Alternative Trailer Configurations for Maximizing Payloads

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Abstract

In order for harvesting contractors to stay ahead of increasing costs, it is imperative that they employ all options to maximize productivity and efficiency. Transportation can account for half the cost to deliver wood to a mill. Contractors seek to maximize truck payload to increase productivity. The Forest Operations Research Unit, Southern Research Station, USDA Forest Service located in Auburn, AL has accumulated data from various research projects on alternative trailers and loading techniques that allow harvesting contractors to increase payload. This paper presents the results of the evaluation of two alternative trailer designs and two alternative loading techniques used in the Southern United States.

Keywords: payload, trailers, transport, loading

Introduction

The Forest Operations Research Unit, Southern Research Station, USDA Forest Service, is located in Auburn, Alabama. The unit engages in research to improve forest operations technology, investigate the implications of forest operations on the environment and develop tools to improve forest decision making and business management of forest operations. This paper discusses aspects from recent research relating to equipment and methods that allow harvesting contractors to increase transported payload. The four cases include transportation studies from a larger collaborative research project and individual case studies of alternative loading techniques.

High Capacity Chip Trailers

The “High Tonnage” study was implemented to evaluate alternative methods of harvesting and transporting woody biomass. The study was funded by the Department of Energy and involved multiple research partners. One area of research was to evaluate the potential to increase the value of the final product by removing moisture from the biomass before transporting it to the mill. To achieve this, a 30 acre stand of

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loblolly pine was felled bunched and allowed to dry for six weeks. An additional 7 acres were left standing to serve as a green chips comparison. After drying, the trees were skidded and chipped with a disc chipper and blown into chip trailers from the rear. The standing trees were also felled, skidded and chipped.

In anticipation of transporting dry, lighter chips, larger capacity trailers were sourced and purchased. The estimated required size of the new trailer to obtain a full legal load was calculated and new trailers (Large) with a capacity of 123 cubic yards were purchased. The contractor's existing trailers consisted of two sizes; 100 cubic yards (Regular) and 88 cubic yards (Small). The results of the study are shown in Table 1 below.

Table 1: Comparison of load ticket data for three trailer sizes hauling dry pine chips.

	Large-Dry (123 yd^3)	Regular-Dry (100 yd^3)	Small-Dry (100 yd^3)
Capacity (yd^3)	39	16	6
Avg. Gross (lbs.)	78,648	73,496	68,496
Avg. Net Wt. (lbs./tons)	47,916 / 23.96	43,016 / 21.51	38,473 / 19.24
Avg. Tare Wt. (lbs./tons)	30,767 / 15.38	30,480 / 15.24	30,023 / 15.01
Avg. Density ($lbs./ft^3$)	14.42	16.00	16.23

Laboratory anaylsis showed that the dry chips had a moisture content of 39% compared to 54% for the green chips. The load tickets for the dry chips indicated that the new Large trailer increased payload with an average of almost 48,000 lbs./load compared to 43,000 lbs./load and 38,000 lbs./load for the two smaller trailers. This equates to a 10% gain in payload for the Large trailer. Gross vehicle weight was still well below the legal limit of 88,000 lbs. for all trailer types. The average load density for the Large trailer was 14.42 $lbs./ft^3$ compared to 16 $lbs./ft^3$ and 16.23 $lbs./ft^3$ for the smaller trailers. This difference suggests that the Large trailers were not filled to capacity. Observations during the study did not indicate that the Large trailers were being underloaded, but the data suggests that there were voids in the load. One possible reason for the lower load density of the Large trailer is the trailer is too long and the lighter chips could not be blown and packed densely at the front of the trailer. A shorter, taller trailer or an alternative loading technique, such as top loading may be a viable solution to increase payload.

High Volume Longwood Trailers

In addition to hauling dry chips, another goal of the "High Tonnage Project" was to evaluate transporting dry longwood. Due to coordination and operational constraints transporting dry longwood was not evaluated. High volume, lighter trailers were sourced and purchased and were used to transport green longwood during the project. The

"Regular" trailer was a 40 ft. long, plantation style trailer with a volume of 2380 cubic feet inside the standards. The new "Large" trailers were also 40 ft. long, plantation style trailers, but incorporated a larger drop behind the 5th wheel and utilized super single tries and aluminum rims. The volume inside the standards was 2790 cubic feet. Load ticket data from two stands where both trailer types were used were evaluated. The analysis was performed after harvesting was complete, therefore no detailed stand or load data was recorded. The data in Table 2 and Table 3 show the results from the two stands.

Table 2: Stand 1 Load ticket data for Large and Regular longwood trailers.

Large Trailer	**Gross (lbs./tons)**	**Tare (tons)**	**Net (tons)**
# Loads	15	15	15
Minimum	81520 / 40.76	13.06	27.45
Maximum	89580 / 44.79	13.95	31.01
Average	85349 / 42.67	13.57	29.10
Regular Trailer	**Gross (lbs./tons)**	**Tare (tons)**	**Net (tons)**
# Loads	19	19	19
Minimum	80580 / 40.29	14.76	25.35
Maximum	89820 / 44.91	15.64	29.73
Average	85698 / 42.85	15.15	27.70
	Gross (lbs./tons)	**Tare (tons)**	**Net (tons)**
Difference, Avg.	-.018	-1.58	1.4

Table 3: Stand 2 Load ticket data for Large and Regular longwood trailers.

Large Trailer	Gross (lbs/tons)	Tare (tons)	Net (tons)
# Loads	52	52	52
Minimum	62700/31.35	12.79	18.27
Maximum	85600/42.80	14.76	28.91
Average	77122/38.56	13.52	25.04
Regular Trailer	**Gross (lbs/tons)**	**Tare (tons)**	**Net (tons)**
# Loads	43	43	43
Minimum	69420/34.71	14.21	18.82
Maximum	87040/43.52	16.30	28.36
Average	79206/39.60	15.27	24.32
	Gross (lbs/tons)	**Tare (tons)**	**Net (tons)**
Difference, Avg.	-1.04	-1.75	0.72

The data from both Stand 1 and Stand 2 show that the Large trailer weighed (tare weight) on average 1.58 and 1.75 tons lighter than the Regular trailer. The Large trailer also had a higher net load than the Regular trailer on both Stand 1 and Stand 2, of 1.4 and 0.72 tons, respectively. Stand 2 gross weight for the Large trailer and Regular trailer were both well below the legal limit at 5.44 and 4.41 tons, respectively. The contractor's foreman indicated that the trees in Stand 2 were noticeably shorter than those of Stand 1. This data suggests that an alternative loading technique could have been utilized to increase payload on Stand 2.

Indexing

Indexing is a loading technique where the tops and butts of trees are alternated during loading. Figure 1 shows a load of indexed wood being transported to the mill. The technique eliminates the triangular shape of a load of longwood due to the natural taper of the trees and allows the contractor to maximize payload. Indexing is generally only suitable for plantation first thinnings where the merchandised tree length closely matches the length of the trailer. Few mills accept indexed wood due to the possibility of the wood to "jackstraw" upon unloading and is harder to deck and regrapple. Therefore, mills that accept indexed wood must be able to unload in one grapple bite and the load placed directly in the debarker. Gallagher, et.al. (2005) found in a study of mill gate

tickets across the Southeastern United States a payload advantage ranging from 1700 to 2800 lbs. for indexed wood compared to standard loads. The Forest Operations Research Unit is in the process of conducting an additional study to further quantify the advantages and disadvantages of indexing.

Figure 1: Log truck hauling a load of indexed pulpwood.

Untrimmed (Whole) Tree

Increases in biomass usage for fuels and energy has required a re-examination of harvesting and transportation systems. Biomass harvesting may produce a traditional tree stem or a bundle, bale, chip or chunk. These alternative products require different handling and transportation systems. Often, woody biomass is the unmerchantable material left over from commercial harvesting operations. In this case, a potentially more efficient way to utilize traditional products and biomass is to transport both at the same time. Transporting untrimmed (whole) trees is a loading technique where the trees are not trimmed and topped before being transported to the mill. There are potential advantages and disadvantages to transporting whole trees.

Some of the advantages include higher in-woods productivity, increase in gross tonnage removed, transporting two products on one load and reduced site prep costs. Disadvantages include specialized trailers to haul untrimmed trees, increased trimming and binding time, increased complexity in setting purchase price, additional handling and processing at the mill and decreased nutrients left on-site. Figures 2 – 4 below show the specialized trailers used to haul untrimmed trees and what a load of

untrimmed trees looks like in a commercial operation. The specialized trailers consist of a “basket” built into the rear bunk of the trailer. The basket consists of side panels and a belly pan that is designed to keep the limbs and tops within the trailer. Most baskets are custom built by the logging contractor or a local fabrication shop and can add between 1000 and 1500 lbs. to the weight of the trailer.

Figure 2: Log trailer with "basket" for hauling untrimmed trees.

Figure 3: Log trailer being loaded with untrimmed trees.

Figure 4: Log trailer with a load of untrimmed trees.

Conclusions

The results from these studies demonstrate that there are methods harvesting contractors can use to increase transportation productivity and efficiency. From updating to new lighter, higher volume trailers to employing alternative loading techniques when appropriate, harvesting contractors are continuing to innovate. The Forest Operation Research Unit is focused on research to identify and quantify new equipment and techniques to bring increased productivity and efficiency to the forest industry.

References

Gallagher, Tom, Tim McDonald, Mathew Smidt and Robert Tufts. 2005. Let's Talk Trucking: Weights and Loading Methods. Forest Resources Association Inc. FRA Technical Paper 05-P-2.