

P:\2016\Projects\Verizon Wireless\SMR\CO1 Hayden\HAYDEN CDs\T100.DWG
PLOTTED Oct 25, 2016 AT 4:22pm

GENERAL CONSTRUCTION

HYBRID & COAX CABLES

POWER/GROUNDING

FIBER

ANTENNAS

RR/HBBU

PENETRATIONS



SITE NAME: **CO1 HAYDEN**
PROJECT: **SMR PCS/AWS**
SITE I.D.#: **803**
ADDRESS: **N 40°27'47.4", W 107°6'41.7"**
ROUTT COUNTY, CO

R C R B D
RECORD SET



PROJECT INFORMATION
SITE NAME
CO1 HAYDEN
SITE I.D.
803
N 40°27'47.4", W 107°6'41.7"
ROUTT COUNTY, CO
CONSULTANT

EXISTING CONDITIONS



PROJECT DESCRIPTION

- REMOVE (9) ANTENNAS AND REPLACE WITH (6) NEW ANTENNAS ON EXISTING TOWER
- ADD NEW EQUIPMENT AT ANTENNAS AND IN EXISTING EQUIPMENT SHELTER
- ADD (1) NEW AND (1) FUTURE HYBRID CABLES FROM EQUIPMENT SHELTER TO ANTENNAS
- NEW ITEMS TO COMPLY WITH IFC SECTION 608 RE: 3/G1.00

PROJECT TEAM

OWNER
GHOST RANCH, LLC
JEAN P SAGOUSPE
259 I ST.
LOS BANOS, CA 93635
PHONE: 209.826.3891

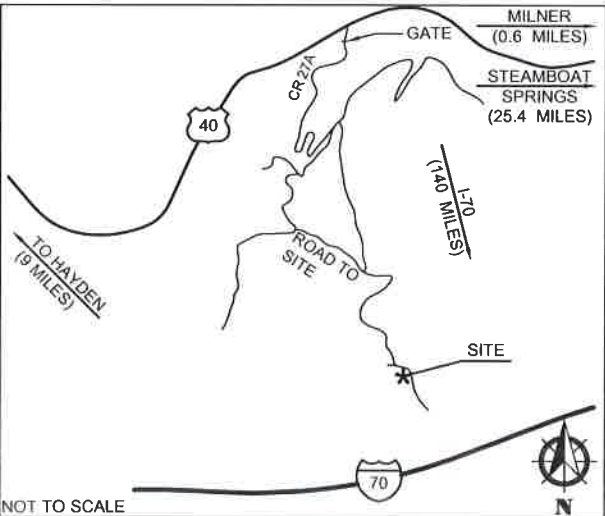
CLIENT
VERIZON WIRELESS
CONSTRUCTION ENGINEER
JASON SHELLEDY
3131 S. VAUGHN WAY
SUITE 550
AURORA, CO 80014
CELL: 970.646.1283

SITE ACQUISITION
DAVE CLOSSER
CLOSSER CONSULTING LLC
4628 GORDON DR.
BOULDER, CO 80305
PHONE: 303.554.5627
MOBILE: 303.859.1080
FAX: 303.554.2002

RF ENGINEER
VERIZON WIRELESS
RF ENGINEER
RAM NANDIRAJU
3131 S. VAUGHN WAY
SUITE 550
AURORA, CO 80014
PHONE: 303.873.2693

ARCHITECT
CHARLES STECKLY, AIA
CSAI
5935 S. ZANG STREET
SUITE 280
LITTLETON, CO 80127
PHONE: 303.932.9974

VICINITY MAP



DIRECTIONS

- FROM DENVER,
- I-70 WEST (50 MILES)
 - RIGHT ON EXIT 205 CO9 (37 MILES)
 - LEFT ON US40 TO STEAMBOAT SPRINGS (68 MILES)
 - LEFT ON CR27A
 - THRU SECURED GATE (CODE REQUIRED)
 - OVER BRIDGE
 - PAST GREY STEEL BUILDING
 - RIGHT WHEN ROAD GOES LEFT
 - PAST OLD BUILDING RUINS
 - LEFT AT SECOND ROAD
 - FOLLOW RIDGE TO SITE

PROJECT DATA

JURISDICTION: - ROUTT COUNTY
APN: - 938192001
ZONING DESIGNATION: - AG W/ RESIDENCE

EQUIPMENT SHELTER
OCCUPANCY GROUP: - S-2
CONSTRUCTION TYPE: - VB
FULLY SPRINKLERED: - NO
NO. OF STORIES: - 1

GOVERNING CODES IF APPLICABLE:
2009 IBC, 2009 IMC, 2009 IFC, 2011 NEC

A.D.A. COMPLIANCE:
THIS FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION.

DRAWING INDEX

SHEET	DESCRIPTION
T1.00	TITLE SHEET
G1.00	GENERAL NOTES
A1.00	ENLARGED SITE PLAN AND HYBRID CABLE CHART
A2.00	EQUIPMENT SHELTER FLOOR PLAN
A2.10	EQUIPMENT SHELTER RCP
A2.20	ANTENNA PLANS & NOTES
A3.00	SOUTH ELEVATION
A4.00	DETAILS
A5.00	HAZMAT RACK ELEVATION
A5.10	RACK ELEVATION
A6.00	GROUNDING SCHEMATIC

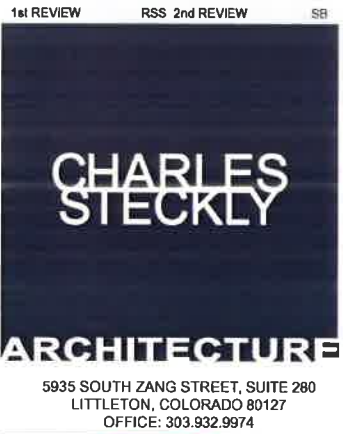
ATTACHMENTS:

STRUCTURAL ANALYSIS
BY: OTEGUI STRUCTURAL SERVICES LLC
DATED: (PENDING)

1. IBC 501.2 Premises identification. Approved numbers or addresses shall be provided for new buildings in such a position as to be clearly visible and legible from the street or roadway fronting the property. Letters or numbers shall be a minimum 3 inches (76 mm) in height and stroke of minimum 0.5 inch (12.7 mm) of a contrasting color to the background itself.
2. Stationary batteries utilized for facility emergency power, uninterrupted power supply or telecommunication facilities provided that the batteries are provided with safety venting caps and ventilation is provided in accordance with the International Mechanical Code. Ventilation shall be provided in an approved manner in battery-charging areas to prevent a dangerous accumulation of flammable gases.
- ✓ Items noted above are required and will be checked by field inspectors.

A 08/29/16 CD REVIEW DPL
B 08/15/16 CLIENT COMMENTS DPL
O 10/25/16 CD ISSUE DPL

R C R B D
RECORD SET
ELECTRICAL



TITLE SHEET

T1.00

GIS/Addressing OK
EK 20161108

GENERAL CONSTRUCTION
HYBRID & COAX CABLES
POWER/GROUNDING
FIBER
ANTENNAS
RRH/BBU
PENETRATIONS

ABBREVIATIONS

@	AT	HR.	HR.
⊕	CENTERLINE	HT.	HEIGHT
°	DEGREES	ILC	INTEGRATED LOAD CENTER
Ø	DIAMETER	INT.	INTERIOR
A/C	AIR CONDITIONER	L.F.	LINEAR FEET
APPROX.	APPROXIMATE	LTE	LIMIT TO EXTEND
ARCH.	ARCHITECTURAL	MAX.	MAXIMUM
A.F.F.	ABOVE FINISH FLOOR	MECH.	MECHANICAL
A.F.G.	ABOVE FINISH GRADE	MFGR.	MANUFACTURER
ALU	ALCATEL LUCENT	MGB	MAIN GROUND BAR
ATS	AUTOMATIC TRANSFER SWITCH	MIN.	MINIMUM
AWS	ADVANCED WIRELESS SYSTEM	MSDS	MATERIAL SAFETY DATA SHEET
BBU	BASE BAND UNIT	MTL.	METAL
BCEM	BASE CHANNEL ELEMENT MODULE	MTS	MANUAL TRANSFER SWITCH
BLDG.	BUILDING	N.T.S.	NOT TO SCALE
B.O.	BOTTOM OF		
CLG.	CEILING	O.C.	ON CENTER
COL.	COLUMN	O.D.	OUTSIDE DIAMETER
CONC.	CONCRETE	OVP	OVER VOLTAGE PROTECTION
DBL.	DOUBLE	PCS	PERSONAL COMMUNICATIONS SERVICE
DIA.	DIAMETER		
DIM.	DIMENSION		
DISC.	DISCONNECT	RAD.	RADIUS
DN.	DOWN	R.O.	ROUGH OPENING
DWG.	DRAWING	RRH	REMOTE RADIO HEAD
(E)	EXISTING	SHTG.	SHEATHING
EA	EACH	SIM.	SIMILAR
ELEV.	ELEVATION	SPEC.	SPECIFICATION
ELEC.	ELECTRICAL	S.S.	STAINLESS STEEL
EQ.	EQUAL	STL.	STEEL
EXT.	EXTERIOR	STRUCT.	STRUCTURAL
F.E.	FIRE EXTINGUISHER	T.C.	TEMPERATURE CONTROL
FIN.	FINISH	TELCO	TELECOMMUNICATIONS
FLR.	FLOOR	T.O.	TOP OF
FUT.	FUTURE	TYP.	TYPICAL
GA.	GAUGE	U.G.	UNDERGROUND
GALV.	GALVANIZED	U.N.O.	UNLESS NOTED OTHERWISE
GEN.	GENERATOR		
GPS	GLOBAL POSITIONING SYSTEM	VERT.	VERTICAL
GWB	GYPSUM WALLBOARD	V.I.F.	VERIFY IN FIELD
H.M.	HOLLOW METAL	W/	WITH
HORZ.	HORIZONTAL		

SYMBOLS LEGEND

-----	EASEMENT	
-----	LEASE LINE	
-----	PROPERTY LINE	
—□—□—	WOODEN FENCE	
— x — x —	CHAIN LINK FENCE	
— OH —	(E) OVERHEAD UTILITY	
— OHE —	(E) OVERHEAD ELEC.	
— SS — SS —	(E) SANITARY SEWER	
— W — W —	(E) WATER LINE	
— T — T —	(E) TELCO CABLE	
— FIBER —	(E) FIBER CABLE	
— E — E —	(E) ELECTRICAL	
— COAX —	(E) COAX CABLE	
	REVISION NUMBER	

NEW WORK COLOR LEGEND

GENERAL CONSTRUCTION SOW	
HYBRID & COAX CABLES	
DC POWER	
FIBER	
ANTENNAS	
RRH/BBU	
PENETRATIONS	

4 - ABBREVIATIONS, SYMBOLS AND LEGEND

EXISTING BATTERY SPECIFICATION:

(FIAMM 2SLA1500) EACH CELL HAS AN ELECTROLYTE CAPACITY OF 4.56 GALLONS EACH. (12) CELLS IN THIS OCCUPANCY, RESULTING IN AN AGGREGATE ELECTROLYTE VOLUME OF 54.72 GALLONS. STATIONARY LEAD-ACID BATTERY SYSTEMS AND VALVE-REGULATED LEAD-ACID BATTERY SYSTEMS CONTAINING MORE THAN 50 GALLONS OF ELECTROLYTE SHALL COMPLY WITH IFC 608.

SPECIFICATIONS AND CONDITIONS

- IFC 608.5 SPILL CONTROL & NEUTRALIZATION
 - SPILL CONTROL: IFC 608.5 EXCEPTION: VRLA, LITHIUM-ION, LITHIUM METAL POLYMER OR OTHER TYPES OF SEALED BATTERIES WITH IMMOBILIZED ELECTROLYTE SHALL NOT REQUIRE SPILL CONTROL
 - IFC 608.5.2: RECOMBINANT BATTERY NEUTRALIZATION: FOR VRLA OR OTHER TYPES OF SEALED BATTERIES WITH IMMOBILIZED ELECTROLYTE, THE METHOD AND MATERIAL SHALL BE CAPABLE OF NEUTRALIZING A SPILL OF 3.0 PERCENT OF THE CAPACITY OF THE LARGEST BLOCK IN THE ROOM (SEE CHART) TO A PH BETWEEN 5.0 AND 9.0. PROVIDE ENER-SYS EMERGENCY SPILL KIT MODELS:853620-853615 (OR EQUAL)

TOTAL ACID GAL.	50	60	70	80	90	100	110	120
3%	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6

- IFC 608.3 PROVIDE UL LISTED THERMAL RUNAWAY DETECTION DEVICE: EAGLE EYE BTM SERIES THERMAL RUNAWAY MONITOR (OR EQ.) CONNECT TO ALARM BLOCK.
- IFC 608.6.1 ROOM VENTILATION FOR FLOODED LEAD-ACID, FLOODED Ni-CAD AND VRLA BATTERIES, THE VENTILATION SYSTEM SHALL BE DESIGNED TO LIMIT THE MAXIMUM CONCENTRATION TO 1.0 PERCENT OF THE TOTAL VOLUME OF THE ROOM. PER IEEE 1635 HYDROGEN GENERATION FOR VLRA BATTERIES IS DETERMINED AS:

$$H_2\text{-RATE (CFM)} = N_c \times C_8 \times 2.82 \times 10^{-7}$$

N_c = NUMBER OF BATTERY CELLS
 C_8 = 8H AMPERE CELL RATING TO 1.75V @25°C

HYDROGEN GENERATION RATE OF THIS INSTALLATION IS .004 CFM
REQUIRED FAN SIZE TO KEEP HYDROGEN BELOW 1% = .004 / .01 = 4 CFM
THE EXISTING FAN IS RATED AT 50 CFM WHICH MEETS THESE REQUIREMENTS.

- IFC 608.7. DOORS INTO ROOMS AND BUILDINGS CONTAINING STORED EMERGENCY POWER SUPPLY SYSTEMS SHALL BE PROVIDED WITH APPROVED SIGNS. THE SIGNS SHALL STATE:
 - THE ROOM CONTAINS ENERGIZED BATTERY SYSTEMS
 - THE ROOM CONTAINS ENERGIZED ELECTRICAL CIRCUIT
 - THE BATTERY ELECTROLYTE SOLUTIONS ARE CORROSIVE LIQUIDS.
- IFC 608.8 SEISMIC PROTECTION. BOLT DOWN / ANCHOR BATTERY BASE W/ (4) 5/8" MASONRY ANCHORS, MIN 4" EMBED INTO CONCRETE FLOOR. MODULAR STEEL SEISMIC FRAME PROVIDED WITH BATTERIES.
- "NO SMOKING SIGNS SHALL BE PROVIDED ON DOORS LEADING INTO BATTERY ROOMS. PLACARDS SHALL BE PROVIDED ACCORDING TO NATIONAL FIRE PROTECTION ASSOCIATION STANDARD 704. PLACARDS POSTED ON THE INTERIOR OF THE FACILITY SHALL BE A MINIMUM 10 INCHES EACH SIDE AND PLACARDS POSTED ON THE EXTERIOR SHALL BE A MINIMUM 15 INCHES EACH SIDE.



3 - HAZMAT REVIEW

GENERAL CONTRACTOR NOTES

CONTRACTOR SHALL VERIFY ALL PLANS AND EXISTING DIMENSIONS AND CONDITIONS ON THE JOB SITE AND SHALL IMMEDIATELY NOTIFY THE ARCHITECT IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME.

THESE DRAWINGS ARE TO SCALE WHEN PLOTTED ON 11X17 SHEET.

CALL BEFORE YOU DIG - COLORADO LAW REQUIRES 3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE.

THESE DRAWINGS MAY NOT SHOW ALL UNDERGROUND PIPING AND UTILITIES. THE CONTRACTOR SHALL EXERCISE EXTREME CARE DURING ALL EXCAVATION AND OTHER CONSTRUCTION ACTIVITIES.

UTILITY NOTIFICATION CENTER OF COLORADO - 1-800-922-1987

THE CONTRACTOR IS RESPONSIBLE FOR ALL UTILITY LOCATES AND UTILITY RELOCATIONS REQUIRED FOR THIS INSTALLATION. THE CONTRACTOR WILL SCHEDULE AND COORDINATE ALL WORK WITH THE OWNER TO ENSURE NO DISRUPTION TO OWNERS OPERATIONS.

SUBCONTRACTORS SHALL VERIFY ALL PLANS & EXISTING DIMENSIONS & CONDITIONS ON THE JOB SITE & SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME.

2 - GENERAL CONTRACTOR NOTES

1. DRAWINGS ARE NOT TO BE SCALED, WRITTEN DIMENSIONS TAKE PRECEDENCE, AND THIS SET OF PLANS IS INTENDED TO BE USED FOR DIAGRAMMATIC PURPOSES ONLY, UNLESS NOTED OTHERWISE. THE GENERAL CONTRACTOR'S SCOPE OF WORK SHALL INCLUDE FURNISHING ALL MATERIALS, EQUIPMENT, LABOR, AND ANYTHING ELSE DEEMED NECESSARY TO COMPLETE INSTALLATIONS AS DESCRIBED HEREIN. REFER TO BID PACKAGE FOR MORE DATA.

2. PRIOR TO THE SUBMISSION OF BIDS, THE CONTRACTORS INVOLVED SHALL VISIT THE JOB SITE AND FAMILIARIZE THEMSELVES WITH ALL CONDITIONS AFFECTING THE PROPOSED PROJECT WITH THE CONSTRUCTION AND CONTRACT DOCUMENTS, FIELD CONDITIONS AND CONFIRM THAT THE PROJECT MAY BE ACCOMPLISHED AS SHOWN PRIOR TO PROCEEDING WITH CONSTRUCTION. ANY ERRORS, OMISSIONS, OR DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE ARCHITECT/CONSTRUCTION ENGINEER IN WRITING.

3. THE GENERAL CONTRACTOR SHALL RECEIVE WRITTEN AUTHORIZATION TO PROCEED WITH CONSTRUCTION PRIOR TO STARTING WORK ON ANY ITEM NOT CLEARLY DEFINED BY THE CONSTRUCTION DRAWINGS/CONTRACT DOCUMENTS.

4. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE PROJECT DESCRIBED HEREIN. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES AND FOR COORDINATING ALL PORTIONS OF THE WORK UNDER THE CONTRACT.

5. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS ACCORDING TO MANUFACTURER'S, VENDOR'S, & VERIZON WIRELESS SPECIFICATIONS UNLESS NOTED OTHERWISE OR WHERE LOCAL CODES OR ORDINANCES TAKE PRECEDENCE NOTIFY CONSTRUCTION ENGINEER.

6. ALL WORK PERFORMED ON PROJECT AND MATERIALS INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS, AND ORDINANCES. CONTRACTOR SHALL GIVE ALL NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY, MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS, AND LOCAL AND STATE JURISDICTIONAL CODES BEARING ON THE PERFORMANCE OF THE WORK.

7. THE STRUCTURAL COMPONENTS OF THIS PROJECT SITE/FACILITY ARE NOT TO BE ALTERED BY THIS CONSTRUCTION PROJECT UNLESS NOTED OTHERWISE.

8. NEW TOWERS ARE UNDER A SEPARATE CONTRACT. THE CONTRACTOR SHALL ASSIST ANTENNA INSTALLATION SUBCONTRACTOR IN TERMS OF COORDINATION AND SITE ACCESS. ERECTION SUBCONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTION OF PERSONNEL AND PROPERTY FROM HAZARDOUS EXPOSURE TO OVERHEAD DANGERS.

9. GENERAL CONTRACTOR SHALL PROVIDE AT THE PROJECT SITE A FULL SET OF PERMITTED CONSTRUCTION DOCUMENTS UPDATED WITH THE LATEST REVISIONS AND ADDENDA OR CLARIFICATIONS FOR THE USE BY ALL PERSONNEL INVOLVED WITH THE PROJECT.

10. DETAILS INCLUDED HEREIN ARE INTENDED TO SHOW END RESULT OF DESIGN. MINOR MODIFICATIONS MAY BE REQUIRED TO SUIT JOB CONDITIONS OR SITUATIONS, AND SUCH MODIFICATIONS SHALL BE INCLUDED AS PART OF THE SCOPE OF WORK.

11. THE FACILITY IS CELLULAR RADIO EQUIPMENT, ANTENNAS, & SUPPORTING UTILITIES.

12. THE CONTRACTOR SHALL MAKE NECESSARY PROVISIONS TO PROTECT EXISTING IMPROVEMENTS, EASEMENTS, PAVING, CURBING, ETC. DURING CONSTRUCTION UPON COMPLETION OF WORK. CONTRACTOR SHALL REPAIR ANY DAMAGE THAT MAY HAVE OCCURRED DUE TO CONSTRUCTION ON OR ABOUT THE PROPERTY.

13. CONTRACTOR SHALL ENSURE THE GENERAL WORK AREA IS KEPT CLEAN AND HAZARD FREE DURING CONSTRUCTION AND DISPOSE OF ALL DIRT, DEBRIS, RUBBISH AND REMOVE EQUIPMENT NOT SPECIFIED AS REMAINING ON THE PROPERTY, PREMISES SHALL BE LEFT IN CLEAN CONDITION AND FREE FROM PAINT SPOTS, DUST, OR SMUDGES OF ANY NATURE.

14. THE ARCHITECTS/ENGINEERS HAVE MADE EVERY EFFORT TO SET FORTH IN THE CONSTRUCTION AND CONTRACT DOCUMENTS THE COMPLETE SCOPE OF WORK. CONTRACTORS BIDDING THE JOB ARE NEVERTHELESS CAUTIONED THAT MINOR OMISSIONS OR ERRORS IN THE DRAWINGS AND OR SPECIFICATIONS SHALL NOT EXCUSE SAID CONTRACTOR FROM COMPLETING THE PROJECT AND IMPROVEMENTS IN ACCORDANCE WITH THE INTENT OF THESE DOCUMENTS. THE BIDDER SHALL BEAR THE RESPONSIBILITY OF NOTIFYING (IN WRITING) THE CONSTRUCTION ENGINEER OF ANY CONFLICTS, ERRORS, OR OMISSIONS PRIOR TO THE SUBMISSION OF CONTRACTOR'S PROPOSAL.

15. SPECIAL INSPECTION TESTING REQUIRING SPECIAL INSPECTIONS SHALL BE PERFORMED BY AN INDEPENDENT SPECIAL INSPECTOR PER SECTION 1704 OF THE INTERNATIONAL BUILDING CODE (IBC) FOR ITEMS NOTED ON S1.00 IF INCLUDED IN CONSTRUCTION DOCUMENTS. THE INSPECTOR SHALL BE HIRED BY THE CONTRACTOR & COORDINATION SHALL BE ARRANGED BY THE CONTRACTOR FOR REQUIRED INSPECTIONS.

RCRBD

RECORD SET



UNDERGROUND SERVICE ALERT
UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
WWW.UNCC.ORG
3 WORKING DAYS UTILITY NOTIFICATION PRIOR TO CONSTRUCTION

1 - GENERAL NOTES

verizon
VERIZON WIRELESS SERVICES
3131 S. VAUGHN WAY, SUITE 550
AURORA, CO 80014

PROJECT INFORMATION

SITE NAME

CO1 HAYDEN

SITE I.D.

803

N 40°27'47.4", W 107°6'41.7"
ROUTT COUNTY, CO

CONSULTANT

A 08/29/16 CD REVIEW DPL
B 09/15/16 CLIENT COMMENTS DPL
O 10/25/16 CD ISSUE DPL

RCRBD

RECORD SET

ELECTRICAL

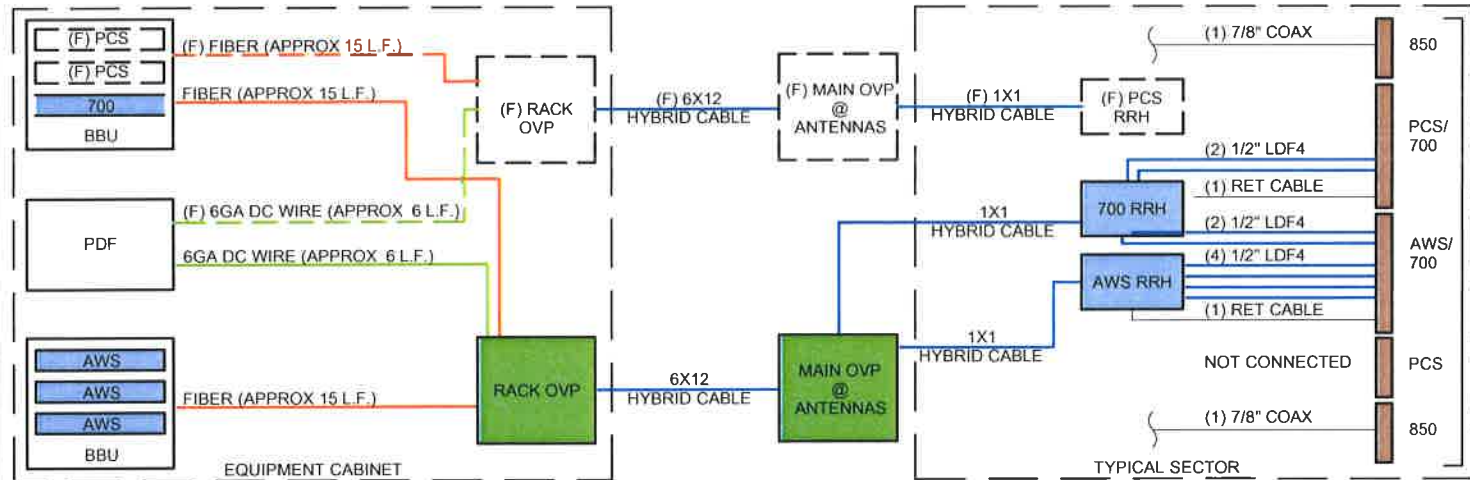
1st REVIEW RSS 2nd REVIEW SB



GENERAL NOTES

G1.00

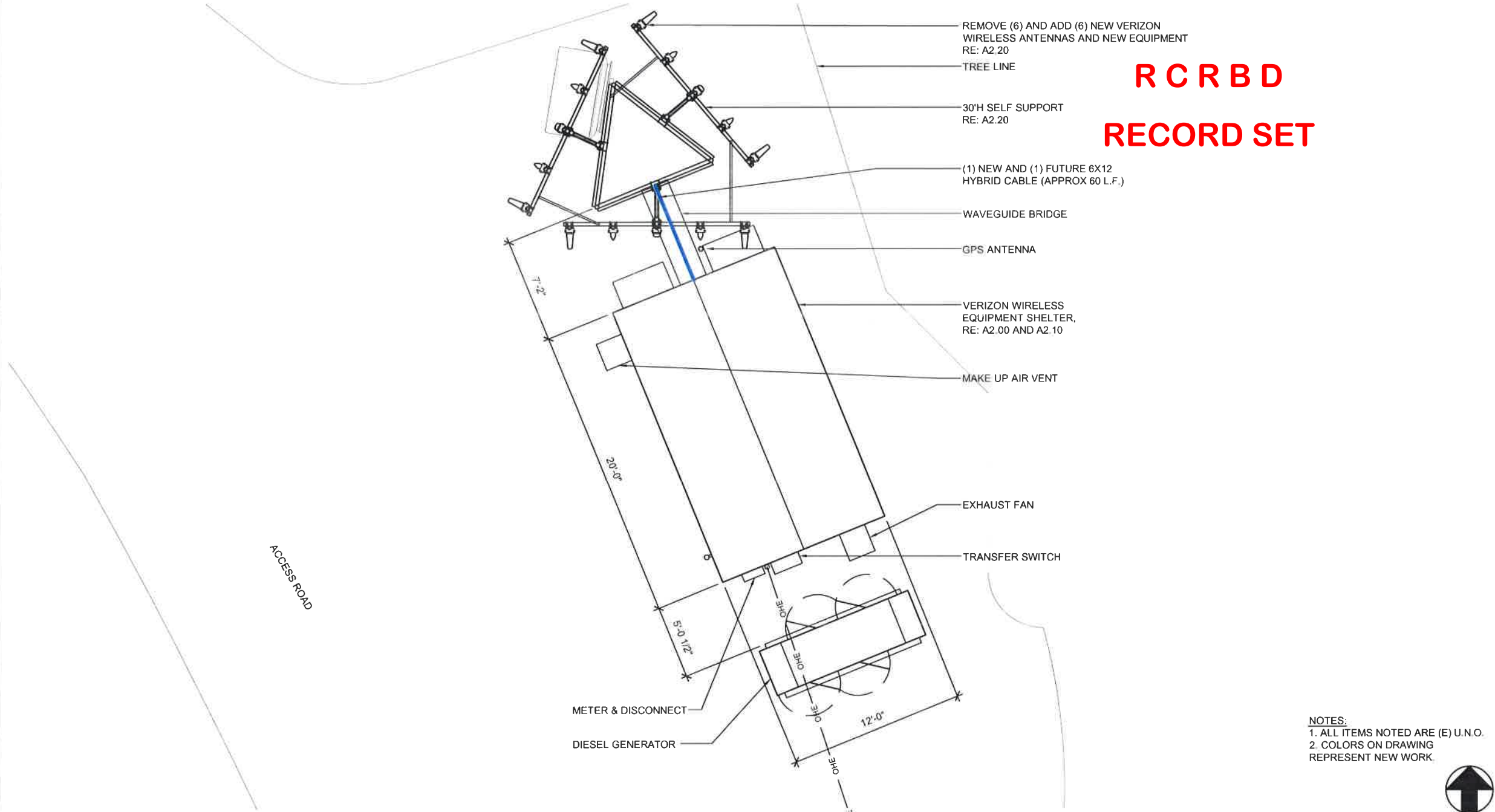
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RACK OVP @ CABINET TO MAIN OVP @ ANTENNAS						MAIN OVP TO RRH CONNECTION				
RACK OVP		6X12 HYBRID CABLE		MAIN OVP @ ANTENNAS		1X1 HYBRID CABLE		PCS RRH	700 RRH	AWS RRH
SECTOR	QTY	LENGTH	QTY	TOTAL WEIGHT	QTY	LENGTH	QTY	QTY	QTY	QTY
X	(1) NEW (1) FUT.	60 L.F. EACH	(1)	175 LBS (1.44 LBS/LF)	(1)	14'-0"	(2) NEW (1) FUT.	(F)	(1)	(1)
Y	(1) NEW (1) FUT.	60 L.F. EACH	(1)	175 LBS (1.44 LBS/LF)	(1)	14'-0"	(2) NEW (1) FUT.	(F)	(1)	(1)
Z	(1) NEW (1) FUT.	60 L.F. EACH	(1)	175 LBS (1.44 LBS/LF)	(1)	14'-0"	(2) NEW (1) FUT.	(F)	(1)	(1)

NOTE:
RE: 1/A2.20 FOR ANTENNA CONFIGURATION AND MAIN OVP LOCATIONS

2 - HYBRID CABLE DIAGRAM



NOTES:
1. ALL ITEMS NOTED ARE (E) U.N.O.
2. COLORS ON DRAWING
REPRESENT NEW WORK.



1/8" = 1'-0"



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1st REVIEW RSS 2nd REVIEW SB

CHARLES STECKLY
ARCHITECTURE
5935 SOUTH ZANG STREET, SUITE 280
LITTLETON, COLORADO 80127
OFFICE: 303.932.9974

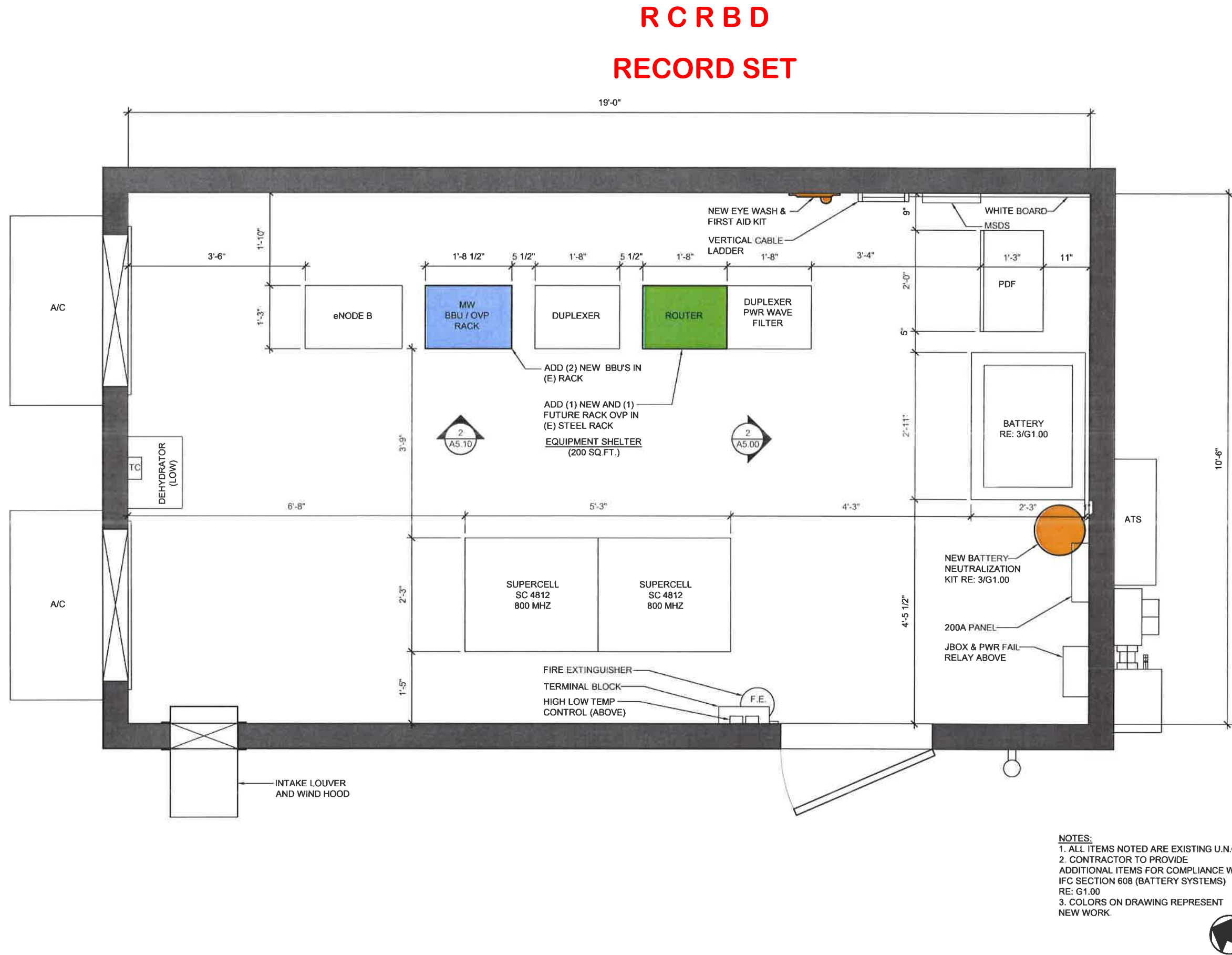


**ENLARGED SITE
PLAN & HYBRID
CABLE CHART**

A1.00

P:\2016\Projects\Verizon Wireless\SMRICO1 Hayden\HAYDEN CDs\A200.dwg
PLOTTED Oct 25, 2016 AT 4:22pm

GENERAL CONSTRUCTION
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NOTES:
1. ALL ITEMS NOTED ARE EXISTING U.N.O.
2. CONTRACTOR TO PROVIDE
ADDITIONAL ITEMS FOR COMPLIANCE W/
IFC SECTION 608 (BATTERY SYSTEMS)
RE: G1.00
3. COLORS ON DRAWING REPRESENT
NEW WORK.



3/8" = 1'-0"

1 - EQUIPMENT SHELTER FLOOR PLAN



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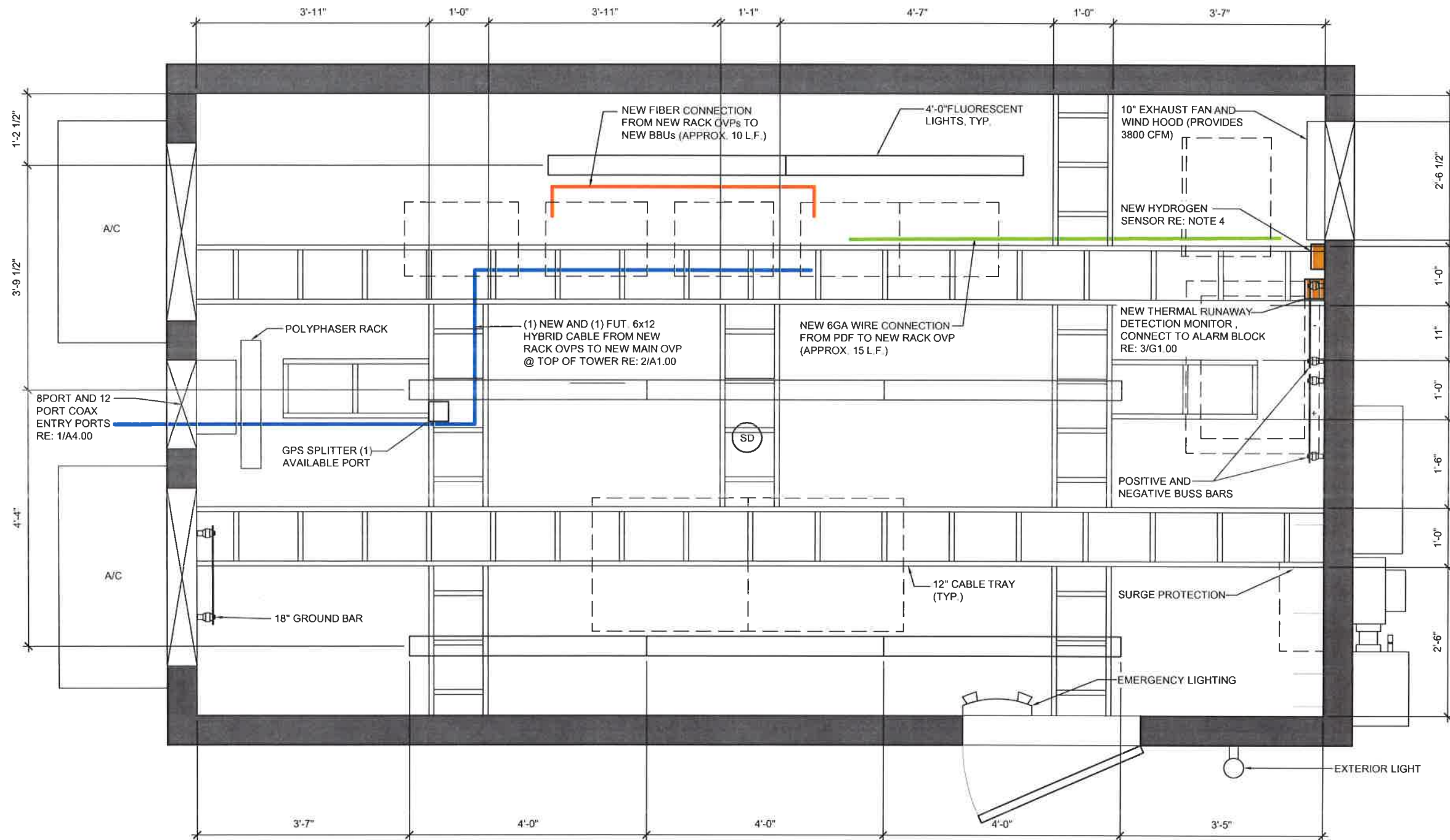
EQUIPMENT SHELTER
FLOOR PLAN

A2.00

P:\2016\Projects\Verizon Wireless\SMR\CO1 Hayden\HAYDEN CDs\A210.dwg
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RCRBD RECORD SET



- NOTES:
1. ALL ITEMS NOTED ARE EXISTING U.N.O.
 2. CONTRACTOR TO PROVIDE ADDITIONAL ITEMS FOR COMPLIANCE W/ IFC SECTION 608 (BATTERY SYSTEMS) RE: G1.00
 3. COLORS ON DRAWING REPRESENT NEW WORK.
 4. INSTALL NEW UL LISTED HYDROGEN SENSOR AND CONNECT TO ALARM BLOCK; MODEL #: MACURCO GD-6 GAS DETECTOR (OR EQ.)



verizon
VERIZON WIRELESS SERVICES
3131 S. VAUGHN WAY, SUITE 550
AURORA, CO 80014

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ARCHITECTURE
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LITTLETON, COLORADO 80127
OFFICE: 303.932.9974



**EQUIPMENT
SHELTER RCP**

A2.10

1 - EQUIPMENT SHELTER REFLECTED CEILING PLAN

3/8" = 1'-0"

A	08/28/16	CD REVIEW	DPL
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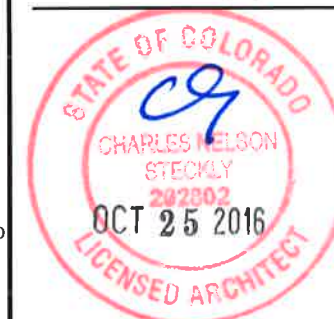
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RECORD SET
ELECTRICAL

1st REVIEW	RSS	2nd REVIEW	SE
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CHARLES
STECKLY

ARCHITECTURE

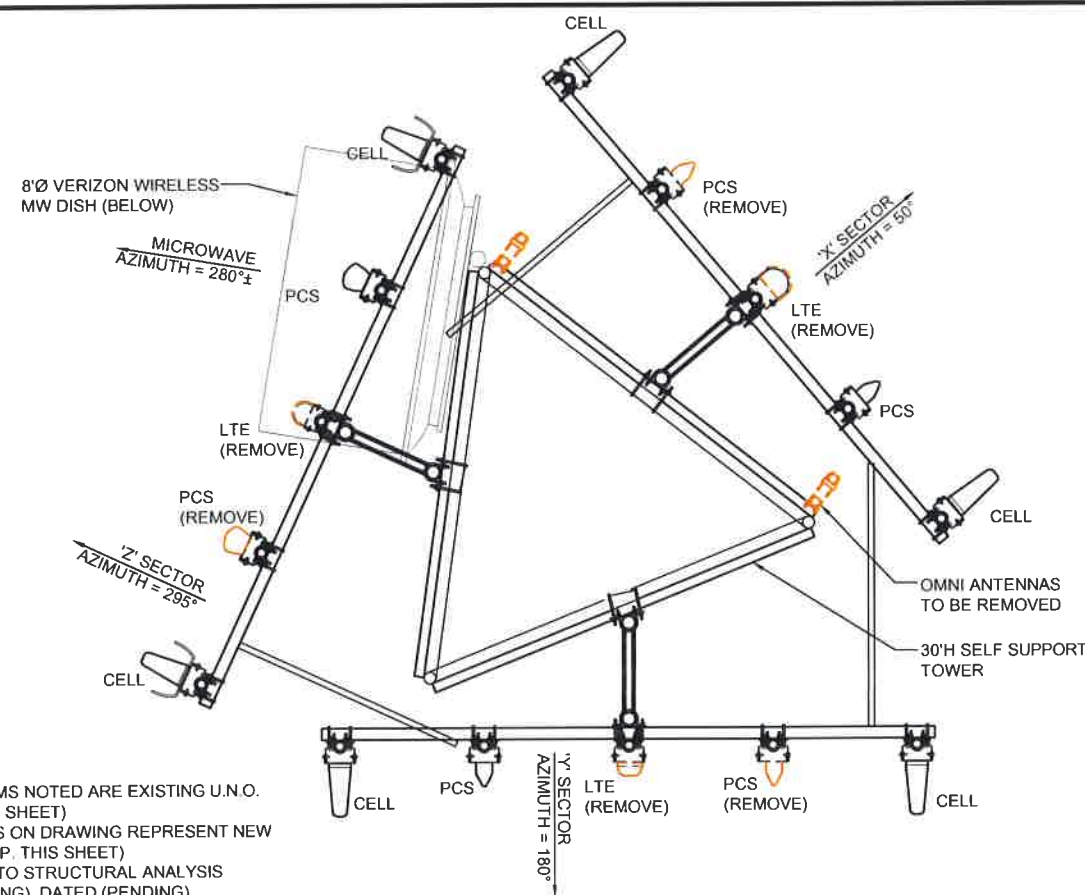
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ANTENNA PLANS & NOTES

A2.20

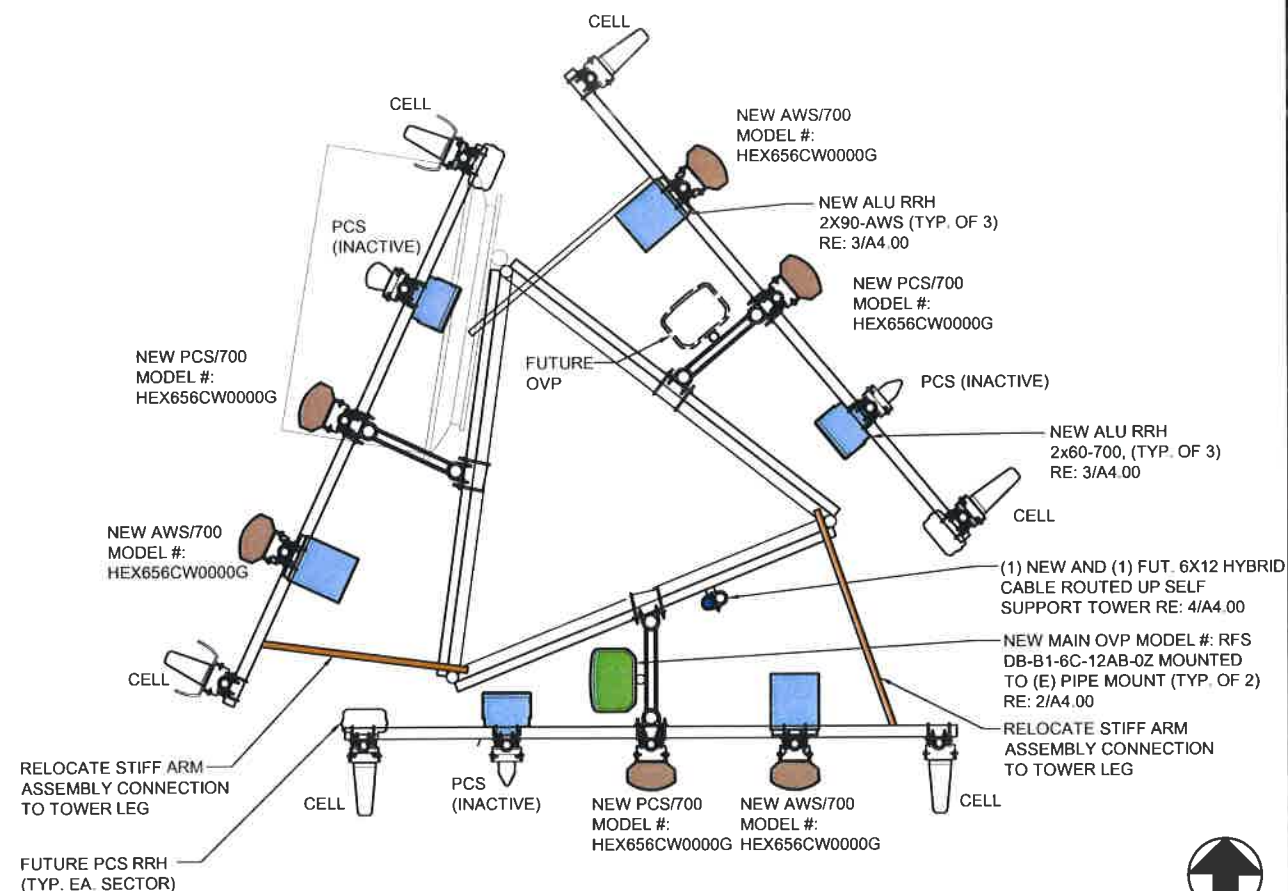
R C R B D
RECORD SET



NOTES:
1. ALL ITEMS NOTED ARE EXISTING U.N.O.
(TYP. THIS SHEET)
2. COLORS ON DRAWING REPRESENT NEW
WORK (TYP. THIS SHEET)
3. REFER TO STRUCTURAL ANALYSIS
BY (PENDING), DATED (PENDING).


$$1/d'' = 1/d'$$

2 - ANTENNA DEMO PLAN


$$1/4'' = 1'$$

4 - PHOTO OF ANTENNAS

1. GENERAL: PROVIDE ALL LABOR, EQUIPMENT AND MATERIALS NECESSARY FOR RECEIVING, INSTALLING, TESTING AND ADJUSTING ANTENNA CABLES FROM THE ANTENNA TO THE CONNECTORS AT THE BASE TRANSMISSION SYSTEM (BTS). THIS SHALL INCLUDE ALL EQUIPMENT SHOWN OR REQUIRED FOR A COMPLETE OPERATING SYSTEM. ANTENNA, ANTENNA CABLES, CONNECTORS, AND FITTINGS SHALL BE THIRD PARTY FURNISHED COMPONENTS AS SHOWN ON THE BILL OF MATERIALS.

2. MATERIALS

- A. RE: 2/A1.00 FOR HYBRID CABLE DIAGRAM AND INFORMATION
- B. CABLE HANGERS: INSTALLED AT MAXIMUM 4' SPACING
- C. GROUND EQUIPMENT PER VERIZON WIRELESS SPECS RE: A6.00

3. INSTALLATION

- INSTALLATION
- A. ANTENNA CABLE LENGTHS SHALL BE FIELD MEASURED PRIOR TO PURCHASE OF CABLE. INSTALLER SHALL NOTIFY VERIZON WIRELESS OF THE OVERALL LENGTH REQUIRED.
- B. CABLES SHALL BE LABELED IN ACCORDANCE WITH VERIZON WIRELESS SPECIFICATIONS.
- C. ALL OUTSIDE CABLE CONNECTIONS SHALL BE COVERED WITH WEATHER PROOFING TAPE.
- D. THE MINIMUM BENDING RADIUS FOR ALL ANTENNA CABLES SHALL BE SHOWN AS BELOW OR AS PER THE MANUFACTURER, WHICHEVER IS MORE CONSERVATIVE:

CABLE	IN AIR / CABLE TRAY	IN CONDUIT
1/2"	5"	10"
7/8"	10"	18"
1 5/8"	20"	28"
1X1 HYBRID	5"	10"
6X12 HYBRID	12"	16"

- E. CABLES SHALL BE INSTALLED WITH THE MINIMUM NUMBER OF BENDS, CABLES SHALL NOT BE LEFT UNTERMINATED IN THE FIELD
- F. GROUNDING KITS - AFTER INSTALLATION OF GROUND STRAPS, THE CONNECTION SHALL BE MADE WEATHER TIGHT USING WEATHERPROOFING KITS AS IDENTIFIED ABOVE. GROUND PIGTAILS SHALL BE BROUGHT OUT IN THE DOWNWARD DIRECTION FROM THE CONNECTIONS TO THE ANTENNA CABLE WITHOUT ANY SHARP BENDS (MINIMUM BEND RADIUS 10") AND CONNECTION SHALL BE MADE TO GROUNDING SYSTEM.

3 - ANTENNA NOTES

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PLOTTED Oct 25, 2016 AT 4:22pm

GENERAL CONSTRUCTION

HYBRID & COAX CABLES

POWER/GROUNDING

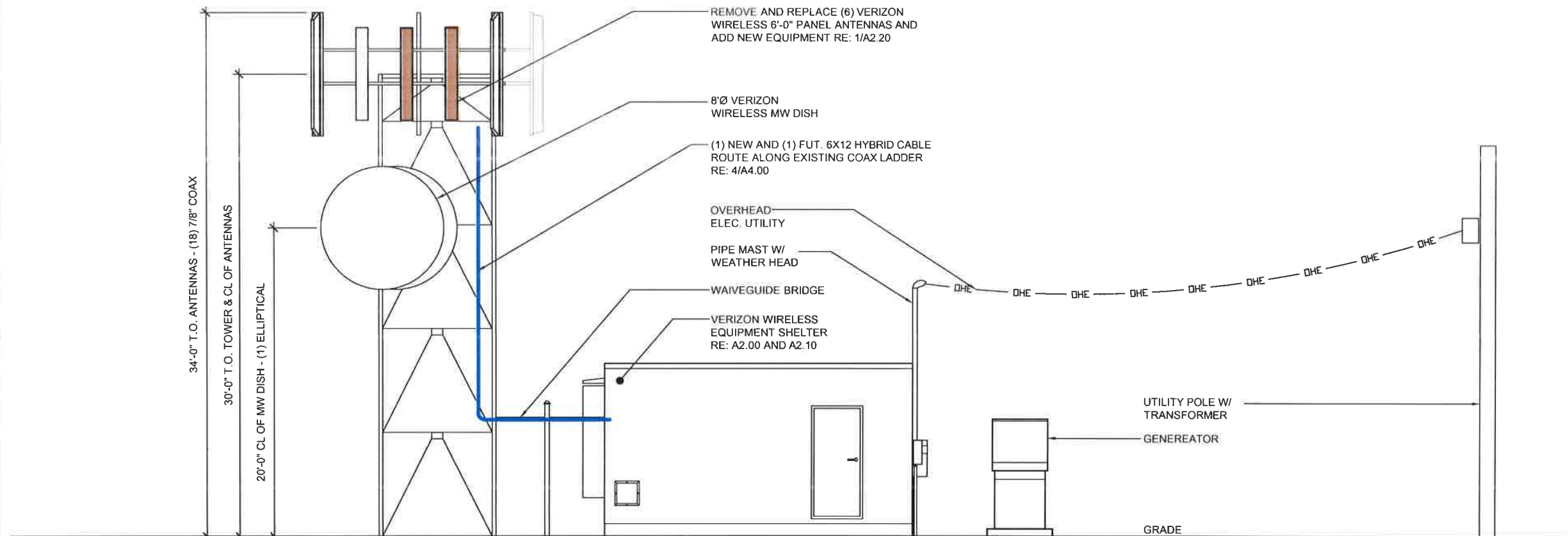
FIBER

ANTENNAS

RRH/BBU

PENETRATIONS

RCRBD RECORD SET



NOTES:
1. ALL ITEMS NOTED ARE (E) U.N.O.
2. COLORS ON DRAWING REPRESENT NEW WORK.
3. REFER TO STRUCTURAL BY (PENDING) DATED:
(PENDING)

1 - SOUTH ELEVATION

1/8" = 1'-0"

verizon
VERIZON WIRELESS SERVICES
3131 S. VAUGHN WAY, SUITE 550
AURORA, CO 80014

PROJECT INFORMATION

SITE NAME

CO1 HAYDEN

SITE I.D.

803

N 40°27'47.4", W 107°6'41.7"
ROUTT COUNTY, CO

CONSULTANT

A	08/29/16	CD REVIEW	DPL
B	09/15/16	CLIENT COMMENTS	DPL
O	10/25/16	CD ISSUE	DPL

RCRBD RECORD SET ELECTRICAL

1st REVIEW RSS 2nd REVIEW SB

**CHARLES
STECKLY**

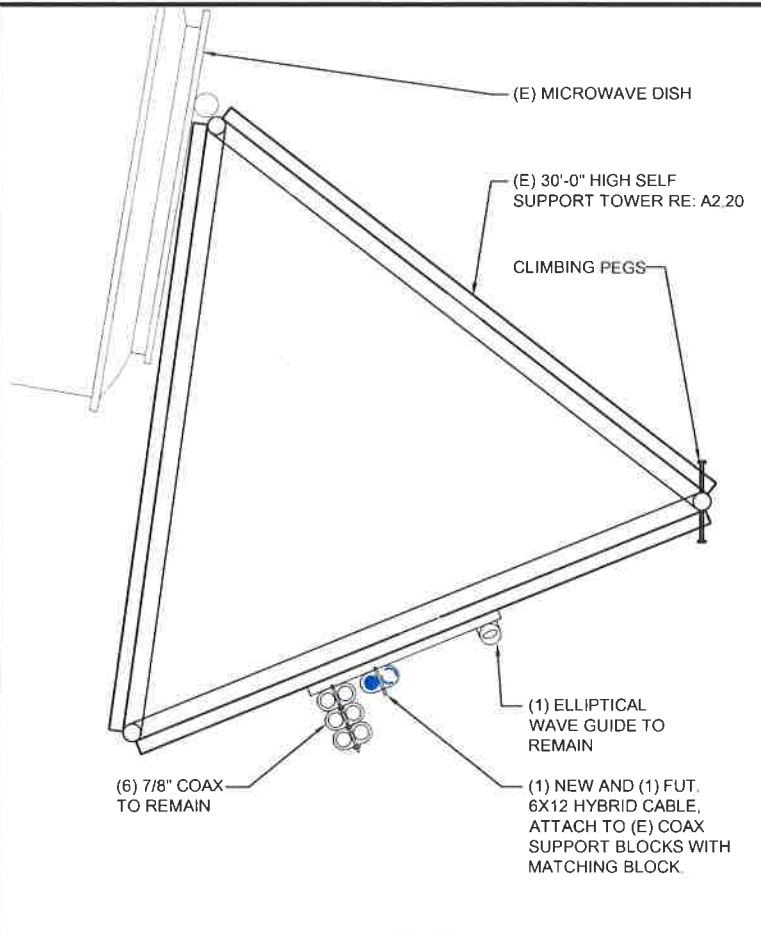
ARCHITECTURE

5935 SOUTH ZANG STREET, SUITE 280
LITTLETON, COLORADO 80127
OFFICE: 303.932.9974

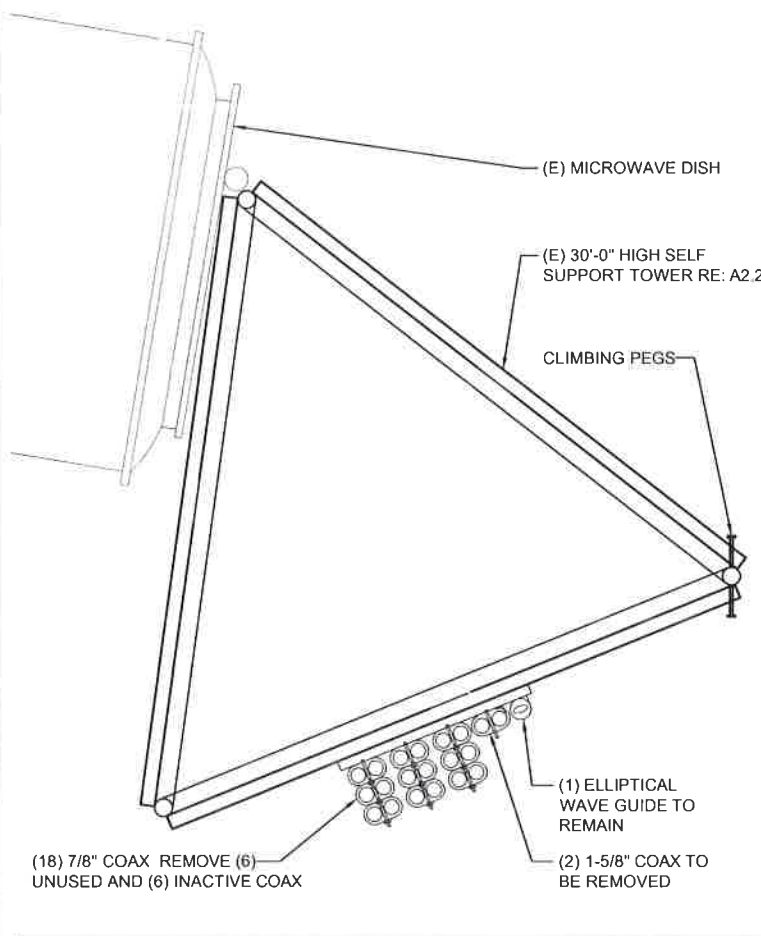


SOUTH ELEVATION

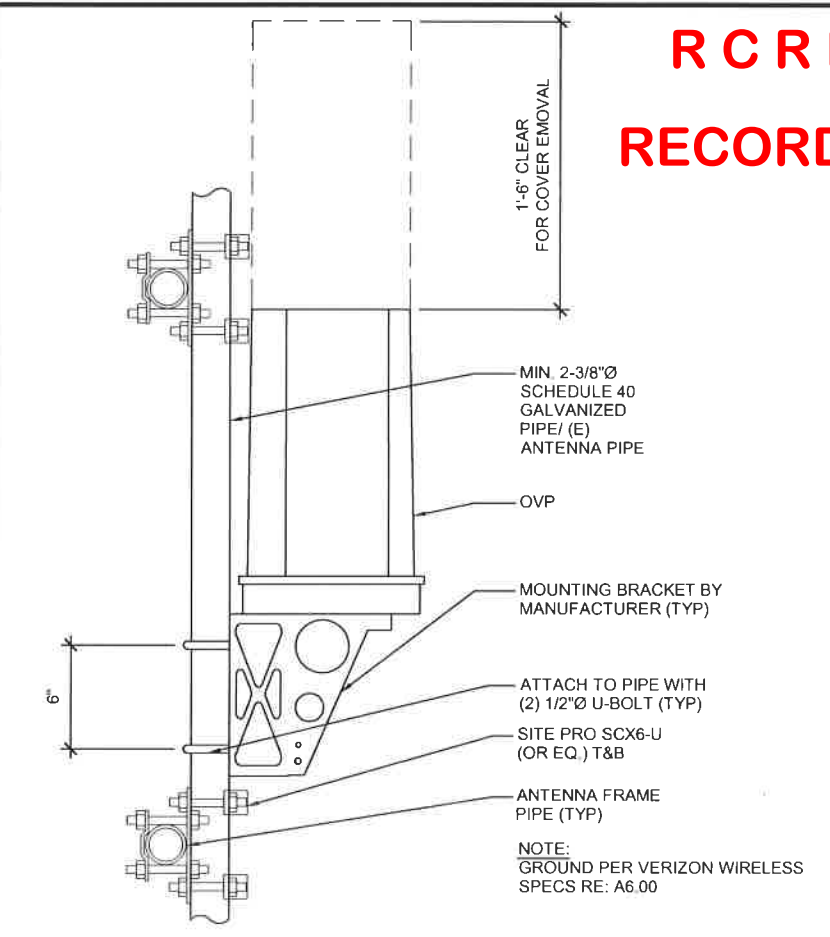
A3.00



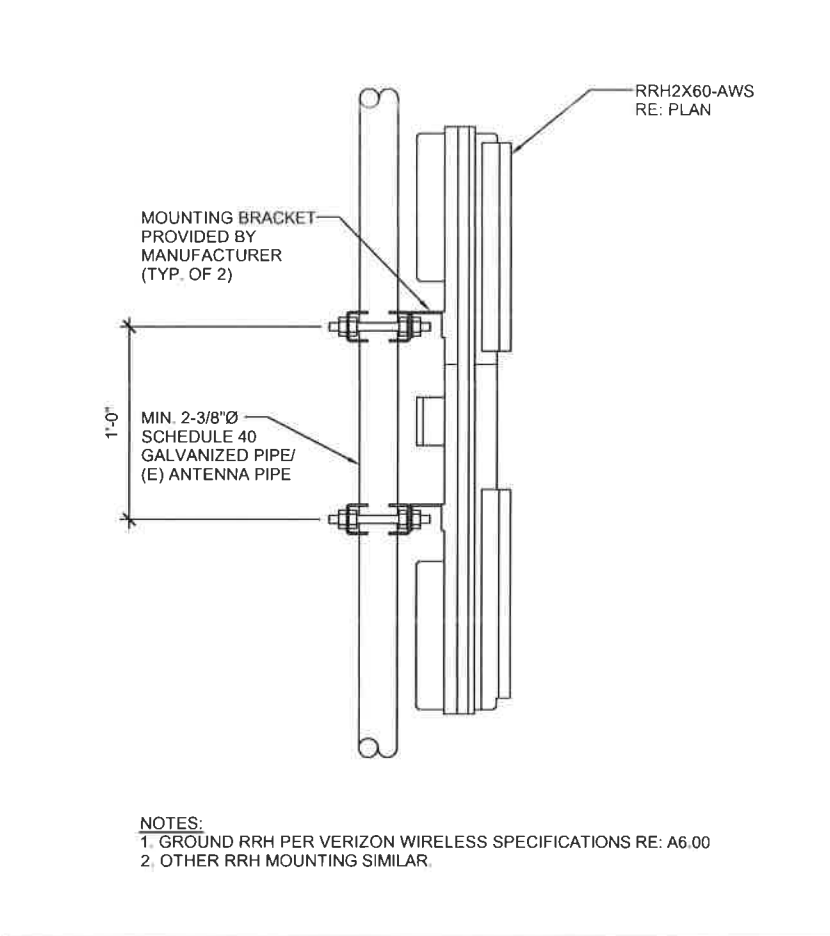
5 - COAX ROUTING PLAN N.T.S.



4 - COAX DEMO PLAN N.T.S.



3 - OVP MOUNTING DETAIL N.T.S.



2 - RRH MOUNTING DETAIL N.T.S.

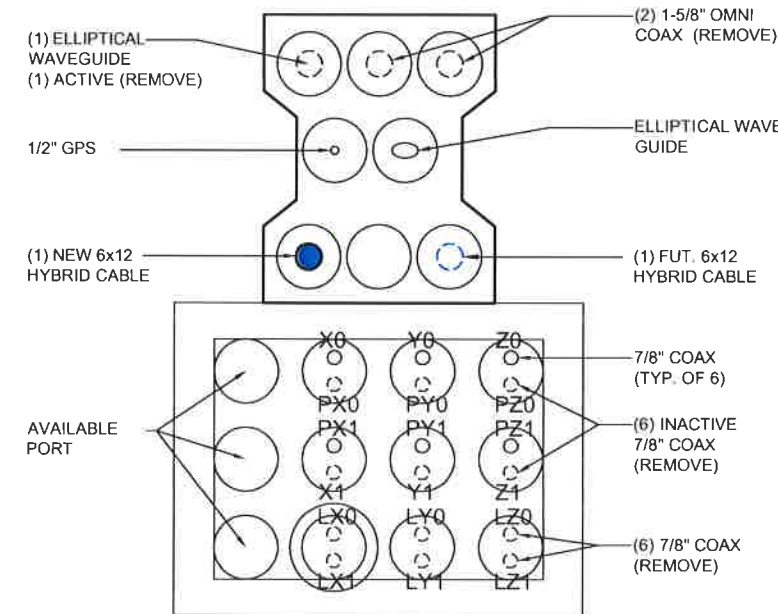
RCRBD RECORD SET



EXTERIOR VIEW



INTERIOR VIEW



1 - COAX PORT DETAIL N.T.S.

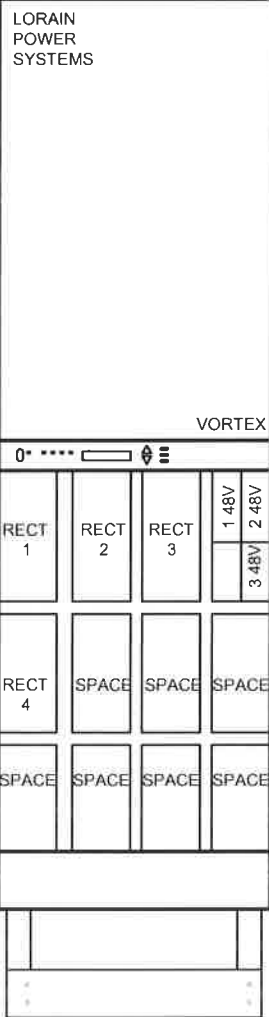
RCRBD RECORD SET ELECTRICAL

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PLOTTED Oct 25, 2016 AT 4:23pm

GENERAL CONSTRUCTION
HYBRID & COAX CABLES
POWER/GROUNDING
FIBER
ANTENNAS
RRH/JBBU
PENETRATIONS

PDF RACK

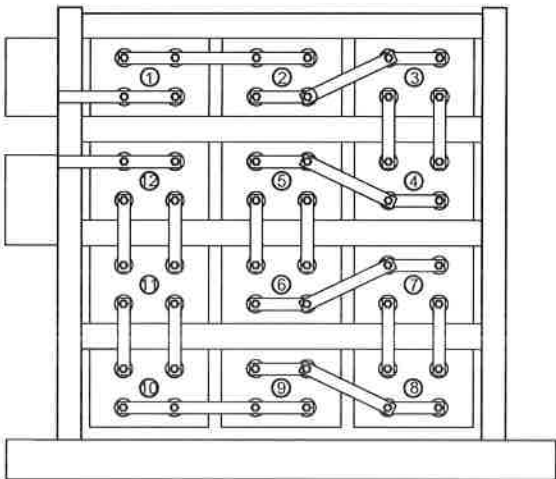
LORAIN POWER SYSTEMS
VORTEX RECTIFIERS
(4) 24 VDC RECTIFIERS IN USE
SYSTEM LOAD 24VDC 212A
(3) -48 VDC RECTIFIERS IN USE
PCU LOAD 214A



R C R B D
RECORD SET

BATTERY RACK

2SLA1500
(12) CELLS
WARRANTEE DATE: 09/21/24
SHIP DATE: 09/21/12



NOTES:
1. ALL OTHER EQUIPMENT NOT
SHOWN FOR CLARITY
2. ALL ITEMS ARE EXISTING U.N.O.
3. COLOR ON DRAWING
REPRESENTS NEW WORK

2 - HAZMAT RACK ELEVATION



FLOOR BOLTED STACKABLE
STEEL SEISMIC TRAY FRAME
SYSTEM PROVIDED WITH
BATTERIES BY
MANUFACTURER RE: 3/G1.00

SPILL CONTAINMENT

1 - HAZMAT RACK PHOTOS

verizon
VERIZON WIRELESS SERVICES
3131 S. VAUGHN WAY, SUITE 550
AURORA, CO 80014

PROJECT INFORMATION

SITE NAME
CO1 HAYDEN
SITE I.D.
803
N 40°27'47.4", W 107°6'41.7"
ROUETT COUNTY, CO
CONSULTANT

A 08/29/16 CD REVIEW DPL
B 09/15/16 CLIENT COMMENTS DPL
O 10/25/16 CD ISSUE DPL

R C R B D
RECORD SET
ELECTRICAL

1st REVIEW RSS 2nd REVIEW SB

**CHARLES
STECKLY**
ARCHITECTURE
5935 SOUTH ZANG STREET, SUITE 280
LITTLETON, COLORADO 80127
OFFICE: 303.932.9974



HAZMAT RACK
ELEVATION

A5.00

GENERAL CONSTRUCTION

HYBRID & COAX CABLES

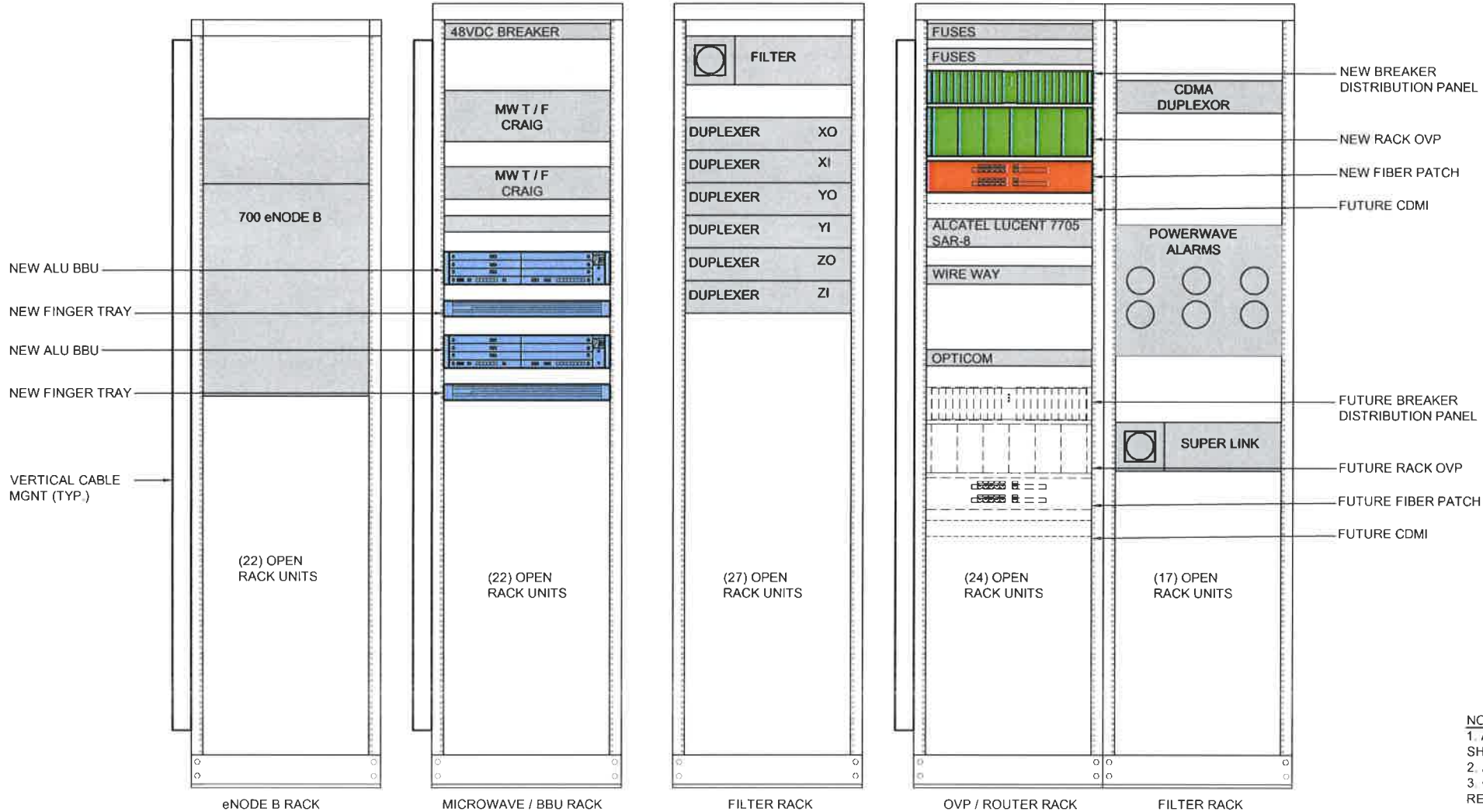
POWER/GROUNDING

FIBER

ANTENNAS

RRH/BBU

PENETRATIONS



NOTES:
1. ALL OTHER EQUIPMENT NOT SHOWN FOR CLARITY
2. ALL ITEMS ARE EXISTING U.N.O.
3. COLOR ON DRAWING REPRESENTS NEW WORK.

verizon
VERIZON WIRELESS SERVICES
3131 S. VAUGHN WAY, SUITE 550
AURORA, CO 80014

PROJECT INFORMATION

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CO1 HAYDEN

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N 40°27'47.4", W 107°6'41.7"
ROUTT COUNTY, CO

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R C R B D
RECORD SET
ELECTRICAL

1st REVIEW RSS 2nd REVIEW SB

CHARLES STECKLY
ARCHITECTURE

5935 SOUTH ZANG STREET, SUITE 280
LITTLETON, COLORADO 80127
OFFICE: 303.932.9974

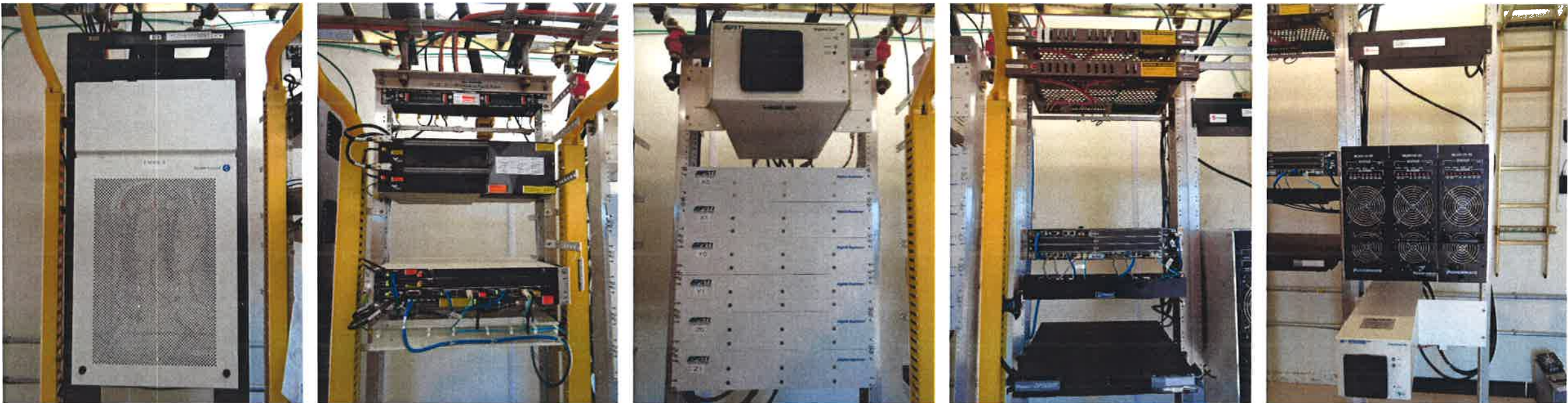
STATE OF COLORADO
Charles Nelson Steckly
202802
OCT 25 2016
LICENSED ARCHITECT

RACK ELEVATION

A5.10

2 - RACK ELEVATION

1/2" = 1'-0"



1 - RACK PHOTOS

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PLOTED Oct 25, 2016 AT 4:23pm

GENERAL CONSTRUCTION

HYBRID & COAX CABLES

POWER/GROUNDING

FIBER

ANTENNAS

RRH/BBU

PENETRATIONS

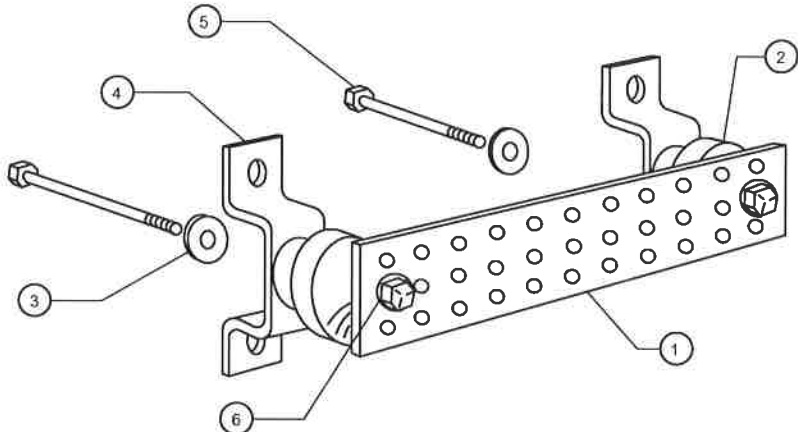
GROUNDING NOTES

- REFER TO VERIZON WIRELESS GROUNDING SPECIFICATIONS FOR ALL GROUNDING REQUIREMENTS.
- BOND AND GROUND ANY PROPOSED STRUCTURAL STEEL, CONCRETE REINFORCING AND OTHER METALLIC BUILDING ELEMENTS, REFER TO VERIZON WIRELESS SPECIFICATIONS FOR EXACT REQUIREMENTS.
- THE ELECTRICAL CONTRACTOR SHALL PERFORM ALL BONDING AND GROUNDING TO THE SITE'S OUTER GROUNDING SYSTEM DURING THE CONSTRUCTION PHASE OF THE BUILDING.
- CONTRACTOR IS TO CONDUCT FREQUENT INSPECTIONS DURING THE CONSTRUCTION PHASE TO ENSURE THAT ALL GROUNDING ARRANGEMENTS ARE MADE ACCORDING TO THE GROUNDING DESIGN SPECIFICATIONS.
- DO NOT RETROFIT (OR UPGRADE) ESTABLISHED SITES THAT DO NOT MEET ALL THE REQUIREMENTS OF VERIZON WIRELESS GROUNDING STANDARD UNLESS THERE ARE DOCUMENTED OCCURRENCES OF EQUIPMENT DAMAGES AND/OR SERVICE AFFECTING CONDITIONS.
- USE ONLY VERIZON WIRELESS-APPROVED MATERIALS SUCH AS COPPER FOR MOST ELECTRICAL WORK AND ALUMINUM FOR CERTAIN APPLICATIONS FOR SITE GROUNDING SYSTEM, ELECTRICAL PROTECTION COMPONENTS AND AC WIRING. USE THE SAME METAL THROUGHOUT THE GROUND SYSTEM WHEN POSSIBLE.
- IF DIFFERENT METALS MUST BE CONNECTED, BOND THEM BY EXOTHERMICALLY WELDING THEM TOGETHER.
- USE TINNED COPPER WHEN CONNECTING TO GALVANIZED STEEL.
- DO NOT BOND COPPER AND ALUMINUM TOGETHER UNLESS USING SPECIFICALLY DESIGNED EXOTHERMIC MATERIALS DESIGNED FOR THIS APPLICATION ARE USED OR A BIMETALLIC TRANSITIONAL CONNECTION IS UTILIZED.
- MAKE ALL BONDING ATTACHMENTS TO CLEAN, UNPAINTED METAL SURFACES OR USE APPROVED PAINT PIERCING WASHERS.
- PAINTED SURFACES MUST BE SCRAPPED, CLEANED, AND LIGHTLY COATED WITH THE APPLICABLE COMPOUND.
- ALL INDOOR OR OUTDOOR POWER OR GROUNDING CONNECTIONS SHALL BE PROTECTED AGAINST CORROSION BY USE OF A THIN COATING OF ANTI-OXIDATION COMPOUND. A COPPER COSMOLINE GREASE BASED COMPOUND (NO OX-ID) SHALL BE USED ON ALL COPPER TO COPPER CONNECTIONS. A ZINC BASED (GREY COLORED) COMPOUND SHALL BE USED ON ALL COPPER TO STEEL CONNECTIONS. WHERE OTHER COMPOUNDS SUCH AS KOPPER-SHIELD ETC EXIST, THEY MAY BE 'GRANDFATHERED' IN PLACE. PENTROX GREASE OR AN APPROVED EQUAL SHALL BE USED ON ALUMINUM CONNECTIONS.
- DO NOT WELD GROUNDING CONDUCTORS TO THE STRUCTURAL MEMBERS OF TOWERS, INCLUDING DOWN GUYS AND ANCHOR RODS.
- BOND ALL METALLIC OBJECTS (SUCH AS WATER PIPES, CONDUITS, METAL FUEL TANKS WITHOUT CATHODIC PROTECTION, METAL FENCES, HVAC, ETC.) THAT ARE WITHIN 6 FEET (1.8 M) OF THE GROUND RING, OR FROM ANY OTHER GROUNDED CONDUCTOR, TO GROUND RING OR TO THE GROUNDED CONDUCTOR. HARDWARE ALL OUTDOOR HARDWARE (BOLTS, SCREWS, NUTS, WASHERS) SHALL BE 18-8 STAINLESS STEEL TYPE GRADE. INDOORS, GRADE 5 STEEL HARDWARE MAY BE USED. CHOOSE BOLT LENGTH TO ALLOW THE EXPOSURE OF AT LEAST TWO THREADS.
- WHEN BONDING TO A METALLIC OBJECT WHERE ACCESS IS LIMITED TO ONLY ONE SURFACE, USE DRILLING & TAPPING OR SELF DRILLING SCREWS. DO NOT USE SHEET METAL SCREWS.
- ALL GROUNDING CONDUCTORS SHOULD PRESERVE A DOWNWARD TO HORIZONTAL COURSE AND BE AS STRAIGHT AS POSSIBLE AND AVOID SHARP TURNS.
- DO NOT USE U-SHAPED GROUNDING CONDUCTOR RUNS (U-TURNS IN THE WIRING) OR BONDING LAYOUTS TO REDUCE ARC-OVERS.
- ALL GROUNDING CONDUCTS MUST BE RUN IN NONMETALLIC CONDUIT. ROUTE ALL CONDUCTORS THROUGH NONMETALLIC SLEEVES WHEN PENETRATING FLOORS, CEILINGS, AND WALLS.
- IF THE USE OF METALLIC CONDUIT CANNOT BE AVOIDED, BOND BOTH ENDS OF THE CONDUIT TO THE GROUNDING CONDUCTOR BEING ROUTED THROUGH THE CONDUIT.
- KEEP LENGTHS OF CONDUCTORS TO A MINIMUM.
- USE MULTIPLE CONDUCTING PATHS. PARALLEL PATHS ARE ONLY DESIRABLE WHEN SENSITIVE ELECTRONIC EQUIPMENT IS NOT PART OF THE CONDUCTOR PATH.
- KEEP BENDS IN CONDUCTORS TO A MINIMUM.
- THE MINIMUM INSIDE BENDING RADIUS IS:
 - 6 INCHES (0.15M) FOR CONDUCTORS UP TO #6 GAUGE.
 - 12 INCHES (0.3M) FOR CONDUCTORS #6 TO #4/0 GAUGE.
 - 24 INCHES (0.6M) FOR CONDUCTORS #4/0 GAUGE AND LARGER.
- GROUND CONDUCTORS MUST NEVER BE ENCIRCLED WITH FERROUS METAL CLAMPS, PLACED THROUGH METAL WALLS, METAL PLATES, OR SHORT SECTIONS OF METAL CONDUIT, AND MUST NEVER BE PLACED IN THE SAME CABLE RACK AS DC POWER CABLES, HIGH FREQUENCY CABLES, ETC.
- WHEN ATTACHING PVC CONDUITS TO ANY SURFACE UTILIZE NONCONDUCTIVE FASTENERS OR NONFERROUS FASTENERS ONLY.
- IF CONNECTIONS BETWEEN ALUMINUM CONDUCTORS AND STEEL OBJECTS MUST BE MADE, TINNED LUGS AND PENTROX SHALL BE USED. WHERE THERE ARE CONCERNS THAT THE PENTROX MAY NOT PROVIDE ADEQUATE INTERFACING, THEN A BIMETAL SPLICE BETWEEN THE ALUMINUM CONDUCTOR AND A SHORT LENGTH OF COPPER CONDUCTOR MAY BE USED.
- ALL OF THE BONDING AND GROUNDING CONDUCTORS SPECIFIED FOR ROOFTOP CELL AND MICROWAVE SYSTEMS IS BARE WIRE. INSULATED WIRE SHALL NOT BE SPECIFIED OR SUBSTITUTED FOR THE BONDING AND GROUNDING CONDUCTORS OF ROOFTOP INSTALLATIONS.

4 - GROUNDING NOTES

- KEY NOTES:
- 1) COPPER GROUND BAR OR APPROVED EQUAL, 1/4" x 4" X 12" HOLE CENTERS TO MATCH NEMA DOUBLE LUG CONFIGURATION.
 - 2) SPACERS AS REQUIRED
 - 3) 5/8" LOCKWASHERS
 - 4) WALL MOUNTING BRACKET
 - 5) 5/8" -11 H.H.C.S. BOLTS (VERIFY LENGTH)
 - 6) USE TAMPER RESISTANT MOUNTING HARDWARE

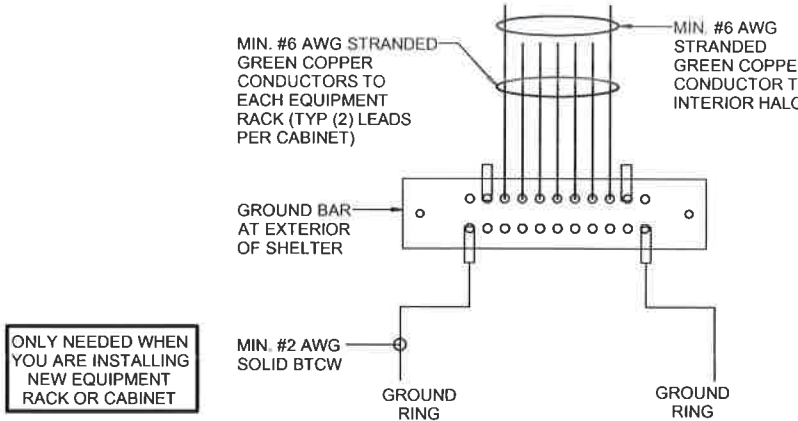
ONLY NEEDED WHEN YOU ARE INSTALLING NEW GROUND BAR



- NOTES:
1. THE DISTANCE BETWEEN COAXIAL CABLE SHIELD CIGBE BARS SHALL NOT EXCEED 100'. THIS MAY REQUIRE BONDING AT THE TOP, BOTTOM AND TWO LOCATIONS IN THE MIDDLE OF THE TOWER FOR TALLER TOWERS. EACH RF CABLE SHIELD SHALL BE BONDED AT A MINIMUM OF TWO (2) POINTS ON THE TOWER (TOP AND BOTTOM).

3 - GROUND BAR DETAIL

N.T.S.

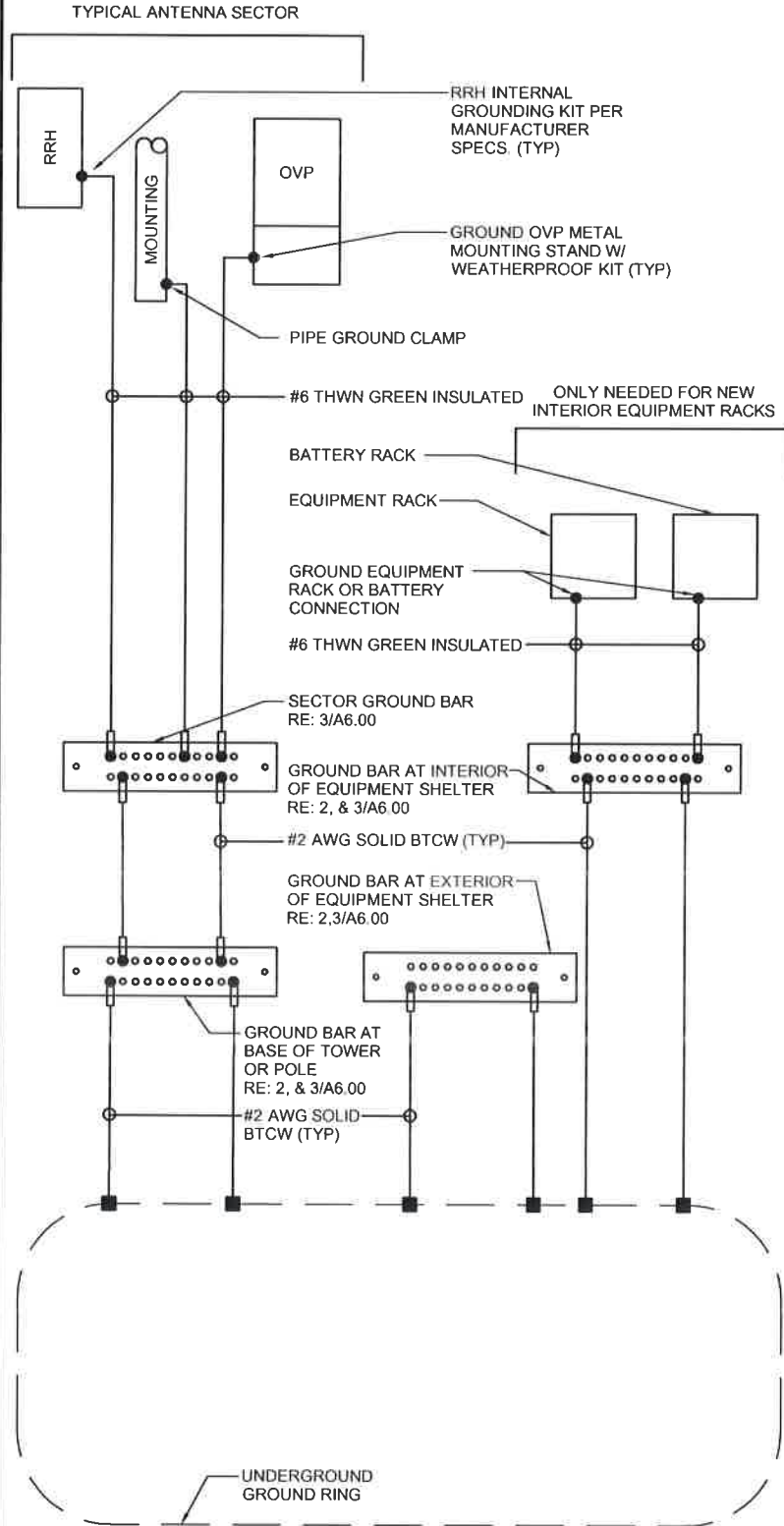


ONLY NEEDED WHEN YOU ARE INSTALLING NEW EQUIPMENT RACK OR CABINET

- NOTES:
1. VERIFY EXISTING INTERIOR GROUNDING IS SUFFICIENT FOR NEW EQUIPMENT INSTALLATION AND GROUND ALL NEW INSTALLED EQUIPMENT AS REQUIRED BY VERIZON WIRELESS STANDARDS
 2. CONNECT THE EQUIPMENT FRAMES TO THE MGB/FGB, USING A MINIMUM OF #6 AWG STRANDED COPPER, GREEN-INSULATED CONDUCTOR. TO ASSURE A GOOD CONNECTION AT THE FRAME, CLEAN THE CONNECTION POINT ON THE FRAME TO BARE METAL, APPLY AN ANTI-OXIDATION COMPOUND, AND CONNECT USING A TWO-HOLE, LONG-BARREL COMPRESSION LUG. SOME EXISTING SITES MAY BE USING SINGLE HOLE LUGS FOR THESE PURPOSES. THESE CONNECTIONS SHOULD NOT BE REPLACED "IF" THE RUNS ARE TO SHORT AND THERE IS NO LIKELIHOOD OF MECHANICAL STRESS ON THE CABLE THAT WOULD LOOSEN THESE CONNECTIONS.
 3. DC DISTRIBUTION PANELS, CHASSIS, BATTERY RACKS, FRAMES AND CHASSIS OF RECTIFIERS AND RECTIFIERS SHOULD BE BONDED DIRECTLY TO THE MGB/FGB. WHEN UTILIZING AN INTEGRATED DC/DC CONVERTER SYSTEM, THE 48-VOLT RETURN DISTRIBUTION BAR SHALL BE BONDED TO THE 24-VOLT RETURN DISTRIBUTION BAR WITH A MINIMUM CONDUCTOR SIZE OF A #2, STRANDED COPPER CONDUCTOR, IN A WIRELESS SHELTER WITH A DEDICATED 48-VOLT PLANT. THE 48-VOLT RETURN DISTRIBUTION BAR SHALL BE BONDED TO THE MGB. ALL BATTERY FRAMES SHALL BE BONDED TO THE MGB WITH A #6 GREEN THWN INSULATED CONDUCTOR. (ONLY APPLICABLE WHEN MODIFICATIONS ARE REQUIRED TO THE BATTERY OR POWER PLANT.)
 4. VERIFY (E) SYSTEM IS PER ATTACHED NOTES AND DETAILS AND IF NOT NOTIFY P.M. FOR REQUIRED UPGRADES.

2 - INTERIOR GROUNDING

N.T.S.



- COMPRESSION TYPE CONNECTION
- EXOTHERMIC WELD

NOTE:
GROUNDING SCHEMATIC IS DIAGRAMMATIC AND DOES NOT REFLECT ACTUAL EQUIPMENT LAYOUT ORIENTATION. REFER TO PLANS FOR DIRECTION.

1 - GROUNDING SCHEMATIC

N.T.S.

verizon
VERIZON WIRELESS SERVICES
3131 S. VAUGHN WAY, SUITE 550
AURORA, CO 80014

PROJECT INFORMATION

SITE NAME

CO1 HAYDEN

SITE I.D.

803

N 40°27'47.4", W 107°6'41.7"
ROUTT COUNTY, CO

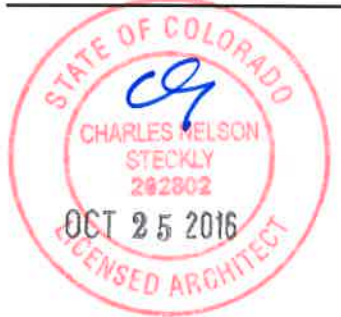
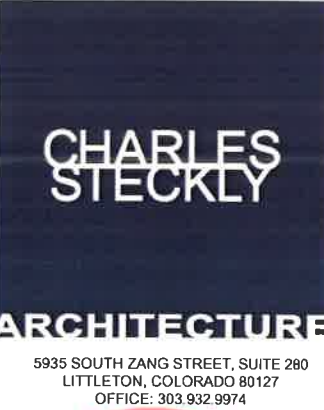
CONSULTANT

A	08/29/16	CD REVIEW	DPL
B	09/15/16	CLIENT COMMENTS	DPL
O	10/25/16	CD ISSUE	DPL

R C R B D

RECORD SET
ELECTRICAL

1st REVIEW RSS 2nd REVIEW SB



GROUNDING SCHEMATIC

A6.00



Otegui Structural Services, LLC

10812 West Powers Place Littleton, CO 80127

Phone: 720-981-5333

e-mail: mikeo@oteguieng.com

October 26, 2012

Charles Steckly
Charles Steckly Architecture
5935 S. Zang St
Suite 280
Littleton, CO 80127

**R C R B D
RECORD SET**

RE:CO1 Hayden
N:40-24-47.4 W:-107-6-41.7
Routt County, Colorado
Verizon Wireless # 803

Dear Charles:

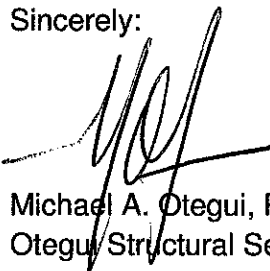
I am writing you this letter in response to your request for analysis of an existing 30'-0" three sided Rohn self supported tower with the intent to remove existing Omni antennas and replace with new flat panel antennas and 7/8" coax lines.

Analysis was done using the following: TIA/EIA-222-G code, 90 mph (3-sec gust), Exposure C, or 50 mph with 1/2" ice for maximum stress calculations, and a 60 mph wind speed for deflection calculations.

Our analysis based on the information in the attached report finds that the tower will have a **rating of 57%, or satisfactory** for the new loading conditions. Please refer to the attached report for more details.

Please feel free to call us with any questions or concerns.

Sincerely:



Michael A. Otegui, P.E.
Otegui Structural Services, LLC



GENERAL

The purpose of this report is to analyze an existing Rohn three sided self supporting tower with the intent to remove existing Omni antennas and coax, and install (15) new flat panel antennas and coax to determine if it complies with the TIA/EIA-222-G code and the current International Building Code.

The tower is 30 ft tall with steel pipe legs and steel pipe diagonals. See attached output for a more detailed description of geometry.

The existing tower is located in Routt County, Colorado. Wind load of 90 mph (3-sec gust), exposure C is required for the County. Tower is located on top of a hill therefore a topographic category of 3 was used.

INFORMATION PROVIDED FOR ANALYSIS

Analysis was based on tower drawings by Rohn Communications Corporation dated 1996, a report by Tower Technologies Inc. dated 2002, and a report by BCI Wireless dated 2007. All framing member sizes and steel grades were taken from these reports.

ASSUMPTIONS

Tower is assumed to be in good condition with no modifications from original design. All appurtenance information were provided by others.

DESIGN CRITERIA

The following is the design criteria used for this report:

- Tower is located in Routt County, Colorado.
- Basic wind speed of 90 mph.
- Structure Class III.
- Exposure Category C.
- Topographic Category 3.
- Crest Height 200 ft.
- Nominal ice thickness of 0.500 in.
- Ice thickness is considered to increase with height.
- Ice density of 56 pcf.
- A wind speed of 50 mph is used in combination with ice.
- Temperature drop of 50 °F.
- Deflections calculated using a wind speed of 60 mph.
- Pressures are calculated at each section.
- Stress ratio used in tower member design is 1.

APPURTENANCES

The following appurtenances attached to the tower were used in the analysis:

- (2) 7'-10"x10" LPD-6516 flat panel antennas at elevation 30' **(new)**
- (2) 5'-11"x6" LPA-185063-12CF flat panel antennas at elevation 30' **(new)**
- (4) 5'-11"x4" LPA-185080-12CF flat panel antennas at elevation 30' **(new)**
- (1) 7'-11"x11" BXA-70063-8CF flat panel antenna at elevation 30' **(new)**
- (2) 5'-11"x8" BXA-70080-6CF flat panel antenna at elevation 30' **(new)**
- (4) 5'-11"x6" LPA-80080-6CF flat panel antennas at elevation 30' **(new)**
- (18) 7/8" coax to elevation 30' **(new)**
- (1) 8'-0" diameter Microwave Dish with 7/8" Coax (existing)
- (1) Lightning rod **(new)**
- Feed line ladder full height (existing)

RESULTS

The analysis finds that the tower will have a rating of 57%. That is, the highest stress on any one member is at 57% of its code allowed maximum.

Highest stressed members are as follows:

Diagonals	57%
Leg	51%
Bolts	24%

Maximum deflections at service loading can be expected as follows:

Elevation	Deflection	Tilt	Twist
175ft	0.11"	0.02°	0.02°

Un-Factored total foundation reactions are as follows: Shear = 8 kips, Vertical = 14 kips, Overturning moment = 179 kip-ft. All values are in the range of the Rohn design values of: Shear =15 kips, Vertical = 44 kips, Overturning moment = 313 kip-ft. Therefore it can be assumed that the existing foundations are adequate for the new loading.

See output for a more detailed summary of all members.

CONCLUSIONS

In our opinion the tower is **adequate** for the addition of new coax cables and flat panel antennas described above.

No attempt was made by Otegui Structural Services LLC to verify sizes, elevations or condition of the existing tower or framing. All framing information used in this report was provided by others. It is assumed that the tower is in good condition with no deterioration. Owner should verify that the tower is in good condition. This report does not imply a warranty for the tower.

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
8' Lightning Rod	35	LPA-80080/6CF	30
LPA-185063-12CF-EDIN	30	LPA-80080/6CF	30
BXA-70063-8CF-DIN-X-FP	30	LPA-185080-12CF	30
LPD-6516 w/Mount Pipe	30	LPA-185080-12CF	30
LPD-6516 w/Mount Pipe	30	BXA-7080-6CF	30
LPA-80080/6CF	30	VFA12-U 12'-6" V-Frame	30
LPA-80080/6CF	30	VFA12-U 12'-6" V-Frame	30
LPA-185080-12CF	30	VFA12-U 12'-6" V-Frame	30
LPA-185080-12CF	30	LPA-185063-12CF-EDIN	30
BXA-7080-6CF	30	8' PAD w/ Radome	20

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 Routt County, Colorado.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 90 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50 mph basic wind with 0.50 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class III.
7. Topographic Category 3 with Crest Height of 200.000 ft

30.0 ft

0.0 ft

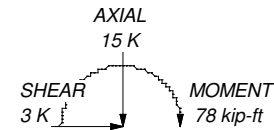
ALL REACTIONS
ARE FACTORED

MAX. CORNER REACTIONS AT BASE:

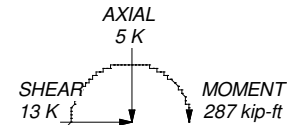
DOWN: 39 K

UPLIFT: -38 K

SHEAR: 6 K



TORQUE 2 kip-ft
50 mph WIND - 0.500 in ICE



TORQUE 11 kip-ft
REACTIONS - 90 mph WIND

Otegui Structural Services, LLC

10812 West Powers Place

Littleton, CO 80127

Phone: 720-981-5333

FAX:

Job: **CO1 Hayden**

Project: **212120**

Client: Verizon Wireless

Drawn by: Mike Otegui

App'd:

Code: TIA-222-G

Date: 10/26/12

Scale: NTS

Path: C:\Otegui Structural Services\Job Files\212120-CO1 Hayden\212120-CO1 Hayden.dwg

Dwg No. E-1

Stress Distribution Chart

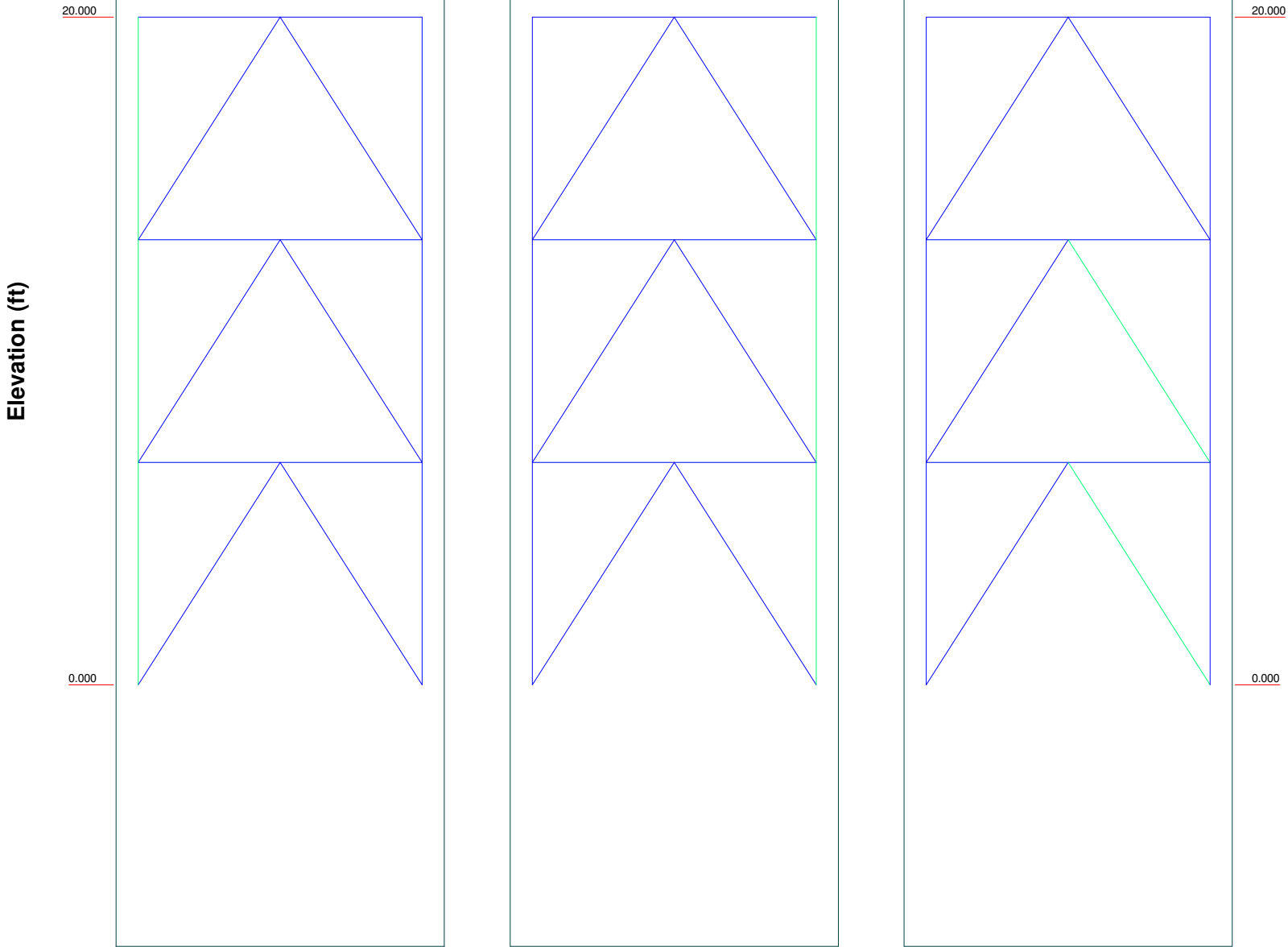
0' - 20'

> 100% 90%-100% 75%-90% 50%-75% < 50% Overstress

Face A

Face B

Face C



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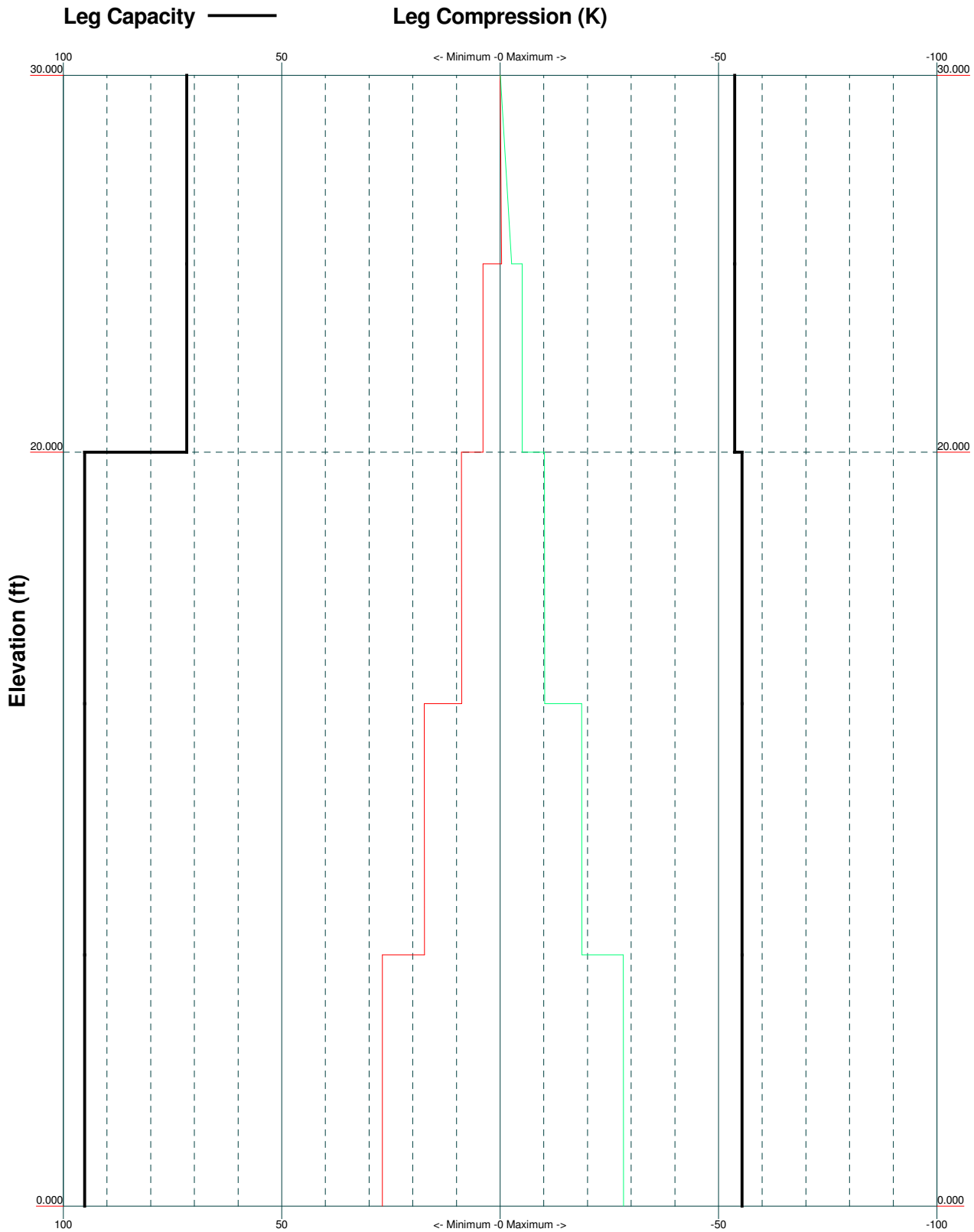
Date: 10/26/12

Scale: NTS

Path: C:\Otegui Structural Services\Job Files\212120-CO1 Hayden\212120-CO1 Hayden.dwg

Dwg No. E-8

TIA-222-G - 90 mph/50 mph 0.500 in Ice Exposure C



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App'd:

Code: TIA-222-G

Date: 10/26/12

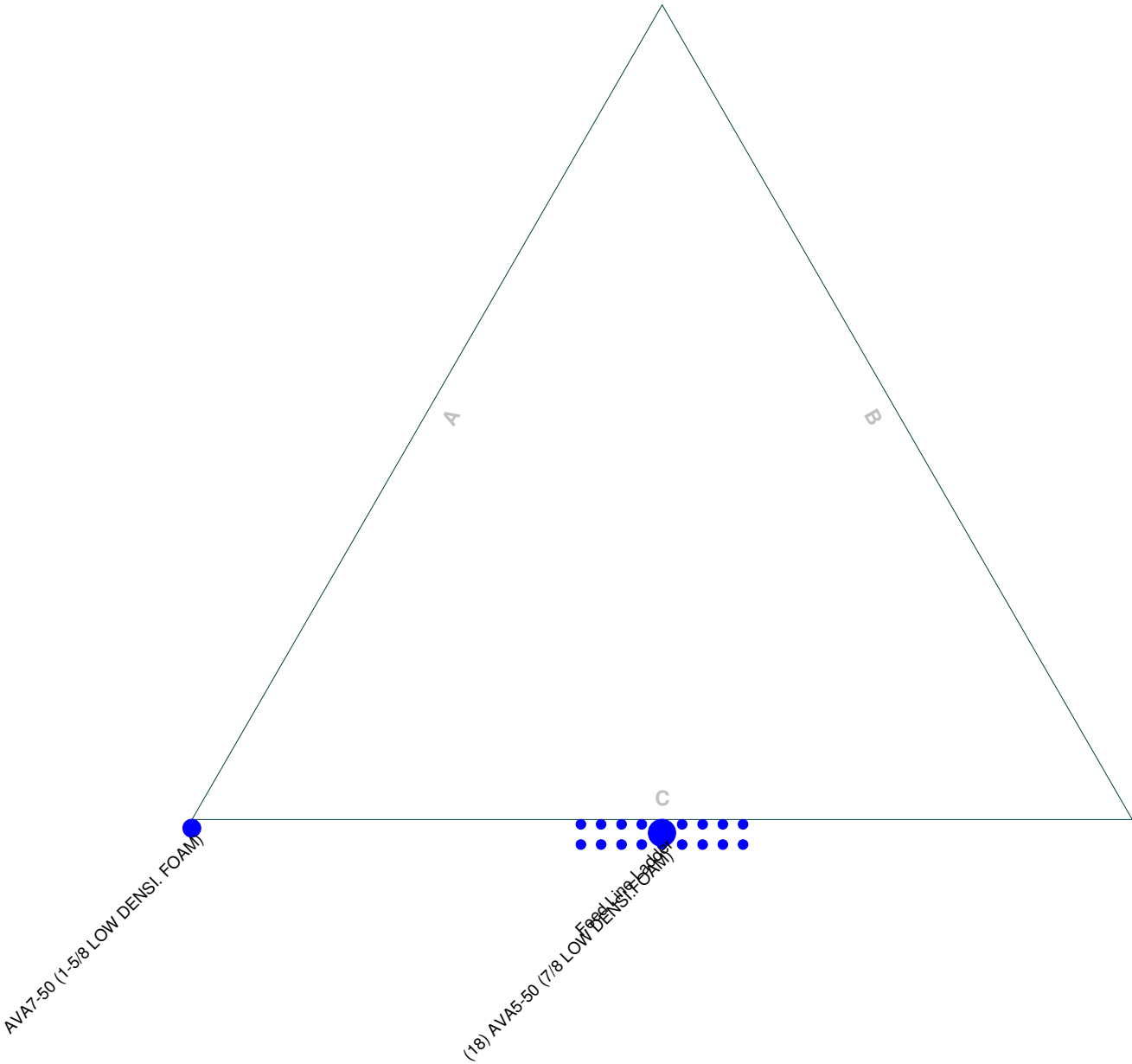
Scale: NTS

Path: C:\Otegui Structural Services\Job Files\212120-CO1 Hayden\212120-CO1 Hayden.er

Dwg No. E-3

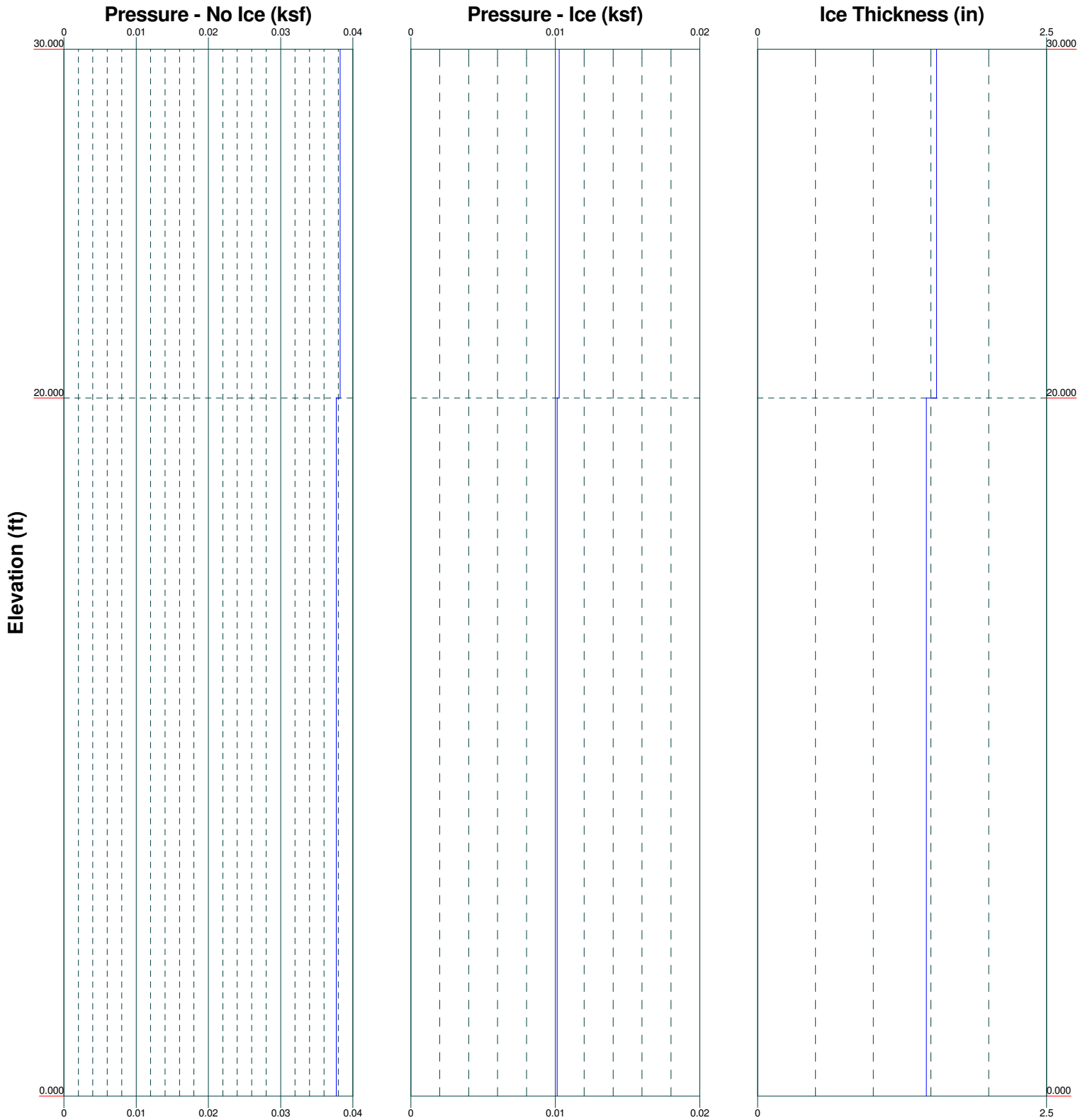
Feedline Plan

Round Flat App In Face App Out Face



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Project: 212120				Client: Verizon Wireless		
Code: TIA-222-G				Date: 10/26/12		Scale: NTS
Path: C:\Otegui Structural Services\Job Files\212120-CO1 Hayden\212120-CO1 Hayden.er				Dwg No. E-7		

Wind Pressures and Ice Thickness
TIA-222-G - 90 mph/50 mph 0.500 in Ice Exposure C



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Littleton, CO 80127

Phone: 720-981-5333

FAX:

Job: **CO1 Hayden**

Project: **212120**

Client: Verizon Wireless

Drawn by: Mike Otegui

App'd:

Code: TIA-222-G

Date: 10/26/12

Scale: NTS

Path: C:\Otegui Structural Services\Job Files\212120-CO1 Hayden\212120-CO1 Hayden.er

Dwg No. E-9

<i>tnxTower</i> <i>Otegui Structural Services, LLC</i> 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job CO1 Hayden	Page 1 of 19
	Project 212120	Date 10:52:46 10/26/12
	Client Verizon Wireless	Designed by Mike Otegui

Tower Input Data

The main tower is a 3x free standing tower with an overall height of 30.000 ft above the ground line.

The base of the tower is set at an elevation of 0.000 ft above the ground line.

The face width of the tower is 8.500 ft at the top and 8.500 ft at the base.

This tower is designed using the TIA-222-G standard.

The following design criteria apply:

Tower is located in Routt County, Colorado.

Basic wind speed of 90 mph.

Structure Class III.

Exposure Category C.

Topographic Category 3.

Crest Height 200.000 ft.

Nominal ice thickness of 0.500 in.

Ice thickness is considered to increase with height.

Ice density of 56 pcf.

A wind speed of 50 mph is used in combination with ice.

Temperature drop of 50 °F.

Deflections calculated using a wind speed of 60 mph.

A non-linear (P-delta) analysis was used.

Pressures are calculated at each section.

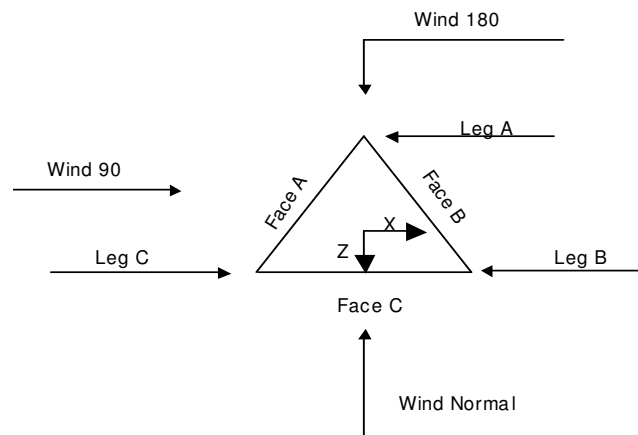
Stress ratio used in tower member design is 1.

Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

Consider Moments - Legs	Distribute Leg Loads As Uniform	Treat Feedline Bundles As Cylinder
Consider Moments - Horizontals	Assume Legs Pinned	Use ASCE 10 X-Brace Ly Rules
Consider Moments - Diagonals	√ Assume Rigid Index Plate	√ Calculate Redundant Bracing Forces
Use Moment Magnification	√ Use Clear Spans For Wind Area	Ignore Redundant Members in FEA
√ Use Code Stress Ratios	√ Use Clear Spans For KL/r	SR Leg Bolts Resist Compression
√ Use Code Safety Factors - Guys	√ Retension Guys To Initial Tension	√ All Leg Panels Have Same Allowable
Escalate Ice	Bypass Mast Stability Checks	Offset Girt At Foundation
Always Use Max Kz	√ Use Azimuth Dish Coefficients	√ Consider Feedline Torque
Use Special Wind Profile	√ Project Wind Area of Appurt.	Include Angle Block Shear Check
√ Include Bolts In Member Capacity	√ Autocalc Torque Arm Areas	Poles
√ Leg Bolts Are At Top Of Section	SR Members Have Cut Ends	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
Add IBC .6D+W Combination		

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	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	ft			ft		ft
T1	30.000-20.000			8.500	1	10.000
T2	20.000-0.000			8.500	1	20.000

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	30.000-20.000	5.000	K Brace Down	No	Yes	0.000	0.000
T2	20.000-0.000	6.667	K Brace Down	No	Yes	0.000	0.000

Tower Section Geometry (cont'd)

Tower Elevation	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
ft						
T1 30.000-20.000	Pipe	HSS2.875x.203	A572-50	Pipe	HSS2.375x.154	A36

<i>tnxTower</i> Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	3 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

<i>Tower Elevation ft</i>	<i>Leg Type</i>	<i>Leg Size</i>	<i>Leg Grade</i>	<i>Diagonal Type</i>	<i>Diagonal Size</i>	<i>Diagonal Grade</i>
T2 20.000-0.000	Pipe	HSS2.875x0.276	(50 ksi) A572-50 (50 ksi)	Pipe	HSS2.375x.154	(36 ksi) A36 (36 ksi)

Tower Section Geometry (cont'd)

<i>Tower Elevation ft</i>	<i>No. of Mid Girts</i>	<i>Mid Girt Type</i>	<i>Mid Girt Size</i>	<i>Mid Girt Grade</i>	<i>Horizontal Type</i>	<i>Horizontal Size</i>	<i>Horizontal Grade</i>
T1 30.000-20.000	None	Flat Bar		A36 (36 ksi)	Pipe	HSS1.9x.145	A36 (36 ksi)
T2 20.000-0.000	None	Flat Bar		A36 (36 ksi)	Pipe	HSS1.9x.145	A36 (36 ksi)

Tower Section Geometry (cont'd)

<i>Tower Elevation ft</i>	<i>Secondary Horizontal Type</i>	<i>Secondary Horizontal Size</i>	<i>Secondary Horizontal Grade</i>	<i>Inner Bracing Type</i>	<i>Inner Bracing Size</i>	<i>Inner Bracing Grade</i>
T1 30.000-20.000	Solid Round		A572-50 (50 ksi)	Single Angle	L2x2x1/8	A36 (36 ksi)
T2 20.000-0.000	Solid Round		A572-50 (50 ksi)	Single Angle	L2x2x1/8	A36 (36 ksi)

Tower Section Geometry (cont'd)

<i>Tower Elevation ft</i>	<i>Gusset Area (per face)</i> <i>ft²</i>	<i>Gusset Thickness</i> <i>in</i>	<i>Gusset Grade</i>	<i>Adjust. Factor A_f</i>	<i>Adjust. Factor A_r</i>	<i>Weight Mult.</i>	<i>Double Angle Stitch Bolt Spacing Diagonals in</i>	<i>Double Angle Stitch Bolt Spacing Horizontal in</i>
T1 30.000-20.000	0.000	0.250	A36 (36 ksi)	1	1	1	36.000	36.000
T2 20.000-0.000	0.000	0.250	A36 (36 ksi)	1	1	1	36.000	36.000

Tower Section Geometry (cont'd)

K Factors¹

tnxTower Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	4 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

Tower Elevation	Calc K Single Angles	Calc K Solid Rounds	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
ft										
T1	Yes	Yes	1	1	1	1	1	1	1	1
30.000-20.000				1	1	1	1	1	1	1
T2	Yes	Yes	1	1	1	1	1	1	1	1
20.000-0.000				1	1	1	1	1	1	1

¹Note: 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	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
30.000-20.000														
T2	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
20.000-0.000														

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	Flange	0.625	4	0.625	3	0.625	2	0.625	2	0.625	0	0.625	2	0.625	0
30.000-20.000		A325N		A325N		A325N		A325N		A325N		A325N		A325N	
T2	Flange	0.750	4	0.625	3	0.625	2	0.625	2	0.625	0	0.625	2	0.625	0
20.000-0.000		A325N		A325N		A325N		A325N		A325N		A325N		A325N	

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight klf
AVA5-50 (7/8 LOW DENSITY FOAM)	C	No	Ar (CaAa)	30.000 - 0.000	0.000	0	18	9	1.100	1.100		0.000
AVA7-50 (1-5/8 LOW DENSITY FOAM)	C	No	Ar (CaAa)	20.000 - 0.000	0.000	0.5	1	1	1.980	1.980		0.001
Feed Line	C	No	Ar (CaAa)	30.000 - 0.000	0.000	0	1	1	3.000	3.000		0.002

tnxTower Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	5 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	# Per Row	# Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight klf
Ladder												

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight K
T1	30.000-20.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	22.697	0.000	0.074
T2	20.000-0.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	49.393	0.000	0.162

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A _R ft ²	A _F ft ²	C _A A _A In Face ft ²	C _A A _A Out Face ft ²	Weight K
T1	30.000-20.000	A	1.548	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	34.492	0.000	0.621
T2	20.000-0.000	A	1.459	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	77.873	0.000	1.330

Feed Line Center of Pressure

Section	Elevation ft	CP _x in	CP _z in	CP _x Ice in	CP _z Ice in
T1	30.000-20.000	0.000	4.758	0.000	3.430
T2	20.000-0.000	-0.619	5.065	-0.856	3.919

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K _a No Ice	K _a Ice
T1	1	AVA5-50 (7/8 LOW DENSIFOAM)	20.00 - 30.00	0.6000	0.6000
T1	3	Feed Line Ladder	20.00 - 30.00	1.0000	1.0000
T2	1	AVA5-50 (7/8 LOW DENSIFOAM)	0.00 - 20.00	0.6000	0.6000
T2	2	AVA7-50 (1-5/8 LOW DENSIFOAM)	0.00 - 20.00	0.6000	0.6000

<i>tnxTower</i> Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	6 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

<i>Tower Section</i>	<i>Feed Line Record No.</i>	<i>Description</i>	<i>Feed Line Segment Elev.</i>	<i>K_a No Ice</i>	<i>K_a Ice</i>
T2	3	DENSI. FOAM) Feed Line Ladder	0.00 - 20.00	1.0000	1.0000

Discrete Tower Loads

<i>Description</i>	<i>Face or Leg</i>	<i>Offset Type</i>	<i>Offsets: Horz Lateral Vert ft ft ft</i>	<i>Azimuth Adjustment °</i>	<i>Placement ft</i>		<i>C_{AA} Front ft²</i>	<i>C_{AA} Side ft²</i>	<i>Weight K</i>
LPA-185063-12CF-EDIN	C	From Face	2.000 3.000 0.000	0.000	30.000	No Ice 1/2" Ice	4.972 5.417	5.094 5.722	0.031 0.070
LPA-185063-12CF-EDIN	C	From Face	2.000 -3.000 0.000	0.000	30.000	No Ice 1/2" Ice	4.972 5.417	5.094 5.722	0.031 0.070
BXA-70063-8CF-DIN-X-FP	C	From Leg	2.000 0.000 0.000	0.000	30.000	No Ice 1/2" Ice	10.656 11.260	7.060 7.914	0.047 0.113
LPD-6516 w/Mount Pipe	C	From Face	2.000 6.000 0.000	0.000	30.000	No Ice 1/2" Ice	12.874 13.594	12.557 13.990	0.090 0.151
LPD-6516 w/Mount Pipe	C	From Face	2.000 -6.000 0.000	0.000	30.000	No Ice 1/2" Ice	12.874 13.594	12.557 13.990	0.090 0.151
LPA-80080/6CF	A	From Face	2.000 6.000 0.000	0.000	30.000	No Ice 1/2" Ice	4.331 4.769	9.694 10.432	0.032 0.087
LPA-80080/6CF	A	From Face	2.000 -6.000 0.000	0.000	30.000	No Ice 1/2" Ice	4.331 4.769	9.694 10.432	0.032 0.087
LPA-185080-12CF	A	From Face	2.000 3.000 0.000	0.000	30.000	No Ice 1/2" Ice	3.532 3.964	5.151 5.780	0.031 0.064
LPA-185080-12CF	A	From Face	2.000 -3.000 0.000	0.000	30.000	No Ice 1/2" Ice	3.532 3.964	5.151 5.780	0.031 0.064
BXA-7080-6CF	A	From Face	2.000 0.000 0.000	0.000	30.000	No Ice 1/2" Ice	5.769 6.221	4.962 5.534	0.025 0.066
LPA-80080/6CF	B	From Face	2.000 6.000 0.000	0.000	30.000	No Ice 1/2" Ice	4.331 4.769	9.694 10.432	0.032 0.087
LPA-80080/6CF	B	From Face	2.000 -6.000 0.000	0.000	30.000	No Ice 1/2" Ice	4.331 4.769	9.694 10.432	0.032 0.087
LPA-185080-12CF	B	From Face	2.000 3.000 0.000	0.000	30.000	No Ice 1/2" Ice	3.532 3.964	5.151 5.780	0.031 0.064
LPA-185080-12CF	B	From Face	2.000 -3.000 0.000	0.000	30.000	No Ice 1/2" Ice	3.532 3.964	5.151 5.780	0.031 0.064
BXA-7080-6CF	B	From Face	2.000	0.000	30.000	No Ice	5.769	4.962	0.025

tnxTower Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	7 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C _{AA} Front ft ²	C _{AA} Side ft ²	Weight K
			0.000 0.000			1/2" Ice	6.221	5.534	0.066
VFA12-U 12'-6" V-Frame	A	From Face	1.000 0.000 0.000	0.000	30.000	No Ice 1/2" Ice	6.000 8.000	2.500 4.000	0.300 0.500
VFA12-U 12'-6" V-Frame	B	From Face	1.000 0.000 0.000	0.000	30.000	No Ice 1/2" Ice	6.000 8.000	2.500 4.000	0.300 0.500
VFA12-U 12'-6" V-Frame	C	From Face	1.000 0.000 0.000	0.000	30.000	No Ice 1/2" Ice	6.000 8.000	2.500 4.000	0.300 0.500
8' Lightning Rod	C	None	0.000	0.000	35.000	No Ice 1/2" Ice	1.600 2.425	1.600 2.425	0.020 0.032

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft	Aperture Area ft ²	Weight K
8' PAD w/ Radome	C	Paraboloid w/Radome	From Leg	0.000 0.000 0.000	45.000		20.000	8.000	No Ice 1/2" Ice	50.270 51.320
										0.380 0.560

Tower Pressures - No Ice

$$G_H = 0.850$$

Section Elevation ft	z ft	K _Z	q _z ksf	A _G ft ²	F a c e ft ²	A _F ft ²	A _R ft ²	A _{leg} ft ²	Leg %	C _{AA} In Face ft ²	C _{AA} Out Face ft ²
T1 30.000-20.000	25.000	0.945	0.038	87.396	A B C	0.000 0.000 0.000	12.456 12.456 12.456	4.792	38.47 38.47 38.47	0.000 0.000 22.697	0.000 0.000 0.000
T2 20.000-0.000	10.000	0.85	0.038	174.792	A B C	0.000 0.000 0.000	22.631 22.631 22.631	9.583	42.35 42.35 42.35	0.000 0.000 49.393	0.000 0.000 0.000

Tower Pressure - With Ice

$$G_H = 0.850$$

<i>tnxTower</i> Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	8 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

Section Elevation	z	K _Z	q _z	t _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	in	ft ²		ft ²	ft ²	ft ²			
T1 30.000-20.000	25.000	0.945	0.010	1.548	89.977	A	0.000	28.465	9.953	34.97	0.000	0.000
						B	0.000	28.465		34.97	0.000	0.000
						C	0.000	28.465		34.97	34.492	0.000
T2 20.000-0.000	10.000	0.85	0.010	1.459	179.656	A	0.000	49.600	19.312	38.94	0.000	0.000
						B	0.000	49.600		38.94	0.000	0.000
						C	0.000	49.600		38.94	77.873	0.000

Tower Pressure - Service

$$G_H = 0.850$$

Section Elevation	z	K _Z	q _z	A _G	F a c e	A _F	A _R	A _{leg}	Leg %	C _A A _A In Face ft ²	C _A A _A Out Face ft ²
ft	ft		ksf	ft ²		ft ²	ft ²	ft ²			
T1 30.000-20.000	25.000	0.945	0.015	87.396	A	0.000	12.456	4.792	38.47	0.000	0.000
					B	0.000	12.456		38.47	0.000	0.000
					C	0.000	12.456		38.47	22.697	0.000
T2 20.000-0.000	10.000	0.85	0.015	174.792	A	0.000	22.631	9.583	42.35	0.000	0.000
					B	0.000	22.631		42.35	0.000	0.000
					C	0.000	22.631		42.35	49.393	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K				ksf			ft ²	K	klf	
T1 30.000-20.000	0.074	0.603	A	0.143	2.799	0.038	1	1	7.060	1.123	0.112	C
			B	0.143	2.799		1	1	7.060			
			C	0.143	2.799		1	1	7.060			
T2 20.000-0.000	0.162	1.175	A	0.129	2.848	0.038	1	1	12.804	2.194	0.110	C
			B	0.129	2.848		1	1	12.804			
			C	0.129	2.848		1	1	12.804			
Sum Weight:	0.236	1.778						OTM	50.010 kip-ft	3.317		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z	D _F	D _R	A _E	F	w	Ctrl. Face
ft	K	K				ksf			ft ²	K	klf	
T1 30.000-20.000	0.074	0.603	A	0.143	2.799	0.038	0.8	1	7.060	1.123	0.112	C
			B	0.143	2.799		0.8	1	7.060			
			C	0.143	2.799		0.8	1	7.060			
T2	0.162	1.175	A	0.129	2.848	0.038	0.8	1	12.804	2.194	0.110	C

<i>tnxTower</i> Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	9 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z ksf	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
ft	K	K										
20.000-0.000			B	0.129	2.848		0.8	1	12.804			
			C	0.129	2.848		0.8	1	12.804			
Sum Weight:	0.236	1.778						OTM	50.010 kip-ft	3.317		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z ksf	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
ft	K	K										
T1	0.074	0.603	A	0.143	2.799	0.038	0.85	1	7.060	1.123	0.112	C
30.000-20.000			B	0.143	2.799		0.85	1	7.060			
			C	0.143	2.799		0.85	1	7.060			
T2	0.162	1.175	A	0.129	2.848	0.038	0.85	1	12.804	2.194	0.110	C
20.000-0.000			B	0.129	2.848		0.85	1	12.804			
			C	0.129	2.848		0.85	1	12.804			
Sum Weight:	0.236	1.778						OTM	50.010 kip-ft	3.317		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z ksf	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
ft	K	K										
T1	0.621	1.983	A	0.316	2.253	0.010	1	1	17.198	0.540	0.054	C
30.000-20.000			B	0.316	2.253		1	1	17.198			
			C	0.316	2.253		1	1	17.198			
T2	1.330	3.362	A	0.276	2.362	0.010	1	1	29.355	1.039	0.052	C
20.000-0.000			B	0.276	2.362		1	1	29.355			
			C	0.276	2.362		1	1	29.355			
Sum Weight:	1.951	5.345						OTM	23.890 kip-ft	1.579		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z ksf	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
ft	K	K										
T1	0.621	1.983	A	0.316	2.253	0.010	0.8	1	17.198	0.540	0.054	C
30.000-20.000			B	0.316	2.253		0.8	1	17.198			
			C	0.316	2.253		0.8	1	17.198			

<i>tnxTower</i> Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	10 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z ksf	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
ft	K	K										
T2 20.000-0.000	1.330	3.362	A B C	0.276 0.276 0.276	2.362 2.362 2.362	0.010	0.8 0.8 0.8	1 1 1	29.355 29.355 29.355	1.039	0.052	C
Sum Weight:	1.951	5.345						OTM	23.890 kip-ft	1.579		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z ksf	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
ft	K	K										
T1 30.000-20.000	0.621	1.983	A B C	0.316 0.316 0.316	2.253 2.253 2.253	0.010	0.85 0.85 0.85	1 1 1	17.198 17.198 17.198	0.540	0.054	C
T2 20.000-0.000	1.330	3.362	A B C	0.276 0.276 0.276	2.362 2.362 2.362	0.010	0.85 0.85 0.85	1 1 1	29.355 29.355 29.355	1.039	0.052	C
Sum Weight:	1.951	5.345						OTM	23.890 kip-ft	1.579		

Tower Forces - Service - Wind Normal To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z ksf	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
ft	K	K										
T1 30.000-20.000	0.074	0.603	A B C	0.143 0.143 0.143	2.799 2.799 2.799	0.015	1 1 1	1 1 1	7.060 7.060 7.060	0.434	0.043	C
T2 20.000-0.000	0.162	1.175	A B C	0.129 0.129 0.129	2.848 2.848 2.848	0.015	1 1 1	1 1 1	12.804 12.804 12.804	0.848	0.042	C
Sum Weight:	0.236	1.778						OTM	19.327 kip-ft	1.282		

Tower Forces - Service - Wind 60 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z ksf	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
ft	K	K										
T1 30.000-20.000	0.074	0.603	A B	0.143 0.143	2.799 2.799	0.015	0.8 0.8	1 1	7.060 7.060	0.434	0.043	C

tnxTower Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	11 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z ksf	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
ft	K	K										
T2	0.162	1.175	C	0.143	2.799		0.8	1	7.060			
20.000-0.000			A	0.129	2.848	0.015	0.8	1	12.804	0.848	0.042	C
			B	0.129	2.848		0.8	1	12.804			
			C	0.129	2.848		0.8	1	12.804			
Sum Weight:	0.236	1.778						OTM	19.327 kip-ft	1.282		

Tower Forces - Service - Wind 90 To Face

Section Elevation	Add Weight	Self Weight	F a c e	e	C _F	q _z ksf	D _F	D _R	A _E ft ²	F K	w klf	Ctrl. Face
ft	K	K										
T1	0.074	0.603	A	0.143	2.799	0.015	0.85	1	7.060	0.434	0.043	C
30.000-20.000			B	0.143	2.799		0.85	1	7.060			
			C	0.143	2.799		0.85	1	7.060			
T2	0.162	1.175	A	0.129	2.848	0.015	0.85	1	12.804	0.848	0.042	C
20.000-0.000			B	0.129	2.848		0.85	1	12.804			
			C	0.129	2.848		0.85	1	12.804			
Sum Weight:	0.236	1.778						OTM	19.327 kip-ft	1.282		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M _x kip-ft	Sum of Overturning Moments, M _z kip-ft	Sum of Torques kip-ft
Leg Weight	0.594					
Bracing Weight	1.184					
Total Member Self-Weight	1.778					
Total Weight	3.906			2.111	1.957	
Wind 0 deg - No Ice		0.182	-7.878	-179.007	-2.197	-5.868
Wind 90 deg - No Ice		8.289	-0.047	0.652	-183.537	6.933
Wind 180 deg - No Ice		0.180	8.089	187.445	-1.138	6.504
Member Ice	3.567					
Total Weight Ice	14.274			8.125	5.824	
Wind 0 deg - Ice		0.048	-3.240	-64.072	4.767	-1.823
Wind 90 deg - Ice		3.365	-0.010	7.829	-67.890	2.184
Wind 180 deg - Ice		0.055	3.299	81.512	4.836	2.003
Total Weight	3.906			2.111	1.957	
Wind 0 deg - Service		0.070	-3.045	-68.497	0.291	-2.268
Wind 90 deg - Service		3.204	-0.018	0.936	-69.792	2.680
Wind 180 deg - Service		0.070	3.126	73.127	0.700	2.514

tnxTower Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	12 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	0.9 Dead+1.6 Wind 0 deg - No Ice
4	1.2 Dead+1.6 Wind 90 deg - No Ice
5	0.9 Dead+1.6 Wind 90 deg - No Ice
6	1.2 Dead+1.6 Wind 180 deg - No Ice
7	0.9 Dead+1.6 Wind 180 deg - No Ice
8	1.2 Dead+1.0 Ice+1.0 Temp
9	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
10	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
11	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
12	Dead+Wind 0 deg - Service
13	Dead+Wind 90 deg - Service
14	Dead+Wind 180 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	30 - 20	Leg	Max Tension	7	3.938	0.003	-0.035
			Max. Compression	2	-5.071	0.017	0.036
			Max. Mx	4	-0.688	-0.046	-0.019
			Max. My	6	-0.766	-0.008	-0.047
			Max. Vy	4	-1.987	0.000	-0.000
		Diagonal	Max. Vx	2	2.269	-0.000	-0.000
			Max Tension	5	3.660	0.000	0.000
			Max. Compression	4	-3.722	0.000	0.000
			Max. Mx	11	0.650	0.040	0.000
			Max. My	6	-0.210	0.000	-0.000
		Horizontal	Max. Vy	11	0.024	0.000	0.000
			Max. Vx	6	0.000	0.000	0.000
			Max Tension	4	2.403	0.000	0.000
			Max. Compression	5	-2.364	0.000	0.000
			Max. Mx	11	0.063	-0.025	-0.001
		Top Girt	Max. My	6	-0.051	-0.011	-0.005
			Max. Vy	11	-0.026	-0.025	-0.001
			Max. Vx	6	0.001	-0.011	-0.005
			Max Tension	6	2.617	-0.007	0.003
			Max. Compression	2	-2.618	-0.008	-0.003
		Inner Bracing	Max. Mx	11	-0.323	-0.024	-0.002
			Max. My	6	-1.111	-0.008	-0.007
			Max. Vy	11	-0.026	-0.024	-0.002
			Max. Vx	6	0.002	-0.008	-0.007
			Max Tension	2	0.045	0.000	0.000
			Max. Compression	2	-0.045	0.000	0.000
			Max. Mx	8	0.000	-0.023	0.000
			Max. My	11	-0.001	0.000	0.000
			Max. Vy	8	0.022	0.000	0.000
			Max. Vx	11	0.000	0.000	0.000
T2	20 - 0	Leg	Max Tension	7	26.961	0.002	-0.103
			Max. Compression	2	-28.258	0.000	0.000
			Max. Mx	5	13.968	-0.111	-0.017
			Max. My	6	17.108	0.002	-0.103
			Max. Vy	4	-1.043	-0.025	0.007
			Max. Vx	6	-0.940	0.014	-0.015

tnxTower Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	13 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
		Diagonal	Max Tension	5	8.971	0.000	0.000
			Max. Compression	4	-9.037	0.000	0.000
			Max. Mx	11	1.395	0.046	0.000
			Max. My	6	-1.488	0.000	-0.000
			Max. Vy	11	0.023	0.000	0.000
			Max. Vx	6	0.000	0.000	0.000
		Horizontal	Max Tension	4	4.839	0.000	0.000
			Max. Compression	5	-4.825	-0.006	0.000
			Max. Mx	11	0.160	-0.027	-0.002
			Max. My	6	-0.270	-0.023	-0.008
			Max. Vy	11	-0.026	-0.027	-0.002
			Max. Vx	6	0.002	-0.023	-0.008
		Inner Bracing	Max Tension	6	0.005	0.000	0.000
			Max. Compression	4	-0.006	0.000	0.000
			Max. Mx	8	0.000	-0.022	0.000
			Max. My	11	-0.001	0.000	0.000
			Max. Vy	8	0.020	0.000	0.000
			Max. Vx	11	0.000	0.000	0.000

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	6	20.725	1.279	-3.888
	Max. H _x	6	20.725	1.279	-3.888
	Max. H _z	3	-18.109	-1.462	3.831
	Min. Vert	5	-32.099	-5.837	1.124
	Min. H _x	5	-32.099	-5.837	1.124
	Min. H _z	6	20.725	1.279	-3.888
Leg B	Max. Vert	4	34.752	-5.813	-1.120
	Max. H _x	3	-16.961	1.851	2.633
	Max. H _z	3	-16.961	1.851	2.633
	Min. Vert	3	-16.961	1.851	2.633
	Min. H _x	4	34.752	-5.813	-1.120
	Min. H _z	6	21.337	-2.231	-2.755
Leg A	Max. Vert	2	38.894	-0.681	6.149
	Max. H _x	6	-37.375	0.664	-6.299
	Max. H _z	2	38.894	-0.681	6.149
	Min. Vert	7	-37.675	0.664	-6.307
	Min. H _x	5	1.230	-1.620	0.068
	Min. H _z	7	-37.675	0.664	-6.307

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	3.906	0.000	0.000	2.111	1.957	0.000
1.2 Dead+1.6 Wind 0 deg - No Ice	4.687	0.291	-12.604	-274.808	-4.292	-9.392
0.9 Dead+1.6 Wind 0 deg - No Ice	3.515	0.291	-12.604	-275.413	-4.880	-9.391

tnxTower Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	14 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

<i>Load Combination</i>	<i>Vertical K</i>	<i>Shear_x K</i>	<i>Shear_z K</i>	<i>Overturning Moment, M_x kip-ft</i>	<i>Overturning Moment, M_z kip-ft</i>	<i>Torque kip-ft</i>
1.2 Dead+1.6 Wind 90 deg - No Ice	4.687	13.263	-0.076	0.206	-281.996	11.096
0.9 Dead+1.6 Wind 90 deg - No Ice	3.515	13.263	-0.076	-0.428	-282.554	11.096
1.2 Dead+1.6 Wind 180 deg - No Ice	4.687	0.288	12.942	286.625	-2.600	10.409
0.9 Dead+1.6 Wind 180 deg - No Ice	3.515	0.288	12.942	285.961	-3.187	10.408
1.2 Dead+1.0 Ice+1.0 Temp	15.055	0.000	0.000	8.545	6.213	0.000
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	15.055	0.048	-3.240	-59.975	5.169	-1.825
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	15.055	3.365	-0.010	8.260	-63.820	2.185
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	15.055	0.055	3.299	78.270	5.232	2.004
Dead+Wind 0 deg - Service	3.906	0.070	-3.045	-64.874	0.353	-2.269
Dead+Wind 90 deg - Service	3.906	3.204	-0.018	1.548	-66.720	2.680
Dead+Wind 180 deg - Service	3.906	0.070	3.126	70.728	0.761	2.514

Solution Summary

<i>Load Comb.</i>	<i>Sum of Applied Forces</i>			<i>Sum of Reactions</i>			<i>% Error</i>
	<i>PX K</i>	<i>PY K</i>	<i>PZ K</i>	<i>PX K</i>	<i>PY K</i>	<i>PZ K</i>	
1	0.000	-3.906	0.000	0.000	3.906	0.000	0.000%
2	0.291	-4.687	-12.604	-0.291	4.687	12.604	0.000%
3	0.291	-3.515	-12.604	-0.291	3.515	12.604	0.000%
4	13.263	-4.687	-0.076	-13.263	4.687	0.076	0.000%
5	13.263	-3.515	-0.076	-13.263	3.515	0.076	0.000%
6	0.288	-4.687	12.942	-0.288	4.687	-12.942	0.000%
7	0.288	-3.515	12.942	-0.288	3.515	-12.942	0.000%
8	0.000	-15.055	0.000	0.000	15.055	0.000	0.000%
9	0.048	-15.055	-3.240	-0.048	15.055	3.240	0.000%
10	3.365	-15.055	-0.010	-3.365	15.055	0.010	0.000%
11	0.055	-15.055	3.299	-0.055	15.055	-3.299	0.000%
12	0.070	-3.906	-3.045	-0.070	3.906	3.045	0.000%
13	3.204	-3.906	-0.018	-3.204	3.906	0.018	0.000%
14	0.070	-3.906	3.126	-0.070	3.906	-3.126	0.000%

Non-Linear Convergence Results

<i>Load Combination</i>	<i>Converged?</i>	<i>Number of Cycles</i>	<i>Displacement Tolerance</i>	<i>Force Tolerance</i>
1	Yes	6	0.00000001	0.00000001
2	Yes	6	0.00000001	0.00000001
3	Yes	6	0.00000001	0.00000001
4	Yes	6	0.00000001	0.00000001
5	Yes	6	0.00000001	0.00000001
6	Yes	6	0.00000001	0.00000001
7	Yes	6	0.00000001	0.00000001
8	Yes	6	0.00000001	0.00000001
9	Yes	6	0.00000001	0.00000001
10	Yes	6	0.00000001	0.00000001

<i>tnxTower</i> Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	15 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

11	Yes	6	0.00000001	0.00000001
12	Yes	6	0.00000001	0.00000001
13	Yes	6	0.00000001	0.00000001
14	Yes	6	0.00000001	0.00000001

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	30 - 20	0.118	14	0.020	0.015
T2	20 - 0	0.068	14	0.018	0.014

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
35.000	8' Lightning Rod	14	0.118	0.020	0.015	161390
30.000	LPA-185063-12CF-EDIN	14	0.118	0.020	0.015	161390
20.000	8' PAD w/ Radome	14	0.068	0.018	0.014	92223

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	30 - 20	0.476	6	0.077	0.061
T2	20 - 0	0.279	6	0.071	0.056

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
35.000	8' Lightning Rod	6	0.476	0.077	0.061	41997
30.000	LPA-185063-12CF-EDIN	6	0.476	0.077	0.061	41997
20.000	8' PAD w/ Radome	6	0.279	0.071	0.056	23998

Bolt Design Data

tnxTower Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	16 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load K	Ratio Load Allowable	Allowable Ratio	Criteria
T1	30	Leg	A325N	0.625	4	0.219	20.709	0.011 ✓	1	Bolt Tension
		Diagonal	A325N	0.625	3	1.241	12.425	0.100 ✓	1	Bolt Shear
		Horizontal	A325N	0.625	2	1.201	12.425	0.097 ✓	1	Bolt Shear
		Top Girt	A325N	0.625	2	1.309	12.425	0.105 ✓	1	Bolt Shear
T2	20	Leg	A325N	0.750	4	2.209	29.821	0.074 ✓	1	Bolt Tension
		Diagonal	A325N	0.625	3	3.012	12.425	0.242 ✓	1	Bolt Shear
		Horizontal	A325N	0.625	2	2.419	12.425	0.195 ✓	1	Bolt Shear

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	30 - 20	HSS2.875x.203	10.000	5.000	63.0 K=1.00	1.595	-5.071	53.678	0.094 ¹ ✓
T2	20 - 0	HSS2.875x0.276	20.000	6.667	86.0 K=1.00	2.114	-28.258	55.376	0.510 ¹ ✓

¹ P_u / φP_n controls

Diagonal 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	30 - 20	HSS2.375x.154	6.562	6.377	96.8 K=1.00	1.003	-3.722	19.842	0.188 ¹ ✓
T2	20 - 0	HSS2.375x.154	7.906	7.683	116.6 K=1.00	1.003	-9.037	15.882	0.569 ¹ ✓

¹ P_u / φP_n controls

Horizontal Design Data (Compression)

tnxTower Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	17 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

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	30 - 20	HSS1.9x.145	8.500	4.130	79.2 K=1.00	0.749	-2.364	17.434	0.136 ¹
T2	20 - 0	HSS1.9x.145	8.500	4.130	79.2 K=1.00	0.749	-4.825	17.434	0.277 ¹

¹ P_u / φP_n controls

Top Girt 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	30 - 20	HSS1.9x.145	8.500	4.130	79.2 K=1.00	0.749	-2.618	17.434	0.150 ¹

¹ P_u / φP_n controls

Inner Bracing 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	30 - 20	L2x2x1/8	4.250	4.250	128.3 K=1.00	0.484	-0.045	6.565	0.007 ¹
T2	20 - 0	L2x2x1/8	4.250	4.250	128.3 K=1.00	0.484	-0.006	6.565	0.001 ¹

¹ P_u / φP_n controls

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	30 - 20	HSS2.875x.203	10.000	5.000	63.0	1.595	3.938	71.768	0.055 ¹
T2	20 - 0	HSS2.875x0.276	20.000	6.667	86.0	2.114	26.961	95.118	0.283 ¹

tnxTower Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	18 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

¹ $P_u / \phi P_n$ controls

Diagonal Design Data (Tension)

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	30 - 20	HSS2.375x.154	6.562	6.377	96.8	1.003	3.660	32.488	0.113 ¹
T2	20 - 0	HSS2.375x.154	7.906	7.683	116.6	1.003	8.971	32.488	0.276 ¹

¹ $P_u / \phi P_n$ controls

Horizontal Design Data (Tension)

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	30 - 20	HSS1.9x.145	8.500	4.130	79.2	0.749	2.403	24.253	0.099 ¹
T2	20 - 0	HSS1.9x.145	8.500	4.130	79.2	0.749	4.839	24.253	0.200 ¹

¹ $P_u / \phi P_n$ controls

Top Girt Design Data (Tension)

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	30 - 20	HSS1.9x.145	8.500	4.130	79.2	0.749	2.617	24.253	0.108 ¹

¹ $P_u / \phi P_n$ controls

Inner Bracing Design Data (Tension)

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	30 - 20	L2x2x1/8	4.250	4.250	81.4	0.484	0.045	15.694	0.003 ¹
T2	20 - 0	L2x2x1/8	4.250	4.250	81.4	0.484	0.005	15.694	0.000 ¹

<i>tnxTower</i> Otegui Structural Services, LLC 10812 West Powers Place Littleton, CO 80127 Phone: 720-981-5333 FAX:	Job	CO1 Hayden	Page	19 of 19
	Project	212120	Date	10:52:46 10/26/12
	Client	Verizon Wireless	Designed by	Mike Otegui

Section No.	Elevation ft	Size	L ft	L _u ft	Kl/r	A in ²	P _u K	φP _n K	Ratio $\frac{P_u}{\phi P_n}$
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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	30 - 20	Leg	HSS2.875x.203	3	-5.071	53.678	9.4	Pass
		Diagonal	HSS2.375x.154	9	-3.722	19.842	18.8	Pass
		Horizontal	HSS1.9x.145	7	-2.364	17.434	13.6	Pass
		Top Girt	HSS1.9x.145	6	-2.618	17.434	15.0	Pass
		Inner Bracing	L2x2x1/8	26	-0.045	6.565	0.7	Pass
T2	20 - 0	Leg	HSS2.875x0.276	30	-28.258	55.376	51.0	Pass
		Diagonal	HSS2.375x.154	33	-9.037	15.882	56.9	Pass
		Horizontal	HSS1.9x.145	31	-4.825	17.434	27.7	Pass
		Inner Bracing	L2x2x1/8	40	0.005	15.694	0.4	Pass
		Summary						
		Leg (T2)				51.0		Pass
		Diagonal (T2)				56.9		Pass
		Horizontal (T2)				27.7		Pass
		Top Girt (T1)				15.0		Pass
		Inner Bracing (T1)				0.7		Pass
		Bolt Checks				24.2		Pass
		RATING =				56.9		Pass