

ALUMINUM COMPANY OF AMERICA SAG AND TENSION DATA

BOSCOWEN MERRIMACK RIVER TDS Telecom

Conductor Nominal Diameter 5/16x 7 Strand Steel EHS

Area= .0595 Sq. In Dia= .312 In Wt= .205 Lb/F RTS= 11200 Lb
Data from Chart No. 1-1293
English Units

Span= 448.5 Feet NESC Heavy Load Zone
Creep is NOT a Factor

Design Points				Final		Initial		Sag Ft	Tension Lb
Temp F	Ice In	Wind Psf	K Lb/F	Weight Lb/F	Sag Ft	Tension Lb	Sag Ft		
0.	.50	4.00	.30	1.434	7.94	4547.	7.94	4547.	
32.	.50	4.00	.00	.834	5.75	3651.	5.62	3734.	
-20.	.00	.00	.00	.205	1.46	3536.	1.41	3653.	
0.	.00	.00	.00	.205	1.54	3351.	1.48	3483.	
30.	.00	.00	.00	.205	1.68	3074.	1.60	3227.	
60.	.00	.00	.00	.205	1.84	2800.	1.74	2970.	
90.	.00	.00	.00	.205	2.04	2530.	1.90	2714.	
120.	.00	.00	.00	.205	2.28	2265.	2.10	2460.	
167.	.00	.00	.00	.205	2.76	1866.	2.49	2075.	
212.	.00	.00	.00	.205	3.40	1515.	2.99	1727.	

Above: Initial Data Prior to Cable Installation

Below: 1 Non-Supporting Cable(s) Added, Dia= .400 In, Wt= .047Lb/F+ .006Lb/F

0.	.50	4.00	.30	2.202	10.30	5392.	10.30	5392.	
32.	.50	4.00	.00	1.602	8.87	4550.	8.67	4656.	
-20.	.00	.00	.00	.258	1.82	3560.	1.68	3847.	
0.	.00	.00	.00	.258	1.92	3376.	1.76	3680.	
30.	.00	.00	.00	.258	2.09	3104.	1.89	3427.	
60.	.00	.00	.00	.258	2.28	2836. *	2.04	3175.	
90.	.00	.00	.00	.258	2.52	2573.	2.22	2923.	
120.	.00	.00	.00	.258	2.80	2316.	2.42	2673.	
167.	.00	.00	.00	.258	3.35	1936.	2.82	2293.	
212.	.00	.00	.00	.258	4.03	1607.	3.32	1949.	

* Design Condition

The table above shows sag and tension data for cable mounting points at the same elevation resulting in a sag point at mid-span and equal tension at each attachment point. Due to different ground elevations at either end of the actual span, the attachment point elevations will be approximately 6.71 feet different. Adjusting for this difference in elevation, the sag and tension values will be as follows (refer to attached plan for graphic representation):

Pole #2 – CE21 NET 27/18
Pole #1 – CE1 NET 27/19

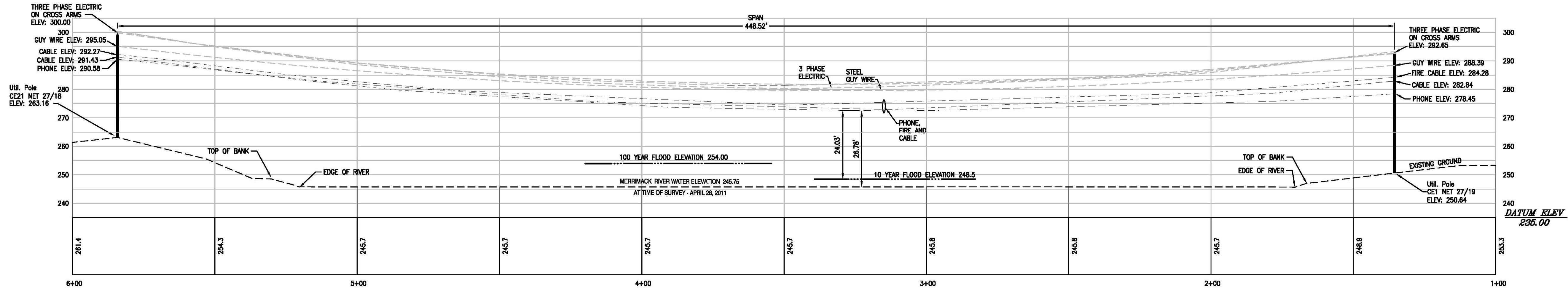
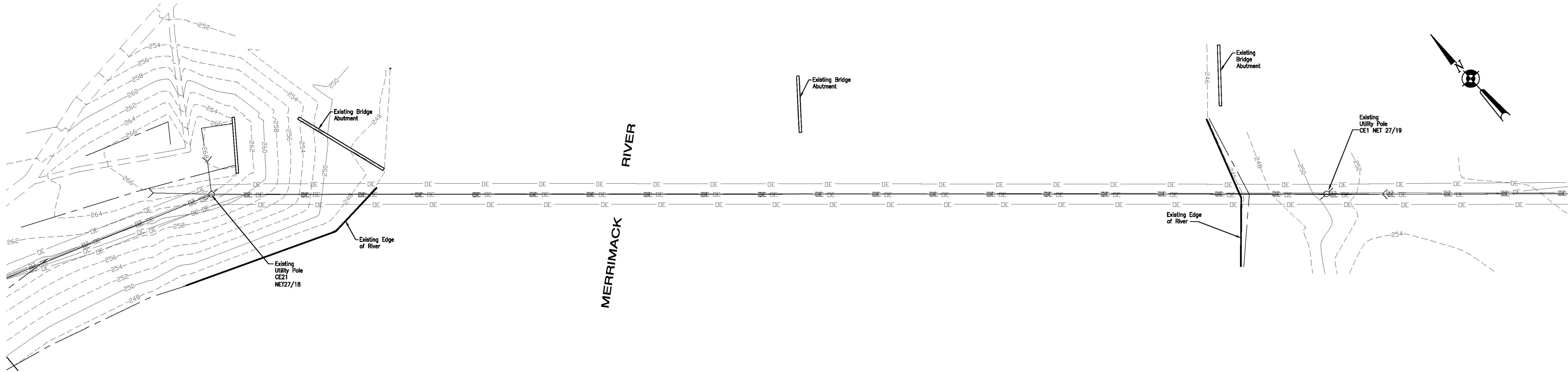
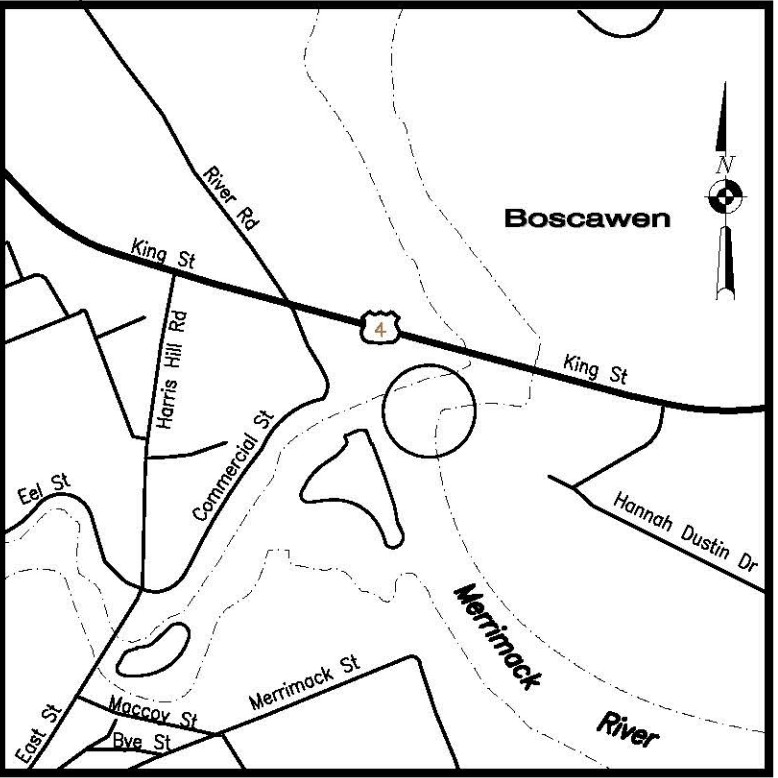
Located on West Side
Located on East Side

Distance from Pole #2 to Sag Point = S_1 = 263.53 ft.
Distance from Pole #1 to Sag Point = S_2 = 184.97 ft.

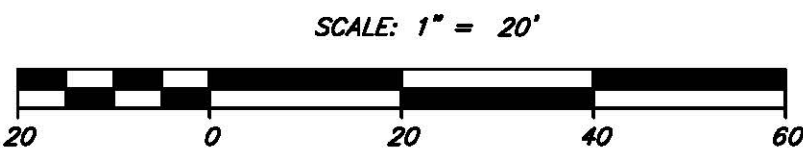
Tension at Pole #2 = 5407 Lbs, which is 48.27% of the rated strength of the messenger cable.
Tension at Pole #2 = 5393 Lbs, which is 48.15% of the rated strength of the messenger cable.
NESC guidelines recommend tension not exceed 60% of rated cable strength.

Elevation at Sag Point = 276.90, which is 28.40 feet above the 10 Year flood elevation of the Merrimack River at this location.

This crossing is located near Commercial Street on the West side of the river and near Hannah Duston Drive on the East side of the river.



FLOOD ELEVATIONS DERIVED FROM FEMA FLOOD INSURANCE RATE MAPS, COMMUNITY-PANEL NUMBER 330013C0337E LAST REVISED APRIL 19 2010



HOLDEN ENGINEERING & SURVEYING, Inc.

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EXISTING CONDITIONS
TDS TELECOM FIBER OPTIC CABLE
OVER THE MERRIMACK RIVER, BOSCAWEN, NH

Date:	Revisions Description	Dr. By	Chk. By	Book	Page	Date:	05-20-11 Scale: 1"=20' Dr. By: MK Ck By: BT Job No. 1120053 Sheet no 1 of 2

ALCOA SAG10 INCLINED SPAN CALCULATIONS

HORIZONTAL TENSION = 5381 LB
WEIGHT = 2.02 LB/F
HORIZONTAL SPAN = 448.5 FEET
ELEVATION DIFFERENCE = 6.71 FEET
S1= 184.97 S2= 263.53 S3= 39.28 FEET
D = 9.45 D1= 6.42 D2= 13.05 D3= 0.29 FEET
T1= 5,393.98 LB T2= 5,407.35 LB
CALCULATE SAG-TENSION USING INCLINED SPAN (SL) = 448.55 FEET
AND TENSION AT SPECIFIED CONDITION (PAV) = 5,391.13 LB
S3= DISTANCE FROM CENTER OF SPAN

ALUMINUM COMPANY OF AMERICA SAG AND TENSION DATA

BOSCAWEN MERRIMACK RIVER

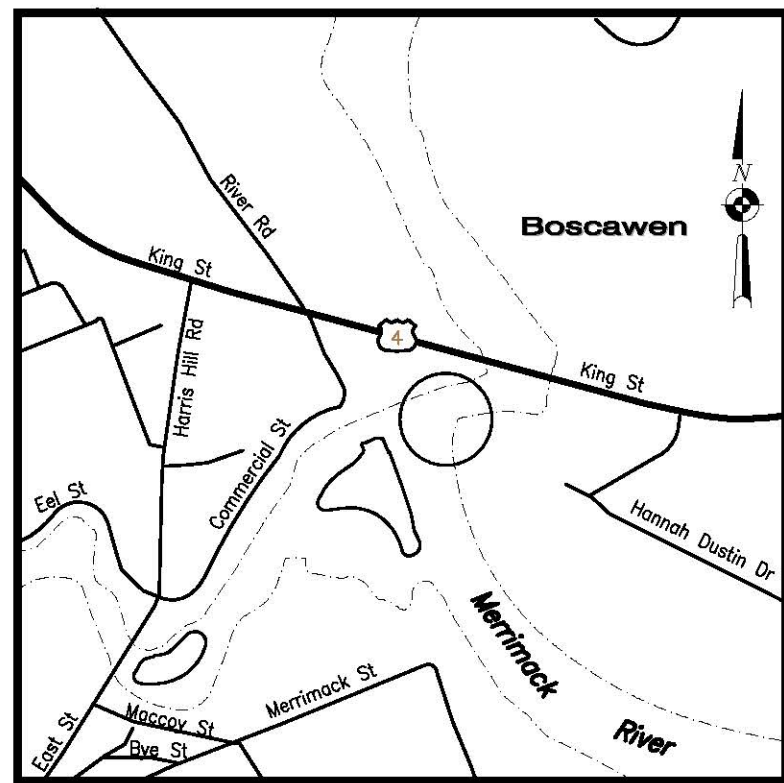
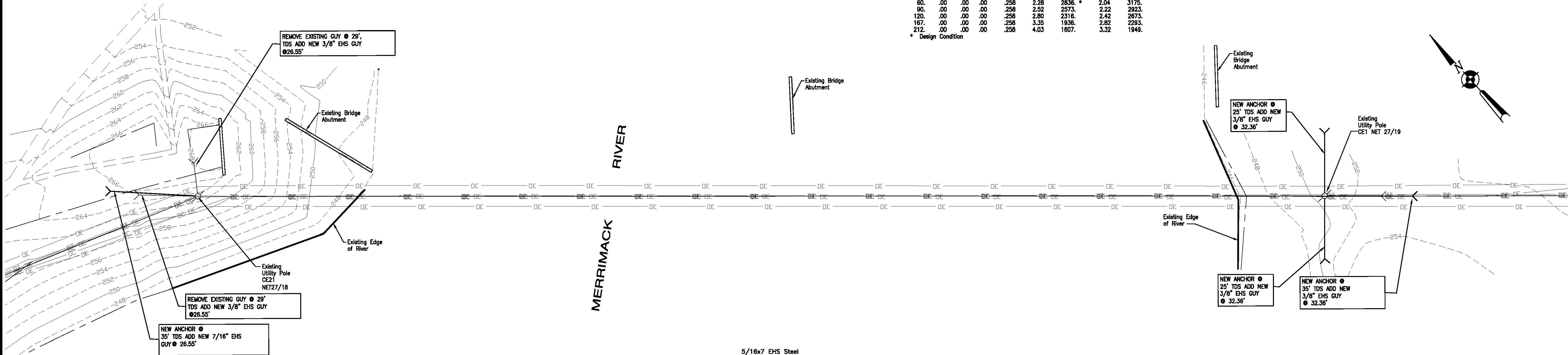
Conductor Nominal Diameter 5/16x 7 Strand Steel/EHS

Arec= .0595 Sq. In Dia= .312 In Wt= .205 Lb/F RTS= 11200 Lb
Data from Chart No. 1-1293
English Units

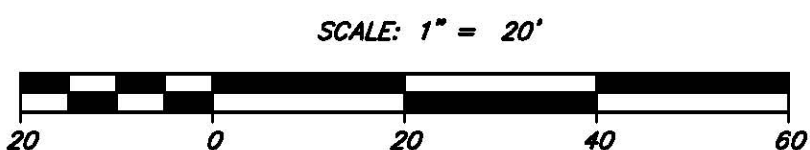
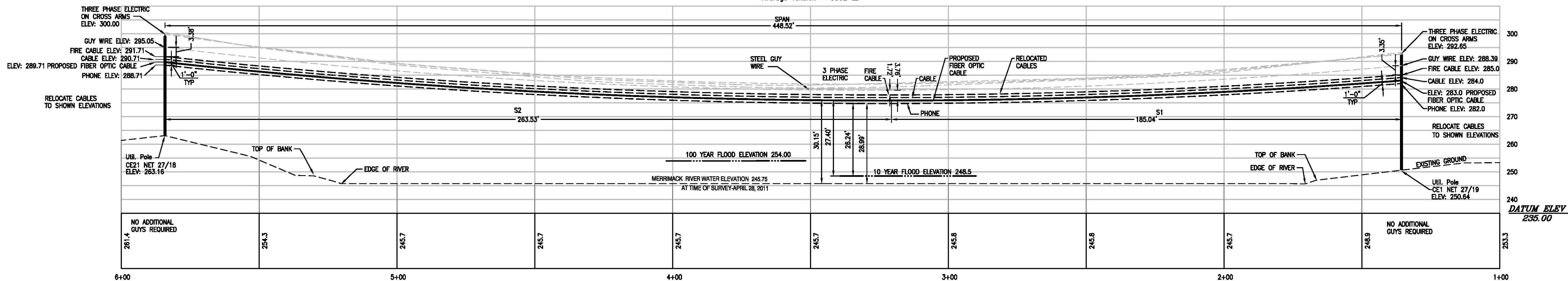
Span= 448.5 Feet NESC Heavy Load Zone

Creep is NOT a Factor

Design Points		Initial		Final	
Temp	Ice	Wind	K	Weight	Sag
F	In	Psf	Lb/F	Lb/F	Ft
0.	.50	4.00	.30	1.434	7.94
32.	.50	4.00	.00	.834	5.75
-20.	.00	.00	.00	.205	1.46
0.	.00	.00	.00	.205	1.54
30.	.00	.00	.00	.205	1.68
60.	.00	.00	.00	.205	1.84
90.	.00	.00	.00	.205	2.04
120.	.00	.00	.00	.205	2.28
167.	.00	.00	.00	.205	2.76
212.	.00	.00	.00	.205	3.40
Above: Initial Data Prior to Cable Installation					
Below: 1 Non-Supporting Cable(s)		Added Dia= .400 In		Wt= .047 Lb/F	
0.	.50	4.00	.30	2.202	10.30
32.	.50	4.00	.00	1.602	8.87
-20.	.00	.00	.00	.258	1.82
0.	.00	.00	.00	.258	1.92
30.	.00	.00	.00	.258	2.09
60.	.00	.00	.00	.258	2.28
90.	.00	.00	.00	.258	2.52
120.	.00	.00	.00	.258	2.80
167.	.00	.00	.00	.258	3.35
212.	.00	.00	.00	.258	4.03
* Design Condition					

LOCATION MAP
NOT TO SCALE

5/16x7 EHS Steel
R.S. = 448.5 Ft
H Tens= 5381.1 Lb
Weight= 2.02 Lb/Ft
Catenary - Initial
Temp = 0. deg F
Ice = .5 in
Wind = 4 psf
Average Tension = 5392 Lb



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PROPOSED CONDITIONS
TDS TELECOM FIBER OPTIC CABLE
OVER THE MERRIMACK RIVER, BOSCAWEN, NH

Date:	Revisions	Dr.	Chk.	By	By	Book	Page	Date:
02-24-12	ADD MAKE READY WORK	DS	BT					05-20-11
02-29-12	REVISE GUYS PER CLIENT							Scale: 1"=20'
03-06-12	REVISE GUYS PER CLIENT							Dr. By: MK Ck By: BT
03-23-12	REVISE PER CLIENT							Job No. 1120053
								Sheet no 2 of 2



Unitil - Boscawen, NH
Special Crossing - Structure CE1
Revised Recommendations
12-13-2011 ~ MG

Retention
Merlins to
NESC Heavy
4500# ~ 6.7'
loaded sag

New Anchor
90 deg, 25' Lead

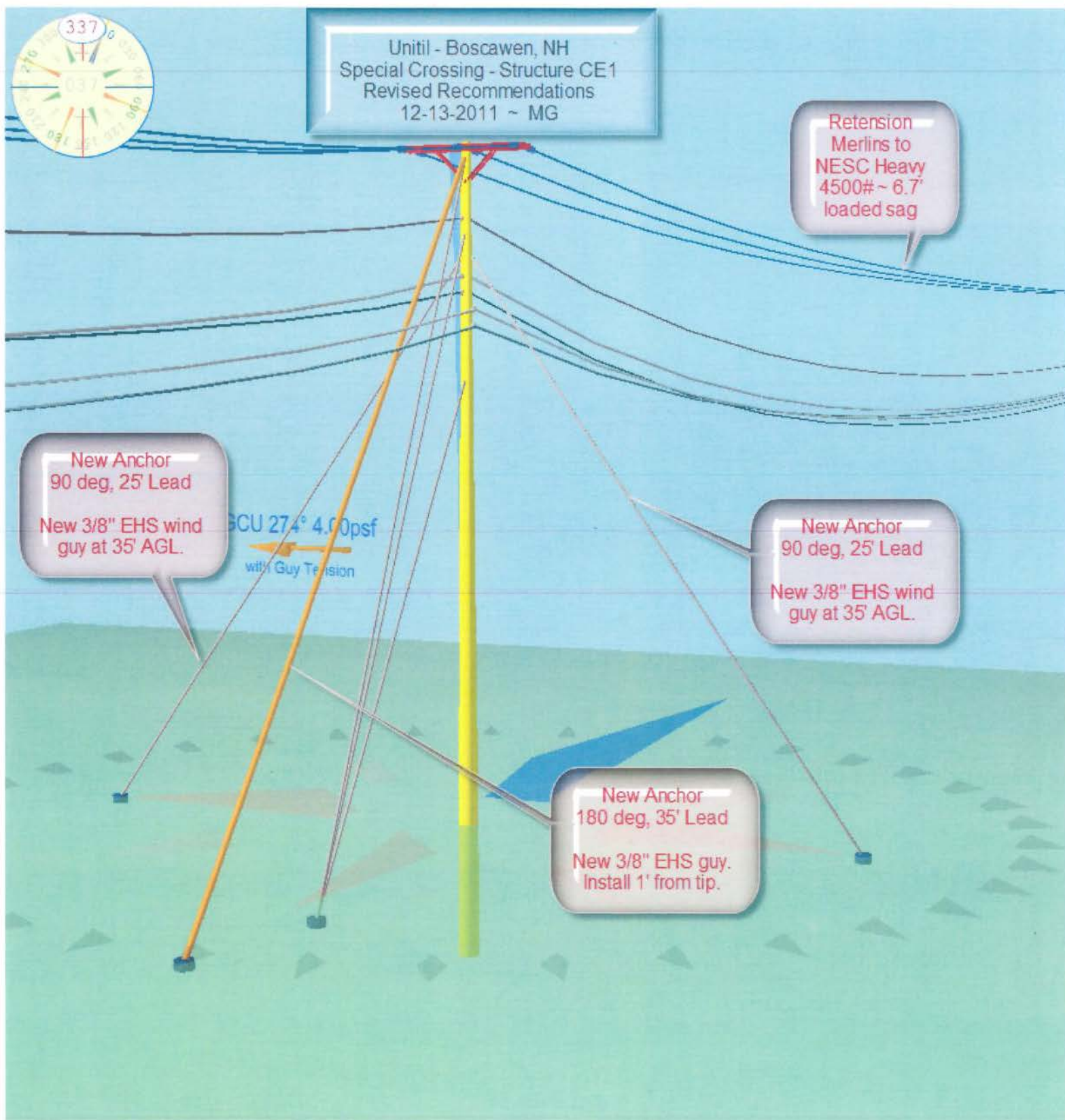
New 3/8" EHS wind
guy at 35' AGL.

BCU 274° 4.00psf
with Guy Tension

New Anchor
90 deg, 25' Lead
New 3/8" EHS wind
guy at 35' AGL.

New Anchor
180 deg, 35' Lead

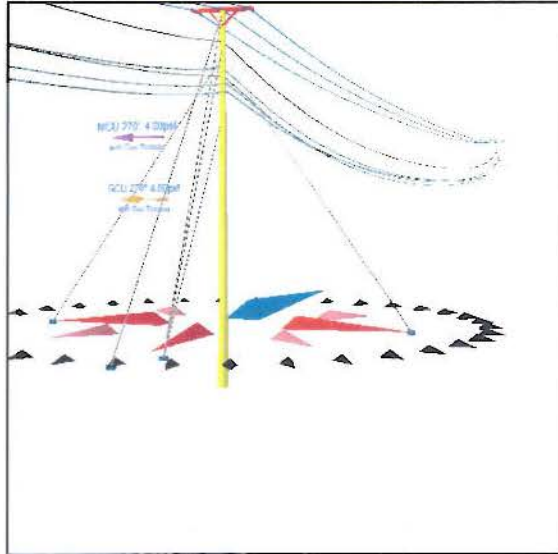
New 3/8" EHS guy.
Install 1' from tip.



O-Calc® Pro Analysis Report

Tuesday, December 13, 2011 11:07:23 AM

File Name:	CE 1.pplx	Pole Length / Class:	50 / 3	Code:	NESC	Structure Type:	Guyed
Pole Num:	CE 1	Pole Species:	SOUTHERN PINE	NESC Rule:	Rule 250B	Status:	N/A
WO#:		Setting Depth (ft):	8.16	Construction Grade:	B	Pole Strength Factor:	0.65
Elevation:		G/L Circumference (in):	47.00	Loading District:	Heavy	Transverse Wind LF:	2.50
Latitude:		G/L Fiber Stress (psi):	8,000	Ice Thickness (in):	0.50	Wire Tension LF:	1.65
Longitude:		Allowable Stress (psi):	5,200	Wind Speed (mph):	39.53	Vertical LF:	1.50
Pole		Fiber Stress Ht. Reduction:	No	Wind Pressure	4.00		



Pole Capacity Utilization		Height	Wind Angle
Maximum:	46.4%	35.3 ft	270.0°
Groundline:	14.2%	0.0 ft	277.9°
Vertical:	25.7%	36.5 ft	0.0°

Pole Moments		Load Angle	Wind Angle
Max Capac. Util:	10,166 ft-lb	277.7°	270.0°
Groundline:	15,004 ft-lb	289.9°	277.9°

Guy Summary		Guy Tensions		Maximum Guy Tensions	
	Attach Height (ft)	% Allowable Tension	Wind Angle	% Allowable Tension	Wind Angle
Guy 1	40.8	88.5%	277.9°	88.5%	277.9°
Guy 2	40.6	57.8%	277.9°	57.8%	82.8°
Guy 3	36.3	54.2%	277.9°	54.2%	282.8°
Guy 4	35.0	0.0%	277.9°	59.5%	90.0°
Guy 5	35.0	58.3%	277.9°	58.9%	270.0°
Guy 6	27.5	39.7%	277.9°	40.0%	282.8°

Anchor Summary		
	Lead Length (ft)	Max. % Allow. Capacity
Anchor 1	21.0	57.2%
Anchor 2	25.0	41.3%
Anchor 3	25.0	40.8%
Anchor 4	35.0	61.3%

GROUNDLINE LOAD SUMMARY: *Wind at 277.9°, Applied Moment 15,004 ft-lb at 289.9°, Allowable Moment 142,451 ft-lb

	Shear Load (lbs)*	Percent Applied Load	Bending Moment (ft-lb)	Percent of Applied Moment**	Percent of Pole Capacity	Bending Stress (+/-psi)	Vertical Load (lbs)	Vertical Stress (psi)	Total Stress (psi)	Percent of Pole Capacity
Powers:	6,220	1051.0	248,980	1146.4	81.0	9,089	2,369	13	9,102	175.0
Comms:	2,850	481.6	90,839	418.7	29.6	3,316	1,766	10	3,326	64.0
Guys/Braces:	-8,904	-1504.4	-333,607	-357.9	-25.3	-12,178	25,986	148	-12,030	-231.3
Pole:	380	64.2	7,041	69.9	4.9	257	2,649	15	272	5.2
Crossarms:	8	1.3	321	1.7	0.1	12	159	1	13	0.2
Insulators:	37	6.3	1,430	1.7	0.1	52	144	1	53	1.0
Pole Load:	592	100.0	15,004	149.0	10.5	548	33,073	188	736	14.2
Pole Reserve Capacity:			127,448		89.5	4,652			4,464	85.8

LOAD SUMMARY BY OWNER

<Undefined>:	-2,238		-70,739			-2,582	28,986	165	-2,417	-46.5
FIBER:	672		22,781			832	276	2	833	16.0
CATV:	334		11,060			404	621	4	407	7.8
TELCO:	782		23,955			874	269	2	876	16.8
NEW FIBER:	662		20,906			763	273	2	765	14.7
Pole:	380		7,041			257	2,649	15	272	5.2
Totals	592		15,004			548	33,073	188	736	14.2

Detailed Load Components

Power:		Owner	Height (ft)	Horiz. Offset (in)	Cable Dia. (in)	Rotate Angle (deg)	Cable Weight (lbs/ft)	Lead/ Span Length (ft)	Span Angle (deg)	Wire Length (ft)	Tension (lbs)	Tension Moment (ft-lb)*	Offset Moment (ft-lb)*	Wind Moment (ft-lb)*	Moment at GL (ft-lb)*
Primary	ACSR 336.4 KCM 18/1 MERLIN		41.35	25.07	0.6840	-	0.365	448.0	0.0	448.3	4,465	103,273	32	12,109	115,414
Primary	ACSR 336.4 KCM 18/1 MERLIN		41.35	50.64	0.6840	-	0.365	448.0	0.0	448.3	4,465	103,273	-61	12,109	115,321
Primary	ACSR 336.4 KCM 18/1 MERLIN		41.35	50.64	0.6840	-	0.365	448.0	0.0	448.3	4,465	103,273	92	12,109	115,474
Primary	ACSR 336.4 KCM 18/1 MERLIN		41.35	25.07	0.6840	-	0.365	234.7	180.0	234.9	2,264	-52,363	-20	6,344	-46,039
Primary	ACSR 336.4 KCM 18/1 MERLIN		41.35	50.64	0.6840	-	0.365	234.7	180.0	234.9	2,264	-52,363	39	6,344	-45,980
Primary	ACSR 336.4 KCM 18/1 MERLIN		41.35	50.64	0.6840	-	0.365	234.7	180.0	234.9	2,264	-52,363	-59	6,344	-46,078
Neutral	ACSR 1/0 AWG 6/1 RAVEN		37.26	6.58	0.3980	-	0.145	448.0	0.0	449.5	1,398	29,103	41	9,059	38,202
Neutral	ACSR 1/0 AWG 6/1 RAVEN		37.26	6.58	0.3980	-	0.145	234.7	180.0	234.9	1,296	-27,010	1	4,746	-22,263
Other	BELOPTIX MLD6072 - 72 FIBERS - OUTDOOR (0.593)		33.79	6.89	0.5930	-	0.130	448.0	0.0	449.6		0	40	8,929	8,970
Other	BELOPTIX MLD6072 - 72 FIBERS - OUTDOOR (0.593)		33.79	6.89	0.5930	-	0.130	234.7	180.0	235.1		0	1	4,678	4,679
Other	New Fiber		31.81	7.07	0.4000	-	0.048	448.0	0.0	449.4		0	-80	7,493	7,413
Other	New Fiber		31.81	7.07	0.4000	-	0.048	234.7	180.0	235.1		0	-41	3,908	3,867
Totals:											154,822		-15	94,172	248,980

Comm:		Owner	Height (ft)	Horiz. Offset (in)	Cable Dia. (in)	Rotate Angle (deg)	Cable Weight (lbs/ft)	Lead/ Span Length (ft)	Span Angle (deg)	Wire Length (ft)	Tension (lbs)	Tension Moment (ft-lb)*	Offset Moment (ft-lb)*	Wind Moment (ft-lb)*	Moment at GL (ft-lb)*
Overlashed	Span Bundle	FIBER	33.84	6.89	0.2420	-	0.104	448.0	0.0	449.6	1,753	33,171	39	8,942	42,152
Overlashed	Span Bundle	FIBER	33.84	6.89	0.2420	-	0.104	234.7	180.0	235.1	1,271	-24,057	1	4,685	-19,371
CATV	CATV .50	CATV	32.84	6.98	0.5700	-	0.600	448.0	0.0	449.8	2,270	41,699	79	8,967	50,744
CATV	CATV .50	CATV	32.84	6.98	0.5700	-	0.600	234.7	180.0	234.9	2,415	-44,385	3	4,697	-39,685
Overlashed	Span Bundle	TELCO	30.84	7.16	0.2420	-	0.104	448.0	0.0	449.1	1,979	34,138	-110	8,098	42,126
Telco	26 GA 50 PR (0.58)		30.79	7.16	0.5800	-	0.160	448.0	0.0	449.1		0	-121	8,085	7,964
Overlashed	Span Bundle	TELCO	30.84	7.16	0.2420	-	0.104	234.7	180.0	235.1	1,296	-22,356	-57	4,242	-18,171
Telco	26 GA 50 PR (0.58)		30.79	7.16	0.5800	-	0.160	234.7	180.0	235.1		0	-63	4,236	4,173
Overlashed	Span Bundle	NEW FIBER	31.84	7.07	0.3125	-	0.205	448.0	0.0	449.4	1,829	32,562	-110	7,499	39,952
Overlashed	Span Bundle	NEW FIBER	31.84	7.07	0.3125	-	0.205	234.7	180.0	235.1	1,286	-22,900	-56	3,911	-19,045
Totals:											27,872		-396	63,362	90,839

Crossarm:		Owner	Height (ft)	Horiz. Offset (in)	Offset Angle (deg)	Rotate Angle (deg)	Unit Weight (lbs)	Unit Height (in)	Unit Depth (in)	Unit Diameter (in)	Unit Length (in)	Tension Moment (ft-lb)*	Offset Moment (ft-lb)*	Wind Moment (ft-lb)*	Moment at GL (ft-lb)*
Normal	CROSSARM 3-1/2 X 4-1/2 X 8		41.49	5.44	0.0	0.0	53.00	4.50	3.50	-	96.00	-	12	160	173
Normal	CROSSARM 3-1/2 X 4-1/2 X 8		41.49	5.44	180.0	180.0	53.00	4.50	3.50	-	96.00	-	-12	160	148
Totals:											0		0	321	321

Insulator:	Owner	Height (ft)	Horiz. Offset (in)	Offset Angle (deg)	Rotate Angle (deg)	Unit Weight (lbs)	Unit Height (in)	Unit Depth (in)	Unit Diameter (in)	Unit Length (in)	Tension Moment (ft-lb)*	Offset Moment (ft-lb)*	Wind Moment (ft-lb)*	Moment at GL (ft-lb)*
Deadend	Deadend Insulator - 35 kV	41.49	0.00	0.0	0.0	4.00	19.63	-	3.00	-	-	4	166	170
Deadend	Deadend Insulator - 35 kV	41.49	44.00	82.9	0.0	4.00	19.63	-	3.00	-	-	-16	166	150
Deadend	Deadend Insulator - 35 kV	41.49	-44.00	277.1	0.0	4.00	19.63	-	3.00	-	-	25	166	191
Deadend	Deadend Insulator - 35 kV	41.49	0.00	180.0	0.0	4.00	19.63	-	3.00	-	-	-4	166	162
Deadend	Deadend Insulator - 35 kV	41.49	44.00	262.9	0.0	4.00	19.63	-	3.00	-	-	16	166	182
Deadend	Deadend Insulator - 35 kV	41.49	-44.00	97.1	0.0	4.00	19.63	-	3.00	-	-	-25	166	141
Bolt	Insulator, 15 kV	37.26	4.08	0.0	0.0	8.99	8.00	-	3.00	-	-	3	61	63
Bolt	Insulator, 15 kV	37.26	4.08	201.0	201.0	8.99	8.00	-	3.00	-	-	0	61	61
Bolt	Insulator, 15 kV	33.84	4.39	0.0	0.0	8.99	8.00	-	3.00	-	-	3	55	58
Bolt	Insulator, 15 kV	33.84	4.39	201.0	201.0	8.99	8.00	-	3.00	-	-	0	55	55
Bolt	Insulator, 15 kV	32.84	4.48	0.0	0.0	8.99	8.00	-	3.00	-	-	3	54	56
Bolt	Insulator, 15 kV	32.84	4.48	201.0	201.0	8.99	8.00	-	3.00	-	-	0	54	54
Bolt	Insulator, 15 kV	30.84	4.66	90.0	0.0	8.99	8.00	-	3.00	-	-	-8	50	43
Bolt	Insulator, 15 kV	31.84	4.57	90.0	0.0	8.99	8.00	-	3.00	-	-	-7	52	44
Totals:											0	-7	1,437	1,430

Guy Wire and Brace:	Owner	Attach Height (ft)	End Height (ft)	Lead/Span Length (ft)	Wire Dia. (in)	Percent Solid (%)	Lead Angle (deg)	Incline Angle (deg)	Wire Weight (lbs/ft)	Rest Length (ft)	Stretch Length (in)
Guy 1: NEW EHS GUY	Down	40.84	0.00	35.00	0.375	100.0	180.0	49.4	0.273	52.29	3.03
Guy 2: EHS 5/16	Down	40.58	0.00	21.00	0.312	75.0	180.0	62.6	0.205	43.19	2.28
Guy 3: EHS 1/4	Down	36.28	0.00	21.00	0.250	75.0	180.0	59.9	0.121	39.42	1.81
Guy 4: NEW EHS GUY	Down	35.00	0.00	25.00	0.375	100.0	270.0	54.5	0.273	41.51	0.00
Guy 5: NEW EHS GUY	Down	35.00	0.00	25.00	0.375	100.0	90.0	54.5	0.273	41.51	1.58
Guy 6: EHS 1/4	Down	27.45	0.00	21.00	0.250	75.0	180.0	52.6	0.121	32.06	1.08

Guy Wire and Brace (Loads and Reactions)		Elastic Modulus (psi)	Rated Tensile Strength (lbs)	Guy Strength Factor	Allowable Tension (lbs)	Initial Tension (lbs)	Required Tension² (lbs)	Required Tension³ (lbs)	Applied Tension³ (lbs)	Vertical Load³ (lbs)	Shear Load in Guy Dir³ (lbs)	Shear Load at Report Angle³ (lbs)	Moment at GL³ (ft-lb)*
Guy 1: NEW EHS GUY	Down	23,000,000	15,400	0.90	13,860	700	12,267	12,267	12,267	9,315	7,983	-2,711	-109,961
Guy 2: EHS 5/16	Down	23,000,000	11,200	0.90	10,080	700	5,824	5,823	5,823	5,171	2,676	-909	-36,031
Guy 3: EHS 1/4	Down	23,000,000	6,650	0.90	5,985	700	3,244	3,242	3,242	2,806	1,624	-551	-19,338
Guy 4: NEW EHS GUY	Down	23,000,000	15,400	0.90	13,860	700	8,252	0	0	0	0	0	40
Guy 5: NEW EHS GUY	Down	23,000,000	15,400	0.90	13,860	700	8,161	8,077	8,077	6,572	4,694	-4,415	-155,246
Guy 6: EHS 1/4	Down	23,000,000	6,650	0.90	5,985	700	2,394	2,373	2,373	1,885	1,442	-490	-13,072
									Totals:	25,749	18,419	-9,076	-333,607

Anchor/Rod Load Summary:	Owner	Rod Length AGL (in)	Lead Length (ft)	Lead Angle (deg)	Strength of Assembly (lbs)	Anchor/Rod Strength Factor	Allowable Load (lbs)	Max Load ² (lbs)	Load at Pole MCU ³ (lbs)	Max Required Capacity ² (%)
Anchor		30.00	21.00	180.0	20,000	1.00	20,000	11,432	11,408	57.2
Single Helix Anchor		18.00	25.00	270.0	20,000	1.00	20,000	8,252	0	41.3
Single Helix Anchor		18.00	25.00	90.0	20,000	1.00	20,000	8,161	8,077	40.8
Single Helix Anchor		18.00	35.00	180.0	20,000	1.00	20,000	12,267	12,267	61.3

Pole Buckling

Buckling Constant	Buckling Column Hgt (ft)	Buckling Section Height (% Buckling Col. Hgt.)	Buckling Section Diam. (in)	Min. Buckling Diam. at GL (in)	Diameter at Tip (in)	Diameter at GL (in)	Modulus of Elasticity (psi)	Pole Density (pcf)	Ice Density (pcf)	Pole Tip Height (ft)	Buckling Load Capacity at Hgt. (lbs)	Buckling Load Applied at Hgt. (lbs)	Buckling Load Factor of Safety
0.71	36.53	36.69	12.51	34.76	7.32	14.97	1,600,000	60.00	57.00	41.84	128,548	33,073	3.89



Retension
Merlins to
NESC Heavy
4500#

Unitil - Boscawen, NH
Special Crossing - Structure CE21
Revised Recommendations
12-13-2011 ~ MG

Existing Anchor at 23 ft.

Remove existing guy at 28
ft AGL.

Add new 3/8" EHS guy at
25 ft. AGL.

New Anchor
20 deg, 35' Lead

New 716" EHS wind
guy at 1' below
crossarm

Existing Anchor at 13 ft.

Remove existing guy at 29
ft AGL.

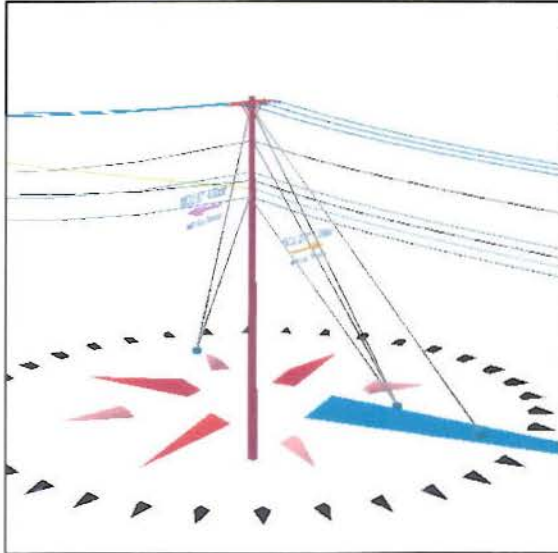
Add new 3/8" EHS guy at
26 ft. AGL.

Ground Level
←

O-Calc® Pro Analysis Report

Tuesday, December 13, 2011 11:09:55 AM

File Name:	CE 21.pplx	Pole Length / Class:	45 / 3	Code:	NESC	Structure Type:	Angle
Pole Num:	CE21	Pole Species:	SOUTHERN PINE	NESC Rule:	Rule 250B	Status:	N/A
WO#:		Setting Depth (ft):	7.42	Construction Grade:	B	Pole Strength Factor:	0.65
Elevation:		G/L Circumference (in):	40.00	Loading District:	Heavy	Transverse Wind LF:	2.50
Latitude:		G/L Fiber Stress (psi):	8,000	Ice Thickness (in):	0.50	Wire Tension LF:	1.65
Longitude:		Allowable Stress (psi):	5,200	Wind Speed (mph):	39.53	Vertical LF:	1.50
Pole		Fiber Stress Ht. Reduction:	No	Wind Pressure	4.00		



Pole Capacity Utilization		Height	Wind Angle
Maximum:	61.5%	27.7 ft	86.9°
Groundline:	31.4%	0.0 ft	278.4°
Vertical:	60.9%	32.0 ft	221.1°

Pole Moments		Load Angle	Wind Angle
Max Capac. Util:	14,341 ft-lb	14.7°	86.9°
Groundline:	19,176 ft-lb	253.9°	278.4°

Guy Summary		Guy Tensions		Maximum Guy Tensions	
	Attach Height (ft)	% Allowable Tension	Wind Angle	% Allowable Tension	Wind Angle
Guy 1	36.3	78.1%	278.4°	78.3%	284.1°
Guy 2	36.0	86.3%	278.4°	89.2%	90.0°
Guy 3	35.9	76.6%	278.4°	83.2%	100.0°
Guy 4	32.3	80.1%	278.4°	87.5%	100.0°
Guy 5	26.0	84.5%	278.4°	84.7%	284.1°
Guy 6	25.0	81.0%	278.4°	89.4%	100.0°

Anchor Summary		
	Lead Length (ft)	Max. % Allow. Capacity
Anchor 1	13.0	49.9%
Anchor 2	23.0	72.4%
Anchor 3	35.0	83.4%

GROUNDLINE LOAD SUMMARY: *Wind at 278.4°, Applied Moment 19,176 ft-lb at 253.9°, Allowable Moment 87,812 ft-lb

	Shear Load (lbs)*	Percent Applied Load	Bending Moment (ft-lb)	Percent of Applied Moment**	Percent of Pole Capacity	Bending Stress (+/-psi)	Vertical Load (lbs)	Vertical Stress (psi)	Total Stress (psi)	Percent of Pole Capacity
Powers:	14,650	1620.3	526,468	-76.2	-11.3	31,176	2,534	20	31,196	599.9
Comms:	10,811	1195.7	291,456	-61.0	-9.1	17,259	1,929	15	17,274	332.2
Guys/Braces:	-24,879	-2751.6	-804,846	-980.2	-145.5	-47,661	56,404	443	-47,218	-908.0
Pole:	286	31.6	4,885	37.5	5.6	289	1,900	15	304	5.9
Crossarms:	-1	-0.1	-21	-0.2	0.0	-1	159	1	0	0.0
Insulators:	36	4.0	1,235	1.0	0.2	73	157	1	74	1.4
Pole Load:	904	100.0	19,176	147.2	21.8	1,136	63,083	495	1,631	31.4
Pole Reserve Capacity:			68,636		78.2	4,064			3,569	68.6

LOAD SUMMARY BY OWNER

<Undefined>:	-7,140		-194,957			-11,545	59,679	469	-11,076	-213.0
FIBER:	287		8,246			488	245	2	490	9.4
CATV:	2,772		76,434			4,526	639	5	4,531	87.1
TELCO:	286		7,342			435	255	2	437	8.4
NEW FIBER:	4,414		117,225			6,942	366	3	6,945	133.6
Pole:	286		4,885			289	1,900	15	304	5.9
Totals	904		19,176			1,136	63,083	495	1,631	31.4

Detailed Load Components

Power:		Owner	Height (ft)	Horiz. Offset (in)	Cable Dia. (in)	Rotate Angle (deg)	Cable Weight (lbs/ft)	Lead/ Span Length (ft)	Span Angle (deg)	Wire Length (ft)	Tension (lbs)	Tension Moment (ft-lb)*	Offset Moment (ft-lb)*	Wind Moment (ft-lb)*	Moment at GL (ft-lb)*
Primary	ACSR 336.4 KCM 18/1 MERLIN		36.68	25.10	0.6840	-	0.365	110.5	0.0	110.7	758	-12,616	-13	2,703	-9,926
Primary	ACSR 336.4 KCM 18/1 MERLIN		36.68	50.65	0.6840	-	0.365	110.5	0.0	110.7	758	-12,616	-47	2,703	-9,960
Primary	ACSR 336.4 KCM 18/1 MERLIN		36.68	50.65	0.6840	-	0.365	110.5	0.0	110.7	758	-12,616	34	2,703	-9,879
Primary	ACSR 336.4 KCM 18/1 MERLIN		36.68	24.81	0.6840	-	0.365	448.0	201.0	448.3	4,283	156,000	72	8,978	165,050
Primary	ACSR 336.4 KCM 18/1 MERLIN		36.68	56.31	0.6840	-	0.365	448.0	201.0	448.3	4,283	156,000	133	8,978	165,111
Primary	ACSR 336.4 KCM 18/1 MERLIN		36.68	43.96	0.6840	-	0.365	448.0	201.0	448.3	4,283	156,000	-89	8,978	164,889
Neutral	ACSR 1/0 AWG 6/1 RAVEN		32.30	6.54	0.3980	-	0.145	110.5	0.0	110.7	500	-7,323	-15	1,976	-5,362
Neutral	ACSR 1/0 AWG 6/1 RAVEN		32.30	6.54	0.3980	-	0.145	448.0	201.0	449.5	1,397	44,782	84	6,563	51,429
Other	BELOPTIX MLD6072 - 72 FIBERS FIBER - OUTDOOR (0.593)		28.48	6.81	0.5930	-	0.130	110.5	0.0	110.7		0	-7	1,894	1,887
Other	BELOPTIX MLD6072 - 72 FIBERS FIBER - OUTDOOR (0.593)		28.48	6.81	0.5930	-	0.130	448.0	201.0	449.6		0	69	6,290	6,359
Other	New Fiber		26.50	6.96	0.4000	-	0.048	448.0	201.0	448.0		0	78	5,217	5,295
Other	New Fiber		26.50	6.96	0.4000	-	0.048	110.0	0.0	110.2		0	17	1,557	1,574
Totals:											467,611	316	58,541	526,468	

Comm:		Owner	Height (ft)	Horiz. Offset (in)	Cable Dia. (in)	Rotate Angle (deg)	Cable Weight (lbs/ft)	Lead/ Span Length (ft)	Span Angle (deg)	Wire Length (ft)	Tension (lbs)	Tension Moment (ft-lb)*	Offset Moment (ft-lb)*	Wind Moment (ft-lb)*	Moment at GL (ft-lb)*
Overlashed	Span Bundle		28.53	6.81	0.2420	-	0.104	110.5	0.0	110.7	760	-9,839	-7	1,897	-7,948
Overlashed	Span Bundle		28.53	6.81	0.2420	-	0.104	448.0	201.0	449.6	1,753	49,644	66	6,301	56,011
CATV	CATV .50	CATV	27.53	6.88	0.5700	-	0.600	110.5	0.0	110.7	861	-10,756	-28	1,892	-8,893
CATV	CATV .50	CATV	27.53	6.88	0.5700	-	0.600	448.0	201.0	449.1	2,885	78,884	160	6,282	85,326
Overlashed	Span Bundle		25.53	7.03	0.2420	-	0.104	110.5	0.0	110.7	771	-8,936	-7	1,687	-7,256
Telco	26 GA 50 PR (0.58)	TELCO	25.48	7.03	0.5800	-	0.160	110.5	0.0	110.7		0	-8	1,684	1,676
Overlashed	Span Bundle		25.53	7.03	0.2420	-	0.104	448.0	201.0	449.8	1,735	43,977	67	5,603	49,647
Telco	26 GA 50 PR (0.58)	TELCO	25.48	7.03	0.5800	-	0.160	448.0	201.0	449.8		0	74	5,592	5,666
Overlashed	Span Bundle	NEW FIBER	26.53	6.96	0.3125	-	0.205	448.0	201.0	448.0	4,488	118,327	107	5,222	123,656
Overlashed	Span Bundle	NEW FIBER	26.53	6.96	0.3125	-	0.205	110.0	0.0	110.2	666	-8,013	24	1,558	-6,431
Totals:											253,288	448	37,719	291,456	

Crossarm:		Owner	Height (ft)	Horiz. Offset (in)	Offset Angle (deg)	Rotate Angle (deg)	Unit Weight (lbs)	Unit Height (in)	Unit Depth (in)	Unit Diameter (in)	Unit Length (in)	Tension Moment (ft-lb)*	Offset Moment (ft-lb)*	Wind Moment (ft-lb)*	Moment at GL (ft-lb)*
Normal	CROSSARM 3-1/2 X 4-1/2 X 8		36.82	5.47	0.0	0.0	53.00	4.50	3.50	-	96.00	-	-10	-11	-21
Normal	CROSSARM 3-1/2 X 4-1/2 X 8		36.82	5.47	180.0	180.0	53.00	4.50	3.50	-	96.00	-	10	-11	-1
Totals:											0	0	-21	-21	

Insulator:		Owner	Height (ft)	Horiz. Offset (in)	Offset Angle (deg)	Rotate Angle (deg)	Unit Weight (lbs)	Unit Height (in)	Unit Depth (in)	Unit Diameter (in)	Unit Length (in)	Tension Moment (ft-lb)*	Offset Moment (ft-lb)*	Wind Moment (ft-lb)*	Moment at GL (ft-lb)*
Deadend	Deadend Insulator - 35 kV		36.82	0.00	0.0	0.0	4.00	19.63	-	3.00	-	-	-3	137	134
Deadend	Deadend Insulator - 35 kV		36.82	44.00	82.9	0.0	4.00	19.63	-	3.00	-	-	-25	137	112
Deadend	Deadend Insulator - 35 kV		36.82	-44.00	277.1	0.0	4.00	19.63	-	3.00	-	-	18	137	155
Deadend	Deadend Insulator - 35 kV		36.82	0.00	180.0	21.0	4.00	19.63	-	3.00	-	-	7	137	144
Deadend	Deadend Insulator - 35 kV		36.82	44.00	262.9	21.0	4.00	19.63	-	3.00	-	-	28	137	165
Deadend	Deadend Insulator - 35 kV		36.82	-44.00	97.1	21.0	4.00	19.63	-	3.00	-	-	-14	137	123
Bolt	Insulator, 15 kV		32.30	4.04	0.0	0.0	8.99	8.00	-	3.00	-	-	-2	49	47
Bolt	Insulator, 15 kV		32.30	4.04	201.0	201.0	8.99	8.00	-	3.00	-	-	4	49	53
Bolt	Insulator, 15 kV		28.53	4.31	0.0	0.0	8.99	8.00	-	3.00	-	-	-2	43	41
Bolt	Insulator, 15 kV		28.53	4.31	201.0	201.0	8.99	8.00	-	3.00	-	-	5	43	48
Bolt	Insulator, 15 kV		27.53	4.38	0.0	0.0	8.99	8.00	-	3.00	-	-	-2	42	40
Bolt	Insulator, 15 kV		27.53	4.38	201.0	201.0	8.99	8.00	-	3.00	-	-	5	42	46
Bolt	Insulator, 15 kV		25.53	4.53	0.0	0.0	8.99	8.00	-	3.00	-	-	-2	39	37
Bolt	Insulator, 15 kV		25.53	4.53	201.0	201.0	8.99	8.00	-	3.00	-	-	5	39	43
Bolt	Insulator, 15 kV		26.53	4.46	270.0	0.0	8.99	8.00	-	3.00	-	-	8	40	48
Totals:												0	27	1,208	1,235

Guy Wire and Brace:		Owner	Attach Height (ft)	End Height (ft)	Lead/Span Length (ft)	Wire Dia. (in)	Percent Solid (%)	Lead Angle (deg)	Incline Angle (deg)	Wire Weight (lbs/ft)	Rest Length (ft)	Stretch Length (in)
Guy 1: EHS 3/8	Down		36.26	0.00	13.00	0.375	75.0	90.0	63.7	0.273	36.02	2.46
Guy 2: EHS 7/16	Down		36.00	0.00	35.00	0.438	75.0	20.0	41.5	0.399	47.71	3.57
Guy 3: EHS 3/8	Down		35.90	0.00	23.00	0.375	75.0	18.0	53.3	0.273	40.14	2.68
Guy 4: EHS 5/16	Down		32.30	0.00	23.00	0.312	75.0	18.0	49.9	0.205	37.15	2.72
Guy 5: NEW EHS GUY Relocated	Down		26.00	0.00	13.00	0.375	75.0	90.0	50.9	0.273	26.57	1.96
Guy 6: NEW EHS GUY Relocated	Down		25.00	0.00	23.00	0.375	75.0	18.0	41.0	0.273	31.47	2.22

Guy Wire and Brace (Loads and Reactions)		Elastic Modulus (psi)	Rated Tensile Strength (lbs)	Guy Strength Factor	Allowable Tension (lbs)	Initial Tension (lbs)	Required Tension ² (lbs)	Required Tension ³ (lbs)	Applied Tension ³ (lbs)	Vertical Load ³ (lbs)	Shear Load in Guy Dir ³ (lbs)	Shear Load at Report Angle ³ (lbs)	Moment at GL ³ (ft-lb)*
Guy 1: EHS 3/8	Down	23,000,000	15,400	0.90	13,860	700	10,858	10,831	10,831	9,707	4,805	-4,617	-127,724
Guy 2: EHS 7/16	Down	23,000,000	20,800	0.90	18,720	700	16,689	16,148	16,148	10,707	12,089	-7,119	-238,914
Guy 3: EHS 3/8	Down	23,000,000	15,400	0.90	13,860	700	11,535	10,611	10,611	8,512	6,336	-3,551	-114,975
Guy 4: EHS 5/16	Down	23,000,000	11,200	0.90	10,080	700	8,816	8,072	8,072	6,173	5,201	-2,914	-84,653
Guy 5: NEW EHS GUY Relocated	Down	23,000,000	15,400	0.90	13,860	700	11,743	11,717	11,717	9,094	7,389	-7,099	-131,669
Guy 6: NEW EHS GUY Relocated	Down	23,000,000	15,400	0.90	13,860	700	12,395	11,223	11,223	7,364	8,469	-4,746	-106,911
Totals:										51,557	44,288	-30,047	-804,846

Anchor/Rod Load Summary:		Owner	Rod Length AGL (in)	Lead Length (ft)	Lead Angle (deg)	Strength of Assembly (lbs)	Anchor/Rod Strength Factor	Allowable Load (lbs)	Max Load ² (lbs)	Load at Pole MCU ³ (lbs)	Max Required Capacity ² (%)
Anchor			30.00	13.00	90.0	45,000	1.00	45,000	22,461	22,408	49.9
Anchor			30.00	23.00	18.0	45,000	1.00	45,000	32,599	29,773	72.4
Anchor			30.00	35.00	20.0	20,000	1.00	20,000	16,689	16,148	83.4

Pole Buckling

Buckling Constant	Buckling Column Hgt (ft)	Buckling Section Height (% Buckling Col. Hgt.)	Buckling Section Diam. (in)	Min. Buckling Diam. at GL (in)	Diameter at Tip (in)	Diameter at GL (in)	Modulus of Elasticity (psi)	Pole Density (pcf)	Ice Density (pcf)	Pole Tip Height (ft)	Buckling Load Capacity at Hgt. (lbs)	Buckling Load Applied at Hgt. (lbs)	Buckling Load Factor of Safety
0.71	32.02	35.43	11.10	44.90	7.32	12.74	1,600,000	60.00	57.00	37.58	103,533	63,083	1.64