

Ponderosa Pine Round Guardrail Post Testing and Evaluation Program—Phase II

Over the past several decades, the southwestern United States experienced numerous forest fires, prompting a need for more preventive techniques. In 2000, President Bill Clinton initiated the creation of the National Fire Plan, which centered around four main goals:

1. Improve prevention and suppression
2. Reduce hazardous fuels
3. Restore fire-adapted ecosystems
4. Promote community assistance

Historically, fuel management has been a commonly used technique for fire protection. In the 1960s, the U.S. Department of Agriculture (USDA) Forest Service began managing fuels using controlled-burn techniques, which are generally effective. To remove small-diameter forest thinnings (SDTs) from an area, fires were started with containment. The thinnings, which could help fuel a future fire, consisted mostly of pine and fir species. However, because of the lack of economic benefits and the high risk involved with controlled-burn methods, more cost-efficient methods were sought to remove SDTs. The Forest Products Laboratory (FPL) has conducted several guardrail post studies exploring the potential value-added use of small-diameter round wood from fuel reduction thinnings. In Phase II of this study, investigation of the potential use of round ponderosa pine posts within existing standard guardrail systems continues.

Background

Small-diameter trees can be used for a variety of products, including lumber, structural round wood, wood composites, wood fiber products, compost, mulch, energy, and fuels. Selling the potential fuel as



Rigid nose steel-framed surrogate bogie vehicle for round post component tests.

various products helps offset the cost of SDT removal. Developing more uses for small-diameter trees would increase their product potential. In response to this need, researchers and engineers at the Midwest Roadside Safety Facility (MwRSF), University of Nebraska–Lincoln (UNL), in cooperation with FPL, completed a study to determine appropriate sizes of southern yellow pine (SYP), Douglas-fir, and ponderosa pine (PP) round posts for use in the 31-in.- (787-mm-) tall Midwest Guardrail System (MGS).

In a related development, several recent fires harmed large forests of PP timber in Arizona. With vast forests of affected timber, local producers within the timber industry began exploring the use of PP as posts in corrugated-beam guardrail systems. Unfortunately, no research had been performed to determine the appropriate sizes, required grading and strength, and embedment depths of PP posts for use in Arizona and U.S. W-beam guardrail installations (28 in. (711 mm) and 27¾ in. (706 mm) tall, with 35-in. and 43¼-in. embedment depths, respectively). Therefore, research was needed



Example of dynamically tested ponderosa pine post.

to determine appropriate PP post dimensions for use as surrogate posts in common Arizona and U.S. guardrail systems.

Longitudinal barriers, or guardrail systems, fulfill several functions along highways and roadways; among other functions, they (1) safely contain and redirect errant vehicles and prevent impacts with hazardous fixed objects or geometric features and (2) dissipate an errant vehicle's kinetic energy without imparting excessive risk to the occupants. The safety performance of strong-post, W-beam guardrail systems depends greatly on the post-soil behavior of vertical posts. For wood posts, the post-soil behavior is controlled by post size and strength, embedment depth, load height, and soil compaction. Wood posts should possess sufficient structural capacity, provide adequate lateral resistance, and exhibit reasonable energy dissipation characteristics during rotation in soil.

The Midwest Roadside Safety Facility (MwRSF) of the University of Nebraska-Lincoln (UNL) is continuing its study of round guardrail posts by conducting dynamic bogie tests on rectangular SYP and round PP guardrail posts for the Arizona Department of Transportation (AzDOT), members of the Arizona Timber Industry, and the FPL.

Objective

The objective of this project is to continue expanding opportunities for using round PP as a substitute for rectangular posts in guardrail systems beyond the already approved MGS.

Approach

For this study, MwRSF will conduct low-speed, dynamic component tests on nine round PP posts and three rectangular SYP post in a compacted, crushed limestone soil material. Each dynamic component test will be performed at a speed of 15–20 miles/h using a rigid nose, steel-framed, surrogate bogie vehicle. Rectangular SYP posts are frequently used in Arizona and represent controls for comparison.

Expected Outcomes

This research program should provide test results to allow round ponderosa pine posts to be substituted into existing U.S. highway guardrail systems. A summary report will be completed to document the performance testing of round ponderosa pine posts for use in AzDOT and U.S. highway guardrail systems and to provide standard plans.

Timeline

The project was initiated July 2013. Testing is scheduled for completion by October 2014. The final report and recommendations will be completed by December 2014.

Cooperators

University of Nebraska-Lincoln, Midwest Roadside Safety Facility
USDA Forest Service, Forest Products Laboratory

Contact Information

Ronald K. Faller
Midwest Roadside Safety Facility
University of Nebraska-Lincoln
Lincoln, Nebraska
(402) 472-6864; rfaller1@unl.edu

David E. Kretschmann
USDA Forest Service, Forest Products Laboratory
Madison, Wisconsin
(608) 231-9307; dkretschmann@fs.fed.us