

***Crosstie & Fastener Test  
Implementation Plan***  
*December, 1999*

**FAST/HAL Program**

**Transportation Technology Center, Inc.**  
*A Subsidiary of the Association of American Railroads*  
**5550 D.O.T. Road**  
**P.O. Box 11130**  
**Pueblo, Colorado, USA 81001**

One of the lessons learned in tie testing at FAST is that short test zones are influenced by adjacent zones such that it is difficult to isolate and identify their performance. To eliminate the effects of short test zones, future installations consist of, at minimum, 100-tie test zone.

The test zones of this implementation plan use about 2127 ft. of Section 25, which is 2700 ft. in length and has a 1660-tie capacity. That leaves 573 ft. available for additional test zones. The tables in attachment 3 group the tie types/species to be tested.

Since crosstie testing at FAST continues to evolve from mostly wood-tie and wood-product ties and now includes ties made of alternative materials, the new test is renamed "Crosstie & Fastener Test".

## Test Objective

The objective of the Crosstie & Fastener Test is to quantify the performance, identify the failure modes, and estimate the service life of the basic solid-sawn wood ties, manufactured wood-product ties, steel ties, polymer ties, and other ties made of alternative materials.

## Methodology

The following table lists the parameters, method of measurement, and measurement frequency of the Crosstie & Fastener Test

| PARAMETER  | MEASUREMENT  | MEASUREMENT FREQUENCY (MGT) |
|--|--|-----------------------------|
| Track Geometry:<br>Track surface and alignment degradation | EM-80 Track Geometry Car   | 50                          |
| Gage degradation (widening)                                | Modified track gage that measures net gage degradation (total gage widening minus rail wear) | 50                          |
| Vehicle response   | Measure vertical and lateral loads using instrumented wheelset (IWS)                         | 50                          |
| Fastener stiffness degradation (gage-spreading)            | Lateral Track Loading Fixture (LTLF) ----->  | 50                          |
|  | AND<br>Gage Restraint Measurement System (GRMS) ----->                                       | When available              |

## **Deliverables**

Provide research report (s) per section 8.3 of the FRA contract, which will include the performance of the parameters listed in the Methodology section of this proposal, the maintenance requirements, as well as the conclusions drawn and the observations made during the test period.

## **Transportation Technology Center (TTCI) Contacts:**

Rafael Jimenez                      719-584-0691

David Davis                            719-584-0754

Joseph LoPresti                      719-584-0589

Current as of 06/20/99

| Section 7, 5 Degree, 4 Inch Superlevation, 814 Ties |             |             |               |                 |                 |                 |                |              |              |              |                 |
|---|-------------|-------------|---------------|-----------------|-----------------|-----------------|----------------|--------------|--------------|--------------|-----------------|
| Tie Type  | Oak         | Douglas Fir | Laminated /   | Oak             | Douglas Fir     | Parallem /      | Oak            | USPL Plastic | USPL Plastic | USPL Plastic | Oak             |
| Tie No. (198)                                       | 1-80 (80)   | 81-98 (18)  | 100-200 (101) | 201-278 (78)    | 280-300 (21)    | 301-340 (40)    | 341-368 (28)   | 400-474 (75) | 475-478 (4)  | 479-478 (2)  | 477-478 (2)     |
| Rail Fasteners                                      | Cut Splices | Cut Splices | Cut Splices   | Parallem e-clip | Parallem e-clip | Parallem e-clip | Doublet e-clip | Cut Splices  | Cut Splices  | Cut Splices  | Parallem e-clip |
| Hold Down   | Cut Splices | Cut Splices | Cut Splices   | Lock Splices    | Lock Splices    | Lock Splices    | Lock Splices   | Cut Splices  | Cut Splices  | Cut Splices  | Cut Splices     |
| Anchor End Plates                                   | Yes         | No          | All Boared    | No              | No              | No              | No             | No           | No           | No           | No              |
| Density (pcf)                                       | 38          | 28          | 35            | 28              | 28              | 30              | 28             | 36           | 37           | 37           | 40              |
| Dimensions  | 7x8x8.5'    | 7x8x8.5'    | 7x8x8.5'      | 7x8x8.5'        | 7x8x8.5'        | 7x8x8.5'        | 7x8x8.5'       | 7x8x8.5'     | 7x8x8.5'     | 7x8x8.5'     | 7x8x8.5'        |
| Date Installed                                      | 08/01/89    | 06/01/90    | 06/01/90      | 06/01/90        | 06/01/90        | 06/20/97        | 06/01/98       | 06/16/97     | 02/12/96     | 06/20/96     | 02/12/96        |
| Tie Tonnage (lbf)                                   | 939.81      | 939.81      | 761.74        | 939.81          | 939.81          | 229.05          | 939.81         | 241.31       | 105.10       | 77.04        | 165.10          |

| Section 25, 6 Degree, 5 Inch Superlevation, 1646 Ties |                 |                      |                      |                      |                      |                      |                      |                      |                      |                      |                      |
|---|-----------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Tie Type  | Oak / Dwell Lam | Southern Yellow Pine | Southern Yellow Pine | Southern Yellow Pine | Southern Yellow Pine | Southern Yellow Pine | Southern Yellow Pine | Southern Yellow Pine | Southern Yellow Pine | Southern Yellow Pine | Southern Yellow Pine |
| Tie No. (198)   | 17 to 87 (71)   | 88-187 (100)         | 188-282 (95)         | 283-357 (75)         | 358-457 (100)        | 458-507 (50)         | 508-564 (56)         | 565-634 (69)         | 635-634 (0)          | 635-634 (0)          | 635-634 (0)          |
| Rail Fasteners  | Cut Splices     | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          |
| Hold Down   | Cut Splices     | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          | Cut Splices          |
| Anchor End Plates                                     | All Boared      | All Boared           | All Boared           | All Boared           | All Boared           | All Boared           | All Boared           | All Boared           | All Boared           | All Boared           | All Boared           |
| Density (pcf)   | 44              | 41                   | 41                   | 41                   | 39                   | 40                   | 40                   | 47                   | 47                   | 47                   | 47                   |
| Dimensions  | 7x8x8.5'        | 7x8x8.5'             | 7x8x8.5'             | 7x8x8.5'             | 7x8x8.5'             | 7x8x8.5'             | 7x8x8.5'             | 7x8x8.5'             | 7x8x8.5'             | 7x8x8.5'             | 7x8x8.5'             |
| Date Installed  | 11/02/95        | 11/02/95             | 11/02/95             | 11/02/95             | 11/02/95             | 11/02/95             | 03/25/96             | 03/25/96             | 03/25/96             | 03/25/96             | 03/25/96             |
| Tie Tonnage (lbf)                                     | 490.35          | 490.35               | 490.35               | 490.35               | 490.35               | 490.35               | 490.35               | 490.35               | 490.35               | 490.35               | 490.35               |

| Section 31, 5 Degree, 4 Inch Superlevation, 178 Ties |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |                    |
|--|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Tie Type   | Azobe              | Azobe              | Azobe              | Azobe              | Azobe              | Azobe              | Azobe              | Azobe              | Azobe              | Azobe              | Azobe              |
| Tie No. (198)  | 1-48 (48)          | 49-100 (52)        | 101-127 (27)       | 128-178 (51)       | 179-178 (0)        | 179-178 (0)        | 179-178 (0)        | 179-178 (0)        | 179-178 (0)        | 179-178 (0)        | 179-178 (0)        |
| Rail Fasteners                                       | Cut Splices        | Cut Splices        | Cut Splices        | Parallem e-clip    | Parallem e-clip    | Parallem e-clip    | Parallem e-clip    | Parallem e-clip    | Parallem e-clip    | Parallem e-clip    | Parallem e-clip    |
| Hold Down  | Cut Splices        | Cut Splices        | Cut Splices        | Cut Splices        | Cut Splices        | Cut Splices        | Cut Splices        | Cut Splices        | Cut Splices        | Cut Splices        | Cut Splices        |
| Anchor End Plates                                    | Every Other Boared | Every Other Boared | Every Other Boared | Every Other Boared | Every Other Boared | Every Other Boared | Every Other Boared | Every Other Boared | Every Other Boared | Every Other Boared | Every Other Boared |
| Density (pcf)  | 56                 | 56                 | 56                 | 56                 | 56                 | 56                 | 56                 | 56                 | 56                 | 56                 | 56                 |
| Dimensions   | 7x8x8.5'           | 7x8x8.5'           | 7x8x8.5'           | 7x8x8.5'           | 7x8x8.5'           | 7x8x8.5'           | 7x8x8.5'           | 7x8x8.5'           | 7x8x8.5'           | 7x8x8.5'           | 7x8x8.5'           |
| Date Installed                                       | 01/18/99           | 01/18/99           | 01/18/99           | 01/18/99           | 01/18/99           | 01/18/99           | 01/18/99           | 01/18/99           | 01/18/99           | 01/18/99           | 01/18/99           |
| Tie Tonnage (lbf)                                    | 519.35             | 519.35             | 457.75             | 457.75             | 457.75             | 457.75             | 457.75             | 457.75             | 457.75             | 457.75             | 457.75             |

## ATTACHMENT 1 FAST/HAL Wood Tie & Fastener Test

## Background

The objective of this Crosstie & Fastener Test Implementation Plan is to simplify the experiment in order to provide the industry with the most relevant answers to questions of crosstie performance. By reducing the number of sections where test zones are currently established on the High Tonnage Loop (HTL) from four to one, it will be possible to eliminate redundancy in terms of test zone duplication. Under the new implementation plan, all crosstie testing will be conducted in the 6-degree, 5-inch superelevation curve of Section 25.

The 6-degree curve in Section 25 was chosen because:

- It already contains the majority of tie types whose performance is of interest to the railroads
- At 2700 ft., it is the longest of the four test sections currently used for crosstie testing on the HTL, allowing space for additional tie types to be added to the test as they become available.
- And because it exposes ties and fasteners to the most severe lateral load environment on the HTL.

As the FAST/HAL program enters Phase V of testing using a consist equipped with standard suspension trucks, we have the opportunity not only to continue to monitor traditional solid-sawn ties but also to study the performance of new non-traditional alternative material ties under a more severe load environment.

Attachment 1 shows the test sections and tie types currently in test. The four test sections consist of two 5-degree curves located in Sections 7 and 31, the 6-degree curve in Section 25, and a tangent test zone in Section 33.

Attachment 2 shows the new implementation test located in Section 25. The tie types in red indicate test zones currently in track that will continue to be in-test. The tie types in green are those that will be dropped from the test and can be replaced with new ties as they become available. Since the only plastic composite ties currently in test are located in Section 7, we will replace the Oak ties in Section 25, zone 11 (shown in attachment 1) with a 100-tie plastic composite test zone (shown in yellow in attachment 2).

The reconfiguration of the Crosstie & Fastener Test, for the implementation plan, involves minimum effort in terms of labor and materials since most of the ties to be tested, with the exception of the plastic composite ties, are already in place.



**ATTACHMENT 3**  
**FAST/HAL Cross-tie & Fastener Test**  
**Section 25 6-Degree 5-Inch Superelevation Curve**

| SOLID-SAWN WOOD TIES |             |                |           |                  |
|----------------------|-------------|----------------|-----------|------------------|
| SPECIE               | LOCATION    | NUMBER OF TIES | FASTENER  | ZONE LENGTH (ft) |
| Oak                  | S25 zone 9  | 100            | Cut spike | 163              |
|                      | S25 zone 12 | 100            | e-clip    | 163              |
|                      | S25 zone 6  | 100            | Cut spike | 163              |
|                      | S25 zone 13 | 100            | e-clip    | 163              |
| Southern Yellow Pine | S25 zone 2  | 100            | Cut spike | 163              |
|                      | S25 zone 17 | 99             | Safelok   | 161              |
| Yellow Poplar        | S25 zone 16 | 103            | e-clip    | 168              |
| Intermixed Oak/SYP*  | S25 zone 5  | 100            | Cut spike | 163              |
| <b>Total</b>         |             |                |           | <b>1307</b>      |

\* Continue monitoring. First choice for replacement with new test ties after all other available space has been used.

| MANUFACTURED WOOD-PRODUCT TIES          |             |                           |           |                  |
|---|-------------|---------------------------|-----------|------------------|
| TIE TYPE                                | LOCATION    | NUMBER OF TIES            | FASTENER  | ZONE LENGTH (ft) |
| Glue-Lams (SYP)                         | S25 zone 7  | 50 vertical laminations   | Cut spike | 161              |
|   | S25 zone 8  | 49 horizontal laminations |           |                  |
| Parallel Strand Lumber (PSL) (Parallam) | S25 zone 14 | 59                        | e-clip    | 96               |
| <b>Total</b>                            |             |                           |           | <b>257</b>       |

| STEEL TIES   |           |                |          |                  |
|--------------|-----------|----------------|----------|------------------|
| MANUFACTURER | LOCATION  | NUMBER OF TIES | FASTENER | ZONE LENGTH (ft) |
| T&TS         | Sec 25    | 100            | Safelok  | 200              |
|              | Sec 25-26 | 100            | e-clip   | 200              |
| <b>Total</b> |           |                |          | <b>400</b>       |

| PLASTIC COMPOSITE TIES |                        |                |                  |                  |
|------------------------|------------------------|----------------|------------------|------------------|
| MANUFACTURER           | LOCATION               | NUMBER OF TIES | FASTENER         | ZONE LENGTH (ft) |
|                        | Install Sec 25 zone 11 | 100            | To be determined | 163              |

This proposed layout will use 2127 ft. of Section 25 (2700 ft. 1.660-tie capacity) leaving 573 ft. available for additional test zones.