Figures

Figure 1. New ties stored under a water sprinkler after nondestructive evaluation in the ballast rock bed and before destructive flexural testing.

Figure 2. Demonstration of static bending test in Instron 600 kN capacity universal testing machine.

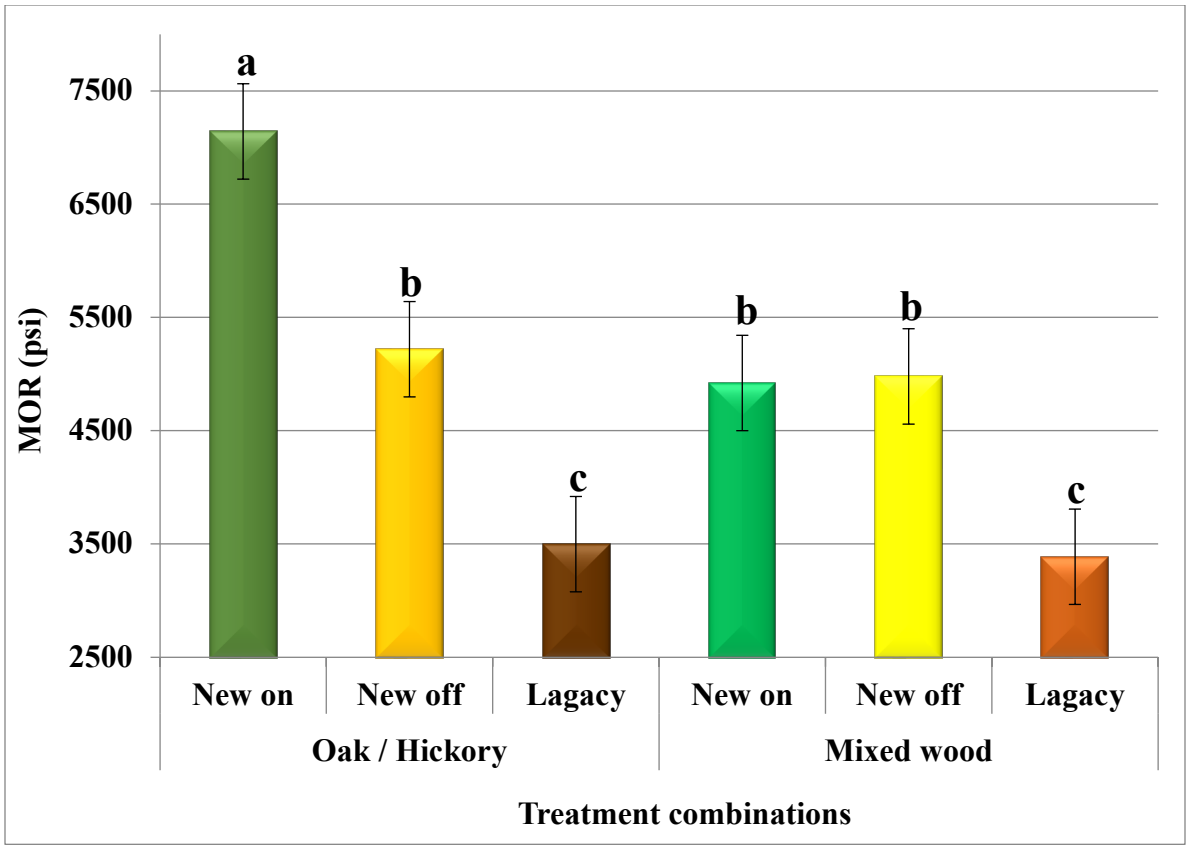


Figure 3. Interaction effects of species and boundary effects on modulus of rupture (MOR) of railroad ties.

[a-c] Treatment means within the same column within effect without common superscripts are significantly different (*P-values* ≤ 0.05). The number of replications per treatment combination is 154; SEM= 65274

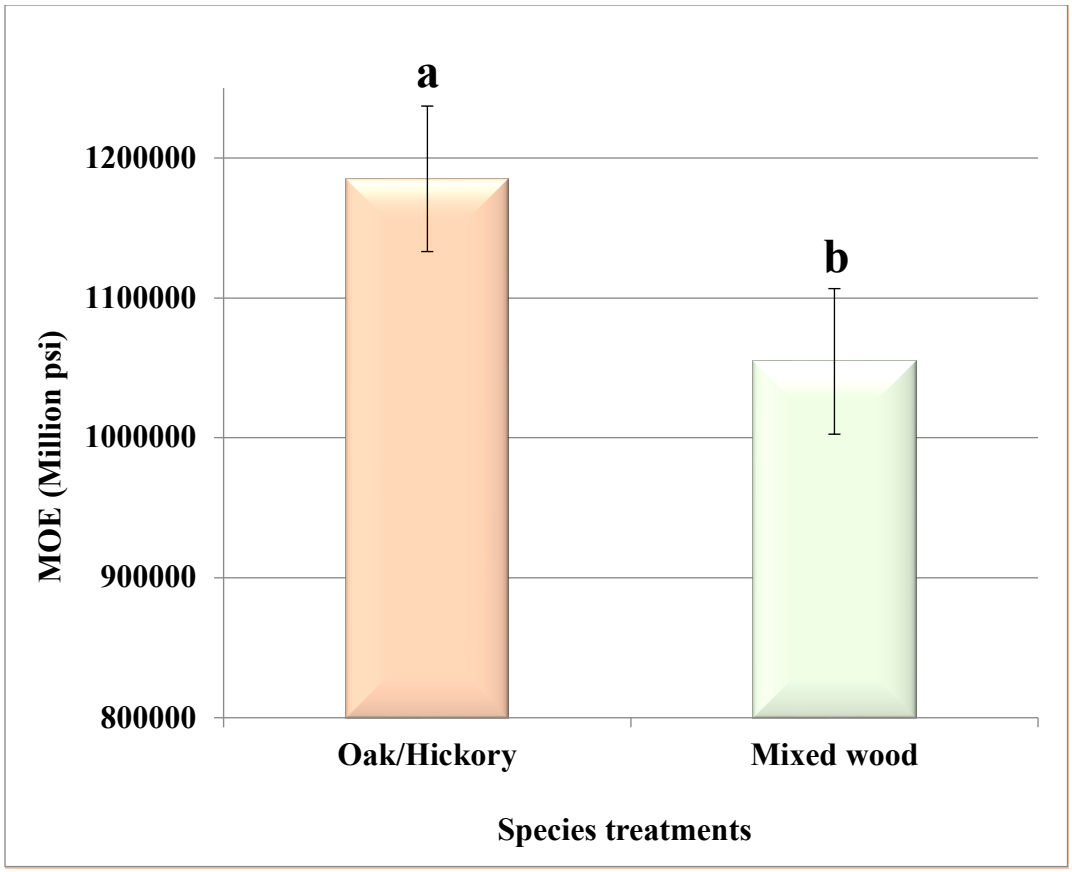


Figure 4. Main effect of oak/hickory species and mixed hardwoods species on modulus of elasticity (MOE) of railroad ties. (The number of replications per treatment combination is 148; SEM= 52005).

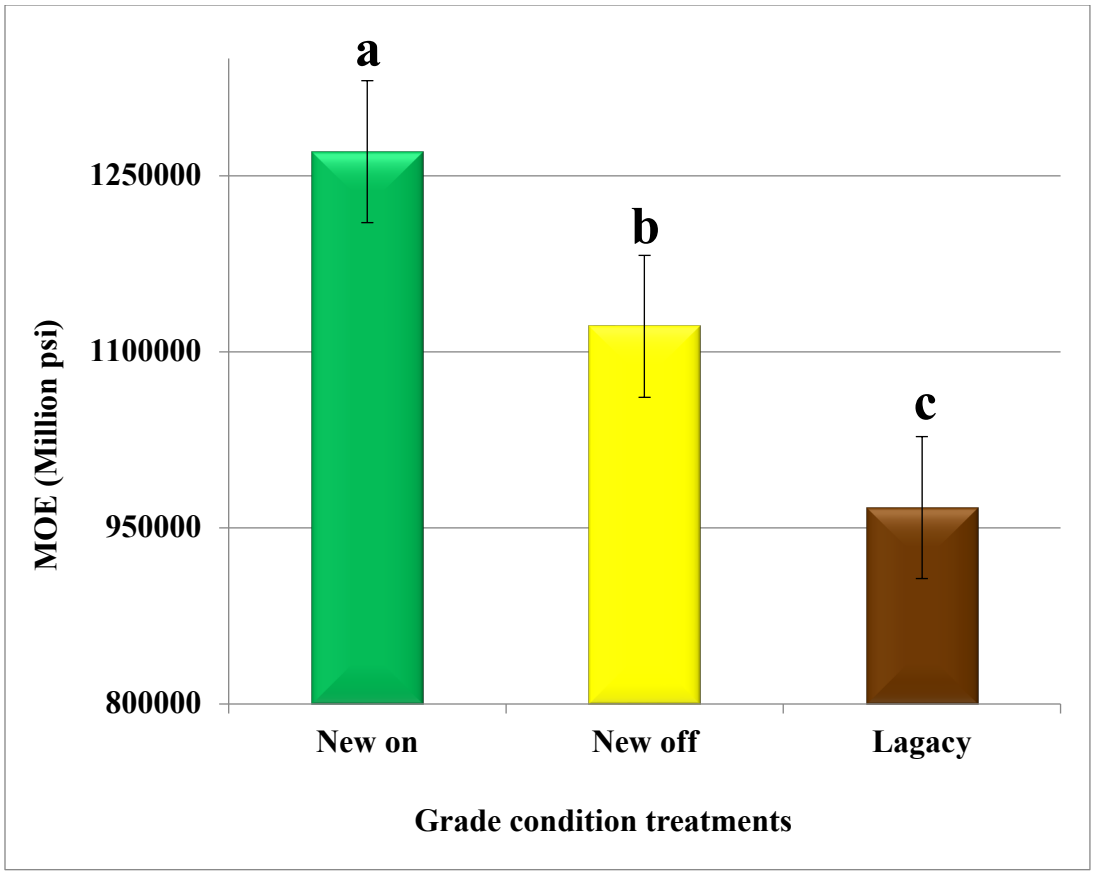
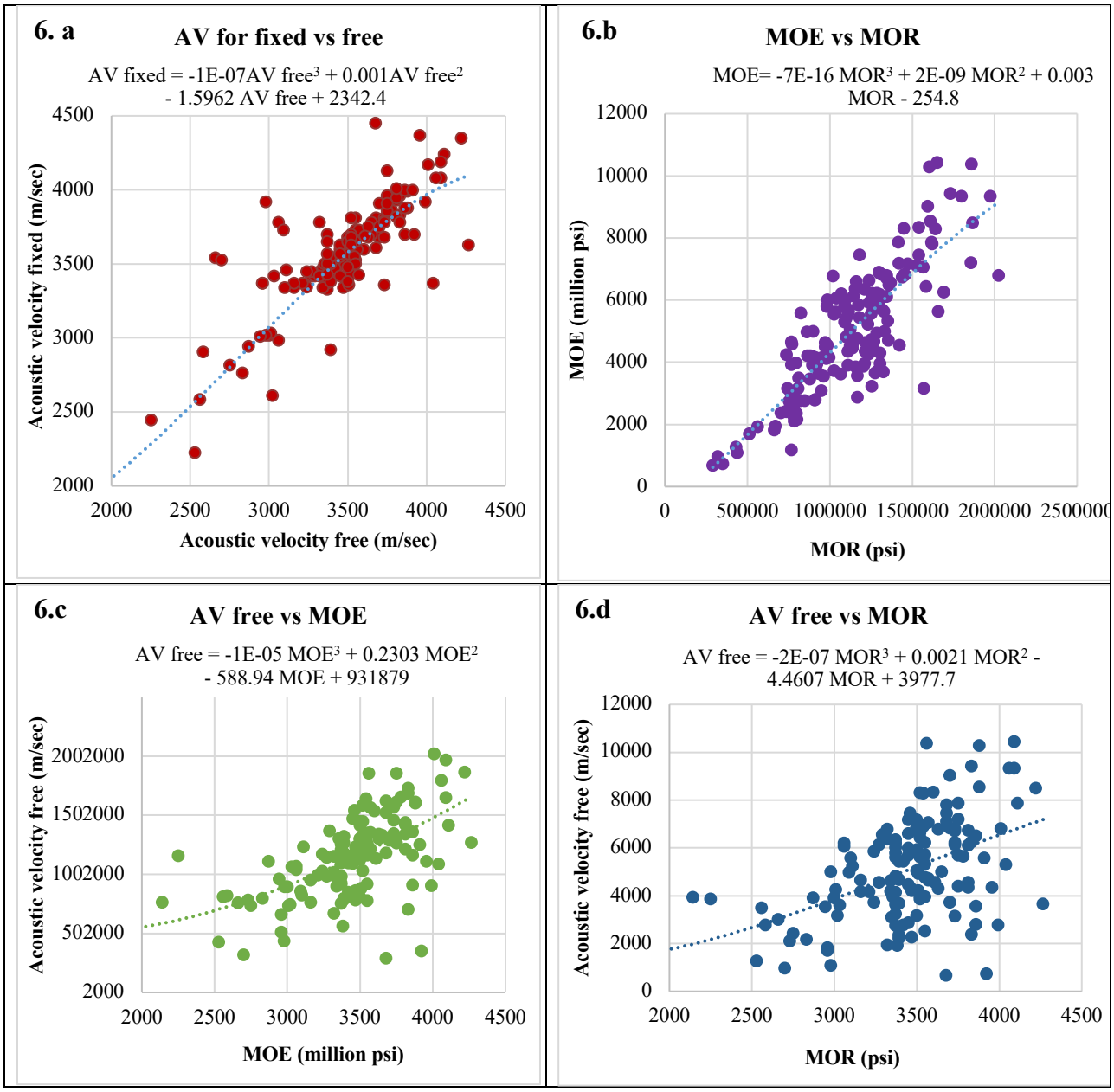


Figure 5. Main effect of new freshly sawn green ties (New on) that were either on grade versus off grade (New off) or legacy that was taken out of service on modulus of elasticity (MOE) of railroad ties.
[a-c] Treatment means within the same column within effect without common superscripts are significantly different (*P-values* ≤ 0.05). The number of replications per treatment combination is 148; SEM= 60474


6. a
AV for fixed vs free
AV fixed = -1E-07AV free³ + 0.001AV free² - 1.5962 AV free + 2342.4
Acoustic velocity fixed (m/sec)
Acoustic velocity free (m/sec)
6.b
MOE vs MOR
MOE= -7E-16 MOR³ + 2E-09 MOR² + 0.003 MOR - 254.8
MOE (million psi)
MOR (psi)
6.c
AV free vs MOE
AV free = -1E-05 MOE³ + 0.2303 MOE² - 588.94 MOE + 931879
Acoustic velocity free (m/sec)
MOE (million psi)
6.d
AV free vs MOR
AV free = -2E-07 MOR³ + 0.0021 MOR² - 4.4607 MOR + 3977.7
Acoustic velocity free (m/sec)
MOR (psi)

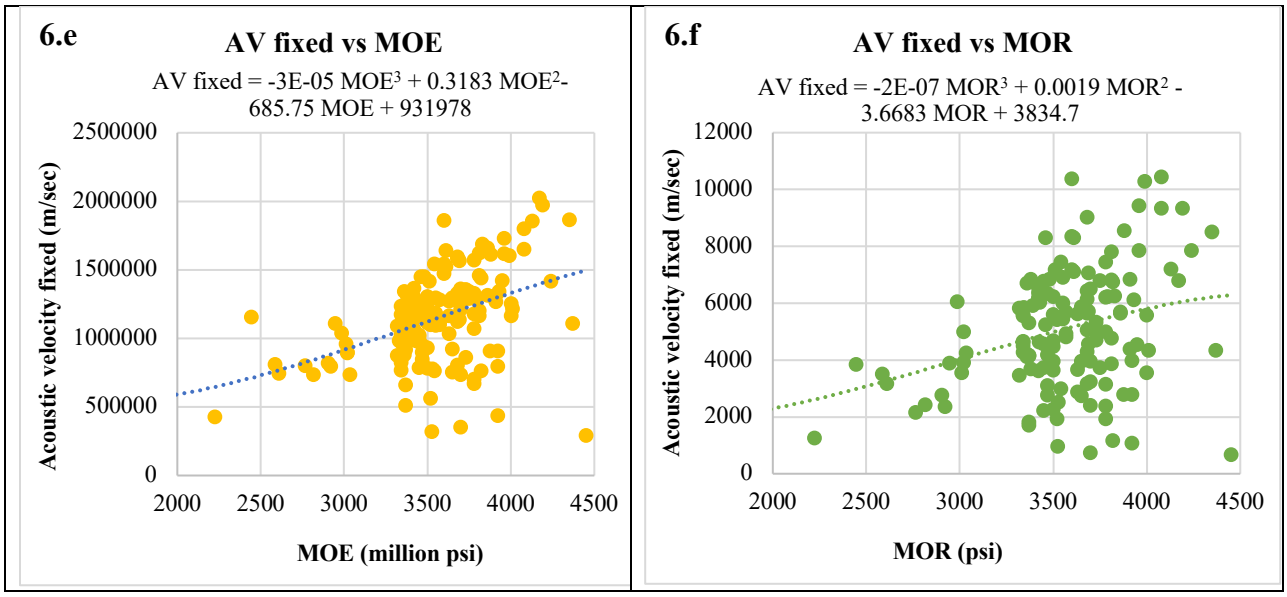


Figure 6 (a-f). Regressed relationship of acoustic velocity between acoustic velocity free (AV free) vs fixed (AV fixed) boundary conditions with modulus of elasticity (MOE) vs modulus of rupture (MOR) for all ties.
a. Polynomial regression between AV free and AV fixed; b. Polynomial regression between MOE and MOR; c. Polynomial regression between AV free and MOE; d. Polynomial regression between AV free and MOR; e. Polynomial regression between AV fixed and MOE; f. Polynomial regression between AV fixed and MOR.