$$D = (6.78 \times P \times H^3)/ (E \times d_g^3 \times d_t)$$ **Equation-9.4**

Where: D = Deflection in inches
P = Load in pounds
H = Height of pole from ground line to the point where the load is applied
E = Modulus of Elasticity
d_g = Diameter of pole at ground level line
d_t = Diameter of pole at the point where load is applied

Table- 9.12
Deflection of SYP Pole for 150 feet span

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Item No. & Pole Size	Moment due to wind on pole for Grosbeak & Mallard ft-lbs	BM at GL for Transverse load for Grosbeak	BM at GL for Transverse load for Mallard	BM at GL for Transverse & wind load for Grosbeak ft-lbs	BM at GL for Transverse & wind load for Mallard ft-lbs	Allowable pole deflection in inch	Total load for Grosbeak, P	H for Grosbeak in inch	Total load for Mallard, P	H for Mallard in inch	Pole deflection for Grosbeak in inch	Pole deflection for Mallard in inch
1	2	3	4	5	6	7	8	9	10	11	12	13
R-43; 35′-N6	2241.98	10171	11402	12412	13643.5	12.344	465.64	319.88	521.33	314	11.645	12.34
R-44; 35′-N5	2459.5	10171	11402	12630	13861.1	11.030	467.37	324.28	523.06	318	8.6121	9.089
R-45; 40′-N5	3587.7	12406	13916	15994	17503.6	12.210	472.88	405.87	528.57	397	11.362	11.92
R-46; 40′-N4	3771.7	12406	13916	16178	17687.6	14.053	473.79	409.76	529.48	401	10.786	11.29
R-47; 45′-N4	4913.6	14419	16179	19332	21092.4	18.744	477.98	485.35	533.67	474	16.254	16.93
R-48; 50′-N4	6226.6	16431	18442	22658	24668.4	23.948	482.33	563.70	538.02	550	23.164	24.03
R- ; 55′-N3	8343.0	18443	20705	26786	29047.6	27.103	489.98	656.02	545.67	639	24.902	25.60
R-49; 60′-N2	10890	20456	22968	31346	33857.9	30.481	498.37	754.77	554.06	733	26.879	27.41
35′-N4	2677.0	10171	11402	12847	14078.6	10.023	469.10	328.65	524.79	322	6.5427	6.879
35′-N3	2896.1	10171	11402	13067	14297.7	9.166	470.85	333.01	626.54	326	5.066	5.307
40′-N3	4070.6	12406	13916	16477	17986.5	13.055	475.81	415.55	531.50	406	8.5106	8.872
40′-N2	4369.6	12406	13916	16776	18285.5	12.188	477.84	421.29	533.53	411	6.8364	7.101
45′-N3	5327.7	14419	16179	19746	21506.5	16.85	480.54	493.10	536.23	481	12487	12.96
45′-N2	5708.7	14419	16179	20127	21887.5	15.907	482.82	500.25	538.51	488	10.171	10.51
50′-N3	6740.0	16431	18442	23171	25181.7	21.763	485.17	573.10	540.86	559	18.042	18.63
50′-N2	7253.3	16431	18442	23684	25695.0	19.931	488.01	482.39	543.70	567	14.34	14.75
55′-N2	8988.6	18443	20705	27412	29673.3	24.991	493.11	667.08	548.80	649	19.977	20.46
60′-N2	10890	20456	22968	31346	33857.9	30.481	498.37	754.77	554.06	733	26.879	27.41

Table- 9.13
Deflection of SYP Pole for 200 feet span

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Item No. & Pole Size	Moment due to wind on pole for Grosbeak & Mallard ft-lbs	BM at GL for Transverse load for Grosbeak	BM at GL for Transverse load for Mallard	BM at GL for Transverse & wind load for Grosbeak ft-lbs	BM at GL for Transverse & wind load for Mallard ft-lbs	Allowable pole deflection in inch	Total load for Grosbeak, P	H for Grosbeak in inch	Total load for Mallard, P	H for Mallard in inch	Pole deflection for Grosbeak in inch	Pole deflection for Mallard in inch
1	2	3	4	5	6	7	8	9	10	11	12	13
R-43; 35′-N6	2241.98	13302	14943	15544	17185	12.344	603.00	309.33	677.25	305	13.637	14.61
R-44; 35′-N5	2459.5	13302	14943	25762	17403	11.030	604.73	312.76	678.98	308	9.9976	10.68
R-45; 40′-N5	3587.7	16225	18237	19812	21825	12.210	610.24	389.60	684.49	283	12.969	13.78
R-46; 40′-N4	3771.7	16225	18237	19996	22009	14.053	611.15	392.64	685.40	385	12.241	12.98
R-47; 45′-N4	4913.6	18855	21202	23769	26116	18.744	615.34	463.53	689.59	454	18.228	19.25
R-48; 50′-N4	6226.6	21486	24167	27712	30393	23.948	619.69	536.63	693.94	526	25.676	27.01
R- ; 55′-N3	8343.0	24116	27131	32459	35474	27.103	627.34	620.89	701.59	607	27.03	28.21
R-49; 60′-N2	10890	26747	30096	37637	40986	30.481	635.73	710.43	709.98	693	28.593	29.61
35′-N4	2677.0	13302	14943	15979	17620	10.023	606.46	316.18	680.71	311	7.5316	8.02
35′-N3	2896.1	13302	14943	16198	17840	9.166	608.21	319.59	682.46	314	5.7841	6.14
40′-N3	4070.6	16225	18237	20295	22308	13.055	613.17	397.19	687.42	389	9.5768	10.12
40′-N2	4369.6	16225	18237	20594	22607	12.188	615.20	401.71	789.45	393	7.6303	8.036
45′-N3	5327.7	18855	21202	24183	26530	16.845	617.90	469.55	692.15	460	13.872	14.60
45′-N2	5708.7	18855	21202	24564	26911	15.907	620.18	475.29	694.43	465	11.205	11.75
50′-N3	6739.96	21486	24167	28226	30907	21.763	622.53	544.08	696.78	532	19.808	20.76
50′-N2	7253.28	21486	24167	28739	31420	19.931	625.37	551.46	699.62	539	15.602	16.29
55′-N2	8968.64	24116	27131	33085	36100	24.991	630.47	629.72	704.72	615	21.486	22.34
60′-N2	10890.4	26747	30096	37637	40986	30.481	635.73	710.43	709.98	693	28.593	29.61

Each cell of column-7 is higher than column-12 or column-13 for 150 ft. span i.e. Grosbeak or Mallard is okay for 150 ft span. For 200 ft. span R-43 is not suitable for Mallard. All other pole are okay for both Grosbeak & Mallard conductor as regard for deflection which is within the tolerable range.

10. Angle Structure or Angle Pole

When survey is conducted to select the route for construction of distribution or transmission line, for various reason the line route is not straight and line angle is required. When there is

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line angle the horizontal tension of the conductor of both side of the pole are not in line, thus not balance by themselves and make a resultant pull inward of the angle. It then forms the case of cantilever beam and tends to deflect or break the pole. This may also be happened due to deadends, long spans, slack spans, changing of conductors or changing of ruling spans. Guys and anchors are generally used to take the pull of the conductor.

For angles between 10 and 45 degrees, bisector guys are generally used. Above 45 degrees and for double deadends head & back guys are used. For large angle structures, the transverse load due to conductor's tension is a heavy permanent load, so, head & back guys will be more effective.

Guys and anchors are used at deadends, angle, long spans where pole strength is exceeded or unbalanced conductor tension condition e.g. for changing of ruling span or slack span and where the soil condition is not good.

To determine the resultant conductor tension at the point of conductor attachment due to line angle and wind loading, the resultant conductor tension for each conductor at the point of conductor attachment due to line angle and wind load on each conductor are to be calculated. So the total tension due to line angle and due to wind for each conductor can be calculated by the equation given below-

$$R = (2T(\text{Sin}(\text{Ø}/2))\ F_c + W_c(\text{Cos}(\text{Ø}/2))F_w((S_1 + S_2)/2) \qquad \text{Equation- 10.1}$$

Where: R = Resultant tension of each conductor due to angle at the point of conductor attachment in

T = Maximum design tension on each conductor in lns.

Ø = Line angle.

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W_c = Wind loading on conductor in lbs/fr^2

S_1 = Back span in ft.

S_2 = Forward span in ft.

F_c = OCF for conductor tension.

F_w = OCF for wind load.

The tension of each conductor is to be balanced or overcome by installing guy. To determine the pull on the guy wire, the horizontal pull on the guy is to be determined which can be calculated by taking moment about ground line. Following equation is used to determine the horizontal pull on guy attachment-

$$\mathbf{P_{GH} = ((R_A \times H_A + R_B \times H_B + R_C \times H_C + R_{OG} \times H_{OG})/H_{GA})} \qquad \textbf{Equation- 10.2}$$

Where: P_{GH} = Horizontal pull on guy attachment due to line angle and wind load for all conductor and OHGW

H_A = Height from ground line to the attached point of conductor A at pole

H_B = Height from ground line to the attached point of conductor B at pole

H_C = Height from ground line to the attached point of conductor C at pole

H_{OG} = Height from ground line to the attached point of OHGW at pole

H_{GA} = Height from ground line to the attached point at pole

Wind load on pole may also act along the direction of the resultant tension of conductor. The resultant wind load at pole and the point of acting the wind load may have from Table- 9.1A or 9.1B Column- 8 & 9 for SPC pole and Table- 9.8 column-9 for SYP pole. This will be found by the following equation-

$$\mathbf{P_{WP} = ((M_P \times F_W)/H_{GA})} \qquad \textbf{Equation- 10.3}$$

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Where: P_{WP} = Total wind load on pole as shown in Table-9.3 Column-5 for SPC pole and Table-9.8 Column-6 for SYP pole.

M_P = Total moment on pole due to wind loading in ft-lbs

Now the total resultant tension at guy attachment, P_{TH} is the summation of P_{GH} and P_{WP} . That is $P_{TH} = P_{TH} + P_{WP}$ **Equation- 10.4**

P_{TH} = Total resultant tension at the guy attachment. This is the horizontal component of guy tension.

Other symbols are mentioned earlier.

The tension P_{TH} is the Cos component of the guy wire tension, so the guy wire tension will be

$P_{TG} = P_{TH}/ \text{Sin}Ø$ **Equation- 10.5**

Where: P_{TG} = The guy wire tension along the guy wire

Ø = Angle between the guy wire and the pole

From the equation 9.6 it is clear that the magnitude and direction of "R" varies with "Ø". The different Sine & Cosine value of Ø/2 are furnished below-

$T_{G.beak}$	7056
$T_{Mallard}$	10752
$T_{GW3/8}$	3780

$W_{CG.beak}$	0.7425
$W_{CMallard}$	0.855
$W_{CGW3/8}$	0.270

F_C	1.15
F_W	2
$FT_{GW7/16}$	5075

S_{150}	150
S_{200}	200
$WT_{CGW7/16}$	0.33

Table 10.1
Line Angle in Degrees

Angle Ø	10^O	15^O	20^O	25^O	30^O	35^O	40^O	45^O	50^O	55^O	60^O	DE

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Sign(Ø/2)	0.087	0.13	0.174	0.2162	0.2588	0.301	0.342	0.383	0.423	0.46	0.500	1.00
Cos(Ø/2)	0.996	0.99	0.985	0.9764	0.9659	0.954	0.940	0.924	0.906	0.89	0.866	0.00
$R_{GW3/8-150}$	838.4	1215	1589	1958.3	2328.4	2692	3050	3401.9	3747.7	4086	4417	4347
$R_{G.KW150}$	1636	2339	3037	3725.3	4415.5	5092	5760	6416.2	7060.5	7691	8307	8114
$R_{Mallard-150}$	2411	3482	4547	5595.7	6648.3	7681	8699	9700.5	10684	11646	12587	12365
$R_{GW7/16-150}$	1115	1621	2123	2618.6	3115.6	3603	4084	4557.3	5021.7	5477	5921	5836
$R_{GW3/8-200}$	865.3	1242	1616	1984.7	2354.5	2717	3075	3426.8	3772.1	4110	4441	4347
$R_{GK.200}$	1710	2413	3111	3797.8	4487.2	5163	5830	6484.8	7127.8	7757	8372	8114
$R_{Mllard-200}$	2796	3567	4631	5679.2	6730.9	7762	8779	9779.5	10761	11722	12661	12365
$R_{GW7/16-200}$	1147	1653	2155	2650.4	3147.1	3634	4115	4587.4	5051.3	5506	5949	5836

Horizontal pull P_{GH} at guy attachment due to line angle and wind load for all conductor and OHWG are to be calculated. To find this, the height of different phases and OHGW for different pole from ground line are to be determined. Here guy attachment position of Grosbeak conductor at 10^0 is determined. This will vary for different angle as well as for different conductor.

Table- 10.2

Guy Attachment Location

Item No. & Pole Size	Pole Height L in feet	Design Setting depth	With OHGW (From GL)				Without OHGW (From GL)		
			To OHGW	To Phase	To Y & B Phase	To guy Attachment Phase	To R Phase	To Y & B Phase	To guy Attachment Phase

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1	2	3	4	5	6	7	8	9	10
R-43; 35′-N6	35	6.0	28.5	25.44	20.44	23	28.5	23.50	22
R-44; 35′-N5	35	6.0	28.5	25.44	20.44	23	28.5	23.50	22
R-45; 40′-N5	40	6.0	33.5	30.44	25.44	28	33.5	28.50	27
R-46; 40′-N4	40	6.0	33.5	30.44	25.44	28	33.5	28.50	27
R-47; 45′-N4	45	6.5	38.0	34.94	29.94	32	38.0	33.00	31
R-48; 50′-N4	50	7.0	42.5	39.44	34.44	36	42.5	37.50	35
R- ; 55′-N3	55	7.5	47.0	43.94	38.94	40	47.0	42.00	39
R-49; 60′-N2	60	8.0	51.5	48.44	43.44	44	51.5	46.50	43
35′-N4	35	6.0	28.5	25.44	20.44	23	28.5	23.50	22
35′-N3	35	6.0	28.5	25.44	20.44	23	28.5	23.50	22
40′-N3	40	6.0	33.5	30.44	25.44	28	33.5	28.50	27
40′-N2	40	6.0	33.5	30.44	25.44	27	33.5	28.50	27
45′-N3	45	6.5	38.0	34.94	29.94	32	38.0	33.00	31
45′-N2	45	6.5	38.0	34.94	29.94	32	38.0	33.00	31
50′-N3	50	7.0	42.5	39.44	34.44	36	42.5	37.50	35
50′-N2	50	7.0	42.5	39.44	34.44	36	42.5	37.50	35
55′-N2	55	7.5	47.0	43.94	38.94	40	47.0	42.00	39
60′-N2	60	8.0	51.5	48.44	43.44	44	51.5	46.50	43

If the guy attachment position shown in column-7 and 10 in Table 11.2 is same for all angles as for other conductor, the horizontal pull at guy attachment can be seen from following tables.

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Table 10.3

Horizontal Pull at Guy Attachment for Grosbeak 150′ Span with OHGW

Item No. Pole Size	$R_{GH\ Grosbek\text{-}150}$ With 3/8 OHGW											
	Angle Ø											
	10^O	15^O	20^O	25^O	30^O	35^O	40^O	45^O	50^O	55^O	60^O	DE
1	2	3	4	5	6	7	8	9	10	11	12	13
R-43; 35′-N6	5913	8432	10934	13399	15873	18299	20691	23043.2	25352	27613	29822	29172
R-44; 35′-N5	5929	8450	10955	13423	15898	18327	20721	23076.2	25388	27651	29862	29211
R-45; 40′-N5	5978	8511	11027	13505	15992	18432	20837	23202.0	25524	27797	30017	29363
R-46; 40′-N4	5987	8520	11036	13415	16003	18443	20848	23214.2	25537	27810	30031	29377
R-47; 45′-N4	6024	8566	11091	13578	16074	18522	20935	23308.9	25639	27920	30148	29491
R-48; 50′-N4	6063	8614	11148	13643	16148	18604	21026	23407.8	25746	28035	30271	29610
R- ; 55′-N3	6132	8697	11245	13755	16274	18744	21180	23575.1	25926	28228	30477	29812
R-49; 60′-N2	6208	8789	11352	13878	16412	18898	21348	23758.5	26124	28441	30703	30034
35′-N4	5944	8468	10976	13446	15924	18355	20752	23109.2	25423	27689	29901	29250
35′-N3	5960	8487	10997	13469	15950	18383	20783	23142.5	25459	27727	29942	29290
40′-N3	6006	8541	11061	13543	16033	18476	20885	23253.8	25579	27856	30079	29424
40′-N2	6023	8563	11085	13570	16064	18510	20922	23293.3	25621	27901	30127	29471
45′-N3	6047	8593	11122	13614	16114	18566	20983	23360.9	25695	27980	30212	29553
45′-N2	6068	8617	11150	13645	16148	18604	21025	23405.7	25743	28031	30266	29606
50′-N3	6089	8644	11183	13683	16192	18653	21079	23465.8	25808	28102	30342	29680
50′-N2	6115	8674	11218	13723	16236	18702	21133	23523.5	25870	28168	30412	29749
55′-N2	6160	8731	11284	13799	16323	18798	21239	23639.1	25995	28302	30555	29889
60′-N2	6208	8789	11352	13878	16412	18898	21348	23758.5	26124	28441	30703	30034

Table 10.4

BANGLADESH RURAL ELECTRIFICATION BOARD				
PBS Instruction 100-70: LINE CONSTRUCTION DESIGN FOR 795 MCM AND 636 MCM CONDUCTORS				
Date of Origin	Revised by	Approved by	Page No.	Revision No.
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Revision Date: -				

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Horizontal Pull at Guy Attachment for Mallard 150′ Span with OHGW

Item No. Pole Size	$R_{GH.Mallard-150}$ With 3/8 OHGW											
	Angle Ø											
	10^O	15^O	20^O	25^O	30^O	35^O	40^O	45^O	50^O	55^O	60^O	DE
1	2	3	4	5	6	7	8	9	10	11	12	13
R-43; 35′-N6	8169	11761	15331	18847	22376	25837	29251	32608.6	35905	39133	42286	41551
R-44; 35′-N5	8187	11783	15356	18876	22408	25873	29290	32651.3	35951	39182	42339	41603
R-45; 40′-N5	8264	11885	15482	19025	22582	26071	29511	32894.7	36217	39470	42648	41907
R-46; 40′-N4	8273	11894	16494	19037	22594	26083	29525	32909.3	36232	39486	42665	41924
R-47; 45′-N4	8329	11968	15583	19145	22719	26226	29683	33084.1	36423	39692	42886	42141
R-48; 50′-N4	8385	12041	15672	19250	22841	26363	29837	33253.3	36607	39892	43100	42352
R- ; 55′-N3	8474	12153	15809	19410	23024	26570	30066	33505.1	36881	40187	43417	42663
R-49; 60′-N2	8569	12274	15955	19581	23220	26790	30311	33773.4	37173	40501	43753	42995
35′-N4	8205	11804	15381	18904	22440	25909	29330	32693.9	35997	39231	42391	41655
35′-N3	8223	11826	15406	18933	22473	25945	29369	32737.1	36044	39281	42444	41707
40′-N3	8294	11920	15522	19071	22633	26127	29572	32960.8	36288	39545	42728	41986
40′-N2	8315	11945	15552	19105	22671	26170	29619	32012.2	36343	39605	42792	42049
45′-N3	8356	12001	15622	19190	22770	26282	29746	33152.3	36497	39771	42971	42225
45′-N2	8380	12030	15656	19229	22814	26331	29800	33210.9	36560	39839	43043	42296
50′-N3	8415	12077	15716	19300	22898	26427	29907	33329.6	36690	39980	43195	42445
50′-N2	8445	12114	15759	19351	22954	26490	29977	33405.6	36772	40069	43289	42538
55′-N2	8507	12194	15857	19466	23087	26640	30144	33589.6	36973	40285	43522	42767
60′-N2	8569	12274	15955	19581	23220	26790	30311	33773.3	37173	40501	43753	42995

Table 10.5

BANGLADESH RURAL ELECTRIFICATION BOARD				
PBS Instruction 100-70: LINE CONSTRUCTION DESIGN FOR 795 MCM AND 636 MCM CONDUCTORS				
Date of Origin	Revised by	Approved by	Page No.	Revision No.
19/02/2020	BREB	BREB Board	Page 60 of 93	-
Revision Date: -				

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Horizontal Pull at Guy Attachment for Grosbeak 200′ Span with OHGW

Item No. Pole Size	$R_{GH.Grosbek-200}$ With 3/8 OHGW											
	Angle Ø											
	10^0	15^0	20^0	25^0	30^0	35^0	40^0	45^0	50^0	55^0	60^0	DE
1	2	3	4	5	6	7	8	9	10	11	12	13
R-43; 35′-N6	6162.3	8680	11181	13643	16114.2	18537	20926	23274.3	25579.1	27835	30038	29172
R-44; 35′-N5	6178.2	8698	11202	13667	16140.2	18566	20957	23307.5	25614.7	27873	30078	29211
R-45; 40′-N5	6229.4	8761	11275	13751	16235.6	18672	21073	23434.8	25752.1	28020	30236	29363
R-46; 40′-N4	6237.6	8770	11285	13761	16246.2	18683	21085	23447.1	25765	28034	30250	29377
R-47; 45′-N4	6276.5	8817	11340	13825	16318.2	18763	21173	23542.9	25868.5	28145	30368	29491
R-48; 50′-N4	6316.8	8866	11398	13892	16393.3	18847	21265	23642.8	25976.5	28261	30491	29610
R- ; 55′-N3	6387.3	8951	11497	14005	16520.9	18988	21420	23811.6	26158.4	28456	30699	29812
R-49; 60′-N2	6464.6	9044	11606	14129	16660.9	19143	21591	23996.7	26358	28669	30927	30034
35′-N4	6194	8717	11223	13690	16166.1	18594	20987	23340.7	25650.2	27911	30118	29250
35′-N3	6210	8735	11244	13714	16192.3	18623	21019	23374.2	25686.1	27949	30159	29290
40′-N3	6256.2	8791	11309	13789	16277.2	18717	21122	23486.9	25807.7	28079	30298	29424
40′-N2	6274.7	8813	11334	13817	16308.1	18751	21159	23526.7	25850.3	28125	30346	29471
45′-N3	6300	8845	11372	13861	16385.5	18807	21222	23595.2	25924.7	28205	30431	29553
45′-N2	6320.9	8869	11400	13893	16393.5	18846	21263	23640.3	25973.1	28256	30486	29606
50′-N3	6342.9	8897	11434	13932	16438.1	18896	21319	23701.2	26039.2	28328	30562	29680
50′-N2	6368.9	8928	11469	13972	16482.8	18945	21373	23759.4	26101.7	28394	30633	29749
55′-N2	6416	8985	11537	14049	16570.4	19043	21480	23876.1	26227.8	28530	30778	29889
60′-N2	6464.6	9044	11606	14129	16660.9	19143	21591	23996.7	26358	28669	30927	30034

Table 10.6
Horizontal Pull at Guy Attachment for Mallard 200′ Span with OHGW

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Item No. Pole Size	$R_{GH.Mallard-150}$ With 3/8 OHGW											
	Angle Ø											
	10^O	15^O	20^O	25^O	30^O	35^O	40^O	45^O	50^O	55^O	60^O	DE
1	2	3	4	5	6	7	8	9	10	11	12	13
R-43; 35'-N6	8450.6	12042	15609	19123	22648.7	26107	29517	32869.8	36161.2	39383	42531	41551
R-44; 35'-N5	8468.8	12063	15634	19152	22681.3	26143	29556	32912.8	36207.6	39433	42584	41603
R-45; 40'-N5	8548.1	12167	15763	19304	22857.2	26342	29779	33158.1	36475.2	39723	42895	41907
R-46; 40'-N4	8556.9	12177	15773	19315	22869.4	26355	29793	33172.8	36490.6	39739	42912	41924
R-47; 45'-N4	8615.0	12252	15866	19425	22996.1	26499	29953	33348.9	36682.7	39946	43134	42141
R-48; 50'-N4	8672.1	12326	15956	19532	23119.2	26638	30108	33519.4	36868.5	40147	43350	42352
R- ; 55'-N3	8762.8	12441	16095	19693	23304.6	26847	30339	33773.1	37144.1	40444	43668	42663
R-49; 60'-N2	8860.3	12564	16243	19866	23502.5	27069	30585	34043.2	37437.5	40760	44006	42995
35'-N4	8486.9	12085	15660	19181	22713.9	26179	29596	32955.8	36253.8	39483	42636	41655
35'-N3	8505.3	12107	15686	19210	22746.8	26216	29636	32999.2	36300.6	39533	42690	41707
40'-N3	8578.3	12203	15803	19350	22908.5	26399	29840	33224.6	36546.6	39799	42975	41986
40'-N2	8599.7	12229	15834	19380	22947.5	26442	29888	33276.4	36602.4	39859	43039	42049
45'-N3	8642.4	12286	15905	19470	23047.5	26556	30016	33417.6	36757.0	40026	43219	42225
45'-N2	8666.5	12315	15940	19510	23091.9	26606	30070	33476.6	36820.6	40094	43292	42296
50'-N3	8702.5	12363	16000	19582	23176.5	26702	30178	33596.2	36951.5	40236	42445	42445
50'-N2	8732.9	12401	16044	19633	23233.8	26766	30248	33672.7	37034.3	40325	43540	42538
55'-N2	8796.4	12482	16143	19750	23368.1	26917	30417	33858.1	37236.1	40543	43773	42767
60'-N2	8860.3	12564	16243	19866	23502.5	27069	30585	34043.2	37437.5	40760	44006	42995

In case of angle structure, anchor(s) and guy(s) are to be installed before stringing. When the structure is a double dead end or large angle, the pole, guys, and anchors must be such that these are capable of sustaining the full dead end load with the overload factor. For the tangent double dead end fittings, the pole must be capable of sustaining the maximum axial load which might occur if all phase conductors of one side of structures were removed. A higher class pole is to be used in such cases.

When guy is used, a vertical component is acted on pole. This component can be reduced, if a higher height of tangent structure is installed adjusted to the guyed angle or dead ends and by installing a shorter pole at guyed structure.

Also decreasing the guy slop, the vertical load component on the pole can be reduced. Line survey should be conducted meticulously so that angle and dead end structure should not be

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more than 5% of total number of structures. If the line angle is more, it will significantly increase the total cost of line.

The above table from 9.16 to 9.19 the horizontal pull at guy attachment is shown. To find the tension in the guy wire, the equation 9.10 is to be used.

Above 450 angle unequal tensions are developed which can't be carried by resultant or bisector guy. Head and back guys carry this load effectively.

Table 10.7
Base Guy Wire Data

Guy Wire Size	Guy Wire Diameter in inch d_{GW}	Cross Sectional Area of Guy Wire inch^2	Weight (GW); lbs/ ft	Ultimate Strength of Guy Wire	Maximum Strength of Guy Wire, 90% of US..
1	2	3	4	5	6
3/8 HS Steel	0.360	0.0792	0.273	5400	9720
7/16 HS Steel	0.435	0.116	0.399	14500	13050
7/16 EHS Steel	0.435	0.116	0.399	20800	18720

According to Table- 11.3 Column-13, maximum horizontal strength of guy wire can be known by $\mathbf{P_{TG} = P_{TH}/Sin\ \emptyset}$

For a dead end 40′-N3 pole with grosbeak conductor having span 150′ one to one lead to height ratio is 29363 lbs,

So the Guy tension $P_{TG} = 29363/0.7071 = 41526$

If 4 nos. of 7/16 HS steel are used, the maximum strength of guy wire will be 13050×4 = 52200 lbs. Guy strength is higher than the guy tension, so it is okay.

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Again according to Table-11.6 Column-13, maximum horizontal strength of guy wire can be known by for a dead end 40′-4 pole with Mallard conductor having span 200′ one to one lead to height ratio is 41907 lbs,

So the Guy tension $P_{TG} = 41907//0.7071 = 59266$

If 5 nos. of 7/16 HS steel are used, the maximum strength of guy wire will be 13050×5 = 65250 lbs. Guy strength is higher than the guy tension, so it is okay.

Pole Stability or Vertical Load on Pole against Buckling:

It is understood that the tension in the guy wire has two component, one is horizontal component which is taken by the horizontal component of the conductor and other is vertical component which is taken by the pole. The weight of conductor and insulator are also taken by pole. Now it is a question whether the pole has got the strength to carry this compressive load. So after calculating the tension in the guy wire, the compressive strength of pole is to checked. The consideration of material strength i.e. fiber stress and cross-sectional area is not sufficient to find out the behavior of a long slender member. The axial load which makes a pole from stable or equilibrium condition to unstable or in-equilibrium condition can be calculated by the following formula which is also called Euler's Formula for column with one free end-

$P_{cr} = n^2EI/4l^2 = n^3\ Ed^4/32Fl^2$

Where

P_{cr} = Vertical load from lower guy to ground line in pound;

E = Modulus of Elasticity

d = Diameter of 2/9 distance from the lower guy

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F = Factor of safety;

l = Height from lower guy to ground line of pole

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Table- 10.8

Guy Attachment Location

Item No. & Pole Size	Pole Height L in feet	Wooden Class	Top Diameter in inch	Setting Depth	Diameter at GL in inch	Load Area due to Wind in Sft	2/9 Distance from the lower guy in inch	Height of 2/9 Distance from lower guy inch to ground line of pole	Diameter at 2/9 Distance from the Lower guy in inches	Vertical load in Lbs
1	2	3	4	5	6	7	8	9	10	11
R-43; 35′-N6	35	5	6.05	6.0	9.23	18.46	5	18	9.562	9373499.1
R-44; 35′-N5	35	4	6.68	6.0	10.03	20.19	5	18	10.78	15179730.6
R-45; 40′-N5	40	4	6.68	6.0	11.46	25.70	6	21	11.99	15851377.9
R-46; 40′-N4	40	3	7.32	6.0	11.46	26.61	6	21	11.82	149.33246.3
R-47; 45′-N4	45	3	7.32	6.5	11.88	30.80	7	25	12.02	11943463.4
R-48; 50′-N4	50	3	7.32	7.0	12.30	35.15	8	28	13.39	14328938.2
R- ; 55′-N3	55	2	7.96	7.5	13.67	42.80	9	31	14.77	17057785.7
R-49; 60′-N2	60	1	8.59	8.0	15.03	51.19	10	35	15.98	19270563.8
35′-N4	35	3	7.32	6.0	10.82	21.92	5	18	10.68	14669486.3
35′-N3	35	2	7.96	6.0	11.63	23.67	5	18	11.00	17082327.4
40′-N3	40	2	7.96	6.0	12.25	28.63	6	21	11.85	15148639.4
40′-N2	40	1	8.59	6.0	13.05	30.66	6	21	12.96	21744821.5
45′-N3	45	2	7.96	6.5	12.84	33.36	7	25	12.50	14044767.6
45′-N2	45	1	8.59	6.5	13.62	35.64	7	25	13.73	20490123.1
50′-N3	50	2	7.96	7.0	13.25	37.99	8	28	14.93	22217084.6
50′-N2	50	1	8.59	7.0	14.19	40.83	8	28	13.87	16605402.6
55′-N2	55	1	8.59	7.5	14.61	45.93	9	31	13.92	13504383.6
60′-N2	60	1	8.59	8.0	15.03	51.19	10	35	15.83	18529851.7

The buckling load of SPC pole is not checked. Concerned authority was requested for some relevant data. Manufacturer also assured they will take care of buckling load.

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Anchors:

Guys and anchors are installed at dead ends, angles, loan spans or where there is unbalanced conductor tension. The guys or anchors have the tendency to get uplift due to tension of the conductor or OHGW for angle or dead end or unbalanced tension in the conductor. This is resisted ultimately by the soil. This resistance of soil must be equal or more than the tension in the guy wire or anchor. If the soil is very loose or soft or wet, it may not hold the guy. So it is to be considered whether the soil is wet or dry, soft or stiff, hard or loose, disturbed or undisturbed. The holding power of an anchor is actually the weight of earth of an inverted frustum of a pyramid whose apex is the anchor, whose sides are at the slop of the natural angle of response of the soil(may be considered 60^{o} foe average soil) and whose height is the depth of the anchor. The guyed pole may continually sink into the ground due to vertical load if the soil capacity is not enough to resist. This can be overcome by increasing the pole butt area. Vertical components are the dead weight of pole and equipment and the vertical component of guy tensions.

There are different type of anchors, such as (i) Log anchors, (ii) Power screw anchors, (iii) Plate anchors, and (iv) rock anchors. As in PBS electrical network system, mostly log anchors are used, and as it also serve the purpose of transmission line, so here also the log anchor assemblies may be used. There are generally two types of log anchors. These are (i) 3′-6″×8″ and (ii) 6′-0″×12″. This log using one anchor rod may be used to provide sufficient holding power for guys. Log anchors should not be used in soils of soft clay, or organic material, or loose soil or slit.

Rod Anchor:

The anchor rod must have to hold the tension of the guy with safety margin. The tensile strength of anchor rod is furnished below-

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Twin- eye anchor rods shall be capable to withstanding tensile stresses specified ANSI C135.2. The rods shall not fail at stress levels below the listed minimums.

Table 10.9
Strength of Anchor Rod

Item No.	Minimum Load Kg(Pounds)
B-62	7,257.6 (16,000)
B-63	10,432.8 (23,000)

Table 10.10
Anchor Rod Thread Dimensions (Rolled Threads)

Item No.	Rod Size Cm (Inch)	Thread Type	Thread Series and Class	Rod		Major	
				r (inch)	Max^{m} Cm (inch)	Mini^{m} Cm (inch)	Er (inch)
B-62	1.5875 (5/8)	Rolled	11-UNS-2A	1.5291 (-0.602)	1.56464 (-0.616)	1.66014 (-0.6536)	1.7064 (-0.672)
B-63	1.905 (3/4)	Rolled	10-UNS-2A	1.9355 (-0.762)	1.88458 (-0.742)	1.99161 (-0.7841)	2.0406 (-0.803)

For the guy strength less than 16,000 lbs B-62 can be used and for guy less than 23,000 lbs but higher than 16,000 lbs B-62 can be used.

H-Frame Structure

In case of H-pole or 3-pole structure, it can be assumed that H-pole or 3-pole will have more strength than that of a single pole.

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11. Loads on Cross Arm

The strength of cross arm must be checked to determine its ability to withstand all expected vertical and longitudinal loads. The cross arm should be capable of supporting a lineman and his equipment at the outermost extremity in addition to the weight to bare conductors and insulators.

The maximum fiber bending stress in cross arms are to be calculated by taking moment about through bolt. The strength of cross arm brace should not be counted. This bending stress should not be more than 25% of the ultimate bending stress of that material. The vertical weight of conductors supported by this cross arm is the weight of vertical span under those conditions which yields the maximum vertical weight supported by the structure. The vertical span is the horizontal distance between the low points of sag of the adjacent span. The strength of brace is considered to support any unexpected loads. When considering the strength of longitudinal loadings, the moment capacity due to bolt holes is to be reduced from the moment capacity of cross arm. It is also to be noted that for wooden cross arm 1/8 inch are to be deducted from cross-section of cross arm as tolerance.

The strength of double cross arm is assumed double the strength of single cross arm. The moment capacity of cross arm can be determined from the following equation-

$$M = f \times Z \qquad \text{Equation- 11.01}$$

Where

M = Bending Moment, in-lb

f = Ultimate strength of the material/ Factor of safety, psi

Z = Section Modulus, in^3 I/C

I = Moment of Inertia about neutral axis, in^4

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C = Distance from neutral axis to the extreme fiber, in

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Table- 11.01
Design of Cross Arm and Loading

Type of Cross Arm	Cross Section of Cross Arm in inch	Breadth in inch, b	Height in inch, d	Thickness in inch, t	Length in feet	Cross Sectional Area in inch^2	Distance from neutral axis to extreme fiber, c in inch	Moment of Inertia, inch^4, I	Section Modulus, Z, inch^3	Fiber stress of materials /F_{safe}, f, psi	Resisting Bending Moment, M, inch-lb	Lever arm, inch
1	2	3	4	5	6	7	8	9	10	11	12	13
Wooden X-arm1	4⅝"×5⅝"	4.5	5.5	-	8	24.75	2.75	62.3906	22.688	2000	45375	42
	4⅝"×5⅝"	4.5	5.5	-	10	24.75	2.75	62.3906	22.688	2000	45375	54
Wooden X-arm2	3½"×4½"	3.38	4.375	-	8	14.77	2.188	23.5519	10.767	2000	21533	42
	3¾"×4¾"	3.63	4.625	-	10	16.77	2.313	29.8856	12.924	2000	25847	54
Steel Angle-3	3"×3"×¼"	3.00	3.00	0.25	8	1.438	2.158	1.24424	0.5767	15680	9042	42
	3"×3"×¼"	3.00	3.00	0.25	10	1.438	2.158	1.24424	0.5767	15680	9042	54
Steel Angle-4	3"×3"×¼"	3.00	3.00	0.25	3.5	1.438	2.158	1.24424	0.5767	15680	9042	30
	3"×3"×¼"	3.00	3.00	0.25	6.58	1.438	2.158	1.24424	0.5767	15680	9042	33
Steel Angle-5	3"×3"×⅜"	3.00	3.00	0.325	8	2.109	2.113	1.75968	0.833	15680	13061	42
	3"×3"×⅜"	3.00	3.00	0.325	10	2.109	2.113	1.75968	0.833	15680	13061	54
Steel Angle-6	3"×3"×⅜"	3.00	3.00	0.325	3.5	2.109	2.113	1.75968	0.833	15680	13061	30
	3"×3"×⅜"	3.00	3.00	0.325	6.5	2.109	2.113	1.75968	0.833	15680	13061	33
Steel Angle-7	4"×4"×⅜"	4.00	4.00	0.325	8	2.859	2.862	4.35862	1.5231	15680	23882	42
	4"×4"×⅜"	4.00	4.00	0.325	10	2.859	2.862	4.35862	1.5231	15680	23882	54
Steel Angle-8	4"×4"×⅜"	4.00	4.00	0.325	3.5	2.859	2.862	4.35862	1.5231	15680	23882	30
	4"×4"×⅜"	4.00	4.00	0.325	6.5	2.859	2.862	4.35862	1.5231	15680	23882	33
Steel Angle-9	4"×4"×½"	4.00	4.00	0.5	8	3.75	2.817	5.56146	1.9745	15680	30960	42
	4"×4"×½"	4.00	4.00	0.5	10	3.75	2.817	5.56146	1.9745	15680	30960	54
Steel Angle-10	4"×4"×½"	4.00	4.00	0.5	3.5	3.75	2.817	5.56146	1.9745	15680	30960	30
	4"×4"×½"	4.00	4.00	0.5	6.5	3.75	2.817	5.56146	1.9745	15680	30960	33

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Table- 11.01, Continuation
Deflection of Cross Arm

Type of Cross Arm	Cross Section of Cross Arm in inch	Load at Lever Arm, lbs	Column-14 (-) Wt of Insulator & Lineman, lbs	Vertical Wt. of Conductor for 150′ span with Grosbeak, lbs	Vertical Wt. of Conductor for 150′ span with Mallard, lbs	Vertical Wt. of Conductor for 200′ span with Grosbeak, lbs	Vertical Wt. of Conductor for 200′ span with Mallard, lbs	Remarks	Modulus of elasticity, E , psi	Allowable Deflection, inch
1	2	14	15	16	17	18	19	20	21	22
Wooden X-arm1	4⅝″×5⅝″	1080.4	895.4	144.38	203.78	192.5	271.7	Col-15> Col-19, Satisfactory	1800000	0.2376
	4⅝″×5⅝″	840.28	655.3	144.38	203.78	192.5	271.7		1800000	0.3927
Wooden X-arm2	3½″×4½″	512.7	327.7	144.38	203.78	192.5	271.7	Col-15> Col-19, Satisfactory	1800000	0.2987
	3¾″×4¾″	478.65	293.6	144.38	203.78	192.5	271.7		1800000	0.4670
Steel Angle-3	3″×3″×¼″	215.29	30.29	144.38	203.78	192.5	271.7	Col-15> Col-19, Not Satisfactory	29120000	0.1467
	3″×3″×¼″	167.45	-17.6	144.38	203.78	192.5	271.7		29120000	0.2426
Steel Angle-4	3″×3″×¼″	301.41	116.4	144.38	203.78	192.5	271.7	Col-15> Col-19, Not Satisfactory	29120000	0.0749
	3″×3″×¼″	274.01	89.01	144.38	203.78	192.5	271.7		29120000	0.0906
Steel Angle-5	3″×3″×⅜″	310.98	126	144.38	203.78	192.5	271.7	Col-15> Col-19, Not Satisfactory	29120000	0.1499
	3″×3″×⅜″	241.87	56.87	144.38	203.78	192.5	271.7		29120000	0.2478
Steel Angle-6	3″×3″×⅜″	435.37	250.4	144.38	203.78	192.5	271.7	Satisfied for 150′ span for both conductor and 200′ span for G.beak conductor	29120000	0.0765
	3″×3″×⅜″	395.79	210.8	144.38	203.78	192.5	271.7		29120000	0.0925
Steel Angle-7	4″×4″×⅜″	568.62	383.6	144.38	203.78	192.5	271.7	Satisfied for 150′ span for both conductor and 200′ span for G.beak conductor	29120000	0.1106
	4″×4″×⅜″	442.26	257.3	144.38	203.78	192.5	271.7		29120000	0.1829
Steel Angle-8	4″×4″×⅜″	611.1	611.1	144.38	203.78	192.5	271.7	Col-15> Col-19, Satisfactory	29120000	0.0564
	4″×4″×⅜″	538.7	538.7	144.38	203.78	192.5	271.7		29120000	0.683
Steel Angle-9	4″×4″×½″	552.1	552.1	144.38	203.78	192.5	271.7	Col-15> Col-19, Satisfactory	29120000	0.1124
	4″×4″×½″	388.3	388.3	144.38	203.78	192.5	271.7		29120000	0.1858
Steel Angle-10	4″×4″×½″	847.0	847.0	144.38	203.78	192.5	271.7	Col-15> Col-19, Satisfactory	29120000	0.0574
	4″×4″×½″	753.2	753.2	144.38	203.78	192.5	271.7		29120000	0.0694

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Wooden cross arm as mentioned in the table or steel cross arm of size 4″×4″×⅜″ can be used. As the cross arm is okay for Mallard conductor, so it will also be okay for Grosbeak conductor. Size of steel cross arm-6 though is suitable for Grosbeak, but different sizes of cross arm may make confusion in using in the field. That is why steel cross arm-8 is recommended. The deflection of cross arm is shown in Column022.

Brace Design & Tension in the Brace of Top Cross arm of Tangent Pole Assembly Unit TS-1

Maximum applied load on top cross arm for 200′ span with Mallard conductor as per column-19 in lb + Weight of insulator + Weight of one lineman. 456.70.

So, the maximum load on the other side of the cross arm in lb. = 456.70

Fiber stress on brace with safety factor = 15680

So the tension along the brace in lb = Reaction on the other side of cross arm/ cosine of angle with brace = 456.70 (height of brace from fastening point to cross arm point/ length of brace) = Tensile load on brace = 456.70/(3.0/4.25) = 456.70/ 0.7059 = 647.00

So, the area required for brace = 546.98/15680 = 0.413

The area of angle = 2½″×2½″×¼″ = 1.19 inch^2 which is okay.

The size of brace for cross arm = 2½″×2½″×¼″ - 4′5″ - 1 No. like B-43 of BREB Material.

(Length of brace may be required to be adjusted according to the need)

Brace Design & Tension in the Brace of Bottom Cross arm of Tangent Pole Assembly Unit TS-1

Maximum applied load on bottom cross arm for 200′ span with Mallard conductor as per column-19 in lb + Weight of insulator + Weight of one lineman. 456.70.

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So, the maximum load on the both the side of the cross arm in lb. = 456.70

The load on cross arm is balanced by pole reaction. There should not be any load on brace except some unexpected load. So the brace with same cross sectional area can be used.

The size of brace for bottom cross arm = 2½″×2½″×¼″ - 4′9″ - 2 No. like B-43 of BREB Material or 2½″×2½″×¼″ - 9′6″

Cross Arm Design & Tension in the Cross Arm of Top or Bottom Cross arm Angle Pole Assembly Unit TS-2

According to Table-10.1, the tension at cross-section for 20^0 angle with Mallard conductor for 200′ span in lbs = 4631. Fiber stress on cross are with safety factor in lbs/ $inch^2$ = 15680.

So, the area required for cross arm in $inch^2$ = 4631/15680 = 0.2953

The area of angle = 4″×4″×⅜″ = 2.859 $inch^2$ which is okay.

As there is double cross arm, so, the area will also be double.

The longitudinal tension will be balanced by each other, So, for Grosbeak conductor with 200′ span it will also be okay.

Assembly Unit TH-1

According to Table-10.1, the tension at cross-section for 40^0 angle with Mallard conductor for 200′ span in lbs = 8779. Fiber stress on cross are with safety factor in lbs/ $inch^2$ = 15680.

So, the area required for cross arm in $inch^2$ = 8779/15680 = 0.5599

The area of angle = 4″×4″×⅜″ = 2.859 $inch^2$ which is okay.

As there is double cross arm, so, the area will also be double.

The longitudinal tension will be balanced by each other, So, for Grosbeak conductor with 200′ span it will also be okay.

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Assembly Unit TH-2

According to Table-10.1, the tension at cross-section for dead end with Mallard conductor for 200′ span in lbs = 8114. The resisting moment of the cross arm = 23882.
As there is double cross arm, so, the area will also be double i.e. = 47764
The moment due conductor on cross arm = 48684

The resisting moment and the moment due to load is more or less or same, so, it is okay. The excess will be take care by the safety factor.

So for Grosbeak conductor with 200′ span, it will also be okay.

Assembly Unit T3P-1 and T3P-2

According to Table-10.1, the tension at cross-section for dead end with Mallard conductor for 200′ span in lbs = 12365. The resisting moment of the cross arm = 23882.
As there is double cross arm, so, the area will also be double i.e. = 47764
Maximum allowable horizontal strength of Guy Wire = 13050× 0.707 = 9226.4
Unbalanced load will be taken by cross arm, braces and pole and one extra guy for 3 conductors, So it is okay.

12. Hardware

Hardware for power transmission lines can be classified as conductor related hardware and structure related hardware. Conductor related hardware including suspension clamp or tension

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clamp, jointing or repairing sleeves, armor rod, anchor shackle etc. Structure related hardware including machine bole, eye bolt, washers, lag screw etc. Most of the hardware are presently used by BREB and they are very much acquainted with the mechanical strength of these hardware. Still then as the conductors are of higher sizes, the suspension clamp tor tension clamps are to be procured accordingly considering their diameter and strength.

Suspension Clamps:

Suspension clamps should be such that it matches the conductor diameter with appropriate liner or armor rod. For liners 2.54 mm (0.1 inch) to the conductor diameter. Weight per feet, tensile strength are also to be taken into consideration.

Deadend Clamps:

For higher sizes conductors crimped compression type splice is used because of its high strength capabilities. Splices should have same strength, corrosion resistance and hear tolerance capacity as have dead end clamp.

Suspension Insulators:

Suspension insulator must not be loaded more than 50% of their M&E rating. At tangent point, it must carry the weight span of the conductor. At dead end spans, it must carry the total conductor tension. At angle, it carry the resultant tension of the conductor. Normally insulators with a 15,000 lbs M&E rating will be satisfactory at most tangent type structures and for angle type structures where the maximum loading tension is 6,000 lbs. When the spans are long with higher size conductors and at dead ends where the conductor's tension is more than 6,000 lbs, higher size suspension insulator i.e. 25,000 lbs M&E is used.

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Fittings of Suspension Insulators:

The strength of all the fittings of suspension insulator should have more than double of the load on the fittings. In other words the load on the fittings should be less than 50% of their ultimate strength.

Armor Rod:

All conductors are in some state of vibration. Suspension clamps hold the conductor and can be designed so that it will keep minimum the effect of vibration the conductor. Armor rod controls mild vibration on the conductor. It makes additional rigidity to the conductor at its point of support. It will also protect from mechanical wear at the point of support.

Vibration Damper:

To control sever vibration to some extent, vibration dampers can be used. The number of dampers required as well as their location in the span should be determined by the damper manufacturer.

13. Conclusion:

Construction design for 33 KV line is done with 795 MCM and 636 MCM conductor using as much as possible the existing facilities.

As a tangent pole, the following table may be followed-

BANGLADESH RURAL ELECTRIFICATION BOARD				
PBS Instruction 100-70: LINE CONSTRUCTION DESIGN FOR 795 MCM AND 636 MCM CONDUCTORS				
Date of Origin	Revised by	Approved by	Page No.	Revision No.
19/02/2020	BREB	BREB Board	Page 77 of 93	-
Revision Date: -				

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Table- 13.1
Category of Tangent Pole/ Structure to be Used

Item No. & Pole Size	Pole Height L in feet	Wooden Class	Grosbeak Conductor with OHGW		Mallard Conductor with OHGW		Grosbeak Conductor without OHGW		Mallard Conductor without OHGW	
			150′ Span	200′ Span	150′ Span	200′ Span	150′ Span	200′ Span	150′ Span	200′ Span
1	2	3	4	5	6	7	8	9	10	11
R-43; 35′-N6	35	5	-	-	-	-	H-Pole	H-Pole	H-Pole	H-Pole
R-44; 35′-N5	35	4	-	-	-	-	S-Pole	H-Pole	S-Pole	H-Pole
R-45; 40′-N5	40	4	S-Pole	H-Pole	S-Pole	H-Pole	S-Pole	H-Pole	S-Pole	H-Pole
R-46; 40′-N4	40	3	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
R-47; 45′-N4	45	3	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
R-48; 50′-N4	50	3	S-Pole	S-Pole	S-Pole	H-Pole	S-Pole	S-Pole	S-Pole	H-Pole
R- ; 55′-N3	55	2	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
R-49; 60′-N2	60	1	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
35′-N4	35	3	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
35′-N3	35	2	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
40′-N3	40	2	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
40′-N2	40	1	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
45′-N3	45	2	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
45′-N2	45	1	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
50′-N3	50	2	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
50′-N2	50	1	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
55′-N2	55	1	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole
60′-N2	60	1	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole	S-Pole

Where-

S-Pole = Single Pole and H-Pole = Double Pole

Up to line angle 30^{O}, Grosbeak conductor with OHGW can be used for 200′ span with single pole (S-pole) and above 30^{O} to dead end should be made with Double pole (H-pole).

For Mallard conductor with OHGW, up to line angle 20^{O} single pole (S-pole), up to 40^{O} Double pole (H-pole) and more than 40^{O} line angle to dead end 3-pole structure should be used.

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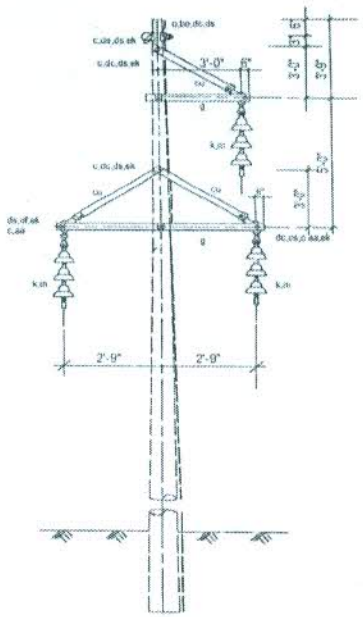

ITEM	Matarial code	QTY	DESCRIPTION	ITEM	Matarial code	QTY	CODE No-
dc		4	Washer, Curved, 4" dia x 1/4", dia,1/4" 11/16" hole	k		9	Insulator, Suspensoin
ds		7	Washar, Spring, 11/16" hole	g		1	X-arm, Top, 4"x4"x3/8"-3'-6"
dc		3	Washer, flat, 2 ½" sqx 5/16"-11/16" hole	g		1	X-arm, Botom, 4"x4"x3/8"-6'-6"
ds		3	Washer, Spring, 11/16" hole	cu		3	Brace,X-arm, Botom, 2 ½"x2 ½"x¼"-4'-9"
m		3	Clamp, Suspensoin	sk		11	Locknut 5/8" dia
c		6	Bolt, Machine 5/8"Ø 1" or 1.5"	u		1	Clamp, Ground Wire 1/2" dia
aa		3	Nut, Eye 5/8" dia	o		1	Bolt, eye,5/8" (8" or 10" as req.d
c		4	Bolt, Machine 5/8" dia (8" or 10" as req.d Length)	bo		1	Shackle, Anchor

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: TANGENT- SINGLE ARM (Transmission Line Structure 33 KV)				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2019	BREB	BREB Board	-	TS-1
Revision Date: -				

BANGLADESH RURAL ELECTRIFICATION BOARD				
PBS Instruction 100-70: LINE CONSTRUCTION DESIGN FOR 795 MCM AND 636 MCM CONDUCTORS				
Date of Origin	Revised by	Approved by	Page No.	Revision No.
19/02/2020	BREB	BREB Board	Page 79 of 93	-
Revision Date: -				

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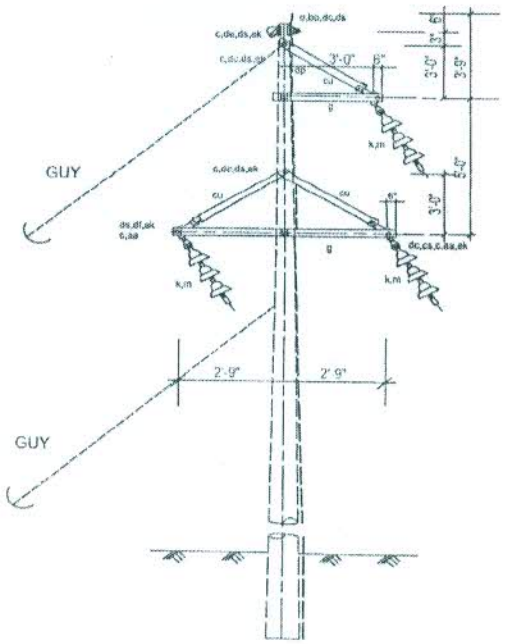
৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৭০০



ITEM	Matarial code	QTY	DESCRIPTION	ITEM	Matarial code	QTY	CODE No-
g		2	X-arm, Top, 4"x4"x3/8"-3'-6"	ds		18	Washer, Spring, 11/16" hole
g		2	X-arm, Botom, 4"x4"x3/8"-6'-6"	aa		3	Nut, Eye 5/8" dia
cu		6	Brace,X-arm, 2½"x2½"x¼"-4'-9"	o		1	Bolt, eye 5/8" dia
k		9	Insulator, Disc	bo		4	Shackle, anchor
m		3	Clam, Suspensoin	df		1	Washer, 2½" sq. 1⅛" hole
c		12	Bolt, Machine 5/8" dia (as req'd or 1"-1.5")	c		4	Bolt, Machine 5/8" dia (as req'd 10" or 12")
n		3	Bolt, double arming 5/8" dia	ek		3	Plate, double Arm 4" x 4"x 3/8" -1-2" or Angle- 11-16" hole- 34-nos
		3	Plate double arming 4"x4"x3/8" (10" or 12" or 1'-2")	ek		29	Locknut 5/8" dia

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: SMALL ANGLE SINGLE POLE (Transmission Line Structure 33 KV)				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	TS-2
Revision Date: -				

BANGLADESH RURAL ELECTRIFICATION BOARD				
PBS Instruction 100-70: LINE CONSTRUCTION DESIGN FOR 795 MCM AND 636 MCM CONDUCTORS				
Date of Origin	Revised by	Approved by	Page No.	Revision No.
19/02/2020	BREB	BREB Board	Page 80 of 93	-
Revision Date: -				

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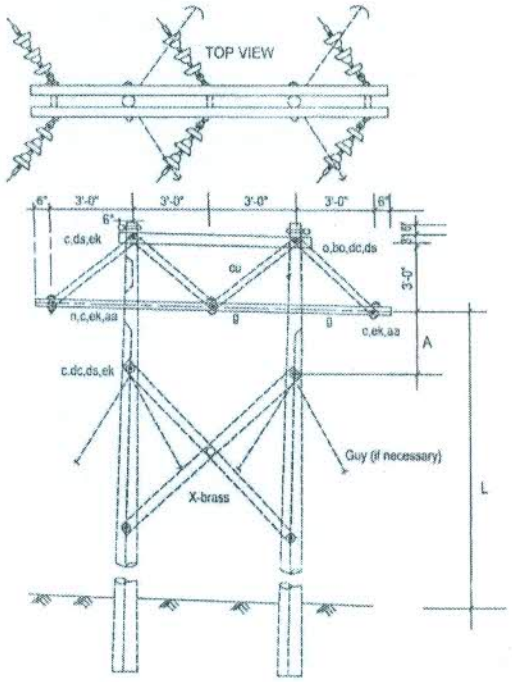
৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৭০০



FRONT VIEW

ITEM	Matarial code	QTY	DESCRIPTION	ITEM	Matarial code	QTY	CODE No-
g		2	X-arm 4"x 4" x 3/8"-13'	bo		4	shackle anchor
		2	Top horizontal Brace 3" x3" x 1/4" -7'	c		6	Bolt, Machine 5/8"dia-1"-1.5"
cu		8	Brace, X-arm, 2 ½" x2 ½ x¼" -4'-9"			3	Arm plate4"x4"x3/8"-1'-2"
cu		2	X-Brace, 2 ½" x2 ½ x¼" -9'-0"				11/16" hole- 5nos
c		11	Bolt, Machine 5/8" (as req.d length)	k		9	Insulator,Disc
ds		21	Washer Spring, 11/16" hole	n		3	Bolt , double arming
o		1	Bolt, Eye 5/8" (as req.d length)	aa+c+ek or bo		3	Nut eye, Bolt machine- 5/8" dia + 3ek or Shacle anchor
		1	Pipe speacer for 5/8" dia bolt (10" or 12" or 1'-2")	do		4	Washer 2¼" sq 1/16" hole
				ek		30	Locknut 5/8" hole
				m		3	Clamp, Suspendion

NOTE :
Up to 20° for mallard Conductor
Up to 40° for Grosbeak Conductor
A = 1/2 (L - 6')

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: SMALL ANGLE- H FRAME (Transmission Line Structure 33 KV)				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	TH-1
Revision Date: -				

BANGLADESH RURAL ELECTRIFICATION BOARD				
PBS Instruction 100-70: LINE CONSTRUCTION DESIGN FOR 795 MCM AND 636 MCM CONDUCTORS				
Date of Origin	Revised by	Approved by	Page No.	Revision No.
19/02/2020	BREB	BREB Board	Page 81 of 93	-
Revision Date: -				

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৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৭০০

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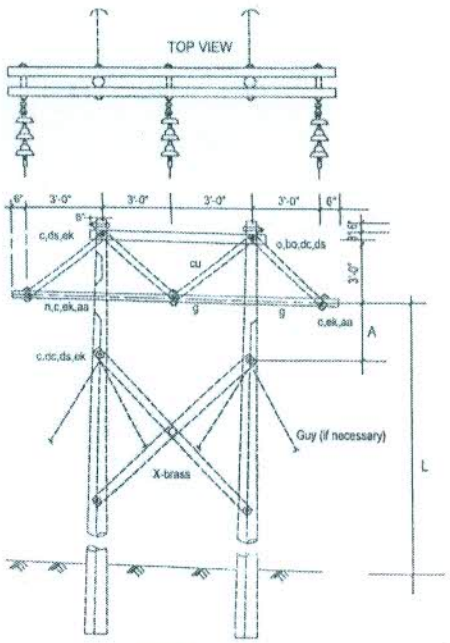

FRONT VIEW

ITEM	Matarial code	QTY	DESCRIPTION	ITEM	Matarial code	QTY	CODE No-
g		2	X-arm 4"x 4" x 3/8"-13'	bo		1	shackle anchor
		2	Top horizontal Brace 3" x3" x 1/4" -7'	c		15	Bolt, Machine 5/8"dia-1"-1.5"
cu		8	Brace, X-arm, 2½" x2½ x¼" -4'-9"	k		9	Insulator,Disc
		2	X-Brace, 2½" x2½ x¼" -9'-0"	m		3	Bolt , double arming
c		4	Bolt, Eye 5/8" (as req.d length)	aa		3	Nut eye
c		11	Bolt, Machine 5/8" (as req.d length)	df		1	Washer 2½" sq 11/16" hole
ds		21	Washer Spring, 11/16" hole	ek		39	Locknut 5/8" hole
d3		1	Bolt, Eye 5/8" (as req.d length)	m		3	Clamp, Suspendion
		1	Pipe speacer for 5/8" dia bolt (10" or 12" or 1'-2")				

NOTE :

A = 1/2 (L - 6')

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: TANGENT SINGLE DEADEND (Transmission Line Structure 33 KV)				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/20/2020	BREB	BREB Board	-	TH-2
Revision Date: -				

BANGLADESH RURAL ELECTRIFICATION BOARD				
PBS Instruction 100-70: LINE CONSTRUCTION DESIGN FOR 795 MCM AND 636 MCM CONDUCTORS				
Date of Origin	Revised by	Approved by	Page No.	Revision No.
19/02/2020	BREB	BREB Board	Page 82 of 93	-
Revision Date: -				

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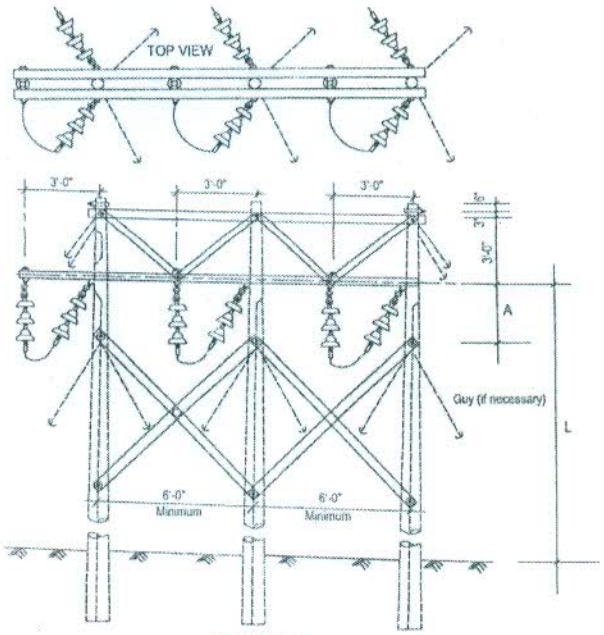
৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৯০০

৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৯



FRONT VIEW

ITEM	Matarial code	QTY	DESCRIPTION	ITEM	Matarial code	QTY	CODE No-
g		2	X-arm 4"x 4" x 3/8"-16'	bo		7	Shackle anchor
		2	Top horizontal Brace 3" x3" x 1/4" -13'	k		27	Insulator disc
cu		8	Brace, X-arm, 2 ½" x2 ½ x¼" -4'-9"	aa		6	Nut, eye-5/8"
cu		4	X-Brace, 2 ½" x2 ½ x¼" -9'	ek		33	Locknut 5/8"
o		4	Bolt, Eye 5/8" (as req,d length)			3	Arming plate
c		14	Bolt, Machine 5/8" (as req,d length)	c		3	Bolt machine 3/8" (1"- 1 ½")
n		3	Bolt, double arming 5/8" (as req,d length)	i		6	Tension Clamp
ds		12	Washer Spring, 11/8" hole	m		3	Suspension Clamp
		2	Pipe spacer for 5/8" dia bolt				

NOTE :

Up to 40° for mallard Conductor

A = 1/2 (L - 6')

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: LARGE TANGENT 3- POLE FRAME (Transmission Line Structure 33 KV)				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/20/2020	BREB	BREB Board	-	T3P-1
Revision Date: -				

BANGLADESH RURAL ELECTRIFICATION BOARD				
PBS Instruction 100-70: LINE CONSTRUCTION DESIGN FOR 795 MCM AND 636 MCM CONDUCTORS				
Date of Origin	Revised by	Approved by	Page No.	Revision No.
19/02/2020	BREB	BREB Board	Page 83 of 93	-
Revision Date: -				

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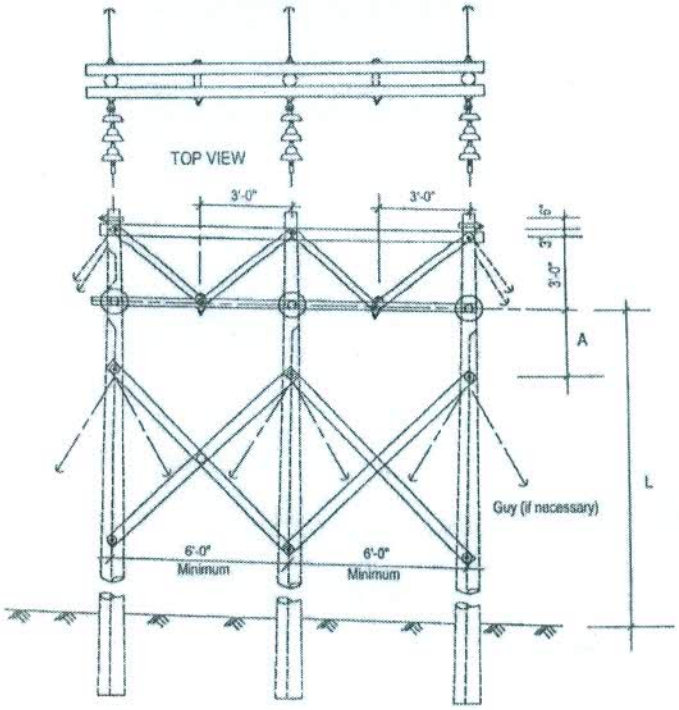
৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৭০০

৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৭



FRONT VIEW

ITEM	Matarial code	QTY	DESCRIPTION	ITEM	Matarial code	QTY	CODE No-
g		2	X-arm 4"x 4" x 3/8"-16'	bo		1	shackle anchor
		2	Top horizontal Brace 3" x3" x 1/4" -13'	c			Bolt, Machine 5/8", 1
cu		8	Brace, X-arm, 2 ½" x2 ½ x¼" -4'-9"	ek		9	Insulator, Disc
		4	X-Brace, 2 ½" x2 ½ x¼" -9'-0"			30	Lockunt
o		4	Bolt, Eye 5/8" (as req,d length)	ı		3	Tension clamp
o		14	Bolt, Machine 5/8" (as req,d length)				
m		3	Bolt, double arming 5/8" (as req,d length)				
d3		12	Washer Spring, 11/16" hole				
		2	Pipe spacer for 5/8" dia bolt				

NOTE :
A = 1/2 (L - 6')

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: TANGENT 3- POLE DEADEND (Transmission Line Structure 33 KV)				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	T3P-2
Revision Date: -				

BANGLADESH RURAL ELECTRIFICATION BOARD				
PBS Instruction 100-70: LINE CONSTRUCTION DESIGN FOR 795 MCM AND 636 MCM CONDUCTORS				
Date of Origin	Revised by	Approved by	Page No.	Revision No.
19/02/2020	BREB	BREB Board	Page 84 of 93	-
Revision Date: -				

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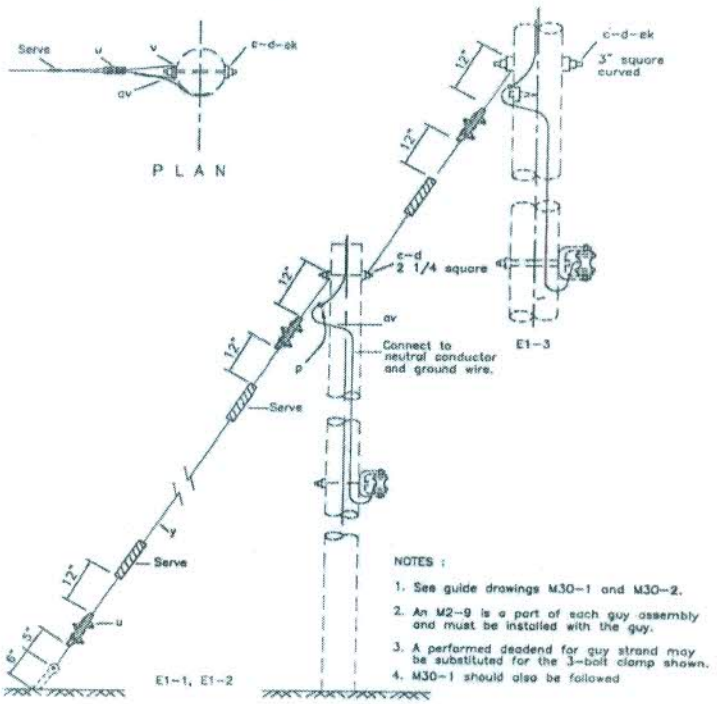
৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৭০০

৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং



			ASSEMBLY UNIT		
			E1~1 1/4" Guy Wire	E1~2 3/8" Guy Wire	E1~3 7/16" Guy Wire
ITEM	MATERIAL	MAT. CODE	No. REQ'D.	No. REQ'D.	No. REQ'D.
c	Bolt, machine, 5/8" x req'd. length	B6/7/8	1	1	1
d	Washer, 2 1/4" square	B46/118	1	1	
d	Washer, 3" Curved	B~49		1	1
j	Screw, lag, 1/2" req'd. length	B~40			1
p	Connectors	16	as req'd.	as req'd.	as req'd.
u	Deadend for guy strand	B69/70/E21/22/23	2 Light duty	2 Light duty	2 Heavy duty
v	Guy attachment	B56/57/58	1 Light duty	1 Light duty	1 Heavy duty
y	Guy wire, H.S., 7 strand	N~2/3/4	req'd. length	req'd. length	req'd. length
av	Jumper, No. 4 stranded Al alloy or equiv.	D~4	1	1	1
ek	Locknuts, as required	B50			

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: 6.35/11 KV SINGLE DOWN GUY THROUGH BOLT TYPE				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	TE-1-1, TE1-2, TE1-3
Revision Date: -				

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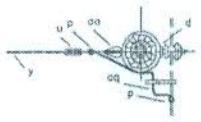
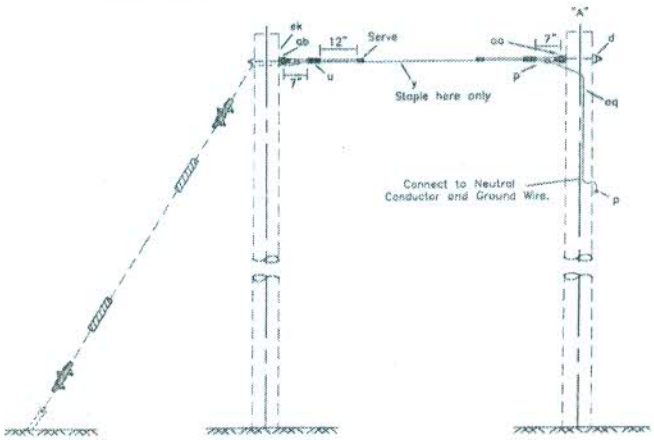
৬১১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৭০০

৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৭৫



PLAN OF POLE "A"



NOTE :

1. Other accepted and equivalent items of deadend material may be substituted for 3-bolt clamp shown.
2. M30-1 should also be followed

ITEM	MATERIAL	MAT. CODE	ASSEMBLY UNIT E2-1 1/4" Guy Wire No. REQ'D.	E2-2 3/8" Guy Wire No. REQ'D.	E2-3 7/16" Guy Wire No. REQ'D.
al	Staples	B-67	4	4	4
d	Washer, 2 1/4" square	B-46/118	1		
d	Washer, 3" Curved	B-49		1	1
ao	Bolt, thimble eye, 5/8" x req'd. length	B-24	1	1	1
p	Connectors	I-6	2	2	2
u	Deadend for guy strand	B69/E-21	2 Light duty	2 Light duty	2 Heavy duty
ab	Nut, thimble type eye, 5/8"	B-54	1	1	1
y	Guy wire, H.S., 7 strand	N-1/2/3	req'd. length	req'd. length	req'd. length
aa	Jumper, 4 Al. Alloy, Meter	D-4	2.66	2.66	2.66
ek	Locknuts, as required	B50	1	1	1

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: 6.35/11 KV SINGLE OVERHEAD GUY THROUGH BOLT TYPE				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	TE2-1, TE2-2, TE2-3
Revision Date: -				

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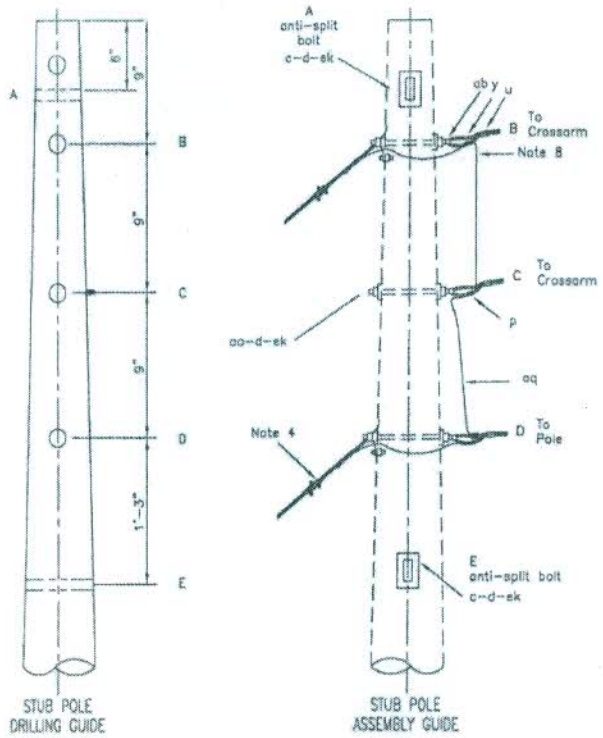
৬২১ তম বোর্ড সভায় অনুমোদিত সিদ্ধান্ত নং ১৭৭০৫



NOTES :

1. Stub pole holes A, B, C and E are pre-drilled as per pole framing guide M20.
2. Observe the 25° max. angle from the horizontal. Normally this may be accomplished with a stub pole 5'-0" shorter than the deadend pole.
3. This type of guy is req'd. for crossarm construction where the unbalanced loaded conductor tension is more than 1000 pounds per conductor for two 8 feet crossarms or 1500 pounds for three 8 feet x-arms. Guying req'ts for using this unit are depicted on individual pole top const'n assembly units.
4. The down guy units E1-2 or E1-3 must be specified separately. Thimbleye nuts are added to the down guy machine bolts & the suspension insulator double arming bolts.
5. Two anti-split bolts are req'd to be installed on the stub pole using holes identified as A & E.
6. With multiple down guys two or more anchors may be req'd. If two anchors are req'd. the spacing between the anchors shall be sufficient to provide the max. holding power of each anchor. The absolute minimum anchor separation shall be 5 feet.
7. A preformed deadend for guy wire may be substituted for the 3-bolt clamp depicted on the drawing.
8. On the deadend pole connect lower guy to the neutral conductor and ground wire. On the stub pole interconnect all overhead down guys.

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: 6.35/11 KV CROSSARM GUYS FOR HORIZONTAL DEADENDS				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	TE5-1, TE5-2
Revision Date: -				

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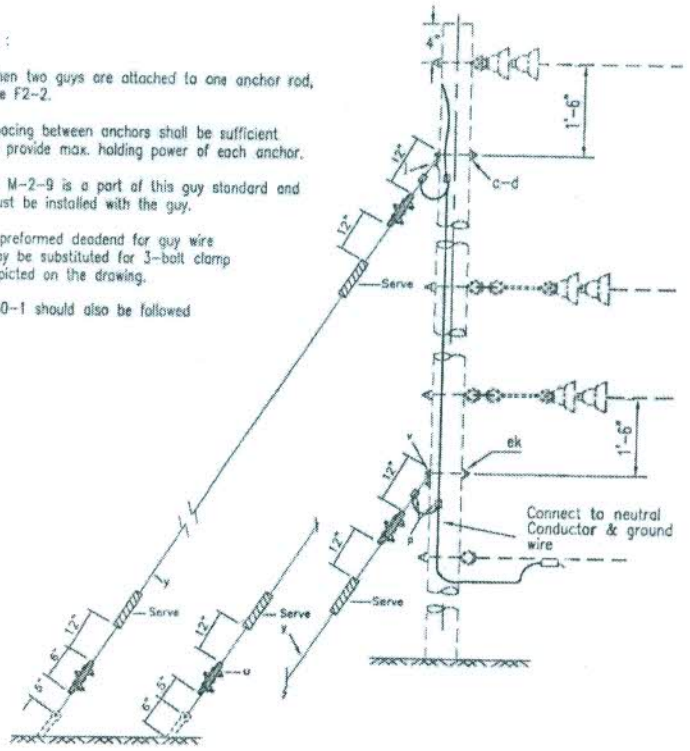
NOTES :

1. When two guys are attached to one anchor rod, use F2-2.
2. Spacing between anchors shall be sufficient to provide max. holding power of each anchor.
3. An M-2-9 is a part of this guy standard and must be installed with the guy.
4. A preformed deadend for guy wire may be substituted for 3-bolt clamp depicted on the drawing.
5. M30-1 should also be followed



ITEM	MATERIAL	MAT. CODE	ASSEMBLY UNIT E6-2 3/8" GUY WIRE No. REQ'D.	ASSEMBLY UNIT E6-3 7/16" GUY WIRE No. REQ'D.
c	Bolt, machine, 5/8" x req'd. length	B-7/8	2	2
d	Washer, 2 1/4" square	B-46	2	
d	Washer, 3"x5/16" curved	B-49		2
j	Screw, lag, 1/2" req'd. length	B-40		2
p	Connectors	I-6		
u	Deadend for guy strand	B69/70/E21	4 Light duty	4 Heavy duty
v	Guy attachment	B56/57/58		2
y	Guy wire, H.S., 7 strand	N-3/4	req'd. length	req'd. length
av	Jumper, No. 4 stranded Al alloy or equiv.	D-4	as required	as required
ek	Locknuts, as required	B50		
ck	Clamp, guy bond, as required	-		

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: 6.35/11 KV DOUBLE DOWN GUY				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	TE6-2, TE6-3
Revision Date: -				

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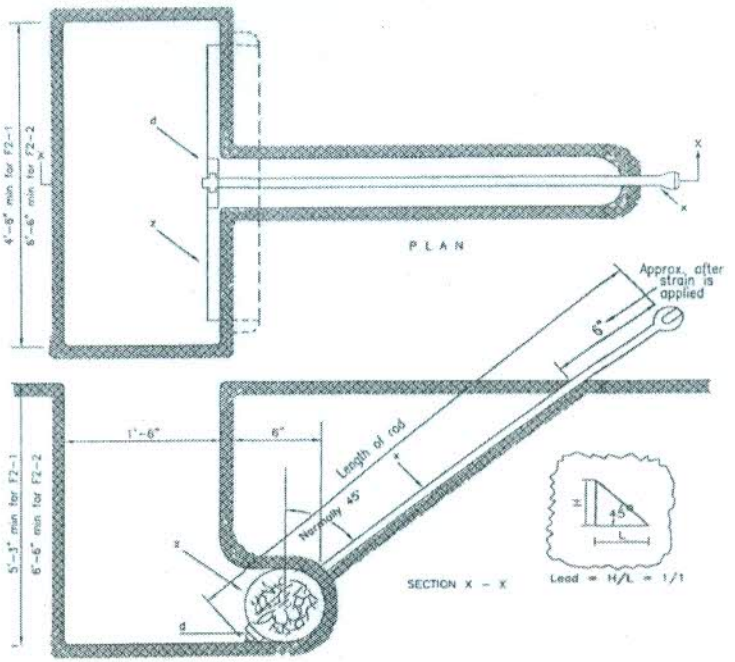

ITEM	MATERIAL	MAT. CODE	ASSEMBLY UNIT F2-1 NO.	ASSEMBLY UNIT F2-2 NO.
d	Washer square flat 4"x4"x1/2" with 13/16" dia hole	B-47/110	1	1
x	Rod, Anchor, twineye, 5/8"x8'-0"	B-62	1	
x	Rod, Anchor, twineye, 3/4"x10'-0"	B-63		1
z	Anchor, creosated Log, 8"x3'-6"	Z1	1	
z	Anchor creosated Log, 12"x6'-0"	Z2		1
	Total Tension (1/1 Lead) Average soil (pounds)		7000	15,000
	Total Tension (1/1 Lead) Poor soil (pounds)		4000	10,000

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: LOG ANCHOR ASSEMBLY				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	TF2-1, TF2-2
Revision Date: -				

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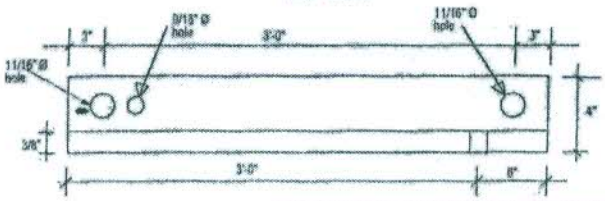
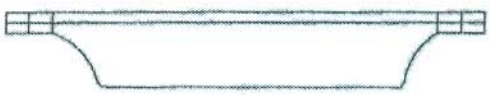
TOP CROSS ARM & BRACE

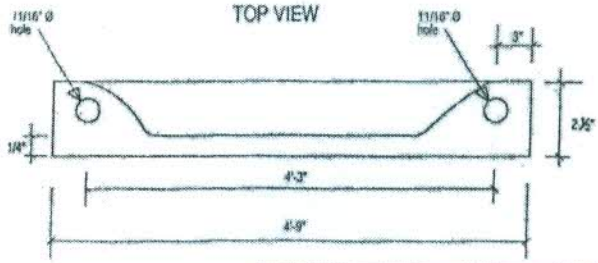
TOP VIEW



STRUCTERE FOR TS1, TS-2		
DESIGN	SCALE	TYPE
ALL ANGLE SLAM	NTS	TM-1



TOP VIEW



STRUCTERE FOR TS1, TS-2, TH-1, TH-2, T3P-1, T3P-2		
DESIGN	SCALE	TYPE
ALL ANGLE SLAM	NTS	TM-2

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: STRUCTURE FOR TS-1, TS-2, TH-1, TH-2, T3P-1, T3P-2				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	TM-2
Revision Date: -				

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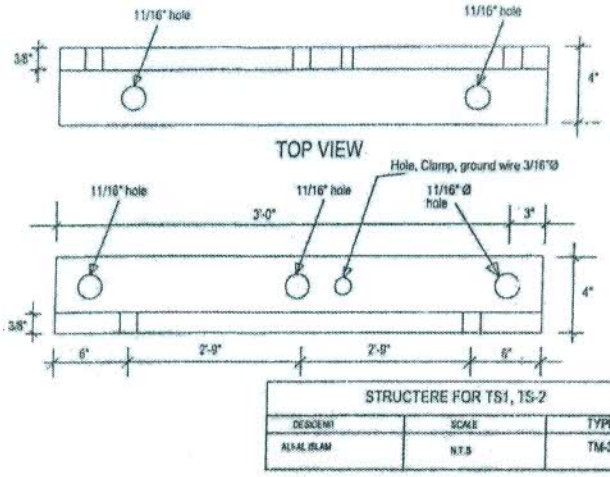
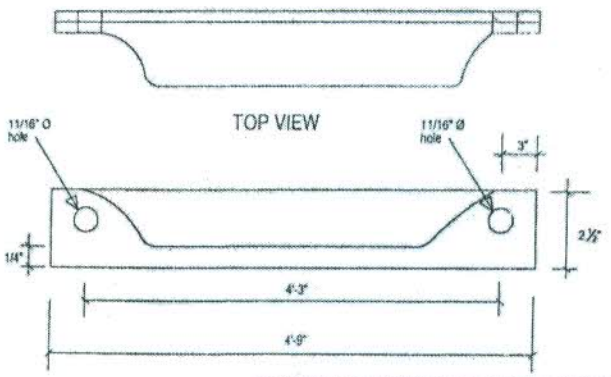
BOTTOM CROSS ARM & BRACE



STRUCTERE FOR TS1, TS-2		
DESIGNED	SCALE	TYPE
ALHAL ISLAM	N.T.S	TM-3



STRUCTERE FOR TS1, TS-2, TH-1, TH-2, T3P-1, T3P-2		
DESIGNED	SCALE	TYPE
ALHAL ISLAM	N.T.S	TM-4

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: STRUCTURE FOR TS-1, TS-2, TH-1, TH-2, T3P-1, T3P-2				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	TM-4
Revision Date: -				

BANGLADESH RURAL ELECTRIFICATION BOARD				
PBS Instruction 100-70: LINE CONSTRUCTION DESIGN FOR 795 MCM AND 636 MCM CONDUCTORS				
Date of Origin	Revised by	Approved by	Page No.	Revision No.
19/02/2020	BREB	BREB Board	Page 91 of 93	-
Revision Date: -				

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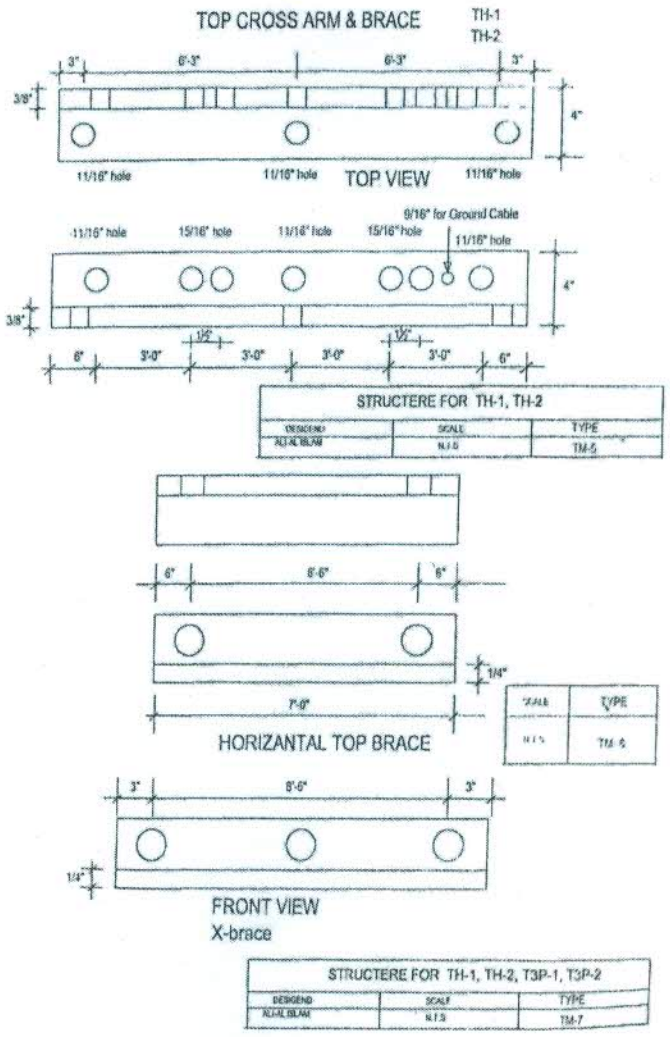

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: STRUCTURE FOR TH-1, TH-2, T3P-1, T3P-2				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	TM-7
Revision Date: -				

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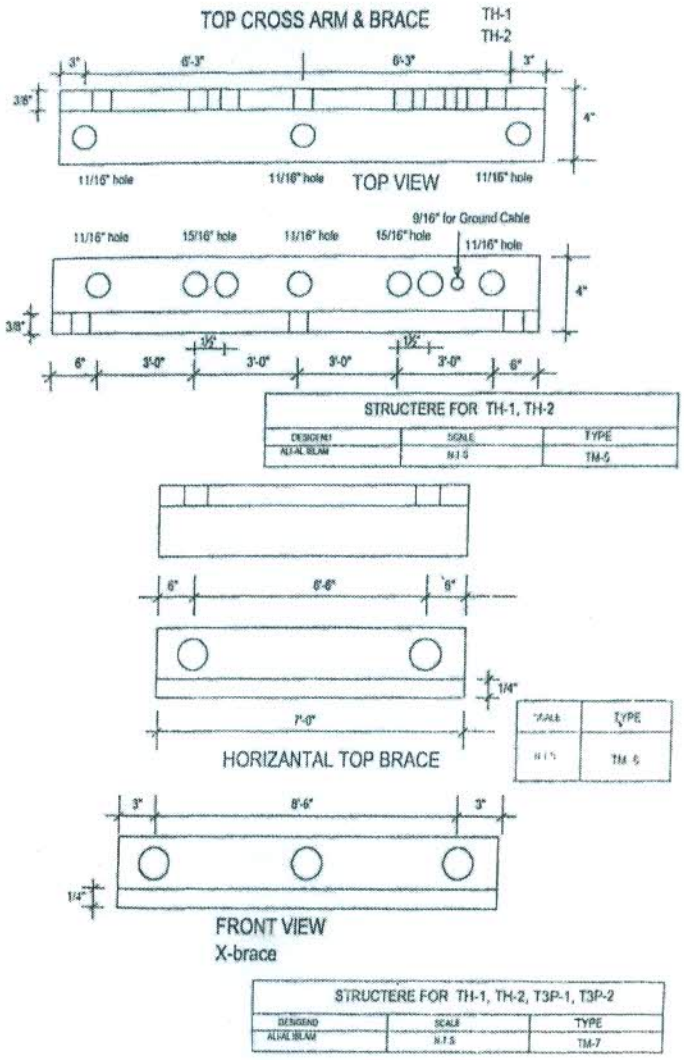

BANGLADESH RURAL ELECTRIFICATION BOARD				
Unit Description: STRUCTURE FOR TS-2, TH-1, T3P-1				
Date of Origin	Revised by	Approved by	Revision No.	Unit Designation
19/02/2020	BREB	BREB Board	-	TM-10
Revision Date: -				

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