



Supply of Steel Tubular Monopoles

CALCULATION NOTE

N.D.C. : 14849/108

Ø	07/03/2007	First issue	CTH	
Rev:	Date	Modifications	Designer	

Gemeente Maastricht
Veiligheid en Leefbaarheid

CALCULATION NOTE

Ontvangen op : 13-11-2017

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1) GE NL 18M 3 P 2 FLOODLIGHTS

1.1) Ultimate Limit State Mast Design note

PETITJEAN SAS Software ETOXY - TECAND release V.2.19.0 : Design Engineer cth Date : March 7, 2007

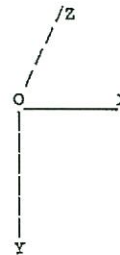
- DIMENSIONAL PROPERTIES :

SECTION	DIAMETERS(mm)		THICKNESS	LENGTH	UPPER LEVEL	OUTREACH	ANGLE/OY	YIELD POINT	CROSS SECTION
	base	top	mm		meters		degrees	daN/mm2	
1	286.4	186.6	4.00	9.100	9.100	.000	.000	35.50	OCTAG. ACROSS FLATS
2	194.6	101.5	3.00	8.500	17.600	.000	.000	35.50	OCTAG. ACROSS FLATS

WEIGHT OF POLE (kg) : 333.

- DESIGN HYPOTHESES :

STANDARDS: EN 40-3 B (classe)
 REFERENCE WIND VELOCITY(m/s): 27.50
 TERRAIN CATEGORY: II
 TOPOGRAPHY FACTOR: 1.00
 DRAG FACTOR (STANDARD)
 WIND ACC. TO AXIS: OZ
 YOUNG'S MODULUS (daN/mm2): 21000.
 MODULUS OF TRANSV. ELASTICITY(daN/mm2): 8100.



SAFETY FACTOR, F.O.S.: 1.00

RESULTS OF NONLINEAR ANALYSIS.

NATURAL PERIOD (sec) : 1.31

- LOADS APPLIED TO THE POLE :

LEVELS	Cd*AREAS	WEIGHTS	LOADS	BETA	QW*DELTA
m	m2	kg	daN		daN/m2
17.600	.610	55.00	94.85	1.594	97.57
WIND LOAD FACTOR Gw : 1.20					
DEAD LOAD FACTOR Gp : 1.20					
MATERIAL FACTOR Gm : 1.05					

						Dx (m)	Dy (m)	Qte
17.600	.610	66.00	113.82	1.594	97.57	.000	.000	1

OPEN SECTION			CLOSED SECTION		
Mt.ox1*FOS	Mt.oz1*FOS	(MTtors*FOS)	(MTfle*FOS)	(MTtors*FOS)	
CSR = ----- + ----- + (-----)			CSR = (-----) + (-----)		
Mtmax.ox1	Mtmax.oz1	(TORMax)	(MFmax)	(TORMax)	

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SECTION: 1		THICKNESS (mm): 4.00		CROSS SECTION : OCTAG. ACROSS FLATS												
STRAINS		AT LEVEL (meters): .000														
		X Y Z														
MOMENTS (m*daN):		-7099. 0. 0.														
LOADS (daN):		0. 457. 712.														
LEVELS	DIAM	Zp	Q-WIND	Mt.oX	Mt.oZ	MTfle	MTtors	MFmax	TORMax	CSR	DEFLECTIONS			ANGLES		
m	mm	cm3	daN/m2	m*daN	m*daN	m*daN	m*daN	m*daN	m*daN		mm	X	Y	Z	degrees	X Y Z
.000	286.4	344.	65.	-7099.	0.	7099.	0.	9455.	8469.	.75	0	0	0	.00	.00	.00
.500	280.9	331.	65.	-6748.	0.	6748.	0.	9154.	8144.	.74	0	0	1	-.25	.00	.00
DOOR :1 ANGLE/AXIS X(degrees): .0 TWO REINFORCEMENTS : 400. mm2 IPA(cm4): 1.33 IPB(cm4): 1.33																
DOOR OPENING (mm) :147.4 AT LEVEL (meters): .50																
According to oz1:Axis PARALLEL to door plan Mt.oz1 Mtmax.oz1																
.500	280.9	317.	65.	-6748.	0.	0.	0.	8760.	2246.	.65	0	0	1	-.25	.00	.00
According to ox1:Axis PERPEND. to door plan Mt.ox1 Mtmax.ox1																
.500	280.9	377.	65.	-6748.	0.	-6748.	0.	10414.	2246.	.65	0	0	1	-.25	.00	.00
DOOR OPENING (mm) :143.2 AT LEVEL (meters): 1.00																
According to oz1:Axis PARALLEL to door plan Mt.oz1 Mtmax.oz1																
1.000	275.4	307.	65.	-6408.	0.	0.	0.	8537.	2164.	.63	0	0	4	-.50	.00	.00
According to ox1:Axis PERPEND. to door plan Mt.ox1 Mtmax.ox1																
1.000	275.4	364.	65.	-6408.	0.	-6408.	0.	10120.	2164.	.63	0	0	4	-.50	.00	.00
DOOR OPENING (mm) :142.4 AT LEVEL (meters): 1.10																
According to oz1:Axis PARALLEL to door plan Mt.oz1 Mtmax.oz1																
1.100	274.3	305.	65.	-6341.	0.	0.	0.	8493.	2148.	.63	0	0	5	-.55	.00	.00
According to ox1:Axis PERPEND. to door plan Mt.ox1 Mtmax.ox1																
1.100	274.3	361.	65.	-6341.	0.	-6341.	0.	10062.	2148.	.63	0	0	5	-.55	.00	.00
1.100	274.3	316.	65.	-6341.	0.	6341.	0.	8798.	7762.	.72	0	0	5	-.55	.00	.00
1.250	272.7	312.	65.	-6242.	0.	6242.	0.	8710.	7668.	.72	0	0	7	-.62	.00	.00
DOOR :2 ANGLE/AXIS X(degrees): .0 TWO REINFORCEMENTS : 400. mm2 IPA(cm4): 1.33 IPB(cm4): 1.33																
DOOR OPENING (mm) :146.4 AT LEVEL (meters): 1.25																
According to oz1:Axis PARALLEL to door plan Mt.oz1 Mtmax.oz1																
1.250	272.7	296.	65.	-6242.	0.	0.	0.	8276.	2057.	.63	0	0	7	-.62	.00	.00
According to ox1:Axis PERPEND. to door plan Mt.ox1 Mtmax.ox1																
1.250	272.7	357.	65.	-6242.	0.	-6242.	0.	9972.	2057.	.63	0	0	7	-.62	.00	.00
DOOR OPENING (mm) :144.3 AT LEVEL (meters): 1.50																
According to oz1:Axis PARALLEL to door plan Mt.oz1 Mtmax.oz1																
1.500	269.9	291.	65.	-6078.	0.	0.	0.	8166.	2018.	.62	0	0	10	-.75	.00	.00
According to ox1:Axis PERPEND. to door plan Mt.ox1 Mtmax.ox1																
1.500	269.9	351.	65.	-6078.	0.	-6078.	0.	9828.	2018.	.62	0	0	10	-.75	.00	.00
DOOR OPENING (mm) :141.4 AT LEVEL (meters): 1.85																
According to oz1:Axis PARALLEL to door plan Mt.oz1 Mtmax.oz1																
1.850	266.1	284.	65.	-5853.	0.	0.	0.	8013.	1964.	.61	0	0	15	-.92	.00	.00
According to ox1:Axis PERPEND. to door plan Mt.ox1 Mtmax.ox1																
1.850	266.1	342.	65.	-5853.	0.	-5853.	0.	9627.	1964.	.61	0	0	15	-.92	.00	.00
1.850	266.1	297.	65.	-5853.	0.	5853.	0.	8361.	7297.	.70	0	0	15	-.92	.00	.00
2.000	264.5	293.	65.	-5758.	0.	5758.	0.	8275.	7206.	.70	0	0	17	-1.00	.00	.00

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DOOR :3 ANGLE/AXIS X(degrees): .0 TWO REINFORCEMENTS : 400. mm2 IPA(cm4): 1.33 IPB(cm4): 1.33

DOOR OPENING (mm) :145.4 AT LEVEL (meters): 2.00

According to oz1:Axis PARALLEL to door plan Mt.oz1 Mtmax.oz1
2.000 264.5 276. 65. -5758. 0. 0. 0. 7800. 1876. .60 0 0 17 -1.00 .00 .00

According to ox1:Axis PERPEND. to door plan Mt.ox1 Mtmax.ox1
2.000 264.5 338. 65. -5758. 0. -5758. 0. 9539. 1876. .60 0 0 17 -1.00 .00 .00

DOOR OPENING (mm) :141.2 AT LEVEL (meters): 2.50

According to oz1:Axis PARALLEL to door plan Mt.oz1 Mtmax.oz1
2.500 259.0 267. 65. -5446. 0. 0. 0. 7585. 1802. .59 0 0 27 -1.25 .00 .00

According to ox1:Axis PERPEND. to door plan Mt.ox1 Mtmax.ox1
2.500 259.0 325. 65. -5446. 0. -5446. 0. 9258. 1802. .59 0 0 27 -1.25 .00 .00

DOOR OPENING (mm) :140.4 AT LEVEL (meters): 2.60

According to oz1:Axis PARALLEL to door plan Mt.oz1 Mtmax.oz1
2.600 257.9 265. 65. -5385. 0. 0. 0. 7542. 1788. .59 0 0 29 -1.30 .00 .00

According to ox1:Axis PERPEND. to door plan Mt.ox1 Mtmax.ox1
2.600 257.9 323. 65. -5385. 0. -5385. 0. 9202. 1788. .59 0 0 29 -1.30 .00 .00

2.600	257.9	278.	65.	-5385.	0.	5385.	0.	7933.	6846.	.68	0	0	29	-1.30	.00	.00
3.000	253.5	269.	65.	-5143.	0.	5143.	0.	7708.	6612.	.67	0	0	39	-1.51	.00	.00
3.500	248.0	257.	65.	-4849.	0.	4849.	0.	7431.	6325.	.65	0	0	54	-1.77	.00	.00
4.000	242.5	246.	65.	-4562.	0.	4562.	0.	7157.	6044.	.64	0	0	70	-2.03	.00	.00
4.500	237.1	235.	67.	-4284.	0.	4284.	0.	6888.	5769.	.62	0	0	89	-2.29	.00	.00
5.000	231.6	224.	69.	-4013.	0.	4013.	0.	6623.	5501.	.61	0	0	110	-2.56	.00	.00
5.500	226.1	213.	71.	-3752.	0.	3752.	0.	6362.	5239.	.59	0	0	134	-2.82	.00	.00
6.000	220.6	203.	73.	-3498.	0.	3498.	0.	6105.	4984.	.57	0	0	159	-3.09	.00	.00
6.500	215.1	193.	75.	-3254.	0.	3254.	0.	5852.	4735.	.56	0	0	188	-3.36	.00	.00
7.000	209.7	183.	76.	-3018.	0.	3018.	0.	5604.	4493.	.54	0	0	218	-3.63	.00	.00
7.500	204.2	173.	78.	-2790.	0.	2790.	0.	5360.	4256.	.52	0	0	251	-3.90	.00	.00
8.000	198.7	164.	79.	-2572.	0.	2572.	0.	5120.	4026.	.50	0	0	286	-4.17	.00	.00
8.500	193.2	155.	81.	-2362.	0.	2362.	0.	4884.	3803.	.48	0	0	324	-4.44	.00	.00
8.650	191.6	152.	81.	-2300.	0.	2300.	0.	4814.	3737.	.48	0	0	335	-4.52	.00	.00

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SECTION: 2 THICKNESS (mm): 3.00 CROSS SECTION : OCTAG. ACROSS FLATS

STRAINS AT LEVEL (meters): 9.100
 X Y Z
 MOMENTS (m*daN): -2121. 0. 0.
 LOADS (daN): 0. 192. 382.

LEVELS m	DIAM mm	Zp cm3	Q-WIND daN/m2	Mt.oX m*daN	Mt.oZ m*daN	MTfle m*daN	MTtors m*daN	MFmax m*daN	TORMax m*daN	CSR	DEFLECTIONS mm			ANGLES degrees		
											X	Y	Z	X	Y	Z
9.100	194.6	119.	82.	-2121.	0.	2121.	0.	3382.	2926.	.63	0	0	372	-4.77	.00	.00
9.500	190.3	114.	83.	-1968.	0.	1968.	0.	3256.	2793.	.60	0	0	406	-5.02	.00	.00
10.000	184.8	107.	84.	-1785.	0.	1785.	0.	3100.	2632.	.58	0	0	451	-5.33	.00	.00
10.500	179.3	101.	85.	-1610.	0.	1610.	0.	2947.	2476.	.55	0	0	499	-5.63	.00	.00
11.000	173.8	95.	86.	-1444.	0.	1444.	0.	2798.	2324.	.52	0	0	549	-5.94	.00	.00
11.500	168.3	89.	87.	-1286.	0.	1286.	0.	2651.	2178.	.49	0	0	603	-6.23	.00	.00
12.000	162.9	83.	88.	-1137.	0.	1137.	0.	2508.	2036.	.45	0	0	658	-6.53	.00	.00
12.500	157.4	77.	89.	-996.	0.	996.	0.	2368.	1899.	.42	0	0	716	-6.81	.00	.00
13.000	151.9	72.	90.	-864.	0.	864.	0.	2230.	1766.	.39	0	0	777	-7.09	.00	.00
13.500	146.4	67.	91.	-739.	0.	739.	0.	2097.	1639.	.35	0	0	840	-7.35	.00	.00
14.000	140.9	62.	92.	-622.	0.	622.	0.	1966.	1516.	.32	0	0	905	-7.61	.00	.00
14.500	135.5	57.	93.	-513.	0.	513.	0.	1839.	1398.	.28	0	0	973	-7.85	.00	.00
15.000	130.0	52.	94.	-412.	0.	412.	0.	1715.	1284.	.24	0	0	1042	-8.06	.00	.00
15.500	124.5	48.	95.	-318.	0.	318.	0.	1595.	1176.	.20	0	0	1114	-8.26	.00	.00
16.000	119.0	44.	95.	-231.	0.	231.	0.	1475.	1072.	.16	0	0	1186	-8.43	.00	.00
16.500	113.5	40.	96.	-152.	0.	152.	0.	1339.	973.	.11	0	0	1261	-8.57	.00	.00
17.000	108.1	36.	97.	-79.	0.	79.	0.	1209.	879.	.07	0	0	1336	-8.66	.00	.00
17.500	102.6	32.	97.	-12.	0.	12.	0.	1086.	790.	.01	0	0	1411	-8.70	.00	.00
17.600	101.5	31.	98.	0.	0.	0.	0.	1062.	773.	.00	0	0	1427	-8.70	.00	.00

- DEFLEXION REQUIREMENTS (Serviceability limit state) :

CLASS FOR MAXIMAL HORIZONTAL DEFLEXION : 3
 NOMINAL HEIGHT OF THE COLUMN h (mm): 17600. BRACKET PROJECTION w (mm): 0.
 ALLOWABLE HORIZONTAL DEFLEXION (mm): 1760.0 CALCULATED HORIZONTAL DEFLEXION (mm): 1179.1