Wood RR Ties: UNDERSTANDING SPECIES & DEFECT SPECIFICATIONS

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Overview of RR Tie Production
Ties Are Received, Graded & Sorted

Usually ties are graded twice: Green and Seasoned
Ties Are Often Incised
To Control Drying Checks

Two sets of rollers (horizontal and vertical) incise all four sides
Incised Oak Ties
(Pre- and Post-seasoning)
Air-Drying Ties: 
German Stacking
Air-Drying Ties: Stick Stacking
Creosote Impregnation
Creosote Impregnation
Creosote Impregnation
 Specifications Maximize Tie Life

~35 years average tie life in SE U.S., a high-decay region.
Why Species Matters

Species differ by:

- Hardness, strength
- Natural durability (rot resistance)
- Amount of creosote absorbed, heartwood treatability
Generally Acceptable Species

(* RR’s specifications differ *)

- Ash
- Beech
- Birch
- Elm
- Gums
- Hackberries
- Hemlock
- Hickories
- Locusts
- Maples
- Mulberry
- Oaks
- Sassafras
- Sycamore
- Southern pines
- Cherry, walnut, yellow-poplar**
Multiple Elements in Track

**Ties**, preservative, rail, tie plate assemblies, fasteners, clips, ballast, …
Some ties outlast others in track – WHY?
Some species resist plate cutting better than others.
Some species hold spikes better than others.
Some ties are more rot-resistant than others.
Some ties are more rot-resistant than others.
Preservative penetration affects decay resistance.

Creosote use has been widespread only since ~ 1921. (First used in L&N RR, 1876 bridge timbers)
Heartwood - Sapwood

Both color and permeability differences
If preservative only gets into the sapwood, there’s a problem.

Heartwood isn’t always rot-resistant – depends on the species
Heartwood and sapwood both treat well. The large earlywood pores contain most of the creosote in each ring, giving these cores a striped appearance.

3 ½” long borings from center of tie side
White Oak

Only the sapwood will treat, so only ¾”-1” penetration is possible. 7 to 40 year life depending on location.
Hickory sapwood is often wide & treats very well. Some species have treatable heartwood, but others do not.
Dual Treatment Option
Dip or Pressure-Treat with Borate Solution

Water-soluble borate followed by creosote overcoat
TIE SPECIFICATIONS

http://www.rta.org/specifications

SPECIFICATIONS FOR TIMBER CROSSTIES AND SWITCH TIES
Grade Ties, Industrial Grade (IG) Ties or Cull

1) Size & species acceptable (Grader sorts by both)

2) Amount/number of defects

3) No decay!

*(See RTA “Cheat Sheet”)*
## Comparison of Specifications for Grade and Industrial Grade (IG) Crossties

<table>
<thead>
<tr>
<th>Grade Crossties</th>
<th>Industrial Grade Crossties</th>
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<tbody>
<tr>
<td><strong>Wane:</strong> 6&quot; x 8&quot; ties: Maximum 1&quot; wane in top RBA 7&quot; x 8&quot; ties: Minimum 8&quot; face in RBA (no wane) 7&quot; x 9&quot; ties: Maximum 1&quot; wane in top RBA Maximum of 1&quot; wane anywhere on bottom</td>
<td>Wane: 6&quot; x 8&quot; ties: Minimum 6&quot; face in RBA 7&quot; x 8&quot; &amp; 7&quot; x 9&quot; ties: Minimum 6&quot; face in RBA Outside RBA, up to 5&quot; of wane is allowed on top &amp; bottom</td>
</tr>
<tr>
<td><strong>Dimensions:</strong> Ties shall be 8&quot;, 8½&quot; or 9&quot; as specified by customer. Thickness, width and length are minimum dimensions for green ties; dry or treated ties can be up to ¾&quot; thinner or narrower than specified. Ties exceeding these dimensions by more than 1&quot; shall be rejected.</td>
<td>Dimensions: Dry or treated ties may be 1&quot; narrower or ¾&quot; thinner than specified sizes. Thickness &amp; width may not vary more than 1&quot; from end to end. Tie body may be out of square by no more than 1&quot; throughout length. Tie length may vary from +1/2&quot; to -3/4&quot; for length specified.</td>
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<tr>
<td><strong>Decay:</strong> No decay accepted. Blue stain is ok.</td>
<td>Decay: Ties with decay greater than 1.5&quot; in diameter in RBA will be rejected. Slight incipient decay allowed if tie as a whole is of good quality. Decay allowed outside RBA if it does not exceed 3&quot; diameter. Ties with decay over 2&quot; diameter on both ends will be rejected.</td>
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<tr>
<td><strong>Holes:</strong> No large holes, defined as a hole more than ¾&quot; diameter x 3&quot; deep in RBA, or more than ¼&quot; width of the surface on which it appears x 3&quot; deep outside RBA; numerous holes = holes with equivalent dimensions.</td>
<td>Holes: Allowed up to 1-1/2&quot; wide on any surface or 3&quot; deep in RBA on any surface. Allowed up to 3&quot; diameter or 4&quot; deep on any surface outside RBA; numerous holes = holes with equivalent dimensions.</td>
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<tr>
<td><strong>Knots:</strong> Allowed up to 1/8&quot; in width on which it appears in RBA, no limit outside the RBA.</td>
<td><strong>Knots:</strong> Up to 3&quot; in RBA, no limit outside of RBA</td>
</tr>
<tr>
<td><strong>Shake:</strong> Not more than 1/3 tie width or narrower than 1&quot; to any surface permitted.</td>
<td><strong>Shake:</strong> Permitted up to 3/8&quot; wide. Shake may appear on one face or both ends as long as it is not closer than 1&quot; to any other face. It cannot run the entire length of the tie.</td>
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<tr>
<td><strong>Splits:</strong> In green ties, up to 1/8&quot; wide and/or 4&quot; long is acceptable; in seasoned ties, splits no wider than 3/8&quot; and/or no longer than the width of the face on which it is seen (ex, 9&quot; on a 9&quot; face) in seasoned ties, splits exceeding these limits are acceptable if end-plated.</td>
<td><strong>Splits:</strong> In seasoned ties, up to 1/2&quot; wide or 11&quot; long is acceptable; in seasoned ties, splits exceeding these limits are acceptable if end-plated.</td>
</tr>
<tr>
<td><strong>Checks:</strong> Continuous checks ok up to ¼ the thickness and ½ the length in fully seasoned or treated ties.</td>
<td><strong>Checks:</strong> Checks greater than 2&quot; deep or ¼&quot; wide shall be rejected as IGs.</td>
</tr>
<tr>
<td><strong>Slope of Grain:</strong> Ok up to 1&quot; in 15&quot; – not restricted for interlocked grain species.</td>
<td><strong>Cress or Spiral Grain:</strong> Ok up to 2&quot; in 15&quot; – not restricted for interlocked grain species.</td>
</tr>
<tr>
<td><strong>Bark Seams:</strong> Ok if bark is no deeper than 2&quot; from surface and/or &lt;10&quot; long.</td>
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</tr>
<tr>
<td><strong>Manufacturing Defects:</strong> No bow in excess of 15° No score marks exceeding ¾&quot; Parallel top and bottom, within ½&quot; Tie ends must be flat, end sloped no more than ¾&quot;</td>
<td><strong>Manufacturing Defects:</strong> No bow in excess of 2° No score marks exceeding 1&quot; Parallel top and bottom, within 11&quot; Tie ends must be flat, end sloped no more than ¾&quot;</td>
</tr>
</tbody>
</table>

TEC October 2016
Tie Dimensions

Atlantic, Mississippi and Ohio RR, from Norfolk and Western Historical Photograph Collection
Dimensions

• **Length**
  - Mostly 8’6”
    • Maybe some 8’ or 9’ ties
    • Switch ties may go 12’ to ~16’ (+)

• **Cross-section**
  - Mostly 7” x 9” ties
    • Some 6”x8”, 7”x8” ties
Rail-Bearing Area (RBA)

8’ 6” Crosstie

10’–12’(+ ) length that could be spiked

Switch or Bridge
Ties Must Be Properly Sized

Exclusive of wane, all dimensions are the minimum for green Grade ties.
Defects to Avoid
Color as well as texture reveals decay. Look for decay around broken limbs, large knots.

Grade ties cannot have any decay.
“Stack Burn” = Incipient Decay

Slight incipient decay is allowed in IG ties if the tie looks good otherwise.
Rot

(Seen Here In Drying Stacks)
Wane decreases the bearing surface under the tie plate.

Wane often shows up when the log is too small and a sawyer tries to make two ties.

1” of wane is allowed in the top RBA (Grade ties). There isn’t a rule for wane outside the top RBA, but 2” is generally allowed.

Up to 1” wane allowed on bottom.
Bark prevents creosote penetration.
Bark seams cannot be deeper than 2” or longer than 10” (both Grade and IG ties).
Bark Seam
Cull
Bark Seam - Cull
Twin Hearts = Usually OK

Don’t use the end surface when measuring a bark seam.
When the grain isn’t straight, the spikes can cause edge-to-edge splitting. That’s effectively a broken tie - it can’t hold gage.
Grade ties: Up to 1 in 15 slope of grain acceptable
IG ties: Up to 2 in 15 slope of grain acceptable
A little crossgrain, a little rot – look what happens!
Sound Knots (Grade Ties)

Max 1/3 of surface width in RBA (on average)

The arrows are 3” long, and the face is 9” wide here. No limits on knot size outside the RBA for Grade ties.
Sound Knots (IG Ties)

Knots are allowed up to 3” across in the RBA (compared to 1/3 the face dimension in Grade ties).
No limits on knot size outside the RBA for IG ties.
Rotten Knot in RBA

Cull for rot, cull for knot size.
Wind, snow & ice loads bend tree trunks and cause growth rings to separate. These breaks don’t heal. Spikes driven into these separations create splits.
Shake (Grade ties)

3” Maximum Width

Not closer than 1” to any surface

9” Face

Shake width is always measured perpendicularly down from the wide face.

Grade tie specs illustrated.
Shake

Too wide for a 7” x 9” Grade tie, but up to 5” wide is allowed for an IG tie.
Shake Must Not Run the Entire Tie Length

Shake can affect both RBAs, a very serious defect.
Shake with any degree of decay is the worst combination.
Shake Frequency & Species

- Some species are more prone to shake than others.
- **Sycamore** is especially notorious for being prone to shake. Some railroads won’t accept it at all for this reason.
- Elm and maple are prone to shake also.
A fire scar must conform to the same rules as a bark seam.

Cannot be deeper than 2” or longer than 10”
Fire scars always exhibit a little point where the initial scar healed and enclosed the healing bark.
Fire Scars Often Contain Decay
Fire Scar
Fire Scar/Shake
Holes

Grade ties:
Within the RBA, holes can’t be larger than ½” diameter AND 3” deep.

Outside RBA, no knots > ¼ any surface width AND 3” deep.

Numerous holes = Large hole
Cull For Holes in RBA
(Ant damage shown)

IG ties: Allowed up to 1-1/2” wide holes on any surface or 3” deep in RBA on any surface. Allowed up to 3” diameter or 4” deep on any surface outside RBA.
Cull For Holes

A tape extended 6 feet into this hole!

White oak
Cull For Holes
Without dual treatment, knots or holes can lead to premature failure in species where creosote won’t penetrate the heartwood (white oak, maple, sweet gum).
Splits: From one surface to another

Unseasoned Grade ties: the maximum split allowed is 1/8” wide and/or 4” long

Seasoned Grade ties: ¼” by face width splits allowed. Often plated & accepted if larger.

Up to 1/2” wide x 11” long allowed for seasoned IG ties

Don’t count the end as a surface when measuring length!
Don’t Try to Make This Into a Tie!
End plates cannot fix large splits.
How Ties Are Cut Affects Life and Grade (and what you get paid!)

**BOXED-HEART TIE**

*Heartwood Centered*

*Well Treated Sapwood Protects Heartwood*

**SPLIT-HEART TIE**

*Heart Face Turned Up - Checks Catch Rain*

*Heart Face Has Least Creosote*

**SPLIT-HEART TIE**

*Heart Face Turned Down - Fewer Checks To Catch Rain*

*Sap Face Has Most Creosote*
A split or quartered heart turned up is the worst condition in track.

Heart checks allows moisture to enter freely.
Tie Grading Guide
By Western Wood Preservers Institute

Open iTunes to buy and download apps.

Description
The RTA Tie Grading Guide offers detailed information and training on specifications, grades and limiting defects for preservative treated wood rail ties.

Western Wood Preservers Institute Web Site › Tie Grading Guide Support ›

Screenshots

- Tie Grading Guide
- Defect Specifications
- Tie Grading Videos
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Customer Ratings
We have not received enough ratings to display an average for the current version of this application.

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