#### **ADDENDUM #6**

PUBLIC SAFETY RADIO COMMUNICATIONS SYSTEM SITE DEVELOPMENT, CONSTRUCTION, AND CIVIL ENGINEERING SERVICES

ESSEX COUNTY PURCHASING 7551 COURT STREET P.O. BOX 217 ELIZABETHTOWN, NY 12932 (518) 873-3330

August 29, 2012

This Addendum, issued to bid document holders of record, indicates changes to the bid documents for the *Public Safety Radio Communications System Site Development, Construction, and Civil Engineering Services*.

All additions and revisions described herein (identified as "revisions" or "additions" throughout) shall be incorporated into PROPOSERS' bid proposals. This Addendum is hereby made part of the Contract Documents. All other requirements of the Contract Documents remain if full force and effect. *Please include this Addendum as part of your bid specifications.* 

#### <u>ADDENDUM TO RFP SECTION 5.4 – Grandpas Knob</u>

- A. **[revision]** Section 5.4.1, Existing Documentation Review:
  - This Addendum hereby REPLACES the Grandpas Knob ZD contained within Attachment D with Attachment T – Grandpas Knob CD and Construction Specifications.
- B. **[revision]** Section 5.4.2, Site Construction:
  - 1. This Addendum hereby **REPLACES** the existing RFP specifications contained within Section 5.4.2 with the *Grandpas Knob Construction Specifications* provided in Attachment T.

Please sign and return with your proposal:							
I,, of(Company)							
(Company)							
Have received the Addendum and will include it with the specifications for the above Essex County Proposal.							
Linda M. Wolf, CPA, CPPB Purchasing Agent							
– END OF ADDENDUM # 6 –							

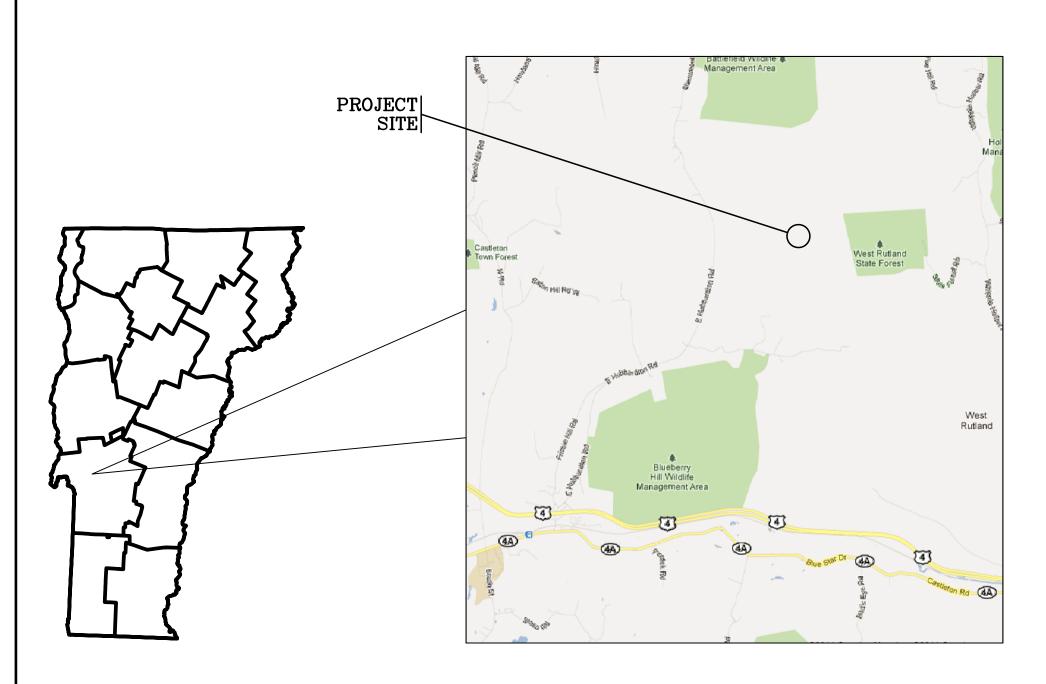
This Addendum is hereby made part of the Contract Documents.

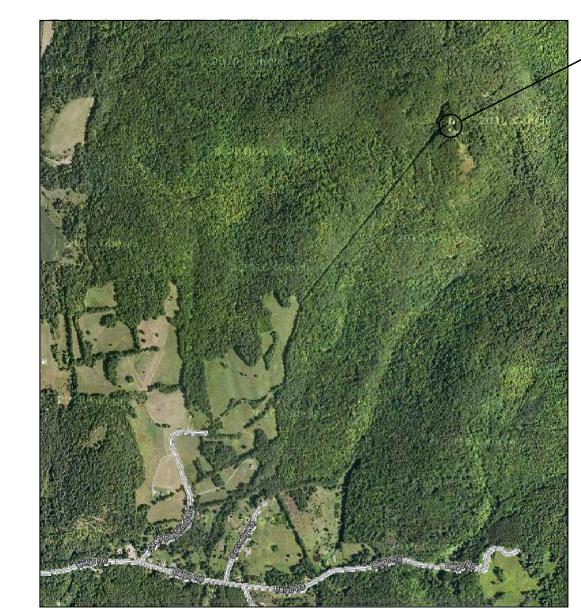
# ESSEX COUNTY, NEW YORK PUBLIC SAFETY RADIO COMMUNICATIONS SYSTEM



# GRANDPA'S KNOB TELECOMMUNICATIONS SHELTER ALTERATIONS

CASTLETON, RUTLAND COUNTY, VERMONT





#### GENERAL NOTES

- . THESE DRAWINGS WERE PREPARED FOR THE PURPOSE OF OBTAINING APPROVAL FROM THE STATE OF VERMONT AND BIDDING AND CONSTRUCTION PURPOSES.
- 2. THIS LOCATION IS ONE OF THE TRANSMISSION SITES OF THE NEW ESSEX COUNTY, NY PUBLIC SAFETY COMMUNICATIONS NETWORK.
- 3. PROJECT DESCRIPTION: INSTALLATION OF EQUIPMENT WITHIN AN EXISTING EQUIPMENT SHELTER AND ADDITION OF ANTENNAS ON AN EXISTING TOWER WITH ASSOCIATED APPURTENANCES.
- 4. LATITUDE: 43° 39' 31.9" N LONGITUDE: 73° 06' 23.5" W
- 5. PROJECT LANDLORD: VERMONT PUBLIC TELEVISION 204 ETHAN ALLEN DRIVE COLCHESTER, VT 05446
- 6. APPLICANT: EMERGENCY SERVICES
  ESSEX COUNTY, NY
  702 STOWERSVILLE ROAD
- 7. PROJECT ADDRESS: 2196 GRANDPA'S KNOB ROAD CASTLETON, VT 05735

LEWIS, NY 12950

#### DRAWING LIST

DWG. NO.

G-001

TITLE SHEET

C-101

SITE PLANS

S-100 ICE BRIDGE & CABLE TRAY SUPPORTS PLANS, SECTIONS & DETAILS

A-501 RADIO TOWER ELEVATIONS

E-001 ELECTRICAL NOTES, ONE-LINE DIAGRAMS & DETAILS

E-101 ELECTRICAL PLANS

REFERENCE DRAWINGS:

V-101 EXISTING CONDITIONS (TOPOGRAPHIC MAP)

T. 1 OF 1 BOUNDRY SURVEY (BY VERMONT SURVEY CONSULTANTS)
OF VERMONT ETV INC. PROPERTY

#### ABBREVIATIONS

ABBREVIATION	DESCRIPTION
ACP	ACOUSTIC CEILING PANEL
ADJ.	ADJUSTABLE
A.F.F.	ABOVE FINISH FLOOR
ALT.	ALTERNATE
AL.	ALUMINUM
ARCH.	ARCHITECTURAL
APPROX.	APPROXIMATE
A or AMP	AMPERE
@	AT
<u> </u>	AI
BD	BOARD
B.I.	BLACK IRON
BLDG.	BUILDING
BM.	BEAM
B. P.	BEARING PLATE
BLK	BLOCK
BSMT.	BASEMENT
BTM.	ВОТТОМ
BT/SH	BATHTUB/SHOWER
51, 511	D. CHILLIAN STITUTE OF
CARR	CARRET
CARP.	CARPET
CATV	CABLE TELEVISION
CTR	CENTER
<u>Q</u>	CENTERLINE
C.B.	CATCH BASIN
CB.	CIRCUIT BREAKER
C.T.	CERAMIC TILE
CU.	COPPER
CI or C.I.	CAST IRON
CJ	CONTROL JOINT
CLG.	CEILING
CH	CHANNEL
CL.	CLOSET
CMU or C.M.U.	CONCRETE MASONRY UNIT
COL.	COLUMN
CO or C.O.	CLEAN OUT
CONC.	CONCRETE
CONT.	CONTINUOUS
COND.	CONDUIT
CONTR.	CONTRACTOR
CONSTR.	CONSTRUCTION
OONSTA.	CONSTRUCTION
DELLO	DEMOLITION.
DEMO.	DEMOLITION
DTL.	DETAIL
DIA. or Ø	DIAMETER
D.F.	DRINKING FOUNTAIN
DR DR	DOOR
DSB	DEEP SUMP BASIN
DN	DOWN
DWG.	DRAWING
EA.	EACH
EA. E.C.	EACH ELECTRICAL CONTRACTOR
E.C.	ELECTRICAL CONTRACTOR
E.C. EL. or ELEV.	ELECTRICAL CONTRACTOR ELEVATION
E.C. EL. or ELEV. ELEC.	ELECTRICAL CONTRACTOR ELEVATION ELECTRICAL
E.C. EL. or ELEV. ELEC. ENGR.	ELECTRICAL CONTRACTOR ELEVATION ELECTRICAL ENGINEER
E.C. EL. or ELEV. ELEC. ENGR. EQUIP.	ELECTRICAL CONTRACTOR ELEVATION ELECTRICAL ENGINEER EQUIPMENT
E.C. EL. or ELEV. ELEC. ENGR.	ELECTRICAL CONTRACTOR ELEVATION ELECTRICAL ENGINEER
E.C. EL. or ELEV. ELEC. ENGR. EQUIP.	ELECTRICAL CONTRACTOR ELEVATION ELECTRICAL ENGINEER EQUIPMENT
E.C. EL. or ELEV. ELEC. ENGR. EQUIP. EXIST.	ELECTRICAL CONTRACTOR ELEVATION ELECTRICAL ENGINEER EQUIPMENT EXISTING
E.C. EL. or ELEV. ELEC. ENGR. EQUIP. EXIST. EXT.	ELECTRICAL CONTRACTOR ELEVATION ELECTRICAL ENGINEER EQUIPMENT EXISTING EXTERIOR
E.C. EL. or ELEV. ELEC. ENGR. EQUIP. EXIST. EXT.	ELECTRICAL CONTRACTOR ELEVATION ELECTRICAL ENGINEER EQUIPMENT EXISTING EXTERIOR FOUNDATION
E.C. EL. or ELEV. ELEC. ENGR. EQUIP. EXIST. EXT. FDN. FG.	ELECTRICAL CONTRACTOR ELEVATION ELECTRICAL ENGINEER EQUIPMENT EXISTING EXTERIOR  FOUNDATION FIBERGLASS
E.C. EL. or ELEV. ELEC. ENGR. EQUIP. EXIST. EXT.	ELECTRICAL CONTRACTOR ELEVATION ELECTRICAL ENGINEER EQUIPMENT EXISTING EXTERIOR FOUNDATION

FL.	FLOOR
FR	FRAME
FTG.	FOOTING
F.D.	FLOOR DRAIN
GA.	GAUGE
GALV.	GALVANIZED
GAL.	GALLON
G.C.	GENERAL CONTRACTOR
GEN.	GENERAL
GWB or G.W.B.	GYPSUM WALL BOARD
GYP.	GYPSUM
011.	011 00111
H.C.	HEATING CONTRACTOR
HDWR.	HARDWARE
HGT.	HEIGHT
HTG.	HEATING
	HEATING, VENTILATION & COOLING
HVAC	,
H.W.	HOT WATER
H.M.	HOLLOW METAL
H.T.	HOUSE TRAP
INIEC	LINES DIALETON
INFO.	INFORMATION
INSUL.	INSULATION
INT.	INTERIOR
INV.	INVERT
I.E.	INVERT ELEVATION
JAN.	JANITOR
JT	JOINT
LAV.	LAVATORY/VANITY
LT.	LIGHT
M.H.	MANHOLE
MAT.	MATERIAL
MAX.	MAXIMUM
MECH.	MECHANICAL
M.C.	MECHANICAL CONTRACTOR
MFR.	MANUFACTURER
MIN.	MINIMUM
MISC.	MISCELLANEOUS
M.R.	MOISTURE RESISTANT
MTD.	MOUNTED
MTL.	METAL
N.I.C.	NOT IN CONTRACT
NO.	NUMBER
N.T.S.	NOT TO SCALE
0.C. or 0/C	ON CENTER
OPG.	OPENING
	OIL/WATER SEPARATOR
OWS or O.W.S.	<del>  '</del>
OWS or O.W.S.	,
OWS or 0.W.S.	PLUMBING CONTRACTOR
OWS or O.W.S.	PLUMBING CONTRACTOR PLUMBING
OWS or 0.W.S.	
OWS or O.W.S. P.C. PLUMB.	PLUMBING
P.C. PLUMB. PLYWD.	PLUMBING PLYWOOD
P.C. PLUMB. PLYWD. PR.	PLUMBING PLYWOOD PAIR
P.C. PLUMB. PLYWD. PR. PT or P.T.	PLUMBING PLYWOOD PAIR PRESSURE TREATED
P.C. PLUMB. PLYWD. PR. PT or P.T. PTD.	PLUMBING PLYWOOD PAIR PRESSURE TREATED PAINTED
P.C. PLUMB. PLYWD. PR. PT or P.T. PTD.	PLUMBING PLYWOOD PAIR PRESSURE TREATED PAINTED

	AES
	Architecture, Engineering, and Land Surveying Northeast, P 10-12 City Hall Place, Plattsburgh, NY 12901 Phone: (518) 561-1598 Fax: (518) 561-1990 © Copyright 2012 AES Northeast, PLLC, All Rights Reserved  NOTE: IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTI UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR, TO ALTER AN ITEM IN ANY WAY AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR
	SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.
	ARCHITECT – ENGINEER – LAND SURVEYOR

PROJECT TITLE:

SHELF & CLOSET ROD

SPECIFIED / SPECIFICATION
STAINLESS STEEL

TONGUE & GROOVE
TRENCH DRAIN
TELEPHONE

TOP OF CONCRETE

UNLESS NOTED OTHERWISE

SIMILAR

STANDARD STORAGE SUSPENDED SYSTEM

THROUGH

TOILET

TSR or T.S.R. | TRUNK SEWER REPLACEMENT

TYPICAL

VCB or V.C.B. VINYL COVE BASE

VCT or V.C.T. VINYL COMPOSITE TILE

VTH or V.T.H. | VENT TO HEADER

VERTICAL VESTIBULE

VTR or V.T.R. TENT THROUGH ROOF

VWC or V.W.C. VINYL WALL COVERING
VSF or V.S.F. VINYL SHEET FLOORING

WOOD

WMR or W.M.R. | WATER MAIN REPLACEMENT

VERIFY IN FIELD

WATER HEATER

WWF or WM WOVEN WIRE FABRIC/MESH
W.R. WATER RESISTANT

ESSEX COUNTY, NEW YORK
PUBLIC SAFETY RADIO
COMMUNICATIONS SYSTEM

# GRANDPA'S KNOB TELECOMMUNICATIONS SHELTER ALTERATIONS

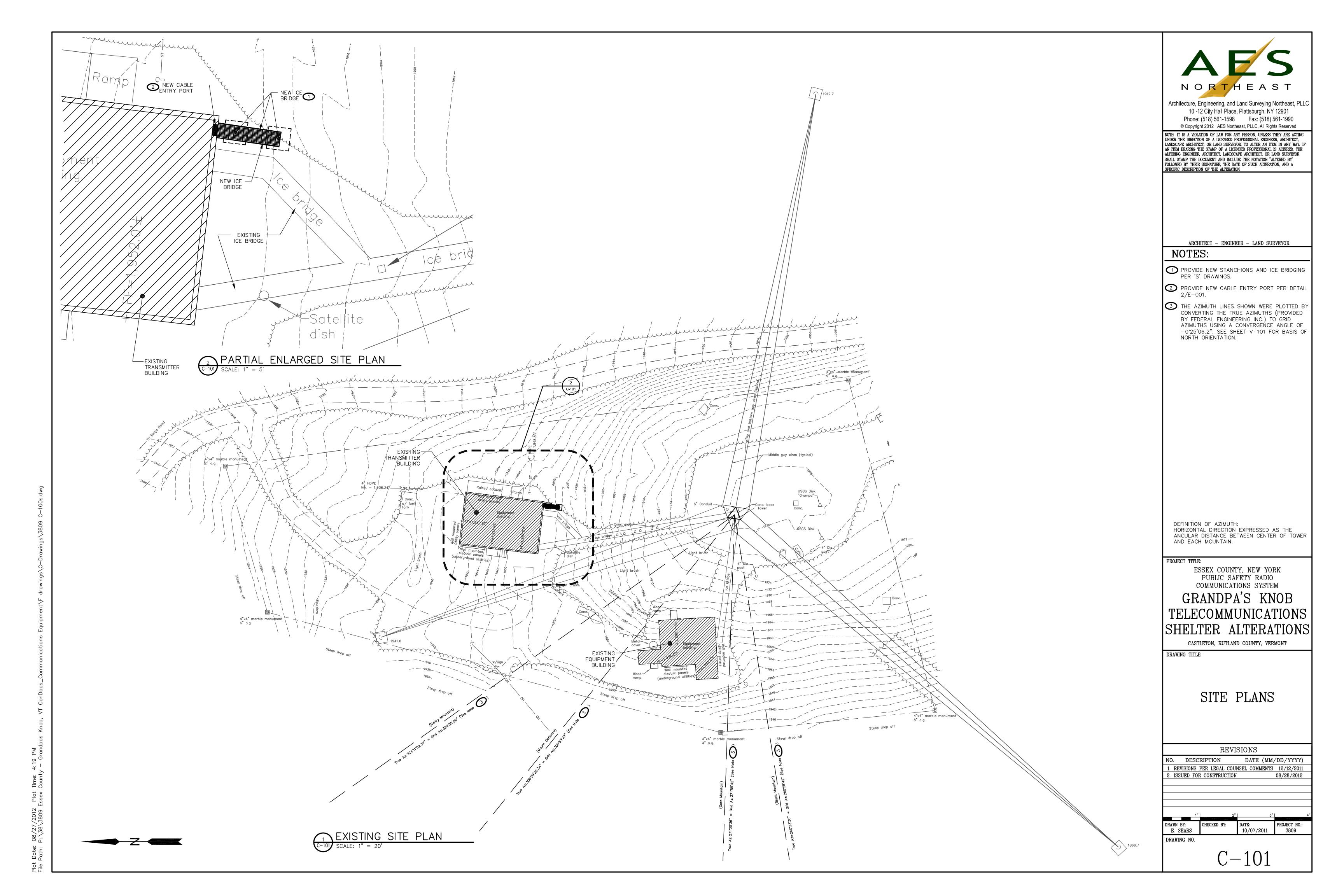
CASTLETON, RUTLAND COUNTY, VERMONT

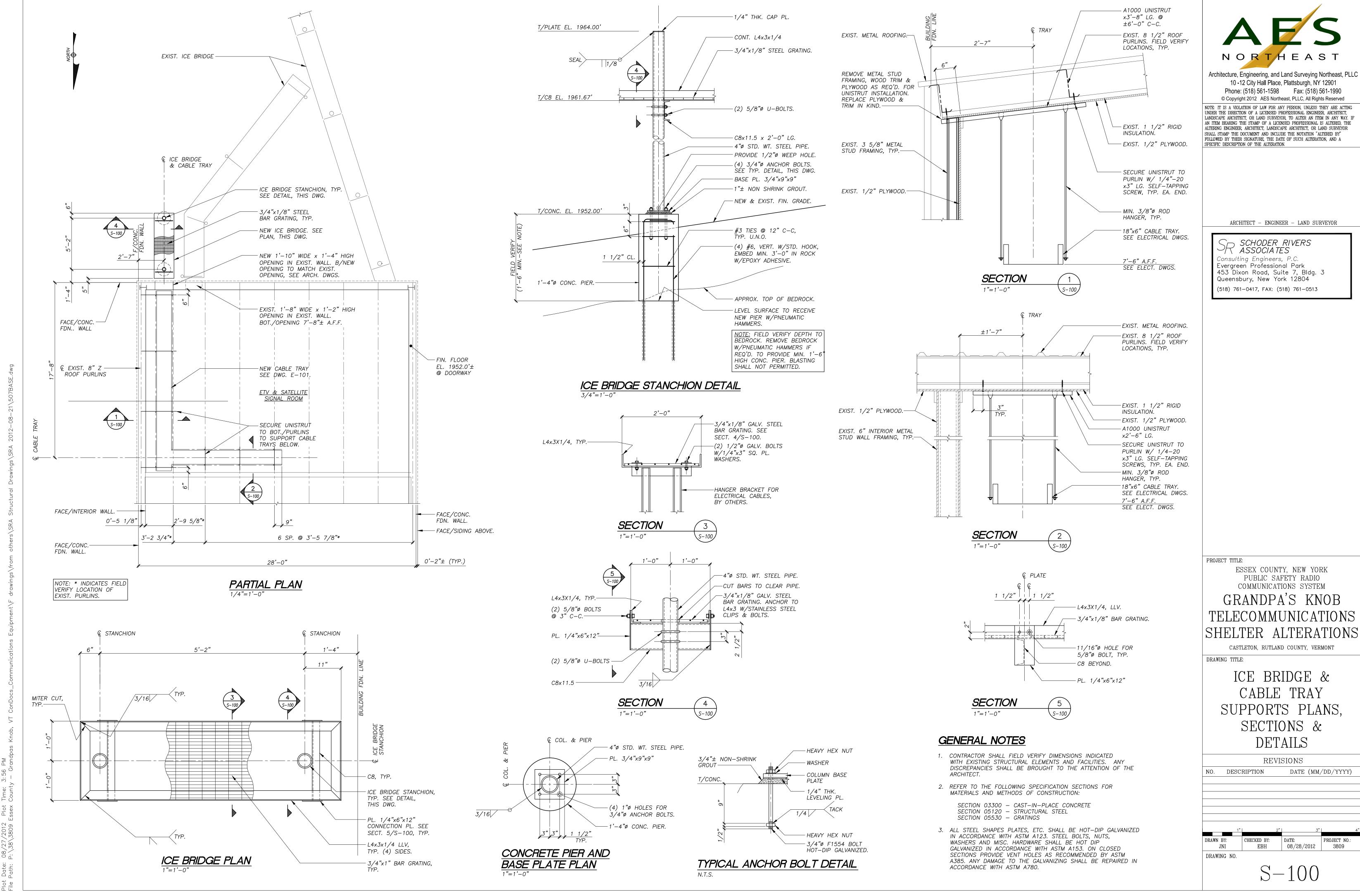
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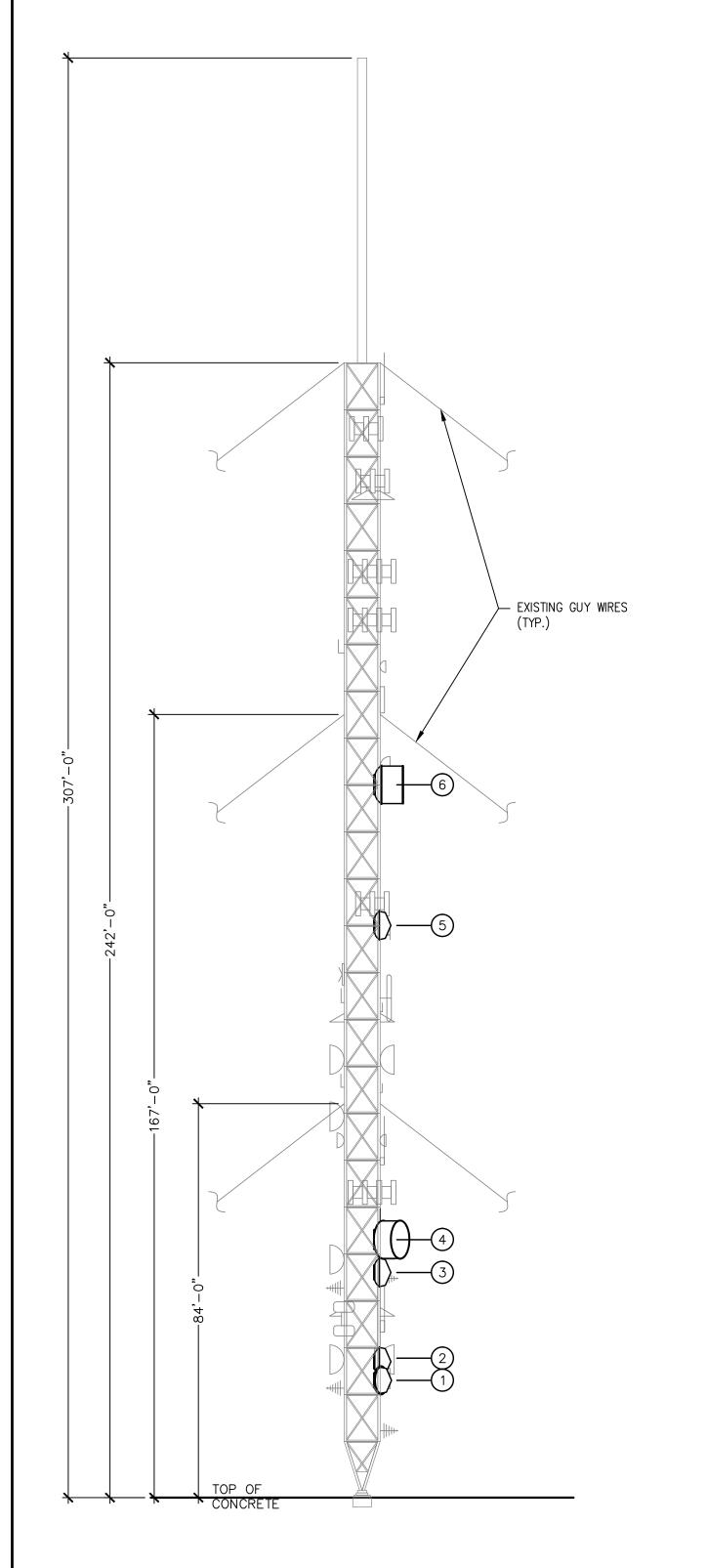
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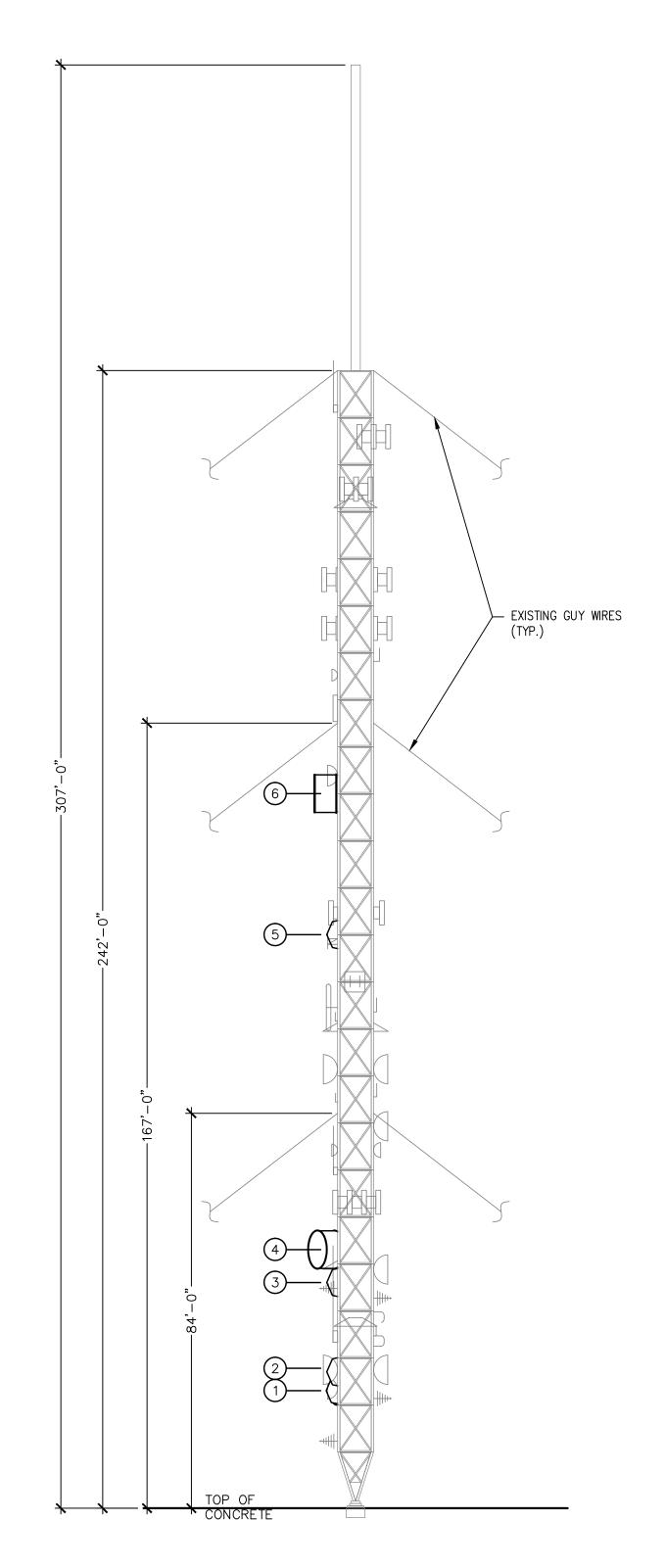
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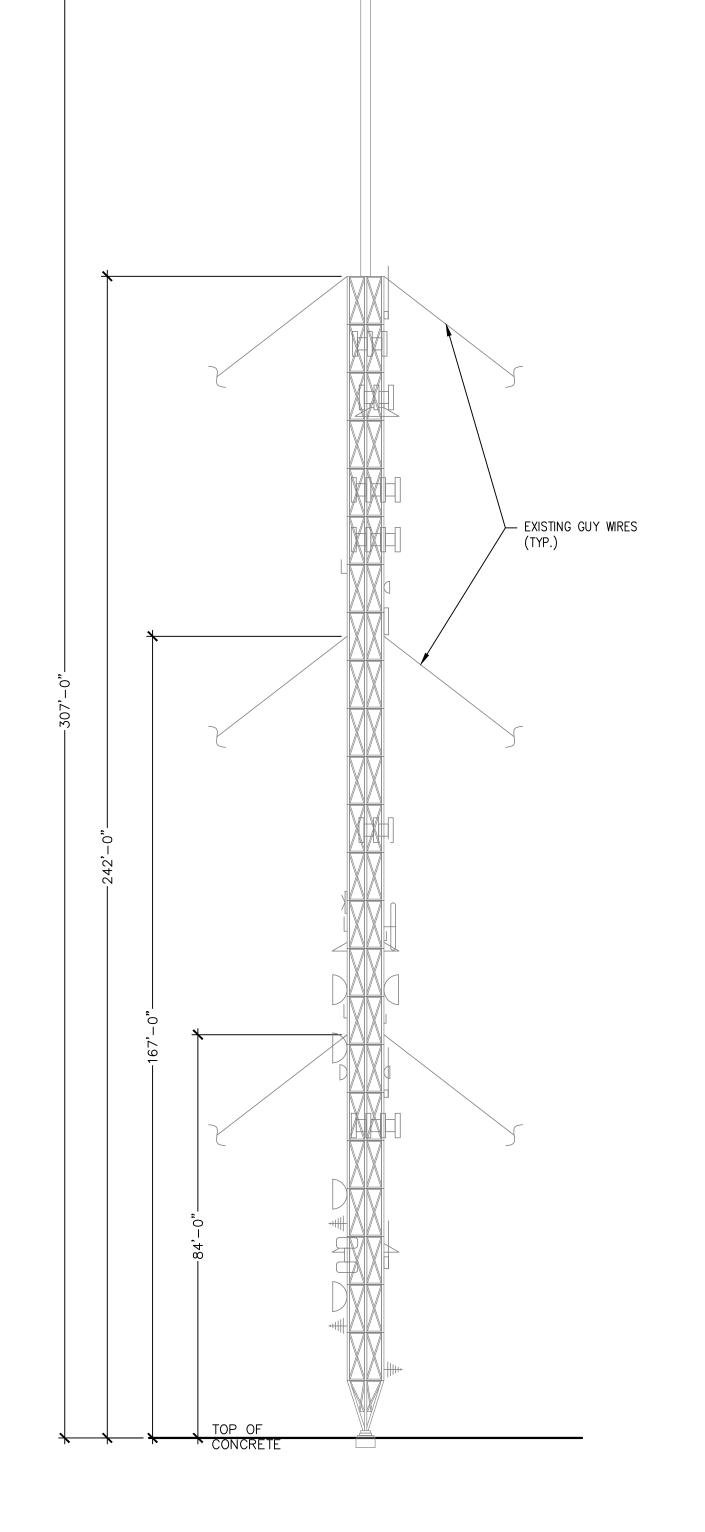
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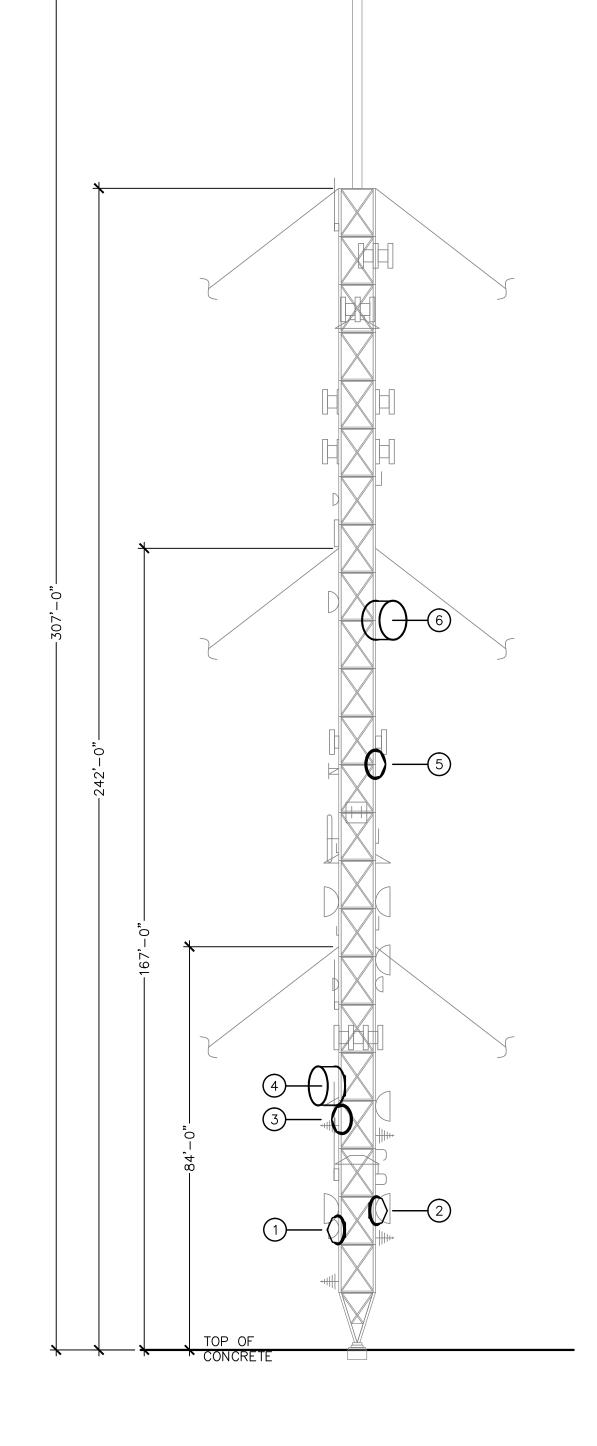




















No.	Equipment Name	Quantity	Manufacturer	Dimensions	Weight	Frequency	Mounting Height	Angle/Direction
1	PAD6-59BC Microwave Antenna (Radome)	1	Radio Frequency Systems (RFS)	6 ft. dia.	185 lbs / 225 lbs. w/ Radome	5.925-6.425 GHz	25 ft.	324° 11' 2.37" (Belfry Mt.)
2	PAD6-59BC Microwave Antenna (Radome)	1	Radio Frequency Systems (RFS)	6 ft. dia.	185 lbs / 225 lbs. w/ Radome	5.925-6.425 GHz	29 ft.	260° 33' 36" (Black Mt.)
3	PAD6-59BC Microwave Antenna (Radome)	1	Radio Frequency Systems (RFS)	6 ft. dia.	185 lbs / 225 lbs. w/ Radome	5.925-6.425 GHz	48 ft.	308° 28' 20.34" (Mt. Defiance)
4	DA8-59AC Microwave Antenna (High Performance)	1	Radio Frequency Systems (RFS)	8 ft. dia.	396 lbs.	5.925-6.425 GHz	55 ft.	324° 11' 2.37" (Belfry Mt.)
5	PAD6-59BC Microwave Antenna (Radome)	1	Radio Frequency Systems (RFS)	6 ft. dia.	185 lbs / 225 lbs. w/ Radome	5.925-6.425 GHz	122 ft.	271° 30′ 36″ (Gore Mt.)
6	DA8-59AC Microwave Antenna (High Performance)	1	Radio Frequency Systems (RFS)	8 ft. dia.	396 lbs.	5.925-6.425 GHz	152 ft.	271° 30' 36" (Gore Mt.)

#### SPECIAL NOTE REGARDING ANTENNAS & TOWER:

THE STRUCTURAL ADEQUACY OF TOWER TO ACCEPT ADDITIONAL ANTENNAS HAS BEEN DETERMINED BY OTHERS. A SEPARATE STRUCTURAL ANALYSIS WAS COMPLETED BY TOWER TECHNOLOGY INC. KANSAS CITY, MO; DATED SEPTEMBER 9, 2009, AND OUTLINED STRUCTURAL MODIFICATIONS THAT ARE NECESSARY. ALSO, THE STRUCTURAL ATTACHMENT OF ANY NEW ANTENNAS WILL BE DETERMINED BY OTHERS. AES NORTHEAST, PLLC IS NOT RESPONSIBLE FOR STRUCTURAL EVALUATION OF ANTENNA, ANTENNA ORIENTATION, PLACEMENT OR ATTACHMENT TO TOWER.



Architecture, Engineering, and Land Surveying Northeast, PLLC 10 -12 City Hall Place, Plattsburgh, NY 12901
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ARCHITECT - ENGINEER - LAND SURVEYOR

#### NOTES:

- ALL WORK SHOWN ON THIS DRAWING IS FOR REFERENCE PURPOSES ONLY. ANTENNAS & TRANSMISSION LINES WILL BE PROVIDED BY
- 2. EXISTING TOWER ELEVATIONS ARE SCHEMATIC REPRESENTATIONS.
- ATTACH NEW EQUIPMENT IN ACCORDANCE WITH INDUSTRY STANDARDS AND VERMONT CODES.
- 4. FIELD VERIFY FINAL LOCATION OF EQUIPMENT WITH ESSEX COUNTY, FEDERAL ENGINEERING AND ACUTEL PRIOR TO INSTALLATION.

PROJECT TITLE:

ESSEX COUNTY, NEW YORK
PUBLIC SAFETY RADIO
COMMUNICATIONS SYSTEM

# GRANDPA'S KNOB TELECOMMUNICATIONS SHELTER ALTERATIONS

CASTLETON, RUTLAND COUNTY, VERMONT

DRAWING TITLE:

RADIO TOWER ELEVATIONS

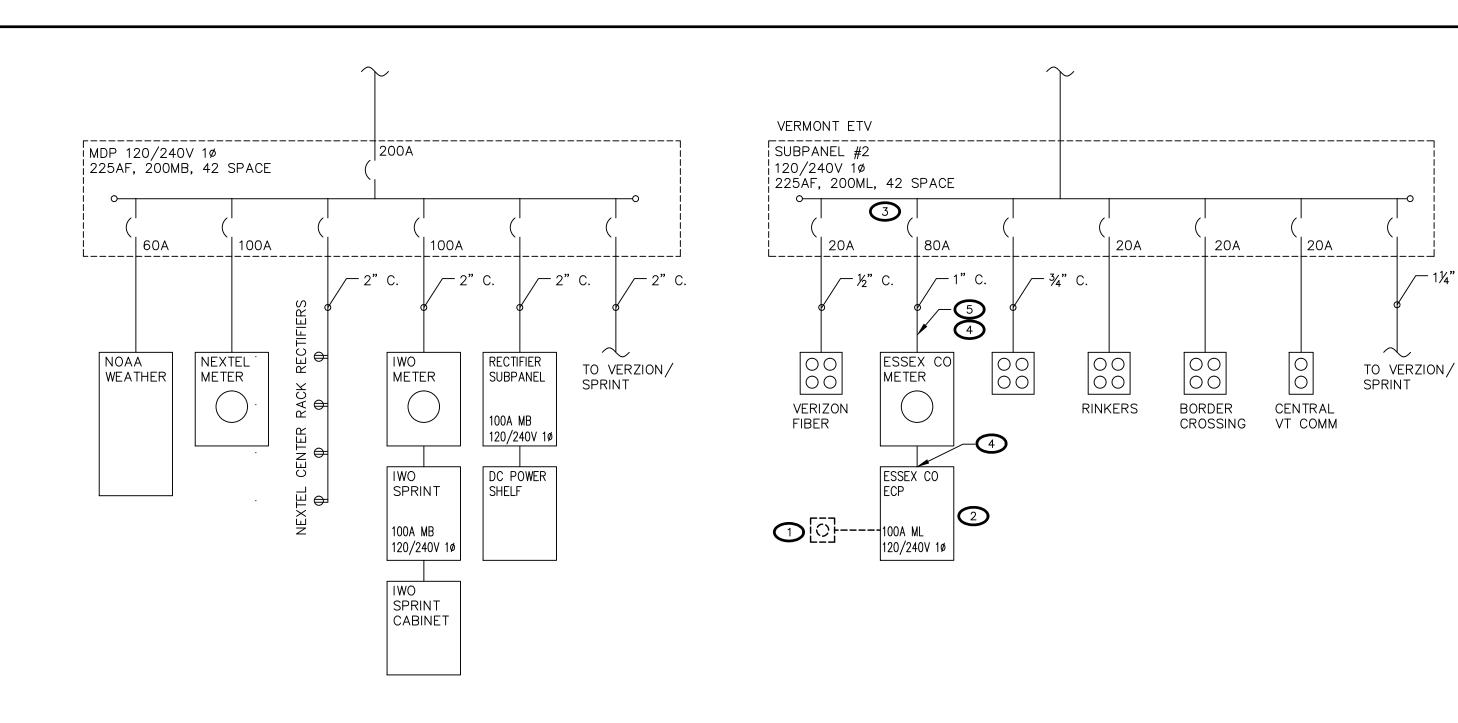
REVISIONS

NO.DESCRIPTIONDATE (MM/DD/YYYY)1.REVISIONS PER LEGAL COUNSEL COMMENTS 12/12/20112.ISSUED FOR CONSTRUCTION08/28/2012

A - 501

e: 08/27/2012 Plot Time: 3:56 PM : P:\38\3809 Essex County — Grandpas Knob, VT ConD

DRAWING NO.



<u>PANEL</u>	ECP	100	AM	MAIN	LUG			BRAN	CH BREA	KER SUM	IMARY		
BUSES	CU.	W/ GRD B	us ,		ISO. GRD BUS		POLES	AMPS.	USED	SPARE	TOTAL	TOTAL POLES	
120/2	10V 1-PHASE	3-WIRE	•				1	20	1	1	2	2	
BREA	KER INTERF	G CAPACIT	Υ		10,000 AIC			30	2	0	2	4	
ENCLO	SURE	NEMA 1		COVER TYPE									
SURF	ACE MOUNT		>	CLA	MPED ONLY								
FLUSH	MOUNT			D00	R-IN-DOOR	Х							
CIRCU	IT BREAKER	TYPE		_									
BOLT-	-ON		>	PLU	PLUG-IN				BL	.ANKS	0	6	
	BRAI	NCH CIRCUITS	5				-			WIRIN	G		
CKT.	BREAKERS	S PH.	COI	I. LOAD	OAD EQUIP		OAD EQUIPMEN		IT	T LOAD GROUND		(	COND.
NO.	POLE AN	1P.   '''	KVA	HP.					WIRE	WIRE		JOI1D.	

RECEPT. / RECTIFIER

RECEPT. / RECTIFIER

RECEPT. / DEHYDRATOR

#10

#10

#12

#10

#10

#12

3/4"

3/4"

3/4"

ABBREVIATION	DESCRIPTION
AF	AMPERE FRAME
A OR AMP	AMP
A.F.F.	ABOVE FINISHED FLOOR
A.F.G.	ABOVE FINISHED GRADE
ALUM.	ALUMINUM
CU	COPPER
NC	DOWN
E.C.	ELECTRICAL CONTRACTOR
EF-X	EXHAUST FAN, X DENOTES NUMBER
ELEV.	ELEVATION
F.F.	FINISHED FLOOR
G.C.	GENERAL CONTRACTOR
M.C.	MECHANICAL CONTRACTOR
PTD.	PAINTED
S.C.	SITE CONTRACTOR
S.S.	STAINLESS STEEL
TYP.	TYPICAL
JH-X	UNIT HEATER, X DENOTES NUMBER
J.NO.	UNLESS NOTED OTHERWISE

ARCHITECT - ENGINEER - LAND SURVEYOR NOTES:

1 REMOVE DUPLEX RECEPTACLE.

SPECIFIC DESCRIPTION OF THE ALTERATION.

REMOVE EXISTING WBTV 2-SPACE LOADCENTER AND REPLACE WITH 6-SPACE LOADCENTER.

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FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A

3 REMOVE EXISTING 60A 2-POLE CB AND REPLACE WITH 80A 2-POLE CB.

4 REMOVE EXISTING CONDUCTORS AND REPLACE WITH (2) #4 AND (1) #8 GROUND. 5 MAINTAIN EXISTING METER CABINET AND

ELECTRICAL DEVICE LEGEND

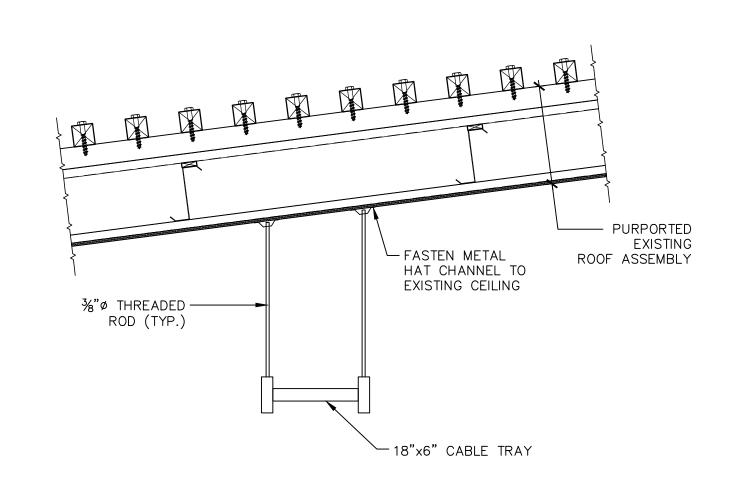
SYMBOL	DESCRIPTION	SPEC.
S	LIGHT SWITCH	16140
φ	SIMPLEX RECEPTACLE	16140
φ	DUPLEX RECEPTACLE	16140
$\Phi_{ extsf{GFI}}$	RECEPTACLE WITH GROUND FAULT PROTECTION	16140
JÓ	JUNCTION BOX (SIZED PER NEC)	16130
<b>€</b> PP−X	SURFACE MTD. POWER PANEL	16440
	HOME RUN POWER CIRCUIT	16123
	BELOW SLAB/FLOOR CONDUIT	16130
	ABOVE FLOOR CONDUIT	16130
	CABLE TRAY	16133

\*VERIFY NEW R.O. DOES NOT CONFLICT WITH EXISTING METAL BUILDING GIRT 20 GA. METAL TRACK AROUND OPENING SEALANT @ PERIMETER — 20 GA. GALVANIZED -METAL SLEEVE W/ 2" FLANGES CABLE ENTRY PORT PANELS 12-PORT - CABLES (N.I.C.) - PURPORTED EXISTING EXTERIOR WALL SECTION — CABLE ENTRY PORT

SCALE: 1 1/2" = 1'-0"

ONE-LINE DIAGRAMS - ETV & SATELITE SIGNAL RM.

SCALE: N.T.S.



<u></u> 1¼" C.

1 2 30 1 5.9

2 2 30 1 5.9

5 | 1 | 20 | 1 | 0.4

6 | 1 | 20 | 1 | -

SECTION — CABLE TRAY

SCALE: 3/4" = 1'-0"

PROJECT TITLE:

ESSEX COUNTY, NEW YORK PUBLIC SAFETY RADIO COMMUNICATIONS SYSTEM

GRANDPA'S KNOB TELECOMMUNICATIONS SHELTER ALTERATIONS

CASTLETON, RUTLAND COUNTY, VERMONT

DRAWING TITLE:

ELECTRICAL NOTES, ONE-LINE DIAGRAMS & DETAILS

REVISIONS

DATE (MM/DD/YYYY) NO. DESCRIPTION . REVISIONS PER LEGAL COUNSEL COMMENTS 12/12/2011 2. ISSUED FOR CONSTRUCTION

DATE: 10/07/2011 E. SEARS

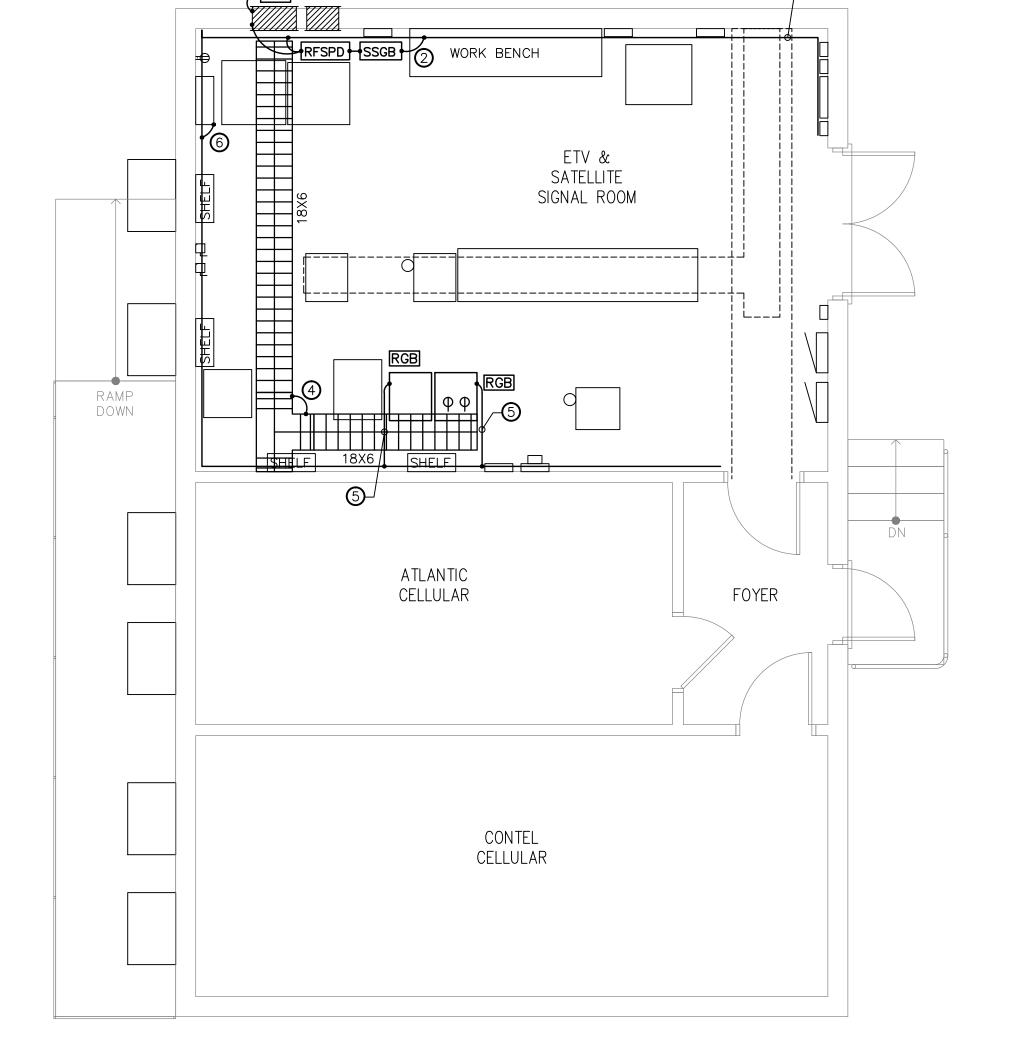
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E - 001

#### COMMUNICATION EQUIPMENT SCHEDULE

ITEM NO.	EQUIPMENT NAME/DESCRIPTION	VOLTAGE	PHASE	CYCLE	NEMA	TYPE	QTY	VOLT-AMPS (VA)	TOTAL VA	REMARKS
1	IWO SPRINT									
2	VERIZON FIBER	-	-	-	-	-	-	=	-	EXIST. TO REMAIN
3	DC POWER SHELF	-	-	-1	н	-	F	В	i-	EXIST. TO REMAIN
4	NEXTEL CABINETS	-	-	-	1	-	-	-	-	EXIST. TO REMAIN
5	GLENAYRE/CENTER VT COMMUN.	=	J <del>.</del>	=		.=	:-	-	.=	EXIST. TO REMAIN
6	BORDER CROSSING	-	ı <del></del>	-1	1	æ	-	=	i-	EXIST. TO REMAIN
7	RINKERS MOTOROLA	_	7-	<b>-</b> 7	i i	-	-	-	-	EXIST. TO REMAIN
8	NOAA WEATHER SERVICE	-	-	-	-	-	-	-	-	EXIST. TO REMAIN
9	PROPOSED MICROWAVE RACK	-	-	-1	-	-	-	-	-	
10	PROPOSED RECTIFIER & BATTERIES	240	1	60	L14-30R	SIMPLEX	2	5950	11900	RECEPTS. CLG MTD
11	DEHYDRATOR	120	1	60	5-20R	DUPLEX	1	350	350	RECEPTS. WALL MTD @ 36" A.F.F.

## 16133 – CABLE ENTRY - EXIST. CABLE - RECTIFIER SUBPANEL ENTRY PORT 12 PORT SEE DETAIL 2/E-001 WORK BENCH - IWO SPRINT METER IWO SPRINT SUBPANEL ETV & SIGNAL ROOM BTM. OF EXIST 18x1 CABLE TRAY EL. 7'-6" A.F.F. 16133 CABLE TRAY BTM. @ 7'-6" (SEE DETAIL 3/E-001) HVAC VERMONT ETV SUBPANEL #2 DOWN F 18X6 SHELF EXIST. METER SOCKET HVAC NEW ESSEX CO LOADCENTER ATLANTIC CELLULAR FOYER | HVAC| | HVAC| CONTEL CELLULAR HVAC





#### GROUNDING LEGEND:

MGB MAIN GROUND BUSS BAR

SSGB SUB SYSTEM GROUNDING BUS BAR

RGB RACK GROUND BUS BAR

EGB EXTERNAL GROUND BUS BAR

RFSPD RF SURGE PROTECTIVE DEVICE

(1) MGB GROUNDING CONDUCTOR: #2 CU. TO ACEG BARE

② COMMUNICATION BONDING BACKBONE: JACKETED #2 CU.

(3) INTERIOR PERIMETER GROUNDING BUS (IPGB)(4) BOND CABLE TRAY SECTIONS W/ JUMPERS: JACKETED #6 CU.

(5) TYP. RACK GROUND BUS BAR GROUNDING CONDUCTOR: JACKETED #2 CU.

6 TYP. EQUIPMENT GROUNDING CONDUCTOR

TYP. COMMUNICATION DISH SUPPORT BONDING

8 SCH. 40 PVC SLEEVE

9 GENERATOR CHASSIS GROUND

EXTERNAL GROUND BUS CONDUCTOR. #% CU, BARE

-3 EXISTING

RF SURGE PROTECTION GROUND CONDUCTOR, #6 CU, BARE

AES

Architecture, Engineering, and Land Surveying Northeast, PLLC 10 -12 City Hall Place, Plattsburgh, NY 12901
Phone: (518) 561-1598 Fax: (518) 561-1990
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ARCHITECT - ENGINEER - LAND SURVEYOR

#### NOTES:

THESE DRAWINGS REPRESENT SCHEMATIC REPRESENTATION OF BUILDING GROUNDING SYSTEM. REFER TO SPEC SECTION 16060 FOR SPECIAL REQUIREMENTS. NOT ALL EQUIPMENT/FIXTURES REQUIRING GROUNDING/BONDING ARE ILLUSTRATED ON THESE DRAWINGS.

2 RF SURGE PROTECTION DEVICES (N.I.C.)
PROVIDED BY COMMUNICATION SYSTEM
VENDOR.

REUSE EXIST. WBTV METER FOR PROPOSED EQUIPMENT 9 & 10. RE-LABEL EQUIPMENT TO ESSEX CO.

PROJECT TITLE:

ESSEX COUNTY, NEW YORK
PUBLIC SAFETY RADIO
COMMUNICATIONS SYSTEM

# GRANDPA'S KNOB TELECOMMUNICATIONS SHELTER ALTERATIONS

CASTLETON, RUTLAND COUNTY, VERMONT

DRAWING TITLE:

ELECTRICAL PLANS

REVISIONS

 NO.
 DESCRIPTION
 DATE
 (MM/DD/YYYY)

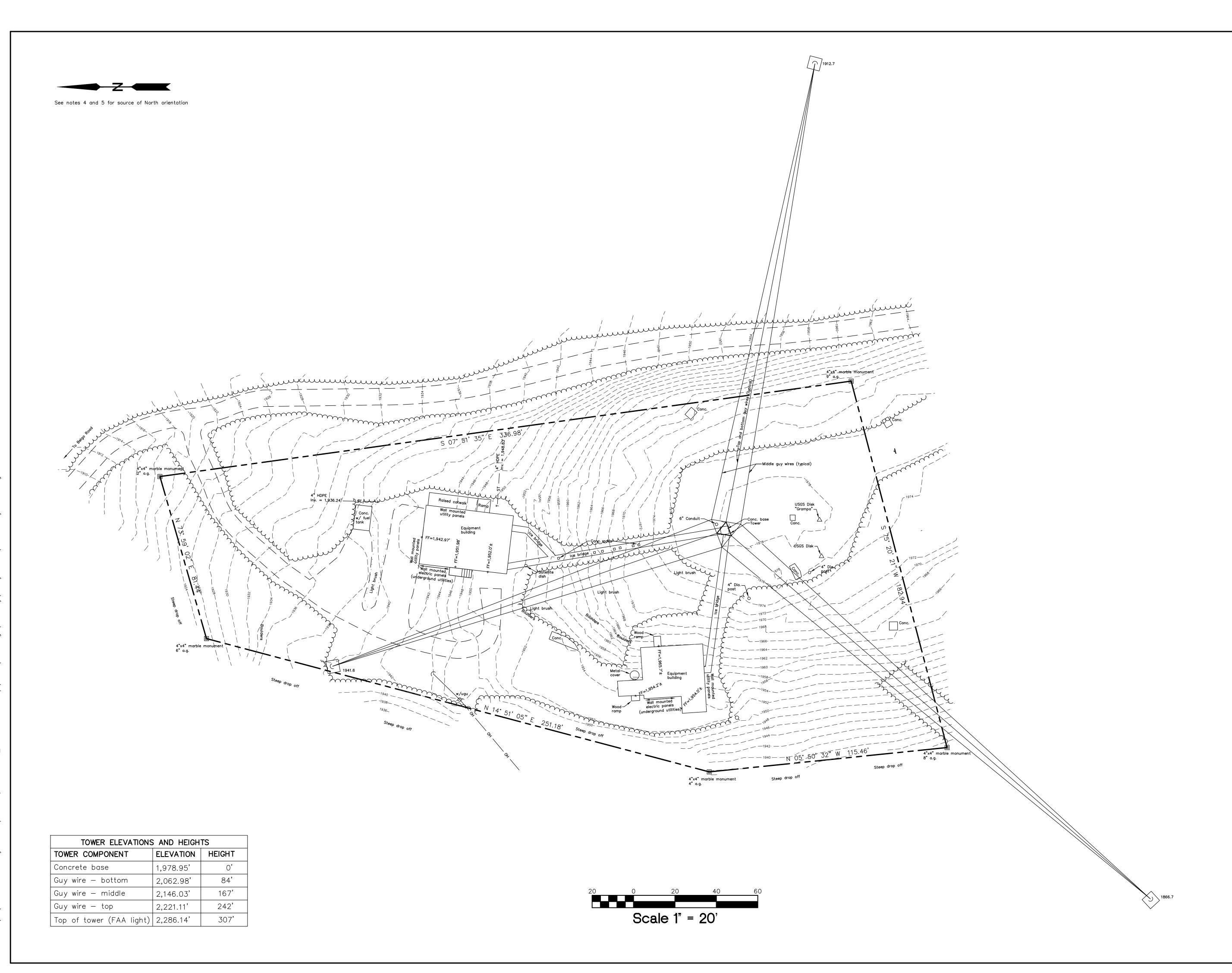
 1.
 REVISIONS PER LEGAL COUNSEL COMMENTS
 12/12/2011

 2.
 ISSUED FOR CONSTRUCTION
 08/28/2012

DRAWING NO.

E - 101

Plot Date: V8/2//2012 Plot Ilme: 3:36 PM File Path: P:\38\3809 Essex County — Grandpas Knob, VT ConDocs\_Communications Equipment\F drawings\E





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- . The location of underground improvements or encroachments are not always known and often must be estimated. If any underground improvements or encroachments exist or are shown, the improvements o encroachments are not covered by surveyor's certification.Utility locations shown are approximate and are for informational purposes only. Before you dig, call 811 or visit the web site www.digsafelynewyork.com.
- The boundary line shown hereon is based on the following map: "BOUNDARY SURVEY, VERMONT ETV, INC. PROPERTY, GRAMPA'S KNOB ROAD..." prepared by Vermont Survey Consultants, LLC., dated November 3,
- 5. Datum for survey:

Coordinate System: Vermont State Plane Coordinate System (Based on reference map)

Vertical Datum: NAVD 88 (Geoid 03) based on GPS observations

Map distances shown, if any, are grid distances.

PROJECT TITLE:

ESSEX COUNTY, NEW YORK PUBLIC SAFETY COMMUNICATIONS
NETWORK PROJECT

## GRANDPA'S KNOB BUILDING & TOWER ALTERATIONS

CASTLETON, RUTLAND COUNTY, VERMONT

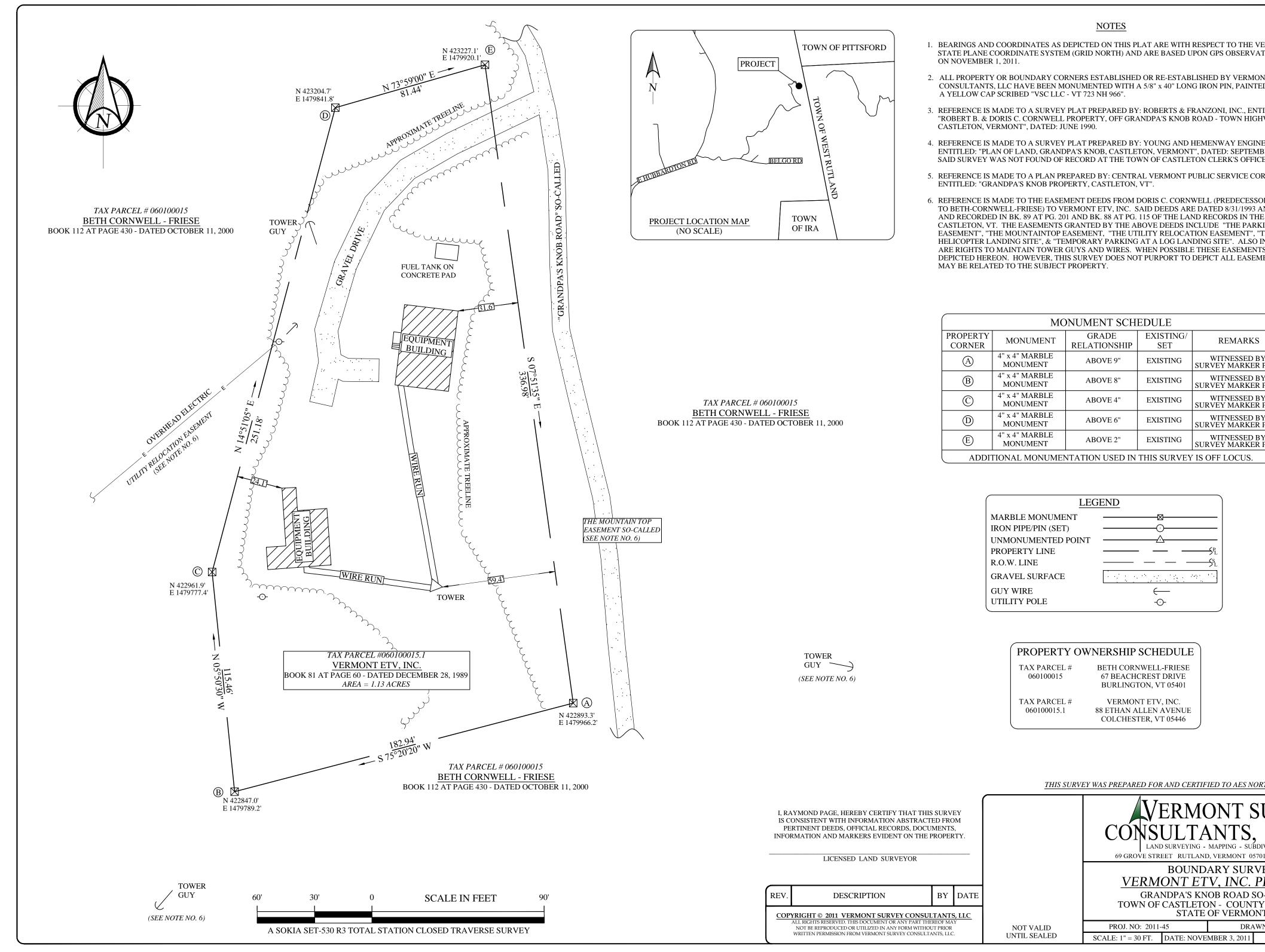
DRAWING TITLE:

### **EXISTING** CONDITIONS

		RE	CVI	SIONS		
NO.	DESC:	RIPTION		DATE	(MM/	DD/YYYY)
	1"		2"		3"	4
DRAWN BY: G. Pawlo		CHECKED BY:		DATE: 11/28/20	011	PROJECT NO.: 3809

G. Pawlowski DRAWING NO.

V - 101



- 1. BEARINGS AND COORDINATES AS DEPICTED ON THIS PLAT ARE WITH RESPECT TO THE VERMONT STATE PLANE COORDINATE SYSTEM (GRID NORTH) AND ARE BASED UPON GPS OBSERVATIONS MADE
- 2. ALL PROPERTY OR BOUNDARY CORNERS ESTABLISHED OR RE-ESTABLISHED BY VERMONT SURVEY CONSULTANTS, LLC HAVE BEEN MONUMENTED WITH A 5/8" x 40" LONG IRON PIN, PAINTED RED WITH A YELLOW CAP SCRIBED "VSC LLC - VT 723 NH 966".
- 3. REFERENCE IS MADE TO A SURVEY PLAT PREPARED BY: ROBERTS & FRANZONI, INC., ENTITLED: "ROBERT B. & DORIS C. CORNWELL PROPERTY, OFF GRANDPA'S KNOB ROAD - TOWN HIGHWAY NO. 30, CASTLETON, VERMONT", DATED: JUNE 1990.
- 4. REFERENCE IS MADE TO A SURVEY PLAT PREPARED BY: YOUNG AND HEMENWAY ENGINEERS, ENTITLED: "PLAN OF LAND, GRANDPA'S KNOB, CASTLETON, VERMONT", DATED: SEPTEMBER 1966. SAID SURVEY WAS NOT FOUND OF RECORD AT THE TOWN OF CASTLETON CLERK'S OFFICE.
- 5. REFERENCE IS MADE TO A PLAN PREPARED BY: CENTRAL VERMONT PUBLIC SERVICE CORPORATION, ENTITLED: "GRANDPA'S KNOB PROPERTY, CASTLETON, VT".
- 6. REFERENCE IS MADE TO THE EASEMENT DEEDS FROM DORIS C. CORNWELL (PREDECESSOR IN TITLE TO BETH-CORNWELL-FRIESE) TO VERMONT ETV, INC. SAID DEEDS ARE DATED 8/31/1993 AND 5/10/1983 AND RECORDED IN BK. 89 AT PG. 201 AND BK. 88 AT PG. 115 OF THE LAND RECORDS IN THE TOWN OF CASTLETON, VT. THE EASEMENTS GRANTED BY THE ABOVE DEEDS INCLUDE "THE PARKING EASEMENT", "THE MOUNTAINTOP EASEMENT, "THE UTILITY RELOCATION EASEMENT", "TEMPORARY HELICOPTER LANDING SITE", & "TEMPORARY PARKING AT A LOG LANDING SITE". ALSO INCLUDED ARE RIGHTS TO MAINTAIN TOWER GUYS AND WIRES. WHEN POSSIBLE THESE EASEMENTS ARE DEPICTED HEREON. HOWEVER, THIS SURVEY DOES NOT PURPORT TO DEPICT ALL EASEMENTS THAT MAY BE RELATED TO THE SUBJECT PROPERTY.

	MONUMENT SCHEDULE									
PROPERTY CORNER	MONUMENT GRADE RELATIONSHIP		EXISTING/ SET	REMARKS						
A	4" x 4" MARBLE MONUMENT	ABOVE 9"	EXISTING	WITNESSED BY SURVEY MARKER POST						
B	4" x 4" MARBLE MONUMENT	ABOVE 8"	EXISTING	WITNESSED BY SURVEY MARKER POST						
©	4" x 4" MARBLE MONUMENT	ABOVE 4"	EXISTING	WITNESSED BY SURVEY MARKER POST						
(D)	4" x 4" MARBLE MONUMENT	ABOVE 6"	EXISTING	WITNESSED BY SURVEY MARKER POST						
Œ	4" x 4" MARBLE MONUMENT	ABOVE 2"	EXISTING	WITNESSED BY SURVEY MARKER POST						

LEGEND	
MARBLE MONUMENT IRON PIPE/PIN (SET) UNMONUMENTED POINT	—————————————————————————————————————
PROPERTY LINE R.O.W. LINE	
GRAVEL SURFACE GUY WIRE	
UTILITY POLE	

PROPERTY OWNERSHIP SCHEDULE TAX PARCEL# BETH CORNWELL-FRIESE 67 BEACHCREST DRIVE 060100015 BURLINGTON, VT 05401 VERMONT ETV, INC. TAX PARCEL# 88 ETHAN ALLEN AVENUE COLCHESTER, VT 05446

THIS SURVEY WAS PREPARED FOR AND CERTIFIED TO AES NORTHEAST, PLLC.

## VERMONT SURVEY CONSULTANTS, LLC

LAND SURVEYING - MAPPING - SUBDIVISIONS 69 GROVE STREET RUTLAND, VERMONT 05701 (802) 773-2210

**BOUNDARY SURVEY** VERMONT ETV, INC. PROPERTY GRANDPA'S KNOB ROAD SO-CALLED

TOWN OF CASTLETON - COUNTY OF RUTLAND STATE OF VERMONT DRAWN BY: RHP PROJ. NO: 2011-45 NOT VALID UNTIL SEALED SCALE: 1" = 30 FT. DATE: NOVEMBER 3, 2011 SHEET 1 OF 1



## Public Safety Radio Communications System Grandpa's Knob, Vermont Telecommunications Shelter Alterations

#### TECHNICAL SPECIFICATIONS

AES PROJECT NO. 3809 August 28, 2012

THE ARCHITECT CERTIFIES THAT TO THE BEST OF HIS KNOWLEDGE, INFORMATION, AND BELIEF; THE PLANS AND SPECIFICATIONS ARE IN CONFORMANCE WITH APPLICABLE REQUIREMENTS OF THE NEW YORK STATE UNIFORM FIRE PROTECTION AND BUILDING CODES.

**PROJECT ENGINEER** 



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**PROJECT ARCHITECT** 

#### DOCUMENT 00010

#### TABLE OF CONTENTS – TECHNICAL SPECIFICATIONS

Section Title

#### **SERIES 0 DOCUMENTS**

MISCELLANEOUS DOCUMENTS

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**DIVISION 2 - SITE CONSTRUCTION** 

02316 Rock Removal

**DIVISION 3 - CONCRETE** 

03300 Cast-In-Place Concrete

**DIVISION 5 - METALS** 

05120 Structural Steel

05530 Gratings

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

07900 Joint Sealers

#### DIVISION 16 – ELECTRICAL

16060 Grounding and Bonding

16070 Electrical Supports

16075 Electrical Identification

16123 Building Wire and Cable

16130 Raceway and Boxes

16133 Cable Trays for Communications Systems

16140 Wiring Devices

16440 Panelboards

#### **END OF SECTION**

#### **SECTION 02316**

#### **ROCK REMOVAL**

#### PART 1 GENERAL

#### 1.1 SUMMARY

A. Section includes removal of identified and discovered rock during excavation and expansive tools to assist rock removal. ROCK REMOVAL BY EXPLOSIVE METHOD IS NOT PERMITTED.

#### 1.2 DEFINITIONS

- A. Site Rock: Solid mineral material with volume in excess of one and one half (3/4) cu yd or solid material that cannot be removed with one and one half (1½) cu yd capacity excavator without drilling or blasting.
- B. Trench Rock: Solid mineral material with volume in excess of one and one half (3/4) cu yd or solid material that cannot be removed with one and one half (1½) cu yd capacity excavator without drilling or blasting.
- C. Rock: Solid mineral material of size that cannot be removed with one and one half  $(1\frac{1}{2})$  cu yd capacity excavator.

#### 1.3 SCHEDULING

- A. Section 01300 Administrative Requirements: Coordination and project conditions.
- B. Schedule Work to avoid disruption to occupied buildings nearby.

#### PART 2 PRODUCTS

#### 2.1 MATERIALS (NONE)

#### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Section 01300 Administrative Requirements: Coordination and project conditions.
- B. Verify site conditions and note subsurface irregularities affecting Work of this section.

#### 3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

#### 3.3 ROCK REMOVAL BY MECHANICAL METHOD

- A. Excavate and remove rock by mechanical method.
  - 1. Drill holes and use expansive tools and wedges to fracture rock.
- B. Cut away rock at bottom of excavation to form level bearing.
- C. Remove shaled layers to provide sound and unshattered base for footings and foundations.
- D. In single pipe utility trenches, excavate to 6 inches below invert elevation of pipe and 36 inches wider than pipe diameter.
- E. In dual pipe utility trenches, excavate to 6 inches below invert elevation of pipe and 48 inches wider than pipe diameter.
- F. Remove excavated materials from site.
- G. Correct unauthorized rock removal with lean concrete fill as directed by Engineer.

#### 3.4 FIELD QUALITY CONTROL

- A. Section 01400 Quality Requirements: Testing and Inspection Services.
- B. Request visual inspection of foundation bearing surfaces by Engineer before installing subsequent work.

**END OF SECTION** 

#### **SECTION 03300**

#### **CAST-IN-PLACE CONCRETE**

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Stanchion Support Piers.

#### 1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
- B. Data:
  - 1. Admixtures.
  - 2. Form materials and form-release agents.
  - 3. Pre-Mixed Bag Concrete
  - 4. Adhesives.
- C. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing pre-mixed bag concrete.
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

- C. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician Grade II.
- D. Source Limitations: Obtain pre-mixed bag concrete material of the same brand from the same manufacturer's plant. Obtain admixtures from single source from single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5. Sections 1 through 5.
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
  - 3. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures. See Below.
- F. Special Inspections: The Owner will retain the services of a qualified Special Inspector for this project. The Special Inspector will provide and/or coordinate inspection and testing requirements in accordance with the provisions of Section 1704 of the International Building Code, and the Statement of Special inspections. The contractor shall provide access as required for the special inspections to take place. The contractor shall notify the special inspector of the construction schedule so that the inspections are completed in a timely manner.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Pre-Mixed Bag Concrete: Keep dry in a well-ventilated enclosure at all times. All damaged bags will be rejected.

#### PART 2 - PRODUCTS

#### 2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Metal, adhesive laminated paperboard, or other approved panel materials.
  - 2. One piece, round laminated paperboard forms shall be Sonotubes by Sonoco or equal.
- B. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

#### 2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

#### 2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

#### 2.4 CONCRETE MATERIALS

- A. Cementitious Material: Pre-mixed bag concrete shall contain the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type I/II.
- B. Normal-Weight Aggregates: Pre-mixed bag concrete shall contain ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Maximum Coarse-Aggregate Size: 1 inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: Potable.

#### 2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

#### 2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

#### 2.7 RELATED MATERIALS

A. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

B. Bonding Adhesive for Rebar Dowels: Hilti HIT-HY 150 Adhesive as manufactured by Hilt Corp. or equivalent .

#### 2.8 CONCRETE MIXTURES, GENERAL

- A. Cementitious Materials: If possible, use fly ash, pozzolan, or ground granulated blast-furnace slag as needed to reduce the total amount of portland cement, which would otherwise be used. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent.
  - 2. Combined Fly Ash and Pozzolan: 25 percent.
  - 3. Ground Granulated Blast-Furnace Slag: 50 percent.
- B. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing admixture in concrete, as required, for placement and workability.

#### 2.9 CONCRETE MIXTURES

- A. Footings: Supply pre-mixed bag concrete product meeting the following requirements:
  - 1. Minimum Compressive Strength: 4000 psi at 28 days.
  - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
  - 3. Slump Limit: 5 inches.
  - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

#### 2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

#### 2.11 CONCRETE MIXING

- A. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in strict accordance with pre-mixed bag concrete manufacturer's requirements. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

#### **PART 3 - EXECUTION**

#### 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  - 1. Class C, 1/2 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
- F. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- G. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- H. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

#### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor bolts, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

#### 3.3 REMOVING AND REUSING FORMS

A. General: Formwork for foundations that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 36 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

#### 3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

#### 3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- C. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- D. Hot-Weather Placement: Comply with ACI 301 and as follows:
  - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

#### 3.6 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to all vertical concrete surfaces.
- B. Related Unformed Surfaces: At tops of foundations and similar unformed surfaces adjacent to formed surfaces, strike off smooth and apply a smooth trowel finish.

#### 3.7 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with inplace construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

#### 3.8 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

#### 3.9 CONCRETE SURFACE REPAIRS

A. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

- B. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

#### C. Repairing Unformed Surfaces:

- 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
- 2. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- 3. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- D. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

#### 3.10 FIELD QUALITY CONTROL

**A.** Testing and Inspecting: Testing and Inspecting: Contractor will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Contractor shall be responsible to notify special inspector of when tests will be performed. Notify special inspector at least 24 hours in advance of testing.

#### B. Inspections:

- 1. Steel reinforcement placement.
- 2. Verification of use of required design mixture.
- 3. Concrete placement, including conveying and depositing.
- 4. Curing procedures and maintenance of curing temperature.

- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture.
  - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  - 3. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  - 4. Compression Test Specimens: ASTM C 31/C 31M.
    - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
  - 5. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
  - 6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  - 7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
  - 8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
  - 9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
  - 10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M.
  - 11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION

#### **SECTION 05120**

#### STRUCTURAL STEEL

#### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Channels, angles, and pipes.
  - 2. Fasteners, connectors, and anchors.
  - 3. Grout.

#### 1.2 SUBMITTALS

A. Shop Drawings: Indicate sizes, spacing, and locations of structural members, openings, connections, cambers, loads, and welded connections.

#### 1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
  - 1. AISC Code of Standard Practice for Steel Buildings and Bridges.
  - 2. AISC Seismic Provisions for Structural Steel Buildings.
  - 3. RCSC Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.
  - B. Special Inspections: The Owner will retain the services of a qualified Special Inspector for this project. The Special Inspector will provide and/or coordinate inspection and testing requirements in accordance with the provisions of Section 1704 of the International Building Code, and the Statement of Special inspections. The contractor shall provide access as required for the special inspections to take place. The contractor shall notify the special inspector of the construction schedule so that the inspections are completed in a timely manner.

#### 1.4 QUALIFICATIONS

- A. Fabricator: Company specializing in performing Work of this section with minimum 3 years experience with one of the following current AISC Certification:
  - 1. Standard Steel Building Structures (STD).
  - 2. Conventional Steel Building Structures (SBD).
  - 3. Complex Steel Building Structures (CBD).
  - 4. Erector: Company specializing in performing Work of this section with minimum 3 years experience.
- B. Shop Painter: Company specializing in performing Work of this section with minimum 3 years experience.

C. Welders and Welding Procedures: AWS D.1 qualified within previous 12 months.

#### **PART 2 PRODUCTS**

#### 2.1 STRUCTURAL STEEL

- A. Channels, Angles, and Plates: ASTM A36/A36M.
- B. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

#### 2.2 FASTENERS, CONNECTORS, AND ANCHORS

- A. Bolts: ASTM A325; Type 1, Heavy Hex.
  - 1. Finish. Hot-Dipped Galvanized, ASTM A 153.
- B. Nuts: ASTM A563, heavy hex type.
  - 1. Finish: Hot-Dipped Galvanized, ASTM A 153.
- C. Washers: ASTM F436; Type 1, circular
  - 1. Finish: Hot-Dipped Galvanized, ASTM A 153.

#### 2.3 WELDING MATERIALS

A. Welding Materials: AWS D1.1; type required for materials being welded.

#### 2.4 ACCESSORIES

- A. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 7,000 psi at 28 days.
- B. Shop and Touch-Up Primer: SSPC-Paint 20, ASTM A 780.

#### 2.5 FABRICATION

- A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- B. Fabricate connections for bolt, nut, and washer connectors in the field.

#### 2.6 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
  - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
  - 2. Galvanize all structural steel and associated hardware.

#### 2.7 SOURCE QUALITY CONTROL AND TESTS

A. Shop test bolted and welded connections as specified for field quality control tests.

#### PART 3 EXECUTION

#### 3.1 EXAMINATION

A. Verify bearing surfaces are at correct elevation.

#### 3.2 PREPARATION

A. Furnish templates for installation of anchor rods and embedments in concrete..

#### 3.3 ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until installation of permanent bracing.
- B. Shop weld components indicated on shop drawings. Field welding is not permitted.
- C. Do not field cut or alter structural members without approval of Architect/Engineer.
- D. After erection, touch up welds and abrasions to match shop finishes.

#### 3.4 GROUT INSTALLATION

- A. Fill void under bearing surface with grout. Install and pack grout to remove air pockets.
- B. Moist cure grout.
- C. Remove forms after grout is set. Trim grout edges to from smooth surface, splayed 45 degrees.

#### 3.5 FIELD QUALITY CONTROL

#### A. Welding:

- 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
- 2. Visually inspect all welds.
- B. Correct defective welds.

END OF SECTION

#### **SECTION 05530**

#### **GRATINGS**

#### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section includes gratings for ice bridge.
- B. Related Sections:
  - 1. Section 05120 Structural Steel.

#### 1.2 REFERENCES

- A. ASTM International:
  - 1. ASTM A36/A36M Standard Specification for Carbon Structural Steel.
  - 2. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 3. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- B. American Welding Society:
  - 1. AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination.
  - 2. AWS D1.1 Structural Welding Code Steel.
- C. National Association of Architectural Metal Manufacturers:
  - 1. NAAMM MBG 531 Metal Bar Grating Manual.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Design Live Load: Uniform load of 100 lb/sq ft minimum; concentrated load of force 300 lb.
- B. Maximum Allowable Deflection Under Live Load: L/360.

#### 1.4 SUBMITTALS

- A. Shop Drawings: Indicate details of gratings, component supports, anchorage, perimeter construction details, and tolerances. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- B. Product Data: Submit span and deflection tables.

#### 1.5 QUALITY ASSURRANCE

- A. Metal Bar Grating Standards: Comply with NAAMM, "Metal Bar Grating Manual.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel.""

#### 1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

#### PART 2 PRODUCTS

#### 2.1 GRATINGS

- A. Manufacturers:
  - 1. McNichols.
  - 2. Ohio Gratings.
  - 3. Neenah Foundry Model.

#### 2.2 COMPONENTS

- A. Carbon Steel Light Duty Welded Bar Grating Fabricated by Press Welding steel cross bars into rectangular bearing bars thus permanently locking the bars in place.
  - 1. Bearing Bar Spacing: 15/16" on center.
  - 2. Bearing Bar Depth: As shown on the drawings..
  - 3. Bearing Bar Thickness: As shown on the drawings.
  - 4. Top Surface of Bearing Bars: Smooth.
  - 5. Cross Bar Spacing: 4" on center.
- B. Bearing bars and banding are Carbon Steel type ASTM A-1011 CS Type B and Steel Cross Bars are type ASTM A-510.
- C. Welding Materials: AWS D1.1, type required for materials being welded.
- D. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 zinc rich.

#### 2.3 ACCESSORIES

- A. Provide Type 304 stainless-steel fasteners for exterior use.
  - 1. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts.
  - 2. Provide stainless steel saddle clips.
- B. Perimeter Closure: Same material as grating.

#### 2.4 FABRICATION

- A. Grating Type: NAAMM MBG 531 Welded Type.
- B. Weld joints of intersecting metal sections.

#### 2.5 SHOP FINISHING

A. Galvanizing: ASTM A123/A123M; minimum 2.0 oz/sq ft coating thickness; galvanize after fabrication.

#### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify dimensional tolerances are acceptable.
- B. Verify supports and anchors are correctly positioned.

#### 3.2 INSTALLATION

- A. Prior to grating installation, contractor shall inspect supports for correct alignment and conditions for proper attachment and support of the gratings. Any inconsistencies between contract drawings and supporting structure deemed detrimental to grating placement shall be reported in writing to the architect or Owner's agent prior to placement.
- B. Install grating in accordance with shop drawings and standard installation clearances as recommended by ANSI/NAAMM MB-531-09 Metal Bar Grating Manual.

#### 3.3 ERECTION TOLERANCES

A. Conform to NAAMM MBG 531.

#### 3.4 CLEANING

A. Clean welds and damaged coatings and apply two coats of touch-up primer.

#### END OF SECTION

#### **SECTION 07900**

#### **JOINT SEALERS**

#### PART 1 GENERAL

#### 1.1 SUMMARY

A. Section includes sealants and joint backing, and accessories.

#### 1.2 REFERENCES

- A. American Society for Testing and Materials:
  - 1. ASTM C834 Standard Specification for Latex Sealants.
  - 2. ASTM C919 Standard Practice for Use of Sealants in Acoustical Applications.
  - 3. ASTM C920 Standard Specification for Elastomeric Joint Sealants.
  - 4. ASTM C1193 Standard Guide for Use of Joint Sealants.
  - 5. ASTM D1056 Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
  - 6. ASTM D1565 Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).
  - 7. ASTM D1667 Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
  - 8. ASTM D2628 Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

#### 1.3 SUBMITTALS

A. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

#### 1.4 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 Products Requirements.
- B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

#### **PART 2 PRODUCTS**

#### 2.1 JOINT SEALERS

- A. Manufacturers:
  - 1. Sika Corp.
  - 2. Dow Corning Corp.
  - 3. Substitutions or approved equal: Section 01600 Products Requirements.

#### B. Products Description:

1. High Performance General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.

Joint Sealers 07900

- a. Color: Standard colors matching finished surfaces.
- b. Applications: Use for:
  - 1) Control, expansion, and soft joints in masonry.
  - 2) Joints between concrete and other materials.
  - 3) Joints between metal frames and other materials.
  - 4) Other exterior nontraffic joints for which no other sealant is indicated
- 2. Exterior Foam Expansion Joint Sealer: Precompressed foam sealer; Polyurethane with water-repellent.
  - a. Color: Black color.
  - b. Size: As required to provide watertight seal when installed.
  - c. Applications: Use for exterior wall expansion joints.
- 3. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
  - a. Color: Standard colors matching finished surfaces.
  - b. Applications: Use for interior wall and ceiling control joints, joints between door and window frames and wall surfaces, and other interior joints for which no other type of sealant is indicated.

#### 2.2 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D1056, sponge or expanded rubber D1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

#### 2.3 EXPANDING FOAM TAPE

- A. Product Descriptions:
  - 1. Preformed elastic self-adhesive expanding tape seal. Polyurethane expanding foam impregnated with water based acrylic modified asphalt emulsion.
  - 2. 3/4" x 1" supplied size; 3" x 1" full expanded size.
  - 3. Surface must be absolutely free of dust, cement laitance, or dirt.

#### 2.4 FOAM SEALANT

- A. Product Description:
  - 1. Minimal expanding single component polyurethane foam sealant. UL classified ASTM C557.93.

#### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Section 01300 Administrative Requirements: Coordination and project conditions.
- B. Verify substrate surfaces and joint openings are ready to receive work.
- C. Verify joint backing and release tapes are compatible with sealant.

#### 3.2 PREPARATION

- A. Remove loose materials and foreign matter impairing adhesion of sealant.
- B. Clean and prime joints.
- C. Perform preparation in accordance with ASTM C1193.
- D. Protect elements surrounding Work of this section from damage or disfiguration.

#### 3.3 INSTALLATION

- A. Perform installation in accordance with ASTM C1193.
- B. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- C. Install bond breaker where joint backing is not used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Tool joints concave.
- G. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.
- H. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

#### 3.4 CLEANING

- A. Section 01700 Execution Requirements: Final cleaning.
- B. Clean adjacent soiled surfaces.

#### 3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01700 - Execution Requirements: Protecting installed construction.

B. Protect sealants until cured.

#### 3.6 SCHEDULE

- A. Exterior Joints for Which No Other Sealant Type is Indicated: Polyurethane.
- B. Exterior Wall Expansion Joints: Polyurethane (High Elasticity).
- C. Control, Expansion, and Soft Joints in Masonry, and between Masonry and Adjacent Work: Polyurethane (Low Elasticity).
- D. Joints between Exterior Metal Frames and Adjacent Work: Polyurethane.
- E. Interior Joints for Which No Other Sealant is Indicated: Silicone.

**END OF SECTION** 

#### **SECTION 16060**

#### **GROUNDING AND BONDING**

#### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section includes:
  - 1. Interior Grounding System
  - 2. Exterior Grounding System
  - 3. Grounding Conductors
  - 4. Mechanical connectors.
  - 5. Exothermic connections.

#### 1.2 REFERENCES

- A. NECA (National Electrical Contractors Association) Standard of Installation.
- B. NFPA 70 (National Fire Protection Association) National Electrical Code, 2008 Edition
- C. NFPA 101 (National Fire Protection Association) Life Safety Code
- D. NFPA 111 (National Fire Protection Association) Standard on Stored Electrical Energy, Emergency and Standby Power Systems.
- E. NFPA 780 (National Fire Protection Association) Standard for the installation of Lightning Protection Systems.
- F. Underwriters Laboratories
  - 1. UL 467-2004 Grounding and Bonding Equipment
  - 2. UL 497A Secondary Protectors for Communication circuits
  - 3. UL 497B Protectors for Data Communication and Fire Alarm Circuits.
  - 4. UL 1449 Transient Voltage Surge Suppressors
- G. NWSM 30-4106-2004 Lightning Protection, Shielding, Bonding, Grounding and Surge Protection Requirements
- H. Motorola R-56 Standard and Guidelines for Communication Sites

#### 1.3 SYSTEM DESCRIPTION

- A. Grounding electrode system shall consist of the following elements:
  - 1. Rod or plate electrodes
  - 2. Exterior Building Ground Ring.
  - 3. Internal and External Grounding electrode conductors
  - 4. Foundation Encased Electrode

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- 5. External Ground Bus Bar
- 6. Master Ground Bus Bar
- 7. Subsystem Ground Bus Bar
- 8. Rack Ground Bus Bar
- 9. Interior Perimeter Ground Conductor
- 10. Communication Bonding Backbone Conductor
- 11. Equipment Grounding Conductors

#### 1.4 SUBMITTALS

- A. Section 01330 Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit product data on grounding conductors, bus bars, connections and supports, drilling and boring methods, and conductive concrete.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Section 01700 Execution Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of components and grounding electrodes.
- C. Grounding electrode system testing/verification test report.

#### **PART 2 PRODUCTS**

#### 2.1 ROD ELECTRODES

A. Specified in Part 3 below.

#### 2.2 GROUND BUS BARS

A. Specified in Part 3 below.

#### 2.3 GROUNDING CONDUCTORS

- A. Exterior exposed locations: Insulated Copper wire, solid or stranded, sizes as specified. Jacketing shall be labeled/color coded per NFPA 70 Article 250.119A and ANSI –J-STD-607-A-2002.
- B. Partially below or completely below grade: Insulated Copper wire, stranded or solid, sizes as specified.
- C. Interior locations: Jacketed Copper wire, stranded, sizes as specified. Jacketing shall be labeled/color coded per NFPA 70 Article 250.119A and ANSI –J-STD-607-A-2002.

#### 2.4 GROUNDING CONNECTIONS

- A. Mechanical Connections (below grade): UL listed irreversible high compression fittings. Fittings and compression tools (mechanical, hydraulic, battery powered) rated for 12 tons of force. All mechanical connections shall be coated with a conductive anti-oxidant compound, liberally applied between the two metals being connected.
- B. Mechanical Connections (above grade): UL listed irreversible high compression fittings. Fittings and compression tools (mechanical, hydraulic, battery powered) rated for 12 tons of force. UL listed clamps, pressure fittings and 2-hole lugs, bolts, washers as required. Connectors matching type of conductors, conductor quantity, designed for the application. All mechanical connections shall be coated with a conductive anti-oxidant compound, liberally applied between the two metals being connected.
- C. Exothermic Connections (above and below grade): Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.
- D. Listings: Exterior installations: UL 467 with minimum 88% conductivity rating. Interior installations: UL 486A with minimum 88% conductivity rating. Compression systems shall include crimped die index and company logo for inspection purposes.

#### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Section 01300 Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify final backfill and compaction has been completed before driving rod electrodes.

#### 3.2 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points, prior to performing connections.

#### 3.3 EXTERNAL GROUNDING SYSTEM

#### A. External Grounding Conductors:

- 1. Above ground conductors used for bonding metallic objects shall be minimum #6 AWG jacketed copper. Solid straps or bars may be used in lieu of wire as long as the cross sectional area equals the above ground conductor specified.
- 2. External grounding conductors bend angle shall be no less than 90 degrees nor have a bed radius smaller than 8". It shall be run to the grounding electrode system in a direct manner, without loops or sharp bends.
- 3. Above grade conductors shall be protected, when subject to physical damage.

- B. <u>External Ground Bus Bar (EGB)</u>: EGB shall provide a convenient termination point for the communication cabling's entry point prior to entering the building. The cables metallic sheath shall be bonded to the EGB at this location.
  - 1. The EGB shall be designed for the purposes of the grounding and shall be UL listed.
  - 2. The EGB shall be installed just outside the building, adjacent to the microflect entry port.
  - 3. The EGB shall be connected to the electrical grounding system with a direct run and a minimum #1/0 AWG copper conductor.
  - 4. Bare solid alloy copper bus bar or plate, one piece. 12"L (minimum) x 2" H x 0.25" thick. Fiberglass or polyester insulators with 15 kV min. dielectric strength, flame resistant. Mounting holes shall be 0.4375" diameter min. on 0.75" centers for 2-hole lug connections. Stainless steel mounting brackets.
  - 5. Attachment shall be by exothermic welding, irreversible crimp connections.

## C. General Requirements for External Bonding:

- 1. All mechanical and compression type connectors shall be UL 467 listed for size and application.
- 2. Clamps shall be UL 467 listed and have an 88% conductivity rating.

## 3.4 INTERNAL GROUNDING SYSTEM

- A. <u>Master Ground Bus Bar (MGB)</u>: Provides internal grounding termination point for communication system and is a dedicated extension of sites common grounding system.
  - 1. Bare solid allow copper bus bar or plate, one piece. 18"L (minimum) x 2" H x 0.25" thick. Fiberglass or polyester insulators with 15 kV min. dielectric strength, flame resistant. Mounting holes shall be 0.4375" diameter min. on 0.75" centers for 2-hole lug connections. Attachment shall be by exothermic welding, irreversible crimp connections.
  - 2. MGB conductor shall be splice free.
  - 3. MGB Grounding Conductor bend angle shall be no less than 90 degrees nor have a bed radius of 8".
  - 4. MGB shall be insulated from its support structure with a minimum of 2" separation.
  - 5. Connection to external grounding system shall be with a multi-stranded bare copper conductor.
  - 6. MGB Grounding Conductor shall not be placed in ferrous conduit.
  - 7. Provide Schedule 40 PVC sleeve when routing MGB Grounding Conductor to exterior grounding system. Install sleeve at 45 degree angle and seal with RTV silicone.
- B. <u>Subsystem Ground Bus Bar (SSGB):</u> Provides a single point termination point for internal ground bus conductors, internal perimeter ground bus conductor, and equipment grounding conductors within a common subsystem equipment room.
  - 1. Bare solid allow copper bus bar or plate, one piece. 12"L (minimum) x 2" H x 0.25" thick. Fiberglass or polyester insulators with 15 kV min. dielectric strength, flame resistant. Mounting holes shall be 0.4375" diameter min. on 0.75"

centers for 2- hole lug connections. Attachment shall be by exothermic welding, irreversible crimp connections.

- 2. SSGB conductor shall be splice free.
- 3. SSGB conductor shall be #2 copper.
- 4. SSGB shall be insulated from its support structure with a minimum of 2" separation.
- 5. The SSGB bar shall be bonded to the MGB and the communication bonding backbone
- 6. MGB Grounding Conductor bend angle shall be no less than 90 degrees nor have a bed radius of 8". It shall be run to the grounding electrode system in a direct manner, without loops or sharp bends.
- 7. MGB Grounding Conductor shall not be placed in ferrous conduit.
- C. Rack Ground Bus Bar (RGB): Installed within an equipment rack or cabinet. It shall provide a single termination point for equipment grounding conductors with the rack or cabinet.
  - 1. The RGB shall be securely mounted to the rack or cabinet with appropriate standoff clearance for separation from dissimilar metals and for attachment of grounding conductors.
  - 2. RGB grounding conductor shall be jacketed #2 copper.
  - 3. RGB grounding conductor shall be splice free.
  - 4. Attachment shall be by exothermic welding or irreversible crimp connections.

5.

- 6. The SSGB bar shall be bonded to the MGB and the communication bonding backbone
- D. <u>Internal Perimeter Ground Bus Conductors (IPGB)</u>: Existing to remain. The IPGB provides a grounding electrode conductor for the MGB for support apparatus, electrical conduits, equipment and other metallic items throughout the shelter.
  - 1. The IPGB shall not be used to ground communication rack equipment and enclosures.
  - 2. The IPGB shall encompass the entire communication or equipment room with two independent grounding conductors on opposite sides of the room with one end terminated to the MGB or SSGB. IPGB shall be routed horizontally approximately 1'-0" from the ceiling.
- E. <u>Communication Bonding Backbone Conductors (CBBC)</u>: Conductor connecting all main SSGB's serving as a grounding equalizer. CBBC equalizes the potential differences between separate communication SSGB's within a building.
  - 1. CBBC shall originate at the MBG and connect to all SSGB's, finally terminating at the furthest SSGB.
  - 2. CBBC shall be installed to be protected from physical damage. CBBC can be routed through communication pathways (cable trays) en route to other SSGB's.
  - 3. CBBC grounding conductor shall be jacketed #2 copper with maximum of 33' in length. If the length is greater than 33', the CBBC grounding conductor shall be increased in size for 2 kcmil per linear foot of conductor length, with a maximum size of 3/0 AWG.
  - 4. CBBC grounding conductor shall be splice free.

- F. <u>Equipment Grounding Conductors (EGC)</u>: Bonds equipment chassis, frames, and metallic support equipment to the grounding electrode system.
  - 1. EGC shall be bonded to the MGB, SSGB, RGB, or IPGB using methods described in Parts 3.4 A, B and C above.
  - 2. Braided conductors shall not be used.
  - 3. The EGC shall be a minimum of #6 copper bare or jacketed, sized based on the length of the EGC as outlined below:

Conductor Length (ft)	Conductor Size (AWG)
Less than 4	6
4-6	4
6-8	3
8-10	2

- 4. Examples of the equipment requiring EGC's include (but not limited to):
  - a. light fixtures
  - b. unit heaters
  - c. electrical panels
  - d. door and window frames
  - e. storage racks
  - f. metal fencing
  - g. cable trays
  - h. conduit
  - i. HVAC units
  - j. ductwork, grilles
  - k. generator and exhaust systems
  - 1. communication dish structural supports
- G. <u>Bonding Jumpers</u>: Creates a conductive path between electrical components, such as cable trays, piping, conduits or structural framing.
  - 1. Bonding jumpers shall be as short as possible, routed directly to equipment, free of bends or loops.
  - 2. Attachment points shall be free of paint or other coatings to allow for a conductive path.
  - 3. Bonding jumpers shall be no longer than 6'-0" when installed outside a raceway or enclosure.
- H. General Requirements for Internal Bonding:
  - 1. All mechanical and compression type connectors shall be UL 486A listed for size and application.
  - 2. Clamps shall be UL 486A listed and have a 88% conductivity rating.
  - 3. Compression lugs shall be two-hole, long barrel type.
  - 4. Connection between dissimilar metals shall not be used unless conductors are separated by a suitable material that is part of the attachment device.
  - 5. Self tapping or sheet metal type screws shall not be used for any grounding attachments.
  - 6. Insulating piercing connectors are not acceptable.
  - 7. Aluminum connection devices are not acceptable.

- 8. Daisy chain connections between chassis and equipment is not permitted.
- 9. Mechanical lugs and clamps shall not be used on solid conductors.
- 10. Each electrical equipment or device shall have a separate independent grounding conductor.
- 11. Only SSGB's shall be bonded back to the CBBC.
- 12. The DC power plant return bus shall be bonded to the SSGB. The grounding conductor shall be no smaller than the largest conductor supplied by the DC power system or no smaller than the grounding conductor for the SSGB or MGB (#2 copper).
- 13. Conduits joined with threaded couplings, threadless couplings, or threadless compression connectors that terminate in a bonded metallic enclosure may be considered adequately bonded and do not require additional bonding. If conduits do not meet this requirement, metallic conduits shall be bonded at points whenever they cross within 12" of the IPGB. Conduits run parallel to the IPGB shall be bonded at the point it enters AND exits 6" from the IPGB. All set screw couplings shall be bridged with a bonding jumper.
- 14. All surge protective devices (SPD) shall be bonded back to the internal grounding system with minimum #6 AWG copper.
- 15. Telecommunication metallic shields shall be bonded to the internal grounding system. These shall be the metallic elements of the cables, such as paired conductor and fiber optic cables. These shall be grounded to the SSGB or MGB at the facilities cable entry point. Each metallic member shall be grounded to the SSGB with minimum #6 AWG copper or with a transmission line grounding kit.

## 3.5 GROUNDING SYSTEM TESTING/VERIFICATION

- A. Upon completion of the grounding electrode system and before bonding to the utility feed neutral wire, resistance testing shall be preformed on the grounding electrode system.

  The testing shall be preformed using the test method listed below:
  - 1. Clamp-on Ohmmeter Test
- B. Refer to Motorola's R-56 Standard for testing prerequisites, procedures, and test worksheets for each test listed above. Field verify all grounding connections are complete before performing test. Upon completion of the test, submit results in report format to engineer for review. Include locations of site test locations.

#### 3.6 GENERAL INSTALLATION

- A. Install grounding and bonding conductors concealed from view.
- B. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- C. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

- D. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC.
- E. Permanently attach equipment and grounding conductors prior to energizing equipment.
- F. Install bonding jumper only in power distribution panel. Installing bonding jumper in any other cabinets could lead to electrification of cabinets and or conduit within the structure. Distribution panel in stepped down system requires jumper as it is a separately derived system.

#### SECTION 16070

#### **ELECTRICAL SUPPORTS**

## PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Hangers and supports for electrical equipment and systems.

#### 1.2 REFERENCES

- A. NFPA 70 (National Fire Protection Association) National Electrical Code.
- B. NECA (National Electrical Contractors Association) Standard of Installation.

## 1.3 SUBMITTALS

- A. Section 01330 Submittal Procedures: Requirements for submittals.
- B. Product Data:
  - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
- C. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified professional engineer. Professional engineer qualification requirements are specified in Division 1 Section "Quality Requirements." Include the following:
  - 1. Fabricated Supports: Representations of field-fabricated supports not detailed on Drawings.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

## 1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements: Environmental conditions affecting products on site.

#### **PART 2 PRODUCTS**

#### 2.1 CONDUIT SUPPORTS

- A. Hanger Rods: Threaded high tensile strength electroplated steel with free running threads. Stainless steel in exterior areas.
- B. Conduit clamps general purpose: One hole malleable iron for surface mounted conduits. Stainless steel in exterior areas.
- C. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self-locking.

## 2.2 FORMED STEEL CHANNEL

- A. Product Description:
  - 1. Interior areas Galvanized 12 gage thick steel, 1 5/8 strut channel with holes 1-1/2 inches on center.
  - 2. Exterior areas 304 stainless steel, 12 gage thick, 1 5/8" strut channel.

#### PART 3 EXECUTION

#### 3.1 EXAMINATION

A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.

#### 3.2 PREPARATION

A. Do not drill or cut structural members.

## 3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Locate and install anchors, fasteners, and supports in accordance with NECA Standard of Installation.
- B. Install conduit and raceway support and spacing in accordance with NEC.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- D. Install multiple conduit runs on common hangers.

## 3.4 CLEANING

A. Section 01700 - Execution Requirements: Requirements for cleaning.

#### 3.5 PROTECTION OF FINISHED WORK

- A. Section 01700 Execution Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

#### **SECTION 16075**

#### **ELECTRICAL IDENTIFICATION**

## PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section includes:
  - 1. Nameplates.
  - 2. Labels.
  - 3. Wire markers.
  - 4. Conduit markers.

#### 1.2 SUBMITTALS

- A. Section 01330 Submittal Procedures: Submittal procedures.
- B. Product Data:
  - 1. Submit manufacturer's catalog literature for each product required.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Section 01700 Execution Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

# 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with NEC, latest edition.

# 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

# 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept identification products on site in original containers. Inspect for damage.
- C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

# 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01600 Product Requirements: Environmental conditions affecting products on site.
- B. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

#### PART 2 PRODUCTS

## 2.1 NAMEPLATES & SIGNS

- A. Manufacturers:
  - 1. MSI Marking Services.
  - 2. Seton Identification Products
- B. Product Description:
  - 1. Laminated three layer plastic with engraved black letters on light contrasting background color.
  - 2. 1/16 inch plastic stock with adhesive backing.
  - 3. Color Schedule: Black with white letters.
  - 4. Nameplates shall be provided for the following: panelboards, transfer switches, and equipment disconnect switches.

# 2.2 CONDUIT AND CABLE ID

- A. Manufacturers:
  - 1. MSI Marking Services, MS-900.
  - 2. Seton Identification Products.
- B. Product Description:
  - 1. Fade resistant, heavy duty vinyl with adhesive backing.
  - 2. Size: ½"x 2 ½".
- C. Color:
  - 1. 240/120 Volt System: Black lettering on white background

# 2.3 WIRE MARKERS

- A. Manufacturers:
  - 1. MSI Marking Services.
  - 2. Seton Identification Products.
- B. Description: Split sleeve or tubing type wire markers.
- C. Legend:

- 1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
- 2. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams and Drawings.

#### PART 3 EXECUTION

#### 3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

# 3.2 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Nameplate Installation:
  - 1. Install nameplate parallel to equipment lines.
  - 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.
  - 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
  - 4. Secure nameplate to equipment front using screws, or adhesive.
  - 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
  - 6. Install nameplates for the following:
    - a. Loadcenters.
    - b. Meter Cabinets.
    - c. Service Disconnects.

#### C. Label Installation:

- 1. Install label parallel to equipment lines.
- 2. Install label for identification of individual control device stations.
- 3. Install labels for permanent adhesion and seal with clear lacquer.

#### D. Wire Marker Installation:

- 1. Install wire marker for each conductor at panelboard, gutters, pull boxes, outlet and junction boxes, and each load connection.
- 2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
- 3. Install labels at data outlets identifying patch panel and port designation.
- E. Conduit or Raceway Marker Installation:
  - 1. Install conduit raceway marker for each conduit raceway longer than 6 feet.
  - 2. Conduit Raceway Marker Spacing: 20 feet on center.

#### **SECTION 16123**

#### **BUILDING WIRE AND CABLE**

#### PART 1 GENERAL

### 1.1 SUMMARY

A. Section includes building wire and cable; and wiring connectors and connections.

## 1.2 REFERENCES

- A. NECA (National Electrical Contractors Association) Standard of Installation.
- B. NETA ATS (International Electrical Testing Association) Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. NYSEG specifications for electrical installations and customer services-SP-1099.

# 1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
  - 1. Stranded conductor for feeders and branch circuits 10 AWG and smaller.
  - 2. Stranded conductors for control circuits.
  - 3. Conductor not smaller than 12 AWG for power and lighting circuits.
  - 4. Conductor not smaller than 14 AWG for control circuits.
- B. Wiring Methods: Provide the following wiring methods:
  - 1. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.
  - 2. Exterior Locations: Use only building wire, Type THWN insulation, in raceway.

## 1.4 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper, unless specified otherwise.

#### 1.5 SUBMITTALS

- A. Section 01330 Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit for building wire and each cable assembly type.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Section 01700 Execution Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of components and circuits.

#### 1.7 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

#### 1.8 COORDINATION

- A. Section 01300 Administrative Requirements: Requirements for coordination.
- B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.
- C. Wire and cable routing indicated is approximate unless dimensioned.

## **PART 2 PRODUCTS**

#### 2.1 BUILDING WIRE

- A. Product Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts. Type THHN/THWN unless otherwise noted.
- D. Insulation Temperature Rating: 75°C.
- E. Control wire: 14 AWG copper conductor, unless otherwise noted.

#### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Section 01300 Administrative Requirements: Coordination and project conditions.
- B. Verify interior of building has been protected from weather.
- C. Verify mechanical work likely to damage wire and cable has been completed.
- D. Verify raceway installation is complete and supported.

### 3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

## 3.3 INSTALLATION

- A. Route wire and cable to meet Project conditions.
- B. Install wire and cable in accordance with NECA "Standard of Installation."
- C. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- D. Identify and color code wire and cable. Identify each conductor with its circuit number or other designation indicated.
- E. Special Techniques Building Wire in Raceway:
  - 1. Pull conductors into raceway at same time.
  - 2. Install building wire 4 AWG and larger with pulling equipment.

- F. Special Techniques Wiring Connections:
  - 1. Clean conductor surfaces before installing lugs and connectors.
  - 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
  - 3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
  - 4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
  - 5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
  - 6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
  - 7. Install solid conductor for feeders and branch circuits 10 AWG and smaller.
  - 8. Install stranded conductors for branch circuits 10 AWG and smaller. However, when stranded conductors are used in lieu of solid, then install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

#### 3.4 WIRE COLOR

#### A. General

- 1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
  - a. Black, red, and blue for circuits at 120/240 volts single phase.
- 2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
  - a. Black, red, and blue for circuits at 120/240 volts single phase.
- B. Neutral Conductors: 120/240 white. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.
- C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.
- D. Feeder Circuit Conductors: Uniquely color code each phase.
- E. Ground Conductors:
  - 1. For 6 AWG and smaller: Green or green with yellow stripe.
  - 2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

#### **SECTION 16130**

#### **RACEWAY AND BOXES**

#### PART 1 GENERAL

#### 1.1 SUMMARY

A. Section includes conduit and tubing, outlet boxes, pull and junction boxes.

## 1.2 REFERENCES

- A. ANSI C80.1 Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 Electrical Metallic Tubing, Zinc Coated
- C. NECA (National Electrical Contractor's Association) "Standard of Installation"
- D. NEMA FB 1 (National Electrical Manufacturers Association) Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- E. NEMA OS 1 (National Electrical Manufacturers Association) Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- F. NEMA 250 (National Electrical Manufacturers Association) Enclosures for Electrical Equipment (1000 Volts Maximum).

## 1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Above Grade (Outdoors): Provide rigid steel conduit. Provide cast metal outlet, pull, and junction boxes.
- C. Above Grade (Indoors): Provide electrical metallic tubing. Provide sheet metal boxes.
- D. Wall Sleeves for Grounding Systems: Provide rigid PVC conduit.

# 1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

## 1.5 SUBMITTALS

A. Section 01330 – Submittal Procedures: Submittal procedures.

- B. Product Data: Submit for the following:
  - 1. Liquid tite flexible metal conduit.
  - 2. Rigid metal conduit.
  - 3. Electrical metallic conduit.
  - 4. Conduit bodies...
  - 5. Pull and junction boxes.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 Product Requirements: Product storage and handling requirements.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

#### 1.7 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

#### PART 2 PRODUCTS

- 2.1 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)
  - A. Product Description: Interlocked steel construction with PVC jacket.
  - B. Fittings: NEMA FB 1.
- 2.2 RIGID METAL CONDUIT (RMC)
  - A. Product Description: ANSI C80.1; galvanized steel conduit.
  - B. Fittings and Conduit Bodies: NEMA FB1, all steel.
- 2.3 ELECTRIC METALLIC CONDUIT (EMT)
  - A. Product Description: ANSI C80.3, galvanized tubing.
  - B. Fittings and Conduit Bodies: NEMA FB1, steel, compression type.

#### 2.4 OUTLET BOXES

- A. Sheet metal outlet boxes: NEMA-OS1, galvanized steel.
- B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

## 2.5 PULL & JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Surface Mounted Cast Metal Box: NEMA 250, type 4X; flat-flanged, surface mounted junction box:
  - 1. Material: Cast aluminum.
  - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

### PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Section 01300 Administrative Requirements: Coordination and project conditions.
- B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

## 3.2 INSTALLATION

- A. Install raceway and boxes in accordance with NECA "Standard of Installation."
- B. Ground and bond raceway and boxes in accordance with Section 16060.
- C. Fasten raceway and box supports to structure and finishes in accordance with Section 16070.
- D. Identify raceway and boxes in accordance with Section 16075.
- E. Arrange raceway and boxes to maintain headroom and present neat appearance.

# 3.3 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack.
- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.
- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Construct wireway supports from steel channel specified in Section 16070.

- H. Route exposed raceway parallel and perpendicular to walls.
- I. Route raceway parallel and perpendicular to walls and ceilings.
- J. Route conduit in and under slab from point-to-point.
- K. Maintain clearance between raceway and piping for maintenance purposes.
- L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- M. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- N. Bring conduit to shoulder of fittings; fasten securely.
- O. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- P. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams.
- Q. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- R. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- S. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- T. Close ends and unused openings in wireway.

## 3.4 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.
- B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- F. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- G. Install stamped steel bridges to fasten flush mounting outlet box between studs.
- H. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

- I. Install adjustable steel channel fasteners for hung ceiling outlet box.
- J. Do not fasten boxes to ceiling support wires or other piping systems.
- K. Support boxes independently of conduit.
- L. Install gang box where more than one device is mounted together. Do not use sectional box.
- M. Install gang box with plaster ring for single device outlets.

# 3.5 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements.
- B. Locate outlet boxes to allow luminaires positioned as indicated on reflected ceiling plan.
- C. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

## 3.6 ADJUSTING

- A. Section 01700 Execution Requirements: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

# 3.7 CLEANING

- A. Section 01700 Execution Requirements: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

#### **SECTION 16133**

#### CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

#### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section includes ladder style cable trays for communication systems and microflect entry ports for building service entrances.
- B. Related Sections:
  - 1. Section 16060 Grounding and Bonding for Electrical and Communications Systems.
  - 2. Section 16070 Hangers and Supports

#### 1.2 REFERENCES

- A. ASTM International:
  - 1. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 2. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. National Electrical Manufacturers Association:
  - 1. NEMA VE 1 Metal Cable Tray Systems.
  - 2. NEMA VE 2 Metal Cable Tray Installation Guidelines.
- C. National Electric Code (NEC) Article 392 Cable Trays.
- D. IEC 61537 (2001) Cable Tray Systems and Cable Ladder Systems for Cable Management.
- E. TIA 569-A (1998) Commercial Building Standard for Telecommunications Pathways and Spaces.
- F. ASTM A 510 Specification for General Requirements for Wire Rods and Coarse Round wire, Carbon Steel.

### 1.3 SUBMITTALS

- A. Shop Drawings: Indicate tray type, dimensions, support points, and finishes.
- B. Product Data: Submit fittings and accessories.
- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.

Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

#### 1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual routing of cable tray and locations of supports.

# 1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

#### PART 2 PRODUCTS

### 2.1 METAL LADDER-TYPE CABLE TRAY

- A. Manufacturers:
  - 1. Cooper B-Line, Series 24
  - 2. Wiremold
- B. Product Description: Ladder type consisting of (2) longitudinal rails with transverse rungs welded to the side rails. The rail is a single aluminum extrusion with extended flanges that provide rung support. Each rung shall support a 200# concentration load at the center of the tray with a safety factor of 1.5. Splice plates shall be of the wedge lock design.
- C. Material: 6063 Aluminum
- D. Finish: Galvanized to ASTM A123 after fabrication.
- E. Inside Width: 18 inches (interior tray)
- F. Inside Depth: 6 inches.
- G. Straight Section Rung Spacing: 6 inches.
- H. Inside Radius of Fittings: 24 inches.
- I. Trays shall be constructed and installed according to NEMA VE 2.
- J. Furnish manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

### 2.2 MICROFLECT ENTRY PORT

- A. Manufacturers:
  - 1. Valmont Microflect or equal.

- B. Aluminum entry panel with 4" diameter entry ports. Powder coated machine grey. Furnished with sealing caps and installation hardware. Fasteners and brackets shall be stainless steel. Sealing caps shall provide a water tight cover on the entry ports and shall be replaceable with a boot when a port becomes active.
- C. Configurations:
  - 1. Exterior Wall: 12 port, 3 x 4.

#### PART 3 EXECUTION

# 3.1 INSTALLATION

- A. Install metal cable tray in accordance with NEMA VE 2.
- B. Support trays and fasten to structure and finishes in accordance with Section 16070. Install supports at each connection point, at end of each run, and at other points to maintain spacing between supports of 4 feet maximum (interior).
- C. Install expansion connectors where recommended by manufacturer.
- D. Ground and bond metal cable tray in accordance with Section 16060.
  - 1. Provide continuity between tray components.
  - 2. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
  - 3. Install 2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component.
  - 4. Make connections to tray using mechanical, compression or exothermic connectors.

#### **SECTION 16140**

#### WIRING DEVICES

## PART 1 GENERAL

#### 1.1 SUMMARY

A. Section includes receptacles, device plates and decorative box covers

### 1.2 REFERENCES

- A. NECA (National Electrical Contractors Association) Standard of Installation.
- B. NEMA WD 1 (National Electrical Manufacturers Association) General Requirements for Wiring Devices.
- C. NEMA WD 6 (National Electrical Manufacturers Association) Wiring Device Dimensional Requirements.

## 1.3 SUBMITTALS

- A. Section 01330 Submittal Procedures: Submittal procedures.
- B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

## PART 2 PRODUCTS

## 2.1 RECEPTACLES

- A. Product Description: NEMA WD 1, Heavy-duty general use receptacle meeting federal specification W-C-596 and UL 496.
- B. Device Body: Gray plastic.
- C. Configurations: NEMA WD 6, type as indicated on Drawings.
  - 1. Simplex, 20A, 125V, NEMA 5-20R.
  - 2. Simplex, 30A, 240V, NEMA L14-30R
  - 3. Duplex, 20A, 125V, NEMA 5-20R.

#### 2.2 WALL PLATES

A. Cover Plate: Gray plastic.

#### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Section 01300 Administrative Requirements: Coordination and project conditions.
- B. Verify outlet boxes are installed at proper height.
- C. Verify wall openings are neatly cut and completely covered by wall plates.
- D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

#### 3.2 PREPARATION

A. Clean debris from outlet boxes.

#### 3.3 INSTALLATION

- A. Install in accordance with NECA "Standard of Installation."
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Install receptacles with grounding pole on top.
- F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- G. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.
- H. Use jumbo size plates for outlets installed in masonry walls.

## 3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 16130 to obtain mounting heights as specified and as indicated on drawings.
- B. Install wall switch 44 inches above finished floor (unless noted otherwise).
- C. Install convenience receptacle 18 inches above finished floor (unless noted otherwise).

- D. Install communication room equipment receptacle as noted on drawings.
- E. Install weatherproof receptacles 24" above grade.

# 3.5 ADJUSTING

- A. Section 01700 Execution Requirements: Testing, adjusting, and balancing.
- B. Adjust devices and wall plates to be flush and level.

# 3.6 CLEANING

- A. Section 01700 Execution Requirements: Final cleaning.
- B. Clean exposed surfaces to remove splatters and restore finish.

#### SECTION 16440

#### **PANELBOARDS**

#### PART 1 GENERAL

#### 1.1 SUMMARY

A. Loadcenters - Furnish and install loadcenter as specified herein and where shown on the associated drawings.

#### 1.2 REFERENCES

- A. The panelboard(s) and circuit breaker(s) referenced herein are designed and manufactured according to the latest revision of the following specifications:
  - 1. NEMA PB 1 Panelboards.
  - 2. NEMA PB 1.1 Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
  - 3. NEMA AB 1 Molded Case Circuit Breakers.
  - 4. NEMA KS 1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
  - 5. UL 50 Enclosures for Electrical Equipment.
  - 6. UL 67 Panelboards.
  - 7. UL 98 Enclosed and Dead-front Switches.
  - 8. UL 489 Molded-Case Circuit Breakers and Circuit Breaker Enclosures.
  - 9. CSA Standard C22.2 No. 29-M1989 Panelboards and Enclosed Panelboards.
  - 10. CSA Standard C22.2 No. 5-M91 Molded Case Circuit Breakers.
  - 11. Federal Specification W-P-115C Type I Class 1.
  - 12. Federal Specification W-P-115C Type II Class 1.
  - 13. Federal Specification W-C-375B/Gen Circuit Breakers, Molded Case, Branch Circuit and Service.
  - 14. Federal Specification W-C-865C Fusible Switches.
  - 15. NFPA 70 National Electrical Code (NEC).
  - 16. ASTM American Society of Testing Materials.

# 1.3 SUBMITTAL AND RECORD DOCUMENTATION

A. Approval documents shall include drawings. Drawings shall contain overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. In addition, the drawing shall illustrate one line diagrams with applicable voltage systems.

## 1.4 QUALIFICATIONS

A. Panelboards shall be manufactured in accordance with standards listed Article 1.2 - REFERENCES.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inspect and report concealed damage to carrier within their required time period.
- B. Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.
- C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

#### 1.6 OPERATIONS AND MAINTENANCE MATERIALS

A. Manufacturer shall provide installation instructions and NEMA Standards Publication PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards rated 600 Volts or less.

#### 1.7 WARRANTY

A. Manufacturer shall warrant specified equipment free from defects in materials and workmanship for the lesser of one (1) year from the date of installation or eighteen (18) months from the date of purchase.

### **PART 2 PRODUCTS**

#### 2.1 LOADCENTERS

- A. Manufacturers:
  - 1. Square D.
  - 2. GE Electrical.
  - 3. Siemens.
- B. Product Description: Circuit breaker load center, with bus ratings as indicated on Drawings.
- C. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
- D. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 240 volt panelboards.
- E. Molded Case Circuit Breakers: NEMA AB 1,bolt-on type, inverse time, thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
- F. Enclosure: NEMA 1.
- G. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt panelboards.

H. Cabinet Front: Dead front, surface mounted with door and pull ring and latch lock on door. Finish in manufacturer's standard gray enamel.

#### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Retain paragraph below if seismic controls are Project requirement. Coordinate with Drawings.
- C. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Revise paragraph below if "Balancing Loads" Paragraph is deleted from "Field Quality Control" Article below.
- F. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- G. Install filler plates in unused spaces.
- H. Retain paragraph below unless ceilings are not accessible.
- I. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

## 3.2 IDENTIFICATION

- A. Select Division 16 Section "Basic Electrical Materials and Methods" for projects with simple requirements and Division 16 Section "Electrical Identification" for projects with complex requirements.
- B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Basic Electrical Materials and Methods Electrical Identification."
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### 3.3 CONNECTIONS

A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

# 3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
  - 1. Measure as directed during period of normal system loading.
  - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
  - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

## 3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

## 3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.