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SKYLINE LOGGING

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PLANNING SINGLE-SPAN SKYLINES

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PLANNING IS THE KEY TO SUCCESSFUL OPERATIONS WITH SKYLINE CRANES. The ever-increasing demand for logs requires the harvest of old-growth as well as second-growth timber from steep, difficult terrain. Logging practices that will protect soil, water, scenic beauty, and other forest values are preferred today—and these attributes are preserved in yarding systems with skyline cranes. We now have a yarding system that will transport logs from steep slopes and, when stands can be partially cut, leave the forest in a nearly natural condition.

SKYLINE CRANES CAN TRANSPORT logs from steep slopes. That some operations are more profitable than others, however, may be attributed to the planning and layout before equipment is moved to logging sites.

Before we discuss the problems of planning a skyline show, let us look briefly at the skyline crane and how it functions. Skyline cranes are not new to the logging industry. Forerunners to our present machines were the 200-ton steam skidders used in railroad logging.

Although the skyline-crane system is not new, technological improvements have brought a whole new generation of equipment with greatly advanced capabilities.

The equipment ranges from large machines equipped with 5,000 feet of 2-inch-diameter cable, for clearcutting, to small machines with 1,200 feet of 1 1/8-inch cable, for partial cutng.

A skyline crane operates differently from conventional logging equipment. A skyline crane can move logs laterally to a skyline and transport them either up or down the skyline. The logs can be free of the ground or one end can drag. Skylines may be classified as standing, live, or running. A standing skyline is fixed—anchored at both ends during the yarding cycle. Live and running skylines may be raised and lowered during yarding. Because of their capability for lateral skidding, either clear or partial cuts may be made with skyline cranes, depending on the practice needed for a particular stand.

With this brief look at fundamentals, we can readily see that planning for single-span skylines is complex because of the wide range of capabilities. Again, the key to successful operation of the skyline crane is planning. When logging plans are developed, a complete drainage should be studied. Skylines provide just one means of yarding, and an integrated plan should be developed with yarding systems best suited to topography and cutting practice.

Logging planning has been summarized by J. Kenneth Pearce (3):

"The logging planner is the architect of the logging plan. To arrive at the best plan, he must consider many factors. Given the basic data on timber and topography, logging planning requires the concurrent consideration of the following factors:

1. The physical requirements of the applicable logging methods.

2. The most economical combination of yarding costs, road construction costs and trucking costs.

3. The silvicultural system and the priority sequence of cutting.

4. Protection of the uncut stand and soil and water resources.

5. The safety of the men working on the landings and traveling the roads.

Some of these factors may conflict. The final logging plan may be a compromise reached after weighing all factors. The relative weight to be given each factor is an administrative decision based on policy."

Let us now look specifically at what is needed for single-span skylines.

Before beginning a logging plan that includes single-span skylines, the planner should be familiar with criteria for selecting areas suited to this system (1).

Suitable Terrain

As you have heard from previous speakers, a skyline must deflect or sag to carry a load. Shape of terrain is a limiting factor for skylines.

Slope conditions may be classed as concave or constant. Concave slopes are best for single-span skylines. Constant slopes, although more difficult than concave, may be logged when the tail anchor is moved to an opposite hillside or when a spar tree supports the skyline. With spars, skyline distance will usually be less than on concave slopes or when an anchor is located on an opposite slope.

Anchor points sometimes will be outside the boundaries of cutting units.

Compatibility with Transportation Plan

Location of roads will influence whether logs are to be yarded uphill or downhill. With uphill yarding, one end of the logs can drag, which increases load-carrying capability.

In areas with terrain that restricts deflection, uphill yarding with logs dragging may mean the difference between a profitable or unprofitable operation. With downhill yarding on steep slopes, however, logs should be carried above ground to avoid damage to equipment. Allowing logs to drag downhill will also increase cycling time and increase yarding costs. If logs drag when yarded downhill, the limiting slope occurs when logs overrun the carriage.

Adequate Landings

Adequate landings are a requirement for skyline operations. Room must be provided to land, sort, and load logs safely.

Adequate Anchors

Adequate anchors are required for a skyline so that it may be tensioned to carry a load. These anchors must have the capability of withstanding the pull of a skyline. The anchoring of skylines has been discussed elsewhere in this symposium.

Adequate Spar Trees

Adequate spar trees are required to support skylines when terrain does not provide clearance for deflection. Trees selected for spars should be large enough to withstand the stress of a skyline.

Skyline Length and Height

Skyline length will determine size of equipment and whether a standing or live skyline should be used. Skidding-line length will limit skyline height. Where a skidding line will not reach the ground, a live skyline may be used instead of a standing line.

Economical Operation

A skyline operation must be efficient. Many variables that affect skyline yarding costs are beyond consideration in this paper. The important point is that skyline yarding costs should not be compared directly to those of systems that have a shorter yarding distance or operate on more favorable terrain. Skyline logging costs can be compared to other systems on a stump-to-dump basis if we include construction of access roads, protection of soil, and other forest values.

Planning Skylines

Now that we are acquainted with the capabilities of skyline cranes and have identified criteria for planning, we can look briefly at how to make a logging plan for single-span skylines.

The planner or logging engineer should have accurate topographic maps. Maps with a scale of 1 inch to 400 feet and a contour interval of 20 feet are best suited for this work. Timber type maps overlaid on a topographic map are necessary for locating skyline roads and cutting units. Aerial photographs in stereo pairs are invaluable aids in locating landings, anchor points, and spar trees.

A planner should also have accurate data on the volume of timber on an acre, maximum size of logs, average size of logs, and percentage of defect. This information is needed when equipment is selected.

When the planner has the above facts, he may begin the actual planning of single-span skylines. In an undeveloped drainage, for example, the planner will identify areas that may be best logged by tractor, high-lead, or single-span skyline. After the road for the main haul has been established, the location of skyline roads and cutting units may begin.

Because time is limited, I refer you to "Planning Single-Span Skylines" (1), for a step-by-step approach. The most important aspect of planning is that each skyline road should be checked for load-carrying capability. This may be done by the chain-and-board method (2) or with a high-speed computer.

The chain-and-board method is practical for small jobs, but a computer may be more practical for layouts with numerous roads. Whether the payload is determined by chain and board or by computer, the calculations are needed to ensure that logs can, in fact, be yarded to a landing. Once this has been established, a preliminary analysis of logging costs is needed to determine profitability.

The next step is a reconnaissance to determine whether the plan on paper fits the ground. If topographic maps are accurate, the remaining work is to mark landings, spar trees, and anchor points. If a map is not accurate, however, the big job is just starting.

Profiles taken from maps that are known to be inaccurate must be verified by traversing each skyline road on the ground. A traverse of each profile may not always be warranted, but any change in topography indicates the need for a traversed profile. Profiles that are traversed on the ground, like those taken from topographic maps, should be plotted and the load-carrying capability determined.

As can be seen by this brief description, the development of plans for logging with single-span skylines is not simple.

Now let us look at an example of such planning. For an area that is being developed for single-span skylines, we first determined that access roads for vehicles could be located for uphill yarding with one end of logs allowed to drag. This method of yarding would result in minimum disturbance to the soil and provide increased load-carrying capability.

The first layout was developed for a live skyline, with a maximum length of 3,000 feet to reduce construction of access road. A second layout was made, with a maximum skyline length of 1,700 feet.

Total area to be harvested was 2,300 acres. Layout for the 3,000-foot skyline required 234 skyline roads and 17.0 miles of access road. The 1,700-foot skyline length required 292 skyline roads and 21.7 miles of access road. Decreasing skyline length from 3,000 to 1,700 feet increased access road by 4.7 miles.

Skyline length and location of access roads may be varied to give the planner the option of trading costs of yarding with costs of access roads. High cost of access roads may offer the opportunity for longer skylines. Other considerations, such as unacceptable disturbance of the soil by construction of access roads, may require longer skylines. The best plan may require evaluation of several alternate layouts. Regardless of how many layouts are made, each skyline road should be checked for deflection and load-carrying capability, as they were in our example.

Costs must also be analyzed for skyline logging just as for any other yarding method. Logging costs related to protection of forest values may conflict. With the logging plan, an administrator has facts at his command for making the decisions rather than having to rely on guesswork in deciding which logging system will best fit the management objectives of the area.

In closing, I would like to emphasize the following points:

1. Initial planning and location, on site, of skyline roads require a much higher degree of engineering than does high-lead or tractor yarding.

2. Planning and layout costs per unit of volume will be much higher for skylines than for conventional logging systems, particularly in partial cuts where yield per acre is low.

3. Short cuts in planning and layout that do not take into account all criteria foin settings that cannot be logged profitably.

4. Plans for logging should be made for a complete drainage before cutting is started to ensure against high-grading choice settings, which makes the remaining timber unprofitable for logging.

5. A visual survey of a hillside is not a substitute for detailed planning.

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