RESEARCH in Progress

NATIONAL CENTER FOR WOOD TRANSPORTATION STRUCTURES

Crash System Development and Testing of Round Guardrail Posts

Small-diameter timber is in ample suppy and will be around for many years. Reasons for this include timberland practices, land ownership patterns, government regulations, fire prevention measures, and harvesting practices driven by environmental concerns. One major stumbling block to reducing fuel loads in western forests is finding an economically viable use for the small-diameter thinnings that are removed. Round guardrail posts may provide an important value-added option for these thinnings.

Background

The use of round timber for guardrail posts has distinct advantages. First, round guardrail posts require minimum processing to produce. Second, they are believed to have higher strength than the equivalent rectangular volume of material. Third, the resulting value-added product may potentially return more to the producer than lumber. The obstacles to immediate utilization of round ponderosa pine guard posts are the current lack of full-scale crash testing results (as required for use on Federal highways), a visual grading rule, and a user's installation guide.

Full-scale crash test of wood post guardrail system.

Objectives

- Determine dynamic material properties for two sizes per species of round Southern Pine, ponderosa pine, and Douglas-fir posts.
- Test two embedment depths of round Southern Pine, ponderosa pine, and Douglas-fir posts to allow a recommendation of embedment depth for round posts made from these species.
- Determine possible grading practices for round guardrail posts of Southern Pine, ponderosa pine, and Douglas-fir.
- Use Barrier VII computer simulations to make recommendations for round post guardrail systems for Southern Pine, ponderosa pine, and Douglas-fir.
- Conduct full-scale crash tests at the Midwest Roadside Safety Facility (MRSF) crash test site in Lincoln, Nebraska.
- Produce an installation manual and plans for round post guardrail systems made of Southern Pine, ponderosa pine, and Douglas-fir.

Coalition for Advanced Wood Structures
a university, industry, government partnership

USDA

University of Nebraska Lincoln

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Forest Service - Forest Products Laboratory
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Approach

Three types of tests will be conducted:

1. Cantilevered sleeve—Dynamic tests will be performed using a 944-kg bogey vehicle with an impact velocity of approximately 9.4 m/s. Impact forces and deformations will be determined with an on-board accelerometer. The testing will evaluate two sizes of round ponderosa pine posts and two sizes of round Southern Pine posts to produce an optimized grade for these species.
2. Soil embedment—Two embedment depths will be tested for each species. The depths selected will be at the extremes of the anticipated performance. Results will be used in preparing input for the barrier simulation models.
3. Crash testing—According to guidelines presented in National Cooperative Highway Research Program Report 350, two full-scale crash tests are recommended to evaluate the performance of a longitudinal barrier for the basic Test Level 3. The first full-scale test will evaluate performance of the ponderosa pine guardrail system. The second full-scale test will be used to test either Southern Pine or Douglas-fir or to run an additional test of ponderosa pine. For the purpose of evaluating the performance of the round-wood post, W-beam guardrail installation, only Test Designation 3-11 was deemed necessary.

The Test Designation 3-11 test involves a 2,000-kg (4,405-lb) pickup truck impacting the length-of-need section at a nominal speed and angle of 100 km/h (62.2 mi/h) and 25°. The purpose of this crash test is to evaluate the structural adequacy of the barrier in containing and redirecting the 2,000-kg test vehicle.

Expected Outcomes

Three major outcomes are expected:

1. Confirmation of performance of Barrier VII modeling simulations
2. Full-scale crash tests demonstrating acceptable performance of round guardrail systems of ponderosa pine and of a second species
3. Installation Manual and Standard CAD plans for ponderosa pine and Douglas-fir round guardrail systems

Timeline

September 2003	Study began
Summer 2004	Initial dynamic bogie testing
Winter 2004	Barrier VII simulations
Spring 2005	Preliminary guardrail system design
Summer 2005	Full-scale crash testing
Fall 2005	Installation manual
Summer 2006	Final report

Cooperators

USDA Forest Service, Forest Products Laboratory
USDA Forest Service, Region 1 and Region 9
University of Nebraska–Lincoln Midwest Roadside Safety Facility
Timber Products Inspection, Inc.
Burke–Parsons–Bowlby Corporation
Arnold Forest Products Corporation
Interstate Timber Products Corporation
Hills Products Group
All-Weather Wood Treaters

Contact Information

David E. Kretschmann
USDA Forest Service
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53726-2398
(608) 231-9307
dkretschmann@fs.fed.us