

## **RESULTS OF TAPE QUALIFICATION TESTING FOR TAPES USED TO REPAIR DAMAGED SHEATHING**

### **1 – INTRODUCTION**

The Post-Tensioning Institute has published guidelines regarding the repair of sheathing material used on unbonded single strand tendons. Damaged sheathing is to be repaired according to the guidelines published in Section 3.2.5 of PTI's *Specification for Unbonded Single Strand Tendons*<sup>1</sup>. A recommended procedure is detailed in Section 11.6 of PTI's *Field Procedures Manual for Unbonded Single Strand Tendons*<sup>2</sup>.

The *Specification for Unbonded Single Strand Tendons*<sup>1</sup> states that the sheathing repairs shall be watertight. The tape used should have elastic properties, should be self-adhesive and moisture proof, and should have a minimum width of 2 in. (50 mm). Additionally the tape, including adhesive, should be non-reactive with sheathing, coating, or prestressing steel.

### **2 – ACCEPTANCE CRITERIA**

Other than the criteria listed above, no additional commentary or acceptance standards are given with respect to the tape used to perform the repairs. Manufacturers of tape can typically determine the tape's potential to react with sheathing, P-T coating, or prestressing steel, but no standard procedure exists to determine the water tightness of tape used in this specific application.

The requirement for the sheathing to be watertight relates to the corrosion protection of the prestressing steel. Tendons exposed to aggressive environments are required to have watertight connections of the sheathing to the anchorage. Specific guidelines and testing criteria are given in Section 2.2.6.1 of the *Specification*<sup>1</sup>. These connections are required to demonstrate the ability to remain watertight when subjected to a hydrostatic pressure of 1.25 psi (0.0086 MPa) for a period of 24 hours. The tape testing was performed to this same standard.

### **3 – TESTING FACILITY**

The testing was performed from September 28-29, 1998, at the laboratory of AADFW, Inc. in Euless, Texas. AADFW is a metallurgical testing laboratory whose capabilities include failure analysis, mechanical, chemical, and routine testing, including salt spray and strain gauging.

Testing was overseen and certified by Raymond J. Schiltz, Jr., Ph.D., P.E. Dr. Schiltz has degrees in Mechanical Engineering and Engineering Mechanics, as well as a Ph.D. in Metallurgy.

The test assembly included a steel stand, which held a PVC test fixture. The test procedure consisted of standard production quality components.

Complete information on the facility, personnel, and test procedures are included in the report published by AADFW (available from PTI)<sup>3</sup>.

#### 4 – RESULTS

Nine tape samples were tested for each of three different repair methods (tape alone, overlapping split tubing with tape, and two sections of split sheathing with tape) for a total of 27 tests, performed concurrently with a control sample that was damaged but not repaired.

A section of prestressing steel was coated with white colored grease and encased in a 50-mil extruded plastic sheathing. Red dye was placed in the water to assist in indicating if water penetration occurred during the test. A presence of red dye in the white colored grease coating after completion of the tests would indicate water penetration.

The control sample showed obvious staining caused by the dye. Of the 27 tests performed, only one sample showed indications of penetration. The sample that showed penetration was a 4 in. wide tape that was difficult to wrap properly due to its width. All efforts were made to ensure that the tape was wrapped smooth and tight to cause an effective seal. Conclusions in the report by AADFW state that the penetration is not associated with the tape or with the repair method, but rather is most likely associated with the application of the tape.

#### 5 – CONCLUSIONS

This research was undertaken to determine the effectiveness of certain tapes in obtaining a watertight sheathing repair when applied according to PTI's published repair procedures. No testing or evaluations were performed to determine that the tapes or adhesives met the requirement to be non-reactive with sheathing, P-T coating, or prestressing steel. All tapes used should be evaluated for conformance to these criteria prior to use in the field.

PTI's published repair procedures require that the tendon be spirally wrapped with a minimum of two layers of tape extending a minimum of 3 in. (75 mm) past the damaged area in both directions. Taping alone can be used as long as no significant portion of the original extruded sheathing is missing. If excess sheathing is missing it must be replaced by using split tubing or two overlapping pieces of tendon sheathing. Tapes ranging from waterproof duct tape, to PVC pipe wrap tape, to nuclear grade duct tape all showed the ability to attain a watertight seal when properly applied according to the procedures detailed in PTI's *Field Procedures Manual for Unbonded Single Strand Tendons*<sup>2</sup>.

Difficulty in wrapping the tape around the tendon (as encountered with the 4" wide tape) may result in failure to effectively achieve a watertight seal.

<b>Tape Samples Passing All Three Tests</b>
<b>Wimmore Tape #413 (PVC Pipe Wrap Tape)</b>
<b>Polyken #900 (2" wide) general utility pipeline tape</b>
<b>3M Scotch brand No. 481 preservation sealing tape</b>
<b>Polyken #223 waterproof duct tape</b>
<b>3M Scotch brand #226 black polyethylene masking tape</b>
<b>Tape Specialties Limited #355 PVC tape</b>
<b>Polyken #226 nuclear grade duct tape</b>

*Note – This is not an endorsement by PTI of any of these products, nor is this implied to be a complete list of acceptable products.*

## 6 – REFERENCES

1. "Specification for Unbonded Single Strand Tendons", 2nd Edition, Post-Tensioning Institute, Phoenix, Arizona, December 2000
2. "Field Procedures Manual for Unbonded Single Strand Tendons", 3rd Edition, Post-Tensioning Institute, Phoenix, Arizona, October 2000
3. "Tape Repair Report Qualifying Tapes to be Used Following Procedures of the Field Procedures Manual for Unbonded Single Strand Tendons", AADFW, Inc., Euless, Texas, October 1998



**Research Update** December 2002

38800 Country Club Dr. • Farmington Hills, MI 48331  
PHONE 248-848-3180 • FAX 248-848-3181  
[www.post-tensioning.org](http://www.post-tensioning.org)

This document is intended for the use of professionals competent to evaluate the significance and limitations of its contents and who will accept responsibility for the application of the materials it contains. The Post-Tensioning Institute reports the on-going material as a matter of information and therefore disclaims any and all responsibility for application of the stated principals or for the accuracy of the sources other than material developed by the Institute. The Post-Tensioning Institute in publishing this Research Update makes no warranty regarding the recommendations contained herein, including warranties of quality, workmanship or safety, express or implied, further including, but not limited to, implied warranties or merchantability and fitness for a particular purpose. **THE POST-TENSIONING INSTITUTE SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING CONSEQUENTIAL DAMAGES BEYOND REFUND OF THE PURCHASE PRICE OF THIS ISSUE OF RESEARCH UPDATE.**

The incorporation by reference or quotation of material in the Research Update in any specifications, contract, documents, purchase orders, drawings, or per diems shall be done at the risk of those making such reference or quotation and shall not subject the Post-Tensioning Institute to any liability, direct or indirect, and those making such reference or quotation shall waive any claims against the Post-Tensioning Institute.