5.368

LS-1
CONT.

U.S. Department
of Transportation
**Federal Highway
Administration**

NOV 10 1988

400 Seventh St., S.W.
Washington, D.C. 20590

REFER TO:
HNG-14

F. H. Fouad, P.E., Ph.D.
Sherman International, Inc.
Pole Division
P.O. Box 1926
Birmingham, Alabama 35201

Dear Dr. Fouad:

In your October 3 letter to Mr. Thomas O. Willett you requested FHWA acceptance for use on Federal-aid projects of several fiberglass luminaire support poles manufactured by your company. This request was submitted subsequent to our June 15, 1988, acceptance of Sherman International Pole MB36-D-50-S6. Your current request is that the test results for that pole be extrapolated to indicate acceptable performance of the 62 poles listed in the attachment to your letter.

The primary factors in determining the acceptability of your poles are the pole diameter and the thickness of the fiberglass in the matrix at bumper height. The accepted pole had a diameter of 10.44 inches (extrapolated from the given 10.77-inch groundline diameter and the assumed 4.41-inch top diameter) and a cross section made up of three 0.05-inch layers of fiberglass mats (each mat has a nominal effective width of 37.5 inches, yielding a gross cross-sectional area of 5.63 square inches.) Sixteen poles have larger diameters with the same cross-sectional area of fiberglass, giving a maximum 2-percent increase in net area through the hand hole. These 16 poles can be expected to offer approximately the same resistance to impact as the tested pole. Of the 45 poles with lesser diameters, 23 have cross-sectional areas of 1.88 square inches or 3.75 square inches, and 38 have the same area as the tested pole. The poles of lesser cross-sectional area of fiberglass are significantly weaker than the tested pole and should breakaway in an acceptable manner. The remaining poles, those with reduced diameter and the same cross-sectional area of fiberglass, are worthy of further discussion.

The reduced pole diameter and constant amount of glass fiber in the cross section combine to significantly increase the stiffness of the remaining poles. In your letter you suggest that the 4-inch wide hand hole, which is located a minimum of 12 inches above the ground line, reduces the cross section by a greater percentage in smaller diameter poles than it does in the tested pole. We agree with this conclusion. The cross-sectional area of the tested pole is reduced approximately 12 percent at the location of the access panel. The cross-sectional area of a representative small diameter pole, number TB30-B-50, is reduced by approximately 15.5 percent. The result of this is that the smaller diameter poles have less effective cross-sectional area of fiberglass than the tested pole. We note in your catalog, however, that the 4-inch wide hand hole is "optional", the standard hole being 2 1/2 inches wide. Since the test pole featured a 4-inch hand hole, the 2 1/2-inch hand hole would not be acceptable in breakaway poles unless confirmed with further crash testing.

On the basis of the information you have provided and our analysis described above, we find the 62 poles identified in the enclosed list meet the requirements of both the 1975 and 1985 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires and Traffic Signals and will be acceptable for use on Federal-aid highway projects when requested by a highway agency, provided they contain a 4-inch hand hole centered approximately at the tested height of 18 inches. This acceptance is limited to the breakaway characteristics of the poles and does not cover their structural features. Presumably you will supply potential users with sufficient information on structural design and installation requirements to ensure proper pole performance.

We anticipate that the States will require certification from Sherman International that the poles furnished have essentially the same composition, mechanical properties, and geometry as the tested pole or the poles described on the enclosed list and that they will meet specified breakaway requirements.

Sincerely yours,

L. A. Staron

L. A.Staron
Chief, Federal-Aid and Design Division

Enclosure

LS-1

U.S. Department
of Transportation
Federal Highway Administration

400 Seventh St., S.W.
Washington, D.C. 20590

JUN 15 1988

REFER TO:
HNG-14

Fouad H. Fouad, Ph.D., P.E.
Sherman International Incorporation
P.O. Box 1926
Birmingham, Alabama 35201

Dear Mr. Fouad:

Your March 18 letter to Mr. Willett requesting acceptance for use on Federal-aid projects of a fiberglass pole manufactured by your company and the supplemental information you forwarded in April and in June has been reviewed. In support of this request, you submitted a copy of a report detailing the full-scale crash testing that was conducted. The report, FHWA/RD-87-065, Fiberglass Luminaire Supports, was prepared by Mobility Systems and Equipment Company under Contract No. DTFH61-86-Z-00073. You also submitted information on the mechanical properties of spun fiberglass reinforced plastic (FRP) laminate, a description of the spun pole manufacturing process, engineering design calculations for the tested pole, and a shop drawing of the tested pole (enclosed).

Two identical test poles were impacted by 1,800-pound Volkswagen Rabbits at 20 and 60 m.p.h. The tested poles are currently catalogued as MB 36-D-50-56, but were identified as XHD112-105-H at the time the testing was done. They each had a total length of 34 feet, 5 inches and were embedded 5 feet into the ground in an S-1 (strong) soil. Their diameters decreased from 10.6 inches at the ground line to 4.4 inches at the top. Their wall thicknesses varied from .38 inches at ground line to .13 inches at the top. The total weight of each tested installation, including a 6-foot mast arm with a 50-pound weight, was 193 pounds.

In the 20 m.p.h. test, the longitudinal occupant impact velocity was 14.4 feet per second, slightly below the 15 feet per second maximum suggested in NCHRP Report 230. The 60 m.p.h. test resulted in a vehicular change in velocity of 10.3 feet per second, very near the desirable change in velocity of 10 feet per second recommended in the 1985 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. It is noted, however, that, in the high speed test, the pole impacted the roof of the vehicle before it broke away, resulting in deformation of the passenger compartment. This gives us some concern, but we consider the degree of occupant compartment intrusion to be acceptable.

LS-1
CONT

Therefore, based on the information in the test report, we concur that your fiberglass pole MB 36-D-50-56 (previously XHD112 - 105-H) meets current FHWA breakaway requirements and those in the 1985 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals. Thus, it will be acceptable for use on Federal-aid projects if proposed by a State highway agency.

Sincerely yours,

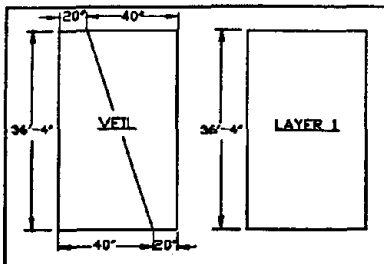
L. A. Staron

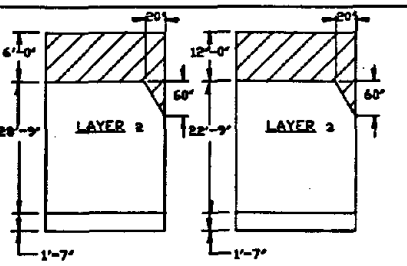
L. A. Staron
Chief, Federal-Aid and Design Division

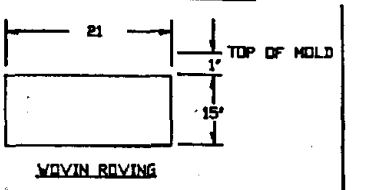
Enclosure

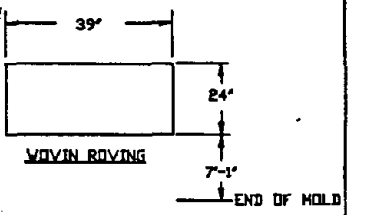
Federal Highway Administration
HNG-14:DPowers/NArtimovich:gt:6-14-88:61320
copies to:
Regional Federal Highway Administrators (w/enclosure)
HNG-1 HNG-10 HNG-14 Reader, 3206
Reader, 3212 Reader, 3128 File, 3128

LS-1
CONT

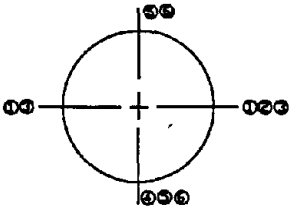








ORIENTATION VIEWED FROM TOP OF POLE



SHAFT INFORMATION

MOLD SIZE

TIP DIA. 4.41 IN. 112 MM.

MOLD LENGTH 36'-4" FT. 11 M.

RESIN

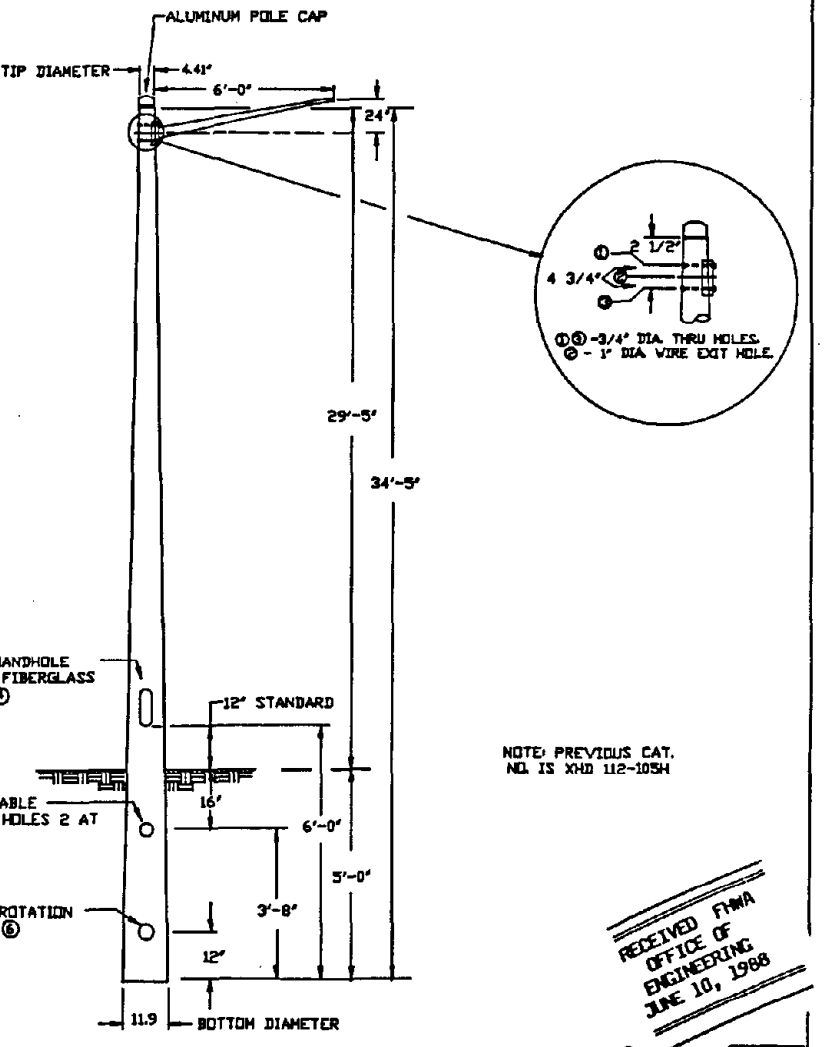
COLOR NO. ____

COLOR _____

VOLUME 91 GAL.

MATERIALS LIST PER POLE

2-1/2"x5" H/H (CAST AL.)	___EA.
4"x12" H/H (FG)	1 EA.
2-1/2"x5' H/H (FG)	___EA.
H/H FASTNER:	
STANDARD HEX. NUT.	1 EA.
3 POINT TAMPER NUT.	___EA.
SNAKE EYE TAMPER PROOF	___EA.
STAINLESS STEEL SCREW	___EA.
TENON SIZE	___"O.D.
PIPE LENGTH	___IN.
POLE CAP (CAST AL.)	1 EA.
POLE CAP (FG)	___EA.
TENON CAP	___EA.
ANTI-ROTATION HOLES	___EA.
ANTI-ROT. WITH PIPE	___EA.
ANCHOR BASE	
TYPE	
BOLT CIRCLE	
ANCHOR BOLTS	___EA.
DIAMETER	___IN.
LENGTH	___IN.
GALVANIZED ___YES ___NO	
ARMS	
4' CURLEE	___EA.
6' CURLEE	1 EA.
8' CURLEE	___EA.
10' CURLEE	___EA.
12' CURLEE	___EA.
15' CURLEE	___EA.
40' FIBERGLAS	___EA.
MOUNTING HARDWARE	___EA.
STAINLESS STEEL ___YES ___NO	
COUPLING SIZE ____"DIA.	___EA.
GROMMET SIZE ____"DIA.	___EA.
PLUG SIZE ____"DIA.	___EA.



NOTE: PREVIOUS CAT. NO. IS XHD 112-105H

FEDERAL HW ..UM.

CAT. NO. MB35-D-50-S6

QUANTITY:	JOB NUMBER:	SPECS	WIND VEL. 100 @ 1.3
PO. NUMBER:	APPD BY: [illegible] 6/9/88	TOT. LENGTH 34'-5"	LUM. WEIGHT 50 LBS
REV. / DATE / BY / REMARKS		EMBED. DEPTH 5'-0"	LUM. EPA 4 SQ FT
		TIP DIA. 4.41"	TOT. DEFL. 15.3 %
		WEIGHT 136.7 LBS.	BY RUNDLE 6-8-88

LIST OF POLES SUBMITTED FOR APPROVAL

SHERMAN POLE DIVISION

CATALOG NUMBER #	SHAFT LENGTH (FT)	G.L. O.D. (IN)	# OF GLASS LAYERS	AREA (IN^ 2)	
MB23-D-50-S6	23.00	8.51	2	3.75	
MB30-D-50-S6	29.58	9.72	3	5.63	
MB35-D-50-S6	34.42	10.77	3	5.63	(Pole tested by
MB36-D-50-S6	36.15	11.14	3	5.63	FHWA)
MB23-D-75-S6	23.00	8.51	3	5.63	
MB30-D-75-S6	29.58	9.72	3	5.63	
MB36-D-75-S6	36.15	11.14	3	5.63	
MB23-D-50-S6	23.00	8.51	2	3.75	
MB30-D-50-D6	29.58	9.72	3	5.63	
MB23-D-75-D6	23.00	8.51	3	5.63	
MB30-D-75-D6	29.58	9.72	3	5.63	
MB23-D-50-S8	23.00	8.51	2	3.75	
MB30-D-50-S8	29.58	9.72	3	5.63	
MD33-F-50-S8	32.88	11.14	3	5.63	
MB39-F-50-S8	39.44	12.56	3	5.63	
MB33-F-75-S8	32.88	11.14	3	5.63	
MB39-F-75-S8	39.44	12.56	3	5.63	
MB23-D-50-D8	23.00	8.51	3	5.63	
MB33-F-50-D8	32.88	11.14	3	5.63	
MB23-D-75-D8	23.00	8.51	3	5.63	
MB33-F-75-D8	32.88	11.14	3	5.63	
MB23-D-50-S10	23.00	8.51	3	5.63	
MB30-D-50-S10	29.58	9.72	3	5.63	
MB33-F-50-S10	32.88	11.14	3	5.63	
MB23-D-50-D10	23.00	8.51	3	5.63	
MB23-D-75-D10	23.00	8.51	3	5.63	

LIST OF POLES SUBMITTED FOR APPROVAL CONT'D.

SHERMAN POLE DIVISION

CATALOG NUMBER #	SHAFT LENGTH (FT)	G.L. O.D. (IN)	# OF GLASS LAYERS	AREA (IN^ 2)
SB16-C-50	16.48	6.61	2	3.75
SB20-C-50	19.75	7.10	2	3.75
SB26-C-50	26.31	8.30	2	3.75
SB30-C-50	29.58	9.01	2	3.75
SB36-C-50	36.15	10.43	3	5.63
SB39-C-50	39.44	11.14	3	5.63
SB46-C-50	45.98	12.34	3	5.63
SB16-D-50-D2	16.48	7.32	2	3.75
SB20-D-50-D2	19.75	7.81	2	3.75
SB26-D-50-D2	26.31	9.01	2	3.75
SB30-D-50-D2	29.58	9.72	3	5.63
SB36-D-50-D2	36.15	11.14	3	5.63
SB39-D-50-D2	39.44	11.85	3	5.63
TB13-B-50	13.19	5.20	1	1.88
TB16-B-50	16.48	5.91	1	1.88
TB20-B-50	19.75	6.40	2	3.75
TB26-B-50	26.31	7.60	2	3.75
TB30-B-50	29.58	8.31	3	5.63
TB36-B-50	36.15	10.43	3	5.63
TB20-D-100	19.71	7.81	2	3.75
TB26-D-100	26.31	9.01	2	3.75
TB30-D-100	29.58	9.72	3	5.63
TB36-D-100	36.15	11.14	3	5.63
TB26-D-200	26.31	9.01	2	3.75
TB30-D-200	29.58	9.72	3	5.63
TB29-F-300	29.58	9.72	3	5.63
MB23-D-50-S4	23.00	8.51	2	3.75
MB30-D-50-S4	29.58	9.72	2	3.75
MB36-D-50-S4	36.15	11.15	3	5.63
MB23-D-75-S4	23.00	8.51	2	3.75
MB30-D-75-S4	29.58	9.72	2	3.75
MB36-D-75-S4	36.15	11.14	3	5.63
MB23-D-50-D4	23.00	8.51	2	3.75
MB30-D-50-S4	29.58	9.72	3	5.63
MB23-D-75-D4	23.00	8.51	2	3.75
MB30-D-75-D4	29.58	9.72	3	5.63

TECHNICAL INFORMATION
SPUN FIBERGLASS REINFORCED PLASTIC POLES

I MATERIALS

The two main components used in the manufacturing of the spun FRP pole are the polyester resin and the fiberglass fabric reinforcement. In addition a non-structural surfacing veil (mat) is used to provide protection to the surface of the pole. The type, trade name, and some of the physical characteristics of the basic materials used are given herein:

(A) Polyester Resin

Type: Unsaturated polyester resin solution
Manufacturer: GLS Fiberglass
Trade Name: GLS 1002-MJC
Viscosity: #3 60 rpm; 400-500 cps
Unit Weight: 9.1 lbs/gallon; specific gravity = 1.10
Vapor Density: Heavier than air
Evaporation Rate: Slower than ether
Boiling Range: 290-295 °F
Percentage Volatile by Volume: 47.4%
Flashpoint: 90°F ; LEL = 1.1%
Gel Time: (mm:ss) = 16:00
Cure Time: (mm:ss) = 27:00
Peak Exotherm = 357 °F

(B) Glass Fabric

Type: "E" glass (electrical grade); undirectional roving
Manufacturer & Class: Syncoglas V672 or Syncoglas 42RK/M300
Weight: 29 oz./sq.yd.
Specific Gravity: = 2.54
Thickness: =.05 in./layer

(C) Surfacing Veil

Type: "C" glass (chemical grade)
Manufacturer & Class: Nicofibers Surmat 100
Weight: =2.2 oz./sq.yd.
Thickness: = .025 in./layer

II MECHANICAL PROPERTIES

Listed below are typical physical and mechanical properties of the composite FRP laminate used in pole construction. The properties are based on a laminate that is composed of 40% glass and 60% polyester resin.

Specific Gravity:	1.7
Tensile Strength (psi)	36,000
Compressive Strength (psi)	30,000
Flexural strength (psi)	35,000
Shear Strength (psi)	6,000
Elastic Modulus (psi)	2,700,000
Poisson's Ratio	0.16

III MANUFACTURING PROCESS

Our manufacturing process may be summarized as follows:

1) A predetermined number of glass fabric layers and a surfacing veil are placed in a hollow steel mold.

2) The mold is rotated slowly so the materials will unwind and conform smoothly to the wall of the mold.

3) The mold is then rotated at a high speed (1200-1500 rpm) during which the polyester resin and special catalyst are injected into the mold.

4) During spinning the resin is being cured using radiant heaters which keep the mold at an elevated temperature.

5) After the laminate achieves complete saturation the speed of the mold is reduced while the resin still continues to cure.

6) The finished pole shaft is removed from the mold after completion of curing.

7) The shaft is then trimmed and subjected to the special fabrication operations as required per shop drawings.

Notes on Pole Manufacturing

1) The resin/glass fiber ratio (by weight) for the main reinforcing glass fabric is approximately 0.60.

2) The resin/glass fiber ratio for the surfacing veil is approximately 0.90.

3) The resin gel time varies between 15 to 20 minutes.

4) The gel time is established and varied by controlling the dosage of MEKP (peroxide catalyst)

5) The curing period is approximately as long as the gel time.