Test Report:

Full-Scale Cyclic Bending Test of Strongwell's SE28 FRP Pole

Submitted to:

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EDM International, Inc.

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REPORT ON FULL-SCALE CYCLIC TESTING OF STRONGWELL'S SE28 FRP POLE

Prepared for: Strongwell, Bristol, VA
Prepared by: EDM International, Inc., Fort Collins, CO

1.0 INTRODUCTION

EDM International, Inc. (EDM) is the recognized leader in providing pole testing services to the electric utility industry. During the past two decades, EDM has tested more poles than any other institution in North America. Strongwell contracted with EDM to conduct independent testing for the purposes of assessing the bending strength of its 80ft SE28 pole. This test was designed to determine the ultimate capacity of a pole after it has been subjected to 100 cycles of pure bending load. The testing was conducted at EDM's laboratory and test facility in Fort Collins, CO on April 9, 2003.

2.0 POLE PREPARATION

One 80-SE28 poles was manufactured by Strongwell and shipped to EDM's test facility for the express purpose of conducting destructive bending tests on them. This pole was single piece with a constant taper from tip to butt. Its 12-sided polygonal geometry used alternating flats of constant and variable widths to effect the taper.

3.0 TEST SETUPS

EDM's test facility is equipped with a pole holding fixture, loading system, electronic load and deflection measuring sensors, and a computerized data acquisition system. Figure 4.1 is a schematic of the pole test setup used for the bending load test.

4.0 BENDING LOAD TESTING

4.1 Test Procedure

For testing, the pole was clamped in a horizontal cantilever arrangement with the load cable attached approximately two feet from the pole tip (refer to Fig. 3.1). Initially, the pole was oriented with two of the variable faces oriented on the tension and compression sides. The pole was then loaded cyclically 50 times from approximately 250 lbs to a minimum of 2500 lbs. Afterwards the pole was reoriented in the test frame such that two of the constant faces were on the tension and compression faces. The pole was again loaded cyclically 50 times from approximately 250 lbs to a minimum of 2500 lbs. Throughout the testing the load was applied at a constant rate of deformation.

Loading and deflection data were captured and recorded electronically multiple times each second. Following completion of the cyclic loading, the pole was loaded to failure.

Deflection measurements were taken near the pole tip and at two points below the groundline. The below groundline measurements were used to calculate the magnitude of base rotation that resulted from the stretching of the anchor straps.

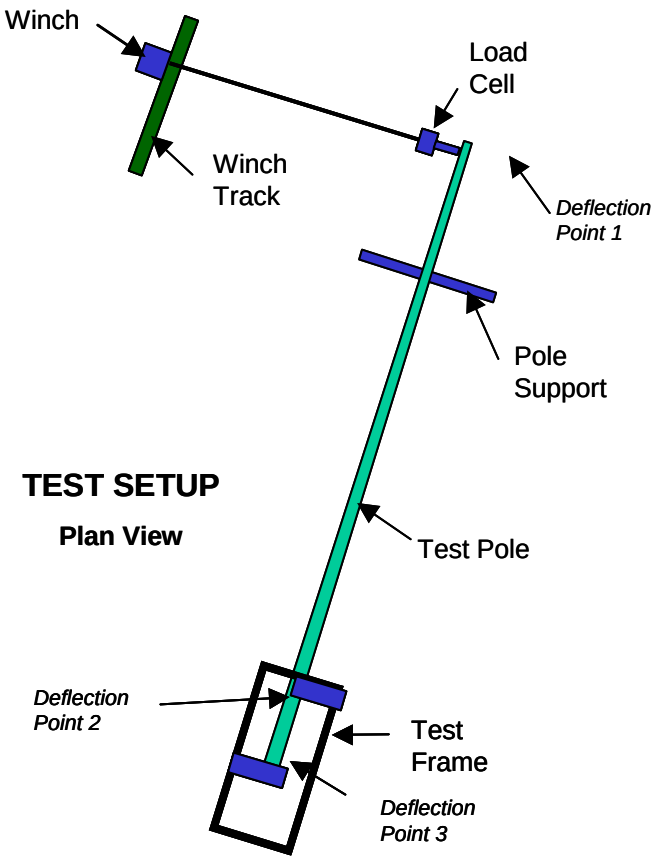


Figure 4-1 – Bending Test Setup

4.2 Test Data

The data sheet for the failure load test follows. Two graphs of the load vs. deflection data are also shown. The second graph is the same as the first, except that both ends have been truncated to eliminate the non-linearities associated with both test start up and buckling failure. The trendline for this graph was used to calculate an MOE for the pole. Note, the tip deflections used for these graphs have been adjusted to compensate for the measured base rotations. Still images of the test setup and the failure mode are provided in Appendix A.

Strongwell
FRP Pole
Destructive Bending Tests

Sheet No. 9
Date 9-Apr-03
Time 18:20

Cyclic Bending Test

Test No. 13 **Length** 80 **Flat** C

C= Constant, V= Variable

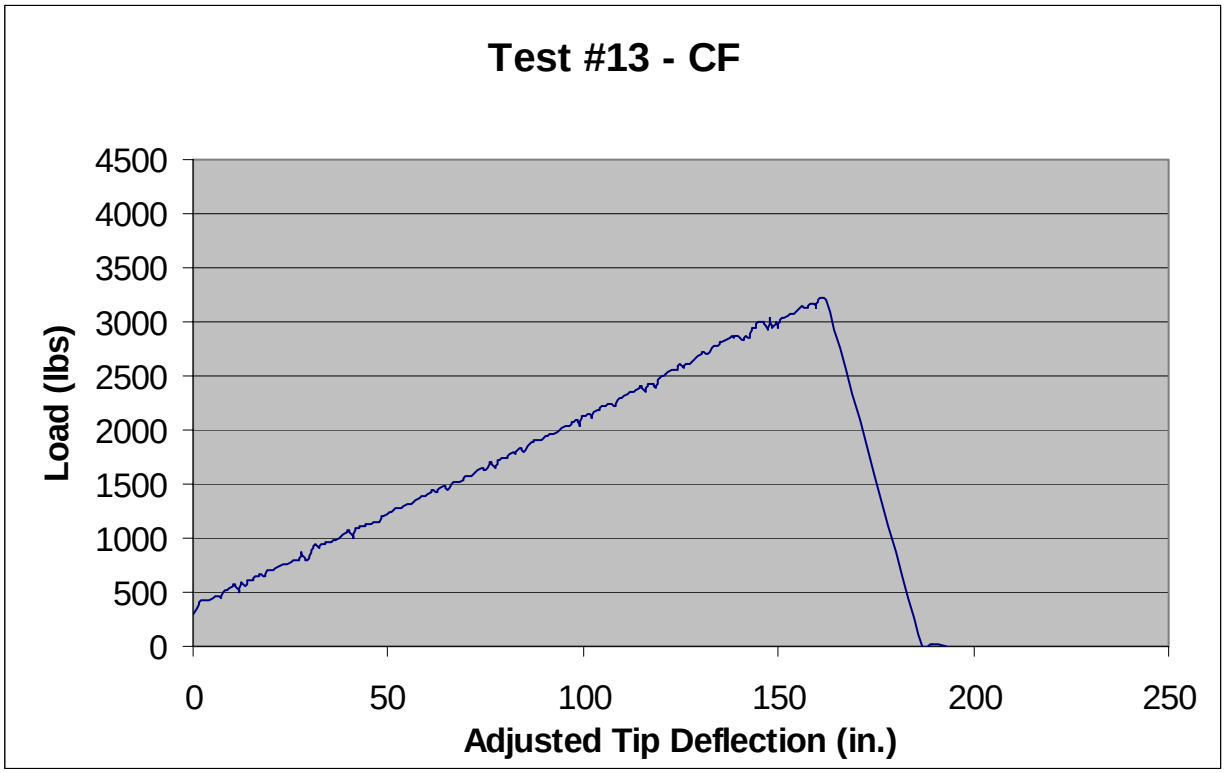
Actual Pole Length	80.08	(ft)
Distance- Butt to G.L.	10.27	(ft)
Distance Tip to Load Point	2.25	(ft)
Distance G.L. to Failure Point	2.67	(ft)
G.L. Diameter (flat-to-flat)	22.21	(in)
Diameter @ Failure Point (flat-to-flat)	21.71	(in)
Maximum Load @ Failure	3219	(lbs)
Distance Tip to Defl. Pt. 1	35.50	(in)
Distance between Butt Defl Pts 2 & 3	93.75	(in)
Adjusted Horizontal Deflection @ 2812# *Deflection Point 1*	135.72	(in)

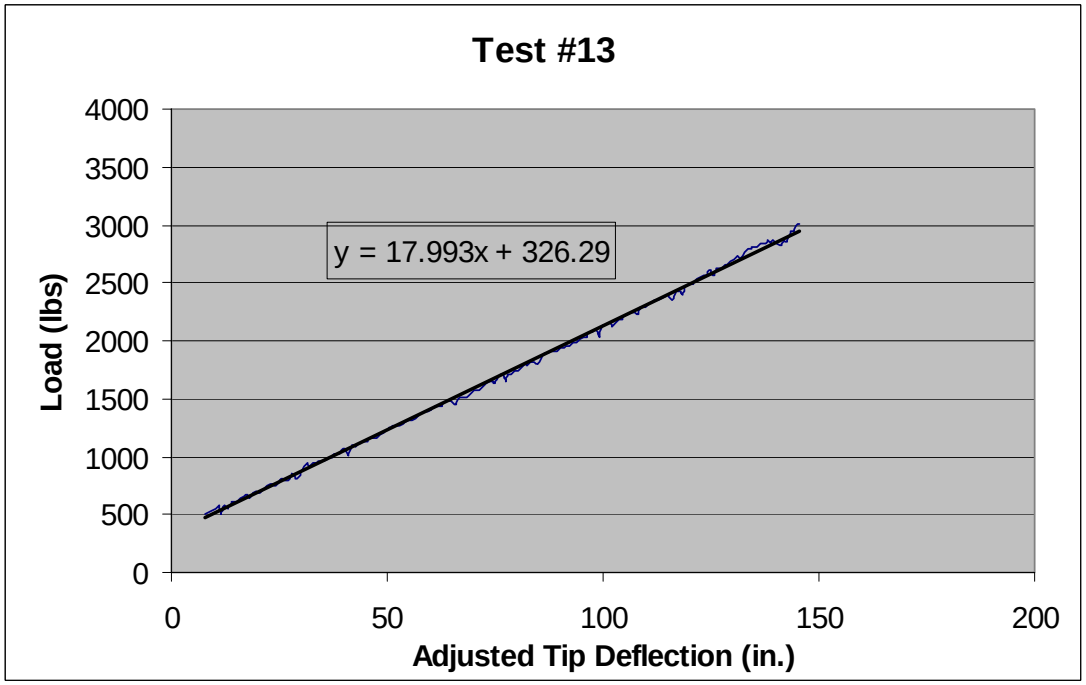
Defl. Pt.	Defl. (in)
1	143.20
2	0.38
3	0.49

Results	Moment (ft-lbs)	S (in3)	Stress (psi)
@ GL	217,476	116.02	22,493
@ Break	208,881	111.06	22,569

Location	Diameter (f-f)
Tip	9.22
GL	22.21
Break	21.71
Butt	24.12

Comments: Pole #9
Buckling Failure
Cycled 50X to 2500# on both variable face and constant face


Test #13 - CF
Load (lbs)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
Adjusted Tip Deflection (in.)


Test #13
y = 17.993x + 326.29
Load (lbs)
4000
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
Adjusted Tip Deflection (in.)

4.3 Test Results

The purpose of these tests was to determine the bending strength of this SE28 pole. Using the *PLS-POLE* software and the load-deflection data that was captured, an approximate modulus of elasticity was calculated for this pole. A summary of the test results is provided in Table 4.1.

Table 4-1 – Summary of Test Results

Test #	Test Flat	Elev @ Break	Max Load	Max Defl @ 2812	Net Defl @ 2812	Stress @ GL	Stress @ Break	MOE (psi)
13	C	67.14	3219	143.2	135.7	22,493	22,569	5070

APPENDIX A – TEST PHOTOGRAPHS

Test Setup			Test Setup
Test Setup			Test Setup
Failure – Test #13			Failure – Test #13