, THE FOLLOWING DEFINITIONS SHALL APPLY:
   GENERAL CONTRACTOR: OVERLAND CONTRACTING INC. (B&V)
   CONTRACTOR: (CONSTRUCTION)
   OWNER: AT&T
2. ALL SITE WORK SHALL BE COMPLETED AS INDICATED ON THE DRAWINGS AND AT&T PROJECT SPECIFICATIONS.
3. GENERAL CONTRACTOR SHALL VISIT THE SITE AND SHALL FAMILIARIZE HIMSELF WITH ALL CONDITIONS AFFECTING THE PROPOSED WORK AND SHALL MAKE NECESSARY PROVISIONS. PRIOR TO PROCEEDING WITH CONSTRUCTION, GENERAL CONTRACTOR SHALL FAMILIARIZE HIMSELF WITH ALL CONTRACT DOCUMENTS, SITE CONDITIONS, DIMENSIONS, AND CONFIRMING THAT THE WORK CAN BE ACCOMPLISHED AS SHOWN ON PLAN. ANY DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER PRIOR TO THE COMMENCEMENT OF WORK.
4. MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS, AND ORDINANCES. GENERAL CONTRACTOR SHALL ISSUE ALL APPROPRIATE NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS, AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF WORK.
5. ALL WORK CARRIED OUT SHALL COMPLY WITH APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS IN ADDITION TO LOCAL JURISDICTIONAL CODES, ORDINANCES, AND APPLICABLE REGULATIONS.
6. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS SHOWN ON THE DRAWINGS.
7. PLANS SHALL NOT BE SCALED. THESE PLANS ARE INTENDED TO BE A DIAGRAMMATIC OUTLINE ONLY, UNLESS OTHERWISE NOTED. DIMENSIONS SHOWN ARE TO FINISH SURFACES, UNLESS OTHERWISE NOTED. SPACING BETWEEN EQUIPMENT IS THE MINIMUM REQUIRED CLEARANCE. IT IS CRITICAL TO FIELD VERIFY ALL DIMENSIONS. SHOULD THERE BE ANY QUESTIONS REGARDING THE PLAN, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A CLARIFICATION FROM THE ENGINEER PRIOR TO PROCEEDING WITH THE WORK. DETAILS ARE INTENDED TO SHOW DESIGN INTENT. MODIFICATIONS MAY BE REQUIRED TO SUIT JOB DIMENSIONS OR CONDITIONS. SUCH MODIFICATIONS SHALL BE INCLUDED AS PART OF WORK AND APPROVED BY THE ENGINEER PRIOR TO PROCEEDING WITH WORK.
8. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.
9. IF THE SPECIFIED EQUIPMENT CANNOT BE INSTALLED AS SHOWN ON THE PLAN, THE CONTRACTOR SHALL PROPOSE AN ALTERNATIVE INSTALLATION SPACE FOR APPROVAL BY THE ENGINEER PRIOR TO PROCEEDING.
10. GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFETY OF WORK AREA, ADJACENT AREAS, AND BUILDING OCCUPANTS THAT ARE LIKELY TO BE AFFECTED BY THE WORK UNDER THIS CONTRACT. WORK SHALL CONFORM TO ALL OSHA REQUIREMENTS AND THE LOCAL JURISDICTION.
11. GENERAL CONTRACTOR SHALL COORDINATE AND SCHEDULE WORK ACTIVITIES WITH OTHER DISCIPLINES.
12. ERECTION SHALL BE DONE IN A WORKMANLIKE MANNER BY COMPETENT, EXPERIENCED WORKMEN IN ACCORDANCE WITH APPLICABLE CODES AND THE BEST ACCEPTED PRACTICE. ALL MEMBERS SHALL BE LAID PLUMB AND TRUE AS INDICATED ON THE DRAWINGS.
13. SEAL PENETRATIONS THROUGH FIRE RATED AREAS, SHALL BE MADE WITH UL LISTED MATERIALS, APPROVED BY THE LOCAL JURISDICTION. CONTRACTOR SHALL KEEP AREA CLEAN AND HAZARD FREE, AND DISPOSE OF ALL DEBRIS DAILY.
14. AS-BUILT CONDITIONS ARE REPRESENTED BY LIGHT SHADED LINES AND NOTES. THE SCOPE OF WORK FOR THIS PROJECT IS REPRESENTED BY DARK SHADED LINES AND NOTES. CONTRACTOR SHALL NOTIFY THE GENERAL CONTRACTOR OF ANY EXISTING CONDITIONS THAT DEVIATE FROM THE DRAWINGS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
15. CONTRACTOR SHALL PROVIDE WRITTEN NOTICE TO THE CONSTRUCTION MANAGER, 48 HOURS PRIOR TO COMMENCEMENT OF WORK.
16. THE CONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS, PAVEMENTS, CURBS, LANDSCAPING, AND STRUCTURES DURING CONSTRUCTION OPERATIONS. ANY DAMAGED AREAS/ SITE ELEMENTS SHALL BE REPAIRED AT CONTRACTOR'S EXPENSE TO THE SATISFACTION OF THE OWNER.
17. THE CONTRACTOR SHALL CONTACT UTILITY LOCATING SERVICES PRIOR TO THE START OF CONSTRUCTION. CONTRACTOR IS ALSO RESPONSIBLE FOR THE NOTIFICATION OF TIER-TWO FACILITY/UTILITY OWNERS.
18. GENERAL CONTRACTOR SHALL COORDINATE AND MAINTAIN ACCESS FOR ALL TRADES AND CONTRACTORS TO THE SITE AND/OR BUILDING.
19. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR SECURITY OF THE SITE FOR THE DURATION OF CONSTRUCTION UNTIL JOB COMPLETION.
20. THE GENERAL CONTRACTOR SHALL MAINTAIN IN GOOD CONDITION ONE COMPLETE SET OF PLANS WITH ALL REVISIONS, ADDENDA, AND CHANGE ORDERS, ON THE PREMISES, AT ALL TIMES.
21. THE CONTRACTOR SHALL PROVIDE PORTABLE FIRE EXTINGUISHERS WITH A RATING OF NOT LESS THAN 2-A OT 2-A:10-B:C LOCATED WITHIN 25 FEET OF TRAVEL DISTANCE TO WORK ALL AREAS OR WHERE WORK IS BEING PERFORMED DURING CONSTRUCTION.
22. ALL EXISTING ACTIVE SEWER, WATER, GAS, ELECTRIC, AND OTHER UTILITIES SHALL BE PROTECTED AT ALL TIMES, AND WHERE REQUIRED FOR THE PROPER EXECUTION OF THE WORK, SHALL BE RELOCATED AS DIRECTED BY THE ENGINEER. EXTREME CAUTION SHOULD BE USED BY THE CONTRACTOR WHEN EXCAVATING OR DRILLING PIERS AROUND OR NEAR UTILITIES. CONTRACTOR SHALL PROVIDE SAFETY TRAINING FOR THE WORKING CREW. TRAINING SHALL INCLUDE BUT NOT BE LIMITED TO A) FALL PROTECTION, B) CONFINED SPACE, C) ELECTRICAL SAFETY, AND D) TRENCHING & EXCAVATION.
23. ALL EXISTING INACTIVE SEWER, WATER, GAS, ELECTRIC, AND OTHER UTILITIES, WHICH INTERFERE WITH THE EXECUTION OF THE WORK, SHALL BE REMOVED, CAPPED, PLUGGED, OR OTHERWISE DISCONNECTED AT POINTS WHICH WILL NOT INTERFERE WITH THE EXECUTION OF THE WORK, AS DIRECTED BY THE RESPONSIBLE ENGINEER, AND SUBJECT TO THE APPROVAL OF THE OWNER AND/OR LOCAL UTILITIES.
24. THE AREAS OF THE OWNER'S PROPERTY DISTURBED BY THE WORK AND NOT COVERED BY THE TOWER, EQUIPMENT, OR DRIVEWAY, SHALL BE GRADED TO A UNIFORM SLOPE AND PROPERLY STABILIZED TO PREVENT EROSION.
25. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO THE SITE DURING CONSTRUCTION. EROSION CONTROL AND SEDIMENT CONTROL MEASURES, IF REQUIRED DURING CONSTRUCTION, SHALL BE IN CONFORMANCE WITH FEDERAL AND/OR LOCAL JURISDICTIONS.
26. FILL OR EMBANKMENT MATERIAL SHALL NOT BE PLACED ON FROZEN GROUND. FROZEN MATERIALS, SNOW, OR ICE SHALL NOT BE PLACED IN ANY FILL OR EMBANKMENT.
27. THE SUBGRADE SHALL BE BROUGHT TO A SMOOTH UNIFORM GRADE AND COMPACTED TO 95 PERCENT STANDARD PROCTOR UNDER PAVEMENT AND STRUCTURES AND 80 PERCENT STANDARD PROCTOR IN OPEN SPACE. ALL TRENCHES IN THE PUBLIC RIGHT-OF-WAY SHALL BE BACKFILLED WITH FLOWABLE FILL OR OTHER MATERIAL, PRE-APPROVED BY THE LOCAL JURISDICTION.
28. ALL NECESSARY RUBBISH, STUMPS, DEBRIS, STICKS, STONES, AND OTHER REFUSE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF IN A LAWFUL MANNER.
29. ALL BROCHURES, OPERATION MANUALS, MAINTENANCE MANUALS, CATALOGS, SHOP DRAWINGS, AND OTHER DOCUMENTS SHALL BE TURNED OVER TO THE GENERAL CONTRACTOR AT COMPLETION OF CONSTRUCTION AND PRIOR TO PAYMENT.
30. CONTRACTOR SHALL SUBMIT A COMPLETE SET OF AS-BUILT REDLINES TO THE GENERAL CONTRACTOR UPON COMPLETION OF PROJECT AND PRIOR TO FINAL PAYMENT.
31. THE PROPOSED FACILITY WILL BE UNMANNED, DOES NOT REQUIRE POTABLE WATER OR SEWER SERVICE, AND IS NOT FOR HUMAN HABITAT (NO HANDICAP ACCESS REQUIRED).
32. OCCUPANCY IS LIMITED TO PERIODIC MAINTENANCE AND INSPECTION OF APPROXIMATELY TWO TIMES PER MONTH BY AT&T TECHNICIANS.
33. NO OUTDOOR STORAGE OR SOLID WASTE CONTAINERS ARE PROPOSED.
34. ALL MATERIAL SHALL BE FURNISHED AND WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE LATEST REVISION AT&T MOBILITY GROUNDING STANDARD "TECHNICAL SPECIFICATION FOR CONSTRUCTION OF GSM WIRELESS SITES" AND "TECHNICAL SPECIFICATION FOR FACILITY GROUNDING". IN CASE OF A CONFLICT BETWEEN THE CONSTRUCTION SPECIFICATIONS AND THE DRAWINGS, THE DRAWINGS SHALL GOVERN.
35. CONTRACTORS SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS AND INSPECTIONS REQUIRED FOR CONSTRUCTION. IF CONTRACTOR CANNOT OBTAIN A PERMIT, THEY MUST NOTIFY THE GENERAL CONTRACTOR IMMEDIATELY.
36. CONTRACTOR SHALL REMOVE ALL TRASH AND DEBRIS FROM THE SITE ON A DAILY BASIS.
37. CONTRACTOR SHALL LEAVE PREMISES IN A CLEAN CONDITION.
38. INFORMATION SHOWN ON THESE DRAWINGS WAS OBTAINED FROM SITE OBSERVATIONS AND/OR DRAWINGS PROVIDED BY THE SITE OWNER. CONTRACTORS SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES PRIOR TO ORDERING MATERIAL OR PROCEEDING WITH CONSTRUCTION.
39. WHITE STROBE LIGHTS ARE NOT PERMITTED. IF LIGHTING IS REQUIRED, IT SHALL MEET FAA STANDARDS AND REQUIREMENTS.
40. ALL COAXIAL CABLE CONTRACTOR SHALL INSTALL PER MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.

ANTENNA MOUNTING

41. DESIGN AND CONSTRUCTION OF ANTENNA SUPPORTS SHALL CONFORM TO CURRENT ANSI/TIA-222 OR APPLICABLE LOCAL CODES.
42. ALL STEEL MATERIALS SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 "ZINC (HOT-DIP GALVANIZED) COATINGS ON IRON AND STEEL PRODUCTS", UNLESS NOTED OTHERWISE.
43. ALL BOLTS, ANCHORS AND MISCELLANEOUS HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153 "ZINC-COATING (HOT-DIP) ON IRON AND STEEL HARDWARE", UNLESS NOTED OTHERWISE.
44. DAMAGED GALVANIZED SURFACES SHALL BE REPAIRED BY COLD GALVANIZING IN ACCORDANCE WITH ASTM A780.
45. ALL ANTENNA MOUNTS SHALL BE INSTALLED WITH LOCK WASHERS AND/OR DOUBLE NUTS, AND SHALL BE TORQUED TO MANUFACTURER'S RECOMMENDATIONS.
46. CONTRACTOR SHALL INSTALL ANTENNA AND ASSOCIATED GROUNDING PER MANUFACTURER'S RECOMMENDATIONS.
47. ALL UNUSED PORTS ON ANY ANTENNA OR TMA, SHALL BE COVERED BY CONCEALOR CAP WITH PROPER WEATHER PROOFING OR BE TERMINATED WITH A 50 Ω LOAD.
48. PRIOR TO SETTING ANTENNA AZIMUTHS AND DOWNTILTS, ANTENNA CONTRACTOR SHALL CHECK THE ANTENNA MOUNT FOR TIGHTNESS AND ENSURE THAT THEY ARE PLUMB. ANTENNA AZIMUTHS SHALL BE SET FROM TRUE NORTH AND BE ORIENTED WITHIN +/- 3 DEGREES AS DEFINED BY THE RFDS. ANTENNA DOWNTILTS SHALL BE WITHIN +/- 0.5 DEGREES AS DEFINED BY THE RFDS. REFER TO ATT-002-290-210.
49. JUMPERS FROM THE TOWER MOUNTED AMPLIFIERS MUST TERMINATE TO OPPOSITE POLARIZATIONS IN EACH SECTOR.
50. CONTRACTOR SHALL RECORD THE SERIAL NUMBER, SECTOR, AND POSITION OF EACH ACTUATOR INSTALLED AT THE ANTENNAS AND PROVIDE THE INFORMATION TO AT&T.
51. TOWER MOUNTED AMPLIFIERS SHALL BE MOUNTED ON PIPE DIRECTLY BEHIND ANTENNAS AS CLOSE TO ANTENNA AS FEASIBLE IN A VERTICAL POSITION.
52. ANTENNAS SHALL HAVE A 4'-0" MINIMUM CENTER-TO-CENTER HORIZONTAL SEPARATION.

TORQUE REQUIREMENTS

53. ALL RF CONNECTIONS SHALL BE TIGHTENED BY A TORQUE WRENCH.
54. A TORQUE MARK FORMING A CONTINUOUS STRAIGHT LINE IS TO BE MADE IN THE FOLLOWING APPLICATIONS:
    A. RF CONNECTIONS – MARK BOTH SIDES OF THE CONNECTOR
    B. GROUNDING AND ANTENNA HARDWARE – MARK ON THE NUT SIDE OF THE BOLT, STARTING FROM THE THREADS TO THE SOLID SURFACE. SOLID SURFACE EXAMPLES INCLUDE A GROUND BAR OR ANTENNA BRACKET METAL.
55. ALL 8M ANTENNA HARDWARE SHALL BE TIGHTENED TO 9 LB-FT (12 NM).
56. ALL 12M ANTENNA HARDWARE SHALL BE TIGHTENED TO 43 LB-FT (58 NM).
57. ALL GROUNDING HARDWARE SHALL BE TIGHTENED UNTIL THE LOCK WASHER COLLAPSES AND THE GROUNDING HARDWARE IS NO LONGER LOOSE.
58. ALL DIN TYPE CONNECTIONS SHALL BE TIGHTENED TO 18-22 LB-FT (24.4 – 29.8 NM).
59. ALL N TYPE CONNECTIONS SHALL BE TIGHTENED TO 15-20 LB-IN (1.7 – 2.3 NM).

FIBER & POWER CABLE MOUNTING

60. THE FIBER OPTIC TRUNK CABLES SHALL BE INSTALLED IN CONDUITS OR INNERDUCT. WHEN UTILIZING A CABLE TRAY SYSTEM, PLACE FIBER OPTIC TRUNK CABLE INTO AN INTER-DUCT. A PARTITION BARRIER SHALL BE INSTALLED BETWEEN THE 600 VOLT CABLES AND THE INTER-DUCT IN ORDER TO SEGREGATE CABLE TYPES. OPTIC FIBER TRUNK CABLES SHALL HAVE APPROVED CABLE RESTRAINTS EVERY (6) SIX FEET AND SHALL BE SECURELY FASTENED TO THE CABLE TRAY SYSTEM. NFPA 70 (NEC) ATRICLE 770 RULES SHALL APPLY.
61. TYPE TC-ER CABLES SHALL BE INSTALLED INTO CONDUITS OR CABLE TRAYS, AND SHALL BE SECURED AT INTERVALS NOT EXCEEDING (6) FEET. WHERE TYPE TC-ER CABLES ARE NOT SUBJECT TO PHYSICAL DAMAGE, CABLES SHALL BE PERMITTED TO MAKE A TRANSITION BETWEEN CONDUITS OR CABLE TRAYS THAT ARE SERVICING UTILIZATION EQUIPMENT OR DEVICES. A TRANSITION DISTACE EXCEEDING (6) FEET REQUIRES CONTINUOUS SUPPORTING. NFPA 70 (NEC) ARTICLES 336 AND 392 RULES SHALL APPLY.
62. WHEN INSTALLING OPTIC FIBER TRUNK CABLES OR TYPE TC-ER CABLES INTO CONDUITS, NFPA 70 (NEC) ARTICLE 300 RULES SHALL APPLY.

COAXIAL CABLE NOTES

63. TYPES AND SIZES OF THE ANTENNA CABLES ARE BASED ON ESTIMATED LENGTHS. PRIOR TO ORDERING CABLE, CONTRACTOR SHALL VERIFY ACTUAL LENGTH BASED ON CONSTRUCTION LAYOUT AND NOTIFY THE PROJECT MANAGER IF ACTUAL LENGTHS EXCEED ESTIMATED LENGTHS.
64. CONTRACTOR SHALL VERIFY THAT THE DOWNTILT OF EACH ANTENNA IS WITHIN +/- 0.5 DEGREES OF SPECIFICATION WITH AN OCI APPROVED DIGITAL LEVEL.
65. CONTRACTOR SHALL CONFIRM COAX COLOR CODING PRIOR TO CONSTRUCTION. REFER TO LASTEST REVISION OF THE "ANTENNA SYSTEM LABELING STANDARD."
66. ALL COAXIAL CABLE SHALL BE SECURED TO THE DESIGNED SUPPORT STRUCTURE IN AN APPROVED MANNER, NOT TO EXCEED MANUFACTURER'S RECOMMENDATIONS.
67. COAXIAL CABLE SHALL BE SECURED TO THE DESIGNATED SUPPORT STRUCTURE(S) PER MANUFACTURER'S SPECIFICATIONS.

GENERAL CABLE AND EQUIPMENT NOTES

68. CONTRACTOR SHALL BE RESPONSIBLE TO VERIFY ANTENNA, TMAS, DIPLEXERS, COAX CONFIGURATION, MAKES, AND MODELS PRIOR TO INSTALLATION.
69. ALL CONNECTIONS FOR HANGERS, SUPPORTS, BRACING, ETC. SHALL BE INSTALLED PER TOWER MANUFACTURER'S RECOMMENDATIONS.
70. CONTRACTOR SHALL REFERENCE THE TOWER STRUCTURAL ANALYSIS/DESIGN DRAWINGS FOR DIRECTIONS ON CABLE DISTRIBUTION/ROUTING.
71. AFTER INSTALLATION AND FINAL CONNECTIONS ARE MADE, ALL OUTDOOR RF CONNECTORS/CONNECTIONS SHALL BE WEATHERPROOFED, EXCEPT THE RET CONNECTORS, USING BUTYL TAPE. BUTYL TAPE SHALL HAVE A MINIMUM OF ONE-HALF TAPE WIDTH OVERLAP ON EACH TURN AND EACH LAYER SHALL BE WRAPPED THREE TIMES. WEATHERPROOFING SHALL BE SMOOTH WITHOUT BUCKLING. BUTYL BLEEDING IS NOT ALLOWED. SELF BONDING TAPE AND PLASTIC ENCLOSURES ARE PERMITTED PER ATT-002-290-041, SECTION 7.
72. IF REQUIRED TO PAINT ANTENNAS AND/OR COAX:
    A. TEMPERATURE SHALL BE ABOVE 50 DEGREES FAHRENHEIT.
    B. PAINT COLOR MUST BE APPROVED BY BUILDING OWNER/LANDLORD.
    C. FOR REGULATED TOWERS, FAA/FCC APPROVED PAINT IS REQUIRED.
    D. DO NOT PAINT OVER COLOR CODING OR ON EQUIPMENT MODEL NUMBERS.
73. ALL CABLES SHALL BE GROUNDED WITH COAXIAL CABLE GROUND KITS. AT THE FOLLOWING LOCATIONS PER MANUFACTURER'S RECOMMENDATIONS:
    A. THE ANTENNA LEVEL.
    B. THE MID LEVEL, TOWERS WHICH ARE OVER 200'-0", ADDITIONAL CABLE GROUNDING REQUIRED.
    C. BASE OF TOWER PRIOR TO TURNING HORIZONTAL.
    D. OUTSIDE THE EQUIPMENT SHELTER AT ENTRY PORT.
74. ANTENNA CONTRACTOR SHALL FURNISH AND INSTALL A 12'-0" T-BOOM SECTOR ANTENNA MOUNT INCLUDING ALL HARDWARE, IF APPLICABLE.

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GENERAL SITE WORK AND DRAINAGE NOTES

PART 1 – GENERAL

CONTRACTOR SHALL PROVIDE CLEARING, GRUBBING, STRIPPING, EROSION CONTROL, SURVEY, LAYOUT, SUBGRADE PREPARATION, AND FINISH GRADING AS REQUIRED TO COMPLETE THE PROPOSED WORK SHOWN IN THESE PLANS.

1.1 REFERENCES:

A. DOT (STATE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, CURRENT EDITION)

B. ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

C. OSHA (OCCUPATION SAFETY AND HEALTH ADMINISTRATION)

1.2 INSPECTION AND TESTING:

A. FIELD TESTING OF EARTHWORK COMPACTION AND CONCRETE CYLINDERS SHALL BE PERFORMED BY AN INDEPENDENT TESTING LAB. THIS WORK SHALL BE COORDINATED BY THE SUBCONTRACTOR.

B. ALL WORK SHALL BE INSPECTED AND RELEASED BY THE GENERAL CONTRACTOR. THE INSPECTIONS SHALL BE CARRIED OUT WITH SPECIFIC CONCERN FOR PROPER PERFORMANCE OF THE WORK AS SPECIFIED AND/OR CALLED FOR ON THE PLAN. IT IS THE SUBCONTRACTOR'S RESPONSIBILITY TO REQUEST THE REQUIRED INSPECTIONS PRIOR TO PROCEEDING WITH FURTHER WORK THAT WOULD MAKE PARTS OF WORK INACCESSIBLE OR DIFFICULT TO INSPECT.

1.3 SITE MAINTENANCE AND PROTECTION:

A. PROVIDE ALL NECESSARY JOB SITE MAINTENANCE FROM COMMENCEMENT OF WORK UNTIL COMPLETION OF THE SUBCONTRACT.

B. AVOID DAMAGE TO THE SITE AND TO EXISTING FACILITIES, STRUCTURES, TREES, AND SHRUBS DESIGNATED TO REMAIN. TAKE PROTECTIVE MEASURES TO PREVENT DAMAGED TO EXISTING FACILITIES THAT ARE NOT DESIGNATED FOR MODIFICATION OR REMOVAL.

C. KEEP SITE FREE OF PONDING WATER.

D. PROVIDE EROSION CONTROL MEASURES IN ACCORDANCE WITH STATE DOT AND EPA REQUIREMENTS.

E. PROVIDE AND MAINTAIN ALL TEMPORARY FENCING, BARRICADES, WARNING SIGNS, AND SIMILAR DEVICES NECESSARY TO PROTECT AGAINST THEFT FROM PROPERTY DURING THE ENTIRE DURATION OF CONSTRUCTION. REMOVE ALL SUCH DEVICES UPON COMPLETION OF THE WORK.

F. DO NOT INTERRUPT EXISTING UTILITIES SERVING FACILITIES OCCUPIED BY THE OWNER OR OTHERS, EXCEPT WHEN PERMITTED IN WRITING BY THE ENGINEER AND THEN ONLY AFTER ACCEPTABLE TEMPORARY UTILITY SERVICES HAVE BEEN PROVIDED.

1. NOTICE TO ENGINEER SHALL BE PROVIDED A MINIMUM OF 48 HOURS PRIOR TO OUTAGE.

PART 2 – PRODUCTS

2.1 SUITABLE BACKFILL: ASTM D2321 (CLASS I, II, III OR IVA) FREE FROM FROZEN LUMPS, REFUSE, STONES OR ROCKS LARGER THAN THREE (3) INCHES IN ANY DIMENSION.

2.2 NON–POROUS GRANULAR EMBANKMENT AND BACKFILL: ASTM D2321 (CLASS III, IVA OR IVB) COARSE AGGREGATE. FREE FROM FROZEN LUMPS, REFUSE, STONES OR ROCKS LARGER THAN THREE (3) INCHES IN ANY DIMENSION.

2.3 POROUS GRANULAR EMBANKMENT AND BACKFILL: ASTM D2321 (CLASS IA, IB OR II) COARSE AGGREGATE FREE FROM FROZEN LUMPS, REFUSE, STONES, OR ROCKS LARGER THAN THREE (3) INCHES IN DIAMETER, OR OTHER MATERIAL THAT MAY MAKE THE INORGANIC MATERIAL UNSUITABLE FOR BACKFILL.

2.4 SELECT STRUCTURAL FILL: GRANULAR FILL MATERIAL MEETING THE REQUIREMENTS OF ASTM E850–95. FOR USE AROUND AND UNDER STRUCTURES WHERE STRUCTURAL FILL MATERIAL IS REQUIRED.

2.5 GRANULAR BEDDING AND TRENCH BACKFILL: WELL–GRADED SAND MEETING THE GRADATION REQUIREMENTS OF ASTM D2487 (CLASSIFIED AS SE OR SW–SM SOILS).

2.6 COARSE AGGREGATE FOR ACCESS ROAD SUBBASE COURSE SHALL CONFORM TO ASTM D2940.

2.7 UNSUITABLE MATERIAL: HIGH AND MODERATELY PLASTIC SILTS AND CLAYS (LL>45). MATERIAL CONTAINING REFUSE, FROZEN LUMPS, DEMOLISHED BITUMINOUS MATERIAL, VEGETATIVE MATTER, WOOD, STONES IN EXCESS OF 3 INCHES IN DIAMETER, AND DEBRIS. THESE WILL BE SOILS CLASSIFIED BY ASTM AS PT, MH, CH, OH, ML, AND OL.

2.8 GEOTEXTILE FABRIC: MIRAFI 500X OR APPROVED EQUIVALENT.

2.9 PLASTIC MARKING TAPE SHALL BE ACID AND ALKALI RESISTANT POLYETHYLENE FILM SPECIFICALLY MANUFACTURED FOR MARKING AND LOCATING UNDERGROUND UTILITIES, SIX (6) INCHES WIDE WITH A MINIMUM THICKNESS OF 0.004" TAPE SHALL HAVE MINIMUM STRENGTH OF 1,500 PSI IN BOTH DIRECTIONS AND MANUFACTURED WITH INTEGRAL CONDUCTORS, FOIL BACKING OR OTHER MEANS TO ENABLE DETECTION BY A METAL DETECTOR WHEN BURIED UP TO 3 FEET DEEP. THE METALLIC CORE OF THE TAPE SHALL BE ENCASED IN A PROTECTIVE JACKET OR PROVIDED WITH OTHER MEANS TO PROTECT IT FROM CORROSION. TAPE COLOR SHALL BE RED FOR ELECTRIC UTILITIES AND ORANGE FOR TELECOMMUNICATION UTILITIES.

PART 3 – EXECUTION

3.1 GENERAL:

A. BEFORE STARTING GENERAL SITE PREPARATION ACTIVITIES, INSTALL EROSION AND SEDIMENT CONTROL MEASURES. THE WORK AREA SHALL BE CONSTRUCTED AND MAINTAINED IN SUCH CONDITION THAT IN THE EVENT OF A RAIN EVENT, THE SITE CAN PROPERLY DRAIN AT ANY TIME.

B. PRIOR TO SURVEY, LAYOUT, STAKING, AND MARKING, ESTABLISH AND MAINTAIN ALL LINES, GRADES, ELEVATIONS, AND BENCHMARKS NEEDED FOR EXECUTION OF THE WORK.

C. CLEAR AND GRUB THE AREA WITHIN THE LIMITS OF THE SITE. REMOVE TREES, BRUSH, STUMPS, RUBBISH, OTHER DEBRIS, AND VEGETATION RESTING ON OR PROTRUDING THROUGH THE GROUND SURFACE.

1. REMOVE THE FOLLOWING MATERIALS TO A DEPTH OF NO LESS THAN 12 INCHES BELOW THE ORIGINAL GROUND SURFACE: ROOTS, STUMPS, BRUSH, REFUSE, AND OTHER DEBRIS EMBEDDED IN OR PROTRUDING THROUGH THE GROUND SURFACE. RAKE, DISK, OR PLOW THE AREA TO A DEPTH OF NO LESS THAN 6 INCHES, AND REMOVE MATERIAL TO A DEPTH OF 12 INCHES BELOW THE BOTTOM DEPTH OF ROOTS AND OTHER DEBRIS.

2. REMOVE TOPSOIL MATERIAL COMPLETELY FROM THE SURFACE UNTIL THE SOIL NO LONGER MEETS THE DEFINITION OF TOPSOIL. AVOID MIXING TOPSOIL WITH SUBSOIL OR OTHER UNDESIRABLE MATERIALS.

3. EXCEPT WHERE EXCAVATION TO GREATER DEPTH IS INDICATED, FILL DEPRESSIONS RESULTING FROM CLEARING, GRUBBING, AND DEMOLITION WORK COMPLETELY WITH SUITABLE FILL.

D. ALL DEBRIS RESULTING FROM CLEARING AND GRUBBING OPERATIONS SHALL BE REMOVED FROM THE SITE AND DISPOSED OF IN AN AUTHORIZED LANDFILL. BURNING OF DEBRIS WILL NOT BE PERMITTED.

E. PRIOR TO EXCAVATING, THOROUGHLY EXAMINE THE AREA TO BE EXCAVATED AND/OR TRENCHED TO VERIFY THE LOCATIONS OF FEATURES INDICATED ON THE DRAWINGS AND TO ASCERTAIN THE EXISTENCE AND LOCATION OF ANY STRUCTURE, UNDERGROUND STRUCTURE, OR OTHER ITEM NOT SHOWN THAT MIGHT INTERFERE WITH THE PROPOSED CONSTRUCTION. NOTIFY THE CONSTRUCTION MANAGER OF ANY OBSTRUCTIONS THAT WILL PREVENT ACCOMPLISHMENT OF THE WORK AS INDICATED ON THE PLANS.

F. SEPARATE AND STOCKPILE ALL EXCAVATED MATERIALS SUITABLE FOR BACKFILL. ALL EXCESS EXCAVATED AND UNSUITABLE MATERIALS SHALL BE DISPOSED OF OFF–SITE IN A LEGAL MANNER.

3.2 BACKFILL:

A. AFTER COMPLETING CONSTRUCTION OF A STRUCTURE, INCLUDING EXPIRATION OF THE SPECIFIED MINIMUM CURING PERIOD FOR CAST–IN–PLACE CONCRETE, BACKFILL THE EXCAVATION WITH APPROVED MATERIAL TO RESTORE THE REQUIRED FINISHED GRADE.

1. PRIOR TO PLACING BACKFILL AROUND STRUCTURES, ALL FORMS SHALL BE REMOVED AND THE EXCAVATION CLEANED OF ALL TRASH, DEBRIS, AND UNSUITABLE MATERIALS.

2. BACKFILL BY PLACING AND COMPACTING SUITABLE BACKFILL MATERIAL IN UNIFORM HORIZONTAL LAYERS OF NO GREATER THAN 8–INCHES LOOSE THICKNESS. WHERE HAND OPERATED COMPACTORS ARE USED, THE FILL MATERIAL SHALL BE PLACED IN LIFTS NOT TO EXCEED 4 INCHES IN LOOSE DEPTH.

3. IF THE DENSITY TESTING INDICATES THAT THE CONTRACTOR HAS NOT OBTAINED THE SPECIFIED DENSITY, THE SUCCEEDING LAYER SHALL NOT BE PLACED UNTIL THE SPECIFICATION REQUIREMENTS ARE MET UNLESS OTHERWISE AUTHORIZED BY THE GEOTECHNICAL ENGINEER. THE CONTRACTOR SHALL TAKE WHATEVER APPROPRIATE ACTION IS NECESSARY, SUCH AS DISKING AND DRYING, ADDING WATER, OR INCREASING THE COMPACTIVE EFFORT TO MEET THE MINIMUM COMPACTION REQUIREMENTS.

B. THOROUGHLY COMPACT EACH LAYER OF BACKFILL TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DRY DENSITY AS PROVIDED BY THE STANDARD PROCTOR TEST, ASTM D698.

3.3 TRENCH EXCAVATION:

A. UTILITY TRENCHES SHALL BE EXCAVATED AT LOCATIONS, DEPTHS, AND WIDTHS SHOWN ON PLAN, OR AS DIRECTED BY THE GENERAL CONTRACTOR. EXCAVATION CONTRACTOR SHALL PROVIDE SHORING, SHEETING, AND BRACING AS REQUIRED TO PREVENT CAVING OR SLOUGHING OF THE TRENCH WALLS.

B. THE TRENCH WIDTH SHALL EXTEND A MINIMUM OF 6 INCHES BEYOND THE OUTSIDE EDGE OF THE OUTERMOST CONDUIT.

3.4 TRENCH BACKFILL:

A. NOTIFY THE GENERAL CONTRACTOR 24 HOURS IN ADVANCE OF BACKFILLING.

B. PROVIDE GRANULAR BEDDING MATERIAL IN ACCORDANCE WITH THE PLAN AND THE UTILITY REQUIREMENTS.

C. CONDUCT UTILITY CHECK TESTS BEFORE BACKFILLING. BACKFILL AND COMPACT TRENCH BEFORE ACCEPTANCE TESTING.

D. PLACE GRANULAR TRENCH BACKFILL UNIFORMLY ON BOTH SIDES OF THE CONDUITS IN 6–INCH UNCOMPACTED LIFTS AND TO 12 INCHES OVER THE CONDUITS. SOLIDLY RAM AND TAMP BACKFILL INTO SPACE AROUND CONDUITS.

E. PROTECT CONDUIT FROM LATERAL MOVEMENT, IMPACT DAMAGE, OR UNBALANCED LOADING.

F. ABOVE THE CONDUIT EMBEDMENT ZONE, PLACE AND COMPACT THE BACKFILL MATERIAL IN MAXIMUM 8–INCH THICK LOOSE LIFTS TO RESTORE THE REQUIRED FINISHED SURFACE GRADE.

G. COMPACT THE TRENCH BACKFILL A MINIMUM OF 95 PERCENT OF THE MAXIMUM DRY DENSITY AS PROVIDED BY THE STANDARD PROCTOR TEST, ASTM D698.

3.5 AGGREGATE ACCESS ROAD:

A. CLEAR, GRUB, STRIP, AND EXCAVATE FOR THE ACCESS ROAD AS SHOWN ON PLAN. SCARIFY TO A DEPTH OF 6 INCHES AND PROOF–ROLL. ALL HOLES, RUTS, SOFT PLACES, AND OTHER DEFECTS SHALL BE CORRECTED.

B. THE SUBGRADE OF THE DISTURBED AREA SHALL BE COMPACTED TO NOT LESS THAN 95 PERCENT OF THE MAXIMUM DRY DENSITY AS PROVIDED BY THE MODIFIED PROCTOR TEST, ASTM D1557.

C. AFTER PREPARATION OF THE ROAD SUBGRADE IS COMPLETE, INSTALL THE GEOTEXTILE FABRIC (MIRAFI 500X) AT LOCATIONS INDICATED ON THE PLAN BY ROLLING THE FABRIC OUT LONGITUDINALLY ALONG THE ROADWAY. THE FABRIC SHALL NOT BE DRAGGED ACROSS THE SUBGRADE. PLACE THE ENTIRE ROLL IN A SINGLE OPERATION AND ROLL IT OUT AS SMOOTHLY AS POSSIBLE.

1. GEOTEXTILE FABRIC OVERLAPS THAT ARE PARALLEL TO THE ROADWAY WILL BE PERMITTED ALONG THE CENTERLINE OF THE ROAD AND AT LOCATIONS BEYOND THE ROADWAY SURFACE WIDTH (I.E. WITHIN THE SHOULDER WIDTH) ONLY. NO LONGITUDINAL OVERLAPS SHALL BE LOCATED BETWEEN THE CENTERLINE AND THE SHOULDER. PARALLEL OVERLAPS SHALL BE A MINIMUM OF 3 FEET WIDE.

2. TRANSVERSE (PERPENDICULAR TO THE ROADWAY) GEOTEXTILE FABRIC OVERLAPS AT THE END OF A ROLL SHALL OVERLAP IN THE DIRECTION OF THE AGGREGATE PLACEMENT WITH THE PREVIOUS ROLL ON TOP OF THE NEW ROLL, AND SHALL HAVE A MINIMUM LENGTH OF 3 FEET.

3. ALL GEOTEXTILE FABRIC OVERLAPS SHALL BE PINNED WITH STAPLES OR NAILS A MINIMUM OF 10 INCHES LONG TO INSURE PROPER POSITIONING DURING PLACEMENT OF AGGREGATE. PIN LONGITUDINAL SEAMS AT A MINIMUM OF 25–FOOT INTERVALS AND TRANSVERSE SEAMS AT A MINIMUM OF 5–FOOT INTERVALS.

D. THE AGGREGATE BASE AND SURFACE AGGREGATE SHALL BE CONSTRUCTED IN LAYERS NOT MORE THAN 4 INCHES (COMPACTED) IN THICKNESS. AGGREGATE TO BE PLACED ON GEOTEXTILE FABRIC SHALL BE END–DUMPED ON THE FABRIC FROM THE FREE END OF THE FABRIC OR OVER PREVIOUSLY PLACED AGGREGATE. THE FIRST LIFT SHALL BE BLADED DOWN TO A THICKNESS OF 8 INCHES PRIOR TO COMPACTION. AT NO TIME SHALL EQUIPMENT, EITHER TRANSPORTING THE AGGREGATE OR GRADING THE AGGREGATE, BE PERMITTED ON THE ROADWAY WITH LESS THAN 4 INCHES OF MATERIAL COVERING THE GEOTEXTILE FABRIC.

E. THE AGGREGATE SHALL BE IMMEDIATELY COMPACTED TO NOT LESS THAN 95 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED BY THE MODIFIED PROCTOR TEST, ASTM D1557. A TAMPING ROLLER, PNEUMATIC–TIRED ROLLER, OR VIBRATORY MACHINE, OR ANY COMBINATION THEREOF MAY BE USED FOR COMPACTION PROCEDURES. THE TOP LAYER SHALL BE GIVEN A FINAL ROLLING WITH A THREE–WHEEL OR TANDEM ROLLER.

3.6 FINISH GRADING:

A. PERFORM ALL GRADING TO PROVIDE POSITIVE DRAINAGE AWAY FROM STRUCTURES AND SMOOTH SURFACE DRAINAGE OF THE ENTIRE AREA WITHIN THE LIMITS OF CONSTRUCTION. GRADING SHALL PROPERLY BLEND WITH SURROUNDING TOPOGRAPHY AND STRUCTURES.

B. IF DEEMED SUITABLE PER GEOTECHNICAL ENGINEER, UTILIZE FILL MATERIAL RESULTING FROM EXCAVATION FOR THE CONSTRUCTION OF FILLS, EMBANKMENTS, AND FOR REPLACEMENT OF REMOVED UNSUITABLE MATERIALS.

C. ACHIEVE FINISHED GRADE BY PLACING A MINIMUM OF 4 INCHES OF 1/2" – 3/4" CRUSHED STONE ON IF APPLICABLE, TOP OF SOIL STABILIZER FABRIC.

D. REPAIR ALL ACCESS ROADS AND SURROUNDING AREAS DISTURBED DURING THE COURSE OF THIS WORK TO THEIR ORIGINAL CONDITION.

3.7 ASPHALT PAVING: SHALL BE PERFORMED PER COLORADO DEPARTMENT OF TRANSPORTATION (CDOT), DIVISION 400 – CDOT PAVEMENT STANDARDS AND SPECIFICATIONS.

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PROJECT/PHASE NO:	129551/1207
DRAWN BY:	PDJ
CHECKED BY:	JMH
RFDS:	___

REV	DATE	DESCRIPTION
0	04/24/24	ISSUED FOR CONSTRUCTION

COLORADO LICENSED
JASON T. KAHRS
52811
PROFESSIONAL ENGINEER
04/24/2024

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT.

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CELL SITE RF MODIFICATIONS

SHEET TITLE
GENERAL SITE WORK & DRAINAGE NOTES

SHEET NUMBER
GN-3

PERMIT NO:
TELE24-00035

GENERAL CONCRETE WORK NOTES

PART 1 – GENERAL

1.1 SCOPE:

A. FORM WORK, REINFORCING STEEL, ACCESSORIES, CAST-IN PLACE CONCRETE, FINISHING, CURING, AND TESTING FOR STRUCTURAL CONCRETE FOUNDATIONS.

1.2 REFERENCES:

A. ACI (AMERICAN CONCRETE INSTITUTE)

1. ACI 301 SPECIFICATION FOR STRUCTURAL CONCRETE FOR BUILDINGS.
2. ACI 304 RECOMMENDED PRACTICE FOR MEASURING, MIXING, TRANSPORTING AND PLACING CONCRETE.
3. ACI 305 RECOMMENDED PRACTICE FOR HOT WEATHER CONCRETING.
4. ACI 306 RECOMMENDED PRACTICE FOR COLD WEATHER CONCRETING.
5. ACI 308 STANDARD PRACTICE FOR CURING CONCRETING.
6. ACI 309 STANDARD PRACTICE FOR CONSOLIDATION OF CONCRETE.
7. ACI 318 BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE.
8. ACI 347 RECOMMENDED PRACTICE FOR CONCRETE FORMWORK.

B. THE APPLICABLE STANDARDS OF THE AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) ARE REFERENCED IN THE ACI STANDARDS AND ARE A PART OF THIS SPECIFICATION.

PART 2 – PRODUCTS

2.1 REINFORCING MATERIALS:

B. REINFORCING BARS: ASTM A615, GRADE 60, PROPOSED DEFORMED BILLET-STEEL BARS, PLAIN FINISH.

C. CONTRACTOR SHALL FURNISH CHAIRS, BOLSTERS, BAR SUPPORTS, SPACERS AS REQUIRED FOR SUPPORT OF REINFORCING STEEL AND WIRE FABRIC.

2.2 CONCRETE MATERIALS:

A. PORTLAND CEMENT SHALL BE TYPE II, CONFORMING TO ASTM C-150.

B. AGGREGATE SHALL CONFORM TO ASTM C-33.

1. FINE AGGREGATE SHALL BE UNIFORMLY GRADED, CLEAN, SHARP, AND WASHED NATURAL OR CRUSHED SAND, FREE FROM ORGANIC IMPURITIES.
2. COARSE AGGREGATE SHALL BE NATURAL WASHED GRAVEL OR CRUSHED ROCK CONSISTING HARD, STRONG, DURABLE PIECES, FREE FROM ADHERENT COATINGS.
3. MAXIMUM SIZE OF COARSE AGGREGATE SHALL BE 3/4 INCH IN ACCORDANCE WITH THE REQUIREMENTS OF ASTM C-33 GRADATION SIZE NO. 67.

C. WATER USED IN CONCRETE MIX SHALL BE POTABLE, CLEAN, AND FREE FROM OILS, ACIDS, SALTS, CHLORIDES, ALKALI, SUGAR, VEGETABLE, OR OTHER DELETARIOUS SUBSTANCES.

D. THE CONCRETE SHALL CONTAIN AN AIR-ENTRAINING ADMIXTURE COMPLYING WITH THE REQUIREMENTS OF ASTM C-260 AND ACI 212. 1R AND A WATER-REDUCING ADMIXTURE COMPLYING WITH THE REQUIREMENTS OF ASTM C-494 AND ACI 212.1R. ADMIXTURES SHALL BE PURCHASED AND BATCHED IN LIQUID SOLUTION. THE USE OF CALCIUM CHLORIDE OR AN ADMIXTURE CONTAINING CALCIUM CHLORIDE IS PROHIBITED. ADMIXTURES SHALL BE OF THE SAME MANUFACTURER TO ASSURE COMPATIBILITY. ACCEPTABLE MANUFACTURERS ARE:

1. W.R. GRACE
2. SIKA CORPORATION
3. MASTER BUILDERS
4. EUCLID CHEMICAL COMPANY

E. CURING COMPOUND SHALL CONFORM TO ASTM C309, TYPE I, ID, CLASS A AND B, AND ASTM C171 AS APPLICABLE.

2.3 CONCRETE MIX:

A. PROPORTION CONCRETE MIX IN ACCORDANCE WITH REQUIREMENTS OF ACI 301. THE STRENGTH OF CONCRETE SHALL BE AS INDICATED ON THE DRAWINGS. WHERE STRENGTH IS NOT CLEARLY INDICATED, CONCRETE OF MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 4,000 PSI SHALL BE USED.

B. THE CONCRETE MIX SHALL BE DESIGNED FOR A MAXIMUM SLUMP OF THREE INCHES AT THE POINT OF DISCHARGE. MIXES OF THE STIFFEST CONSISTENCY THAT CAN BE EFFICIENTLY PLACED SHALL BE USED.

C. ALL CONCRETE SHALL HAVE THREE (3) TO FIVE (5) PERCENT ENTRAINED AIR.

D. ALL STRUCTURAL CONCRETE SHALL CONTAIN A WATER-REDUCING AGENT.

PART 3 – EXECUTION

3.1 GENERAL:

A. CONSTRUCT AND ERECT THE FORM WORK IN ACCORDANCE WITH ACI 301 AND ACI 347.

B. COLD-WEATHER CONCRETING SHALL BE IN ACCORDANCE WITH ACI 306.

C. HOT-WEATHER CONCRETING SHALL BE IN ACCORDANCE WITH ACI 305.

3.2 INSERTS, EMBEDDED COMPONENTS, AND OPENINGS:

A. CONTRACTOR SHALL CHECK ALL CIVIL, ARCHITECTURAL, STRUCTURAL, AND ELECTRICAL DRAWINGS FOR OPENINGS, SLEEVES, ANCHOR BOLTS, INSERTS, AND OTHER ITEMS TO BE INCORPORATED INTO THE CONCRETE WORK.

B. COORDINATE THE WORK OF OTHER SECTION IN FORMING AND SETTING OPENINGS, RECESSES, SLOTS, CHASES, ANCHORS, INSERTS, AND OTHER ITEMS TO BE EMBEDDED.

C. EMBEDDED ITEMS SHALL BE SET ACCURATELY IN LOCATION, ALIGNMENT, ELEVATION AND PLUMBNESS, LOCATED AND MEASURED FROM ESTABLISHED SURVEYED REFERENCE BENCHMARKS.

D. EMBEDDED ITEMS SHALL BE ANCHORED INTO PLACE IN A MANNER TO PREVENT MOVEMENT DURING CONCRETE PLACEMENT AND CONSOLIDATION. COMPONENTS FORMING A PART OF A COMPLETE ASSEMBLY SHALL BE ALIGNED BEFORE ANCHORING INTO PLACE. PROVIDE TEMPORARY BRACING, ANCHORAGE, AND TEMPLATES AS REQUIRED TO MAINTAIN THE SETTING AND ALIGNMENT.

3.3 REINFORCEMENT PLACEMENT:

A. PLACE REINFORCEMENT ACCORDING TO CONSTRUCTION PLAN SET DRAWINGS AND IN ACCORDANCE WITH ACI 301 AND ACI 318.

B. ACCURATELY POSITION, SUPPORT, AND SECURE REINFORCEMENT AGAINST DISPLACEMENT FROM FORM WORK CONSTRUCTION OR CONCRETE PLACEMENT AND CONSOLIDATION. SUPPORT REINFORCING ON METAL CHAIRS, RUNNERS, BOLSTERS, SPACERS AND HANGERS.

C. SPLICES OF REINFORCING BARS SHALL BE CLASS B UNLESS SPECIFIED OTHERWISE ON THE DRAWINGS. SPLICES SHALL BE STAGGERED AND FULL DEVELOPMENT LENGTH SHALL BE PROVIDED ACROSS JOINTS.

D. LOCATE REINFORCING TO PROVIDE CONCRETE COVER AND SPACING SHOWN ON THE DRAWINGS. MINIMUM COVER SHALL BE AS REQUIRED BY ACI 318.

E. WELDING OF AND TO ANY REINFORCING MATERIALS, INCLUDING TACK WELDING OF CROSSING BARS, IS STRICTLY PROHIBITED.

3.4 CONCRETE PLACEMENT:

A. PRIOR TO PLACING CONCRETE, THE FORMS AND REINFORCEMENT SHALL BE THOROUGHLY INSPECTED; ALL TEMPORARY BRACING, TIES, AND CLEATS REMOVED; ALL OPENINGS FOR UTILITIES PROPERLY BOXED; ALL FORMS PROPERLY SECURED IN THEIR CORRECT POSITION AND MADE TIGHT. ALL REINFORCEMENT AND EMBEDDED ITEMS SHALL BE SECURED IN THEIR PROPER LOCATIONS. ALL OLD AND DRY CONCRETE AND DIRT SHALL BE CLEANED OFF AND ALL STANDING WATER AND OTHER FOREIGN MATERIAL REMOVED.

B. CONCRETE SHALL BE IN ACCORDANCE WITH ACI 301 AND ACI 304 AND SHALL BE PLACED AT SUCH A RATE THAT THE CONCRETE PREVIOUSLY PLACED IS STILL PLASTIC AND INTEGRATED WITH THE FRESH CONCRETE. CONCRETE PLACEMENT, ONCE STARTED, SHALL BE CARRIED ON AS A CONTINUOUS OPERATION UNTIL THE SECTION IS COMPLETED. COLD JOINTS ARE NOT ALLOWED UNLESS PRE-APPROVED BY ENGINEER.

C. ALL CONCRETE SHALL BE THOROUGHLY CONSOLIDATED AND COMPACTED BY VIBRATION SPACING, RODDING, OR FORKING DURING THE OPERATION OF PLACING IN ACCORDANCE WITH ACI 309. THE CONCRETE SHALL BE THOROUGHLY WORKED AROUND REINFORCEMENT, EMBEDDED ITEMS, AND INTO THE CORNER OF THE FORMS SO AS TO ELIMINATE ALL AIR POCKETS AND VOIDS.

3.5 FINISHING:

A. FINISHING OF THE FLOOR SLABS SHALL BE IN ACCORDANCE WITH ACI 302.1 SECTION 7.2 AND SHALL INCLUDE A MINIMUM OF THREE TROWELINGS. IN ACCORDANCE WITH ASTM E 1155 THE SLAB FINISH TOLERANCE AS MEASURED SHALL HAVE AN OVERALL TEST NUMBER FOR FLATNESS OF Ff= 20 AND Fl = 15. THE MINIMUM LOCAL NUMBER FOR FLATNESS, Ff= 15 AND Fl=10.

B. SURFACE OF FLOOR SLAB SHALL RECEIVE TWO COATS OF CLEAR SEALER/HARDNER.

C. ABOVE GRADE WALL SURFACES SHALL HAVE A SMOOTH FORM FINISH AS DEFINED IN CHAPTER 10 OF ACI 301.

3.6 CURING:

A. FRESHLY DEPOSITED CONCRETE SHALL BE PROTECTED FROM PREMATURE DRYING AND EXCESSIVELY HOT AND COLD TEMPERATURES, AND SHALL BE MAINTAINED WITH MINIMUM MOISTURE LOSS AT A RELATIVELY CONSTANT TEMPERATURE FOR A PERIOD OF TIME NECESSARY FOR THE HYDRATION OF THE CEMENT AND PROPER CURING OF THE CONCRETE.

B. CONCRETE SHALL BE KEPT CONTINUOUSLY MOIST AT LEAST OVERNIGHT, IMMEDIATELY FOLLOWING THE INITIAL CURING. BEFORE THE CONCRETE HAS DRIED. ADDITIONAL CURING SHALL BE ACCOMPLISHED BY ONE OF THE FOLLOWING MATERIALS OR METHODS:

1. PONDING OR CONTINUOUS SPRINKLING.
2. ABSORPTIVE MAT OR FABRIC KEPT CONTINUOUSLY WET.
3. NON-ABSORPTIVE FILM (POLYETHYLENE) OVER PREVIOUSLY SPRINKLED SURFACE.
4. SAND OR OTHER COVERING KEPT CONTINUOUSLY WET.
5. CONTINUOUS STEAM (NOT EXCEEDING 150 DEGREES FAHRENHEIT OR VAPOR MIST BATH.
6. CURING COMPOUND APPLIED IN TWO COATS, SPRAYED IN PERPENDICULAR DIRECTION

C. THE FINAL CURING SHALL CONTINUE UNTIL THE CUMULATIVE NUMBER OF DAYS OR FRACTION THEREOF, NOT NECESSARILY CONSECUTIVE, DURING WHICH TEMPERATURE OF THE AIR IN CONTACT WITH CONCRETE IS ABOVE 50 DEGREES' FAHRENHEIT HAS TOTALED SEVEN (7) DAYS. CONCRETE SHALL NOT BE PERMITTED TO FREEZE DURING THE CURING PERIOD. RAPID DRYING AT THE END OF THE CURING PERIOD SHALL BE PREVENTED.

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PROJECT/PHASE NO:	129551/1207
DRAWN BY:	PDJ
CHECKED BY:	JMH
RFDS:	___

REV	DATE	DESCRIPTION
0	04/24/24	ISSUED FOR CONSTRUCTION

COLORADO LICENSED
JASON T. KAHRS
52811
PROFESSIONAL ENGINEER
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CELL SITE RF MODIFICATIONS

SHEET TITLE
GENERAL CONCRETE WORK NOTES

SHEET NUMBER
GN-4

PERMIT NO:
TELE24-00035

GENERAL STRUCTURAL STEEL NOTES

PART 1 – GENERAL

1.1 SCOPE:

A. PROVIDE FABRICATION AND ERECTION OF STRUCTURAL STEEL AND OTHER ELEMENTS AS SHOWN ON THE DRAWINGS OR REQUIRED BY OTHER SECTIONS OF THESE SPECIFICATIONS.

1.2 REFERENCES:

A. AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC). MANUAL OF STEEL CONSTRUCTION, ALLOWABLE STRESS DESIGN (ASD).

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).
ASTM A36: STRUCTURAL STEEL
ASTM A53: PIPE, STEEL BLACK AND HOT DIPPED, ZINC–COATED WELDED AND SEAMLESS.
ASTM A108: STEEL BARS, CARBON, COLD FINISHED, STANDARD QUALITY.
ASTM A123: ZINC (HOT–DIPPED GALVANIZED) COATING ON IRON AND STEEL PRODUCTS.
ASTM A307: CARBON STEEL BOLTS AND STUD, 60,000 P.S.I. TENSILE STRENGTH.
ASTM A325: HIGH–STRENGTH BOLT FOR STRUCTURAL STEEL JOINTS.
ASTM A490: HEAT–TREATED, STRUCTURAL STEEL BOLTS, 150 (KSI) (1035MPA) TENSILE STRENGTH.
ASTM A500: COLD–FORMED WELDED AND SEAMLESS CARBON STEEL STRUCTURAL TUBING IN ROUNDS AND SHAPES.
ASTM A563: CARBON AND ALLOY STEEL NUTS.
ASTM B695: COATINGS OF ZINC MECHANICALLY DEPOSITED ON IRON AND STEEL.
ASTM F436: HARDENED STEEL WASHERS.
ASTM F959: COMPRESSIBLE–WASHER–TYPE DIRECT TENSION INDICATOR FOR USE WITH STRUCTURAL FASTENERS.

C. AMERICAN WELDING SOCIETY (AWS):
AWS A5.1: COVERED CARBON STEEL ARC WELDING ELECTRODES.
AWS A5.5: LOW ALLOY STEEL COVERED ARC WELDING ELECTRODES.
AWS D1.1: STRUCTURAL WELDING CODE – STEEL.

D. RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC): "SPECIFICATIONS FOR STRUCTURAL JOINTS USING ASTM A325 BOLTS OR ASTM A490 BOLTS." AS ENDORSED BY AISC.

E. STEEL STRUCTURES PAINTING COUNCIL (SSPC):
SSPC–SP3: POWER TOOL CLEANING.
SSPC–PAINT 11: RED IRON OXIDE, ZINC CHROME, RAW LINSEED OIL OR ALKYD PAINT.

1.3 SUBMITTALS:

A. SUBMIT THE FOLLOWING FOR APPROVAL:

1. FABRICATION AND ERECTION DRAWINGS SHOWING ALL DETAILS, CONNECTIONS, MATERIAL DESIGNATIONS, AND ALL TOP STEEL ELEVATIONS.

B. WELDERS SHALL BE QUALIFIED AS PRESCRIBED IN AWS D1.1.

PART 2 – PRODUCTS

2.1 STRUCTURAL STEEL:

A. SHAPES, PLATES, AND BARS SHALL CONFORM TO ASTM A36.

B. STRUCTURAL TUBING SHALL CONFORM TO ASTM A500, GRADE B. STEEL PIPE SHALL CONFIRM TO ASTM A53, TYPE E OR S, GRADE B.

2.2 ANCHOR BOLTS:

A. ANCHOR BOLTS SHALL CONFORM TO ASTM A307 WITH HEAVY HEXAGONAL NUTS.

2.3 BOLTS:

A. COMMON (MACHINE) BOLTS SHALL CONFORM TO ASTM A307 GRADE A AND NUTS TO ASTM A563. ONE COMMON BOLT ASSEMBLY SHALL CONSIST OF A BOLT, A HEAVY HEX NUT, AND A HARDENED WASHER.

B. HIGH–STRENGTH BOLTS SHALL CONFORM TO ASTM A325 ONE HIGH. STRENGTH BOLT ASSEMBLY SHALL CONSIST OF A HEAVY HEX STRUCTURAL BOLT, A HEAVY HEX NUT, AND A HARDENED WASHER CONFORMING TO ASTM F436. THE HARDENED WASHER SHALL BE INSTALLED AGAINST THE ELEMENT TURNED IN TIGHTENING. UNLESS NOTED OTHERWISE ON THE DRAWINGS, ALL CONNECTIONS SHALL BE BEARING TYPE CONNECTIONS.

2.4 WELDING ELECTRODES:

A. WELDING ELECTRODES SHALL COMPLY WITH AWS D1.1 USING A5.1 OR A5.5 E70XX AND SHALL BE COMPATIBLE WITH THE WELDING PROCESS SELECTED.

2.5 PRIMER:

A. PRIMER SHALL BE RED OXIDE–CHROMATE PRIMER COMPLYING WITH SSPC PAINT SPECIFICATION NO. 11.

PART 3 – EXECUTION

3.1 FABRICATION:

A. SHOP FABRICATE AND ASSEMBLY MATERIALS AS SPECIFIED HEREIN.

1. FABRICATE ITEMS OF STRUCTURAL STEEL IN ACCORDANCE WITH THE AISC–ASD SPECIFICATIONS, AND AS INDICATED ON THE APPROVED SHOP DRAWINGS.
2. ALL EXPOSED STRUCTURAL STEEL SHALL BE HOT DIP GALVANIZED PER ASTM.
3. PROPERLY MARK AND MATCH–MARK MATERIALS FOR FIELD ASSEMBLY AND FOR IDENTIFICATION AS TO INTENDED LOCATION.
4. FABRICATE AND DELIVER IN A SEQUENCE WHICH WILL EXPEDITE ERECTION AND MINIMIZE FIELD HANDLING OF MATERIALS.
5. WHERE FINISHING IS REQUIRED, COMPLETE THE ASSEMBLY, INCLUDING THE WELDING OF UNITS, BEFORE START OF FINISHING OPERATIONS.
6. THE FINISH SURFACE OF MEMBERS EXPOSED IN THE FINISHED STRUCTURE SHALL BE FREE FROM MARKINGS, BURNS, AND OTHER DEFECTS.

B. PROVIDE CONNECTIONS AS SPECIFIED HEREIN:

1. PROVIDE BOLTS AND WASHERS OF TYPES AND SIZE REQUIRED FOR COMPLETION OF FIELD ERECTION. USE 3/4" DIAMETER A325 BOLTS UNLESS NOTED OTHERWISE.
2. INSTALL HIGH STRENGTH THREADED FASTENERS IN ACCORDANCE WITH "SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A325 OR ASTM A490 BOLTS."
3. WELDED CONSTRUCTION SHALL COMPLY WITH AWS D1.1 FOR PROCEDURES, APPEARANCE, QUALITY OF WELD, AND METHODS USED IN CORRECTING WELDED WORK.
4. THE FABRICATOR SHALL FURNISH AND INSTALL ERECTION CLIPS FOR FIT–UP OF WELDED CONNECTIONS.
5. DOUBLE ANGLE MEMBERS SHALL HAVE WELDED FILLERS SPACED IN ACCORDANCE WITH CHAPTER E4 OF THE AISC–ASD SPECIFICATION.
6. GUSSET AND STIFFENER PLATES SHALL BE 3/8" THICK MINIMUM.

3.2 PRIMING:

A. STRUCTURAL STEEL SHALL BE PRIMED AS SPECIFIED HEREIN, UNLESS SHOWN OTHERWISE ON THE DRAWINGS.

B. STRUCTURAL STEEL SURFACE PREPARATION SHALL CONFIRM TO SSPC–SP3, "POWER TOOL CLEANING."

C. SURFACE PREPARATION AND PRIMER SHALL BE IN ACCORDANCE WITH AISC CODE OF STANDARD PRACTICE IN THE ASD MANUAL OF STEEL CONSTRUCTION.

D. MATERIALS SHALL REMAIN CLOSED UNTIL REQUIRED FOR USE. MANUFACTURER'S POT–LIFE REQUIREMENTS SHALL BE STRICTLY ADHERED TO.

E. PRIMER SHALL BE APPLIED TO DRY, CLEAN, PREPARED SURFACE AND UNDER FAVORABLE CONDITIONS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. UNLESS OTHERWISE RECOMMENDED BY THE MANUFACTURER, PRIMING SHALL NOT BE DONE WHEN AMBIENT TEMPERATURE IS LESS THAN 50 DEGREES FAHRENHEIT, THE RELATIVE HUMIDITY IS MORE THAN 90 PERCENT, OR THE SURFACE TEMPERATURE IS LESS THAN 5 DEGREES FAHRENHEIT ABOVE THE DEW POINT.

F. GENERALLY ALL PRIMER SHALL BE SPRAY APPLIED. BRUSH OR ROLLER APPLICATION SHALL BE LIMITED TO TOUCHUP AND TO AREAS NOT ACCESSIBLE BY SPRAY GUN.

G. PRIMER SHALL BE UNIFORMLY APPLIED WITHOUT RUNS, SAGS, SOLVENT BLISTERS, DRY SPRAY, OR OTHER BLEMISHES. ALL BLEMISHES AND OTHER IRREGULARITIES SHALL BE REPAIRED OR REMOVED AND THE AREA RE–COATED. SPECIAL ATTENTION SHALL BE PAID TO CREVICES, WELD LINES, BOLT HEADS, CORNERS, EDGES, ETC., TO OBTAIN THE REQUIRED NOMINAL FILM THICKNESS.

H. DRY COAT FILM THICKNESS OF THE PRIMER SHALL BE 2.0 MILLIMETERS

I. IF THE PRIMER IS DAMAGED BY WELDING OR IN ANY OTHER MANNER, THE AREA SHALL BE TOUCHED UP AND REPAIRED. THE TOUCHUP PAINT SHALL BE COMPATIBLE WITH THE PREVIOUS APPLIED PRIMER COAT WITH MINIMUM DRY FILM THICKNESS OF 1.5 MILLIMETERS.

3.3 INSTALLATION:

A. INSTALLATION OF STRUCTURAL STEEL SHALL COMPLY WITH AISC "CODE OF STANDARD PRACTICE."

B. STRUCTURAL FIELD WELDING SHALL BE DONE BY THE ELECTRIC SUBMERGED OR SHIELDED METAL ARC PROCESS. WELDED CONSTRUCTION METHODS SHALL COMPLY WITH AWS D1.1.

C. PROVIDE ANCHOR BOLTS AND OTHER CONNECTORS REQUIRED FOR SECURING STRUCTURAL STEEL TO MASONARY WALLS AND TO OTHER IN–PLACE WORK. PROVIDE TEMPLATES AND OTHER DEVICES NECESSARY FOR PRESETTING BOLTS AND ANCHORS TO ACCURATE LOCATIONS.

D. SPLICE MEMBERS ONLY WHERE INDICATED ON THE DRAWINGS.

E. PROVIDE TEMPORARY SHORING BRACING WITH CONNECTIONS OF SUFFICIENT STRENGTH TO BEAR IMPOSED LOADS. REMOVE TEMPORARY CONNECTIONS AND MEMBERS WHEN PERMANENT MEMBERS ARE IN PLACE AND THE FINAL CONNECTIONS HAVE BEEN MADE.

F. BEFORE ASSEMBLY ALIGN AND ADJUST MEMBERS AND OTHER SURFACES WHICH WILL BE IN THE PERMANENT CONTACT, BEFORE ASSEMBLY.

G. AS A MINIMUM, HIGH–STRENGTH BOLTS, SHALL BE TIGHTENED TO A "SNUG–TIGHT" CONDITION AS DEFINED IN THE LATEST AISC SPECIFICATIONS. ALL HIGH–STRENGTH BOLTS SPECIFIED ON THE DESIGN DRAWINGS TO BE USED IN PRETENSIONED OR SLIP–CRITICAL JOINTS SHALL BE TIGHTENED TO A BOLT TENSION NOT LESS THAN SPECIFIED IN AISC TABLE J3.1. INSTALLATION SHALL BE BY ANY OF THE FOLLOWING METHODS: TURN–OF NUT METHOD, A DIRECT–TENSION–INDICATOR, TWIST–OFF–TYPE TENSION–CONTROL BOLT, CALIBRATED WRENCH, OR ALTERNATIVE DESIGN BOLT.

at&t

188 INVERNESS DRIVE WEST
SUITE 400
ENGLEWOOD, CO 80112

BLACK & VEATCH

4600 SOUTH SYRACUSE STREET
SUITE 800
DENVER, COLORADO 80237

PROJECT/PHASE NO:	129551/1207
DRAWN BY:	PDJ
CHECKED BY:	JMH
RFDS:	___

REV	DATE	DESCRIPTION
0	04/24/24	ISSUED FOR CONSTRUCTION

COLORADO LICENSED
JASON T. KAHRS
52811
PROFESSIONAL ENGINEER

04/24/2024

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS DOCUMENT.

EDGEMONT
COL01184
5351 WEST 6TH AVENUE
LAKEWOOD, CO 80214
CELL SITE RF MODIFICATIONS

SHEET TITLE
GENERAL STRUCTURAL STEEL NOTES

SHEET NUMBER
GN-5

PERMIT NO:
TELE24-00035

GENERAL ELECTRICAL NOTES

PART 1 – GENERAL

1.1 GENERAL CONDITIONS:

A. CONTRACTOR SHALL INSPECT THE EXISTING SITE CONDITIONS PRIOR TO PERFORMING WORK. ANY QUESTIONS ARISING DURING THE BID PERIOD REGARDING THE CONTRACTORS FUNCTIONS, THE SCOPE OF WORK, OR ANY OTHER ISSUE RELATED TO THIS PROJECT SHALL BE BROUGHT UP DURING THE BID PERIOD WITH THE PROJECT MANAGER FOR CLARIFICATION, PRIOR TO THE AWARD OF THE CONTRACT.

B. THE CONTRACTOR SHALL OBTAIN PERMITS, LICENSES, MAKE ALL DEPOSITS, AND PAY ALL FEES REQUIRED FOR THE CONSTRUCTION PERFORMANCE OF THE WORK UNDER THIS SECTION.

C. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS. DRAWING SHALL NOT BE SCALED TO DETERMINE DIMENSIONS. DRAWINGS SHOW THE GENERAL ARRANGEMENT OF ALL SYSTEMS AND COMPONENTS COVERED UNDER THIS SECTION.

1.2 LAWS, REGULATIONS, ORDINANCES, STATUTES, AND CODES:

A. ALL WORK SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE, AND ALL APPLICABLE LOCAL LAWS, REGULATIONS, ORDINANCES, STATUTES, AND CODES. CONDUIT BENDS SHALL BE THE RADIUS BEND FOR THE TRADE SIZE OF CONDUIT IN COMPLIANCE WITH THE LATEST EDITIONS OF NEC.

1.3 REFERENCES:

A. THE PUBLICATIONS LISTED BELOW ARE PART OF THIS SPECIFICATION. EACH PUBLICATION SHALL BE THE LATEST REVISION AND ADDENDUM IN EFFECT ON THE DATE OF CONSTRUCTION. EXCEPT AS MODIFIED BY THE REQUIREMENT SPECIFIED HEREIN OR THE DETAILS OF THE DRAWINGS, WORK INCLUDED IN THIS SPECIFICATION SHALL CONFORM TO THE APPLICABLE PROVISION OF THESE PUBLICATIONS.

1. ANSI/IEEE (AMERICAN NATIONAL STANDARDS INSTITUTE)
2. ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)
3. ICE (INSULATED CABLE ENGINEERS ASSOCIATION)
4. NEMA (NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION)
5. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)
6. OSHA (OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION)
7. UL (UNDERWRITERS LABORATORIES. INC.)
8. AT&T GROUNDING AND BONDING STANDARDS TP-76416

1.4 SCOPE OF WORK:

A. WORK UNDER THIS SECTION SHALL CONSIST OF FURNISHING ALL LABOR, MATERIAL, AND ASSOCIATED SERVICES REQUIRED TO COMPLETE REQUIRED CONSTRUCTION AND TO ACHIEVE OPERATIONAL STATUS.

B. ALL ELECTRICAL EQUIPMENT UNDER THIS CONTRACT SHALL BE PROPERLY TESTED, ADJUSTED, AND ALIGNED BY THE CONTRACTOR.

C. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL EXCAVATING, DRAINING, TRENCHING, BACKFILLING, AND REMOVAL OF EXCESS SOIL, FILL, AND DEBRIS.

D. THE CONTRACTOR SHALL FURNISH THE OWNER WITH CERTIFICATES OF A FINAL INSPECTION AND APPROVAL FROM THE JURISDICTIONAL AUTHORITIES.

E. IF APPLICABLE, THE CONTRACTOR SHALL PREPARE A COMPLETE SET OF AS-BUILT DRAWINGS TO DOCUMENT ALL WIRING EQUIPMENT CONDITIONS AND CHANGES WHILE COMPLETING THIS CONTRACT. THE AS-BUILT DRAWINGS SHALL BE SUBMITTED AT COMPLETION OF THE PROJECT TO THE APPROPRIATE PARTY.

PART 2 – PRODUCTS

2.1 GENERAL:

A. ALL MATERIALS AND EQUIPMENT SHALL BE NEW, UL LISTED, AND FREE FROM DEFECTS.

B. ALL EQUIPMENT SHALL BEAR THE UNDERWRITERS LABORATORIES (UL) LABEL OF APPROVAL AND SHALL CONFORM TO REQUIREMENT OF THE NATIONAL ELECTRICAL CODE.

C. ALL ITEMS, MATERIALS, AND EQUIPMENT SHALL BE ACCEPTABLE TO THE JURISDICTIONAL AUTHORITY AND SUITABLE FOR THE USE INTENDED.

D. ALL OVERCURRENT DEVICES SHALL HAVE AN INTERRUPTING CURRENT RATING OF GREATER THAN THE SHORT CIRCUIT CURRENT TO WHICH THEY ARE SUBJECTED (10,000 AIC MINIMUM). CONTRACTOR SHALL VERIFY THAT AVAILABLE SHORT CIRCUIT CURRENT DOES NOT EXCEED THE RATING OF ELECTRICAL EQUIPMENT IN ACCORDANCE WITH ARTICLE 110.24 NEC OR THE MOST CURRENT ADOPTED CODE PER THE GOVERNING JURISDICTION.

2.2 MATERIALS AND EQUIPMENT:

A. CONDUIT:

1. RIGID METAL CONDUIT (RMC) SHALL BE HOT-DIPPED GALVANIZED INSIDE AND OUTSIDE INCLUDING ENDS AND THREADS, AND ENAMELED OR LACQUERED INSIDE IN ADDITION TO GALVANIZING.
2. LIQUIDTIGHT FLEXIBLE METAL CONDUIT SHALL BE UL LISTED.
3. CONDUIT CLAMPS, STRAPS, AND SUPPORTS SHALL BE STEEL OR MALLEABLE IRON. ALL FITTINGS SHALL BE COMPRESSION AND CONCRETE-TIGHT TYPE. GROUNDING BUSHINGS WITH INSULATED THROATS SHALL BE INSTALLED ON ALL CONDUIT TERMINATIONS.
4. NONMETALLIC CONDUIT AND FITTINGS SHALL BE SCHEDULE 40 PVC AND INSTALLED USING SOLVENT-CEMENT-TYPE JOINTS AS RECOMMENDED BY THE MANUFACTURER.

B. CONDUCTORS AND CABLE:

1. CONDUCTORS AND CABLE SHALL BE FLAME-RETARDANT, MOISTURE AND HEAT RESISTANT THERMOPLASTIC, SINGLE CONDUCTOR, COPPER, TYPE THHN/THWN-2, 600 VOLT, SIZE AS INDICATED, ON PLANS THE MINIMUM SIZE CONDUCTOR USED SHALL BE #12 AWG.
2. #10 AWG AND SMALLER CONDUCTOR SHALL BE SOLID OR STRANDED. #8 AWG AND LARGER CONDUCTORS SHALL BE STRANDED.
3. SOLDERLESS COMPRESSION TYPE CONNECTORS SHALL BE USED FOR TERMINATION OF ALL STRANDED CONDUCTORS.
4. STRAIN-RELIEF SUPPORTS GRIPS SHALL BE HUBBELL KELLEMS OR APPROVED EQUAL. CABLES SHALL BE SUPPORTED IN ACCORDANCE WITH THE NEC AND CABLE MANUFACTURER'S RECOMMENDATIONS.
5. ALL CONDUCTORS SHALL BE TAGGED AT BOTH ENDS OF THE CONDUCTOR, AT ALL PULL BOXES, J-BOXES, EQUIPMENT. CABINETS SHALL BE IDENTIFIED WITH APPROVED PLASTIC TAGS (ACTION CRAFT, BRADY, OR APPROVED EQUAL).

C. DISCONNECT SWITCHES:

1. DISCONNECT SWITCHES SHALL BE HEAVY DUTY, DEAD-FRONT, QUICK-MAKE, QUICK-BREAK, EXTERNALLY OPERABLE, HANDLE LOCKABLE, INTERLOCK WITH COVER IN CLOSED POSITION, RATING AS INDICATED, UL LABELED, FURNISHED IN NEMA 3R ENCLOSURE, SQUARE-D, OR ENGINEERED APPROVED EQUAL.

D. CHEMICAL ELECTROLYTIC GROUNDING SYSTEM:

1. INSTALL CHEMICAL GROUNDING AS REQUIRED. THE SYSTEM SHALL BE ELECTROLYTIC MAINTENANCE FREE ELECTRODE CONSISTING OF RODS WITH A MINIMUM #2 AWG CU EXOTHERMALLY WELDED PIGTAIL, PROTECTIVE BOXES, AND BACKFILL MATERIAL. MANUFACTURER SHALL BE LYNCOLE XIT GROUNDING ROD TYPES K2-(*)CS OR K2L-(*)CS (*) LENGTH AS REQUIRED.
2. GROUND ACCESS BOX SHALL BE A POLYPLASTIC BOX FOR NON-TRAFFIC APPLICATIONS, INCLUDING BOLT DOWN FLUSH COVER WITH "BREATHER" HOLES, XIT MODEL #XB-22. ALL DISCONNECT SWITCHES AND CONTROLLING DEVICES SHALL BE PROVIDED WITH ENGRAVED LAMICOID NAMEPLATES INDICATING EQUIPMENT CONTROLLED, BRANCH CIRCUITS IDENTIFICATION NUMBERING, AND THE ELECTRICAL POWER SOURCE.
3. BACKFILL MATERIAL SHALL BE LYNCONITE AND LYNCOLE GROUNDING GRAVEL.

E. SYSTEM GROUNDING:

1. ALL GROUNDING COMPONENTS SHALL BE TINNED AND GROUNDING CONDUCTOR SHALL BE #2 AWG BARE, SOLID, TINNED COPPER. ABOVE-GRADE GROUNDING CONDUCTORS SHALL BE INSULATED WHERE NOTED.
2. GROUNDING BUSES SHALL BE BARE, TINNED, ANNEALED COPPER BARS OF RECTANGULAR CROSS SECTION. STANDARD BUS BARS MGB SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR AND THEY SHALL NOT BE FABRICATED OR MODIFIED IN THE FIELD. ALL GROUNDING BUSES SHALL BE IDENTIFIED WITH MINIMUM 3/4" LETTERS BY STENCILING OR DESIGNATION PLATE.
3. CONNECTORS SHALL BE HIGH CONDUCTIVITY, HEAVY DUTY, LISTED AND LABELED AS GROUNDING CONNECTORS FOR THE MATERIALS USED. USE TWO-HOLE COMPRESSION LUGS WITH CLEAR HEAT SHRINK FOR MECHANICAL CONNECTIONS. USE TWO-HOLE COMPRESSION LUGS WITH INSPECTION WINDOW AND CLEAR HEAT SHRINK FOR INTERIOR AND BLACK HEAT SHRINK FOR EXTERIOR.
4. EXOTHERMIC WELDED CONNECTIONS SHALL BE PROVIDED IN KIT FORM AND SELECTED FOR THE SPECIFIC TYPES, SIZES, AND COMBINATIONS OF CONDUCTORS AND OTHER ITEMS TO BE CONNECTED.
5. GROUND RODS SHALL BE ERICO #615800, COPPER-CLAD STEEL WITH HIGH STRENGTH STEEL CORE AND ELECTROLYTIC GRADE COPPER OUTER SHEATH, MOLTEN WELDED TO CORE, AND 5/8"x10'-0". ALL GROUNDING RODS SHALL BE INSTALLED WITH INSPECTION SLEEVES AS SHOWN ON DRAWINGS.
6. INSTALL AN EQUIPMENT GROUNDING CONDUCTOR IN ALL CONDUITS IN COMPLIANCE WITH THE AT&T SPECIFICATIONS AND NEC. THE EQUIPMENT GROUNDING CONDUCTORS SHALL BE BONDED AT ALL JUNCTION BOXES, PULLBOXES, DISCONNECT SWITCHES, STARTERS, AND EQUIPMENT CABINETS.

F. OTHER MATERIALS:

1. THE CONTRACTOR SHALL PROVIDE OTHER MATERIALS, THOUGH NOT SPECIFICALLY DESCRIBED, WHICH ARE REQUIRED FOR A COMPLETELY OPERATIONAL SYSTEM AND PROPER INSTALLATION OF THE WORK.
2. PROVIDE PULL BOXES AND JUNCTION BOXES WHERE SHOWN OR REQUIRED BY NEC.

G. PANELS AND LOAD CENTERS:

1. ALL PANEL DIRECTORIES SHALL BE TYPEWRITTEN.

PART 3 – EXECUTION

3.1 GENERAL:

A. ALL MATERIAL AND EQUIPMENT SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

B. DURING INSTALLATION AND CONSTRUCTION PERIODS EQUIPMENT SHALL BE TIGHTLY COVERED AND PROTECTED AGAINST DIRT, WATER, AND CHEMICAL OR MECHANICAL INJURY.

3.2 LABOR AND WORKMANSHIP:

A. ALL LABOR FOR THE INSTALLATION OF MATERIALS AND EQUIPMENT FURNISHED FOR THE ELECTRICAL SYSTEM SHALL BE INSTALLED BY EXPERIENCED WIREMEN IN A NEAT AND WORKMAN-LIKE MANNER.

B. ALL ELECTRICAL EQUIPMENT SHALL BE ADJUSTED, ALIGNED, AND TESTED BY THE CONTRACTOR AS REQUIRED TO CONFIRM THE INTENDED PERFORMANCE.

C. UPON COMPLETION OF WORK, THE CONTRACTOR SHALL THOROUGHLY CLEAN ALL EXPOSED EQUIPMENT, REMOVE ALL NECESSARY LABELS, DEBRIS, CRATING, OR CARTONS, AND LEAVE THE INSTALLATION FINISHED AND READY FOR OPERATION.

3.3 COORDINATION:

A. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF ELECTRICAL ITEMS WITH THE OWNER-FURNISHED EQUIPMENT DELIVERY SCHEDULE TO PREVENT UNNECESSARY DELAYS IN THE SCHEDULED WORK.

3.4 INSTALLATION:

B. CONDUIT:

1. ALL ELECTRICAL WIRING SHALL BE INSTALLED IN CONDUIT AS SPECIFIED. NO CONDUIT OR TUBING OF LESS THAN ¾" TRADE SIZE SHALL BE UTILIZED.
2. PROVIDE RIGID PVC SCHEDULE 80 CONDUITS FOR ALL RISERS UNLESS OTHERWISE NOTED. EMT MAY BE INSTALLED FOR EXTERIOR CONDUITS WHERE NOT SUBJECT TO PHYSICAL DAMAGE.
3. INSTALL SCHEDULE 40 PVC CONDUIT WITH A MINIMUM COVER OF 24" UNDER ROADWAYS, PARKING LOTS, STREETS, AND ALLEYS. CONDUIT SHALL HAVE A MINIMUM COVER OF 18" IN ALL NON-TRAFFIC APPLICATIONS (REFER TO 2020 OR LASTEST NEC, TABLE 300.5).
4. USE GALVANIZED FLEXIBLE STEEL CONDUIT AT LOCATIONS OF DIRECT CONNECTION TO EQUIPMENT THAT MOVES OR VIBRATES, OR FOR EASE OF MAINTENANCE. USE LIQUID TIGHT, FLEXIBLE METAL CONDUIT FOR OUTDOOR APPLICATIONS. INSTALL GALVANIZED FLEXIBLE STEEL CONDUIT AT ALL POINTS OF CONNECTION TO EQUIPMENT MOUNTED ON SUPPORTS TO ALLOW FOR EXPANSION AND CONTRACTION.
5. A RUN OF CONDUIT BETWEEN BOXES OR EQUIPMENT SHALL NOT CONTAIN MORE THAN THE EQUIVALENT OF THREE QUARTER-BENDS. CONDUIT BEND SHALL BE MADE WITH THE UL LISTED BENDER OR FACTORY 90 DEGREE ELBOWS MAY BE USED.
6. FIELD FABRICATED CONDUITS SHALL BE CUT SQUARE WITH A CONDUIT CUTTING TOOL AND REAMED TO PROVIDE A SMOOTH INSIDE SURFACE.
7. CONTRACTOR IS RESPONSIBLE FOR PROTECTING ALL CONDUITS DURING CONSTRUCTION. TEMPORARY OPENINGS IN THE CONDUIT SYSTEM SHALL BE PLUGGED OR CAPPED TO PREVENT ENTRANCE OF MOISTURE OR FOREIGN MATTER. CONTRACTOR SHALL REPLACE ANY CONDUITS CONTAINING FOREIGN MATERIALS THAT CANNOT BE REMOVED.
8. ALL CONDUITS SHALL BE SWABBED CLEAN BY PULLING AN APPROPRIATE SIZE MANDREL THROUGH THE CONDUIT BEFORE INSTALLATION OF CONDUCTORS OR CABLES. CONDUIT SHALL BE FREE OF DIRT AND DEBRIS.
9. INSTALL PULL STRINGS IN ALL CLEAN EMPTY CONDUITS. IDENTIFY PULL STRINGS AT EACH END.
10. INSTALL 2" HIGHLY VISIBLE AND DETECTABLE TAPE 12" ABOVE ALL UNDERGROUND CONDUITS AND CONDUCTORS.
11. CONDUITS SHALL BE INSTALLED IN SUCH A MANNER AS TO INSURE AGAINST COLLECTION OF TRAPPED CONDENSATION.
12. PROVIDE CORE DRILLING AS NECESSARY FOR PENETRATIONS TO ALLOW FOR RACEWAYS AND CABLES TO BE ROUTED THROUGH THE BUILDING. DO NOT PENETRATE STRUCTURAL MEMBERS. SLEEVES AND/OR PENETRATIONS IN FIRE RATED CONSTRUCTION SHALL BE EFFECTIVELY SEALED WITH FIRE RATED MATERIAL WHICH SHALL MAINTAIN THE FIRE RATING OF THE WALL OR STRUCTURE. FIRE STOPS AT FLOOR PENETRATIONS SHALL BE INSTALLED TO PREVENT PASSAGE OF WATER, SMOKE, FIRE, AND FUMES. ALL MATERIAL SHALL BE UL APPROVED FOR THIS PURPOSE.

B. CONDUCTORS AND CABLE:

1. ALL POWER WIRING SHALL BE COLOR CODED AS FOLLOWS:

DESCRIPTION	208/240/120 VOLT SYSTEMS
PHASE A	BLACK
PHASE B	RED
PHASE C	BLUE
NEUTRAL	WHITE
GROUNDING	GREEN

2. SPLICES SHALL BE MADE ONLY AT OUTLETS, JUNCTION BOXES, OR ACCESSIBLE RACEWAY CONDULETS APPROVED FOR THIS PURPOSE.
3. PULLING LUBRICANTS SHALL BE UL APPROVED. CONTRACTOR SHALL USE NYLON OR HEMP ROPE FOR PULLING CONDUCTOR OR CABLES INTO THE CONDUIT.
4. CABLES SHALL BE NEATLY TRAINED, WITHOUT INTERLACING, AND BE OF SUFFICIENT LENGTH IN ALL BOXES AND EQUIPMENT TO ALLOW FOR A NEAT ARRANGEMENT. CABLES SHALL BE SECURED IN A MANNER TO AVOID TENSION ON CONDUCTORS AND/OR TERMINALS. CONDUCTORS SHALL BE PROTECTED FROM MECHANICAL INJURY AND MOISTURE. SHARP BENDS OVER CONDUIT BUSHINGS ARE PROHIBITED. DAMAGED CABLES SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE.

C. DISCONNECT SWITCHES:

1. INSTALL DISCONNECT SWITCHES LEVEL AND PLUMB, AND CONNECT TO WIRING SYSTEM AND GROUNDING SYSTEM AS REQUIRED.

D. GROUNDING:

1. ALL METALLIC PARTS OF ELECTRICAL EQUIPMENT WHICH DO NOT CARRY CURRENT SHALL BE GROUNDED IN ACCORDANCE WITH THE REQUIREMENTS OF THE BUILDING MANUFACTURER, AT&T GROUNDING AND BONDING STANDARDS TP-76416, TP-76300, AND THE NATIONAL ELECTRICAL CODE.
2. PROVIDE ELECTRICAL GROUNDING AND BONDING SYSTEM WITH ASSEMBLY OF MATERIALS, INCLUDING GROUNDING ELECTRODES, BONDING JUMPERS, AND ADDITIONAL ACCESSORIES AS REQUIRED FOR A COMPLETE INSTALLATION.
3. ALL GROUNDING CONDUCTORS SHALL PROVIDE A STRAIGHT DOWNWARD PATH TO GROUND. GROUNDING CONDUCTORS SHALL NOT BE LOOPED OR SHARPLY BENT. ROUTE GROUNDING CONNECTIONS AND CONDUCTORS TO GROUND IN THE SHORTEST AND STRAIGHTEST PATHS POSSIBLE TO MINIMIZE TRANSIENT VOLTAGE RISES.
4. AT BUILDINGS AND/OR NEW TOWERS GREATER THAN 75 FEET IN HEIGHT AND WHERE THE MAIN GROUNDING CONDUCTORS ARE REQUIRED TO BE ROUTED TO GRADE, THE CONTRACTOR SHALL ROUTE TWO GROUNDING CONDUCTORS FROM THE ROOFTOP, TOWERS, AND WATER TOWER GROUND RING, TO THE EXISTING GROUNDING SYSTEM. THE GROUNDING CONDUCTORS SHALL NOT BE SMALLER THAN #2 AWG COPPER. ROOFTOP GROUND RING SHALL BE BONDED TO THE EXISTING GROUNDING SYSTEM, THE BUILDING STEEL COLUMNS, THE LIGHTNING PROTECTION SYSTEM, AND/OR THE BUILDING MAIN WATER LINE (FERROUS OR NONFERROUS METAL PIPING ONLY). SEE STANDARD 6.3.2.2.
5. TIGHTEN GROUNDING AND BONDING CONNECTORS, INCLUDING SCREWS AND BOLTS, IN ACCORDANCE WITH MANUFACTURER'S PUBLISHED TORQUE TIGHTENING SPECIFICATIONS. WHERE MANUFACTURER'S TORQUING REQUIREMENTS ARE NOT AVAILABLE, TIGHTEN CONNECTIONS TO COMPLY WITH TIGHTENING TORQUE VALUES SPECIFIED IN UL TO ASSURE PERMANENT AND EFFECTIVE GROUNDING.
6. CONTRACTOR SHALL VERIFY THE LOCATIONS OF GROUNDING TIE-IN POINTS TO THE EXISTING GROUNDING SYSTEM. ALL UNDERGROUND GROUNDING CONNECTIONS SHALL BE MADE BY THE EXOTHERMIC WELD PROCESS AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
7. ALL GROUNDING CONNECTIONS SHALL BE INSPECTED FOR TIGHTNESS. EXOTHERMIC WELDED CONNECTIONS SHALL BE APPROVED BY THE INSPECTOR HAVING JURISDICTION PRIOR TO PERMANENT CONCEALMENT.
8. APPLY CORROSION-RESISTANCE FINISH TO FIELD CONNECTIONS AND AREAS/COMPONENTS WHERE FACTORY APPLIED PROTECTIVE COATINGS HAVE BEEN DESTROYED.
9. A SEPARATE, CONTINUOUS, INSULATED EQUIPMENT GROUNDING CONDUCTOR SHALL BE INSTALLED IN ALL FEEDER AND BRANCH CIRCUITS.
10. BOND ALL INSULATED GROUNDING BUSHINGS WITH A BARE #6 AWG GROUNDING CONDUCTOR TO A GROUND BUS.
11. DIRECT-BURIED GROUNDING CONDUCTORS SHALL BE INSTALLED AT A NOMINAL DEPTH OF 30" MINIMUM BELOW GRADE, OR 6" MINIMUM BELOW THE FROST LINE, USING THE GREATER OF THE TWO DISTANCES.
12. ALL GROUNDING CONDUCTORS EMBEDDED IN OR PENETRATING CONCRETE SHALL BE INSTALLED IN SCHEDULE 40 PVC CONDUIT.
13. THE INSTALLATION OF A CHEMICAL ELECTROLYTIC GROUNDING SYSTEM IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. REMOVE SEALING TAPE FROM LEACHING AND BREATHER HOLES. INSTALL THE PROTECTIVE BOX FLUSH WITH GRADE.
14. IF COAX ON THE ICE BRIDGE IS MORE THAN 6 FEET FROM THE GROUND BAR AT THE BASE OF THE TOWER, INSTALL A SECOND GROUND BAR AT THE END OF THE ICE BRIDGE TO GROUND THE COAX CABLE GROUNDING KITS AND IN-LINE ARRESTORS.
15. CONTRACTOR SHALL REPAIR, AND/OR REPLACE, EXISTING GROUNDING SYSTEM COMPONENTS DAMAGED DURING CONSTRUCTION AT THE CONTRACTORS EXPENSE.

3.5 ACCEPTANCE TESTING:

A. CERTIFIED PERSONNEL USING CERTIFIED EQUIPMENT SHALL PERFORM REQUIRED TESTS AND SUBMIT WRITTEN TEST REPORTS UPON COMPLETION.

B. WHEN MATERIAL AND/OR WORKMANSHIP IS FOUND TO BE NON-COMPLIANT WITH THE SPECIFIED REQUIREMENTS, THE NON-COMPLIANT ITEMS/ELEMENTS SHALL BE PROMPTLY REMOVED FROM THE PROJECT SITE AND REPLACED WITH ITEMS COMPLYING WITH THE SPECIFIED REQUIREMENTS.

C. TEST PROCEDURES:

1. ALL FEEDERS SHALL HAVE INSULATION TESTED AFTER INSTALLATION, BEFORE CONNECTION TO DEVICES. THE CONDUCTORS SHALL TEST FREE FROM SHORT CIRCUITS AND GROUNDS. TESTING SHALL BE FOR ONE MINUTE USING 1,000VOLT DC.
2. PRIOR TO ENERGIZING CIRCUITRY, TEST WIRING DEVICES FOR ELECTRICAL CONTINUITY AND PROPER POLARITY CONNECTIONS.
3. MEASURE AND RECORD VOLTAGES BETWEEN PHASES AND BETWEEN PHASE CONDUCTORS AND NEUTRALS. SUBMIT A REPORT OF MAXIMUM AND MINIMUM VOLTAGES TO APPROPRIATE PARTS.
4. PERFORM GROUNDING TEST TO MEASURE RESISTANCE OF GROUNDING SYSTEM USING THE IEEE STANDARD 3-POINT "FALL-OF-POTENTIAL" METHOD. PROVIDE PLOTTED TEST VALUES AND LOCATION SKETCH. NOTIFY THE ENGINEER IMMEDIATELY IF MEASURED VALUE IS OVER 5 OHMS.

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PROJECT/PHASE NO:	129551/1207
DRAWN BY:	PDJ
CHECKED BY:	JMH
RFDS:	___

REV	DATE	DESCRIPTION
0	04/24/24	ISSUED FOR CONSTRUCTION

COLORADO LICENSED
JASON T. KAHRS
52811
PROFESSIONAL ENGINEER
04/24/2024

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CELL SITE RF MODIFICATIONS

SHEET TITLE
GENERAL ELECTRICAL NOTES

SHEET NUMBER
GN-6

PERMIT NO:
TELE24-00035

BATTERY SAFETY NOTES

PART 1 – GENERAL

1.1 LAWS, REGULATIONS, ORDINANCES, STATUTES, AND CODES:

A. ALL WORK SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE, AND ALL APPLICABLE LOCAL LAWS, REGULATIONS, ORDINANCES, STATUTES, AND CODES.

1.2 REFERENCES:

A. THE PUBLICATIONS LISTED BELOW ARE PART OF THIS SPECIFICATION. EACH PUBLICATION SHALL BE THE LATEST REVISION AND ADDENDUM IN EFFECT ON THE DATE OF CONSTRUCTION. EXCEPT AS MODIFIED BY THE REQUIREMENT SPECIFIED HEREIN OR THE DETAILS OF THE DRAWINGS, WORK INCLUDED IN THIS SPECIFICATION SHALL CONFORM TO THE APPLICABLE PROVISION OF THESE PUBLICATIONS.

1. ANSI/IEEE (AMERICAN NATIONAL STANDARDS INSTITUTE)
2. ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)
3. ICE (INSULATED CABLE ENGINEERS ASSOCIATION)
4. NEMA (NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION)
5. NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)
6. OSHA (OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION)
7. UL (UNDERWRITERS LABORATORIES. INC.)
8. AT&T GROUNDING AND BONDING STANDARDS TP-76416
9. IFC (INTERNATIONAL FIRE CODE)
10. IMC (INTERNATIONAL MECHANICAL CODE)

1.3 SCOPE OF WORK:

A. WORK UNDER THIS SECTION SHALL CONSIST OF FURNISHING ALL LABOR, MATERIAL, AND ASSOCIATED SERVICES REQUIRED TO COMPLETE REQUIRED CONSTRUCTION AND TO ACHIEVE OPERATIONAL STATUS.

B. ALL ELECTRICAL EQUIPMENT UNDER THIS CONTRACT SHALL BE PROPERLY TESTED, ADJUSTED, AND ALIGNED BY THE CONTRACTOR.

C. THE BATTERY & POWER SYSTEMS ARE EQUIPPED WITH TEMPERATURE SENSORS & ARE PRE-PROGRAMMED WITH THE BATTERY VOLTAGE TEMPERATURE COMPENSATION & BATTERY THERMAL RUNAWAY MANAGEMENT FEATURES ENABLED PER AT&T MOBILITY'S SPECIFICATIONS.

D. DOOR(S) INTO EQUIPMENT ROOM MUST BE PROVIDED WITH APPROVED SIGNS AND APPROPRIATELY MARKED NFPA 704 PLACARD THAT STATE THE FOLLOWING:
- EQUIPMENT ROOM CONTAINS ENERGIZED BATTERY SYSTEMS
- EQUIPMENT ROOM CONTAINS ENERGIZED ELECTRICAL CIRCUITS
- BATTERY ELECTROLYTE SOLUTIONS WHERE PRESENT, ARE CORROSIVE LIQUIDS

E. CABINETS SHALL HAVE EXTERIOR LABELS THAT IDENTIFY THE MANUFACTURER AND MODEL NUMBER OF THE SYSTEM AND ELECTRICAL RATING (VOLTAGE AND CURRENT) OF THE CONTAINED BATTERY SYSTEM. SIGNS WITHIN THE CABINET SHALL INDICATE RELEVANT ELECTRICAL, CHEMICAL, AND FIRE HAZARDS.

PART 2 – PRODUCTS

2.1 GENERAL:

A. ALL MATERIALS AND EQUIPMENT SHALL BE NEW, UL LISTED, AND FREE FROM DEFECTS.

B. ALL EQUIPMENT SHALL BEAR THE UNDERWRITERS LABORATORIES (UL) LABEL OF APPROVAL AND SHALL CONFORM TO REQUIREMENT OF THE NATIONAL ELECTRICAL CODE.

C. ALL ITEMS, MATERIALS, AND EQUIPMENT SHALL BE ACCEPTABLE TO THE JURISDICTIONAL AUTHORITY AND SUITABLE FOR THE USE INTENDED.

D. ALL OVERCURRENT DEVICES SHALL HAVE AN INTERRUPTING CURRENT RATING OF GREATER THAN THE SHORT CIRCUIT CURRENT TO WHICH THEY ARE SUBJECTED (10,000 AIC MINIMUM). CONTRACTOR SHALL VERIFY THAT AVAILABLE SHORT CIRCUIT CURRENT DOES NOT EXCEED THE RATING OF ELECTRICAL EQUIPMENT IN ACCORDANCE WITH ARTICLE 110.24 NEC OR THE MOST CURRENT ADOPTED CODE PER THE GOVERNING JURISDICTION.

2.2 MATERIALS AND EQUIPMENT:

A. BATTERIES:

1. BATTERIES SHALL BE VRLA(VALVE REGULATED LEAD-ACID) BATTERIES COMPLYING WITH IFC 608.
2. CONTRACTOR TO INSTALL ENERSYS POWERSAFE SBS BATTERIES OR ENGINEERING APPROVED EQUIVALENT.

B. POWER PLANTS/CABINETS:

1. POWER PLANTS/CABINETS SHALL BE EQUIPPED WITH TEMPERATURE SENSORS AND ARE PRE-PROGRAMMED WITH THE BATTERY VOLTAGE TEMPERATURE COMPENSATION & BATTERY THERMAL RUNAWAY MANAGEMENT FEATURES ENABLED PER AT&T MOBILITY'S SPECIFICATIONS.
2. CONTRACTOR TO INSTALL VERTIV POWER PLANTS/CABINETS PER AT&T SPECIFICATIONS; AND COMPLYING WITH IFC 608 AND IMC 502.4.

C. BATTERY RACKS/CABINETS:

1. BATTERY RACKS/CABINETS SHALL BE EQUIPPED WITH TEMPERATURE SENSORS PER AT&T MOBILITY'S SPECIFICATIONS.
2. CONTRACTOR TO INSTALL VERTIV BATTERY RACKS/CABINETS PER AT&T SPECIFICATIONS; AND COMPLYING WITH IFC 608 AND IMC 502.4.

IFC 608 CODE ANALYSIS & COMPLIANCE INFORMATION

- SAFETY CAPS (IFC 608.2.2) – EXISTING POWERSAFE SBS 190F VRLA BATTERIES HAVE SELF-RESEALING SAFETY VENTS WITH FLASH ARRESTORS WHICH SATISFY THIS CODE REQUIREMENT.
- THERMAL RUNAWAY MANAGEMENT (IFC 608.3) – POWER PLANTS/CABINETS SHALL BE EQUIPPED WITH TEMPERATURE SENSORS AND ARE PRE-PROGRAMMED WITH THE BATTERY VOLTAGE TEMPERATURE COMPENSATION AND BATTERY THERMAL RUNAWAY MANAGEMENT FEATURES ENABLED. BATTERY RACKS/CABINETS SHALL BE EQUIPPED WITH TEMPERATURE SENSORS.
- SPILL CONTROL (IFC 608.5) – NOT REQUIRED FOR VRLA BATTERIES PER EXCEPTION.
- NEUTRALIZATION (IFC 608.5.2) – CONTRACTOR TO ENSURE THAT BATTERY SPILL CLEAN-UP KIT IS PROVIDED ON SITE, CAPABLE OF NEUTRALIZING A MINIMUM OF X GALLONS OF SPILLED ELECTROLYTE (WHERE X=3% OF THE TOTAL VOLUME CALCULATED IN THE ELECTROLYTE CALCULATIONS).
- VENTILATION (IFC 608.5.2) – EXHAUST FAN WILL LIMIT CONCENTRATION TO 1% VIA HYDROGEN SENSOR AND MAKEUP AIR INTAKE. HYDROGEN SENSOR TO ACTIVATE DAMPER/FAN AT 1% CONCENTRATION AND SIGNAL AN ALARM TO A MONITORED FACILITY AT 2% CONCENTRATION.
- SIGNAGE (IFC 608.7) – AT&T WILL PLACE UV-RESISTANT SIGNS ON THE EXTERIOR OF THE SHELTER DOOR CAPABLE OF WITHSTANDING THE HARSH SUNLIGHT OUTDOORS PER IFC 608.7.1. IN THE CASE THAT BATTERIES ARE INSTALLED IN A CABINET, CONTRACTOR SHALL PLACE SIGNAGE ON THE CABINET DOOR PER IFC 608.7.2.
- SEISMIC PROTECTION (IFC 608.8) – CONTRACTOR WILL ENSURE THAT THE NEW BATTERY RACKS HAVE THE REQUIRED BRACING TO MEET SEISMIC ZONE 4.
- SMOKE DETECTION (IFC 608.9) – SMOKE DETECTORS TO BE TIED INTO EXISTING ALARMING SYSTEMS. AT&T TO VERIFY OPERATION OF SMOKE DETECTOR/ALARM.

IMC 502.4 CODE ANALYSIS & COMPLIANCE INFORMATION

- (IMC 502.4) STATIONARY STORAGE BATTERY SYSTEMS.
  STATIONARY STORAGE BATTERY SYSTEMS, AS REGULATED BY SECTION 608 OF THE INTERNATIONAL FIRE CODE, SHALL BE PROVIDED WITH VENTILATION IN ACCORDANCE WITH IMC 502.4 AND SECTION 502.4.1 OR 502.4.2.

  EXCEPTION: LITHIUM-ION AND LITHIUM METAL POLYMER BATTERIES SHALL NOT REQUIRE ADDITIONAL VENTILATION BEYOND THAT WHICH WOULD NORMALLY BE REQUIRED FOR HUMAN OCCUPANCY OF THE SPACE.
- (SECTION 502.4.1) HYDROGEN LIMIT IN ROOMS.
  FOR FLOODED LEAD ACID, FLOODED NICKEL CADMIUM AND VRLA BATTERIES, THE VENTILATION SYSTEM SHALL BE DESIGNED TO LIMIT THE MAXIMUM CONCENTRATION OF HYDROGEN TO 1.0 PERCENT OF THE TOTAL VOLUME OF THE ROOM.
- (SECTION 502.4.2) VENTILATION RATE IN ROOMS
  CONTINUOUS VENTILATION SHALL BE PROVIDED AT A RATE OF NOT LESS THAN 1 CUBIC FOOT PER MINUTE PER SQUARE FOOT OF FLOOR AREA OF THE ROOM.
- (SECTION 502.4.3) SUPERVISION
  MECHANICAL VENTILATION SYSTEMS REQUIRED BY SECTION 502.4 SHALL BE SUPERVISED BY AN APPROVED CENTRAL, PROPRIETARY OR REMOTE STATION SERVICE OR SHALL INITIATE AN AUDIBLE AND VISUAL SIGNAL AT A CONSTANTLY ATTENDED ON-SITE LOCATION.

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SHEET TITLE
BATTERY SAFETY NOTES

SHEET NUMBER
GN-7

PERMIT NO:
TELE24-00035

Date: **August 19, 2024**

Morrison Hershfield
1455 Lincoln Parkway, Suite 500
Atlanta, GA 30346
(770) 379-8500

Subject:	**Structural Analysis Report**	
Carrier Designation:	***AT&T Mobility* Co-Locate**	
	Site Number:	COL01184
	Site Name:	Edgemont
	FA Number:	10093889
Crown Castle Designation:	**BU Number:**	855801
	Site Name:	Edgemont
	JDE Job Number:	2115312
	Work Order Number:	2300465
	Order Number:	668587 Rev. 2
Engineering Firm Designation:	**Morrison Hershfield Project Number:** CN13-796 / 2400001	
Site Data:	**5351 West 6th Avenue, Lakewood, Jefferson County, CO 80214**	
	Latitude *39° 43' 37"*, Longitude *-105° 3' 20.1"*	
	160 Foot – Rohn Self Support Tower	

Morrison Hershfield is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above-mentioned tower.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC5: Proposed Equipment Configuration **Sufficient Capacity**

This analysis has been performed in accordance with the 2021 International Building Code based upon a ultimate 3-second gust wind speed of 138 mph. Applicable Standard references and design criteria are listed in Section 2 – Analysis Criteria.

Respectfully submitted by:

G. Lance Cooke, P.E. (CO License No. 44803)
Senior Engineer



PERMIT NO:
TELE24-00035

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PERMIT NO:
TELE24-00035

1) INTRODUCTION

This tower is a 160 ft self-support tower designed by Rohn Industries, Inc.

The tower was modified per reinforcement drawings prepared by Jacobs Engineering Group, Inc in February of 2015. Reinforcement consisted of replacing Diagonal members from 120 ft to 125 ft. Per the post modification inspection completed by Tower Engineering Professionals in July of 2015, these modifications have been properly installed and were considered in this analysis.

2) ANALYSIS CRITERIA

TIA-222 Revision:	TIA-222-H
Risk Category:	II
Wind Speed:	138 mph
Exposure Category:	C
Topographic Factor:	1
Service Wind Speed:	60 mph

Table 1 - Proposed Equipment Configuration

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
157.0	161.0	1	ericsson	AIR 6419 B77G_CCIV2	3 2 2 1 1	1-5/8 1-1/4 3/4 7/8 3/8
	159.0	2	commscope	NNH4-65C-R6-V3 w/ Mount Pipe		
		1	ericsson	RADIO 4490HP B5/B12A		
		1	ericsson	RADIO 4890HP B2/B25 B66		
		1	ericsson	RRUS 4415 B30_CCIV2		
		1	ericsson	RRUS 4478 B14_CCIV2		
		1	raycap	DC6-48-60-18-8F		
	157.0	1	ericsson	AIR 6419 B77D		
		1	-	Sector Mount [SM 1302-1]		
124.0	129.0	1	ericsson	AIR 6419 B77G_CCIV2	2 2 2 1 1	1-5/8 1-1/4 3/4 7/8 3/8
	127.0	2	commscope	NNH4-65C-R6-V3 w/ Mount Pipe		
		1	commscope	WCS-IMFT-AMT		
		1	ericsson	RADIO 4490HP B5/B12A		
		1	ericsson	RADIO 4890HP B2/B25 B66		
		1	ericsson	RRUS 4415 B30_CCIV2		
		1	ericsson	RRUS 4478 B14_CCIV2		
		1	raycap	DC6-48-60-18-8F		
	125.0	1	ericsson	AIR 6419 B77D		
	124.0	1	-	10' Mount Pipe [#P2.5STD]		
		1	-	Sector Mount [SM 1302-1]		
49.0	52.0	1	ericsson	AIR 6419 B77G_CCIV2	5 2 1	7/8 3/4 3/8
	50.0	2	commscope	NNH4-65C-R6-V3 w/ Mount Pipe		
		1	commscope	WCS-IMFQ-AMT		
		1	ericsson	RADIO 4490HP B5/B12A		
		1	ericsson	RADIO 4890HP B2/B25 B66		

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Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
49.0	50.0	1	ericsson	RRUS 4415 B30_CCIV2	-	-
		1	ericsson	RRUS 4478 B14_CCIV2		
		1	raycap	DC6-48-60-18-8F		
	49.0	1	-	15' Support Rail [#P3.0STD]		
		1	-	8' Mount Pipe [#C10900106]		
		1	-	V-Stabilizer Kit		
		1	-	Sector Mount [SM 201-1]		
	48.0	1	ericsson	AIR 6419 B77D		

Table 2 - Other Considered Equipment

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
85.0	85.0	1	kmw communications	ET-X-TS-70-16-62-18-IR-RD w/ Mount Pipe	1	7/8
		1	kmw communications	ET-X-WM-18-65-8P w/ Mount Pipe		
		1	samsung telecommunications	OPTIC FIBER JUNCTION CYLINDER		
		1	samsung telecommunications	POWER JUNCTION CYLINDER		
		1	samsung telecommunications	RRH-B8		
		1	samsung telecommunications	RRH-C2 W/EXT FILTER		
		1	samsung telecommunications	RRH-P4		
		2	-	10' Hor x 3" x 3" Angle Mount		
65.0	65.0	1	kmw communications	ET-X-TS-70-16-62-18-IR-RD w/ Mount Pipe	1	7/8
		1	kmw communications	ET-X-WM-18-65-8P w/ Mount Pipe		
		1	samsung telecommunications	OPTIC FIBER JUNCTION CYLINDER		
		1	samsung telecommunications	POWER JUNCTION CYLINDER		
		1	samsung telecommunications	RRH-B8		
		1	samsung telecommunications	RRH-C2 W/EXT FILTER		
		1	samsung telecommunications	RRH-P4		
		2	-	10' Hor x 3" x 3" Angle Mount		
59.0	59.0	1	kmw communications	ET-X-TS-70-16-62-18-IR-RD w/ Mount Pipe	1	7/8

PERMIT NO:
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Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
59.0	59.0	1	kmw communications	ET-X-WM-18-65-8P w/ Mount Pipe	-	-
		1	samsung telecommunications	OPTIC FIBER JUNCTION CYLINDER		
		1	samsung telecommunications	POWER JUNCTION CYLINDER		
		1	samsung telecommunications	RRH-B8		
		1	samsung telecommunications	RRH-C2 W/EXT FILTER		
		1	samsung telecommunications	RRH-P4		
		2	-	10' Hor x 3" x 3" Angle Mount		

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Reference	Source
4-GEOTECHNICAL REPORTS	4721362	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	5154699	CCISITES
4-TOWER MANUFACTURER DRAWINGS	5154331	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	5570261	CCISITES
4-POST-MODIFICATION INSPECTION	5795281	CCISITES

3.1) Analysis Method

tnxTower (version 8.2.4.3), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A. When applicable, Crown Castle has calculated and provided the effective area for panel antennas using approved methods following the intent of the TIA-222 standard.

3.2) Assumptions

1) Tower and structures were maintained in accordance with the TIA-222 Standard.
2) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.

This analysis may be affected if any assumptions are not valid or have been made in error. Morrison Hershfield should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 4 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T1	160 - 140	Leg	ROHN 2 STD	3	-12.59	38.68	32.5	Pass
T2	140 - 125	Leg	ROHN 2.5 X-STR	39	-23.00	78.15	29.4	Pass

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Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T3	125 - 120	Leg	ROHN 2.5 X-STR	62	-28.08	78.15	35.9	Pass
T4	120 - 100	Leg	ROHN 3 X-STR	71	-47.88	99.06	48.3	Pass
T5	100 - 80	Leg	ROHN 3.5 X-STR	92	-68.26	132.01	51.7	Pass
T6	80 - 60	Leg	ROHN 4 X-STR	113	-91.13	167.90	54.3	Pass
T7	60 - 40	Leg	ROHN 5 X-STR	134	-115.17	211.31	54.5	Pass
T8	40 - 20	Leg	ROHN 5 X-STR	149	-141.12	211.29	66.8	Pass
T9	20 - 0	Leg	ROHN 6 EHS	164	-166.60	256.26	65.0	Pass
T1	160 - 140	Diagonal	L1 1/2x1 1/2x3/16	9	-2.46	7.21	34.1 39.9 (b)	Pass
T2	140 - 125	Diagonal	L1 3/4x1 3/4x1/8	45	-2.37	5.11	46.4 54.4 (b)	Pass
T3	125 - 120	Diagonal	L2x2x1/4	66	-3.24	13.26	24.5 28.0 (b)	Pass
T4	120 - 100	Diagonal	L2x2x3/16	76	-3.78	6.31	59.8	Pass
T5	100 - 80	Diagonal	L2 1/2x2 1/2x3/16	96	-4.34	9.65	44.9 66.4 (b)	Pass
T6	80 - 60	Diagonal	L3x3x3/16	115	-5.03	13.19	38.1 76.5 (b)	Pass
T7	60 - 40	Diagonal	L3x3x1/4	136	-7.37	11.80	62.4	Pass
T8	40 - 20	Diagonal	L3 1/2x3 1/2x1/4	151	-7.71	15.86	48.6 56.5 (b)	Pass
T9	20 - 0	Diagonal	L3 1/2x3 1/2x1/4	166	-8.56	13.56	63.1	Pass
T1	160 - 140	Top Girt	L2x2x3/16	6	-0.29	6.20	4.6	Pass
T2	140 - 125	Top Girt	L2x2x1/8	41	-0.40	4.27	9.3	Pass
							Summary	
						Leg (T8)	66.8	Pass
						Diagonal (T6)	76.5	Pass
						Top Girt (T2)	9.3	Pass
						Bolt Checks	76.5	Pass
						Rating =	76.5	Pass

Table 5 - Tower Component Stresses vs. Capacity – LC5

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	41.1	Pass
1	Base Foundation (Structure)	0	24.2	Pass
1	Base Foundation (Soil Interaction)		30.3	Pass

Structure Rating (max from all components) =	76.5%*

Notes:
1) See additional documentation in “Appendix C – Additional Calculations” for calculations supporting the % capacity consumed.
2) *Rating per TIA-222-H, Section 15.5.

4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the proposed load configuration. No modifications are required at this time.

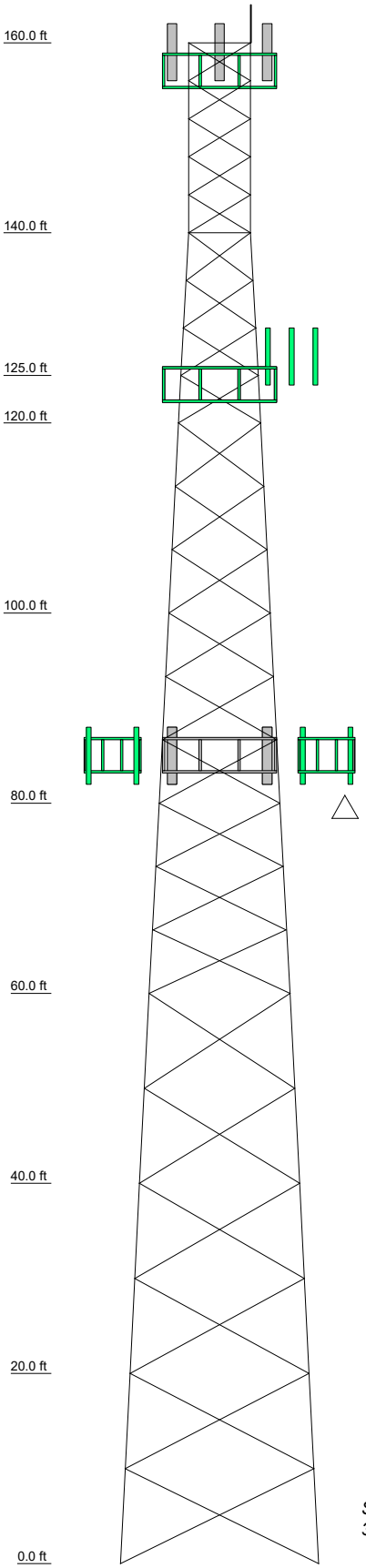
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APPENDIX A

TNXTOWER OUTPUT

PERMIT NO:
TELE24-00035

Section	T9	T8	T7	T6	T5	T4	T3	T2	T1
Legs	ROHN 6 EHS	ROHN 5 X-STR		ROHN 4 X-STR	ROHN 3.5 X-STR	ROHN 3 X-STR		ROHN 2.5 X-STR	ROHN 2 STD
Leg Grade	A572-50								
Diagonals	L3 1/2x3 1/2x1/4		L3x3x1/4	L3x3x3/16	L2 1/2x2 1/2x3/16	L2x2x3/16	A	L1 3/4x1 3/4x1/8	L1 1/2x1 1/2x3/16
Diagonal Grade	A572-50				A36				
Top Girts				N.A.				L2x2x1/8	L2x2x3/16
Face Width (ft)	20.8646	18.8542	16.7708	14.7708	12.6771	10.6354	8.60417	8.09375	6.5625	6.52083
# Panels @ (ft)		6 @ 10			9 @ 6.66667			4 @ 5	5 @ 4
Weight (K)	14.8	3.1	2.8	2.5	2.0	1.6	1.2	0.3	0.6	0.7



SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	L2x2x1/4		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

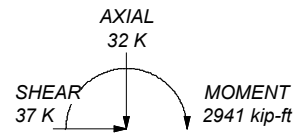
TOWER DESIGN NOTES

1. Tower is located in Jefferson County, Colorado.
2. Tower designed for Exposure C to the TIA-222-H Standard.
3. Tower designed for a 138 mph basic wind in accordance with the TIA-222-H Standard.
4. Deflections are based upon a 60 mph wind.
5. Tower Risk Category II.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. TOWER RATING: 76.5%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 173 K
SHEAR: 22 K

UPLIFT: -147 K
SHEAR: 19 K



TORQUE 35 kip-ft
REACTIONS - 138 mph WIND

Morrison Hershfield
Stantec
Consulting Engineers
1455 Lincoln Parkway, Suite 500
Atlanta, GA 30346
Phone: (770) 379-8500
FAX: (770) 379-8500

Job:	CN13-796 / 2400001		
Project:	855801 / Edgemont		
Client:	Crown Castle USA	Drawn by: RBA	App'd:
Code:	TIA-222-H	Date: 08/19/24	Scale: NTS
Path:			Dwg No. E-

PERMIT NO: TELE24-00035

Tower Input Data

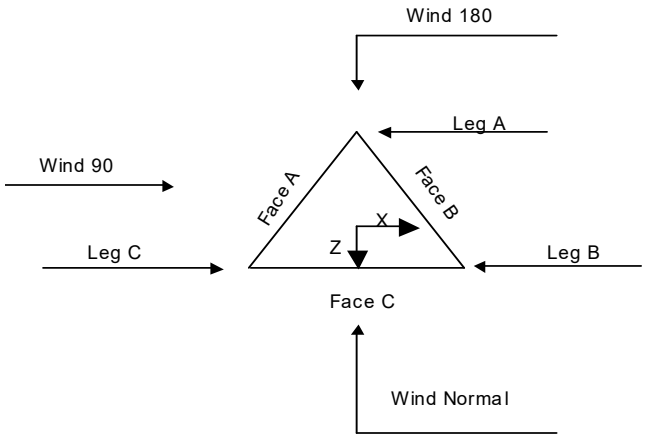
The main tower is a 3x free standing tower with an overall height of 160.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 6.52 ft at the top and 20.86 ft at the base.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

Tower is located in Jefferson County, Colorado.
Tower base elevation above sea level: 5333.00 ft.
Basic wind speed of 138 mph.
Risk Category II.
Exposure Category C.
Simplified Topographic Factor Procedure for wind speed-up calculations is used.
Topographic Category: 1.
Crest Height: 0.00 ft.
Deflections calculated using a wind speed of 60 mph.
Pressures are calculated at each section.
Stress ratio used in tower member design is 1.
Tower analysis based on target reliabilities in accordance with Annex S.
Load Modification Factors used: $K_{es}(F_w) = 0.95$.
Maximum demand-capacity ratio is: 1.05.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

Consider Moments - Legs	Assume Legs Pinned	√ Calculate Redundant Bracing Forces
Consider Moments - Horizontals	√ Assume Rigid Index Plate	Ignore Redundant Members in FEA
Consider Moments - Diagonals	√ Use Clear Spans For Wind Area	SR Leg Bolts Resist Compression
Use Moment Magnification	√ Use Clear Spans For KL/r	All Leg Panels Have Same Allowable
√ Use Code Stress Ratios	Retension Guys To Initial Tension	Offset Girt At Foundation
√ Use Code Safety Factors - Guys	√ Bypass Mast Stability Checks	√ Consider Feed Line Torque
Escalate Ice	√ Use Azimuth Dish Coefficients	√ Include Angle Block Shear Check
Always Use Max Kz	√ Project Wind Area of Appurtenances	Use TIA-222-H Bracing Resist. Exemption
Use Special Wind Profile	√ Alternative Appurt. EPA Calculation	Use TIA-222-H Tension Splice Exemption
√ Include Bolts In Member Capacity	Autocalc Torque Arm Areas	**Poles**
Leg Bolts Are At Top Of Section	Add IBC .6D+W Combination	Include Shear-Torsion Interaction
Secondary Horizontal Braces Leg	√ Sort Capacity Reports By Component	Always Use Sub-Critical Flow
Use Diamond Inner Bracing (4 Sided)	Triangulate Diamond Inner Bracing	Use Top Mounted Sockets
SR Members Have Cut Ends	Treat Feed Line Bundles As Cylinder	Pole Without Linear Attachments
SR Members Are Concentric	Ignore KL/ry For 60 Deg. Angle Legs	Pole With Shroud Or No Appurtenances
Distribute Leg Loads As Uniform	Use ASCE 10 X-Brace Ly Rules	Outside and Inside Corner Radii Are Known

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Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	160.00-140.00			6.52	1	20.00
T2	140.00-125.00			6.56	1	15.00
T3	125.00-120.00			8.09	1	5.00
T4	120.00-100.00			8.60	1	20.00
T5	100.00-80.00			10.64	1	20.00
T6	80.00-60.00			12.68	1	20.00
T7	60.00-40.00			14.77	1	20.00
T8	40.00-20.00			16.77	1	20.00
T9	20.00-0.00			18.85	1	20.00

Tower Section Geometry *(cont'd)*

Tower Section	Tower Elevation	Diagonal Spacing	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset	Bottom Girt Offset
	ft	ft				in	in
T1	160.00-140.00	4.00	X Brace	No	No	0.0000	0.0000
T2	140.00-125.00	5.00	X Brace	No	No	0.0000	0.0000
T3	125.00-120.00	5.00	X Brace	No	No	0.0000	0.0000
T4	120.00-100.00	6.67	X Brace	No	No	0.0000	0.0000
T5	100.00-80.00	6.67	X Brace	No	No	0.0000	0.0000
T6	80.00-60.00	6.67	X Brace	No	No	0.0000	0.0000
T7	60.00-40.00	10.00	X Brace	No	No	0.0000	0.0000
T8	40.00-20.00	10.00	X Brace	No	No	0.0000	0.0000
T9	20.00-0.00	10.00	X Brace	No	No	0.0000	0.0000

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Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 160.00-140.00	Pipe	ROHN 2 STD	A572-50 (50 ksi)	Equal Angle	L1 1/2x1 1/2x3/16	A36 (36 ksi)
T2 140.00-125.00	Pipe	ROHN 2.5 X-STR	A572-50 (50 ksi)	Equal Angle	L1 3/4x1 3/4x1/8	A36 (36 ksi)
T3 125.00-120.00	Pipe	ROHN 2.5 X-STR	A572-50 (50 ksi)	Equal Angle	L2x2x1/4	A36 (36 ksi)
T4 120.00-100.00	Pipe	ROHN 3 X-STR	A572-50 (50 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T5 100.00-80.00	Pipe	ROHN 3.5 X-STR	A572-50 (50 ksi)	Equal Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T6 80.00-60.00	Pipe	ROHN 4 X-STR	A572-50 (50 ksi)	Equal Angle	L3x3x3/16	A36 (36 ksi)
T7 60.00-40.00	Pipe	ROHN 5 X-STR	A572-50 (50 ksi)	Equal Angle	L3x3x1/4	A36 (36 ksi)
T8 40.00-20.00	Pipe	ROHN 5 X-STR	A572-50 (50 ksi)	Equal Angle	L3 1/2x3 1/2x1/4	A572-50 (50 ksi)
T9 20.00-0.00	Pipe	ROHN 6 EHS	A572-50 (50 ksi)	Equal Angle	L3 1/2x3 1/2x1/4	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 160.00-140.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Solid Round		A36 (36 ksi)
T2 140.00-125.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Solid Round		A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
T1 160.00-140.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	0.0000	0.0000	0.0000
T2 140.00-125.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	0.0000	0.0000	0.0000
T3 125.00-120.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	0.0000	0.0000	0.0000
T4 120.00-100.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	0.0000	0.0000	0.0000
T5 100.00-80.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	0.0000	0.0000	0.0000
T6 80.00-60.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	0.0000	0.0000	0.0000
T7 60.00-40.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	0.0000	0.0000	0.0000
T8 40.00-20.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	0.0000	0.0000	0.0000
T9 20.00-0.00	0.00	0.0000	A36 (36 ksi)	1.05	1	1.05	0.0000	0.0000	0.0000

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Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 160.00-140.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 140.00-125.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 125.00-120.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 120.00-100.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 100.00-80.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T6 80.00-60.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T7 60.00-40.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T8 40.00-20.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T9 20.00-0.00	Yes	Yes	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1

[1]*Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.*

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
T1 160.00-140.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T2 140.00-125.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T3 125.00-120.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T4 120.00-100.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 100.00-80.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T6 80.00-60.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T7 60.00-40.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T8 40.00-20.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T9 20.00-0.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

Tower Elevation ft	Redundant Horizontal		Redundant Diagonal		Redundant Sub-Diagonal		Redundant Sub-Horizontal		Redundant Vertical		Redundant Hip		Redundant Hip Diagonal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
T1 160.00-140.00	0.0000	0.75 (1)	0.0000	0.75 (1)	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75 (1)	0.0000	0.75 (1)

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Tower Elevation ft	Redundant Horizontal		Redundant Diagonal		Redundant Sub-Diagonal		Redundant Sub-Horizontal		Redundant Vertical		Redundant Hip		Redundant Hip Diagonal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
	0.0000	0.75 (2)	0.0000	0.75 (2)							0.0000	0.75 (2)	0.0000	0.75 (2)
	0.0000	0.75 (3)	0.0000	0.75 (3)							0.0000	0.75 (3)	0.0000	0.75 (3)
	0.0000	0.75 (4)	0.0000	0.75 (4)							0.0000	0.75 (4)	0.0000	0.75 (4)
T2 140.00-125.00	0.0000	0.75 (1)	0.0000	0.75 (1)	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75 (1)	0.0000	0.75 (1)
	0.0000	0.75 (2)	0.0000	0.75 (2)							0.0000	0.75 (2)	0.0000	0.75 (2)
	0.0000	0.75 (3)	0.0000	0.75 (3)							0.0000	0.75 (3)	0.0000	0.75 (3)
	0.0000	0.75 (4)	0.0000	0.75 (4)							0.0000	0.75 (4)	0.0000	0.75 (4)
T3 125.00-120.00	0.0000	0.75 (1)	0.0000	0.75 (1)	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75 (1)	0.0000	0.75 (1)
	0.0000	0.75 (2)	0.0000	0.75 (2)							0.0000	0.75 (2)	0.0000	0.75 (2)
	0.0000	0.75 (3)	0.0000	0.75 (3)							0.0000	0.75 (3)	0.0000	0.75 (3)
	0.0000	0.75 (4)	0.0000	0.75 (4)							0.0000	0.75 (4)	0.0000	0.75 (4)
T4 120.00-100.00	0.0000	0.75 (1)	0.0000	0.75 (1)	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75 (1)	0.0000	0.75 (1)
	0.0000	0.75 (2)	0.0000	0.75 (2)							0.0000	0.75 (2)	0.0000	0.75 (2)
	0.0000	0.75 (3)	0.0000	0.75 (3)							0.0000	0.75 (3)	0.0000	0.75 (3)
	0.0000	0.75 (4)	0.0000	0.75 (4)							0.0000	0.75 (4)	0.0000	0.75 (4)
T5 100.00-80.00	0.0000	0.75 (1)	0.0000	0.75 (1)	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75 (1)	0.0000	0.75 (1)
	0.0000	0.75 (2)	0.0000	0.75 (2)							0.0000	0.75 (2)	0.0000	0.75 (2)
	0.0000	0.75 (3)	0.0000	0.75 (3)							0.0000	0.75 (3)	0.0000	0.75 (3)
	0.0000	0.75 (4)	0.0000	0.75 (4)							0.0000	0.75 (4)	0.0000	0.75 (4)
T6 80.00-60.00	0.0000	0.75 (1)	0.0000	0.75 (1)	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75 (1)	0.0000	0.75 (1)
	0.0000	0.75 (2)	0.0000	0.75 (2)							0.0000	0.75 (2)	0.0000	0.75 (2)
	0.0000	0.75 (3)	0.0000	0.75 (3)							0.0000	0.75 (3)	0.0000	0.75 (3)
	0.0000	0.75 (4)	0.0000	0.75 (4)							0.0000	0.75 (4)	0.0000	0.75 (4)
T7 60.00-40.00	0.0000	0.75 (1)	0.0000	0.75 (1)	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75 (1)	0.0000	0.75 (1)
	0.0000	0.75 (2)	0.0000	0.75 (2)							0.0000	0.75 (2)	0.0000	0.75 (2)
	0.0000	0.75 (3)	0.0000	0.75 (3)							0.0000	0.75 (3)	0.0000	0.75 (3)
	0.0000	0.75 (4)	0.0000	0.75 (4)							0.0000	0.75 (4)	0.0000	0.75 (4)
T8 40.00-20.00	0.0000	0.75 (1)	0.0000	0.75 (1)	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75 (1)	0.0000	0.75 (1)
	0.0000	0.75 (2)	0.0000	0.75 (2)							0.0000	0.75 (2)	0.0000	0.75 (2)
	0.0000	0.75 (3)	0.0000	0.75 (3)							0.0000	0.75 (3)	0.0000	0.75 (3)
	0.0000	0.75 (4)	0.0000	0.75 (4)							0.0000	0.75 (4)	0.0000	0.75 (4)
T9 20.00-0.00	0.0000	0.75 (1)	0.0000	0.75 (1)	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75 (1)	0.0000	0.75 (1)

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Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T1 160.00-140.00	Flange	0.6250 A325N	4	0.5000 A325N	1	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 140.00-125.00	Flange	0.6250 A325N	0	0.5000 A325N	1	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 125.00-120.00	Flange	0.7500 A325N	4	0.5000 A325X	1	0.5000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 120.00-100.00	Flange	0.8750 A325N	4	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 100.00-80.00	Flange	0.8750 A325N	4	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T6 80.00-60.00	Flange	1.0000 A325N	4	0.5000 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T7 60.00-40.00	Flange	1.0000 A325N	4	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T8 40.00-20.00	Flange	1.0000 A325N	6	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T9 20.00-0.00	Flange	1.0000 A325N	0	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
***													
Climbing Pegs	A	No	No	Ar (CaAa)	60.00 - 0.00	0.0000	0.5	1	1	0.7050	0.7050		1.80
Climbing Pegs	B	No	No	Ar (CaAa)	60.00 - 0.00	0.0000	0.5	1	1	0.7050	0.7050		1.80
Climbing Pegs	C	No	No	Ar (CaAa)	60.00 - 0.00	0.0000	0.5	1	1	0.7050	0.7050		1.80
Safety Line 3/8	C	No	No	Ar (CaAa)	160.00 - 0.00	-16.0000	0.35	1	1	0.3750	0.3750		0.22
Climbing Ladder (Af)	C	No	No	Af (CaAa)	160.00 - 0.00	-16.0000	0.35	1	1	3.0000	3.0000		8.40
***													
Feedline Ladder (Af)	C	No	No	Af (CaAa)	160.00 - 0.00	0.0000	0.1	1	1	3.0000	3.0000		8.40
Feedline Ladder (Af)	C	No	No	Af (CaAa)	160.00 - 0.00	0.0000	-0.1	1	1	3.0000	3.0000		8.40
******													
LDF7-50A(1-5/8)	C	No	No	Ar (CaAa)	157.00 - 0.00	0.0000	-0.15	3	3	0.5000	1.9800		0.82
WR-VG86T(3/4)	C	No	No	Ar (CaAa)	157.00 - 0.00	0.0000	-0.1	2	2	0.5000	0.7560		0.53
***													
WR-VG86ST-BRD(3/4)	C	No	No	Ar (CaAa)	157.00 - 0.00	2.0000	-0.16	2	2	0.5000	0.7950		0.58
FB-L98-002-XXX(3/8)	C	No	No	Ar (CaAa)	157.00 - 0.00	2.0000	-0.14	1	1	0.5000	0.3937		0.06
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	157.00 - 0.00	2.0000	-0.12	1	1	0.5000	1.0900		0.33
*******													
LDF6-50A(1-1/4)	C	No	No	Ar (CaAa)	124.00 - 0.00	0.0000	-0.05	2	2	0.5000	1.5500		0.60
LDF7-50A(1-5/8)	C	No	No	Ar (CaAa)	124.00 - 0.00	0.0000	0	2	2	0.5000	1.9800		0.82

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Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
***													
WR-VG86ST-BRD(3/4)	C	No	No	Ar (CaAa)	124.00 - 0.00	2.0000	-0.1	2	2	0.5000	0.7950		0.58
FB-L98-002-XXX(3/8)	C	No	No	Ar (CaAa)	124.00 - 0.00	2.0000	-0.075	1	1	0.5000	0.3937		0.06
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	124.00 - 0.00	2.0000	-0.05	1	1	0.5000	1.0900		0.33
********													
LDF5-50A(7/8)	A	No	No	Ar (CaAa)	85.00 - 0.00	0.0000	-0.45	1	1	0.5000	1.0900		0.33
******													
LDF5-50A(7/8)	A	No	No	Ar (CaAa)	65.00 - 0.00	0.0000	-0.425	1	1	0.5000	1.0900		0.33
******													
LDF5-50A(7/8)	A	No	No	Ar (CaAa)	59.00 - 0.00	2.0000	-0.45	1	1	0.5000	1.0900		0.33
******													
FB-L98-002-XXX(3/8)	C	No	No	Ar (CaAa)	49.00 - 0.00	3.0000	-0.17	1	1	0.5000	0.3937		0.06
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	49.00 - 0.00	0.0000	-0.05	4	4	0.5000	1.0900		0.33
***													
LDF5-50A(7/8)	C	No	No	Ar (CaAa)	49.00 - 0.00	3.0000	0	1	1	0.5000	1.0900		0.33
WR-VG86ST-BRD(3/4)	C	No	No	Ar (CaAa)	49.00 - 0.00	2.0000	0	2	2	0.5000	0.7950		0.58
*******													

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	160.00-140.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	48.644	0.000	0.59
T2	140.00-125.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	38.851	0.000	0.46
T3	125.00-120.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	17.004	0.000	0.17
T4	120.00-100.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	72.069	0.000	0.70
T5	100.00-80.00	A	0.000	0.000	0.545	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	72.069	0.000	0.70
T6	80.00-60.00	A	0.000	0.000	2.725	0.000	0.01
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	72.069	0.000	0.70
T7	60.00-40.00	A	0.000	0.000	7.841	0.000	0.06
		B	0.000	0.000	1.410	0.000	0.04
		C	0.000	0.000	80.169	0.000	0.76
T8	40.00-20.00	A	0.000	0.000	7.950	0.000	0.06
		B	0.000	0.000	1.410	0.000	0.04
		C	0.000	0.000	88.346	0.000	0.79
T9	20.00-0.00	A	0.000	0.000	7.950	0.000	0.06
		B	0.000	0.000	1.410	0.000	0.04
		C	0.000	0.000	88.346	0.000	0.79

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Feed Line Center of Pressure

Section	Elevation	CP_X	CP_Z	CP_X Ice	CP_Z Ice
	ft	in	in	in	in
T1	160.00-140.00	-0.2541	6.6449	-0.2541	6.6449
T2	140.00-125.00	0.0543	7.2831	0.0543	7.2831
T3	125.00-120.00	0.4838	9.9839	0.4838	9.9839
T4	120.00-100.00	0.6584	11.9841	0.6559	11.9296
T5	100.00-80.00	0.4612	12.4910	0.4563	12.3354
T6	80.00-60.00	-0.3357	12.9107	-0.3305	12.6780
T7	60.00-40.00	-1.6837	16.7230	-1.6226	16.0125
T8	40.00-20.00	-1.4174	17.7699	-1.3794	17.2057
T9	20.00-0.00	-1.4859	18.6192	-1.4275	17.7566

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	5	Safety Line 3/8	140.00 - 160.00	0.6000	0.6000
T1	6	Climbing Ladder (Af)	140.00 - 160.00	0.6000	0.6000
T1	8	Feedline Ladder (Af)	140.00 - 160.00	0.6000	0.6000
T1	9	Feedline Ladder (Af)	140.00 - 160.00	0.6000	0.6000
T1	11	LDF7-50A(1-5/8)	140.00 - 157.00	0.6000	0.6000
T1	12	WR-VG86T(3/4)	140.00 - 157.00	0.6000	0.6000
T1	17	WR-VG86ST-BRD(3/4)	140.00 - 157.00	0.6000	0.6000
T1	18	FB-L98-002-XXX(3/8)	140.00 - 157.00	0.6000	0.6000
T1	19	LDF5-50A(7/8)	140.00 - 157.00	0.6000	0.6000
T2	5	Safety Line 3/8	125.00 - 140.00	0.6000	0.6000
T2	6	Climbing Ladder (Af)	125.00 - 140.00	0.6000	0.6000
T2	8	Feedline Ladder (Af)	125.00 - 140.00	0.6000	0.6000
T2	9	Feedline Ladder (Af)	125.00 - 140.00	0.6000	0.6000
T2	11	LDF7-50A(1-5/8)	125.00 - 140.00	0.6000	0.6000
T2	12	WR-VG86T(3/4)	125.00 - 140.00	0.6000	0.6000
T2	17	WR-VG86ST-BRD(3/4)	125.00 - 140.00	0.6000	0.6000
T2	18	FB-L98-002-XXX(3/8)	125.00 - 140.00	0.6000	0.6000
T2	19	LDF5-50A(7/8)	125.00 - 140.00	0.6000	0.6000
T3	5	Safety Line 3/8	120.00 - 125.00	0.6000	0.6000
T3	6	Climbing Ladder (Af)	120.00 - 125.00	0.6000	0.6000
T3	8	Feedline Ladder (Af)	120.00 - 125.00	0.6000	0.6000
T3	9	Feedline Ladder (Af)	120.00 - 125.00	0.6000	0.6000
T3	11	LDF7-50A(1-5/8)	120.00 - 125.00	0.6000	0.6000
T3	12	WR-VG86T(3/4)	120.00 - 125.00	0.6000	0.6000

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Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T3	17	WR-VG86ST-BRD(3/4)	120.00 - 125.00	0.6000	0.6000
T3	18	FB-L98-002-XXX(3/8)	120.00 - 125.00	0.6000	0.6000
T3	19	LDF5-50A(7/8)	120.00 - 125.00	0.6000	0.6000
T3	21	LDF6-50A(1-1/4)	120.00 - 124.00	0.6000	0.6000
T3	22	LDF7-50A(1-5/8)	120.00 - 124.00	0.6000	0.6000
T3	27	WR-VG86ST-BRD(3/4)	120.00 - 124.00	0.6000	0.6000
T3	28	FB-L98-002-XXX(3/8)	120.00 - 124.00	0.6000	0.6000
T3	29	LDF5-50A(7/8)	120.00 - 124.00	0.6000	0.6000
T4	5	Safety Line 3/8	100.00 - 120.00	0.6000	0.6000
T4	6	Climbing Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T4	8	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T4	9	Feedline Ladder (Af)	100.00 - 120.00	0.6000	0.6000
T4	11	LDF7-50A(1-5/8)	100.00 - 120.00	0.6000	0.6000
T4	12	WR-VG86T(3/4)	100.00 - 120.00	0.6000	0.6000
T4	17	WR-VG86ST-BRD(3/4)	100.00 - 120.00	0.6000	0.6000
T4	18	FB-L98-002-XXX(3/8)	100.00 - 120.00	0.6000	0.6000
T4	19	LDF5-50A(7/8)	100.00 - 120.00	0.6000	0.6000
T4	21	LDF6-50A(1-1/4)	100.00 - 120.00	0.6000	0.6000
T4	22	LDF7-50A(1-5/8)	100.00 - 120.00	0.6000	0.6000
T4	27	WR-VG86ST-BRD(3/4)	100.00 - 120.00	0.6000	0.6000
T4	28	FB-L98-002-XXX(3/8)	100.00 - 120.00	0.6000	0.6000
T4	29	LDF5-50A(7/8)	100.00 - 120.00	0.6000	0.6000
T5	5	Safety Line 3/8	80.00 - 100.00	0.6000	0.6000
T5	6	Climbing Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T5	8	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T5	9	Feedline Ladder (Af)	80.00 - 100.00	0.6000	0.6000
T5	11	LDF7-50A(1-5/8)	80.00 - 100.00	0.6000	0.6000
T5	12	WR-VG86T(3/4)	80.00 - 100.00	0.6000	0.6000
T5	17	WR-VG86ST-BRD(3/4)	80.00 - 100.00	0.6000	0.6000
T5	18	FB-L98-002-XXX(3/8)	80.00 - 100.00	0.6000	0.6000
T5	19	LDF5-50A(7/8)	80.00 - 100.00	0.6000	0.6000
T5	21	LDF6-50A(1-1/4)	80.00 - 100.00	0.6000	0.6000
T5	22	LDF7-50A(1-5/8)	80.00 - 100.00	0.6000	0.6000
T5	27	WR-VG86ST-BRD(3/4)	80.00 - 100.00	0.6000	0.6000

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Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T5	28	FB-L98-002-XXX(3/8)	80.00 - 100.00	0.6000	0.6000
T5	29	LDF5-50A(7/8)	80.00 - 100.00	0.6000	0.6000
T5	31	LDF5-50A(7/8)	80.00 - 85.00	0.6000	0.6000
T6	5	Safety Line 3/8	60.00 - 80.00	0.6000	0.6000
T6	6	Climbing Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T6	8	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T6	9	Feedline Ladder (Af)	60.00 - 80.00	0.6000	0.6000
T6	11	LDF7-50A(1-5/8)	60.00 - 80.00	0.6000	0.6000
T6	12	WR-VG86T(3/4)	60.00 - 80.00	0.6000	0.6000
T6	17	WR-VG86ST-BRD(3/4)	60.00 - 80.00	0.6000	0.6000
T6	18	FB-L98-002-XXX(3/8)	60.00 - 80.00	0.6000	0.6000
T6	19	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T6	21	LDF6-50A(1-1/4)	60.00 - 80.00	0.6000	0.6000
T6	22	LDF7-50A(1-5/8)	60.00 - 80.00	0.6000	0.6000
T6	27	WR-VG86ST-BRD(3/4)	60.00 - 80.00	0.6000	0.6000
T6	28	FB-L98-002-XXX(3/8)	60.00 - 80.00	0.6000	0.6000
T6	29	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T6	31	LDF5-50A(7/8)	60.00 - 80.00	0.6000	0.6000
T6	33	LDF5-50A(7/8)	60.00 - 65.00	0.6000	0.6000
T7	2	Climbing Pegs	40.00 - 60.00	0.6000	0.6000
T7	3	Climbing Pegs	40.00 - 60.00	0.6000	0.6000
T7	4	Climbing Pegs	40.00 - 60.00	0.6000	0.6000
T7	5	Safety Line 3/8	40.00 - 60.00	0.6000	0.6000
T7	6	Climbing Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T7	8	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T7	9	Feedline Ladder (Af)	40.00 - 60.00	0.6000	0.6000
T7	11	LDF7-50A(1-5/8)	40.00 - 60.00	0.6000	0.6000
T7	12	WR-VG86T(3/4)	40.00 - 60.00	0.6000	0.6000
T7	17	WR-VG86ST-BRD(3/4)	40.00 - 60.00	0.6000	0.6000
T7	18	FB-L98-002-XXX(3/8)	40.00 - 60.00	0.6000	0.6000
T7	19	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T7	21	LDF6-50A(1-1/4)	40.00 - 60.00	0.6000	0.6000
T7	22	LDF7-50A(1-5/8)	40.00 - 60.00	0.6000	0.6000
T7	27	WR-VG86ST-BRD(3/4)	40.00 - 60.00	0.6000	0.6000

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Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T7	28	FB-L98-002-XXX(3/8)	40.00 - 60.00	0.6000	0.6000
T7	29	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T7	31	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T7	33	LDF5-50A(7/8)	40.00 - 60.00	0.6000	0.6000
T7	35	LDF5-50A(7/8)	40.00 - 59.00	0.6000	0.6000
T7	37	FB-L98-002-XXX(3/8)	40.00 - 49.00	0.6000	0.6000
T7	38	LDF5-50A(7/8)	40.00 - 49.00	0.6000	0.6000
T7	42	LDF5-50A(7/8)	40.00 - 49.00	0.6000	0.6000
T7	43	WR-VG86ST-BRD(3/4)	40.00 - 49.00	0.6000	0.6000
T8	2	Climbing Pegs	20.00 - 40.00	0.6000	0.6000
T8	3	Climbing Pegs	20.00 - 40.00	0.6000	0.6000
T8	4	Climbing Pegs	20.00 - 40.00	0.6000	0.6000
T8	5	Safety Line 3/8	20.00 - 40.00	0.6000	0.6000
T8	6	Climbing Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T8	8	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T8	9	Feedline Ladder (Af)	20.00 - 40.00	0.6000	0.6000
T8	11	LDF7-50A(1-5/8)	20.00 - 40.00	0.6000	0.6000
T8	12	WR-VG86T(3/4)	20.00 - 40.00	0.6000	0.6000
T8	17	WR-VG86ST-BRD(3/4)	20.00 - 40.00	0.6000	0.6000
T8	18	FB-L98-002-XXX(3/8)	20.00 - 40.00	0.6000	0.6000
T8	19	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T8	21	LDF6-50A(1-1/4)	20.00 - 40.00	0.6000	0.6000
T8	22	LDF7-50A(1-5/8)	20.00 - 40.00	0.6000	0.6000
T8	27	WR-VG86ST-BRD(3/4)	20.00 - 40.00	0.6000	0.6000
T8	28	FB-L98-002-XXX(3/8)	20.00 - 40.00	0.6000	0.6000
T8	29	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T8	31	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T8	33	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T8	35	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T8	37	FB-L98-002-XXX(3/8)	20.00 - 40.00	0.6000	0.6000
T8	38	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T8	42	LDF5-50A(7/8)	20.00 - 40.00	0.6000	0.6000
T8	43	WR-VG86ST-BRD(3/4)	20.00 - 40.00	0.6000	0.6000
T9	2	Climbing Pegs	0.00 - 20.00	0.6000	0.6000
T9	3	Climbing Pegs	0.00 - 20.00	0.6000	0.6000
T9	4	Climbing Pegs	0.00 - 20.00	0.6000	0.6000

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Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T9	5	Safety Line 3/8	0.00 - 20.00	0.6000	0.6000
T9	6	Climbing Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T9	8	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T9	9	Feedline Ladder (Af)	0.00 - 20.00	0.6000	0.6000
T9	11	LDF7-50A(1-5/8)	0.00 - 20.00	0.6000	0.6000
T9	12	WR-VG86T(3/4)	0.00 - 20.00	0.6000	0.6000
T9	17	WR-VG86ST-BRD(3/4)	0.00 - 20.00	0.6000	0.6000
T9	18	FB-L98-002-XXX(3/8)	0.00 - 20.00	0.6000	0.6000
T9	19	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000
T9	21	LDF6-50A(1-1/4)	0.00 - 20.00	0.6000	0.6000
T9	22	LDF7-50A(1-5/8)	0.00 - 20.00	0.6000	0.6000
T9	27	WR-VG86ST-BRD(3/4)	0.00 - 20.00	0.6000	0.6000
T9	28	FB-L98-002-XXX(3/8)	0.00 - 20.00	0.6000	0.6000
T9	29	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000
T9	31	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000
T9	33	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000
T9	35	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000
T9	37	FB-L98-002-XXX(3/8)	0.00 - 20.00	0.6000	0.6000
T9	38	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000
T9	42	LDF5-50A(7/8)	0.00 - 20.00	0.6000	0.6000
T9	43	WR-VG86ST-BRD(3/4)	0.00 - 20.00	0.6000	0.6000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
*******									
Lightning Rod 5/8x4'	B	From Leg	0.00 0.00 2.00	0.0000	160.00	No Ice	0.25	0.25	0.03
6' x 5' Flat Ice Shield	C	None		0.0000	156.00	No Ice	2.54	2.29	0.20
******									
(2) 10' x 2" Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	157.00	No Ice	2.38	2.38	0.04
5' x 2" Pipe Mount	A	From Leg	2.00 0.00 0.00	0.0000	157.00	No Ice	1.19	1.19	0.02
Sector Mount [SM 1302-1]	A	None		0.0000	157.00	No Ice	21.79	8.22	0.47
**									
(2) NNH4-65C-R6-V3 w/ Mount Pipe	A	From Leg	4.00 0.00 2.00	-40.0000	157.00	No Ice	9.68	5.17	0.16
AIR 6419 B77G_CCIV2	A	From Leg	4.00 0.00 4.00	-40.0000	157.00	No Ice	4.76	2.21	0.07
AIR 6419 B77D	A	From Leg	4.00 0.00 0.00	-40.0000	157.00	No Ice	3.47	1.37	0.07
DC6-48-60-18-8F	A	From Leg	4.00 0.00 2.00	0.0000	157.00	No Ice	0.92	0.92	0.02
RADIO 4490HP B5/B12A	A	From Leg	4.00 0.00 2.00	0.0000	157.00	No Ice	2.20	0.99	0.07
RADIO 4890HP B2/B25 B66	A	From Leg	4.00 0.00 2.00	0.0000	157.00	No Ice	2.20	1.01	0.07
RRUS 4478 B14_CCIV2	A	From Leg	4.00 0.00 2.00	0.0000	157.00	No Ice	2.02	1.25	0.06

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Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
RRUS 4415 B30_CCIV2	A	From Leg	4.00 0.00 2.00	0.0000	157.00	No Ice	1.84	0.82	0.05
*******									
10' x 2" Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	124.00	No Ice	2.38	2.38	0.04
6' x 2" Mount Pipe	B	From Leg	2.00 0.00 0.00	0.0000	124.00	No Ice	1.43	1.43	0.02
Sector Mount [SM 1302-1]	B	None		0.0000	124.00	No Ice	21.79	8.22	0.47
*******									
AIR 6419 B77D	B	From Leg	4.00 0.00 1.00	-30.0000	124.00	No Ice	3.47	1.37	0.07
AIR 6419 B77G_CCIV2	B	From Leg	4.00 0.00 5.00	-30.0000	124.00	No Ice	4.76	2.21	0.07
(2) NNH4-65C-R6-V3 w/ Mount Pipe	B	From Leg	4.00 0.00 3.00	-30.0000	124.00	No Ice	9.68	5.17	0.16
RADIO 4490HP B5/B12A	B	From Leg	4.00 0.00 3.00	0.0000	124.00	No Ice	2.20	0.99	0.07
RADIO 4890HP B2/B25 B66	B	From Leg	4.00 0.00 3.00	0.0000	124.00	No Ice	2.20	1.01	0.07
DC6-48-60-18-8F	B	From Leg	4.00 0.00 3.00	0.0000	124.00	No Ice	0.92	0.92	0.02
RRUS 4415 B30_CCIV2	B	From Leg	4.00 0.00 3.00	0.0000	124.00	No Ice	1.84	0.82	0.05
RRUS 4478 B14_CCIV2	B	From Leg	4.00 0.00 3.00	0.0000	124.00	No Ice	2.02	1.25	0.06
WCS-IMFT-AMT	B	From Leg	4.00 0.00 3.00	0.0000	124.00	No Ice	0.64	0.47	0.02
10' Mount Pipe [#P2.5STD]	B	From Leg	4.00 0.00 0.00	0.0000	124.00	No Ice	2.88	2.88	0.06
*******									
ET-X-TS-70-16-62-18-IR-RD w/ Mount Pipe	A	From Face	0.50 0.00 0.00	-5.0000	85.00	No Ice	4.63	3.28	0.07
ET-X-WM-18-65-8P w/ Mount Pipe	A	From Face	0.50 0.00 0.00	-5.0000	85.00	No Ice	4.00	2.30	0.06
RRH-P4	A	From Face	0.50 0.00 0.00	0.0000	85.00	No Ice	2.74	1.79	0.06
RRH-C2 W/EXT FILTER	A	From Face	0.50 0.00 0.00	0.0000	85.00	No Ice	5.29	4.41	0.07
OPTIC FIBER JUNCTION CYLINDER	A	From Face	0.50 0.00 0.00	0.0000	85.00	No Ice	0.39	0.39	0.00
POWER JUNCTION CYLINDER	A	From Face	0.50 0.00 0.00	0.0000	85.00	No Ice	0.37	0.37	0.00
RRH-B8	A	From Face	0.50 0.00 0.00	0.0000	85.00	No Ice	2.88	1.74	0.06
6' x 2" Mount Pipe	A	From Face	0.50	0.0000	85.00	No Ice	1.43	1.43	0.02

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Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00 0.00						
10' Hor x 3" x 3" Angle Mount	A	From Face	0.50 0.00 0.00	0.0000	85.00	No Ice	5.00	0.02	0.05
10' Hor x 3" x 3" Angle Mount	A	From Face	0.50 0.00 0.00	0.0000	85.00	No Ice	5.00	0.02	0.05
******									
ET-X-TS-70-16-62-18-IR-RD w/ Mount Pipe	B	From Face	0.50 0.00 0.00	10.0000	65.00	No Ice	4.63	3.28	0.07
ET-X-WM-18-65-8P w/ Mount Pipe	B	From Face	0.50 0.00 0.00	10.0000	65.00	No Ice	4.00	2.30	0.06
RRH-P4	B	From Face	0.50 0.00 0.00	0.0000	65.00	No Ice	2.74	1.79	0.06
RRH-C2 W/EXT FILTER	B	From Face	0.50 0.00 0.00	0.0000	65.00	No Ice	5.29	4.41	0.07
POWER JUNCTION CYLINDER	B	From Face	0.50 0.00 0.00	0.0000	65.00	No Ice	0.37	0.37	0.00
OPTIC FIBER JUNCTION CYLINDER	B	From Face	0.50 0.00 0.00	0.0000	65.00	No Ice	0.39	0.39	0.00
RRH-B8	B	From Face	0.50 0.00 0.00	0.0000	65.00	No Ice	2.88	1.74	0.06
6' x 2" Mount Pipe	B	From Face	0.50 0.00 0.00	0.0000	65.00	No Ice	1.43	1.43	0.02
10' Hor x 3" x 3" Angle Mount	B	From Face	0.50 0.00 0.00	0.0000	65.00	No Ice	5.00	0.02	0.05
10' Hor x 3" x 3" Angle Mount	B	From Face	0.50 0.00 0.00	0.0000	65.00	No Ice	5.00	0.02	0.05
*******									
ET-X-WM-18-65-8P w/ Mount Pipe	C	From Face	0.50 0.00 0.00	10.0000	59.00	No Ice	4.00	2.30	0.06
ET-X-TS-70-16-62-18-IR-RD w/ Mount Pipe	C	From Face	0.50 0.00 0.00	10.0000	59.00	No Ice	4.63	3.28	0.07
RRH-C2 W/EXT FILTER	C	From Face	0.50 0.00 0.00	0.0000	59.00	No Ice	5.29	4.41	0.07
RRH-P4	C	From Face	0.50 0.00 0.00	0.0000	59.00	No Ice	2.74	1.79	0.06
OPTIC FIBER JUNCTION CYLINDER	C	From Face	0.50 0.00 0.00	0.0000	59.00	No Ice	0.39	0.39	0.00
POWER JUNCTION CYLINDER	C	From Face	0.50 0.00 0.00	0.0000	59.00	No Ice	0.37	0.37	0.00
RRH-B8	C	From Face	0.50 0.00 0.00	0.0000	59.00	No Ice	2.88	1.74	0.06
6' x 2" Mount Pipe	C	From Face	0.00 0.00 0.00	0.0000	59.00	No Ice	1.43	1.43	0.02

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Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
10' Hor x 3" x 3" Angle Mount	C	From Face	0.50 0.00 0.00	0.0000	59.00	No Ice	5.00	0.02	0.05
10' Hor x 3" x 3" Angle Mount ******	C	From Face	0.50 0.00 0.00	0.0000	59.00	No Ice	5.00	0.02	0.05
DC6-48-60-18-8F	C	From Face	1.00 0.00 1.00	0.0000	49.00	No Ice	0.92	0.92	0.02
WCS-IMFQ-AMT	C	From Face	1.00 0.00 1.00	0.0000	49.00	No Ice	0.99	0.64	0.03
(2) 10' x 2" Mount Pipe	C	From Face	1.00 0.00 0.00	0.0000	49.00	No Ice	2.38	2.38	0.04
Sector Mount [SM 201-1] ***	C	From Face	1.00 0.00 0.00	0.0000	49.00	No Ice	17.06	4.95	0.36
(2) NNH4-65C-R6-V3 w/ Mount Pipe	C	From Face	1.00 0.00 1.00	25.0000	49.00	No Ice	9.68	5.17	0.16
AIR 6419 B77G_CCIV2	C	From Face	1.00 0.00 3.00	25.0000	49.00	No Ice	4.76	2.21	0.07
AIR 6419 B77D	C	From Face	1.00 0.00 -1.00	25.0000	49.00	No Ice	3.47	1.37	0.07
RRUS 4478 B14_CCIV2	C	From Face	1.00 0.00 1.00	0.0000	49.00	No Ice	2.02	1.25	0.06
RADIO 4490HP B5/B12A	C	From Face	1.00 0.00 1.00	0.0000	49.00	No Ice	2.20	0.99	0.07
RADIO 4890HP B2/B25 B66	C	From Face	1.00 0.00 1.00	0.0000	49.00	No Ice	2.20	1.01	0.07
RRUS 4415 B30_CCIV2	C	From Face	1.00 0.00 1.00	0.0000	49.00	No Ice	1.84	0.82	0.05
15' Support Rail [#P3.0STD]	C	From Face	1.00 0.00 0.00	0.0000	49.00	No Ice	5.60	0.03	0.12
V-Stabilizer Kit	C	From Face	0.50 0.00 0.00	0.0000	49.00	No Ice	6.32	4.85	0.09
8' Mount Pipe [#C10900106] *******	C	From Face	0.50 0.00 0.00	0.0000	49.00	No Ice	1.90	1.90	0.03

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.0 Wind 0 deg - No Ice
3	0.9 Dead+1.0 Wind 0 deg - No Ice
4	1.2 Dead+1.0 Wind 30 deg - No Ice
5	0.9 Dead+1.0 Wind 30 deg - No Ice
6	1.2 Dead+1.0 Wind 60 deg - No Ice

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Comb. No.	Description
7	0.9 Dead+1.0 Wind 60 deg - No Ice
8	1.2 Dead+1.0 Wind 90 deg - No Ice
9	0.9 Dead+1.0 Wind 90 deg - No Ice
10	1.2 Dead+1.0 Wind 120 deg - No Ice
11	0.9 Dead+1.0 Wind 120 deg - No Ice
12	1.2 Dead+1.0 Wind 150 deg - No Ice
13	0.9 Dead+1.0 Wind 150 deg - No Ice
14	1.2 Dead+1.0 Wind 180 deg - No Ice
15	0.9 Dead+1.0 Wind 180 deg - No Ice
16	1.2 Dead+1.0 Wind 210 deg - No Ice
17	0.9 Dead+1.0 Wind 210 deg - No Ice
18	1.2 Dead+1.0 Wind 240 deg - No Ice
19	0.9 Dead+1.0 Wind 240 deg - No Ice
20	1.2 Dead+1.0 Wind 270 deg - No Ice
21	0.9 Dead+1.0 Wind 270 deg - No Ice
22	1.2 Dead+1.0 Wind 300 deg - No Ice
23	0.9 Dead+1.0 Wind 300 deg - No Ice
24	1.2 Dead+1.0 Wind 330 deg - No Ice
25	0.9 Dead+1.0 Wind 330 deg - No Ice
26	Dead+Wind 0 deg - Service
27	Dead+Wind 30 deg - Service
28	Dead+Wind 60 deg - Service
29	Dead+Wind 90 deg - Service
30	Dead+Wind 120 deg - Service
31	Dead+Wind 150 deg - Service
32	Dead+Wind 180 deg - Service
33	Dead+Wind 210 deg - Service
34	Dead+Wind 240 deg - Service
35	Dead+Wind 270 deg - Service
36	Dead+Wind 300 deg - Service
37	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	160 - 140	Leg	Max Tension	23	9.68	-0.01	0.01
			Max. Compression	2	-12.59	0.00	-0.00
			Max. Mx	11	-0.40	-0.37	0.28
			Max. My	20	-1.98	0.03	0.75
			Max. Vy	10	-0.67	0.29	0.28
			Max. Vx	8	-1.23	-0.03	0.47
		Diagonal	Max Tension	13	2.39	0.00	0.00
			Max. Compression	10	-2.46	0.00	0.00
			Max. Mx	24	0.29	0.01	-0.00
			Max. My	22	-2.08	0.00	-0.00
			Max. Vy	24	-0.01	0.01	-0.00
			Max. Vx	22	0.00	0.00	0.00
		Top Girt	Max Tension	23	0.28	0.00	0.00
			Max. Compression	10	-0.29	0.00	0.00
			Max. Mx	2	0.11	-0.02	0.00
			Max. My	2	-0.28	0.00	0.00
			Max. Vy	2	0.01	0.00	0.00
			Max. Vx	2	-0.00	0.00	0.00
T2	140 - 125	Leg	Max Tension	23	18.85	0.04	0.00
			Max. Compression	2	-23.00	0.29	-0.17
			Max. Mx	22	18.55	-0.36	0.05
			Max. My	4	0.09	-0.01	-0.42
			Max. Vy	22	0.11	-0.36	0.05
			Max. Vx	4	0.13	-0.01	-0.42
		Diagonal	Max Tension	10	2.36	0.00	0.00
			Max. Compression	10	-2.46	0.00	0.00
			Max. Mx	24	0.28	0.01	-0.00
			Max. My	22	-2.02	0.00	-0.00
			Max. Vy	24	-0.01	0.01	-0.00
			Max. Vx	22	0.00	0.00	0.00

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Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
		Top Girt	Max Tension	2	0.03	0.00	0.00
			Max. Compression	15	-0.02	0.00	0.00
			Max. Mx	2	-0.01	-0.01	0.00
			Max. My	2	0.03	0.00	0.00
			Max. Vy	2	0.01	0.00	0.00
			Max. Vx	2	-0.00	0.00	0.00
T3	125 - 120	Leg	Max Tension	23	22.46	-0.35	0.05
			Max. Compression	10	-28.08	0.15	-0.08
			Max. Mx	22	22.17	0.37	0.05
			Max. My	16	-2.34	-0.05	-0.65
			Max. Vy	22	-0.73	-0.36	0.05
			Max. Vx	4	-1.08	-0.01	-0.42
		Diagonal	Max Tension	24	3.22	0.00	0.00
			Max. Compression	12	-3.24	0.00	0.00
			Max. Mx	12	0.94	0.02	0.00
			Max. My	12	-3.23	0.00	0.01
			Max. Vy	12	0.01	0.02	0.00
			Max. Vx	12	-0.00	0.00	0.00
T4	120 - 100	Leg	Max Tension	23	39.31	-0.10	0.03
			Max. Compression	10	-47.88	0.17	-0.03
			Max. Mx	22	26.42	-0.20	0.08
			Max. My	4	-2.14	-0.02	-0.38
			Max. Vy	22	-0.07	-0.20	0.08
			Max. Vx	18	0.12	-0.13	0.37
		Diagonal	Max Tension	24	3.77	0.00	0.00
			Max. Compression	24	-3.78	0.00	0.00
			Max. Mx	10	3.02	0.02	-0.00
			Max. My	16	2.27	0.02	0.00
			Max. Vy	14	0.01	0.02	-0.00
			Max. Vx	16	-0.00	0.00	0.00
T5	100 - 80	Leg	Max Tension	23	57.04	-0.31	0.03
			Max. Compression	10	-68.26	0.34	-0.02
			Max. Mx	10	-68.26	0.34	-0.02
			Max. My	12	-2.04	-0.06	-0.33
			Max. Vy	11	0.32	0.31	-0.03
			Max. Vx	12	-0.34	-0.06	-0.33
		Diagonal	Max Tension	24	4.32	0.00	0.00
			Max. Compression	12	-4.34	0.00	0.00
			Max. Mx	10	3.40	0.04	-0.00
			Max. My	4	-2.37	0.02	-0.01
			Max. Vy	14	0.02	0.03	0.00
			Max. Vx	4	0.00	0.00	0.00
T6	80 - 60	Leg	Max Tension	23	76.33	-0.29	0.01
			Max. Compression	10	-91.13	0.44	-0.05
			Max. Mx	19	-84.39	0.47	0.05
			Max. My	16	-6.55	-0.02	0.59
			Max. Vy	6	-0.29	-0.34	-0.03
			Max. Vx	16	0.27	-0.05	0.21
		Diagonal	Max Tension	8	4.98	0.00	0.00
			Max. Compression	20	-5.03	0.00	0.00
			Max. Mx	14	4.39	0.06	-0.00
			Max. My	18	-5.01	0.01	0.01
			Max. Vy	14	0.02	0.06	-0.00
			Max. Vx	18	-0.00	0.00	0.00
T7	60 - 40	Leg	Max Tension	15	95.37	-0.56	-0.01
			Max. Compression	10	-115.17	0.59	-0.07
			Max. Mx	14	82.46	-0.68	0.00
			Max. My	12	-3.82	0.02	-0.80
			Max. Vy	3	0.74	0.67	0.00
			Max. Vx	4	-0.88	-0.12	-0.77
		Diagonal	Max Tension	8	7.14	0.00	0.00
			Max. Compression	18	-7.37	0.00	0.00
			Max. Mx	10	5.23	0.09	-0.01
			Max. My	18	-0.63	0.04	0.01
			Max. Vy	14	0.03	0.09	-0.01
			Max. Vx	18	-0.00	0.00	0.00
T8	40 - 20	Leg	Max Tension	15	118.83	-0.31	0.01
			Max. Compression	10	-141.12	0.62	-0.06
			Max. Mx	2	-125.73	0.63	0.01

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Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. My	12	-6.61	-0.06	-0.66
			Max. Vy	2	0.13	0.63	0.01
			Max. Vx	10	-0.18	-0.21	-0.63
		Diagonal	Max Tension	20	7.52	0.00	0.00
			Max. Compression	18	-7.71	0.00	0.00
			Max. Mx	10	5.38	0.14	-0.02
			Max. My	18	-7.18	0.03	0.02
			Max. Vy	14	0.05	0.13	-0.01
			Max. Vx	18	-0.00	0.00	0.00
T9	20 - 0	Leg	Max Tension	15	141.37	-0.58	0.01
			Max. Compression	10	-166.60	0.00	0.00
			Max. Mx	2	-152.94	0.62	0.01
			Max. My	12	-8.69	-0.08	-1.27
			Max. Vy	6	-0.15	-0.59	-0.09
			Max. Vx	12	-0.24	-0.08	-1.27
		Diagonal	Max Tension	20	8.14	0.00	0.00
			Max. Compression	18	-8.56	0.00	0.00
			Max. Mx	10	7.23	0.15	0.02
			Max. My	18	5.25	0.14	0.02
			Max. Vy	12	0.05	0.14	-0.02
			Max. Vx	18	-0.00	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	18	168.34	18.97	-9.86
	Max. H_x	18	168.34	18.97	-9.86
	Max. H_z	5	-124.27	-14.06	9.01
	Min. Vert	7	-138.30	-16.31	8.37
	Min. H_x	7	-138.30	-16.31	8.37
	Min. H_z	18	168.34	18.97	-9.86
Leg B	Max. Vert	10	173.06	-19.08	-10.14
	Max. H_x	23	-142.64	16.41	8.65
	Max. H_z	25	-129.30	14.08	9.51
	Min. Vert	23	-142.64	16.41	8.65
	Min. H_x	10	173.06	-19.08	-10.14
	Min. H_z	12	149.39	-15.47	-10.26
Leg A	Max. Vert	2	172.86	0.23	22.31
	Max. H_x	20	11.43	1.83	0.99
	Max. H_z	2	172.86	0.23	22.31
	Min. Vert	15	-147.07	-0.23	-19.34
	Min. H_x	9	4.02	-1.83	0.51
	Min. H_z	15	-147.07	-0.23	-19.34

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	26.31	0.00	0.00	25.46	-1.91	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice	31.57	-0.17	-36.95	-2933.33	44.68	8.98
0.9 Dead+1.0 Wind 0 deg - No Ice	23.68	-0.17	-36.95	-2940.97	45.25	8.98
1.2 Dead+1.0 Wind 30 deg - No Ice	31.57	17.07	-30.24	-2391.53	-1372.92	28.11
0.9 Dead+1.0 Wind 30 deg - No Ice	23.68	17.07	-30.24	-2399.16	-1372.35	28.11

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Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
1.2 Dead+1.0 Wind 60 deg - No Ice	31.57	28.20	-16.47	-1275.40	-2310.13	35.01
0.9 Dead+1.0 Wind 60 deg - No Ice	23.68	28.20	-16.47	-1283.04	-2309.56	35.01
1.2 Dead+1.0 Wind 90 deg - No Ice	31.57	32.03	0.17	77.51	-2648.80	31.02
0.9 Dead+1.0 Wind 90 deg - No Ice	23.68	32.03	0.17	69.88	-2648.23	31.02
1.2 Dead+1.0 Wind 120 deg - No Ice	31.57	30.59	18.05	1511.18	-2518.74	27.53
0.9 Dead+1.0 Wind 120 deg - No Ice	23.68	30.59	18.05	1503.54	-2518.17	27.53
1.2 Dead+1.0 Wind 150 deg - No Ice	31.57	17.37	30.42	2499.59	-1454.27	12.56
0.9 Dead+1.0 Wind 150 deg - No Ice	23.68	17.37	30.42	2491.95	-1453.70	12.56
1.2 Dead+1.0 Wind 180 deg - No Ice	31.57	0.17	34.38	2807.77	-49.25	-8.98
0.9 Dead+1.0 Wind 180 deg - No Ice	23.68	0.17	34.38	2800.13	-48.68	-8.98
1.2 Dead+1.0 Wind 210 deg - No Ice	31.57	-17.07	30.24	2452.62	1368.35	-28.11
0.9 Dead+1.0 Wind 210 deg - No Ice	23.68	-17.07	30.24	2444.98	1368.92	-28.11
1.2 Dead+1.0 Wind 240 deg - No Ice	31.57	-30.42	17.75	1429.83	2467.20	-35.01
0.9 Dead+1.0 Wind 240 deg - No Ice	23.68	-30.42	17.75	1422.19	2467.77	-35.01
1.2 Dead+1.0 Wind 270 deg - No Ice	31.57	-32.03	-0.17	-16.42	2644.22	-31.02
0.9 Dead+1.0 Wind 270 deg - No Ice	23.68	-32.03	-0.17	-24.06	2644.79	-31.02
1.2 Dead+1.0 Wind 300 deg - No Ice	31.57	-28.37	-16.77	-1356.75	2352.52	-27.53
0.9 Dead+1.0 Wind 300 deg - No Ice	23.68	-28.37	-16.77	-1364.39	2353.09	-27.53
1.2 Dead+1.0 Wind 330 deg - No Ice	31.57	-17.37	-30.42	-2438.49	1449.69	-12.56
0.9 Dead+1.0 Wind 330 deg - No Ice	23.68	-17.37	-30.42	-2446.13	1450.27	-12.56
Dead+Wind 0 deg - Service	26.31	-0.03	-7.46	-569.00	7.44	1.79
Dead+Wind 30 deg - Service	26.31	3.45	-6.11	-460.56	-276.99	5.60
Dead+Wind 60 deg - Service	26.31	5.70	-3.33	-236.75	-465.20	6.97
Dead+Wind 90 deg - Service	26.31	6.48	0.03	34.80	-533.21	6.18
Dead+Wind 120 deg - Service	26.31	6.18	3.65	322.43	-506.71	5.48
Dead+Wind 150 deg - Service	26.31	3.51	6.15	520.82	-293.18	2.49
Dead+Wind 180 deg - Service	26.31	0.03	6.95	582.77	-11.25	-1.79
Dead+Wind 210 deg - Service	26.31	-3.45	6.11	511.48	273.18	-5.60
Dead+Wind 240 deg - Service	26.31	-6.15	3.59	306.24	493.55	-6.97
Dead+Wind 270 deg - Service	26.31	-6.48	-0.03	16.11	529.40	-6.18
Dead+Wind 300 deg - Service	26.31	-5.74	-3.39	-252.94	470.73	-5.48
Dead+Wind 330 deg - Service	26.31	-3.51	-6.15	-469.91	289.36	-2.49

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Solution Summary

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
1	0.00	-26.31	0.00	-0.00	26.31	-0.00	0.000%
2	-0.17	-31.57	-36.95	0.17	31.57	36.95	0.000%
3	-0.17	-23.68	-36.95	0.17	23.68	36.95	0.000%
4	17.07	-31.57	-30.24	-17.07	31.57	30.24	0.000%
5	17.07	-23.68	-30.24	-17.07	23.68	30.24	0.000%
6	28.20	-31.57	-16.47	-28.20	31.57	16.47	0.000%
7	28.20	-23.68	-16.47	-28.20	23.68	16.47	0.000%
8	32.03	-31.57	0.17	-32.03	31.57	-0.17	0.000%
9	32.03	-23.68	0.17	-32.03	23.68	-0.17	0.000%
10	30.59	-31.57	18.05	-30.59	31.57	-18.05	0.000%
11	30.59	-23.68	18.05	-30.59	23.68	-18.05	0.000%
12	17.37	-31.57	30.42	-17.37	31.57	-30.42	0.000%
13	17.37	-23.68	30.42	-17.37	23.68	-30.42	0.000%
14	0.17	-31.57	34.38	-0.17	31.57	-34.38	0.000%
15	0.17	-23.68	34.38	-0.17	23.68	-34.38	0.000%
16	-17.07	-31.57	30.24	17.07	31.57	-30.24	0.000%
17	-17.07	-23.68	30.24	17.07	23.68	-30.24	0.000%
18	-30.42	-31.57	17.75	30.42	31.57	-17.75	0.000%
19	-30.42	-23.68	17.75	30.42	23.68	-17.75	0.000%
20	-32.03	-31.57	-0.17	32.03	31.57	0.17	0.000%
21	-32.03	-23.68	-0.17	32.03	23.68	0.17	0.000%
22	-28.37	-31.57	-16.77	28.37	31.57	16.77	0.000%
23	-28.37	-23.68	-16.77	28.37	23.68	16.77	0.000%
24	-17.37	-31.57	-30.42	17.37	31.57	30.42	0.000%
25	-17.37	-23.68	-30.42	17.37	23.68	30.42	0.000%
26	-0.03	-26.31	-7.46	0.03	26.31	7.46	0.000%
27	3.45	-26.31	-6.11	-3.45	26.31	6.11	0.000%
28	5.70	-26.31	-3.33	-5.70	26.31	3.33	0.000%
29	6.48	-26.31	0.03	-6.48	26.31	-0.03	0.000%
30	6.18	-26.31	3.65	-6.18	26.31	-3.65	0.000%
31	3.51	-26.31	6.15	-3.51	26.31	-6.15	0.000%
32	0.03	-26.31	6.95	-0.03	26.31	-6.95	0.000%
33	-3.45	-26.31	6.11	3.45	26.31	-6.11	0.000%
34	-6.15	-26.31	3.59	6.15	26.31	-3.59	0.000%
35	-6.48	-26.31	-0.03	6.48	26.31	0.03	0.000%
36	-5.74	-26.31	-3.39	5.74	26.31	3.39	0.000%
37	-3.51	-26.31	-6.15	3.51	26.31	6.15	0.000%

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	160 - 140	2.270	30	0.1267	0.0219
T2	140 - 125	1.770	30	0.1131	0.0171
T3	125 - 120	1.416	30	0.1047	0.0192
T4	120 - 100	1.305	30	0.0998	0.0182
T5	100 - 80	0.908	30	0.0815	0.0122
T6	80 - 60	0.588	30	0.0631	0.0090
T7	60 - 40	0.342	30	0.0456	0.0066
T8	40 - 20	0.164	30	0.0313	0.0044
T9	20 - 0	0.050	26	0.0154	0.0022

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
160.00	Lightning Rod 5/8x4'	30	2.270	0.1267	0.0219	187593

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Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
157.00	(2) 10' x 2" Mount Pipe	30	2.194	0.1240	0.0207	187593
156.00	6' x 5' Flat Ice Shield	30	2.169	0.1230	0.0203	187593
124.00	10' x 2" Mount Pipe	30	1.393	0.1038	0.0191	70550
85.00	ET-X-TS-70-16-62-18-IR-RD w/ Mount Pipe	30	0.661	0.0678	0.0097	65150
65.00	ET-X-TS-70-16-62-18-IR-RD w/ Mount Pipe	30	0.397	0.0497	0.0072	67739
59.00	ET-X-WM-18-65-8P w/ Mount Pipe	30	0.331	0.0449	0.0065	68809
49.00	DC6-48-60-18-8F	30	0.236	0.0377	0.0054	75135

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	160 - 140	11.135	10	0.6041	0.1096
T2	140 - 125	8.641	10	0.5540	0.0856
T3	125 - 120	6.916	10	0.5065	0.0963
T4	120 - 100	6.379	10	0.4836	0.0911
T5	100 - 80	4.446	10	0.3974	0.0612
T6	80 - 60	2.882	10	0.3084	0.0451
T7	60 - 40	1.675	3	0.2225	0.0331
T8	40 - 20	0.812	3	0.1527	0.0218
T9	20 - 0	0.253	3	0.0752	0.0108

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
160.00	Lightning Rod 5/8x4'	10	11.135	0.6041	0.1096	55289
157.00	(2) 10' x 2" Mount Pipe	10	10.754	0.5957	0.1033	55289
156.00	6' x 5' Flat Ice Shield	10	10.628	0.5929	0.1012	55289
124.00	10' x 2" Mount Pipe	10	6.807	0.5021	0.0956	14389
85.00	ET-X-TS-70-16-62-18-IR-RD w/ Mount Pipe	10	3.239	0.3311	0.0485	13348
65.00	ET-X-TS-70-16-62-18-IR-RD w/ Mount Pipe	10	1.944	0.2424	0.0360	13785
59.00	ET-X-WM-18-65-8P w/ Mount Pipe	3	1.624	0.2188	0.0325	13997
49.00	DC6-48-60-18-8F	3	1.163	0.1837	0.0269	15383

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	160 - 140	ROHN 2 STD	20.00	4.00	61.0 K=1.00	1.0745	-12.59	36.84	0.342 [1]
T2	140 - 125	ROHN 2.5 X-STR	15.03	5.01	65.0 K=1.00	2.2535	-23.00	74.43	0.309 [1]
T3	125 - 120	ROHN 2.5 X-STR	5.01	5.01	65.0 K=1.00	2.2535	-28.08	74.43	0.377 [1]
T4	120 - 100	ROHN 3 X-STR	20.03	6.68	70.5	3.0159	-47.88	94.34	0.507 [1]

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Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	K	K	
T5	100 - 80	ROHN 3.5 X-STR	20.03	6.68	K=1.00 61.3 K=1.00	3.6784	-68.26	125.73	0.543 [1]
T6	80 - 60	ROHN 4 X-STR	20.04	6.68	54.3 K=1.00	4.4074	-91.13	159.90	0.570 [1]
T7	60 - 40	ROHN 5 X-STR	20.03	10.02	65.4 K=1.00	6.1120	-115.17	201.25	0.572 [1]
T8	40 - 20	ROHN 5 X-STR	20.04	10.02	65.4 K=1.00	6.1120	-141.12	201.23	0.701 [1]
T9	20 - 0	ROHN 6 EHS	20.03	10.02	54.0 K=1.00	6.7133	-166.60	244.06	0.683 [1]

[1] P_u / ϕP_n controls

Diagonal Design Data (Compression)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	K	K	
T1	160 - 140	L1 1/2x1 1/2x3/16	7.68	3.62	148.2 K=1.00	0.5273	-2.46	6.87	0.358 [1]
T2	140 - 125	L1 3/4x1 3/4x1/8	9.30	4.55	157.6 K=1.00	0.4219	-2.37	4.86	0.487 [1]
T3	125 - 120	L2x2x1/4	9.73	4.75	145.8 K=1.00	0.9380	-3.24	12.63	0.257 [1]
T4	120 - 100	L2x2x3/16	12.27	6.06	184.5 K=1.00	0.7150	-3.78	6.01	0.628 [1]
T5	100 - 80	L2 1/2x2 1/2x3/16	14.02	6.91	167.6 K=1.00	0.9020	-4.34	9.20	0.472 [1]
T6	80 - 60	L3x3x3/16	15.89	7.83	157.6 K=1.00	1.0900	-5.03	12.56	0.400 [1]
T7	60 - 40	L3x3x1/4	19.10	9.45	191.5 K=1.00	1.4400	-7.37	11.24	0.656 [1]
T8	40 - 20	L3 1/2x3 1/2x1/4	20.89	10.35	179.0 K=1.00	1.6900	-7.71	15.10	0.510 [1]
T9	20 - 0	L3 1/2x3 1/2x1/4	22.69	11.19	193.5 K=1.00	1.6900	-8.56	12.92	0.663 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	K	K	
T1	160 - 140	L2x2x3/16	6.52	6.11	186.2 K=1.00	0.7150	-0.29	5.90	0.049 [1]
T2	140 - 125	L2x2x1/8	6.56	6.11	184.6 K=1.00	0.4844	-0.40	4.07	0.098 [1]

[1] P_u / ϕP_n controls

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Tension Checks

Leg Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	160 - 140	ROHN 2 STD	20.00	4.00	61.0	1.0745	9.68	48.35	0.200 [1]
T2	140 - 125	ROHN 2.5 X-STR	15.03	5.01	65.0	2.2535	18.85	101.41	0.186 [1]
T3	125 - 120	ROHN 2.5 X-STR	5.01	5.01	65.0	2.2535	22.46	101.41	0.222 [1]
T4	120 - 100	ROHN 3 X-STR	20.03	6.68	70.5	3.0159	39.31	135.72	0.290 [1]
T5	100 - 80	ROHN 3.5 X-STR	20.03	6.68	61.3	3.6784	57.04	165.53	0.345 [1]
T6	80 - 60	ROHN 4 X-STR	20.04	6.68	54.3	4.4074	76.33	198.34	0.385 [1]
T7	60 - 40	ROHN 5 X-STR	20.03	10.02	65.4	6.1120	95.37	275.04	0.347 [1]
T8	40 - 20	ROHN 5 X-STR	20.04	10.02	65.4	6.1120	118.83	275.04	0.432 [1]
T9	20 - 0	ROHN 6 EHS	20.03	10.02	54.0	6.7133	141.37	302.10	0.468 [1]

[1] P_u / ϕP_n controls

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	160 - 140	L1 1/2x1 1/2x3/16	7.68	3.62	97.9	0.3076	2.39	13.38	0.179 [1]
T2	140 - 125	L1 3/4x1 3/4x1/8	8.87	4.34	97.8	0.2578	2.36	11.21	0.210 [1]
T3	125 - 120	L2x2x1/4	9.73	4.75	96.1	0.5863	3.22	25.50	0.126 [1]
T4	120 - 100	L2x2x3/16	12.27	6.06	119.8	0.4484	3.77	19.50	0.194 [1]
T5	100 - 80	L2 1/2x2 1/2x3/16	14.02	6.91	108.2	0.5886	4.32	25.60	0.169 [1]
T6	80 - 60	L3x3x3/16	15.89	7.83	101.3	0.7296	4.98	31.74	0.157 [1]
T7	60 - 40	L3x3x1/4	19.10	9.45	123.5	0.9394	7.14	40.86	0.175 [1]
T8	40 - 20	L3 1/2x3 1/2x1/4	20.89	10.35	115.3	1.1269	7.52	54.94	0.137 [1]
T9	20 - 0	L3 1/2x3 1/2x1/4	22.69	11.19	124.6	1.1269	8.14	54.94	0.148 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	160 - 140	L2x2x3/16	6.52	6.11	123.0	0.4484	0.28	19.50	0.014 [1]
T2	140 - 125	L2x2x1/8	6.56	6.11	121.2	0.3047	0.40	13.25	0.030 [1]

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
T1	160 - 140	Leg	ROHN 2 STD	3	-12.59	38.68	32.5	Pass
T2	140 - 125	Leg	ROHN 2.5 X-STR	39	-23.00	78.15	29.4	Pass
T3	125 - 120	Leg	ROHN 2.5 X-STR	62	-28.08	78.15	35.9	Pass
T4	120 - 100	Leg	ROHN 3 X-STR	71	-47.88	99.06	48.3	Pass
T5	100 - 80	Leg	ROHN 3.5 X-STR	92	-68.26	132.01	51.7	Pass

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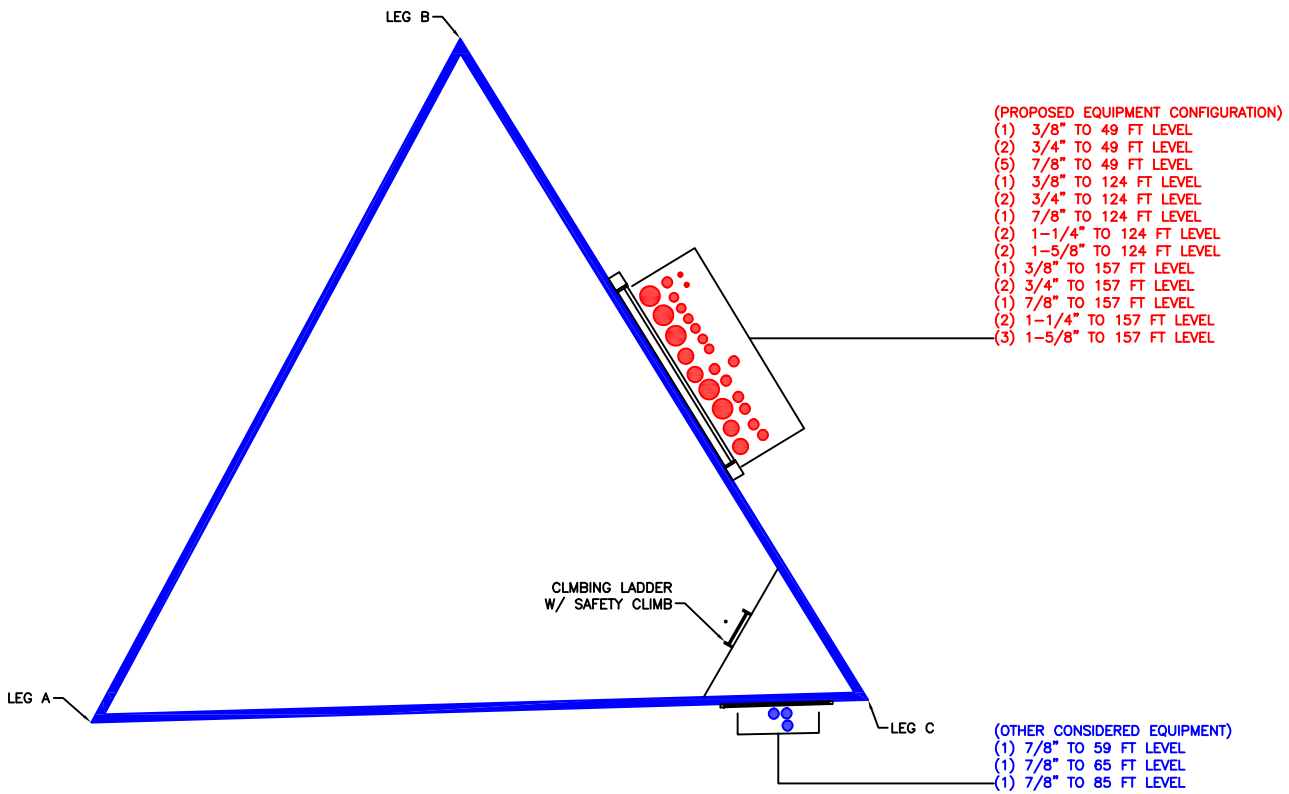
Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
T6	80 - 60	Leg	ROHN 4 X-STR	113	-91.13	167.90	54.3	Pass
T7	60 - 40	Leg	ROHN 5 X-STR	134	-115.17	211.31	54.5	Pass
T8	40 - 20	Leg	ROHN 5 X-STR	149	-141.12	211.29	66.8	Pass
T9	20 - 0	Leg	ROHN 6 EHS	164	-166.60	256.26	65.0	Pass
T1	160 - 140	Diagonal	L1 1/2x1 1/2x3/16	9	-2.46	7.21	34.1	Pass
							39.9 (b)	
T2	140 - 125	Diagonal	L1 3/4x1 3/4x1/8	45	-2.37	5.11	46.4	Pass
							54.4 (b)	
T3	125 - 120	Diagonal	L2x2x1/4	66	-3.24	13.26	24.5	Pass
							28.0 (b)	
T4	120 - 100	Diagonal	L2x2x3/16	76	-3.78	6.31	59.8	Pass
T5	100 - 80	Diagonal	L2 1/2x2 1/2x3/16	96	-4.34	9.65	44.9	Pass
							66.4 (b)	
T6	80 - 60	Diagonal	L3x3x3/16	115	-5.03	13.19	38.1	Pass
							76.5 (b)	
T7	60 - 40	Diagonal	L3x3x1/4	136	-7.37	11.80	62.4	Pass
T8	40 - 20	Diagonal	L3 1/2x3 1/2x1/4	151	-7.71	15.86	48.6	Pass
							56.5 (b)	
T9	20 - 0	Diagonal	L3 1/2x3 1/2x1/4	166	-8.56	13.56	63.1	Pass
T1	160 - 140	Top Girt	L2x2x3/16	6	-0.29	6.20	4.6	Pass
T2	140 - 125	Top Girt	L2x2x1/8	41	-0.40	4.27	9.3	Pass
							Summary	
						Leg (T8)	66.8	Pass
						Diagonal (T6)	76.5	Pass
						Top Girt (T2)	9.3	Pass
						Bolt Checks	76.5	Pass
						RATING =	**76.5**	**Pass**

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APPENDIX B

BASE LEVEL DRAWING

PERMIT NO:
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BUSINESS UNIT: 855801 TOWER ID: C_BASELEVEL

PERMIT NO:
TELE24-00035

APPENDIX C

ADDITIONAL CALCULATIONS

PERMIT NO:
TELE24-00035

Self Support Anchor Rod Capacity

Site Info	
BU #	855801
Site Name	Edgemont
Order #	668587 Rev. 2

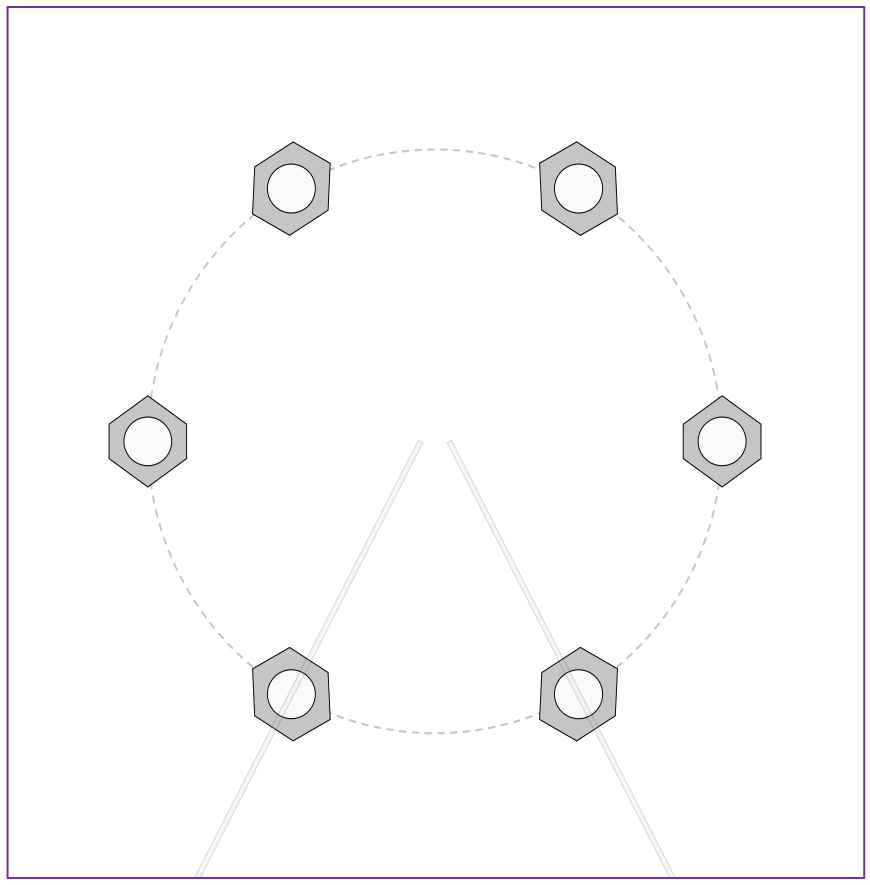
Analysis Considerations	
TIA-222 Revision	H
Grout Considered:	Yes
l_{ar} (in)	1.125

Applied Loads		
	Comp.	Uplift
Axial Force (kips)	173.06	147.07
Shear Force (kips)	21.61	19.34

**TIA-222-H Section 15.5 Applied*

Considered Eccentricity	
Leg Mod Eccentricity (in)	0.000
Anchor Rod N.A Shift (in)	0.000
Total Eccentricity (in)	0.000

**Anchor Rod Eccentricity Applied*



Connection Properties

Anchor Rod Data

(6) 1" ø bolts (A354-BC N; Fy=109 ksi, Fu=125 ksi)

l_{ar} (in): 1.125

Analysis Results

Anchor Rod Summary *(units of kips, kip-in)*

Pu_t = 24.51	ϕPn_t = 56.81	**Stress Rating**
Vu = 3.22	ϕVn = 36.82	**41.1%**
Mu = n/a	ϕMn = n/a	**Pass**

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Drilled Pier Foundation

BU # :	855801
Site Name:	Edgemont
Order Number:	668587 Rev. 2
TIA-222 Revison:	H
Tower Type:	Self Support

Check Limitation	
Apply TIA-222-H Section 15.5:	☑
N/A	☐
Design Options	
Input Effective Depths (else Actual):	☐
Consider non-tapered moment capacity:	☐
Check Shear along Depth of Pier:	☑
Utilize Shear-Friction Methodology:	☐
Override Critical Depth:	☐

Go to Soil Calculations

Applied Loads	Comp.	Uplift
Moment (kip-ft)	0	0
Axial Force (kips)	173.06	147.07
Shear Force (kips)	21.61	19.34

Material Properties		
Concrete Strength, f'c:	3	ksi
Rebar Strength, Fy:	60	ksi
Tie Yield Strength, Fyt:	60	ksi

Pier Design Data		
Depth	40	ft
Ext. Above Grade	0.5	ft
Pier Section 1		
From 0.5' above grade to 40' below grade		
Pier Diameter	3.5	ft
Rebar Quantity	14	
Rebar Size	10	
Rebar Cage Diameter	33	in
Tie Size	5	
Tie Spacing	12	in

Rebar & Pier Options

Embedded Pole Inputs

Belled Pier Inputs

Analysis Results		
Soil Lateral Check	*Compression*	*Uplift*
$D_{v=0}$ (ft from TOC)	20.55	20.55
Soil Safety Factor	29.49	32.95
Max Moment (kip-ft)	310.98	278.31
Rating*	*4.3%*	*3.8%*
Soil Vertical Check	*Compression*	*Uplift*
Skin Friction (kips)	411.37	411.37
End Bearing (kips)	375.01	-
Weight of Concrete (kips)	67.96	50.97
Total Capacity (kips)	786.37	462.34
Axial (kips)	241.02	147.07
Rating*	*29.2%*	*30.3%*
Reinforced Concrete Flexure	*Compression*	*Uplift*
Critical Depth (ft from TOC)	20.66	19.95
Critical Moment (kip-ft)	310.97	278.07
Critical Moment Capacity	1317.51	1096.27
Rating*	*22.5%*	*24.2%*
Reinforced Concrete Shear	*Compression*	*Uplift*
Critical Depth (ft from TOC)	32.02	32.02
Critical Shear (kip)	34.15	30.56
Critical Shear Capacity	264.76	172.65
Rating*	*12.3%*	*16.9%*

Structural Foundation Rating*	**24.2%**
Soil Interaction Rating*	**30.3%**

*Rating per TIA-222-H Section 15.5

Soil Profile

Groundwater Depth	37	# of Layers	9

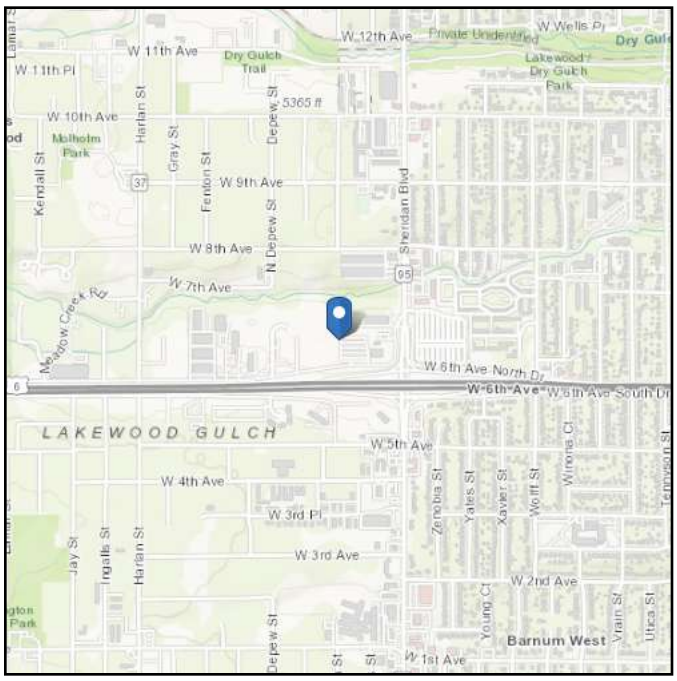
Layer	Top (ft)	Bottom (ft)	Thickness (ft)	γ_{soil} (pcf)	$\gamma_{concrete}$ (pcf)	Cohesion (ksf)	Angle of Friction (degrees)	Calculated Ultimate Skin Friction Comp (ksf)	Calculated Ultimate Skin Friction Uplift (ksf)	Ultimate Skin Friction Comp Override (ksf)	Ultimate Skin Friction Uplift Override (ksf)	Ult. Gross Bearing Capacity (ksf)	SPT Blow Count	Soil Type
1	0	4.167	4.167	115	150	0	0	0.000	0.000	0.00	0.00			Cohesionless
2	4.167	8.5	4.333	115	150	0.5	0	0.275	0.275					Cohesive
3	8.5	14	5.5	120	150	1.5	0	0.825	0.825					Cohesive
4	14	19	5	110	150	0	30	0.849	0.849				7	Cohesionless
5	19	24	5	125	150	1.5	0	0.825	0.825					Cohesive
6	24	29	5	130	150	0	33	2.526	2.526				20	Cohesionless
7	29	37	8	120	150	4	0	2.05	2.05					Cohesive
8	37	39	2	58	87.6	4	0	2.05	2.05					Cohesive
9	39	40	1	63	87.6	6	0	2.70	2.70			51.97		Cohesive

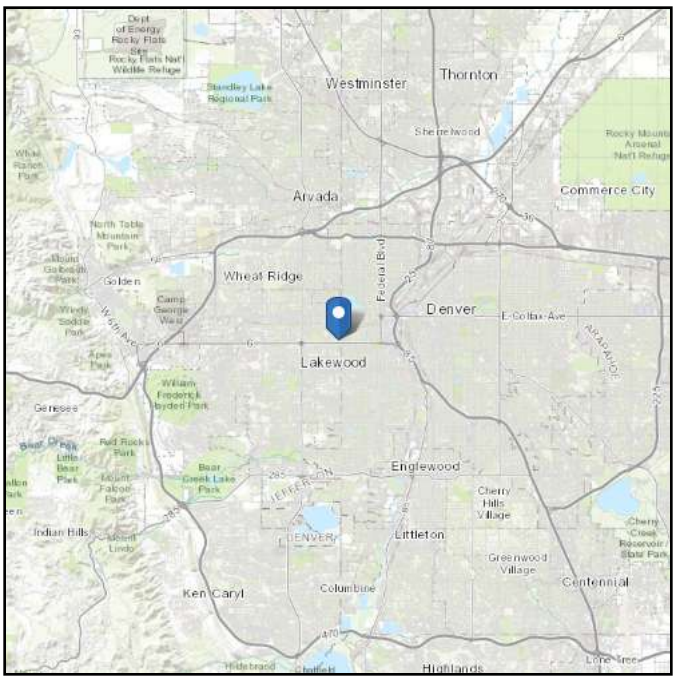
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ASCE Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-16	**Latitude:**	39.726944
Risk Category:	II	**Longitude:**	-105.055583
Soil Class:	D - Default (see Section 11.4.3)	**Elevation:**	5333.199659186005 ft (NAVD 88)





Wind

Results:

Wind Speed	107 Vmph	138 Vmph Wind speed was used as per City of Lakewood requirements
10-year MRI	77 Vmph	
25-year MRI	84 Vmph	
50-year MRI	89 Vmph	
100-year MRI	93 Vmph	

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2

Date Accessed: Mon Aug 19 2024

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

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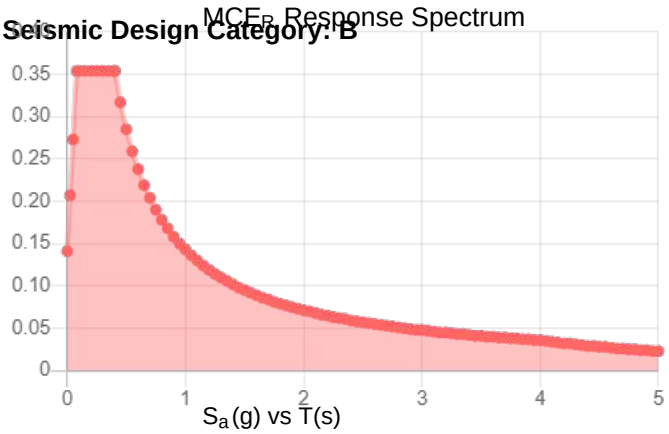
Seismic

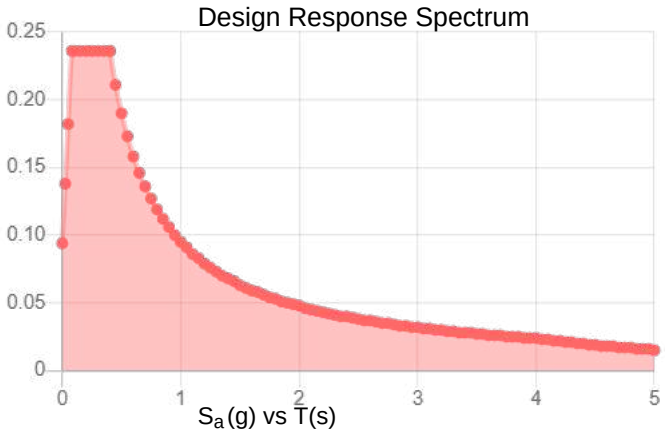
Site Soil Class: D - Default (see Section 11.4.3)

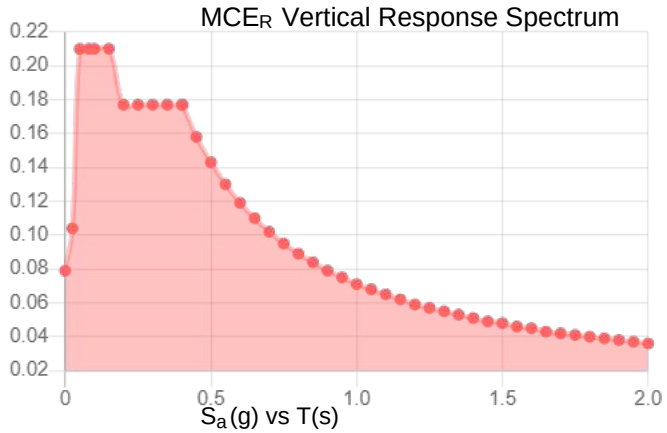
Results:

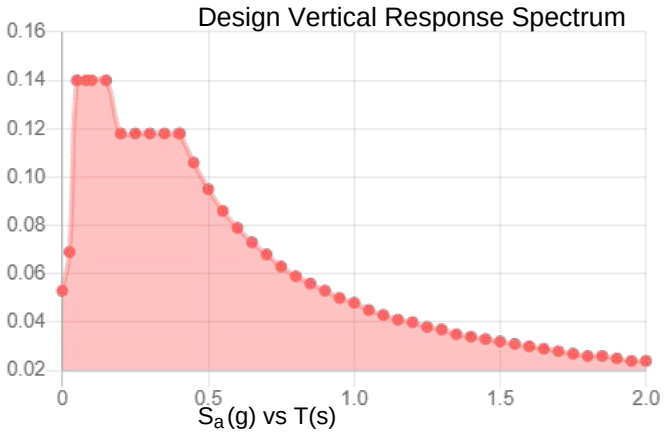
S_S :	0.221	S_{D1} :	0.095
S_1 :	0.059	T_L :	4
F_a :	1.6	PGA :	0.123
F_v :	2.4	PGA_M :	0.191
S_{MS} :	0.354	F_{PGA} :	1.554
S_{M1} :	0.143	I_e :	1
S_{DS} :	0.236	C_v :	0.742

Seismic Design Category: B









Data Accessed: **Mon Aug 19 2024**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

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Ice

Results:

Ice Thickness:	0.25 in.
Concurrent Temperature:	5 F
Gust Speed	50 mph
Data Source:	Standard ASCE/SEI 7-16, Figs. 10-2 through 10-8
Date Accessed:	Mon Aug 19 2024

Ice thicknesses on structures in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

In the mountain west, ice thicknesses may exceed the mapped values in the foothills and passes. However, at elevations above 5,000 ft, freezing rain is unlikely.

Values provided are equivalent radial ice thicknesses due to freezing rain with concurrent 3-second gust speeds, for a 500-year mean recurrence interval, and temperatures concurrent with ice thicknesses due to freezing rain. Thicknesses for ice accretions caused by other sources shall be obtained from local meteorological studies. Ice thicknesses in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

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