WOODLOT TECHNOLOGY

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EVALUATION OF TIMBERJACK 230 8-TON FORWARDER

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Abstract

Wheeled forwarders are commonly used on private woodlot operations in eastern Canada, particularly in the Atlantic region. This Technical Note presents the results of several short-term production studies of the Timberjack 230 8-ton forwarder on contractor operations in Nova Scotia. The forwarders worked in a variety of stand and terrain conditions, and were equipped with both standard (24.5×32) and wide (66/43.00×26) tires.

Introduction

Timberjack Inc. manufacturers two versions of its 230 forwarder. The 8-ton model can carry two tiers of 2.4-m wood, while the 5-ton version can carry only one. The main difference between these two models, in addition to the length of the load bunk and the wheelbase, is that the 8-ton model is equipped with heavier and wider axles. The advantages of the 8-ton model over the 5-ton model are that two sorts can be carried in the same load (without mixing wood in a tier), 4.9-m (16′) sawlogs can be forwarded, and larger loads provide lower costs for long distance forwarding. Conversely, the 5-ton model is better for thinnings because it tracks better in turns (rear tires follow the track of the front tires), and because it is narrower. The 8-ton version (see Figure 1) is more popular than the 5-ton model in Atlantic Canada where the shortwood system is common, both on woodlot and on company-run operations.

The purpose of this study was to evaluate the Timberjack 230 8-ton forwarder in woodlot operations in Atlantic Canada, and also, to compare newer (1987) and older 8-ton models. The information on productivity is also useful to FERIC as basic data for comparing logging machines and systems.

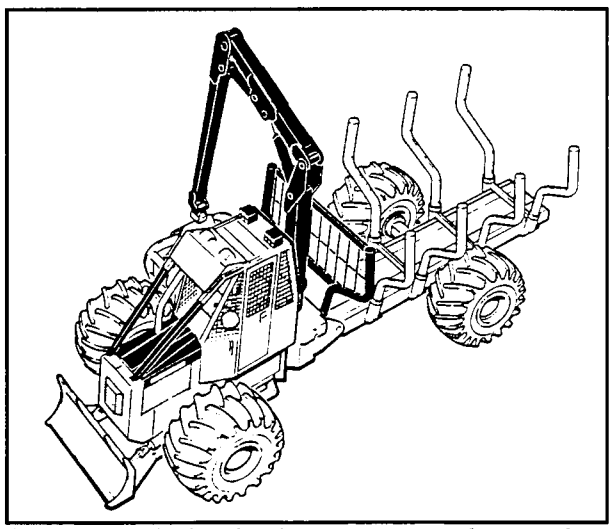

Figure 1. Timberjack 230 8-ton forwarder. (Drawing courtesy of Timberjack Inc.)

This is the third of a series of three Technical Notes that FERIC has recently published on wheeled forwarders. Previous reports provided an overview of the forwarders available in Canada as of 1988 (Makkonen 1988), and discussed various technical features and their influence on forwarder productivity and reliability (Makkonen 1989).

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KEYWORDS: Forwarding, Forwarders, Wheeled vehicles, Woodlot logging, Machine evaluation, Productivity, Ground pressure, Timberjack 230 8-ton forwarder.

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The operators were paid based on the volume of pulpwood forwarded.

Forwarder B was owned by a "stump-to-roadside" contractor with a crew of 10-15 loggers who carried out the entire logging operation. The forwarder operator worked five 8-hour shifts a week and received an hourly wage.

Details of the study sites are provided in Table 1. All forwarders transported manually-prepared bunches in the cutover to a roadside pile. Sites 2 and 3 were beside a truck road. On Sites 1 and 4, the forwarder crossed a farm field to get to the truck road. On Site 5, the forwarder travelled 950 m on a improved forest trail to reach the roadside landing.

Product sorting was done on Sites 1, 2 and 3. Whenever possible, Grades 1 and 2 pulpwood were piled on opposite sides of the road to reduce unloading time and to minimize additional sorting. On Sites 1 and 3, the forwarders transported one product per trip. On site 2, the operator placed Grade 1 and Grade 2 pulpwood in separate tiers; any hardwood (a third product) was usually added to the second tier. When unloading a small quantity of a third sort, the operator often dropped the logs onto the ground. On a later trip, he would pick them up and transport them to the proper pile (a time-saving technique).

Table 1. Operating Conditions

	Site 1	Site 2	Site 3	Site 4	Site 5
Forwarder #	A (1987 model)	A (1987 model)	B	C	C
Operator #	1	2	3	4	4
Conditions at site					
- date	Feb. 16, 1988	Feb. 17, 1988	Feb. 18, 1988	Feb. 19, 1988	Feb. 19, 1988
- weather	+2°C, heavy rain (50 mm) on study day	-12°C, sunny	-5°C, sunny	-10°C, sunny	-8°C, sunny
- terrain	cut area was flat; there was a farm field between cut area and the landing.	cut area was flat, partially rough, and right beside haul road.	cut area was flat and somewhat rough, right beside haul road.	cut area was partly flat, partly steep; travel on trail with 5% slope over the farm field.	cut area was flat; travel was mostly on road with slope 5%.
- terrain classification*	1.1.1.	2.2.1.	2.2.1.	1.1.1. 2.1.2.	1.1.1.
- comments	• snow depth (0-30 cm) did not hamper travel. • Product piles were not in line. • Sorting into piles was only fair (many large diam. logs).	• up to 60 cm of water on the far side of the cut area from rain on the previous day.		• the steep part of the cut area consisted of a wet, slippery slope.	• travel in the cut area was under 50 m; the next 950 m was on an improved forest trail.
- stand composition prior to harvest	spruce	spruce, hardwood	spruce	spruce	spruce
Sorting	yes	yes	yes	no	no
Products/sorts	Grade 1 & 2 pulpwood (all 2.44 m)	Grade 1 & 2 pulpwood, firewood (all 2.44 m)	Grade 1 & 2 pulpwood (all 2.44 m)	Grade 1 pulpwood (all 2.44 m)	Grade 1 pulpwood (all 2.44 m)

* Strength . roughness . slope (Mellgren, 1980).

On Site 3, the machine travelled mainly in cutover conditions and so ground roughness limited travel speed, both when empty and when loaded. The loggers made smaller piles than on most other study sites which partially explains the slower loading rate. Because of a shortage of manpower, the machine worked quite close to the loggers. As such, safety considerations may also have slowed the forwarder operator's loading cycle.

On Site 4, high travel speeds were maintained over the field. However, the slippery slope in the cut area resulted in small loads and a comparitively long "move-during-loading" element. The forwarder had wornout tires and ineffective chains on the front wheels, and thus often spun out or got stuck (delay) on the slope.

On Site 5, high travel speeds were achieved on an improved forest trail. The delay consisted of talking with the woodlot owner.

The *average loading rate* at each site was calculated. Note that loading time does not include "move during loading" (see Figure 2). On Site 1, the loading rate was only 1.05 m^3/min because the logs had not been properly sorted by the loggers. On sites 3, 4 and 5, the loading rates were 1.13 m^3/min, 1.12 m^3/min and 1.16 m^3/min respectively. The loading conditions were best on Site 5. On Site 2, the loading rate was highest at 1.40 m^3/min. However, in FERIC's opinion, the operator at Site 2 worked at a faster rate than he would normally work. He missed about 15 bunches on the site partly because they were covered with wind-blown snow and partly because of his determination to achieve high productivity.

On Sites 1, 4 and 5 (total 21 trips), the forwarder travelled mainly on fields or improved trails, and the average travel speed was 117 m/min empty and 104 m/min loaded. On Sites 2 and 3 (total 21 trips), the travel was mainly over the cutover (rougher terrain) and the average travel speed was 71 m/min empty and 60 m/min loaded. Figure 3 shows calculated productivity curves, both for travel on trails and over the cutover, based on the aforementioned speeds and the overall average terminal time and average load size during the studies. The actual values recorded at each site are also plotted.

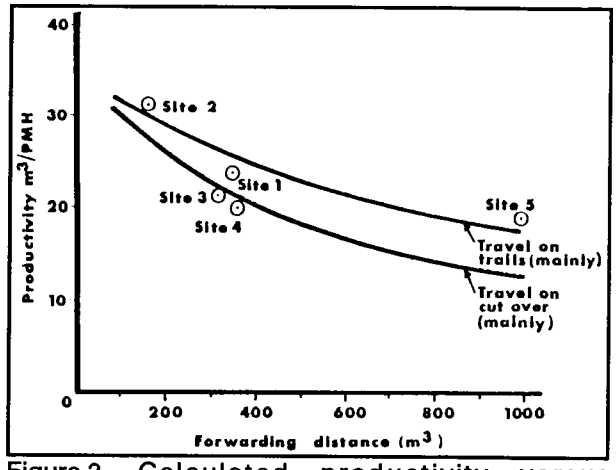

Figure 3. Calculated productivity versus forwarding distance curves.

1987 Model with Wide Tires Compared to Older Models

The use of wide tires on forwarders reduces ground rutting damage and provides a more comfortable ride for the operator. However, because of the higher cost of the wide tires, their owners usually expect the forwarders to be more productive as well. Today in Atlantic Canada, many of the old forwarders with standard tires are being replaced with forwarders equipped with wide tires.

In this study, it was difficult to compare directly the merits of wide vs. narrow tires because of differences in machines, operators and study conditions. The wide tires were mounted on the new (1987) forwarder which also had a larger engine (7 kW more) and therefore more power than the standard-tired machines. In this study, the new wide-tired forwarder (Forwarder A) had higher productivity in the most representative and comparable conditions (i.e., cutover sites 2 vs. 3). The main reason for increased productivity was faster loading and the roughly 30% higher travel speeds. In FERIC's opinion, the higher travel speed resulted mainly from the increased stability, improved flotation and better suspension capacity of the wide tires, plus the higher engine output. Because of the large difference in stability between the two models, it can be expected that the improvement in productivity in rougher terrain and slopes might be more significant than in good terrain.

- The operators were satisfied with the mechanical reliability of the forwarder.
- The rear cab window does not seal off wind adequately at the loader control levers. The control levers are close together and heavy gloves cannot be worn. As a result, the operators' hands often get cold in winter. This has a negative effect on productivity.
- The cab is somewhat too narrow and too short for most operators to find a comfortable position on the seat.
- The noise level in the open cab is too high. NOTE: Noise levels were not measured by FERIC.
- Two operators noted that engine fumes occasionally entered the cab.

Conclusions

The Timberjack 230-8 ton forwarders studied by FERIC in Nova Scotia in 1988 worked in favourable ground and stand conditions and were operated by skilled operators having more than 10-years experience. The resulting productivity was high; it varied from 19.4 m^3 to 31.6 m^3/PMH (solid wood basis). In comparison, a 1987 Newfoundland Govt. study was conducted in less favourable conditions with less experienced operators, resulting in much lower productivity.

The forwarders in FERIC's study were observed to work effectively in terrain conditions 2.2.1. However on Site 4, the productivity dropped sharply when working on a slippery (clay) slope classified as 2.1.2. In fact, piles of wood located on some parts of the slope could not be reached because of traction problems. Lower ground pressure so as not to disturb the surface mat or more aggressive wheel chains would have helped to negotiate the slope.

FERIC's studies showed that the 1987 model Timberjack 230 forwarder equipped with wide tires was more productive than an older unit with standard tires. Despite the winter season, the ground was only partially frozen. The wide tires caused much less rutting than standard tires, especially in soft areas. They also provided a more comfortable ride for the operator.

The 7260-kg (8-ton) load capacity of the Timberjack 230 permits long forwarding distances. This is important in the Atlantic provinces and in other areas where woodlot properties tend to be long and narrow in shape. These woodlots often have a low-quality access road that cannot bear a heavy logging truck, especially during spring breakup or prolonged periods of rain. In these situations, forwarders may be required to forward logs up to one kilometre to a truck road. The Timberjack 230 is well suited to these operating requirements.

The operators' main concerns about the Timberjack 230 forwarder were ergonomic in nature. Timberjack Inc. has indicated that they plan to make improvements in the cab area in the future.

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