AN ABSTRACT OF THE PAPER OF

DENNIS JOHN STIRLER	_ for the degree ofMASTER_OF_FORESTRY
in FOREST ENGINEERING	presented on
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TITLE: A METHOD OF SELECTI	ION OF CABLE HARVESTING MACHINES FOR VERMONT
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There is much interest in the State of Vermont in cable harvesting. Since there are no time studies available for cable harvesting with various machines in Vermont, it is necessary to arrive at production and cost levels by a different method.

The method chosen for this paper is made up of four parts. In the first part a decision table is used to decide which machine or machines best meet the requirements of the Green Mountain National Forest in Vermont. Second, using the (SAP) program for the HP 9830 desktop calculator, the payloads are found for each machine for a representative profile. Third, using this payload in combination with individual machine characteristics, a theoretical production per day is calculated for each machine. Fourth, yarding costs are constructed for a given set of conditions and this is combined with the production per day to arrive at a cost per MBF for each machine.

In this paper the method for arriving at theoretical production

and thus cost per MBF, is compared against an actual study done with a Smith Timbermaster in Newfoundland. The cost from the model was \$27.82 as compared to \$28.35 per MBF from the study.

Using this method the machines found most suitable for conditions in Vermont that were specified were: 1) Ecologger II, 2) Rosedale Timbermaster, 3) Thunderbird, 4) Smith Timbermaster, and 5) Igland-Jones Trailer Alp. Payloads for a given profile were calculated for each machine. Using these payloads and individual characteristics, a theoretical daily production was calculated for each machine. Each machine was then costed out for situations when a skidder: 1) is required, 2) is not required to clear the landing. Both situations were then calculated twice: using 16% (taxes, interest and insurance) and using 20% (taxes, interest and insurance):- The results show the inter-relationships between payload, production, initial costs, other costs, and the final cost per MBF.

Since under present conditions the initial cost may be as important to a purchaser as cost per MBF at the landing, this study allows the people on the Green Mountain National Forest a chance to estimate what they will be loosing or gaining by buying a particular machine.

A METHOD OF SELECTION OF CABLE HARVESTING MACHINES FOR VERMONT

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A PAPER

submitted to[.]

Oregon State University

in partial fulfillment of the requirements for the degree of

Master of Forestry

May 22, 1980

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A METHOD OF SELECTION OF CABLE HARVESTING MACHINES FOR VERMONT

INTRODUCTION

In the past two years there has been a large amount of interest in the use of cable harvesting systems in the State of Vermont. Initially this was brought about by many factors. Some of these are: declining timber supply, decreasing tolerance for environmental disturbance, increasing logging costs, and increasing demands on forests for lumber, fiber and fuel. This prompted the Vermont Department of Forests, Parks and Recreation to contract with E. Gerry Hawkes of Woodstock, Vermont, to research and write a book entitled, Introduction to Cable Harvesting Systems for Small Timber. Partial funding for this project was provided by the U.S. Forest Service. This publication was prepared as part of the effort of the Vermont Department of Forest, Parks and Recreation to upgrade forest management through improved harvesting methods.

Within the past year the interest in cable harvesting in Vermont has become very intense. This was brought about by the energy crunch. The energy situation has had a two-fold impact. First, it has created a market for fuel wood and in turn an interest in finding better methods of harvesting small wood.

Second, there is a great interest in reducing the amount of fuel required to bring the timber out of the woods. In a study done in Newfoundland by Colbert (1979), it was estimated that there could be a savings in the amount of fuel used of between 5 to 1 and 10 to 1 by using cable systems instead of the conventional tractors and skidders. (Presently, they are using 1 or 2 small tractors, 35 to 45 horsepower, to bunch with a medium skidder, 80 to 100 horsepower, for forwarding of distances of up to 1.5 miles.)

In February, 1979, the Advanced Logging Systems Group of the U.S. Forest Service received a request from the Green Mountain National Forest, Rutland, Vermont, for two students to study the feasibility of advanced logging systems in the Green Mountain National Forest. This paper will present a method to select a machine for cable logging in Vermont.

This paper is divided into three parts. Part one is a step-by-step explanation of the method used to make the selection of a machine. Part two is the testing of the model used in the selection process against a real situation. Part three is the actual application of this method in selecting a machine to cable log in Vermont.

STUDY OBJECTIVES

- Determine the class of cable machine which appears to have application to the Green Mountain National Forest.
- Determine the machine or machines that seem most suitable to the Green Mountain National Forest.
- Carry out an economic evaluation and comparison of cable harvesting systems for the Green Mountain National Forest.

LITERATURE REVIEW

Most previous studies of production rates of skylines have been done in the West (Curtis, 1978, Hensel, 1977, Mann, 1979) and have been done under only one set of conditions. However, Peters and Kellogg (1978) did a summary of production data for the Trailer Alp which may have potential in yarding of small timber. This is a summary of work done in Norway, British Columbia and Oregon (Fjalestad, 1975, Kramer, 1978, McMorland, 1978, Maxwell, 1975, and Neilson, 1977). This paper does point out the difficulty of transferring technology from one geographical location to another.

Kramer (1978) looked at the performance of the Trailer Alp Yarder in clearcutting northwest hardwoods. Studies have been done in the northern hardwoods of West Virginia (Gibson and Biller, 1975, Gochenour, <u>et</u>. <u>al</u>., 1978). Because of the experimental nature of these last two studies, it would be hard to extract a production equation that could be used in Vermont.

Perhaps the study that has terrain conditions closest to those in Vermont is a study done by the Department of Forestry and Agriculture, Newfoundland (Colbert, 1979). This study examined the potential of several skyline machines in Newfoundland.

Mifflin and Lysons (1978) present a breakdown of yarding costs and production elements for skyline yarding that allows a straightforward procedure for determining costs. Seabaugh and Yerkes (1979) present a method of small yarder comparison similar to Mifflin and Lysons (1978), but use "theoretical" data rather than time study data.

Since time study data is not available for all machines that will be examined in this paper, the method used by Seabaugh and Yerkes (1979) was selected.

METHOD

The method of achieving the goals can be broken down into four parts:

- Use a decision table or matrix to decide what machine best meets requirements of the Green Mountain National Forest.
- 2. Use the Skyline Analysis Program (SAP) (Sessions, 1978) or Multispan Skyline Analysis Program (MSAP) (Sessions, 1978) designed for the Hewlett-Packard Model 9830 (HP 9830) desk top computer to arrive at the payload for a representative profile.
- 3. Use gross payload from (2), and individual machine characteristics and size of logging corridor to arrive at a "theoretical" production per day.
- Construct yarding costs and combine this with the production from (3) to arrive at a cost per MBF.

USE OF THE DECISION TABLE

A decision table is a tabular display of all known factors considered significant in making a choice. The table provides an opportunity to quantify the real factors which affect selection, as well as to make a numerical comparison of the relationship between the various pieces of equipment.

A decision table was selected as part of the selection process

because it allows for adjustment as conditions and policies change. This method forces Green Mountain National Forest staff to decide just what attributes they want in a machine. This method provides documentation of the processes that were utilized in machine selection. When the information used in the process changes, a re-evaluation can be readily accomplished.

This procedure consists of the following steps:

- Determine which factors are important in the selection of yarding equipment for a particular location. Gather information that will allow determination of the relative importance between these factors. At the same time, determine which factors <u>absolutely</u> must be met.
- 2. By use of the above "must" factors, determine which equipment will be feasible for the location, i.e., if intermediate supports are needed, machines such as running skylines will not be feasible.
- Perform a comparative rating on each of the feasible pieces of equipment for each factor or group of factors considered important.
- 4. Combine the data developed thus far in a decision table and develop numerical rating for the machines.
- 5. Analyze results. Perform sensitivity tests on results.

6. Make selection.

Selection Of Key Factors For Cable Equipment

Key factors are anything that require a certain configuration of machine or that are important in selecting skyline equipment. For most applications, these factors can be segmented into five groups: 1) physical; 2) economic; 3) environmental considerations; 4) management implications; and 5) safety. When it comes to rating these factors, the factor as a whole can be rated or individual elements can each be rated.

1. Physical Considerations:

A. Terrain--Terrain factors are slope, profile and drainage location. Information on terrain factors for a given area should be collected in the best method possible since these will be the factors which most likely will be "must" factors. Collecting data will entail the use of topographic maps, aerial photos and personal knowledge of the areas to be logged. Map profiles and, if possible, ground profiles should be run. These profiles should be used to determine the slope of the ground as well as give a good idea of intermediate supports which will be needed. Terrain factors may determine the necessity of downhill, as well as uphill, logging. Utilization of photos and topographic maps make it possible to estimate size and availability of landing sites. The person doing the selection should get a feel for maximum reach and average reach that will be required.

B. Stand data--This data eminates from a variety of sources

ranging from personal knowledge to a complete cruise. Whatever the source of information, it will include largest piece, average piece size, variability of piece size, and volume per acre.

2. Economic

The economic comparison of different equipment includes all costs including road costs if additional roads must be built in order to use one type over another. Purchase price is not always the only consideration in making a selection. In fact, it could be argued that low cost per unit of production is a better criteria than low machine price. This does not mean that a detailed costing of each machine is necessary for initial selection. Instead, a relative comparison is made based on experience and judgment which ranks each machine according to cost. Later, a detailed costing is done on the two or three highest ranked machines.

3. Environmental Considerations

Several factors should normally be considered that may influence the decision of equipment purchase. The most commonly considered are stand damage and/or soil disturbance done by both logging and associated landing and road construction. These factors would usually indicate whether you would need full or partial suspension and if you want a short span or a long span machine.

4. Management Implications

Equipment selected on its physical and economic merits alone may adequately meet management requirements. Factors

that should be considered include: availability of parts and service, versatility, and expected life. If all other elements are equal, the equipment that is more versatile or gets better service may be the one selected. Readily available parts may even be a "must" factor.

5. Safety

Almost any type of logging does produce some type of safety hazard. However, some equipment of newer design does give the operator better visability than others. Also, the use of a machine that will need to land logs on the slope rather than on the road prism could create a hazard. These things should be considered.

Factors presented here are not intended to be the only factors that should or would be considered. Factors will differ on a case-by-case basis. Nor are they intended to cover all cases. Those presented here give an idea of what key factors are, and how they are used.

Weighing Factors

After key factors have been selected they are listed and then weighed according to their importance. All "must" factors are separated from the other factors. Remaining factors can then be weighed from 1-5, with 1 being important and 5 being extremely important. These weighing factors will be multiplied by the ratings of each machine for each factor.

Determining Feasible Equipment

Once all "must" factors have been decided, all equipment that is being considered is examined to determine which equipment meets <u>all</u> of the "musts." Any piece of equipment that does not meet them all is no longer to be considered as feasible.

Comparative Ratings for Feasible Equipment for Factors

Now only equipment that can feasibly do the job remains. A comparative rating for each factor considered important is constructed. This is done on any scale as long as the higher the score, the better the equipment. For more information on rating, see Riggs (1977).

Construction of the Decision Table and Numerical Ratings

The table is constructed with the machines listed as columns and the factors as rows. For each piece of equipment the comparative rating for each factor is listed. The weighed rating is then developed by multiplying the rating by the weight of each factor. These weighed ratings are totaled up and each machine is given a rank by total weighed rating. An example of a decision table can be found in Table 5 on page 36 of this report.

Analyzing Results

Once an overall rank has been made it is advisable to cycle back through the process. Sometimes the ranking may point out the criticalness of some factors. If this happens, it is advisable to refine the data used in comparing the equipment. In addition, some other elements can be considered that did not seem too important in the initial selection. If, after going through the process, the selection involves choosing between two equal machines, it must come down to a detailed economic analysis of each machine.

PAYLOAD ANALYSIS

In using the programs (SAP, MSAP), it is important to choose a representative profile to examine. In comparing one machine against another the same profile must be used for each to insure a fair comparison. A fixed set of operational conditions results.

ARRIVING AT A THEORETICAL PRODUCTION

Since time study data is generally from one set of operating conditions for one given machine, it would be impossible to apply this data to a different set of conditions. In addition, most of the data was not collected on a long term basis.

Seabaugh and Yerkes (1979) suggest that a better indication of comparative production potential of different machines is to use known machine characteristics, which govern or limit production potential, and calculate a "theoretical production" for each machine under a fixed set of operational conditions. This allows comparison of different machines using a common base where unknown factors are considered to be similar. This paper uses this method.

Mathematical Formulation for Determining Theoretical Production

Assumptions--Payload calculations were determined by using

the safe working load of the skyline or line pull of the yarder, whichever is less. Practical inhaul speed is 600 feet per minute (fpm) or the actual inhaul speed of the yarder at mid-drum, whichever is less. Analysis of several regression equations for skyline yarding with one end drag indicates that inhaul speeds are very close to 600 fpm. All settings are assumed to be rectangular.

1. Average BF/turn = <u>Gross Payload (1bs.) (HP 9830)</u> 11 pounds/BF ÷ % Turn Making Efficiency
2. Inhaul speed = the smaller of Average Inhaul Speed or 600 fpm
<pre>3. Inhaul Time Min/Turn = External Yarding Distance : Average Outhaul</pre>
4. Outhaul Time Minutes/Turn = <u>External Yarding Distance</u> : 2
Average Outhaul Speed (fpm)
5. For mechanically operated slackpulling carriages: Lateral
Min/Turn = (0.005) (Lateral Distance) + 0.37 minutes
5a. For manually operated slackpulling carriages: Lateral Time
Min/Turn = $(0.005 \text{ Lateral Distance}) + 0.67^{2/}$ minutes
6. Hook/Unhook Min/Turn = (0.0005) (Average BF/Turn) + 0.93 minutes <u>3a</u> /
7. Cycle Min/MBF = <u>Inhaul Time + Outhaul Time + Lateral Time +</u> BF/Turn
Hook/Unhook Time x 1000
<pre>8. MBF/Road = External Horizontal Yarding Distance) x (External 43560</pre>
<u>Horizontal Lateral Distance) x (MBF/Acre)</u> x 2
9. Road Change Min/MBF = <u>Road Change Time</u> MBF Road
10. Total Min/MBF = Cycle Min/MBF + Road Change Min/MBF
<pre>11. Production MBF/Day = Production Min/Day (excluding delays & Total Min/MBF</pre>
<u>Maintenance)</u>

1/This whole formulation from Yerkes and Seabaugh, 1979.

 $[\]frac{2}{1}$ This is the same as #5 except that .3 min/turn were added on to account for manual operation.

<u>3a</u>/Dykstra, D.P., 1976.

This process was programmed on the HP 9830. The inputs needed are as follows:

- 1. Gross Payload Obtained from the HP 9830 (SAP, MSAP) program.
- 2. Percent Turn Making Efficiency Equal to allowable gross payload divided by the average actual payload per turn. For most machines this is between 40% and 75%. When this data is not available, assume the same value for all machines to be examined.
- 3. Inhaul Speed Obtained from the yarder specifications. Most of the time the inhaul is given both for full and empty drum. The speed that most closely reflects the conditions of drum during inhaul can be used or a person can interpolate somewhere inbetween these two values.
- Outhaul Speed Obtained in a manner similar to inhaul speed.
- External Yarding Distance The horizontal distance from the yarder to the tailhold on the representative profile for which the payload was calculated.
- 6. Carriage Type Types of carriages that was used in the payload calculation and slack is either "mechanically" or "manually" pulled in the skidding line. Since it is a must that we partial cut, this means that the carriage must be a slackpulling carriage.
- 7. Lateral Distance The distance that the skidding line is pulled to the side of the skyline corridor. This varies, but is usually between 50 feet and 150 feet. This also varies with the amount of skidding line that can be

pulled through a given carriage.

- 8. Volume Per Acre This should be the volume per acre that you wish to designate as a set operating condition and will be the same for all machines to be examined. This should also be representative of the area you are examining.
- 9. Road Change Time The time in minutes that is required to move the lines and/or yarder from one skyline road to the next. In many cases, this can be obtained from time studies for given machines or personal knowledge.
- Productive Minutes Per 8-Hour Day The amount of time the machine is actually working excluding delays, maintenance and breakdowns.

CONSTRUCTING YARDING COSTS

Items included in cost construction are as follows:

 Depreciation Cost - Calculated for all machines (yarder, tractor, etc.) that are needed to log. Also calculated for radio transmitters, carriage and rigging hardware. Depreciation per hour is equal to new cost plus the cost of freight, minus the residual value, all divided by life in hours.

2. Operating Costs -

- A. Maintenance and Repair calculated as a percent of the depreciation.
- B. Fuel and Lubrication cost for fuel and lubrication for all machines.

C. Labor - total cost to operator including fringe benefits.

3. Fixed Costs -

- A. Move-in Costs calculated by taking the hours to move in, times the sum of the cost for the side, plus the cost of the moving vehicle and driver.
- B. Initial Rig Up equals the hours to move in, times the cost per hour of the side.
- C. Rig Down found in the same manner as cost to initially rig up.
- D. Move Out Costs found in the same manner as move in costs.
- E. Engineering Labor cost to run skyline corridors.
- F. Line and Choker Costs for both line and chokers, cost is found by dividing the cost of each line by its life in MBF and multiplying the result by the sale volume in MBF.
- G. Taxes, Interest and Insurance calculated as a percent of average investment. Average investment is calculated as one half of the sum of the new cost, the salvage value and the depreciation for one year.

All costs except fixed costs are calculated in cost/hour. Fixed costs are first calculated as total costs. Then the volume of the sale is divided by the production per day and the result is divided into the total fixed costs to arrive at a fixed cost per day. Other costs are multiplied by 8 to arrive at a cost per day.

For an example of this calculation, see Appendix I and II.

TESTING OF THE MODEL

To test this system, data provided in a publication, "Cable Logging Trials in Newfoundland, 1978," by K.S. Colbert, was used. This study was done on the Smith Timbermaster yarder, manufactured by G.R. Smith (Engineers), Ltd., Aberfuldy, Scotland. Information needed, but not available in this publication, was obtained by personal communications with K.S. Colbert. A summary of the necessary facts follows:

A. Site Characteristics:

1. Concave slopes (25-40%)

2. External yarding distance - 920 ft.

3. Lateral yarding distance - Average 50 ft.

4. Average road change time - 45 min. (downhill)

B. Machine Characteristics:

1. 24 ft. spar

•		Ci	1	_ <u>Spe</u>	ed	
2.	Lines	Size	Length	<u> </u>	_Full	
	Skyline	1/2" (Sweged)	1475 ft.	-	-	
	Mainline	3/8" (Sweged)	1475 ft.	492	885	
	Haulback	3/8" (Sweged)	3000 ft.	510	1770	
	Strawline	1/4" poly	4000 ft.	-	-	

3. Manual Carriage (Wt. 80 lbs.)

4. 4-6 chokers

C. Stand Data

- 1. .10-0.15 m³ per tree $(3.53 \text{ ft}^3 5.30 \text{ ft}^3)$
- 2. Vol/Acre 200 m³/hour (2859 ft³/Ac.) \approx (12,990 BF/Acre)

D. Crew - 1 operator

1 chokersetter

.5 feller to set chokers

Using site characteristics, a profile was created with a concave slope 925 feet long and a slope that ranged from 15% to 35%. Figure 1 on Page 21 is a graphical representation of this profile. This profile was analyzed using SAP for downhill logging with the Smith Timbermaster. Table 1 on Page 22 lists profile data and gives an example of the printout for the SAP program. Using a loaded carriage clearance of 6 feet, the result was a dragging load of 2009 lbs. (200 lbs. is used here).

THEORETICAL PRODUCTION FOR THE SMITH TIMBERMASTER

Inputs:

1. Gross payload - 2000 lbs.

2. Percent Turn Making Efficiency

Turn making efficiency is based on the fact that 4-6 chokers were used and the volume of each tree was between 3.53 ft³ and 5.30 ft³.

Largest Load: 5.3 ft³ x 6 = (31.80 ft³) Weight of trees = 50 lbs./ft³ Largest payload = 31.80 ft³ x 50 lbs./ft³ = 1590 lbs. $\frac{1590 \text{ lbs.}}{2000 \text{ lbs.}} = 80\%$ turn efficiency

It was assumed that with smaller trees, more chokers (6) would be used.

Therefore, 3.53 ft³ x 6 = 21.18 ft³ 21.18 ft³ x 50 lbs./ft³ of wood = 1059 lbs. $\frac{1059 \text{ lbs.}}{2000 \text{ lbs.}}$ = 53% turn making efficiency

Using this reasoning the turn making efficiency of between 53% and 80%. For this test 60% was used.

3. Inhaul Speed - Use mid-drum of 690 fpm.

4. Outhaul Speed - Use mid-drum of 1140 fpm.

5. External Yarding Distance - 925 ft.

6. Carriage - Manual (load locking).

- 7. Lateral Distance 50 ft.
- Road Change Time 45 min. based on 30-40 min. leaving haulback in place and 1 hour when haulback needed to be changed.

9. Volume Per Acre - 12.9 MBF.

Productive Minutes Per 8 Hour Day - 338 min. Based on 29.4%
 downtime from study.

Additional Assumption

One minute was added to the hook and unhook times/turn because this machine has no chaser while Seabaugh and Yerkes assumed there would be a chaser. The operator must lock yarder, walk out to chokers, unhook chokers, return to yarder and begin outhaul.

This one minute must account for only the additional time it takes without a chaser. This time can be broken down into 3 groups:

 Time for yarder operator to leave the machine and walk to logs and back. This is estimated to be between .25 and .35 minutes.

- 2. Time it takes the operator to sort the deck. This involves flattening the deck or moving logs so that further logs can be landed safely. This is necessary due to the short tower. A chaser would normally do this during the yarding cycle. This amounts to .36 minutes/turn (Neilson, 1977).
- 3. Time needed to correct decking problems. In Neilson's study this is classified as a delay. However, a chaser could prevent most of these delays. These delays account for 3% of total time (Kramer, 1978). For this study, this amounts to .18 minutes.

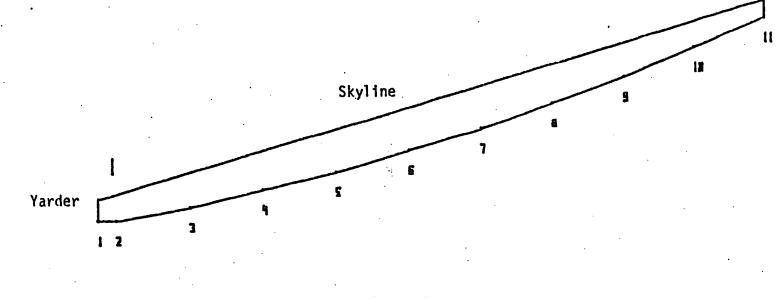
These three total .89 minutes (.35 + .36 + .18). This is only for the case where the operator only walks out to each turn once. If it is necessary to walk out to a turn twice due to something such as a pinched choker, then an additional .35 minutes must be added. This would then be 1.24 minutes. For these reasons, it was felt that one minute was a fair estimate of the additional time due to the lack of a chaser.

RESULTS

The stated values were input to the production program to arrive at a theoretical production of 8.65 MBF/day. The test study had an actual production of 8.67 MBF/day.







Scale 1 inch = 130 ft.

TABLE 1. PROFILE DATA AND SAP OUTPUT FOR TEST.

		Profile Data		
PROFILE	1			
TERRAIN POINT X	COORD	Y COORD	SLOPE DIST	% SLOPE
1 2 3 4 5 6 7 8 9 10 11	1 26 124. 8936353 222. 9517029 321. 0097704 418. 0240204 515. 0382705 610. 8208990 706. 6035275 300. 9893631 895. 3751988	20 20 34. 33404529 54. 4456588 74. 05727232 98. 31083483 122. 5643973 151. 2991859 130. 0339744 213. 0690169 246. 1040594	25 100 100 100 100 100 100 100 100 100	0 15 20 25 25 30 35 35 35
LIVE SKYLINE LOP		Data Input	MPTION)	
ALLOWABLE SKYLI	NE TENSION=	10630		
SKYLINE WT= HEADSPAR HT= HEADSPAR T.P. = INN YARD LIM=	0.54 24 1 1	MAINLINE WT= TAILSPAR HT= TAILSPAR T.P. OUT YARD LIM=	20 = 11	
CARRIAGE WT= LOADED CARRIAGE	80 CLEARANCE=	8		•
TERRAIN POINT	LOG LOAD KELY	/> LOG LOAD (DRAG) LINE	LENGTH
2 3 4 5 6 7 8 9 10	7690 2710 1876 1694 1534 1574 1574 1324 2319	11535 4065 2315 2540 2300 2361 2352 2736 3473	93 92 92 92 92 92 92 92 92 92	6 5 5 5 5 5 4
NFW YF REQD F	PAR LOCATION ARDER SPEC RIGGING LENGTH ING SKYLINE PL			

нем 5PAR LOCATION NEW YARDER SPEC = 1 REQD RIGGING LENGTH = 2 STANDING SKYLINE FLOT= 3

PEQD RIGGING LENGTH = 2 STANDING SKYLINE PLOT= 3

STATION	LOG LOAD (FLY)	LOG LOAD (DRAG)	CLEARANC
90 ·	2418	3628	15
180	1720	2560	13
269	1462	21.92	13
359	1357	2035	13
448	1340	(2009)	12
538	1396	2093	- 11
627	1541	2312	. 9
717	1349	2774	8
896	2641	3962	6
2.10	SU SPAR INCATION	* A	

STANDING SKYLINE PAYLOADS (BASED ON MIN LIVE SKYLINE LENGTH)

2	8100	12150	933
3	2908	4361	927
4	2005	3007	926
5	1798	2697	926
6	1629	2444	925
7	1671	2507	925
8	1677	2516	925
. <u> </u>	1965 200	2947	925
10	2567	3359	924
	NEW SPAR LOCATION	=.0	
	NEW YARDER SPEC	= 1	

CLEARANCE

TERRAIN POINT LOG LOAD (FLY) LOG LOAD (DRAG) LINE LENGTH

INN YARD LIM= 1 CRERIAGE NT= 30 LOADED CARRIAGE CLEARANCE= 6

. . . 0.54 MAINLINE WT= SKYLINE WT= 0.35 HEADSPAR HT= TAILSPAR HT= 20 24 TAILSPAR T. P. = HEADSPAR T. P. = 11 1 OUT YARD LIM≢ · 11

ALLOWABLE SKYLINE TENSION= 10620

LIVE SKYLINE LOAD ANALYSIS (RIGID LINK ASSUMPTION)

COSTS

An explanation of costs used in this analysis is presented in Table 2. These costs should be for the most part self-explanatory.

Depreciations

In Table 2, yarder cost includes carriage. Tractor cost is for a tractor delivered at the site.

Operating Cost

Information for maintenance, repair, fuel, and lube were taken from U.S. Forest Service Timber Appraisal Handbook, Sec. 2409.22 of the Forest Service Handbook.

Labor cost were extracted from Table 3, page 26 of this paper. Labor cost include \$1.39/hour for fringe benefits. Labor cost shown for the hooktender is actually one-half the rate of a feller. This was done because in the study one feller worked part-time as a chokersetter. The feller does not make the same as a chokersetter so he is represented as a hooktender.

Fixed Costs

The study started at the site so there was no move in and move out figured. All cost of lines were as per a letter from Wire Rope Industries Ltd., of Vancouver, B.C., dated May 18, 1977. The machine was purchased in the fall of 1977.

Insurance and Taxes

Found as a percent of average investment.

TABLE 2. EXPLANATION OF COST FOR THE SMITH TIMBERMASTER.

.

	-				LIFE	
EQUIPMENT	NEW	RESIDUAL	FREIGHT	YRS	HRS	\$/HR
APDER	32000	00 3300, 00	0.00	7	7163 4.	14
AD DU/TRANS	0 00	0.00	0000000	4	6400 0	99
ARRIAGE	0 00	0,00	00000000	4.	6400 0.	99
IPSCTOR	a oo	0.00	0.00 é	5	9690 0.4	313
DG. HPW. TT	0.90	0. 99	0000000	4	6499 8.	99

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TOTAL DEPRECIATON COSTS = 4 14 /HR

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8. OPERATING COSTS

MAINTENANCE

AND

REPAIR	EQUIPMENT	XOF DEP.	\$∕H0UR
	YARDER	50	2, 97
	RADIO	60	0. 0 0
	CARRIAGE	50	0.00
	TRACTOR	59	0.00
	RADIO CONT	. 69	0.90

SUBTOTAL 2. 07

FUEL AND LUBRICATION	EQUIPMENT	\$ZHR
	YARDER TRACTOR	1.90 0.00

SUBTOTAL 1. 90

VARDING LABOR(TITLE)	HOURLY RATE	NUMBER	TOTAL COST/HR
	•		
HOOK TENDER	3, 48	1	3. 48
CHOKEP SETTER	7.30	1, 00	7.30
CHASER	0, 00	1	0,00
VARD ING ENGINEER	7.67	1	7.57
SKIDDER OPERATOR	0.00	1	0.00

SUBTOTAL 13.45

C. FIXED COSTS MOVE IN 0.00 HOURS FOR SIDE, VEHICLE AND DRIVER 26.57 + 0.00 * 0.00 = 0.09 INITIAL RIG UP 2.00 HOURS FOR SIDE = 53.13 SAME AS RIG UP 53, 13 RIG DOWN MOVE OUT SAME AS MOVE IN 0.00 ENGINEERING LABOR = 0.00 CHOKERS. 14 00 EACH COST OF CHOKERS = (SALE YOL) * (COST EACH)/LIFE MBF COST OF CHOKERS = 65. 52 OPERATING LINES(EPS) LINE \$1/FT SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (#/M) MAINL) NE 0.50 9.38 1500.00 750.00 8. 00 0.09 HAULBACK 2000.00 1509.00 4. 00 0.50 0. 28 0. 38 SKYLINE 0.67 0.50 2000.00 1340.00 3.00 0.17 SKIDDING 0.00 0.00 0.00 0.00 0.00 0.00 4000.00 6. 00 STRAW INE 0.25 0.05 0.07 289. 99 SLACK PULLING 0 00 0 00 0.00 0.00 -0.00 0.00 0.00 OTHER LINE 0.00 0. 90 0,00 9, 99 0.00 SUBTOTAL : 0.68 /M * 468.00 -319. 61 10TAL F1XED COSTS = 491.39 . Ð. INSURANCE AND TAXES AVERAGE INVESTMENT = (NEW COST + RESID. + DEPP.)/2 INSURANCE AND TAKES = 0.12 % + AVE. INVEST. (20271.43) > INSURANCE AND TAKES = 2.38 \$/HR

where any content operator and a state and a ******* YARDING COST SUMMARY where a set of the interval of the set set of the set o CALCULATED MOF/DAY 8. 65 DEPRECIATION/8 HR. DAY 33. 15 OPERATING COST/8 HR. DAY 179.37 FIXED COST 28 HR. DAY 9.08 INSURANCE AND TAXES28 HR: DAY 19.00 TOTAL COST/8 HR. DAY 240.61 COST/MBE 27. 82 en de relación de secole se sela se

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TABLE 3. COST FOR SMITH TIMBERMASTER FROM TEST CASE (Colbert, 1979).

AVERAGE DAILY PRODUCTION - 54 m^3 (stacked)

Operator	\$6.28/h x 8 x 1	\$ 50.24
Chokerman	5.91/h x 8 x 1	47.28
Fellers	5.56/h x 8 x 2	88.96
C.O.L.A.	0.87/h x 32	27.84
Fringe Benefits	11.10/day x 4	44.40
Camp Cost	6.00/day x 4	24.00
Chain Saw s	7.50/day x 2	15.00
Equipment Rental	12.25/h x 8	98.00

Supervision, foreman, and assistant
Based on 12 machine operation 27.00
including transportation

TOTAL Daily Cost \$422.72

The cost per MBF from the printout is \$27.82.

Cost from Study

To arrive at the cost from the study, the information from Table 3 was used as a basis and adjusted as follows:

Cost which should not be included in yarding cost

1.	1.5 Fellers salary at \$44.48/day	. \$ 66.72
2.	C.I.A./day	27.84
3.	1.5 Fringe Benefits at \$11.10/day	16.65
4.	Camp Cost/day	24.00
5.	Chain Saws	15.00
6.	Supervision	27.00
•	/	
	· · · · · · · · · · · · · · · · · · ·	\$177.21
Total Daily Cost (Preceding Page, Table 3)		\$422.72
Adjusted Daily Cost = \$422.72 - \$177.21 = \$245		\$245.51
Adjusted cost/M ³ = $\frac{$245.51}{2}$ = \$4.55/M ³		

54M³

Adjusted Cost = \$28.35/MBF

Summary of Test Case

The model came remarkedly close to study data. It had been intended to use the turn making efficiency to calibrate the model, however, there was no need. Turn-making-efficiency, hook and unhook time were the only inputs that the study did not actually state.

TABLE 4. RESULTS FOR TEST OF MODEL.

SOURCE	PROD. PER DAY	COST/MBF
Newfoundland Study	8.67 MBF	\$28.35
HP 9830 Model	8.65 MBF	\$27.82

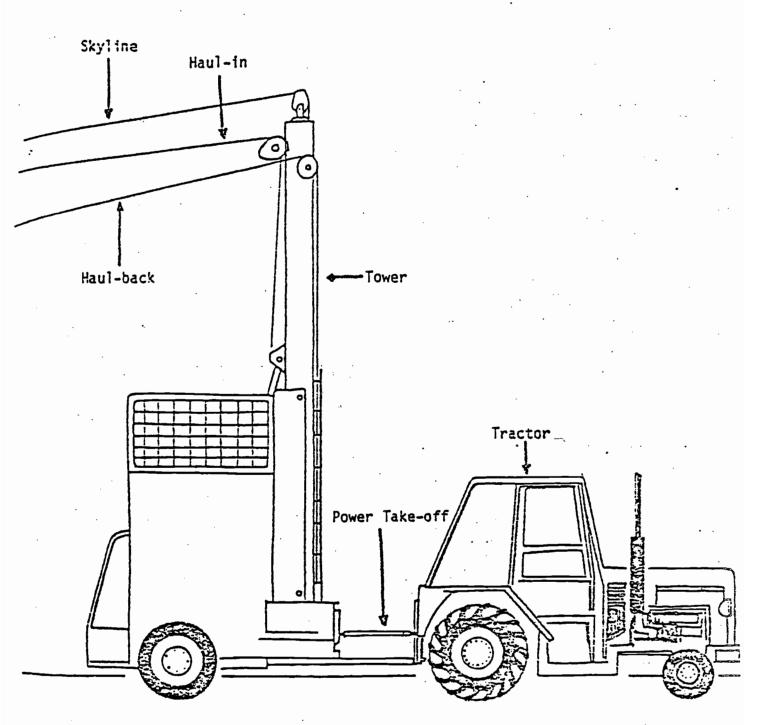


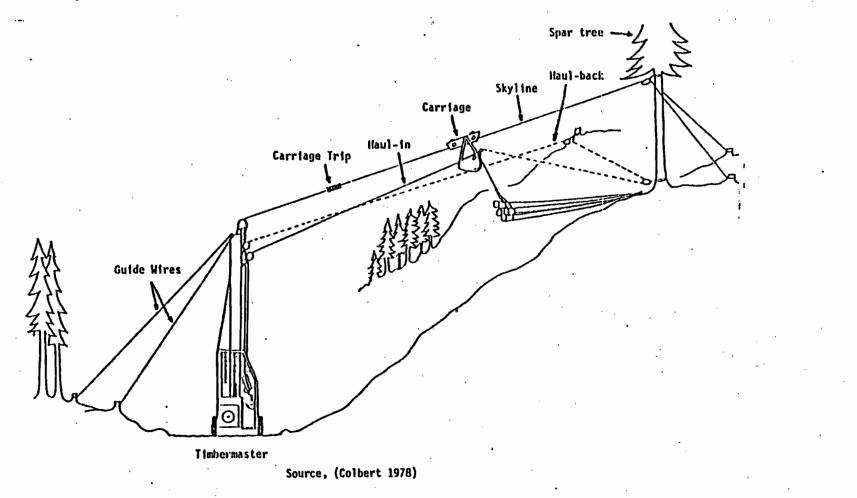
Figure 2. Smith Timbermaster Cable Logging Machine.

Fimbermaster

Source, (Colbert 1978)



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Assumptions that were made worked well. Although the closeness of the model to actual test data may be due to compensating errors, this means that if data used in this model is good, it will predict production in an acceptable model. This model should serve as a good basis for comparing different yarders under similar conditions. Once the test was complete, the next step is to apply the model to the study area.

SELECTION OF A YARDER FOR VERMONT

CONSTRUCTION OF DECISION TABLE

Data to build the decision table was obtained from two sources:

- The Green Mountain National Forest (in particular the Rochester Ranger District) was sent a copy of how to do a decision table and asked to decide on what was needed in their area. They replied as follows:
 - A. Must Factors

1. Capable of multispan

2. At least a 1000 foot reach

- 3. Capable of logging both uphill and downhill
- 4. Capable of partial cut for shelterwood harvesting

B. Key Factors

1. Capable of partial suspension

C. Weighing Factors for Key Factors

1. Highest for partial suspension

D. Other Important Data

1. Minimum log length - 8 feet

2. Maximum diameter of log - 30" small end

3. Average saw log diameter - 14" - 16" small end

2. Personal contact with loggers both during a one month stay in Vermont during the summer of 1979, and while attending a meeting on Cable Logging Systems for New England held on the University of Massachusetts during January of 1980. The major concerns voiced were as follows:

- 1. Low initial cost
- 2. Easy to repair
- 3. Easy to use

All of these factors must be considered in the decision table to assure that both the Forest Service Requirements are met and that it will have a chance of being accepted by the industry.

First, the cable machines that meet all of the must factors were selected. Since, for all intents and purposes, running skyline systems cannot be used with an intermediate support, these systems were disregarded. In addition, the requirement of downhill logging means that a machine must have at least 3 working drums, and last, the machine must have a 1000 foot reach. There are many machines that meet these requirements. Since it has been accepted that it is not economical to log small timber with large standing skylines in the West, it is safe to assume that it would not be economical to do so in Vermont. For this reason they will not be considered. The following is a list that meet the "musts:"

- A. Standing Skyline Yarders
 - 1. Smith Timbermaster
 - 2. Rosedale Timbermaster
 - 3. Highland Trailer Alp
 - 4. Mini Urus Class I
 - 5. Urus Yarders Class II, III and IV
 - 6. Koller 800
 - 7. Ecologger II

8. Timber Tower

B. Skyline Cranes

1. Wyssen Skyline Crane

2. Baco Skyline Crane

3. Joby Combi Cat C-1000/52

4. Vinje K-1200

C. Running Skylines with Optional Skyline Drum

1. Washington 78SL

2. Skagit - 717

3. M.A.C. Thunderbird

In order to simplify the decision table, the yarders with similar characteristics are grouped.

Group 1 - European Trailer Mounted (Smith Timbermaster,

Igland Jones Trailer Alp)

<u>Group 2</u> - Small European Trailer Mounted (Mini Urus)

<u>Group 3</u> - Medium European Truck Mounted Yarders (Urus Yarders -Class II, III, IV and Koller 800)

<u>Group 4</u> - Rosedale Timbermaster (Skidder mounted with a knuckleboom loader)

<u>Group 5</u> - North American Skidder Mounted Yarders (Ecologger II, Timber Tower)

Group 6 - Skyline Cranes (Wyssen, Baco, Jobu and Vinje)

<u>Group 7</u> - Running Skylines with Optional Skyline Drum (Washington 78SL, Skagit 717)

Group 8 - M.A.C. Thunderbird (four drum yarder)

TABLE 5. DECISION TABLE FOR VERMONT.

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	1		2 3		4 5		6		7 8		8					
•.	R**	WR*	R	WR	R	WR	R	WR								
5* - Economics (Init. Cost)	80	400	90	450	60	300	70	350	60	300	40	200	30	150	40	200
5 - Environmental (Par. Susp.)	60	300	30	150	80	400	60	300	70	350	60	300	70	350	80	400
5 - Payload (at least 2050 lbs)	50	250	30	150	70	350	70	350	70	350	90	450	80	400	90	450
3 - Ease of Repair	70	210	50	150	50	150	70	210	80	240	60	180	50	150	60	180
3 - Parts Availability	70	210	50	150	50	150	70	210	80	240	60	180	60	180	60	180
3 - Ease of Use	70	210	50	150	40	120	70	210	70	210	40	120	60	180	60	180
I - Safety	80	80	60	60	70	70	70	70	70	70	60	60	90	90	90	90
WT RATINGS	16	60	1	260	154	10	170	0	17	60	149	90	15	600	1	680
Rank	4		8		5		2		1		7		6	[3	

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*5 = Weighting Factor **R = Rating *WR = Weighted Rating

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100 = Excellent 80 = Good 60 = Fair 40 = Poor 20-0 = Critical Rating Values:

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Weighing Factors

Economics, environmental and payload were given most weight since they are most nearly "must" factors. Ease of repair, parts availability and ease of use are given the next highest weighing since they are not necessary, but still affect the choice of a _____ machine. Safety, although important, is given the lowest weighing since the difference between machines is very small.

A decision table was then constructed (see Table 5, page 36). Only 100 points separated the top four groups. It was, therefore, decided to look at all four. The machines that will be considered further are as follows:

- Group 5 Ecologger II (the timber tower will not be evaluated because it is no longer in production)
- 2. Group 4 Rosedale Timbermaster
- 3. Group 8 M.A.C. Thunderbird
- Group 1 Smith Timbermaster and the Igland-Jones Trailer
 Alp

A brief description of these five machines can be found in Appendix V.

PAYLOAD ANALYSIS

Downhill profiles were examined since Vermont timber staff expressed this as a main interest. Ten downhill profiles in the area of interest that could be logged from the current road system were analyzed, using the SAP program for the HP 9830. For the analysis the Smith Timbermaster was used. The average payload for a dragging load for this machine in the standing skyline configuration was about 2000 lbs., which also corresponded to the load used in the test case. A profile was then selected that gave about this payload and seemed to be representative of the profiles examined. The data for this profile and a plot of this profile can be found on pages 37 and 38. The plot also contains a graphical representation of the Timbermaster tower and skyline.

Using the Skyline Analysis Program, payloads for all remaining four yarders were calculated. The computer printout for the analysis of the five machines on the representative profile is presented in Appendix III. Analysis was done using a safety factor of three and the safe working loads for Extra Improved Plow Steel Lines, except for the Smith Timbermaster for which sweged rope was recommended. The results are as follows:

	Payload in Pounds
Thunderbird	6878
Ecologger II	5146
Rosedale Timbermaster	2694
Smith Timbermaster	1964
Igland-Jones Trailer Alp	2615

THEORETICAL PRODUCTION

To determine theoretical production of the machines that were selected it was decided to use a turn making efficiency of .6. From the best case and other literature this seemed to be a reasonable estimate. Although turn making efficiency probably does vary for different machines under similar conditions, at present there is no way to predict what that difference may be.

TABLE 6. PROFILE DATA FOR REPRESENTATIVE PROFILE.

SKYLINE ANALYSIS PROGRAM (SAP) ***PROGRAM TO ENTER, PLOT, AND ANALYZE PROFILE***

THE FOLLOWING PROFILE DATA INPUT MODES ARE AVAILABLE

INPUT MODE 0 - DIGITIZER INPUT MODE 1 - (X,Y) COORDINATES INPUT MODE 2 - SLOPE DIST, % SLOPE INPUT MODE 3 - TAPE FILE

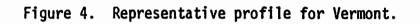
PROFILE DATA RETRIEVAL

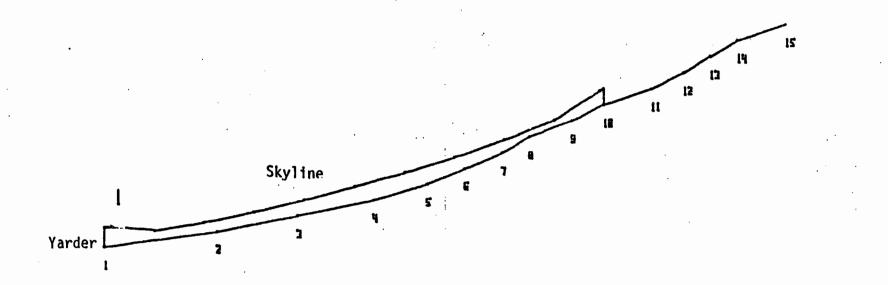
¢

FPOFILE, 1 (FILE 2)	
T P # X 000RD Y	09000
1 0	5999
2 198	5020
3 338 .	5040
4 470	5060
5 564	5080
6 630	5100
7 696	5129
8 743	5140
9 818	5160
10 874	5180
11 958	5200
12 1014	5220
13 1062	5240
14 1110	5260
15 1194	5280

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Scale 1 inch = 175 ft.

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Therefore, to avoid biasing the results, it was decided to assume the same factor for all the yarders.

Inhaul and outhaul speeds were found for individual machines from the specification sheets (see Appendix VI).

Length of the skyline road was taken from profile data for yarding between terrain points 1 and 10. Horizontal distance of the skyline road came out to 874 feet.

Lateral yarding distance was set at 50 feet and was chosen because this is a common distance that one could expect the chokersetter or hooktender to pull slack in the line.

A road change time of 90 minutes was used for two larger machines (Thunderbird and Ecologger II) while 60 minutes was used for the three smaller machines. Although this also varies from machine to machine and the figures that were chosen may not be exact, it does recognize that there is a difference in time required for different size machines. The 60 minutes for the smaller machines seems to be reasonable based on several studies for various machines (Kramer, 1978 and Colbert, 1978) for other than clearcuts which would require shorter times since in many cases the haulback could be left in place for at least some of the raod changes.

A productive minutes per 8-hour day of 330 was used for all calculations. This was based on the studies of Colbert, 1979, and Seabaugh and Yerkes, 1979. Although some machines have less downtime than others, unless there is data to back up a decision to vary the productive time per day for different yarders, it would be unwise to do so and could add bias to the results.

For the two machines (Smith Timbermaster and Igland-Jones Trailer Alp) for which the yarder operator acts as chaser, one minute per turn was added to the unhooking time.

The above mentioned data was combined with the payloads of each machine to arrive at their theoretical production. A copy of the program used to arrive at theoretical production and printout of the results and inputs are found in Appendix IV. The results of these calculations are as follows:

Yarder	Production Per	8 Hour	Day
Thunderbird	22.22	MBF	
Ecologger II	17.70	MBF	
Rosedale Timbermaster	12.94	MBF	
Igland-Jones Trailer Al	9.81	MBF	
Smith Timbermaster	7.77	MBF	

CONSTRUCTION OF YARDING COSTS

Yarding cost was constructed to try to represent, as nearly as possible, the conditions found in Vermont. Six MBF/Acre and 750 MBF total sales volume are used in the calculations. With 6 MBF/Acre on an 874 foot skyline road with lateral yarding 50 feet on either side of the corridor, a volume of about 12 MBF will be brought into each landing. Since many of the profiles previously examined started out fairly flat, it may be possible to deck the wood on the side slope and not require a skidder to swing the wood out from under the skyline. For this reason both cases (with and without a skidder) were computed. Since the volume per landing would be quite low, a used skidder was allowed for at a cost of \$10,000.

For both the Igland-Jones Trailer Alp and the Smith Timbermaster, the cost used for the yarder included a John Deere 2640 farm tractor. Since all of the other cost of yarders were for new costs, it was important to use new costs for the yarder and the tractor in order not to bias the results.

It is very difficult to decide how much should be allowed for interest, taxes and insurance. This is usually expressed as a percent of average investment. Since this could have a large impact on the outcome of the comparison, two cases were examined; one using 16% and the other 20%. Under current conditions it is probably closer to 20%. By doing both cases, it gives the reader an idea of the sensitivity of the cost per MBF for each machine to a change in interest and can be used to adjust the cost to each individual case.

Almost all costs used were from the Forest Service Handbook, section 2409.22 R6, entitled, "Timber Appraisal Handbook, Siuslaw Supplement No. 99 of February, 1980." There were three exceptions: 1) labor costs used were estimated from data gathered in Vermont; 2) new cost for the Smith Timbermaster and the Rosedale were arrived at using cost from 1978 and multiplying by 1.14. This factor was arrived at by using other cost that were available for both times (1978 and 1980); and 3) shipping costs were estimated using information obtained from the Southern Pacific Transportation Company. All costs quoted are as of March 1, 1980.

In the cases without the use of a skidder, a crew of two was considered for the Trailer Alp and the Smith Timbermaster while a crew of three was considered for the Rosedale Timbermaster and the Ecologger II. The Thunderbird was examined using a crew of four. When considering the cases using a skidder, one person was added to each crew.

Cost computations for each case was accomplished using the HP 9830 program found in Appendix VII. Printouts of the yarding cost computations without a skidder is found in Appendix I, while those for the cases using a skidder are found in Appendix II. A summary of these results were found in Table 7. COST/MBF

TABLE 7. SUMMARY OF COSTS.

· · ·	WITHOUT S	KIDDER	WITH SKIE	DDER	Initial Cost	
	Taxes of In 16%	terest & Ins. 20%	Taxes of Int 16%	erest & Ins. 20%		
Ecologger II	31.80	33.15	38.03	39.38	\$182,390	
Rosedale Timbermaster	. 31.54	32.38	*	*	\$ 82,000	
Thunderbird	36.49	37.87	42.75	41.37	\$235,000	
Smith Timbermaster	38.04	39.17	51.98	53.11	\$ 66,000	
Trailer Alp	37.00	38.04	48.02	49.06	\$ 73,000	

* Same as without skidder. Loader can deck so skidder is not necessary.

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DISCUSSION AND SUMMARY

From the table for cost without skidder, it seems that within the accuracy of this study there is virtually a tie for lowest cost between the Ecologger II and the Rosedale Timbermaster. The remaining three machines are tied for third. In the case where the skidder is used to clear the landing, the Rosedale Timbermaster came out by far the best since by using the knuckleboom loader mounted on it, it becomes the only machine that does not require a skidder. It should also be noted that the increase that is realized by adding a skidder to the two larger machines (Ecologger II, Thunderbird), is only about one-half of the increase realized with the other two machines. This is mainly due to the fact that the production per day for the larger machines is considerably greater and thus the increased costs are spread over a larger volume. The Smith Timbermaster seems to come out worst for several reasons. First, it has the smallest skyline size of all the machines, and second, it is tied with the Igland-Jones Trailer Alp for the shortest tower. Both of these add up to a smaller payload for this machine, and therefore, less production. However, the Smith Timbermaster has the lowest initial cost. At times, initial investment on equipment may dictate use of equipment that may not give the lowest cost per MBF at the landing. The Smith and the Igland-Jones Trailer Alp also have the advantage that the purchaser may have a new or used skidder or tractor already and need only to purchase the yarder. Also, it may be possible to use a skidder to power these yarders and disconnect it and use it

to clear the landing at the end of the day. This could be possible since they would be accumulating less than 10 MBF per day on the landing.

As pointed out, Smith Timbermaster was shown to have the smallest payload due to its small skyline (1/2 inch). However, it is capable of holding 2000 feet of line on the skyline drum. This indicates that it could hold slightly over 1300 feet of 5/8 inch skyline. This would be adequate for most cases we would be considering. A recommendation for this change of line size was not found in the literature search. For this reason, it was not examined using this line size, but may be possible since the Rosedale Timbermaster is quite similar and does use 5/8 inch line. If line size change would turn out to be feasible, indications are that the Timbermaster would fall between the Rosedale Timbermaster cost and the Thunderbird. This is because it would have the payload of the Trailer Alp, with faster line speeds and also be the lowest in initial costs. Since this depends on the strength of the tower and guylines, this procedure cannot be recommended without an approval of the manufacturer. This may be taken into account when the purchase of a Smith Timbermaster is considered.

I would like to emphasize that these conclusions are only for the given set of conditions and may not be true for other conditions.

NOTE: Commercial trade names of yarders have been used so that the reader can readily identify machines with known characteristics. The mention of trade names does not constitute endorsement or recommendation for use.

In addition, it should be noted that Forest Service skidding costs do not contain interest, taxes and insurance. Interest in Forest Service appraisals is accounted for under profit and risk. Taxes and insurance are accounted for under overhead. Anyone wishing to compare the yarding cost in this study with skidding cost from the Forest Service appraisal must adjust the appraisal cost accordingly. 48

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APPENDIX 1

YARDING COST COMPUTATIONS (without skidder)

Igland Jones Trailer Alp

								LIFE	
TOUTPMENT	NEM		PESID	JAL	FRE	юнт	ve s	HRS	\$/HR
VAPOER	73000.	00	14600.	00	1466	a. 00	4	6400	9. 35
PAD LOZTRANS	4899	00	480	90	9996	1000	4	6400	0 68
CAPPTAGE	2200	00	460	99	0000	1999	3	12800	9.14
TPACTOR	0	00	0	ର୍ତ୍ତ	ę	9 99	5	8000	0.00
рід чры тт	8000.	99	800	99	ରତ୍ତ୍ର	0000	4	5490	1. 13
512	:= ;	NUMBER	LE?	изтн	COST/FT	тот	COST	LIFE/HPS (:05T/H
GUYLINES 0.7	75	2 00	109	9.99	1.33	13	9 50	12800	0.03

TOTAL DEFRECIATION COSTS = 11.33 //HP

MAINTENANCE AND REPAIR

	· ·	
EQUIPMENT	XOF DEP	≉./HOUP
YARCER	50	4, 63
RADIO	60	0.41
CAPRIAGE	20	0 03
TRACTOR	50	0 00
PHDIO CONT	60	0.00

.

SUBTOTAL 5.11

FUEL AND LUSPICATION

CATION	EQUIPMENT	s/HP
	YAPDER TRACTOR	3, 84 0, 00

SUBTOTAL 3 84

VARDING LABOR(TITLE)	HOURLY PATE	NUMBER	TOTAL COST/HR	
HOOK TENDER	ର ସହ	1	0.00	
CHURES SETTER	3 50	1. 99	5 50	
CHAGER	0,00	- 1	0.00	
YAPOING ENGINEEP	8 59	1	3 50	
GRITODES OPERATOR	ଓ ଜନ	1	0 00	
	USTOTAL 17 0	0		

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C. FIXED COSTS MOVE IN 6. 00 HOURS FOR SIDE, VEHICLE AND DRIVER 37. 28 + 35.00 * 6.00 **=** 433.68 INITIAL RIG UP 2.00 HOURS FOR SIDE = 74.56 RIG DOWN SAME AS RIG UP 74. 56 MOVE OUT SAME AS MOVE IN 433. 68 ENGINEERING LABOR = 0.00 CHOKERS 15. 85 EACH COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MEF COST OF CHOKERS = 113.98 OPERATING LINES(EPS) LINE \$1/FT SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (\$2M)

0.50	0. 38	2100. 00	1050.00	6. 00	6. 18
0.50	. 0.38	2100.00	1050, 00	6.00	0.18
8. 98	0.63	3309. 00	2970.00	8. 00	0. 37
0.00	0.00	9. 99	0.00	0, 00	0. 00
0. 21	9.12	4250, 00	892, 50	5.00	0. 13
0.00	9.99	. 0.00	8. 99	0, 00	9, 99
0. 00	9, 99	0. 00	0.00	a aa'	0. 99
	0, 50 0, 50 0, 90 0, 90 0, 21 0, 00 0, 00	9.50 9.38 9.90 9.63 9.00 8.08 9.21 9.12 9.90 9.09	0.50 0.38 2100.00 0.90 0.63 3300.00 0.00 0.08 0.00 0.21 0.12 4250.00 0.00 0.08 0.00	9.50 9.38 2199.90 1959.90 9.90 9.63 3399.00 2979.99 9.90 8.98 9.90 9.99 9.90 8.98 9.90 9.99 9.21 9.12 4259.99 892.59 9.99 9.99 9.99 9.99	0.50 0.38 2100.00 1050.00 6.00 0.90 0.63 3300.00 2970.00 8.00 0.00 0.00 0.00 0.00 9.00 0.21 0.12 4250.00 892.50 5.00 0.00 0.00 0.00 0.00 0.00

SUBTOTAL: 0. 90 750. 00 674.81 /M *

TOTAL FIXED COSTS = 1810. 17

Ð. INSURANCE AND TAXES

AVERAGE INVESTMENT = (NEW COST + RESID + DEPR.)/2 INSUPANCE AND TAXES = 0.16 % * AVE. INVEST. (51282.50

INSURANCE AND TAXES = 5.13 \$/HR

******** the state and a sta

YARDING COST SUMMARY

CALCULATED MEF/DAY	9.81	· .	
DEPRECIATION/S HR. DAY	90. 63		•
OPERATING COST/3 HR. DAY	207.61		
FIXED COST 28 HR. DAY	23. 68	•	
INSURANCE AND TAXES/8 HR.	DRY 41.03		
TOTAL COST/2 HP. DAY	C62. 95		
COST/MEF	37 00		
- Mezdezőn zőn zőnzákzált tök zón sákzált sönsén zón sék költ ágyát zónzákzák sák térsék alomatosát		ie admade admade admade admade admade admade admade admade a	

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Igland Jones Trailer Alp

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								LIFE	
EQUIPMENT	NEW		RESIDU	AL	FRE	IGHT	YRS	HRS	\$/HF
VARDER	73000.	00	14600.	00	146	0. 00	4	6400	9 35
PADIO/TPANS	4809.	00	480	90	000	0000	4	6400	0.68
CAPRIAGE	2300.	<u>00</u>	460	90	000	0000	3	12800	0. 14
TRACTOR	0.	00	Ø.	00		0.00	5	. 9000	0. 00
PIG. HOW. TT	3000	00	805.	99	000	0000	4	5400	1. 13
513	ZE I	NUMBER	LEN	GTH	COST/FT	тот.	COST I	IFE/HRS C	OST/H
BUYLINES 0.3	75	3. 00	100	. 00	1. 33	19	9. 50	12800	0. 03
	TO	DTAL DE	EPRECIA	TON	COSTS =	· 11. 3	3 /1	łR	

MAINTENANCE AND REPAIR	EGUIPMENT	XOF DEP.	\$/HOUR	
HNU REFAIR				
	YARDER	58	4. 68	
	RADIO	60	0. 41	
	CARRIAGE	29	0. 03	
	TRACTOR	50	0.00	
	RADIO CONT.	69	9, 99	

SUBTOTAL 5. 11

FUEL AND LUBRICATION	EQUIPMENT	\$ZHR
	YARDER TRACTOR	3.84 8.00

SUBTOTAL 3. 84

YARDING LABOR(TITLE)	HOURLY RATE	NUMBER	TOTAL COST/HR	
HOOK TENDER	0. 00	1	0 00	
CHOKER SETTER CHASER	3, 50 8, 00	1.00 1	8.50 0.00	
YARDING ENGINEER SKIDDER OPERATOR	8,50 0,00	1 1	8.50 0.90	-
	SUBTOTAL 17. 00	ð ·		

canale and a set of the set of th C. FIXED COSTS MOVE IN . 6 00 HOURS FOR SIDE, VEHICLE AND DRIVER 37. 28 + 35.99 * 6.00 = 433.68 INITIAL RIG UP HOURS FOR SIDE = 74 56 2.90 SAME AS RIG UP 74 56 RIG DOWN MOVE OUT SAME AS MOVE IN 433. 68 ENGINFERING LABOR = 0.00 CHOKERS 15.85 EACH COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MBF COST OF CHOKEPS = 118, 88 OPERATING LINES(EPS) LINE \$1/FT SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (#/M) MAINLINE 0.50 0.33 2100.00 1050.00 6.00 9.13 9 59 HAULBACK 2100.00 1050.00. 0.33 6.00 9.13 SKYL INE 0, 90 0.63 3300.00 2970.00 8,00 0.27 SKIDDING -- 0.00 ----0.00 0.00 0.00 0.00 0.00 STRAWLINE 0.21 0.12 4250, 00 692..50 [°] 5.00 0.13 SLACK PULLING 0.00 0.00 0.00 0.00 0.00 0.00 9. 99 OTHER LINE 0.00 0.00 0 0 Q 0.00 0.00 SUBTOTAL : 0.90 /11 * 750.00 = 674.81 TOTAL FIXED COSTS = 1910. 17 INSURANCE AND TAXES Ð. AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR >/2 INSURANCE AND TAXES = 0.20 2 * AVE. INVEST. < 51282.50 2 \$/'HP. INSURANCE AND TAXES = 6.41 VARDING COST SUMMERY CALCULATED MEF/DAY 9.81 DEPRECIATION'S HR. DAY 90 63 207 61 OPERATING COST/8 HR. DAY FIXED COST /3 HR. DAY 22.68 INSURANCE AND TAKES/3 HR. DAY 51.23 TOTAL COST/3 HR. DAY 372. 20 COST/MPF 78.04 nge samte eine samte samte eine samte samte samte samte samte eine samte eine samte samte samte samte samte sam

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Smith Timbermaster

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					LIFE	
EQUIPMENT	NEW	RESIDUAL	FREIGHT	*PS	HRS	\$∕HR
YARDER	56000.00	12200.00	1000. 00	7	11200	4. 80
PADIO/TRANS	4809,00	480.90	0000000	4	6400	0.68
CARRIAGE	0 00	0.00	0000000	3	12800	0.00
TRACIOR	9, 99	8, 88	0 00	5	8999	9, 99
RIG. HOW. TT	8898 98	800, 00	0000000	4	6400	1. 13
512	E NUMBER	LENGTH	COST/FT TOT. (OST I	LIFE/HRS C	OST/H
GUYLINES 0.5	9 3 99	200.00	0.70 210	00 0	12800	0. 93
RIG. HOW. TT	8000 00 E NUMBER	SOO OO LENGTH	0000000 COST/FT_TOT. (4 :05T (5400 LIFE/HRS C	1. 1. 057/1

TOTAL DEPRECIATON COSTS = 6.64 /HR

R OPERATING COSTS

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MAINTENANCE AND REPAIR EQUIPM

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२ -	EQUIPMENT	XOF DEP.	\$∕HOUR
	YARCER	50	2.49
	RADIO	60	0.41
	CARPIAGE	20	0. 00
	TRACTOR	50	0.00
	RADIO CONT	60	0.00

SUBTOTAL 2. 81

FUEL AND		•
LUBRICATION	EQUIPMENT	\$/HR
	YARDER	3. 84
	TRACTOR	0.00
	SUBTOTAL	3. 84

VAPDING LABOP(TITLE) HOUPLY PATE NUMBER TOTAL COST/HR

HOOK TENDER	0.00	1	0.00	
CHOKER SETTER	- 3, 50	1. 00	8, 50	
CHASER	0.00	1	0, 00	
YARDING ENGINEER	\$ 50	1	3, 50	
SKIDDER OPERATOR	9, 99	1	0.00	

SUBTOTAL 17.00

FIXED COSTS C MOVE IN 6. 00 HOURS FOR SIDE, VEHICLE AND DRIVER 30. 29 + 35.00 * 6.00 = 391.71 2.00 HOURS FOR SIDE = 69. 57 INITIAL RIG UP SAME AS RIG UP 60. 57 RIG DOWN MOVE OUT SAME AS MOVE IN 391.71 ENGINEERING LABOR = 0.00 CHOKERS 15. 35 EACH COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MBF COST OF CHOKEPS = 118, 88 OPEPATING LINES(EPS) SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (#/M) LINE \$1/FT 0.58 1500.00 759, 99 MAINLINE 0.38 6.00 0. 13 0.38 3000. 00 HALILBACK 0.59 1500.00 5.00 0.25 SKYLINE 0.80 0.50 2008.00 1608.00 S. 00 0.20 0.00 0. 00 SKIDDING 0.09 0.00 0.00 0.99 - STPAWLINE 0.21 0. 25 4000.00 840.00 5.00 0.17 0. 00 SLACK PULLING 0.00 0.00 0. 00 0.00 0. 00 0.00 0. 09 OTHER LINE 0.00 0.00 0.00 0.00 SUBTOTAL : 0.74 /M * 750. 00 557.25 = TOTAL FIXED COSTS = 1580. 69 INSURANCE AND TAXES D AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR.)/2 INSURANCE AND TAXES = 0.16 % * AVE. INVEST (43442.86) INSURANCE AND TAXES = 4.34 \$/HR YARDING COST SUMMARY CALCULATED MBF/DAY 7 71 DEPRECIATION/8 HR. DAY 53. 10 OPERATING COST/8 HR. DAY 187.18 FIXED COST /8 HR. DAY 16. 25 INSUPANCE AND TAXES/8 HR. DAY 34.75 TOTAL COST/S HR. DAV 293.29 COST./MBF 38, 04

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A DEPRECIA		515		•		FE	
EQUIPMENT	NEH		RESIDUAL	FREIGHT	.YPS	HRS	\$/HF
APDER	66009.	0 9	13200, 00	1000. 00	. 7	11200	4. 88
RADIO/TPANS	4809	00	480, 90	0000000	4	6400	0.63
CARRIAGE	0	00	0.00	0000000	8	12300	0.09
TPACTOR	0	00	0, 00	0,00	5	8009	0,00
RIG. HOW. TT	8009	00	800.00	0000000	4	6400	1. 13

TOTAL DEPRECIATON COSTS = 6.64 ZHR

de sie sie sie sie sie 8 OPERATING COSTS

MAINTENANCE	EQUIPMENT	XOF DEP.	\$/HOUR
AND REPAIR	ENGIFIER	KUP DEP.	av Hujuk
	YARDER	59	2.40
	RADIO	60	. 0. 41
	CARRIAGE	29	0.00
	TRACTOR	50 ~	0.00
	RADIO CONT.	60	0. 00

SUBTOTAL 2. 81

FUEL AND		
LUBRICATION	EQUIPMENT	\$/HR
	YARDER	3. 84
	TRACTOR	0. 00

SUBTOTAL 3. 84

YARDING LABOR(TITLE)	HOURLY RATE	NUMBER	TOTAL COST/HR	
HOOK TENDER CHOKER SETTER CHASER YARDING ENGINEER	0. 00 9. 50 0. 00 9. 50	1 1.00 1	0.00 3.50 0.00 3.50	
SKIDDER OPEPATOR	0. 99	ī	0.00	
2	UBTOTAL 17.04	d 		

state sta **C**., FIXED COSTS HOURS FOR SIDE, VEHICLE AND DRIVER MOVE IN 6.00 30. 29 + 35.00 * 6.00 = 391.71 INITIAL RIG UP 2.00 HOURS FOR SIDE = 60.57 RIG DOWN SAME AS RIG UP 60.57 MOVE OUT SAME AS MOVE IN 391.71 ENGINEERING LABOR = 0.00 EACH CHOKERS 15 85 COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MBF COST OF CHOKERS = 118.83OPERATING LINES(EPS) \$1/FT SIZECIND LENGTH(FT) TOTAL LIFE(MM) (#2M) LINE 0. 50 0.38 750 00 MAINLINE 1500.00 6.00 0.13 HAULSACK 0.50 0.38 3000.00 1599, 99 6.00 0.25 0.80 SKYL INE 0. 50 2000. 00 1600.00 3.00 0.20 SKIDDING 0. 09 0.00 0.00 0.00 0.00 0.00 0.21 0.25 4000.00 0. 17 STRAULINE 840.00 5, 60 SLACK PULLING 0.00 0.00 0.00 0.00 0.00 0.99 OTHER LINE 0.00 0.00 0.00 0 00 0.00 0.00 SUBTOTAL : 0.74 /M ★ 759.00 = 557.25 TOTAL FIXED COSTS = 1590.69 INSURANCE AND TAXES D AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR. >/2 INSURANCE AND TAXES = 0.20 % + AVE. INVEST (43442.86 > INSURANCE AND TAXES = 5.43 \$/HR YARDING COST SUMMARY CALCULATED MEF/DAY 7 71 53. 10 DEPRECIATION/8 HR. DAY OPERATING COST/3 HR. DAY 139 13 16. 25 FIXED COST 28 HR. DAY INSURANCE AND TAXES/8 HP. DAY 43, 44 TOTAL COST/3 HP. DAY 301, 97 COST./MRF 29 17

Thunderbird

	EXPLANA TION COSTS	TION OF COS	T 1 de sên sên 242 sên 261 sên 261 sên 261 sên 261 sên 2 1	in sine sije sine sine sine sine	de alfondes des de de de de	nýc nýc nýc
				LI	FE	•
EQUIPMENT	NEW	RESIDUAL	FREIGHT	YRS	HRS	\$/HR
YAPOER	235000.00	47000. 90	<u> </u>	8	12800	15. 39
RADIO/TRANS	4809.00	480.99	0000000	4	6490	0. 68
CARRIAGE	4309. 99	369, 99	0000000	4	6499	0.54
TRACTOR	9, 99	0.00	9,99	6	9600	0.00
FIG. HOW. TT	5000. 00	809. 00	ନ୍ତ୍ରାର୍ଷ୍ଣରତ୍ର	4	6400	1. 13
512	E NUMBER	LENGTH	COST/FT TOT C	OST LI	FE/HRS C	OST/H
GUYLINES 1. :	12 3.00	299. 99	2. 57 771	. 00 1	2800	0.12

TOTAL DEPRECIATON COSTS = 17.85 /HR

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8. OPERATING COSTS

MAINTENANCE AND REPAIR

EQUIPMENT	XOF DEP.	\$/HOUR
YARDER	50	7.70
RADIO	69	0, 41,
CARRIAGE	50	0.27
TRACTOR	50	0.00
RADIO CONT.	69	0.00

SUBTOTAL 8.37

FUEL AND LUBRICATION	EQUIPMENT	3/HR
	YARDER TRACTOR	13. 51 0. 00

SUBTOTAL 13. 51

YARDING LABOR(TITLE)	HOURLY RATE	NUMBER	TOTAL	COST/HR	
HOOK TENDEP CHOKER SETTER CHASEP YAPDING ENGINEER SKIDDER OPEPATOR	ଟ. 50 ଟ. 50 ଟ. 50 ଟ. 50 ଡ. 60	1 1.00 1 1 1	8. 3. 8.	50 50 50 80	
•	SUBTOTAL 24.00	~	·		

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OPERATING LINES(EPS)

	\$1/FT	SIZE(IN)		TOTAL	LIFE(MM) (#/M)	-
MAINLINE	1. 33	0.75	1500. 00	1995.	80 12.80	0. 17
HAULBACK	1. 33	0.75	3500.00	4655.	99 12.99	0.39
SKYLINE	2. 18	1. 90	1800.00	3730.	00 10.00	0.38
SKIDDING	0.00	0.00	0.00	. 0.	00 0. 00	8.00
STRAW INE	9.45	0.38	4000, 00	1800.	00 5.00	0.36
SLACK PULLING	1. 33	0.75	1500.00	1995.	99 12 . 99	0. 17
OTHER LINE	1. 33	0.75	125. 00	156.	25 0. 50	0. 3 3

SUBTOTAL: 1.79 /M * 750.00 = 1343.19

TOTAL FIXED COSTS = 3321.24

D. INSURANCE AND TAXES

AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR.)/2 INSURANCE AND TAXES = 0.16 % * AVE. INVEST. (153312.50)

INSURANCE AND TAXES = 15.33 #/HR

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YARDING COST SUMMARY

DEPRECIATION/8 HR. DAY	142.80	•
OPEPATING COST/8 HR. DAY	447, 94	
FIXED COST 28 HR. DAY	98.40	
INSURANCE AND TAXES/8 HR.	DAY 122.65	
TOTAL COST/8 HP. DAY	810.38	
COST/MBF	36. 49	
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A. DEPRECIAT	ION COSTS					
				LI	FE	
EQUIPMENT	NEW	RESIDUAL	FREIGHT	YRS	HRS	\$/HR
YARDER	235000. 00	47000. 00	9000. 00	8	12800	15. 39
RADIO/TPANS	4809.00	480. 90	0000000	4	6400	0.68
CAPRIAGE	4300.00	860.00	0000000	. 4	6400	0.54
TRACTOR	0.00	0.00	0, 00	5	9600	0.00
RIG. HDW. TT	8000.00	800, 00	0000000	4	5400	1. 13
SIZ		LENGTH			FEZHRS C	
GUYLINES 1.1	2 3.00	200. 00	2. 57 7	71.00 1	2800	8. 12
**************************************	2012 2012 2019 2019 2019 2019 2019 2019	EPRECIATON	COSTS = 17. :			2043.ge 2.gc
**************************************	2012 2012 2019 2019 2019 2019 2019 2019					2013-04-045
	2012 2012 2019 2019 2019 2019 2019 2019					, saesaja saja
MAINTENANCE	G COSTS	in ade ade afte ade age ade age ade age ade a	unden nije nije nije nije nije nije nije ni			2013-2015
MAINTENANCE	G COSTS	XOF DEP. 50 50	\$/HOUP			2019.jaja 2.ja
MAINTENANCE	G COSTS EQUIPMENT YARDER RADIO CAPRIAGE	XOF DEP. 50 50 50	\$/HOUP 7.70 9.41 9.27			
MAINTENANCE	G COSTS EQUIPMENT YARDER RADIO CAPRIAGE TRACTOR	XOF DEP. 50 50 50 50 50	\$/HOUP 7.70 9.41 9.27 9.00			244 ada: 245
MAINTENANCE	G COSTS EQUIPMENT YARDER RADIO CAPRIAGE	XOF DEP. 50 50 50 50 50	\$/HOUP 7.70 9.41 9.27			
MAINTENANCE	G COSTS EQUIPMENT YARDER RADIO CAPRIAGE TRACTOR RADIO CONT	XOF DEP. 50 50 50 50 50	\$/HOUR 7.70 9.41 9.27 9.00 9.00			2014 - 2017
MAINTENANCE AND REPAIP	G COSTS EQUIPMENT YARDER RADIO CAPRIAGE TRACTOR RADIO CONT	XOF DEP. 50 50 50 50 50 50	\$/HOUR 7.70 9.41 9.27 9.00 9.00			*****
MAINTENANCE	G COSTS EQUIPMENT YARDER RADIO CAPRIAGE TRACTOR RADIO CONT	XOF DEP. 50 50 50 50 50 50 50 50 50 50 50 50 50	\$/HOUR 7.70 9.41 9.27 9.00 9.00			340-341
MAINTENANCE AND REPAIP	G COSTS EQUIPMENT YARDER RADIO CAPRIAGE TRACTOR RADIO CONT SUE	XOF DEP. 50 50 50 50 50 50 50 50 50 50 50 50 50	\$/HOUP 7.70 9.41 9.27 9.90 9.90			2010-201

YARDING LABOR(TITLE)	HOURLY RATE		TOTAL	COST/HR
HOOK TENDER	8.50	1	8	50
CHOKER SETTER	3.50	1.00	S.	
CHASER	3.50	1	8.	50
YARDING ENGINEER	8,50	1	8.	50
SKIDDER OPERATOR	0, 00	1	0. 1	9 0
S	UBTOTAL 04 00			

FIMED COSTS C. . 6.00 HOURS FOR SIDE, VEHICLE AND DRIVER MOVE IN 73. 73 + 45.00 * 6.00 = 712.33 HOURS FOR SIDE = 147.46 INITIAL RIG UP 2.00 SAME AS RIG UP 147.46 RIG DOWN MOVE OUT SAME AS MOVE IN 712.38 ENGINFERING LABOR = 0.00 CHOKERS 34 45 EACH COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MBF COST OF CHOKERS = 258.38 OPEPATING LINES(EPS) \$1/FT SIZE(IN) LENGTH(FT) TOTAL LIFE(NM) (\$/M) LINE 1995.00 MAINLINE 1.33 0.75 1560.00 12.00 4655, 08 HAULBACK 1. 33 0.75 3500. 00 12.00 SKYLINE 2.10 1.00 1800.00 3780.00 10.00 0.00 0.00 0.00 0.00 SKIDDING 0.00 STRAW INE 0.45 0.38 4000, 00 1990, 99 5. 00 SLACK PULLING 1.33 0. 75 1500.00 1995.00 12. 00 0.75 OTHER LINE 125. 00 166. 25 0. 50 1. 33

SUBTOTAL: 1.79 /M # 750.00 = 1343.19

TOTAL FIXED COSTS = 3321.24

D. INSURANCE AND TAXES

AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR.)/2 INSURANCE AND TAXES = 0.20 % = AVE. INVEST. (153312.50)

INSURANCE AND TAXES = 19.16 \$/HR

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YARDING COST SUMMARY

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All the rest of the set of the se	***	
CALCULATED MEF/DAY	22. 22	
DEPPECIATION/8 HP. DAY	142.80	
OPERATING COST/8 HR. DAY	447, 64	
FINED COST /8 HR. DAY	98, 40	
INSURANCE AND TAXES/S HR.	DAY 153.31	
TOTAL COST/8 HR. DAY	841.55	
COST/MRF	37. 87	

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0.17

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A DEFRECIATION						
					LIFE	
EQUIPMENT N	EM	RESIDUAL	FREIGHT	YP:	5 HRS	\$/HR
YARDER 320	00. OQ	16400. 00	7500 00	7	11200	6. 53
RADIO/TRANS 48	09 00	480.90	0000000	4	6409	0.69
CAPPIAGE 34	00.00	680.00	0000000	9	12800	9 9.21
TPACTOP	0,00	0.00	0 99	5	9009	0.00
RIG. HOW TT SO	99. 99	800.00	0000000	4	6409	1.13
SIZE	NUMBER	LENGTH	COST/FT TOT	COST	LIFE/HRS	COST/H
GUYLINES 0.75	2,00	100.00	1.33 1	33, 00	12800	0. 02

TOTAL DEPRECIATION COSTS = 8.56 / ZHR

MAINTENANCE			
AND REPAIR	EQUIPMENT	XOF DEP.	\$/'HOUR
	YARDEP	50	3. 26
	RADIO	60	9. 41
•	CARRIAGE	20	0.04
	TRACTOR	50	0.00
	RADIO CONT.	60	0.00

SUBTOTAL 3. 71

FUEL AND LUBRICATION	EQUIPMENT	\$/HR
	YARDER TRACTOR	3. 34 9. 99

SUBTOTAL 3. 84

YARDING LABOR(TITLE) HOURLY RATE NUMBER TOTAL COST/HR

HOOK TENDER	0.00	. 1	0,00	•
CHOKEP SETTER	8.50	1 00	8 50	
CHASER	8, 59	1	S. 50	
VARDING ENGINEER	8, 50	1	8,50	
SKIDDEP OPERATOP	0, 00	1	0 00	
·	SUBTOTAL 25.50			

ft. -FIXED COSTS MOVE IN 6. 00 HOURS FOR SIDE, VEHICLE AND DRIVER 41. 61 + 50.00 * 600 = 549.68 INITIAL RIG UP HOURS FOR SIDE = 83 23 2.00 RIG DOWN SAME AS RIG UP 93: 23 SAME AS MOVE IN MOVE OUT 549.68 ENGINEERING LABOR = 0.00 CHOKERS 15.85 EACH COST OF CHOKEPS = (SALE MOL) * (COST EACH)/LIFE MBF COST OF CHOKERS = 118.88 OPERATING LINES(EPS) LINE \$1/FT SIZECIND LENGTHOFT) TOTAL LIFECMMD (#2M) MAINLINE 0 50 0.38 1950, 90 525 00 6. 90 0.09 HAULSACK 0.50 1950.00 975 00 0.39 6.09 0.16 SKYLINE 0.90 0. 63 1350.00 1215.00 8. 00 0. 15 SKIDDING 0.00 0.00 0. 00 0 00 0. 00 0. 00 1049 09 STRAWL INE 0,40 0.25 2600.00 6.00 0. 17 SLACK PULLING 0.00 0. 00 0. 00 0 00 0, 00 0. 00 OTHER LINE 0.00 0.00 0.00 0 00 0.00 0.00 SUBTOTAL : /M * 750.00 = 431.41 0.53 TOTAL FIXED COSTS = 1816.09 INSURANCE AND TAXES D. AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR)/2 INSURANCE AND TAXES = 0.16 % * AVE. INVEST (34421.43 INSURANCE AND TAXES = 5. 44 \$/HP YARDING COST SUMMARY CALCULATED MBE/DAY 12. 93 DEPRECIATION/8 HR. DAY 58.49 OPERALING COST/S HR. DAY 264.41 FIXED COST /8 HR. DAY 31. 31 INSUPANCE AND TAXES/2 HR. DAV 43. 54 407.75 TOTAL COST/3 HP. DAY COST/MRF 21. 54

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+ DEPRECIA	FION COSTS					
				L.1	IFE .	
EQUIPMENT	NEW	RESIDUAL	FREIGHT	YRS	HPS	\$/HR
PRDER	82000. 00	16400. 00	7500.00	7	11200	6. 53
RADIO/TRANS	4809.00	480, 90	0000000	4	6499	0.68
CARRIAGE	3400,00	680. 00	6000000	8	12300	0. 21
FRACTOR '	0.00	0.00	0, 00	5	8000	0. 99
TT WOH DIS	8000, 00	800.00	0000000	4	6400	1.13

TOTAL DEPRECIATION COSTS = 8 56 /HR

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we will also an and a set of the set of the

8. OPERATING COSTS

MAINTENANCE AND REPAIR

	EQUIPMENT	XOF DEP.	\$/HOUR
	YARDER	50	3. 26
	RADIO	60	0.41
•	CARRIAGE	20	0.04
	TRACTOR	50	0.00
	RADIO CONT.	60	0.00

SUBTOTAL 3.71

FNEL AND LUBRICATION	•	EQUIPMENT	\$/HR		
		YARDER TPACTOR	3. 84 0. 90		

SUBTOTAL 3. 94

YARDING LABOR(TITLS)	HOURLY RATE	NUMBER	TOTAL COST/HR	
HOOK TENDER CHOKER SETTER CHASER YAPDING ENGINEEP SKIDDER OPSPATOR	0.00 8.50 8.50 8.50 0.00	1 1.90 1 1	0.00 8 50 8 50 8 50 9 70 9 70	
· .	SUBTOTAL 25 50)		

strate and a special control of the special c C. FIXED COSTS MOVE IN 6 00 HOURS FOR SIDE, VEHICLE AND OPIVER 41. 61 + 50,00 * 6.00 = 549.68 INITIAL RIG UP 2.00 HOURS FOR SIDE = 83. 23 RIG DOWN SAME AS RIG UP 83.23 MOVE OUT SAME AS MOVE IN 549 68 ENGINEFRING LABOR = 0.00 CHOKEPS 15 85 EACH COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MEF COST OF CHOKERS = 118.88

OPERATING LINES(EPS)

	\$1/FT	SIZECIND	LENGTHOFT	TOTAL	LIFE(MM)	(\$/M)	
· ·	· · ···						
MAINI INE	0 50	0.33	1050.00	525	00 6	5,99 9.	89
HAULBACK	0.50	0. 33	1959.00	975	-90 é	5. 00 0.	16
SKYLINE	0.90	0. 63	1350.00	1215.	00 S	3.00 0.	15
SKIDDING	0.00	0.00	0. 00	0.	00 ° 0	. 00 0.	00
STRAWLINE	0.40	0.25	2600. 90	1040	90 é	5.00 0.	17
SLACK PULLING	0.00	0. 00	0.00	9.	90 e	. 00 0.	00
OTHER LINE	0.00	0.00	0. 00	9.	00 C	1. 00 9 .	00

SUBTOTAL: 0.58 /M * 750.00 = 431.41

TOTAL FIXED COSTS = 1816.09

D. INSURANCE AND TAXES

AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR. >/2 INSURANCE AND TAXES = 0.20 % * AVE. INVEST (54421.43)

INSURANCE AND TAXES = 6.80 \$/HR

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YARDING COST SUMMARY

ağı ziğe ağı	ie nije nije nije nije nije nije nije ni
CALCULATED MBF/DAY	12. 93
DEPRECIATION/3 HR. DAY	68.49
OPERATING COST/8 HR. DAY	264 41
FIXED COST /8 HP. DAY	31. 31
INSURANCE AND TAXES/8 HR.	DAY 54, 42
TOTAL COST/8 HR. DAV	413. 63
COST/MBF	22 38

Ecologger II

EXPLANATION OF COST

	108 00212				LIFE	
FOLITPMENT	NEW	RESIDUAL	FREIGHT	YRS	HRS	\$/HR
VAPDEP	182390 00	36478.00	7500 00	э	12800	11. 9 9
RAD10/TRANS	4803 00	488 98	ааааааа	4	6400	A 68
CAPRINGE	2800 00	560 AQ	аадааца	8	12300	0. 18
TRACTOR	A AA	A 49	а аа		8000	8 89
PTG HOW TT	<u>8000 00</u>	800 00	-	4	F499	1. 13
512		LENGTH	COST/FT TOT	COST	LIFE/HRS (OST/H
GUYLINES A S	RA 4.00	225, 99	1.66 74	7 99	12800	0.12

TOTAL DEPRECIATION COSTS = 14 08 /HR

MAINIENANCE		· · ·	
AND REPATE	EQUIPMENT	XOF DEP	\$/HOUR
	YARDER	59	5 99
	RADIO	60 .	A 41
	CARRIAGE	29	Ø 94
	TRACTOR	59	9 99
	RADIO CONT	60	9 . 99

•

SUBTOTAL 6 43

FHEL AND LUBRICATION	EQUIPMENT	\$/HR
	YARDER	5 92
	TRACTOR	R . AA

SUBTOTAL 5 92

VARDING LABOR(TITLE) HOURLY RATE NUMBER TOTAL COST/HR

		•		
HOOK TENDER	8, 59	1	8 50	
CHOKER SETTER	8 50	1 66	8 59	
CHASEP	a aa	1	A AA	
VARDING ENGINEER	8 50	1	8 50	
SKIDDER OPERATOR	R 99	1	a aa	
•	SUBTOTAL 25 50	ð .		
	،	به جد که که نبیدها انجاب موجد که ه		

6 00 HOURS FOR SIDE, VEHICLE AND DRIVER MOVE IN + 40.00 51. 93 * 6 00 = 551.59 2.90 HOURS FOR STOR = 103 86 INITIAL RIG UP SAME AS RTA UP 103.86 RIG DOWN ···· · · ·· MOVE CUT 551.59 SAME AS MOVE IN ENGINEEPING LABOR = 0.00 CHOKEPS 34 45 FACH COST OF CHOKERS = (SALE YOL) + (COST EACH)/LIFE MART COST OF CHOKEPS = 258.38 OPERATING LINES(EPS). \$1/FT LINE SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (3/M) MAINLINE 1. 27 0 75 2100 00 2567 99 10 00 0.27 HAULBACK 0.63 1999 99 1634.00 8 00 8.86 0.29 SKYL INF 1.66 0.88 1500 00 2499 99 10 99 0. 25 SKIDDING а аа **A AA** ด ดูด ด ดด 0 00 0.00 STRAWL INE 0.45 0.38 2508 00 1125. 00 8 00 0.14 A 44 **Q QQ** A 44 SLACK PHILING 0:00 r ri a aa ATHER LINE а ад 9 90 a aa 0 99 9. 99 0.00 /M + 750.00 =, 645.43 SURTOTAL: 8 86 TOTAL FIXED COSTS = 2214.71 INSURANCE AND TAXES D AVERAGE INVESTMENT = (NEW COST + RESID + DEPP)/2 INSUPANCE AND TAXES = 0.16 % * AVE INVEST (119022. 25) INSURANCE AND TAXES = 11.90 S/HR YARDING COST SUMMARY n már a már a már a már a már a már a feir a fe 17 79 CALCULATED MREZDAY DEPPECTATION/8 HP DAY 112. 53 OPERATING COST/8 HR DAY 382 97 EIXED COST 28 HP DAY 52 27 INSUPANCE AND TAXES/8 HR DAY 95 22 TOTAL COST/9 HP DAY 562 94 COST/MRF 31 80

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FIXED COSTS

C.

Ecologger II

EXPLANATION OF COST

				1	LIFE	
EQUIPMENT	NEW	RESTOURL	FREIGHT	YRS	HRS	\$/HR
VAPNEP	182398 88	36478 QÁ	7500 00	8	12899	11. 99
PANTO/TPANS	4809 00	480 90	aaaaaaa	. 4	6499	0 68
CAPPIAGE	2900 00	560 00	AAAAAAA	8	12899	0.18
TRACTOR	a aa	A 49	A 44	5 1	8000	0.00
RIG HOW TT	2000 00	800 00	<u>Q</u> QQQQQQ	4	6400	1. 13
\$17		LENGTH	COSTZET TOT	COST L	LIFEZHRS C	OST/H
GUYLINES A P	4 99	225, 99	1 66 74	7 88	12899	9 12

TOTAL DEPRECIATON COSTS = 14 98 /HR

					•	
MAT	NTENANCE					
AND	REPAIR	EQUIPMENT	XOF DEP.	\$ZHOUR		
		YARDER	50	5 99		
		RADIO	69	Q 41		
	••••	CARRIAGE	··· 20	' 'A A4		·
		TRACTOR	59	A AA		
		PADIO CONT	69	A AA		
	•	•		•		

SUBTOTAL 6.43

FUEL AND LUBRICATION	EQUIPMENT	\$/HR
	VARDER TRACTOR	5 92 A AA

SUBTOTAL 5 92

VAPOING LABOR(TITLE) HOURLY RATE NUMBER TOTAL COST/HR

	SUBTOTAL 25	5 50		
SKIDDER OPERATOR	<u>a</u> , a a	. 1	a a a	
VARDING FUGINEER	8 59	1	8 50	
CHASER	<u>a</u> 0a	1	A 114	
CHOKER SETTER	8 59	1 0	A 8.5A	
HOOK TENDER	8.59	1	8 50	

MOVE IN -6 00 HOURS FOR STOF, VEHICLE AND DRIVER 51 93 + 40 60 * 6 00 = 551.59 INITIAL PIG UP 2.99 HOURS FOR SIDE = 1.93 86 PTR DOWN SAME AS RIG HP 103 86 MOVE OUT SAME AS MOVE IN 551 59 ENGINEEPING LABOR = 0 00 CHOKERS , R4 45 ERCH COST OF CHOKERS # (SALE VOL) * (COST EACH)/LIFE MAE COST OF CHOKERS = 258 38 OPEPATING LINESCEPSY LINE \$1/FT SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (\$2M) MATNI INE 1 27 0.75 2100 00 2667 00 10 00 0.27 HALL PACK A 85 1900 00 'A 63 1674 00 8 99 0 20 1.66 SKYLINE 0.88 1500 00 2490 00 19.99 0.25 SKIDDING a aa 0 00 a aa 9 99 0. 00 0.03 2500 00 STPAWLINE A 45 1125 00 0. 14 0.38 8. 00 SLACK PULLING 0.00 0. 90 0.00 0.00 0. 00 0. 00. OTHER LINE 0.00 0. 00 0 00 0 00 0.09 9, 99 SUBTOTAL: /M * 750.00 = 645.43 0.86 TOTAL FIXED COSTS = 2214.71 INSURANCE AND TAXES D. AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR.)/2 INSURANCE AND TAXES = 0.20 % * AVE. INVEST (119022, 25) INSURANCE AND TAXES = 14.88 \$/HR YARDING COST SUMMARY ander CALCULATED MEF/DAY 17 79 DEPRECIATION/S HR. DAY 112.63 OPERATING COST/8 HR DAY 302.87 FIXED COST 28 HP DAY 52.27 084 119 02 586 74 INSUPANCE AND TAXES /8 HP TOTAL COST/8 HP DAY COST/MEE 37.15

FIXED COSTS

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APPENDIX II

YARDING COST COMPUTATIONS (with skidder)

:

Igland Jones Trailer Alp

EXPLANATION OF COST

A DEPRECIA	TION COSTS				FE	
EQUIPMENT	NEW	RESIDUAL	FREIGHT	VRS	HRS	\$/HR
ENGLEMENT	NEW	RESIDURE	CHE LUNG	TRO	HR 3	⇒ 2 mm
YARDER	72000.00	14600.00	1460.00	4	6400	9.35
RADIO/TRANS	4809.00	480 90	0000000	4.	6400	0, 63
CAPRIAGE	2200 00	460 00	0000000	8	12800	0.14
TPACTOR	10000.00	1000.00	0.00	5	8000	1, 12
PIG HOW TT	8000.00	800.00	0000000	4	6460	1. 13
SI		LENGTH	COST/FT TOT 0	DST LI	FE/HRS C	OST/H
GUVETNES A	75 7.0A	100 00	1 37 199	50 1	2800	0 07

TOTAL DEPRECIPTON COSTS = 12.45 24P

P OPERATING COSTS

MAINTENANCE AND PEPAIP

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EQUIPMENT	XOF DEP.	\$∠HQUR
YARDEP	50	4, 68
RADIO	50	0 41
CARRIAGE	29	0 03
TRACTOR	50	0.56
RADIO CONT.	60	0.00

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SUBTOTAL 5. 67

FUEL AND	. •	
UBPICATION	EQUIPMENT	\$7HR
	YPRDER	3 94
· ·	TRACTOR	2, 99

SUBTOTAL 6. 82

MARDING LABOR(TITLE)	HOURLY RATE	NUMBER	TOTAL	COST/HR
HOOK TENDER	0.90	1	9.	68
CHOKER SETTER	3.50	1.00	3	50
CHASER	0,00	1	2	32
YARDING ENGINEER	3 50	1	3	50
SKICOFR OFERATOR	8.50	1	9	50
s	UBTOTAL 25. 59			

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C. FIXED COSTS HOURS FOR SIDE, VEHICLE AND DRIVER MOVE IN 6, 00 * 5.00 50.45 + 35.00 = 512.69 INITIAL RIG UP 2.00 HOURS FOR SIDE = 100.90 SAME AS PIG UP 100.90 RIG DOWN MOVE OUT SAME AS MOVE IN 512.69 ENGINFERING LABOR = 0.00 CHOKERS 15, 85 EACH COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MBF COST OF CHOKERS = 118.88 OPERATING LINES(EPS) \$1/FT SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (#/M) LINE 2100.00 1050.00 0, 50 👘 0.28 5.00 0.18 MAINI INE HAULBACK 0.50 0.33 2100.00 1050.00 6.00 0.183300.00 2978 00 8, 99 9.37 0.90 0.63 SKYLINE SKIDDING 0.00 0,00 0. 00 0 00 9 99 0, 60 STRAWLINE 9.21 0.12 4250, 00 - 992, 50 5, 99 0.13 9.99 SLACK PULLING 0.00 0.00 8, 88 0, 00 0.00 OTHER LINE 0.00 0.99 0.00 0.00 9,99 0.00 SUBTOTAL . 0,90 /M * 750,00 = 674.91 TOTAL FIXED COSTS = 2020, 85 D. INSUPANCE AND TAXES AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR.)/2 INSURANCE AND TAXES = 0.16 % * AVE. INVEST. (51282.50) INSURANCE AND TAXES = 5.13 \$/HR VARDING COST SUMMARY ağı ağı ağı ağı ağı şiş çiş çişaş ağı ağı ağı ağı çiş çiş çiş ağı şiş ağı ağı ağı ağı ağı ağı ağı şiş çiş çiş ağ CALCULATED MBF/DAY 9 81 DEPRECIATION/8 HR. CAY 99.63 OPERATING COST/8 HR. DAY 303. 95 FIXED COST 28 HR. DAY 26, 43 INSUFANCE AND TAXES/8 HR. DAY 41.03 TOTAL COST/8 HP. DAY 471, 94 COST/MRF 48, 02

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Igland Jones Trailer Alp

	FXPLANA	TION OF COS	т			
ada	in sin sin sin sin sin sin sin sin sin s	ala ale ale ale ale ale ale ale ale ale	*****	4		1001000
A DEPRECIA	TION COSTS					
				LI	FE	
EQUIPMENT	NEW	RESIDUAL	FREIGHT	YR'S	HRS	\$/HR
YARDER	73000. 00	14600. 00	1460.00	4	6400	9.35
RADIO/TRANS	4809.00	480, 90	0000000	4	6400	0. 68
CAPRIAGE	2300 00	468, 98	0000000	3	12800	0.14
TRACTOR	10000.00	1000, 00	0, 00	5	5999	1. 13
RIG. HOW TT	8000 00	800.00	0000000	4	6400	1. 13
SI	E NUMBER	LENGTH	COSTZET TOT. (COST LI	FE/HRS C	OST/H
GUYLINES 0 7	5 3.00	100.00			2300	0. 03

TOTAL DEPRECIATION COSTS = 12.45 /HR

MAINTENANCE			
AND REPAIR	EQUIPMENT	XOF DEP.	≇/HOUR
	YAPDER	. 50	4. 68
	RADIO	69	0.41
	CARRIAGE	29	R. 83
	TRACTOR	50	0.56
	RADIO CONT.	69	0,00

SUBTOTAL 5. 67

FUEL AND LUBRICATION	EQUIPMENT	\$/HR
	YARDER TRACTOR	3. 84 2. 98

SUBTOTAL 6. 32

YARDING LABOR(TITLE)	HOURLY RATE	NUMBER	TOTAL COST/HR	
	a a a			
HOOK TENDER	9.99	1	0.00	
CHOKEP SETTER	8.50	1,00	8 50	
CHASEP	0 00	. 1	0.00	
YPRDING ENGINEER	8,50	<u> </u>	8,50	
SKIDDER OPEPATOR	8, 50	1	8 50	
· · ·	SUBTOTAL 25.5	0	· .	

OPERATING LINES(EPS)

LINE	\$1/FT	SIZECIND	LENGTHEFT	TOTAL		(\$/M)	
MAINLINE	0.50	0.33	2100.00	1050.	ବହ	6. 89	0. 18
HAULBACK	0.50	0.39	2100. 00	1050.	89	6.00	0.18
SKYLINE	0.90	0.63	3300.00	2970.	99	9.00	0.37
SKIDDING	8.00	9 , 99	0.00	ର.	ରତ	9.99	0.00
STRAWLINE	9.21	9.12	4250. 00	892.	50	5. 00	0. 19
SLACK PULLING	0.00	9 . 00	9.99		ର୍ଷ	0. 00	0. 00
OTHER LINE	9.99	9. 88	9. 80	0	99	0. 00	0. 00
		•					

SUBTOTAL: 0.98 /M * 750.00 = 674 81

TOTAL FIXED COSTS = 2020.85

D. INSURANCE AND TAXES

AVERAGE INVESTMENT = (NEW COST + PESID. + DEPR.)/2 INSURANCE AND TAXES = 0.20 % = AVE. INVEST. (51282.50

INSURANCE AND TAXES = 6.41 \$/HR

YARDING COST SUMMARY

CALCULATED MBE/DAY	9 91		
DEPRECIATION/8 HR. DAY	99. 62		
OPERATING COST/9 HR. DAY	303. 95		
FIXED COST 28 HR. DAY	26. 43		
INSURANCE AND TAXES/8 HP.	DAY 51.28		
TOTAL COST/8 HP DAY	431. 30		
COST MRF	47.96		
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Smith Timbermaster

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			Ł	IFE	
NEW	RESIDUAL	FREIGHT	YRS	HRS	\$/HR
66000. 00	13200. 00	1000. 00	7	11200	4. 80
4803.00	480.90	000000	4	6400	0.68
0.00	0.00	000000	8	12800	0.00
10000.00	1000.00	0. 00	5	8999	1.13
8000.00	800.00	0000000	4	6400	1. 13
E NUMBER	LENGTH	COST/FT TOT (OST L	IFE/HRS C	OST/H
0 3.00	200. 00	0.70 210	9. 99	12800	0. 03
	TON COSTS NEW 66000, 00 4800, 00 0, 00 10000, 00 8000, 00 8000, 00 20 NUMBER	TION COSTS NEW RESIDUAL 66000.00 13200.00 4803.00 480.90 0.00 0.00 10000.00 1000.00 8000.00 500.00 20 NUMBER LENGTH	ION COSTS NEW RESIDUAL FREIGHT 66000.00 13200.00 1000.00 4803.00 480.90 0000000 0.00 0.00 0000000 10000.00 1000.00 0.00 8000.00 1000.00 0.00 8000.00 800.00 0000000 2 NUMBER LENGTH COST/FT TOT.00	TION COSTS NEW RESIDUAL FREIGHT YRS 66000.00 13200.00 1000.00 7 4803.00 480.90 0000000 4 0.00 0.00 0000000 8 10000.00 0.00 5 8000.00 800.00 0000000 4 E NUMBER LENGTH COST/FT TOT. COST L	ION COSTS LIFE NEW RESIDUAL FREIGHT YRS HRS 66000.00 13200.00 1000.00 7 11200 4803.00 480.90 0000000 4 6400 0.00 0.00 0000000 8 12800 10000.00 1000.00 5 8000 8000.00 800.00 9000000 4 6400 2 NUMBER LENGTH COST/FT TOT. COST LIFE

TOTAL DEPRECIATON COSTS = 7.76 2HR

MAINTENANCE AND REPAIR

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-	EQUIPMENT	XOF DEP.	\$/HOUR
	YARDER	50	2.40
	RADIO	60	8. 41
	CARRIAGE	20	0.00
	TRACTOR	50	8.56
	RADIO CONT	60	0.00

SUBTOTAL 3. 37

FUEL AND LUBRICATION	EQUIPMENT	\$//HR
	YARDER TRACTOR	3.84 2.98

SUBTOTAL . 6. 82

YAPDING LABOR(TITLE)	HOURLY RATE	NUMBER	TOTAL COST/HR
HOOK TENDER	9. 00		a. 99
CHOKER SETTER	9.50 9.90	1. 99	8.59 8.69
CHASER YARDING ENGINEER	8. 50	. 1	3.50
SKIDDER OPERATOR	8. 50	1	S. 50
. 9	SUBTOTAL 25 50	l	

nên sêk bên têrsêk bêrbêk bêk têrtêrtêr têr hêr hêrsêk têk têrbêk bên bêrbên tê ule ada ada ada ada ada ada ada ada ada ete: FIXED COSTS ٢: HOURS FOR SIDE, VEHICLE AND DRIVER MOVE IN 6.00 43. 45 + 35.00 * 6.00 # 470.72 . HOURS FOR SIDE = 86. 91 INITIAL RIG UP 2.00 RIG DOWN SAME AS RIG UP 86.91 MOVE OUT SAME AS MOVE IN 479.72 ENGINEERING LABOR = 0.00 CHOKERS 15. 85 EACH COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MEF COST OF CHOKERS = 119.88 OPERATING LINES(EPS) SIZECINO LENGTHCETO TOTAL LIFECMMO (#2M) LINE \$1/FT MAINLINE 0.50 0.38 1500.00 759.00 6.00 0.13 0.50 0..38 1500.00 6. 00 HAULBACK 3000.00 0. 25 SKYLINE 0.30 0.50 2000.00 1600.00 8.00 9. 20 SKIDDING 0.00 0.99 9.99 0, 00 0 00 0. 00 STRAWL INE 0 21 9.25 4000 00 840 00 5 00 0. 17 0.00 SLACK PULLING 0.00 0.00 0.99 0. **00** 0 00 OTHER LINE 0.00 0. 00 9.99 0.00 0.00 0. 00

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SUBTOTAL: 0.74 /M # 750.00 = 557.25

TOTAL FIXED COSTS = 1791. 37

D. INSURANCE AND TAXES

AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR.)/2 INSURANCE AND TAXES = 0.20 % + AVE. INVEST. (43442.56)

INSURANCE AND TAXES = 5. 43 #/HR

CALCULATED MBF//DAY	7 71	
DEFRECIATION/3 HR. DAY	62. 10	
OPERATING COST/3 HR. DAY	235. 52	•
FINED COST /9 HR. DAY	19. 42	
INSURANCE AND TAXES/S HR.	DAY 43 44	
TOTAL COST/8 HR. DAY	700 73	
COST/MRF	53. 11	
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Smith Timbermaster

EXPLANATION OF COST

				· LI	FE		
EQUIPMENT	NEW		RESIDUAL	FREIGHT	YRS	HPS	\$⁄'HR
YARDER	66000.	00	13200. 00	1000.00	7	11209	4. 88
PADIO/TRANS	4809	00	480, 90	0000000	4	6400	9, 68
CARRIAGE	0.	99	0.00	0000000	3	12800	0.00
TRACTOP	10000.	00	1000.00	0 00	5	8000	1. 13
RIG. HOW. TT	8000.	00	800.00	6000000	4	6400	1, 13
SI	ZE I	UMBER	LENGTH	COSTZET TOT. (COST LI	FE/HRS C	057/H
GUYLINES 0.	50	3.00	200 00	0.70 210	. 99 1	2800	0. 03

TOTAL DEPRECIATON COSTS = 7.76 // HR

MAINTENANCE AND REPAIR	EQUIPMENT	XOF DEP. 50	3/HOUR 2,40
	RADIO	ଟେ	0.41
	CARRIAGE	20	0 00
	TRACTOR	50	0, 56
	RADIO CONT.	60	0.00

SUBTOTAL 3. 27

FUEL AND LUEPICATION	EQUIPMENT	\$/HR
	YARDER TRACTOR	3. 84 2. 98

SUBTOTAL 6.82

VAPDING LABOR(TITLE) HOURLY PATE NUMBER TOTAL COST/HR

HOOK 1 ENDER	0.00	1	0.00
CHOKER SETTER	3.50	1.00	8, 59
CHASEP	0,00	1	0 00
YARDING ENGINEER	8.50	1	8, 50
SKIDDER OPERATOR	3, 50	. 1	8,50

SUBTOTAL 25 50

FIXED COSTS C. MOVE IN 6. 99 HOURS FOR SIDE, VEHICLE AND DRIVER . 43. 45 + 35, 60 * 6,90 **=** 470 72 86. 91 INITIAL PIG UP 2. 99 HOURS FOR SIDE = RIG DOWN SAME AS RIG UP 86.91 MOVE OUT SAME AS MOVE IN 470.72 ENGINEERING LABOR = 0.00 15. 95 CHOKEES EACH COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MBF COST OF CHOKERS = 113.88 OPERATING LINES(EPS) LINE SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (\$/M) \$1/FT 750.00 MAINLINE 0.50 0.38 1500.00 5.90 0.13 . 2000. 00 6 99 1599.99 HAULBACK 0, 59 0.38 0.25 1699, 99 0.50 SKYLINE 0.80 2000, 00 8, 99 0.20 SKIDDING 0. 00 0.00 0.00 0.00 0.60 9, 69 STRAW INE 840 00 0.25 4000, 00 0.21 5.00 8. 17 SLACK PULLING 0.00 0.00 0.90 0.00 0. 00 9. 99 OTHER LINE 9, 99 0, 00 0.00 0.00 8.00 0.00 SUBTOTAL : 9.74 /M * 750.00 = 357.25 TOTAL FIXED COSTS = 1791. 37 INSURANCE AND TAXES D. AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR.)/2 INSURANCE AND TAXES = 0.16 % * AVE. INVEST (43442.86) INSUPANCE AND TAXES = 4,34 \$/HR YARDING COST SUMMARY CALCULATED MBF / DAY 7 71 DEPRECIATION/S HR. DAY OPERATING COST/S HR. DAY 62.10 285, 52 FIXED COST Z8 HP. DAY 18 42 INSURANCE AND TAXES/8 HR. DAY 14 75 TOTAL COST/8 HR. DAY 400 79

COST/MRF 51.98

Thunderbird

200 200 200 200 200 200 200 200 200 200	EXPLANA	TION OF COS	T I adalah adalah adalah adalah sebasika adalah sebasika	ic sige side side side side side	ada ada ada ada ada ada ada ada	
A DEPRECIA	TION COSTS					
				LI	FE	
EQUIPMENT	NEW	RESIDUAL	FREIGHT	YRS	HRS	\$/HR
YPPDEP	235000.00	47000, 00	9000.00	8	12809	15. 39
PADIO/TEANS	4809.00	480. 90	9999999	4	6400	0.68
CAPRIAGE	4300.00	860.00	0000000	4	6400	0.54
TEACTOR	10000, 00	1000.00	. 0.00	5	8099	1. 13
RIG. HOW. TT	3000.00	800.00	0000000	4	6400	1. 13
513	ZE NUMBER	LENGTH	COST/FT TOT. (OST LI	FE/HRS C	OST/H
GUYLINES 1.	12 3. 00	200. 90	2. 57 771	. 99 1	2800	0. 12

TOTAL DEPRECIATON COSTS = 13.97 /HR

MAINTENANCE AND REPAIR

REPAIR EQUIPMENT YARDER RADIO CARRIAGE TRACTOR RADIO CON

EQUIPMENT	XOF DEP	\$/HOUR
ARDER	59	7.70
RADIO	- 59	9. 41
CARRIAGE	50	9. 27
FRACTOR	50	0.56
RADIO CONT.	. 60	0.00

SUBTOTAL 8. 93

LUBRICATION	EQUIPMENT	\$/HR
	YARDER TRACTOR	13. 15 2. 97

SUBTOTAL 16. 12

YARDING LABOR(TITLE)	HOUPLY	PATE	NUMBER	TOTAL	COST/HR

HOOK TENDER	8.50	1	8.50
CHOKER SETTER	8.50	1. 09	8.59
CHASER	3, 50	1	8, 59
VAPOING ENGINEER	3 50	1	8 50
SKIDDEN OPERATOR	8, 50	1	8.50

SUBTOTAL 42, 50

C FIXED COSTS. HOURS FOR SIDE, VEHICLE AND DRIVER MOVE IN 6.00 86. 53 + 45.99 * 6.00 = 739.16 HOURS FOR SIDE = 173.05 INITIAL RIG UP 2.00 PIG DOWN SAME AS RIG UP 173.05 MOVE OUT SAME AS MOVE IN 789, 16 ENGINEEPING LABOR = 0.00 CHOKEPS 34 45 EACH COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MBF COST OF CHOKERS = 238.38 OPERATING LINES(EPS) LINE \$1/FT SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (\$/M) MAINLINE 0.75 1. 33 1500.80 1995, 00 0. 17 12.00 HAULBACK 3500.00 .1. 33 9. 75 4555. 99 12.00 0.39 3780. 00 SKYLINE 1.09 1800.00 0.38 2. 10 10.00 SKIDDING 0.00 8. 89 0.00 0.99 8. 89 8. 99 STRAWLINE 0.45 0.38 4000.00 1899. 99 5. 00 0.36 1995. 00 SLACK PULLING 1. 33 0.75 1500. 00 12.00 0. 17 OTHER LINE 1. 33 0.75 125. 00 166.25 0.59 0.33 SUBTOTAL: 1. 79 /M + 750.00 =- 1343.19 TOTAL FIXED COSTS = 3526.00 D. INSURANCE AND TAXES AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR.)/2 INSURANCE AND TAXES = 0.16 % * AVE. INVEST. (153312.50) \$/HR INSURANCE AND TAXES = 15.33 the adversion and a state adversion and a state adversion a YARDING COST SUMMARY 22. 22 CALCULATED MBF/DAY DEPRECIATION/3 HR. DAY 151, 80 OPERATING COST/8 HR. DAY FIXED COST /8 HR. DAY 540, 42 104 46 INSURANCE AND TAXES/8 HR. DAY 122, 65 TOTAL COST/3 HR. DAY 919. 33 COST//MBF 41. 37 **** a 200 - de 20e 20e 20e 20e 20e 20e 20e 20e

Thunderbird

A CEPRECIATI	511 60313				LI	FE	
EQUIPMENT	NEW	RESIDUAL	FREI	GHT	YRS	HRS	\$∕HR
	35000. 00	47090.00	9000		8	12800	15. 39
	4809 80	490.90	9999		4	6400	0.68
	4300.00 .0000 00	860 00 1000 00	9998	9999	4 5	6400 8000	0.54 1.13
	3000.00	809. 00	9999		4	6498	1. 13
SIZE						FE/HRS C	
BUYLINES 1.12	3. 00	200. 00	2. 57	- 771.	00 1	2800	0. 12
	-						
	IUIML DE	EPRECIATION	CUS15 =	18. 97	ZHR		•
- OPEPATING		in 2012 de 2012	a sife sije sije sije sije sije sije sije vije	n a air air air air air air air air air a	30 30 30 30 30 30 30 30 30 30 30 30 30 3	***	1941 244 244
- 0-5-01104							
AINTENANCE		· ·				•	
ND REPAIR	EQUIPMENT	XOF DEP.	\$∕H0UR				
	YARDER	50	7.70				
•	RADIO CARRIAGE	60 50	0.41 0.27				
	TRACTOR	50	0.56				
	RADIO CONT		0. 00				
·	SUE	TOTAL 8. 9	3				
WEL AND		••					
UERICATION	EQUIF	MENT	\$∕HR		•		
·	YARDE		13. 15				
	TRACT	OR	2. 97				
	SI.	IBTOTAL 1	6. 12				
ARDING LABOR	(TITLE) HO	URLY RATE	NUMBER	TOTAL	COST	/HR	
			•				
		8.50	1	_	50		
		8.50 8.50	1. 90 1	-	50 50		
HOKER SETTER			-				
	EEP	8.50	1	8	50		
100K)ENDER HOKER SETTER			–				

the state and a C FIXED COSTS MOVE IN 6.00 HOURS FOR SIDE, VEHICLE AND DRIVER 86. 53 + 45.00 * 6.00 = 789.16 INITIAL RIG UP 2.00 HOURS FOR SIDE = 173.05 RIG DOWN SAME AS RIG UP 173.05 MOVE OUT SAME AS MOVE IN 789.16 ENGINEERING LABOR = 0.00 34.45 CHOKERS EACH COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MBF COST OF CHOKERS = 258.38 OPERATING LINES(EPS) \$1/FT SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (\$/M) LINE MAINLINE 1. 33 1500. 90 1995.00 0. 75 12.00 0. 17 . HAULBACK · 1. 33 0.75 2500. 00 4655. 99 12,00 0.39 1.09 2. 10 . 1890.00 SKYLINE 3780.00 10.00 0.38 SKIDDING 0.00 0.00 0. 00 Ø. ØØ 8.88 0. 20 0. 45 4000, 00 1909. 99 STRAWLINE 0. 33 5. 00 0.36 SLACK PULLING 1. 33 0.75 1500.00 1995: 00 12.00 8. 17 OTHER LINE 1, 32 0.75 125. 00 0.50 166. 25 0.33 SUBTOTAL : 1. 79 /M * 750.00 = 1343.19 TOTAL FIXED COSTS = 3526.00 INSURANCE AND TAXES Ð. AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR.)/2 INSURANCE AND TAXES = 0.20 % + AVE. INVEST. (153312.50) INSURANCE AND TAXES = 19.16 3/HR YARDING COST SUMMARY CALCULATED MBF/DAY 22. 22 INSUPANCE AND TAXES/8 HR. DAY 152. 21 TOTAL COST/8 HR. DAY 949, 99 COST. MBF 42, 75

Ecologger II

A DEPRECIAT	ION COSTS					n sije sije sije sije sije sije sije s	
					· 1.T	FE	
EQUIPMENT	NEW	RESIDUAL	FRE	IGHT	YRS	HRS	\$/HR
YARDER	182398, 88	36479 88	25.0/	a 1913		40000	
RADIUZTRANS	4889 88	480 90		а на Зайа	9	12800	11. 99
CARR HAGE	2800 00	480 30 560 00		3888	4 8	5499	0.68 0.13
• • • • • •	10000 00	1000 00		а ий А	5	12300 8000	0.13 1.13
RTA HOW TT	8000 00	200 00	999		4	6490	1.13
SIZE		LENGTH				FE/HRS C	
GUYLINES 0 SA	4 68	225 00	1. 66	. 747	ин 1	2809	0 12
	TOTAL DE	PRECIATON	COSTS =	15. 20	/HR		
							• • • •
B CPERATING		n 200 2002 200 200 200 200 200 200 200 2	a sija sija sija sija sija sija tija sija s	in sin sin sin sin sin	ade ade ade ade ade a	adar adar adar adar adar adar adar	346 346 346
		·				•	•
			•				
MAINTHNANCE							
AND REPAIR	FOULPMENT	XOF DEP	\$/HOUR				
	YPRDER	50	5.99				
	RADIO	5 9	0,41				
	CARRIAGE	59	r na				
	TRACTOR	58	A 56				
	RADIA CONT	60	a aa				
	508	TOTAL 7. 0	10				
FUEL HND							
UBRICATION	EQUIP	MENT	\$/HR				
	YARDE	-	5, 92				
	TRACT		2.97				
	1874.1	1.514	Z . F				
	SU	RTOTAL 8	39				
VARDING LARDR	TITLES HO	URLY RATE		TOTA	L COST	/HR	
HOOK LENDER		8 50	1		8 50		
CHOKER SETTER		8 50	1 99		8 50		
HASHR		a aa	1.	-	a aa		
ARDING ENGIN		8 50	1.		R 50		
KINDER OPERA	TÜR	8 5 0	1	1	8 50		

შა

C FIXED COSTS MOVE IN RIQA HOURS FOR SIDE. VEHICLE AND DRIVER 65 89 + 40.00 * Б ЙЙ = 630.54 INITIAL RIG UP 2 00 HOURS FOR SIDE = 130 18 SAME AS RIG UP 130.18 RIG DOWN MOVE OUT SAME AS MOVE IN 630.54 ENGINFERING LABOR = 0 00 CHOKERS 24 45 EACH COST OF CHOKERS = (SALE YOL) * (COST EACH)/LIFE MBF COST OF CHOKERS = 258, 28 OPERATING LINESCEPS) L.TNF \$1/FT SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (\$/M)

MATNEINE	1.	27	ą	75	2198	คค	2667	98	10 00	0. 27
HALM_BACK	ø	86	9	63	1988	20	1634	aa 🛛	8.00	0, 20
SKYLINE	1.	66	Й	88	1.500	aa	2490	88	10 00	0.25
SKIDDING	Ø,	88	0	88	я	ыя	Я	'nЙ	A 44	0.00
STRAW INE	9	45	0	38	2500	ю	1125	80	8.99	0. 14
SLACK PULLING	0	99	0.	99	0.	1313	ia.	99	0. 00	8.00
OTHER LINE	0.	99	0.	66	а,	0A	я	88	a aa	0.00

SUBTOTAL 0.86 /M * 750,00 = 645.43

TOTAL FIXED COSTS = 2425 23

D INSURANCE AND TAXES

AVERAGE INVESTMENT = (NEW COST + RESID + DEPR)/2 INSURANCE AND TAXES = 0.20 % + AVE INVEST (119022.25)

INSURANCE AND TAXES = 14 88 #/HR

and and and a special equation and a special equation of the special equation of t

CALCHLATED MBEZDAY 17 7A DEPRECIATIONZA HP DAY 121.63 OPERALING COSTZA HR DAY 399 A9 FIXED COST Z8 HR DAY 399 A9 FIXED COST Z8 HR DAY 399 A2 INSUMANCE AND TAXESZ8 HR DAY 119 02 TOTAL, COSTZ8 HR DAY 696 97 COSTZMBE 39 38

Ecologger II

**************************************		nder soler sole	191 - Alizada Sala Sala Sala Sala Sala Sala Sala S	n sár vecsán sár sársáft			1 244 244 244
EQUIPMENT	NEW	RESIDUAL	5951	GHT	LII 485	FE HRS	\$/HR
CONDITIONED I	NEW .	RESIDONC	FREA		763		₽ 7 mR
YARDER 18	82390. 90	36478.00	7504	1 AA	8	12800	· 11. 9
	1809 00	480. 90	0000		4	6400	0. 68
	180a aa	560.00		iaga .	8	12800	0.18
•••••••••••••••••••••••••••••••••••••••	1099 09	1000 00		1 AA	5	8000	1. 13
RIG HOW TT S	1980. OO	800.00	0000	140A	4	6460	1. 13
SIZE GUYLINES 0.88		LENGTH 225. 00			ST LIP 00 13		05T/H 0. 12
	TOTAL D	EPRECIATON	COSTS =	15. 20	/HR	•	
		Ar sêrsên sêrsên sêrsên sêrsên sêrsên s	ije nje nje nje nje nje nje nje nje nje V	23023023030202020	nija sijasnija sija sija sija	in sijn sijn sijn sijn sijn sijn	ale aller
B. OPERATING	CUSTS						
1A INTENANCE							
AND REPAIR	EQUIPMENT	XOF DEP	≴⁄H0UR				
	YARDER	50	5. 99				•
	RADIO	- 68	0.41				
	CARRIAGE	20	Ø. 194				
	TRACTOR	50	0.56				
	RADIO CON	r 60	8 88	•		· ·	
	SUE	STOTAL 7.	30				
FLIEL AND							
UBRICATION	EQUI	PMENT	\$/HR				
	YARD	R	5. 92				
	TRACI	TOR	2. 97				
	S	JOTOTAL 8	8. 89	•			
YARDING LABOR	TITLES H	URLY RATE	NUMBER	TOTAL	COST/	'HR	
HOOK TENDER		8.50	1		50		
CHOKER SETTER		8,50	1 99		50		
CHASER		19 AA 0 50	1		89 50		
VARDING ENGINE SKIDDER OPERAT		8.50 8.50	1 1	-	50 50		
	C1101	TOTAL 34 P	aa				

C FIXED COSTS MOVE IN 6.00 HOURS FOR SIDE, VEHICLE AND DRIVER 65. 09 + 40.00 * 5.00 = 630.54 INITIAL RIG UP 2.00 HOURS FOR SIDE = 130 18 PIG DOWN SAME AS RIG UP 130.18 MOVE OUT SAME AS MOVE IN 630 54 ENGINEERING LABOR = 0.00 CHOKERS R4 45 EACH COST OF CHOKERS = (SALE VOL) + (COST EACH)/LIFE MBF COST OF CHOKERS = 258.38

OPERATING LINES(EPS)

1.INE	\$1/FT	SIZE(IN)	LENGTHOFTS	TOTAL	LIFE(MM) (\$/M)	
MAINLINE	1. 27	0.75	21.00 00	2667	aa 10.00	0. 27
HAULBACK	0 86	0.63	1900 00	1634	8.99	0. 20
SKYLINE	1.65	r 88	1500 00	2490	AG 10.00	0. 25
SKIDDING	0 90	0.00	0 00	0.	66 6 66 .	8. 99
STRHULINE	0.45	0.38	2500.00	1125	00 8.00	0.14
SLACK. PULLING	0 00	0.00.	. 0.00 .	9	09 0.00	9, 99
OTHER LINE	9 99	8. 89	8 98	. 8	89 8,99	8. 99
TOTAL FIXED CO)STS =	2425. 23				-
D INSURANCE	AND TAX					
AVERABE INVEST INSURANCE AND				DEPR 1	/2 119922, 25)	
INSURANCE AND	TAXES -	11 90	\$/HR	•		

VARDING COST SUMMARY

	n de sin	adın adın adın adın adın adın adın adın	de sêk sên Sêrsên sên sên sên Sêrsên s
	CALCULATED MREZDAY	17 70	
	DEPRECIATION/8 HR DAY	121. 53	
	OPERATING COST/3 HR DAY	399 A9	
	FIXED COST Z8 HP DAY	57 24	
	INSURANCE AND TAXES/8 HR	DAY 95 22	
•	TOTHE COST/8 HP DAY	673 17	
	COSTZMEE	TA A T	

APPENDIX III

PAYLOAD COMPUTATIONS

SKYLINE ANALYSIS PROGRAM (SAP)

•

Smith Timbermaster

LIVE SKYLINE LOAD ANALYSIS (RIGID LINK ASSUMPTION)

ALLOWABLE SKYLINE TENSION= 10630

SKYLINE WT=	0.54	MAINLINE WT= 0.35
HEADSPAR HT=	24	TAILSPAR HT= 20
HEADSPAR T P =	1	TAILSPAR T. $P = 10$
INN YARO LIM≕	1	OUT YARD LIM= 10

CARRIAGE WT= 80 LOADED CARRIAGE CLEARANCE=

LOADED CARRIAGE CLEARANCE= 8 TERMAIN POINT LOG LOAD (FLY) LOG LOAD (DRAG) LINE LENGTH

2	2846		3869	896
3	1839		2758	896
4	2077		3116	897
5	2237		3356	897
÷	2200	·	3300	895
7	2326		3488	896
3	2084		3126	894
Э	3829		5730	895
	NEW SPAR LOCATION	= 9		
	NEW YARDER SPEC	= 1		
	REQD RIGGING LENGTH	a 2		

STANDING SKYLINE PLOT= 3

STANDING SKYLINE PAYLOADS (BASED ON MIN LIVE SKYLINE LENGTH)

STATIO	И	L06	LOAD	(FLY)	LOG	LOAD	(DRAG)	CLE	ARANCE
87			2359			3539			12
175			1681			2521			14
262			1429			2143			15
350			1327			1990			18
437			1310			1964			22
524			1364			2946			23
612			1505			2258			20
699			1804		-	2706			15
737			2571			3856			9
	NEW	SPAR	LOCAT	TON	= 0				

NEW SPAR LUCATION	=	6
NEW YARDER SPEC	×	1
REQD RIGGING LENGTH	=	2
STANDING SKYLINE PLOT	æ	3

Rosedale Timbermaster

LIVE SKYLINE LOAD ANALYSIS (RIGID LINK ASSUMPTION)

ALLOWABLE SKYLINE TENSION= 13700

SKYLINE WT=	8 72	MAINLINE	WT=	0 26
HEADSPAR HT=	28	TAILSPAR	HT=	20
HEADSPAR T.P =	1	TAILSPAR	T. P = -	10 .
INN YARD LIM=	1	OUT YARD	LIM=	10

CARRIAGE WT= 80 LOADED CARRIAGE CLEARANCE= 8

1

TERMAIN POINT LOG LOAD (FLY) LOG LOAD (DRAG) LINE LENGTH

- 3	2599	3399	896
4	2849	4273	897
5	3027	4540	897
6	2962	4443	896
7	3109	4664	895
8	2789	4182	894
9	5013	7519	894
	NEW SPAR LOCATION	= 0	
		-	

NEW YARDER SPEC = 1 REGD RIGGING LENGTH = 2 STANDING SKYLINE PLOT= 3

STANDING SKYLINE PAYLORDS (BASED ON MIN LIVE SKYLINE LENGTH)

STRTION	LOG LOAD	(FLY) LOG	LOAD <	DRAG2	CLEARANCE	
87	3214		4829		15	
175	2312		3468		16	
262	1971	···· ·	2957	·	17	
350	1828		2742		20	
437	1796		2694		23	
524	1859		2788		24	
612	2037		3055		29	
699	2422		3633	•	15	
787	3426		5139		9	
NE	W SPAR LOCAT	10N = 0				

NEW SPAR LOCATION = 0 NEW VARDER SPEC = 1 READ RIGGING LENGTH = 2 STANDING SKYLINE PLOT= 3 Thunderbird

C-LIVE SKYLINE LOAD ANALYSIS (RIGID LINK ASSUMPTION) ALLOWABLE SKYLINE TENSION= SKYLINE WT= 1. 85 MAINLINE WT= 1. 94 HEADSPAR HT= TAILSPAR HT= HEADSPAR T P = TAILSPAR T P = INN YERD LIME OUT YARD LIM= CARRIAGE WT= LOADED CARRIAGE CLEAPANCE= TEPRAIN POINT LOG LOAD (FLY) LOG LOAD (DRAG) LINE LENGTH 3 12364. NEW SPAR LOCATION Ø NEW YARDER SPEC * REGD RIGGING LENGTH -STANDING SKYLINE PLOT= 3 STANDING SKYLINE PAYLOADS (BASED ON MIN LIVE SKYLINE LENGTH) STATION LOG LOAD (FLY) LOG LOAD (DRAG) CLEARANCE NEW SPAR LOCATION a 0 NEW YARDER SPEC * REGD RIGGING LENGTH = 2 STANDING SKYLINE PLOT= 3

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Igland Jones Trailer Alp

	<u>م بر بار او مر او در او در</u>						
LIVE SKYL	INE LOAD ANAL	YSIS (RIGI	D LINK	ASSIJMPT	TON		
ALLOWABLE	SKYLINE TENS	ION= 137	60			· ·	•
Skyline W Headspar I Headspar I Inn Yard I	HT= 24 TP= 1	TA TA		HT=	0.26 29 10 10		
CAPRIAGE N LOADED CAP	it= 80 Rriage Clearai	NCE= 8					
TERRAIN PO	DINT LOG LO	AD (FLY)	LOG LO	IAD (DRA	6) L	INE LENGTH	I
23456789	271 243 273 292 287 302 271 494	5 3 3 3 2	407 363 409 439 431 434 406 741	3 . 6 2 8 2 9		896 395 897 897 896 896 896 896 895	
	NEW SPAR LOCA NEW YARDER SA REOD RIGGING STANDING SKYO	EC = LENGTH =	_	•		. •	
STANDING S	KYLINE PAYLO	ADS (BASED	ON MIN	LIVE S	kyl ine	LENGTH)	
STATION	LOG LOAD	> (FLY)	LOG LOA	o (drag		LEARANCE	
87 175 262 350 437 524 612 699 787	313(224) 191- 177- 174 130 197 235 333 NEW SPAR LOCK NEW YAPDER SF READ RIGGING	4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	1 2	1 2 1 5 7 8 3	•.	12 14 15 13 22 23 20 15 9	
•,	STANDING SKYL	INE PLUTA	\$				

REGGENG LENGTH REQUIRED FOR SKYLINE= 984

.

Ecologger II

LIVE SKYLINE LOAD ANALYSIS (RIGID LINK ASSUMPTION) ALLOWABLE SKYLINE TENSION= 26500 SKYLINE WT= 1. 42 MAINLINE WT= 1. 04 HEADSPAR HT= 49 TAILSPAR HT= 20 HEADSPAR T P = TAILSPAR T P = 1 10 INN VARD LIM= OUT YARD LIM= 1 10 CARRIAGE WT= 680 LOADED CARRIAGE CLEAPANCE= 8 TERPHIN POINT LOG LOAD (FLY) LOG LOAD (DRAG) LINE LENGTH 11844 2 7896 897 3 6073 9110 395 4 6137 9205 895 5 9471 895 6314 9159 6 7 6105 893 5326 892 9489 8 5666 8499 890 9. 9936 14904 891 NEW SPAR LOCATION = 0 NEW YARDER SPEC = 1 REOD RIGGING LENGTH = 2 STANDING SKYLINE PLOT= 3

STANDING SKYLINE PAYLOADS (BASED ON MIN LIVE SKYLINE LENGTH)

STATION	LUG LOAD (FLY)	LOG LOAD (DRAG)	CLEARANCE
87	6332	9573	31
175	4475	6713	29
262	3765	5647	28
358	3477	5215	28
437	3431	5145	29
524	3589	5384	. 28
612	3998	5997	23
533	4858	7287	16
787	7969	10604	8

NEW SPAR LOCATION = 0 NEW YARDER SPEC = 1 REQD RIGGING LENGTH = 2 STANDING SKYLINE PLOT= 3

APPENDIX IV

THEORETICAL DAILY PRODUCTION

C10 DISP "PAYLORD(FROM SAP OR MSAP)"; 20 INPUT A 30 DISP "X TURN MAKING EFFICIENCY": 40 INFUT 81 50 DISP "INHUAL SPEED (FPM.MID DRUMD") 60 INPUT 82 70 DISP "OUTHAUL SPEED (FPM MID DRUMD": . SA INPUT A3 90 DISP "LENGTH OF SKYLINE ROAD": 100 INPUT A4 110 DISP "LATERAL YARDING DISTANCE"; -120 INPUT A5 130 DISP "ROAD CHANGE TIME (MIN)": 140 INFUT AG 150 DISP "PRODUCTIVE MINUTES PER SHR DAY": 160 INPUT A7 170 DISP "CARRIAGE (1) MECH (2) MANUAL"; 180 INPUT AS 190 DISP "MEF/ACRE"; 200 INPUT 49. 210 81=(8*81)/11 220 1F A2>600 THEN 240 230 GOTO 250 240 A2=600 250 82=84/2/82 260 63=84/2/83 270 GOTO AS OF 280-300 280 84=(0 005*85)+0.37 290 60TO 310 300 84=(0,005*85)+0 67 310 E5=(0 0005*E1)+0 93 320 BA=(B2+B3+B4+B5)*1000/B1 330 B2=(84*85*89*2)/43560 340 88=86/87 350 R9#86+88 360 0=87/89 370 FRINT ""C""

RSA END

ENN PAYLOAD(FROM SAP OR MSAP)25146 2 THRN MAKING EFFICIENCY2 6 INHUAL SPEED (FPM MID DRUM)21050 OUTHAUL SPEED (FPM MID DRUM)21050 LENGTH OF SKYLINE ROAD2874 LATERAL YARDING DISTANCE250 ROAD CHANGE TIME (MIN)290 PRODUCTIVE MINUTES PER SHR DAY2330 CARRIAGE (1) MECH (2) MANUAL22 MBEZACRE26

47.69970760

RUN

PAYLOAD(FROM SAP OR MSAP)22694 2 TURN MAKING EFFICIENCY2 6 INHUAL SPEED (FPM.MID DRUM)2750 OUTHAUL SPEED (FPM MID DRUM)21200 LENGTH OF SKYLINE ROAD2874 LATERAL YARDING DISTANCE250 ROAD CHANGE TIME (MIN)260 PRODUCTIVE MINUTES PER 8HR DAY2330 CARRIAGE (1) MECH.(2) MANUAL22 MEF/ACRE26 12 9369054

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RUN

Thunderbird

PAYLORD(FROM SAP OR MSAP)26878 % TURN MAKING EFFICIENCY2 A INHUAL SPEED (FPM.MID DRUM)21454 OUTHAUL SPEED (FPM MID DRUM)21454 LENGTH OF SKYLINE ROAD2874 LATERAL VARDING DISTANCE250 ROAD CHANGE TIME (MIN)290 PRODUCTIVE MINUTES FER SHR DAY2330 CARRIAGE (1) MECH.(2) MANUAL21 MBEZACRE26 22 22222860

RUN

Rosedale Timbermaster

RUN Smith Timbermaster PAYLOAD(FROM SAP OR MSAP)21964 % TURN MAKING EFFICIENCY2 6 INHUAL SPEED (FPM MID DRUM)2690 OUTHAUL SPEED (FPM MID DRUM)21140 LENG)H OF SKYLINE ROAD2874 LATERAL VARDING DISTANCE250 ROAD CHANGE TIME (MIN)260 PRODUCTIVE MINUTES PER SHR DAY2330 CARRIAGE (1) MECH. (2) MANUAL22 MEF/ACRE26 7.771120935

RUN

Igland Jones Trailer Alp

PAYLOAD(FROM SAP OR MSAP)22615 % TURN MAKING EFFICIENCY2 6 INHUAL SPEED (FPM MID DRUM)21000 OUTHAUL SPEED (FPM MID DRUM)21000 LENGTH OF SKYLINE ROAD2874 LATERAL VARDING DISTANCE250 ROAD CHANGE TIME (MIN)260 PRODUCTIVE MINUTES PER SHE DAY2330 CARRIAGE (1) MECH (2) MANUAL22 MEEZACRE26

APPENDIX V

YARDER DESCRIPTIONS

SMITH TIMBERMASTER

The "Timbermaster," designed and manufacturered by a small agricultural engineering firm in Scotland, is a well engineered machine of rugged yet compact design. The unit is trailer mounted for ease of movement and is powered by a standard farm tractor.

Two operators are required for the "Timbermaster," one to run the yarder and one to set chokers. The yarder operator runs the system with two hand levers, one for the mainline winch and one for the haulback winch. Throttle speed is controlled by a foot pedal with a control cable leading to the farm tractor power unit. If a self-releasing choker hook is used, the yarder operator does not have to double as chaser and the turns can be quickly dropped at the landing allowing the skyline carriage to return to the woods without delay. Communications between the chokersetter and yarder operator are by radio.

ROSEDALE_TIMBERMASTER

The Timbermaster is a truck mounted yarder-loader. The drumset includes three operating drums (skyline, mainline and haulback). Self-releasing chokers and a knuckleboom grapple permit the yarder engineer to land and deck logs without assistance provided the log slip is flat and volume per skyline road is low enough to be decked within reach of the knuckleboom. The machine should be capable of performing all the typical three drum live skyline operations described under Ecologger II.

The knuckleboom was assumed to be capable of keeping the

log slip clear in case l, permitting the exclusion of skidder + skidder operator costs.

The Rosedale Timbermaster is actually the same as the Timbermaster Skyline Hauler which is manufactured in Australia and New Zealand.

*NOTE: All descriptions of Yarders from Seabaugh and Yerkes, 1979, except for the Smith Timbermaster which is from Hawkes, 1979.

ECOLOGGER II

The Ecologger II is a three drum (skyline, mainline, haulback) drumset and steel tower mounted on a rubber tired skidder. The machine is capable of yarding in live skyline, highlead, Grabinsky and (with proper carriage and intermediate support equipment) multispan configurations.

In live skyline configuration, operation of a variety of slackpulling carriages is feasible with or without use of the haulback line as chordslope dictates. The yarder can be radio controlled, permitting the yarder operator to also act as chaser when other conditions permit.

The Ecologger II is capable of yarding uphill or downhill and in partial cuts or clearcuts. The christy lightweight yardercontrolled carriage for downhill partial cutting has been developed for this cable configuration.

Costs for a three man crew, including one hooktender, one

chokersetter, one yarder engineer-chaser, and one skidder operator were computed for all logging.

THUNDERBIRD

The Thunderbird is a four drum and fixed boom steel tower available on crawler, rubber tired trailer or self propelled rubber mounted undercarriages. The skidder system (skyline, mainline, slackpuller, haulback, and skidder carriage) is standard logging configuration for the machine. The Thunderbird is also capable of yarding in highlead, Grabinsky, standing skyline, northbend, southbend, block in the bite, Tyler, and multispan configurations.

IGLAND-JONES MINI ALP

The mini alp is a small trailer mounted drumset (skyline, mainline and haulback) and tower. Power is applied from a farm tractor via the power takeoff. The machine is capable of operating in standing skyline, restricted live skyline, and multispan configurations, all with various slackpulling carriages and all with or without the haulback as chordslope dictates.

APPENDIX VI

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	Ecologger II	Rosedale Timbermaster	Igland-Jones Alp	Thunderbird	Smith Timbermaster
Drum Capacities					
Skyline Mainline Slackpulling	1500 2100	1350 1050	3300 2100	1700 1500 1500	2000 1500
Haulback	1900	1950	2100	3100	3000
Line Size					
Skyline	7/8	5/8	5/8	1	1/2
Mainline Slackpulling	3/4	3/8	3/8	3/4 3/4	3/8
Haulback	5/8	3/8	3/8	3/4	3/8
Line Speeds					
Mainline (fpm) Slackpulling	1050	750	. 1000	1454 1454	690
Haulback	1050	1200	1000	3700	1140
Tower Height	49'	28'	24'	45'	24 '
Engine HP	160-200	80	65	320	65
Price (1980)	\$182,000	\$ 82,000	\$ 73,000	\$235,000	\$ 66,000

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APPENDIX VII

CONSTRUCTED COST PROGRAM

FOR THE HP 9830

C0 5 FIXED 2 6 DISP "LIFE OF YARDER IN YEARS": 7 INFUT I S I1=I*1600 10 DISP "NEW COST OF YARDER": 20 INPUT X 30 DISP "FREIGHT COST FOR YARCED"; 40 INPUT X1 50 DISP "TOTAL COST OF RADIO TRANSM. "; 60 INPUT X3 70 DISP "NEW COST OF CARRIAGE": 80 INPUT ×4 90 DISH "NEW COST OF LANDING TRACTOR": 100 INPUT Y 110 DISP "FREIGHT FOR TRACTOR": 120 INPUT 91 130 DISP "COST OF RIGGING HOWR": 140 INPUT Y2 150 DISP "COST OF RADIO CONTROL": 160 INPUT Y7 170 DISP "DIAMETER, COST/FT OF GUYLINES"; 180 INFUT 94, 95 190 DISP "NUMBER, LENGTH IN FT OF GUYLINES"; 200 INPUT Y3. Y6 210 Z=0 2*X 220 71=X-Z+X1 230 8=Z1/I1 240 Z2=0, 1*X3 250 ZR=X3-Z2 260 8=23/6400 270 Z4=0.2*X4 290 Z6=X4-Z4 308 C=Z6/12800 310 Z7=0 1*Y 320 28=7-27+71 330 D=28/8000 340 29=0 1*92 350 W1=Y2-Z9 360 E=W1/6400 270 F=(Y3*Y6*Y5)/12800 780 U2=0 1*Y7 290 W3=Y7-W2 466 6=43/6466 410 S1=(A+8+0+0+E+F+G) 420 DISP "OPERATING COSTS" 430 WAIT 4000 440 NOSP "FUEL AND LUBE FOR YARDER": 450 DIPUT 81 460 DISS "FUEL AND LUBE FOR TRACTOR #/HP": 476 INPUT 62

490 DJSP "HOOKTENDER WAGES \$/HR": 566 INPUT 61 510 DISP " NUMBER OF CHOKER SET, MAGES \$/HR": 520 INPUT 82,83 530 DISP "CHASER WAGES \$/HR": 540 INPUT 84 550 DISP "YARD ENG. WAGES \$/HR"; 560 INPUT 85 570 DJSP "SKIDDER OPER, MAGES \$/HR"; 580 INPUT 86 590 DISP "FIXED COSTS" 600 WAIT 4000 610 DISP "HRS TO MOVE IN, COST OF VEHICLE": 620 INPUT C1, C2 620 DISP "INITIAL RIG UP IN HRS"; 640 INPUT C3 650 DISP "ENGINEERING COSTS"; 660 INPUT C4 €70 DISP "COST PER CHOKER \$"; 680 INPUT C5 690 01=02=03=04=05=06=07=0 700 DISP "MAINLINE COST/FT/ DIAMETER"; 710 INPUT L1/L2 720 DISP "MAINLINE LENGTH, LIFE MM": 730 INPUT L3: L4 740 DISP "HAULBACK COST/FT SIZE") .750 INPUT L5/L6 750 DISP "HAULBACK LENGTH, LIFE MM": 770 INPUT L7, L8 👘 780 DISP "SKYLINE COST/FT, SIZE"; 790 INPUT M1, M2 800 DISP "SKYLINE LENGTH/ LIFE MM"; 810 INPUT M3 M4 820 DISP "SKIDDING LINE COST/FT,SIZE"; -830 INPUT M5, M6 840 DISP "SKIDDING LINE LENGHT/LIFE MM"/ \$50 INPUT M7 M8 860 DISP "STRAWLINE COST/FT/SIZE": 870 INPUT N1, N2 880 DJSP "STRAWLINE LENGTH | LIFE MM") 👘 890 INPUT N3, N4 900 DISP "SLACK PULLING LINE COST/FT/SIZE": 910 INPUT N5/N6 920 DISP "SLACK PULLING LINE LENGTH, LIFE MM"; 930 INPUT N7, N8 940 DISP "OTHER LINES COST/FT, SIZE"; 950 INPUT P1/P2 960 DISP "OTHER LINE LENGTH, LIFE MM") 970 INPUT 93. P4 971 I2=Z1/I 972 IR=(X+Z+I2)/2 973 DISP "INSURANCE AND TAKES AS MOR A.I.": 974 INPUT 14 975 [5=(I3/1600)*I4 490 IF L4=0 THEN 1000 490 01=(|1*L3)/L4/1000 1000 IF | 8=0 THEN 1020 1010 02=(L5*L7)/L8/1000

100

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" 1020 IF"M4=0 THEN 1040" " 1030 03=(M1*M3)/M4/1000 1040 IF M8=0 THEN 1060 1050 04=(M5+M7)/M8/1000 1060 IF N4=0 THEN 1080 1070 Q5=(N1*N3)/N4/1000 1050 IF N8=0 THEN 1100 1090 Q6=(N5+N7)/N8/1000 1100 IF P4=0 THEN 1120 1110 07=(P1*P3)/P4/1000 1110 074(F1#F3)/F4/1005 1120 DISP "TOTAL SALE VOL. MBF"; 1130 INPUT 08 1140 09=(01+02+03+04+05+06+07)*08 1150 P5=(C5+Q8)/100 1150 52=0. 5*R+0. 6*8+0. 2*C+0. 5*D+0. 6*G 1170 SE=A1+A2 1180 54=81+(82*83)+84+85+86 1190 55=52+53+54 1200 56=51+55 1210 P5=(C2+56)*C1 1220 P7#56+03 1230 S7=(2*P6)+(2*P7)+C4+P5+Q9 1240 DISP "PRINTOUT SHORT(1), LONG(2)"; 1250 INPUT 01 1260 GOTO D1 OF 1265, 1306 12:55 PRINT "TOTAL TAXES & INSURANCE ="15"\$"12:55 PRINT "TOTAL DEPRECIATION = "51"\$/HR"12:09 PRINT "TOTAL OPERATING COST = "55"\$/HR12:09 PRINT "TOTAL FIXED COST = "57"\$ " \$/HR" \$ " 1291 DISP "LONG PRINTOUT YES(1) NO(2)"; 1292 INPUT 02 1293 GOTO D2 OF 1306, 1294 1294 STOP 1300 FIXED 2 1301 PRINT "Adaption and the second and the second se 1306 PRINT " EXPLANATION OF COST" 1308 PRINT "A. DEPRECIATION COSTS" 1318 PRINT " LIFE" 1318 PRINT - CARE 1320 PRINT "EQUIPMENT NEW RESIDUAL FREIGHT YRS HRS \$/HR* 1330 PRINT 1339 FIXED 2 1340 PRINT "YARDER "X""Z" "X1"4 6400 "A"" 1341 F1=F*6400

 1341
 F1=F#6400

 1350
 PRINT "RADIO/TRANS "X3" "Z2"
 0000000
 4
 6400 "B""

 1360
 PRINT "CARRIAGE
 "X4" "Z4"
 0000000
 8
 12800 "C""

 1370
 PRINT "TRACTOR
 "Y" "Z7"
 "Y1"5
 8000 "D""

 1380
 PRINT "RIG HOW TT
 "Y2" "Z9"
 0000000
 4
 6400 "E""

 1400 PRINT 1410 PPINT 1420 PRINT " SIZE NUMBER LENGTH COST/FT TOT COST LIFE/HRS COST/H" 1430 PRINT "GUYLINES"Y4""Y3""Y6""Y5""F1"12800 "F" " 1448 PRINT 1441 PRINT 1444 PRINT TOTAL DEPRECIATON COSTS = "S1"/HR" 1450 PRINT " 1460 PRINT 1480 PPINT " B. OPERATING COSTS" 1481. PPINT _____

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1482 PRINT 1490 PRINT "MAINTENANCE" 1500 PRINT "AND REPAIR EQUIPMENT NOF DEP \$/KOUR" 1501 A4=0.5*A 1502 A5=0 6*8 1503 86=0 2*0 1504 A7=0 5+D 1505 A3=0. 6*G 1510 PRINT " YARDER 50 "84" " 1520 PRINT " "A5" " RADIO 60 1520 PRINT " CARRIAGE *85* * 20 50 . 1540 PRINT " "87" " TRACTOR 1550 PRINT * RADIO CONT 60 "AS" " 1560 PRINT 1570 PRINT " SUBTOTAL "S2" 1580 PRINT 1590 PRINT 1600 PRINT "FUEL AND" 1610 PRINT "LUBRICATION EQUIPMENT \$/HR 1620 PRINT 1625 PRINT " VARDER "81"" 1630 PPINT " TRACTOR "82"" 1640 PRINT 1645 PRINT 1650 PRINT " SUBTOTAL "A3" " 1660 PRINT 16T0 PPINT 1580 PRENT "VARDING LABORKTITLED HOURLY RATE NUMBER TOTAL COST/HR" 1630 PPINT "------1700 PRINT 1710 PRINT "HOOK TENDER "81" 1 "B1"" 1712 T1=P2+B3 1720 PRINT "CHOKER SETTER "83" "82""T1"" 1 "B4"" 1730 PRINT "CHASER "B4" 1740 PRINT "YARDING ENGINEER "85" "85" " 1 1750 PRINT "SKIDDER OPERATOR "86" "E6" " 1 1760 PRINT 1765 PRINT SUBTOTAL "S4"" 1770 PRINT " 1790 PPINT 1790 PRINT "-1791 PRINT 1792 PRINT 1793 PRINT 1794 PRINT 1795 PRINT 1796 PPINT 1797 PRINT 1798 PRINT 1810 PRINT "C. FIXED COSTS" 1820 PRINT "C1"HOURS FOR SIDE, VEHICLE AND OPIVER" 1959 PPINT 1860 PRINT "INITIAL RIG UP "C3" HOUPS FOR SIDE = "P7"" 1870 PRINT 1880 PRINT 1890 BEINT "RIG COWN SAME AS RIG UP. "P7""

1900 PRINT 1910 PPINT 1920 PRINT "MOVE OUT SAME AS MOVE IN "P6"" 1930 PRINT 1940 PRINT 1950 PPINT "ENGINEERING LABOR = "C4"" 1960 PPINT 1970 PPINT 1980 PPINT "CHOKERS "C5"EACH" 1990 PSINT 2000 PRINT "COST OF CHOKERS = (SALE VOL) * (COST EACH)/LIFE MBF" 2010 PRINT 2020 PRINT "COST OF CHOKERS = "P5"" 2030 PRINT 2040 PRINT 2070 PRINT "LINE \$1./FT SIZE(IN) LENGTH(FT) TOTAL LIFE(MM) (\$/M)" 2079 PRINT "-2080 PPINT 2081 T2=L1+L2 2082 T2=L5+L7 2082 T4=M1+M2 2094 T5=M5+M7 2085 T6=N1#N3 2086 T7=N5+N7 2097 T9=P1*P3 2088 19=09/08 "L1""L2""L3""T2" "L4""Q1 "L5""L6""L7""T3" "L8""Q2 2090 PRINT "MAINLINE 2100 PRINT "HAULBACK "M1""M2""M3""T4" "M4""Q2 "M5""M6" "M7" "T5" "M9""Q4 2110 PRINT "SKYLINE 2120 PPINT "SKIDDING "N1""N2""N3" "T6" "N4""Q5 2130 PRINT "STRAWLINE 2140 PRINT "SLACK PULLING"N5" "N6" "N7" "T7" "N8""Q6 "P1""P2" 2150 PRINT "OTHER LINE "P3" "T3" "P4""Q7 2160 PRINT 2170 PRINT 2130 PRINT " SUBTOTAL: "T9"/M * "Q8" = "Q9"" 2190 PPINT 2200 FRINT 2210 PRINT "-2220 PRINT "TOTAL FIXED COSTS = "S7"" 2220 FRINT "-2240 FRINT "D. INSURANCE AND TAXES" 2241 PRINT 2242 PRINT "AVERAGE INVESTMENT = (NEW COST + RESID. + DEPR.)/2" 2243 PRINT "INSURANCE AND TAXES = "I4"% * AVE. INVEST. ("I3")" 2244 PRINT 2245 PRINT "INSURANCE AND TAXES = "IS" \$/HR* 2246 PRINT 2250 DISP "COST SUMMARY (1) YES, (2)NO"> 2260 INPUT J5 2270 GOTO J5 OF 2290, 2280 2220 END 2200 PRINT " YARDING COST SUMMARY" 2211 19=15+8 2220 DISP "MEE PER DAV". ----

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