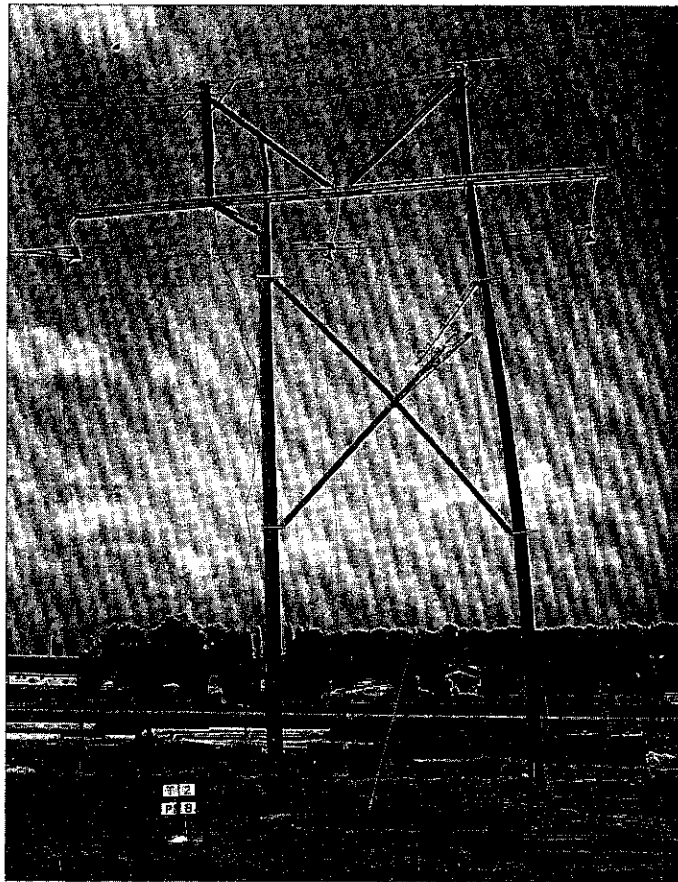


STRUCTURE TEST

JUNE 21, 1984



**KANSAS CITY POWER & LIGHT COMPANY
KANSAS CITY, MISSOURI
HUGHES TYPE C4523-A TANGENT STRUCTURE
345 KV CONSTRUCTION**

HUGHES
BROTHERS
Seward, Nebraska

HUGHES BROTHERS

P.O. BOX 159 • 210 NORTH 13TH STREET • SEWARD, NEBRASKA 68434 • PHONE (402) 643-2991 • TELEX 438076

PURPOSE:

The purpose of these tests was to confirm design calculations and the structural capability of the Hughes Type C4523-A H-frame tangent structure for various loading conditions.

PROCEDURE:

Two structures were framed and erected for these tests. The structure top, from the X-brace up, was framed on short pole stubs. A complete structure was framed on 85 ft. Class I Douglas Fir poles. The actual pole dimensions are listed in the body of the report.

The pole top structure was loaded in the vertical direction to the maximum design load times an overload capacity factor of 4.0. The loading was accomplished by means of hydraulic cylinders and known dead weights. The three phase positions were loaded equally and simultaneously.

The pole top structure was then loaded transversely by means of power winches. The loads were monitored by dynamometers and transverse deflection readings taken.

A premature failure of a 7/8 x 12" drop-forged turnbuckle in the west tension brace caused a short delay. The turnbuckle was replaced with an identical unit and the structure loaded to maximum design load requirements.

The full size structure was initially loaded vertically to NESC light loading conditions times an overload capacity factor of 4.0. The structure was then loaded incrementally in the transverse direction to failure. The transverse loads were applied by power winches and monitored with dynamometers.

DISCUSSION:

Investigation of the failed turnbuckle did not produce any positive reasons for the premature failure. The steel analysis appeared to be normal. The turnbuckle was manufactured by a very reputable and dependable company. Their quality control people are continuing the investigation.

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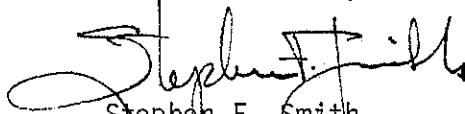
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CONCLUSION:

The Hughes Type C4523-A structure performed favorably. All design criteria was met. Strengthening of the spacer fittings was deemed necessary by the Hughes Brothers, Inc. engineering staff and has been accomplished.

Respectfully submitted,

HUGHES BROTHERS, INC.

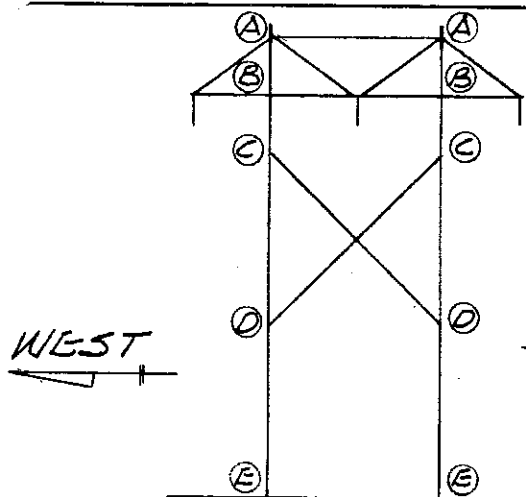


Stephen F. Smith
Vice-President, Engineering

SFS:jap

Approved

Drawn
S. Williams



TYPE C4523-A, 345KV TANGENT STR.
KANSAS CITY POWER & LIGHT CO.
FULL SIZE STRUCTURE TEST
NESC LIGHT

TEST No. 2

DATE: 6-21-84

VERTICAL LOADS

East Phase 10,450 lbs.
Center Phase 10,450 lbs.
West Phase 10,450 lbs.
Per Shield Wire 1,200 lbs.

TRANSVERSE LOADS

LOADS (LBS.)

DEFLECTIONS (IN.)

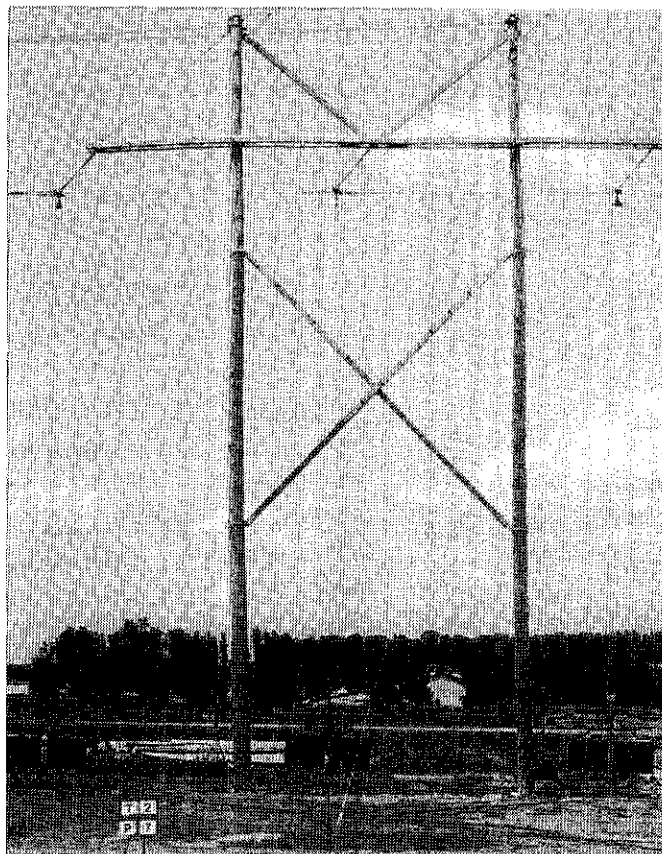
SHIELD WIRE (EA.)	COND (EA.)	TOTAL LOAD	WEST POLE					EAST POLE					PIC. No.	
			A	B	C	D	THRUST	A	B	C	D	UP LIFT		
0	0	0	0	0	0	0	0	0	0	0	0	0	0	T2P1
0	0	0	VERTICAL LOADS APPLIED										T2P2	
300	1,850	6,150	3 3/4	3 1/8	2	1 5/8	1/4	2 5/8	3 1/8	2 3/8	1 3/8	0		T2P3
600	3,700	12,300	7 5/8	6 3/8	4 3/8	3 1/2	1/2	6 3/4	6 3/4	5	3 3/8	1/8		T2P4
900	5,550	18,450	14 3/4	12 3/8	9 1/8	6 3/4	3/4	12 3/4	12	8 7/8	5 7/8	1/8		T2P5
1,200	7,400	24,600	24 3/8	20 5/8	15 3/4	10 3/4	1 1/8	23	20 3/4	15 3/4	10	1/4		T2P6
1,350	8,325	27,675	34 3/8	29 5/8	22 1/2	15	1 1/4	31 1/2	28 1/8	22 1/4	14 1/2			T2P7
1,500	9,250	30,750	FAILURE										T2P8	

* Vertical loads applied during entire test represent NESC LIGHT loading x an overload capacity factor of 4.0.

HUGHES BROTHERS

DRG. NO. A2345-C

Date Printed



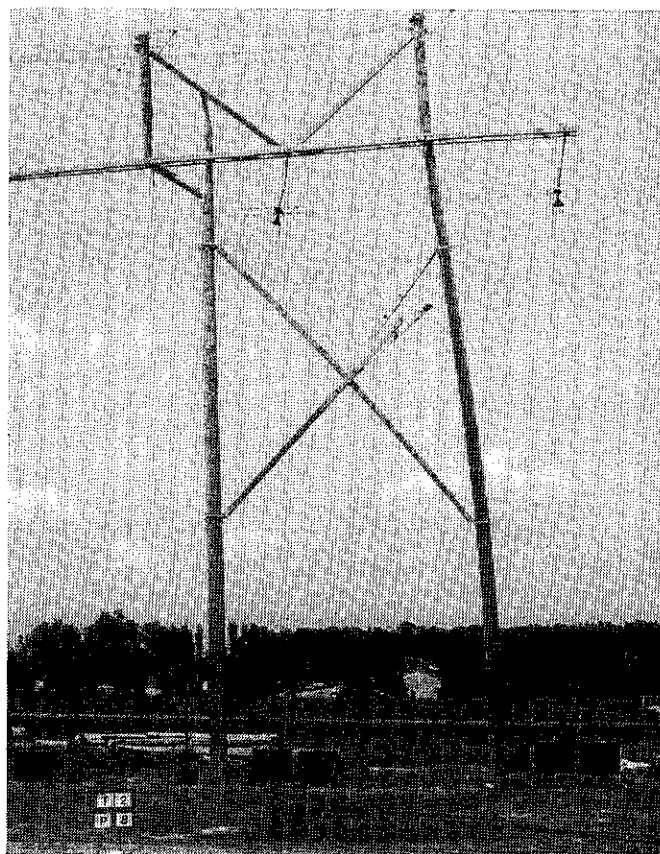
**Test No. 2
Photo No. 7**

Vertical Loads

per shield wire = 1,200 lbs.
per phase = 10,450 lbs.

Transverse Loads

per shield wire = 1,350 lbs.
per phase = 8,325 lbs.
Total = 27,675 lbs.



**Test No. 2
Photo No. 8**

Failure

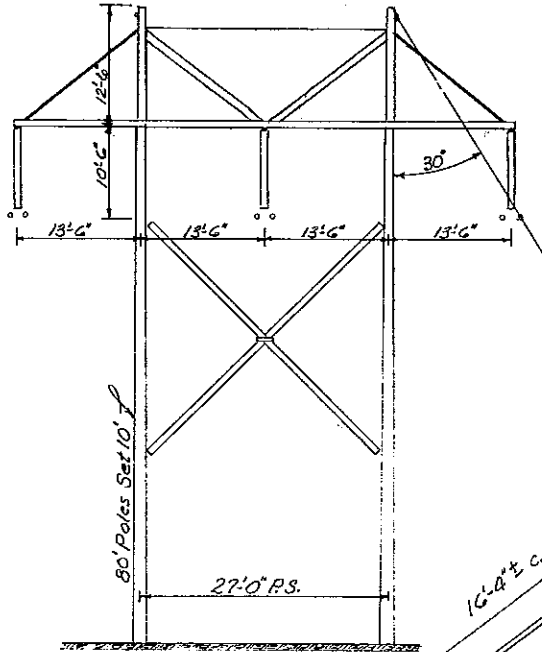
Vertical Loads

per shield wire = 1,200 lbs.
per phase = 10,450 lbs.

Transverse Loads

per shield wire = 1,500 lbs.
per phase = 9,250 lbs.
Total = 30,750

HUGHES
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2835.7B-15304, Shield Wire Support.

7/8" Bolt, Lock Nut, Extra Nut, Spring Washer (2702.8) Bonding Clip (2727.8)

AS2282-B Pole Washer AS2277 Clevis, 23082 Roller, 8" Bolt, Lock Nut

2" 7 Strand EHS Galvanized Steel Strand

AS2545-C 3/8" x 12" Jaw # Jaw Turnbuckle

2815.15, Dead End Tee MIFPX 26082 Grid Gain

BG 2115 Guy Grip

16'-0" ± c. to c.

BG 2116 Guy Grip 28082 Roller

16'-5" c. to c.

9/16" 7 Strand EHS Galvanized Strand.

C4523.2A Vee Brace (38" x 7 1/2")

C4523.1A, Arm With Adj. Spacers - HS-10A Or C4523.3A With Fixed Spacers - HS-10F

5 1/2" x 7 1/2" Laminated Double Arm

8" Thr'd. Rod, 2-MIFPX 2618 Grid Gain, 2-2702.8 Spring Washer, 1-2727.8 Bonding Clip, 3-Nuts (N80), 3-RWS-80 (3" Round Washers) 2-Locknuts (MF80)

See Dr'g. C4523-A1 Detail "A"

340B Adj. Spacer Fitting Or B2529-A Fixed Spacers.

NOTE: Bonding Wire On Cross Arms To Be Field Assembled. (by others)

SEE ARM MOUNTING DETAIL ON C4523-A1

340B Adj. Spacer Or B2529-B Fixed Spacers.

13'-6"

13'-6"

MIFPX 26082 Grid Gain

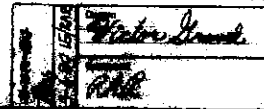
2815.15 Dead End Tee

1 x 3 Bolt, Locknut.

B2527-O X-Brace (38" x 6" Laminated)

3 Bolts, Curved Washers, Locknuts, 2702.8 Spring Washer, 2727.8 Bonding Clip

TYPE HS-10A or HS-10F TANGENT STRUCTURE
345 KV. CONSTRUCTION
KANAS CITY POWER & LIGHT CO.
KANAS CITY, MISSOURI



Date Printed

DRG. C4523-A