

Texas Transportation Pooled Fund Project – Progress Report

Project Title: Investigation of the Fatigue Life of Steel Base Plate to Pole Connections for Traffic Structures	
Project Number: TPF-5(116) / 9-1526	Project Manager – Name & Contact Info: Tim Bradberry, Bridge Division, TxDOT tbradber@dot.state.tx.us
Term of Contract: 11/4/05 – 8/31/09	
Reporting Period: 9/1/08 to 11/30/08	

Analytical Studies

The analytical study to determine the hot spot stress at the weld toe is underway. We have generated detailed models of the connections using the general purpose finite element package Abaqus. We investigated mesh sensitivity and 3 different extrapolation schemes to evaluate the hot spot stress. We have selected to proceed with both Dong's method and the DNV method used in the offshore industry. We have evaluated the influence of base plate thickness and bolt arrangement on the 10 inch mast arm. Similar models have been developed for the high mast towers. We have evaluated the influence of base plate thickness, number of bolts, and the effect of modeling of the anchor bolt connection upon the hot spot stress in the high mast specimens.

Experimental Studies

The specimens from Pelco arrived last month. The mast arm tests are underway. A summary of the Pelco mast arm tests is contained in the table below. The external collar specimens are not performing as well as expected. The fabricator split the collar and then welded the two pieces together. The weld is at the top of the specimens producing a weld intersection between the longitudinal weld splicing the collar and the fillet weld connecting the collar to the shaft. We are in the process of cutting these specimens apart to look further at the welds. The 10 inch full penetration welds are producing good fatigue performance. The 12 inch full penetration welded specimens have lower fatigue strength as expected since the base plate stiffness (thickness) is the same as the 10 inch specimen. We are investigating the relationship between diameter and base plate thickness in the analytical study.

The high mast specimens from Pelco have arrived and testing will be underway shortly. We are modifying the loading box to accept the additional bolts in these specimens. The drilling should be completed this week and we hope to have the first tests underway before the Christmas break.

We have tried unsuccessfully to get a quote from Ameron and Union Metal for additional mast arm specimens. They have not responded to our emails. Pelco donated the specimens in a very timely manner. We are not asking for Ameron and Union Metal to donate specimens, we just need a quote from them to initiate the paper work. We will try again but if we do not get a response, we need to consider other options.

Specimen Name	Description	Stress Range (ksi)	N-Cycles to Failure	Fatigue Constant $A=N \text{ Sr}^3$	Stress Category
10-3R-WY-PG-A	10" Diameter, 7 Ga. 8-Sided Section with Full Penetration Weld, 3" Thick Rectagular Base Plate	24	1,272,665	1.76E+10	B
10-3R-WY-PG-B	10" Diameter, 7 Ga. 8-Sided Section with Full Penetration Weld, 3" Thick Rectagular Base Plate	24	1,210,499	1.67E+10	B
10-2R-EC-PG-A	10" Diameter, 7 Ga. 8-Sided Section with External Collar, 2" Thick Rectagular Base Plate	24	137,220	1.90E+09	E
10-2R-EC-PG-B	10" Diameter, 7 Ga. 8-Sided Section with External Collar, 2" Thick Rectagular Base Plate	24	244,763	3.38E+09	D
12-3R-WY-PG-A	12" Diameter, 7 Ga. 8-Sided Section with Full Penetration Weld, 3" Thick Rectagular Base Plate	24	292,468	4.04E+09	D
12-3R-WY-PG-B	12" Diameter, 7 Ga. 8-Sided Section with Full Penetration Weld, 3" Thick Rectagular Base Plate	24	328,833	4.55E+09	C
12-3R-EC-PG-A	12" Diameter, 7 Ga. 8-Sided Section with External Collar, 2" Thick Rectagular Base Plate	24	Currently Being Tested		
12-3R-EC-PG-B	12" Diameter, 7 Ga. 8-Sided Section with External Collar, 2" Thick Rectagular Base Plate	24	119,289	1.65E+09	E
Expenditures Life-to-date: \$ 465,755					