

Techniques for the WHEELED-SKIDDER Operator

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**U.S.D.A. FOREST SERVICE RESEARCH PAPER NE-170
1970**

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MANUSCRIPT RECEIVED FOR PUBLICATION 7 NOV. 1969.

THE SKIDDER OPERATOR IS A KEY MAN

HOW MUCH PRODUCTION a logger gets from a logging job may depend heavily on his skidder operators. They are key men on any logging job.

This is one conclusion that forestry engineers at the USDA Forest Service's Forestry Sciences Laboratory at Morgantown, West Virginia, came to after studying the operation of wheeled skidders in mountainous Appalachian terrain. Out of these studies we can suggest ways that new or experienced skidder operators might improve their operating ability and thus increase their production.

This information might also be helpful to logging contractors in training their skidder operators for more efficient production.

BUNCHING LOGS FOR SKIDDING

Winching logs from the felling site to the skidroad is usually the most time-consuming phase of skidding. And this phase offers the skidder operator a good chance for increasing production.

The slope a log is winched over affects the winching time most. But winching time is affected by distance, undergrowth, slash, stumps, rocks, soil conditions, and characteristics of the particular skidder.

To see how winching capacity of particular skidders was affected by field conditions, we tested the winching force developed by three different skidders. Testing conditions such as soil moisture, soil texture, and skidder operator were the same for each skidder and for each test. In the tests, the mainline was anchored to a standing tree with a dynamometer in series with the anchor and the mainline. Data were taken on each skidder only after the operator had gained experience operating that skidder.

The winching force varied between skidders as follows:

Skidder	Skidder weight (lbs.)	Winching force	
		Rated ¹ (lbs.)	Maximum ² (lbs.)
A	11,673	18,000	13,000
B	12,400	22,000	13,000
C	14,320	25,900	14,500

Condition of the soil was probably the most important factor in this decrease in winching force under forest conditions, but other factors may have been the differences in skidder weight, distribution of weight, wheel base, and fairlead design.

We tested winching force at distance from 20 to 80 feet. Winching force was not affected by distance.

Winching force dropped off as the angle between skidder and winch line increased (fig. 1). At an angle of 45 degrees, two of the skidders tested were capable of less than 50 percent of their po-

¹ Rating on the winching specification plate.

² This is the maximum force developed under forest conditions. Winching angle and soil conditions permitted a greater winching force than skidder weight.

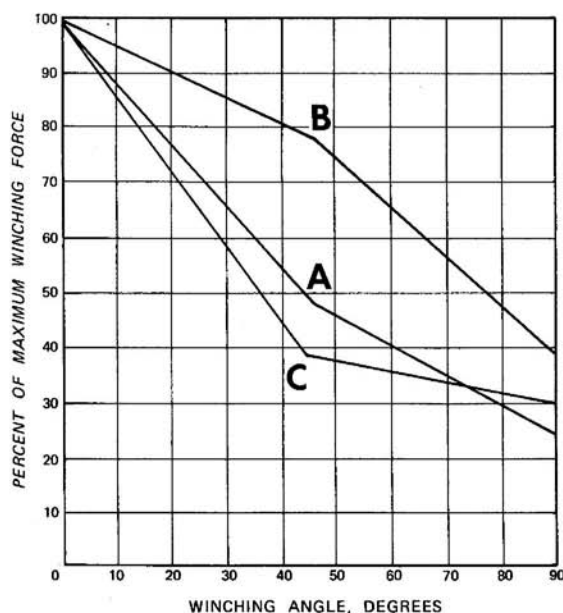


Figure 1. — Percent of maximum forest winching force obtained at different winching angles. (See the tabulation in the text for maximum forest winching forces).

tential winching force relative to winching on a straight line, and the third's force dropped to less than 80 percent. As the winching angle increased to 90 degrees, the winching forces continued to drop. The winching curve for skidder B (fig. 1) indicates that somewhere in the design of this skidder an advantage in stability was gained.

On all skidders, the potential for winching from an extreme angle was poor; therefore, the operator should winch from as straight an angle as possible.

Some wheeled skidder operators in the hardwood areas impact-load the winch mainline to get a large log to start moving. They do this by raising the front of the skidder off the ground with the winch, and then quickly releasing the winch brake until the front of the skidder has gained some downward momentum. Then they re-engage the winch before the front wheels of the skidder hit the ground. This jerks the log into motion.

Impact-loading the mainline is dangerous. If the line breaks, metal fragments and the whipping mainline can be lethal. The loads imposed on the winch, winch mounts, mainline, and other components are high and may damage these components. For a skidder weighing 7 tons, with the front wheels raised 2 feet and then dropped, the force generated would be in the order of 20 to 40 tons!

Engine r.p.m. (revolutions per minute) plays an important role in winching. If the operator cannot see the log, winching should be slow so the operator can detect early when the log has met some obstacle such as a tree or stump. If the engine is turning at a high r.p.m. when an obstacle of this nature is met, the operator may not have time to disengage the winch in time to avoid damage to the machine or cable or to avoid endangering nearby workers.

From our experience with some of the latest skidder models, we recommend that, unless the operator can see the moving log and its path toward the skidder, the engine r.p.m. should be kept under the midpoint of its rated maximum. When the log is visible, the operator can adjust the engine r.p.m. according to existing conditions in the winching path.

Winching from an angle that causes the cable to build up too

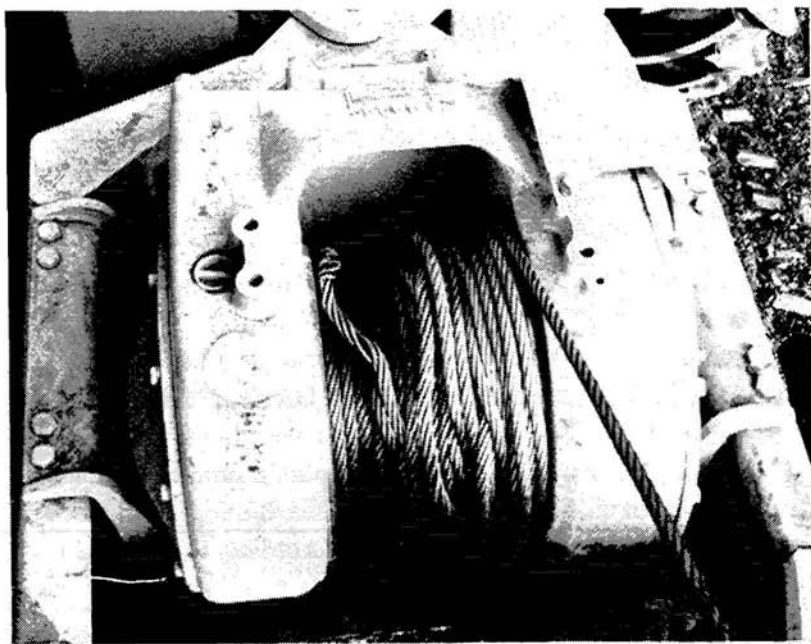
high on one side of the drum can result in permanent damage to the mainline and prevent the mainline from free-wheeling out for the next log (fig. 2). The initial damage shows in a flattened and permanently kinked mainline. The resulting difficulty in pulling the mainline off the drum results in lost time.

The first position selected for winching should be the best one. Moves are time-consuming, especially if the cable has already been pulled out and attached to the log. But if a better position is needed and can be found, it may be best to move the skidder.

The choker setter, by selecting the path of the log through various obstacles, determines to a great degree the efficiency of the winching operation. As a general rule, the winching path should be as straight as possible and as much in line with the log as possible. If a crooked winching path is selected, longer logs can easily become lodged between trees and stumps (fig. 3).

A low obstacle, such as a rock or stump, can be overcome when

Figure 2.—This cable is wound too much to one side of the winch drum. Note the damage to the cable.



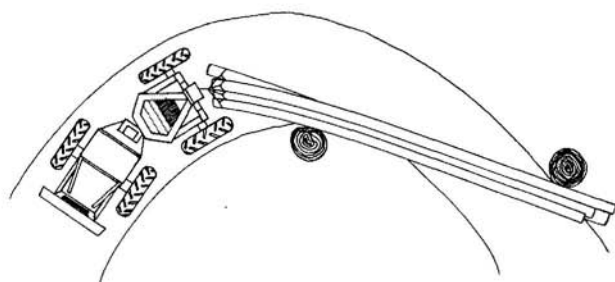


Figure 3.—Problems arise when trying to winch logs out of tight spots at too sharp an angle or when turning too sharply while skidding. The load may lodge against trees, stumps, rocks, or road banks.

it is near the skidder by lifting the front of the log high enough to allow the log to slide over it.

When a large log has been felled in a difficult position because of angle or obstructions, it is best to get the skidder as near the log as possible for winching. This will permit a better view of the obstructions, and the cable will have a greater upward angle, which will aid in sliding the log over rocks, stumps, or slash.

Sometimes a stump or rock will block the winching path for ordinary log-winching methods. There are three good methods of handling this situation. One is to lift the log by moving the skidder near enough for a high-angle pull. The second is to wrap a turn of cable, in addition to the choking loop, around the log to produce a rolling or twisting motion when the cable is pulled. This aids the log in climbing or rolling over the obstruction. The third is to change the angle of pull by looping the cable around a tree or stump (fig. 4)—but be sure no one is near the cable. If the cable slips over the stump, it can injure someone in its path.

Sometimes large logs are difficult to winch uphill and are too heavy to skid. The operator should not try to winch from a long distance, nor should he try to skid the load by spinning the wheels and jerking the skidder. Getting close to the log and aligning the mainline with the direction of travel of the log will usually allow the log to be moved.

Here are a few guidelines for winching:

- When positioning the skidder for winching, keep the angle of pull as small as possible.

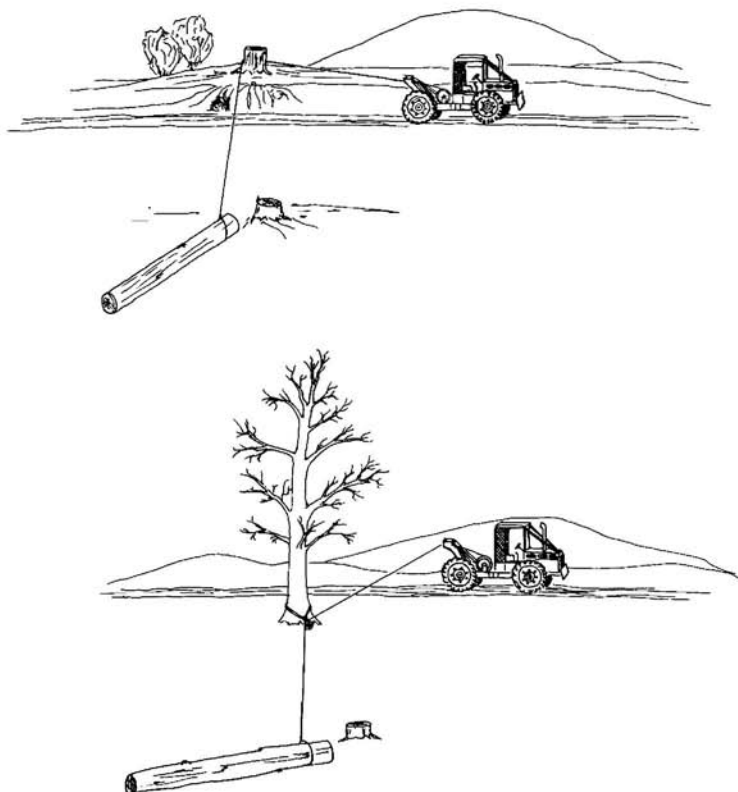


Figure 4.—Two good methods for changing the angle of pull while winching. These are especially valuable in steep terrain. Be sure no one is near the cable. If the cable slips over the stump, it can injure someone in its path.

- Winch slowly at severe angles for better laying of the mainline on the drum.
- Watch the mainline as it is wound onto the winch drum, as this is when the damage usually occurs.
- Operate the hydraulic steering slightly to change the winching angle as the mainline is winding onto the winch drum.
- After the log has been winched a short distance, a smaller winching angle might be attained by repositioning the skidder.
- Do not impact-load the mainline. It is a very dangerous practice.

LOAD SELECTION

The operator should recognize the limitations and potentials of the machine at various load levels under the skidding conditions of the particular logging site. He should select the size of load and the particular logs for each skidding cycle accordingly.

The major factors to be considered in selecting the proper load are:

- Slope of the skidroad.
- Turns in the skidroad.
- Length of the skidroad.
- Soil conditions.
- Log size.
- Skidder weight and horsepower.

The load should be selected by the skidder operator, as he is the person most familiar with the skidder and the prevailing skidroad conditions. The operator should recall the size of the load and the gear in which the skidder successfully negotiated a grade, and whether any downshifting was necessary. The grade may be negotiated without downshifting by only slightly reducing the load.

Soil conditions, such as texture and moisture content, affect selection of the load. Loose ground, wet clay, or rocks are conducive to slippage, which results in excessive tire wear and possible tire damage.³ The operator can best compensate for these soil conditions by decreasing the load size. Many times, only a slight decrease in load is necessary to substantially decrease cycle time and to prevent unnecessary tire wear and damage.

If there are sharp turns in the skidroad, the load should be selected so that there will not be more than one large-diameter log in each load. The large-diameter logs reduce the ability of the skidder to negotiate a sharp turn because they cannot be carried

³ Biller, Cleveland J. PREDICTION OF SKIDDER TIRE WEAR IN APPALACHIA. Presented at ASAE Winter Meeting, 1969, Chicago, Ill. In preparation for publication.

high against the rear of the skidder without interfering with the fenders. Also, the large logs put more weight on the skidder, and more force is required to pivot where the logs attach to the skidder.

There should not be more than one log in each load that is too long to be pulled around a sharp turn without the middle or end of the log dragging against an obstruction (fig. 3). If this occurs frequently, remove the obstruction.

A large load of logs is not necessarily the most economical load. The effect of the load size on the skidding cycle time (the time it takes to make a round trip) must be considered. When a skidder is loaded to its absolute maximum, speed and steering are seriously affected.

A heavy load carried high against the skidder adds to the traction of the rear wheels but does not help the traction of the front wheels. Good front-wheel traction, as well as rear-wheel traction, is desirable for best performance during turning.

A load that is too large may rub against the wheel on the inside of turns. This restricts turning ability, causes tire damage, and, on steep slopes, may upset the skidder.

Reducing the load size will reduce the force necessary to pull the logs, increase traction of the front wheels, reduce physical turning restrictions, and allow more speed while turning, thus allowing the skidder to use its maximum turning ability.

It is a good practice for the skidder operator (or the woods foreman) to periodically check skidding cycle time with a watch. This will give an indication of the effect of overloading or of logs too long for sharp turns.

Overloading puts more strain on the skidder, which leads to more repairs and higher operating costs. The operating costs should not be taken lightly, as they effect the harvesting system much the same as does low production. In fact, breakdowns, tire damage, and cable and choker damage all result in non-productive time, which brings about low production as well as the direct costs of repairs.

Fortunately, the wheeled-skidder operator can control some of the factors that effect production and costs. This is rapidly becoming more important as equipment and repairs are becoming more

expensive. The operator should strive for better utilization of the wheeled skidder through care and maintenance.

SKIDROAD TRAVEL LOADED

After the load has been selected and properly attached to the mainline, the logs are pulled forward and raised to the proper height for skidroad travel. It is easy to raise the forward end of some loads while the skidder is at a standstill. The operator must pay particular attention to the front end of the logs, as they have a tendency to move forward as the lifting begins. Sometimes the logs move forward far enough to catch under the log fenders or the rear of the skidder frame. And unless the operator is alert and disengages the power to the winch, the mainline or chokers may be broken. Because of this, we recommend that the engine be maintained at a low r.p.m. while the logs are being lifted. Otherwise, the momentum built up in the winch by a high engine r.p.m. could allow the winch to cause damage to the wire rope even though the operator did release the power from the engine.

Another technique for lifting the logs is to winch the logs close to the rear of the skidder and then move the skidder forward while the winch is lifting the logs to the desired height. The logs drag on the ground as the machine moves forward, keeping the logs farther back from the log fenders. This is probably the most used of the two techniques, but the operator should use caution while he steers the skidder and watches the winching. Also, this technique pulls the cable more nearly horizontally and may allow a choker to pull off, causing a delay while the log is being re-choked.

The logs should be carried as high as possible. However, two limiting factors are the height of the fairlead and the length of the chokers. The loaded chokers should not be wound onto the winch drum, as the connectors and the underlying layers of cable may be damaged.

If there is a steep side slope to the skidroad, the logs should be carried lower than they would be on a level skidroad. The logs apply more force to the log fenders on the downhill side of the skidder and could cause the skidder to overturn.

Danger of overturning the skidder is greatest when turning on a slope. The two most critical types of turns are traveling down-slope and turning left or right and traveling around a slope and turning up.⁴ These turns are critical with the skidder either loaded or unloaded. Although turns of this nature should be avoided, sometimes they are necessary.

Momentum can be a major factor in overturning or upsetting a skidder while turning, so the operator should proceed slowly. The forward ends of the logs should be carried at a lower level than usual. If the raised logs are pushing or forcing the skidder to overturn, their effect can be eliminated quickly by releasing the winch brake and dropping them to the ground. After they are released and on the ground, they can be used as an anchor for holding the skidder from overturning. This may require that the skidder be turned to a slightly different angle by manipulating the articulated frame while the logs are being dropped to the ground. These techniques require the skidder operator to become as familiar as possible with his skidder and to remain alert to the different forces acting on it.

If the load must be pulled up a steep slope or through a swampy area, the operator should study the ability of the skidder to carry different-size loads over these problem areas. Before entering the problem area, he should shift the skidder into a gear that is low enough that he will not have to shift again until the load is through that area. The gear selected should be low enough that the engine will run against the governors for the entire distance of the slope or marshy area. This will insure constant power to the wheels and will provide a margin of power so that, if the tires begin slipping, the operator can reduce the power to take advantage of the skidder momentum. In this manner he may get through the problem area without stopping. The operator should find the proper gear for each problem area on the first or second trip and use it thereafter.

Often, when forward motion is lost in a swamp or on a slope, and especially if traction is poor because of wet or loose soil, the

⁴ Gibson, Harry G. ARTICULATED-FRAME, FOUR-WHEEL-DRIVE, TRACTOR STABILITY. Master's thesis, W. Va. Univ., Morgantown, W. Va. 125 pp. 1969.

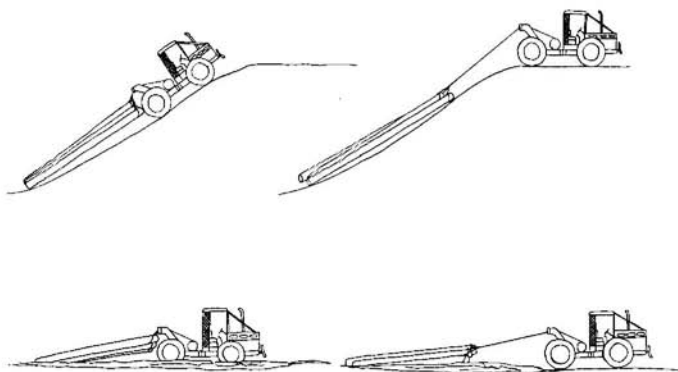
skidder cannot get the load moving again. When this happens, it is often best to release the winch to free-wheeling and move the skidder farther along the skidroad, and then winch the load up to this position (fig. 5). Some skidder operators release part of their load under these conditions and proceed with the remainder; but this is not recommended unless the skidder is unable to winch the entire load through the problem area. The skidder operator should refrain from loading so heavily that this is necessary, especially if skidding distance is short.

If skidding distance is long and the segment of the skidroad that is causing problems is relatively short, winching the load through the problem area to bring in a larger load may prove to be more productive than skidding a smaller load.

The power shift or automatic transmission can also be helpful in problem areas. These transmissions permit the power-train ratio to be changed without a noticeable loss of forward momentum.

When skidding downhill, the skidder can be loaded more heavily, but this too must be watched and controlled closely by the operator, because forces are acting in a different direction on the skidder. A skidroad that is slightly downhill is best, but the operator is usually skidding on less than optimum slopes.

Figure 5.—Steep slopes and muddy areas often necessitate moving the wheeled skidder forward and then winching the logs to the skidder.



Descending a steep slope is dangerous, especially if the skidroad is sloped to one side. As the skidder starts down the steep slope, the logs should be lowered enough to require the engine to operate on a slight pull. Maximum control of the skidder on a steep downhill skidroad can be maintained by manipulating the winch controls to keep the load at the proper height. The operator should not attempt to slow the skidder by excessive use of the brakes. By using good judgement, a certain degree of caution, proper methods of skidder control, and by making an effort to become completely familiar with the particular skidding area or skidroad, the skidder operator can maintain good production from his skidder even on steep skidroads.

TRAVELING EMPTY

It is up to the operator to select the proper engine r.p.m. and gear ratio according to the sound of the engine and the motion of the skidder on the empty return trip. Because of the hydraulic steering system, engine speed must be kept high for best steering control.

On skidders with mechanical transmissions, lost time and excessive wear and tear often result from poorly timed gear changes. And where rolling resistance is high, the skidder may come to a complete stop before shifting can be completed. When the distance to be traveled is short and the skidroad is such that shifting gears is a problem, it is best to run the entire trip in a lower gear.

The following technique requires much practice, but it is used by equipment operators for quick shifting into a higher gear. Accelerate until the skidder will not gain any more speed; slow the engine slightly; and, after a slight pause, rapidly release all pressure from the accelerator. Disengage the clutch just before the last pressure is released from the accelerator. As the clutch becomes disengaged, move the gear level quickly into the next gear, and, at the same time, place a slight load on the engine by activating the winch or blade. Activating the winch or blade places a load on the engine and aids in synchronizing the gears.

Gear shifting must be done as quickly as possible and must be timed perfectly, or the transmission gears can be damaged. If the

gears of the transmission clash, *do not force them*; either quickly shift into the original gear, or stop the skidder and start again.

The empty return trip provides an opportunity for the operator to view the skidroad and to consider repairs. Many minor repairs—such as removal of sharp rocks, snags, and dropped logs—can be made at the end of the day or when the skidder would otherwise be idle (fig. 6).

Water holes should be drained where it is practical. And where the soil is loose or soft, travel patterns should be chosen that prevent rutting and that aid in soil compaction—thereby adding to the quality of the skidroad. This also eliminates unnecessary tire wear and damage from ruts—especially important where the soil freezes.

Turning around on a slope is sometimes a problem. The front of the skidder is the heaviest and should be kept uphill when turning around on steep slopes. All quick turns uphill should be avoided, as this is the maneuver that has overturned many skidders.



Figure 6.—Scraping this skidroad during spare time kept ruts from forming and increased the traction for winching and skidding.

When a turn-around must be made where the ground is too steep for the skidder to leave the narrow skidroad, the forward and backward movement should be slow. Caution must be used here, because the full pivoting of the skidder frame may allow a wheel to get too near the edge of the skidroad.

USING THE BLADE

The wheeled skidder blade is designed primarily for piling logs at the landing (fig. 7). The blade is also useful for other tasks, but its value depends in large part upon the ability of the operator to adapt to the feel of the skidder. On most skidders, the operator's view of the blade is poor; therefore, the operator should select the blade corner that he can see best and use it, along with the sound of the engine, as a guide for lowering or raising the blade.

Helping to make or clear a landing may also be a part of the skidder operator's job. If large log stockpiles are to be handled



Figure 7.—The wheeled skidder is useful for piling logs and maintaining an orderly landing.

over an extended period, the landing should be graded to get a more even working surface, a location should be cleared for log piles, and ample area should be cleared for the loading activities.

The operator is responsible for insuring that the landing will drain properly. Should extended use of the site introduce new drainage problems, the skidder can be used to drain these areas and backfill them. This will aid the trucks that haul from the landing and keep the logs clean for the mill.

The skidder is not designed for moving earth, so earth-moving should be done with a crawler-type tractor. But small jobs can be done with the wheeled skidder if a crawler is not available.

Stumps at or near the landing should either be cut off as near the ground as possible or be completely removed, because the wheeled skidder will be making numerous trips over the landing area. While piling or moving logs, the skidder blade takes unnecessary punishment from stumps that are left too high.

When using the blade to move logs from one place to another on the landing, the operator can see the movements of the log and raise or lower the blade as necessary to maintain a rolling action. Logs can be piled with the wheeled skidder blade by keeping the blade parallel with the log and raising the blade with the log as it moves up the pile. Caution should be used in climbing the pile with the skidder because of the pile's instability. An orderly log pile can be maintained by piling the logs often so that there is always enough room for maneuvering the wheeled skidder.

PREVENTIVE MAINTENANCE TIPS

The service from a wheeled skidder is only as good as the preventive maintenance that it receives. The wheeled skidder operates under some of the most rugged conditions that a machine can be exposed to. Therefore, for the most successful use of a wheeled skidder, proper maintenance as well as operation is essential.

The manufacturers of wheeled skidders provide manuals that give in detail the required maintenance schedule that should be followed for each machine. The time spent studying these manuals will be repaid in a long and satisfactory life of the machine. Also,

the time spent in cleaning, adjusting, and greasing according to the manufacturer's recommendations will be more than repaid by savings in lost time and extra work.

To follow the manufacturer's daily maintenance recommendations precisely will require a lot of time at first. But, as the routine becomes more familiar, it will require less time.

Greasing fittings too heavily is a waste of grease and time, and may damage grease seals. A small amount of grease daily is much better than a large amount less often.

From observations on many logging sites, we have found that loggers tend toward one of two daily maintenance schedules: A small amount of preventive maintenance or no preventive maintenance. Few wheeled skidders are receiving the lubrication and preventive maintenance recommended by the skidder manufacturer.

For wheeled skidders, the purposes of lubrication are:

- To reduce friction.
- To remove foreign materials.
- To seal against entry of foreign materials.
- To cool.
- To prevent corrosion.

Although it is best if the manufacturer's recommendations are followed, here is a list that can be used for a daily routine. This list is not meant to replace the manufacturer's recommendations; but if it is followed, it will eliminate many of the problems that arise from insufficient maintenance.

Cleaning and checking

- ✓ Check the crankcase oil level.
- ✓ Check the radiator coolant level.
- ✓ Check the air cleaner for proper oil level and obstructions.
- ✓ Check the hour meter—clean the face and make sure it is working, as this is the only true indication of time since the last oil change.

- ✓ Check for loose bolts—particularly on the major components, such as the winch mounts, brake mounts, and oscillating axle points.
- ✓ Check for cracks in the skidder frame and at weld points.
- ✓ Check the mainline for weak points—it is easier to repair or replace at the landing than in the woods.
- ✓ Check tires for bad cuts—they are easier to repair before a flat occurs.

Lubricating

- ✓ Universal joints.
- ✓ Splined shafts.
- ✓ Steering cylinder bearings.
- ✓ Pivot pins of articulated frame.
- ✓ Axle pivot points.
- ✓ Blade support points.

THINK AHEAD

Following are some general guidelines for the wheeled skidder operator.

-  Think ahead, and operate the skidder intelligently.
-  Be completely familiar with the operating and service manuals supplied with your skidder.
-  Be aware of nearby workers; you can help protect them.
-  Be alert for accidents; they are usually man-made.
-  The skidder is designed to withstand the forces necessary to skid logs, but it will break; handle it with care. Breakdowns are costly.
-  Discuss any problems or suggestions with your woods boss.

The effect of a single technique or procedure on total production of the operation may be small, but the influence of a number of

these small things add up to something big. Therefore, they should be treated by the operator as if each one of them could result in a large or even a prohibitive cost for the operation.

When it is realized what effect the skidder operation has on the entire logging job—on the welfare and safety of the crew and on the profit margin of the operation—it is obvious that more attention to proper skidder operation is essential.





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