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Portable Bridges for Use on Logging Roads

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PORTABLE BRIDGES FOR USE ON LOGGING ROADS

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R-10

INTRODUCTION

For many years, the blast rock-decked native log stringer bridge has been the mainstay bridging system for logging roads in southeast Alaska. This system has been used almost exclusively, primarily because of the abundance of large, high-quality Sitka Spruce logs near the bridge sites. It has been very economical to construct bridges from these native materials. Cost allowances to loggers for constructing this type of bridge have ranged from $50 to $80 per linear foot.

However, times are changing. Suitable logs for stringers are becoming more difficult to locate, and are having to be transported over increasingly longer distances. Also, increasing pressure is being applied to protect fishery resources from the cyclic disturbance caused by replacement of log stringer bridges.

Rock and soil used for deck material can be spilled into the streams during installation and removal. Only the highest quality logs are suitable for bridge stingers, and loggers are realizing that these high-quality logs are worth more at the head-rig than when left in the woods to span creeks.

It is estimated that about 1.5 million board feet of prime logs are used for log stringer bridges each year in southeast Alaska. Estimating $350/MBM end product price, this represents the equivalent of over $525,000 worth of finished lumber being left in the woods yearly. Perhaps there is a better use for these prime logs?

The purpose of this paper is to explore the concept of using portable, reusable bridges as an alternative to the use of native log stringer bridges.

Most of the logging roads in Region 10 are on the islands of the Alexander Archipelago, thus the region has no interconnected land transportation network. With the few exceptions on the larger islands, most road systems are not connected to any communities and are normally used exclusively for log hauling activities.

Sustained yield management required road access for successive "entries" on 10- to 50-year cycles, with only sporadic and very minor use between entries. It is questionable that such use can truly justify the installation of permanent bridges on arterial and/or collector routes under these circumstances.

Installation and removal of temporary log stringer bridges becomes a more viable alternative in these cases. However, in some cases, installation and removal of log stringer bridges has resulted in unacceptable resource damage with respect to salmonids and/or water quality. A type of bridge that could easily be installed and removed with minimum disturbance to the stream banks and bottom, but that could be left in place for extended periods of time if needed, appears to solve these problems. In addition, if such bridges were reusable, the high-quality logs, which to date have been used for bridge stringers and then discarded, could enter the economy as finished lumber products.

REQUIREMENTS FOR PORTABLE BRIDGES

Bridges, to be classified as "portable," should be:

1. Light in weight;
2. Durable and sturdy;
3. Corrosion-resistant;
4. Repairable if damaged;
5. Easily and rapidly installed and removed with unskilled crews;
6. Handled with normal logging equipment; and
7. Adaptable to many different config rations and conditions.

The above listed characteristics virtually rule out concrete superstructures, which are heavy and difficult to repair if damaged. Also, larger-size bridges would require larger cranes for installation than are normally available in the woods. Timber girder bridges, likewise, would not be very practical because handling damage, holes, etc., are not repairable.

Steel bridges, however, can effectively meet all the above desirable characteristics. If modular systems made up of smaller components are used for the longer spans (50 ft. to 120 ft. or 15.24m to 36.5m), the weight of individual components is well within the lifting capacity of readily available equipment. Two basic types of steel portable bridges will be examined. There may be other types of prefabricated structures that would meet the basic requirements for portable bridges, but they will not be considered at this time.

Figure 1.--Hamilton "E-Z" Bridge with 3 spans--one 40 ft. (12.19m) and two 50-ft. (15.24m). The bridge was installed in 2 days.

Figure 2.--Preparation of abutment sill log for Hamilton Bridge

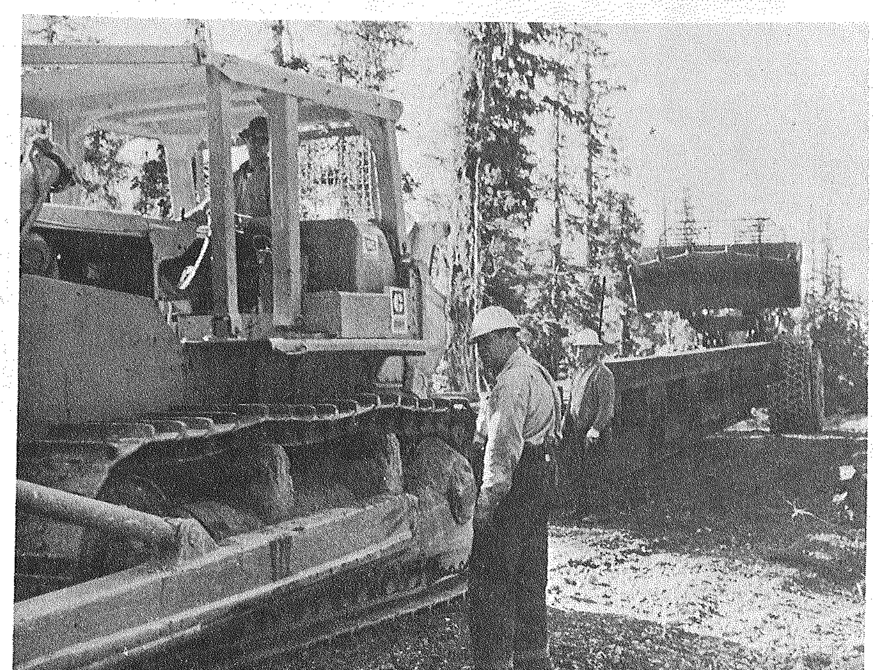

Figure 3.--Moving "E-Z" Bridge superstructure

The Hamilton Construction Company, of Springfield, Oregon, has developed a 1-lane prebuilt steel bridge superstructure, called the "E-Z" Bridge, suitable for permanent or temporary use on logging roads.

Installation is rapid, without the usual lagtime for fabrication, and they can be moved and reused easily. The bridge consists of steel girders with a treated timber deck, split into two sections longitudinally, each section carrying one wheel line. The two sections are connected to each other by bolted diaphragms. They are designed for USFS U80 loading with impact and L90 loading without impact, and are available in either ASTM A-36 painted steel or ASTM A-588 (Cor-10) weathering steel. Bridges furnished in weathering steel average about 16 percent higher in price than those with painted steel. However, from a durability and corrosion-resistance standpoint, the 16 percent additional cost will add many years to the useful life of the structure in the wet southeast Alaska climate.

These structures can be furnished in either 14-ft. or 16-ft. (4.27m or 4.88m) widths for the off-highway logging loadings.

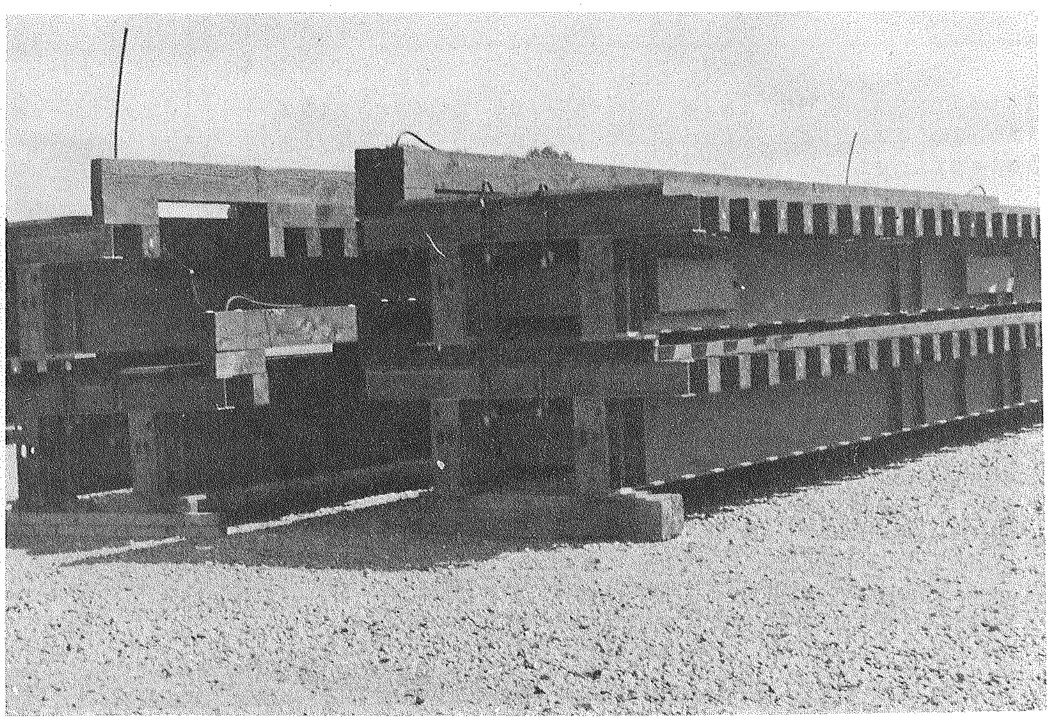

Figure 4.--Hamilton "E-Z" Bridge components

ACROW PANEL BRIDGES (BAILEY-TYPE)

The Acrow Panel Bridge is the modern version of the famous World War II Bailey Bridge. The extreme versatility of the system is its greatest asset. The cantilever launching method is of particular interest where it is important to avoid stream disturbance. Using the cantilever launching method, any length of bridge can be constructed on one bank and launched over rollers (without the need for heavy lifting equipment) using a false nose which is later removed.

The main girders are composed of identical 5-ft. by 10-ft. (1.52m by 30.5m) Acrow panels which are pinned together end to end. When greater load carrying capacity is necessary, the panels can be connected side to side to form continuous girders from bank to bank on either side of the bridge decking. Various widths, as shown in Table 1, are available simply by using different length floor beams (transoms) and a different width of deck unit. Timber decks or steel plate decks can be used.

Figure 5.--Acrow Bridge components

Table 1.--Acrow Panel Bridge widths

Description	Roadway Width	Clearance Between Tresses
Standard	11 ft. 3 in. (3.43m)	12 ft. 4 in. (3.76m)
Extra-Wide	13 ft. 6 3/4 in. (4.13m)	15 ft. 8 in. (4.78m)
Ultra-Wide	15 ft. 10 1/2 in. (4.84m)	17 ft. 11 3/4 in. (5.48m)
Double-Wide	23 ft. 8 1/2 in. (7.23m)	24 ft. 11 in. (7.59m)

In some cases, the extra-wide structure will be adequate; however, if a wider roadway is needed for large yarders or other machines, the ultra-wide configuration should be considered.

Acrow panels also can be used vertically to form piers and towers. In addition, the equipment can be used for falsework or for other applications where temporary heavy support is required.

As with the Hamilton Bridges, durability and corrosion-resistance are important. The Acrow components are not available in weathering steel, but they can be hot-dip galvanized to provide increased corrosion-resistance. This procedure approximately quadruples the useful life at about an 18 percent increase in cost over painted components.

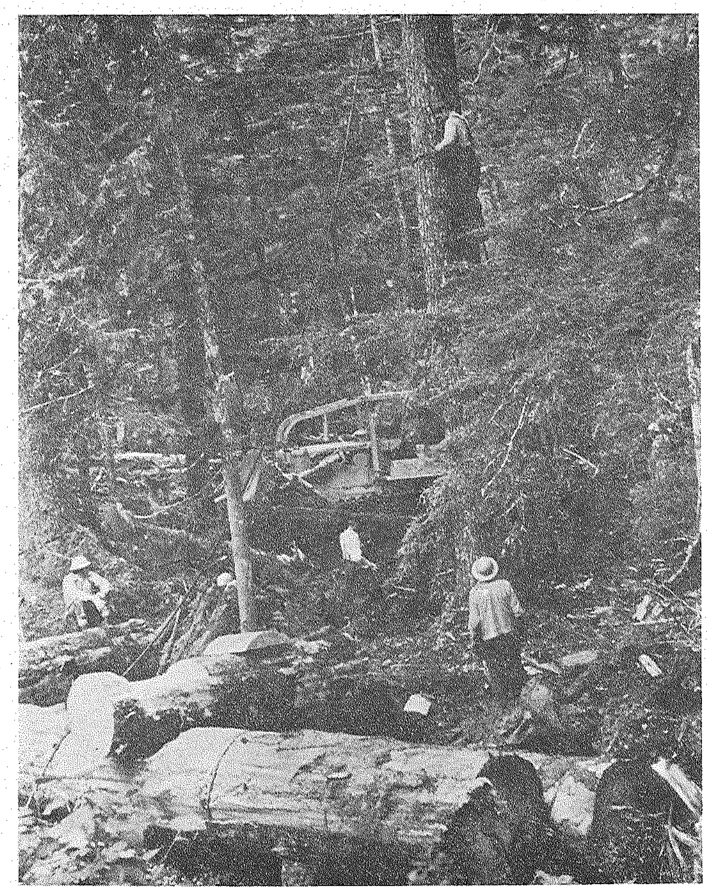

Figure 6 --Rigging Spar Tree to lift abutment cap log and end of bridge superstructure across creek

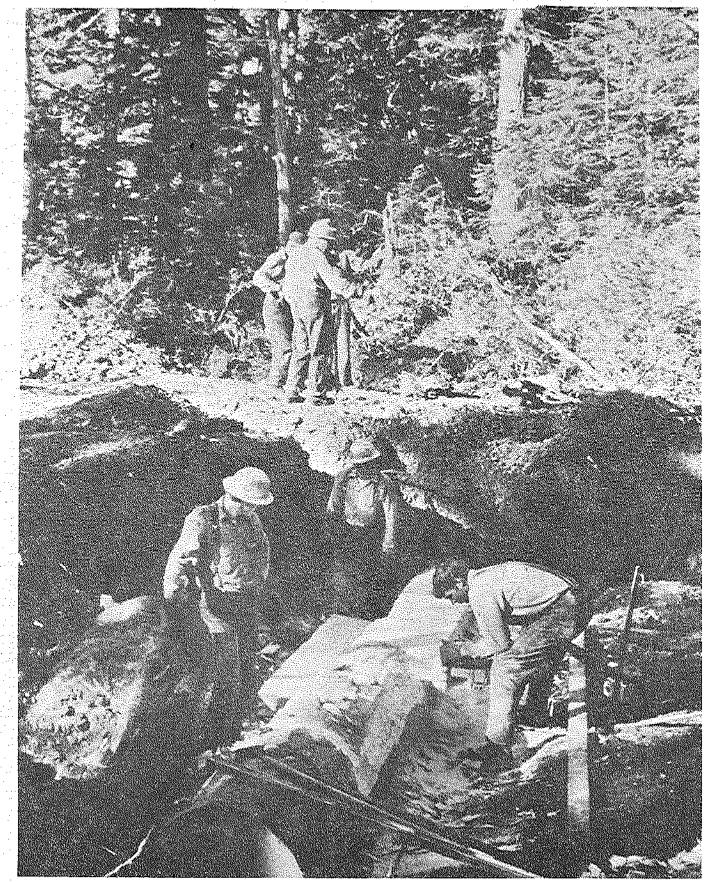

Figure 7 --Preparing beam seats

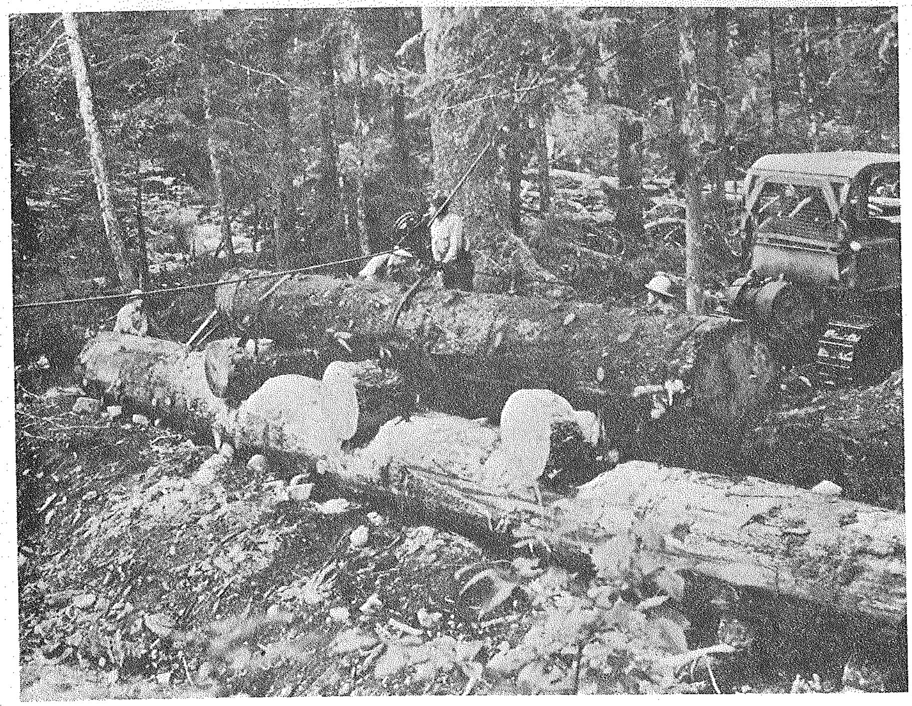

Figure 8.--Building the crib abutment

Figure 9.--Setting abutment--crib cap log

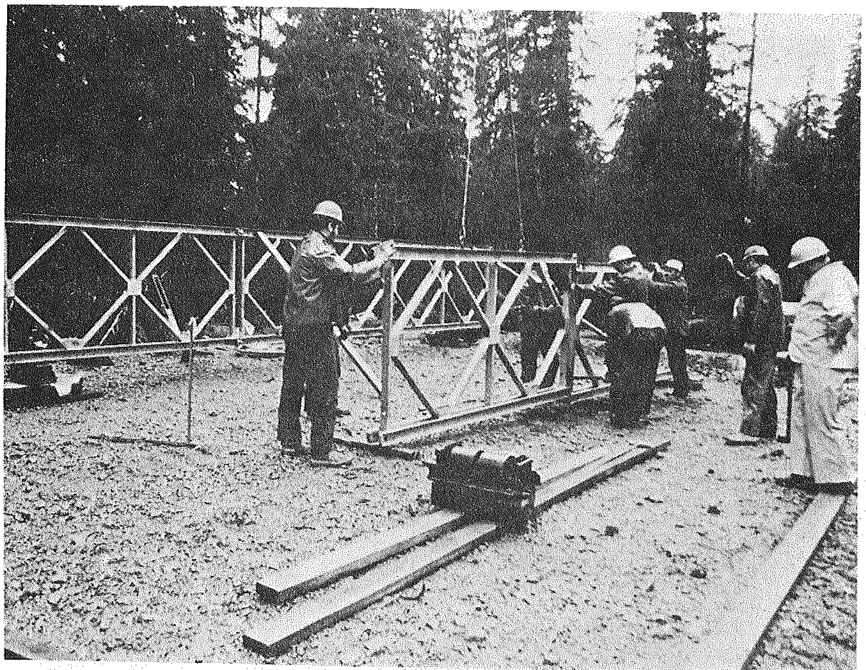

Figure 10.--Assembling panels on rollers--Acrow Bridge

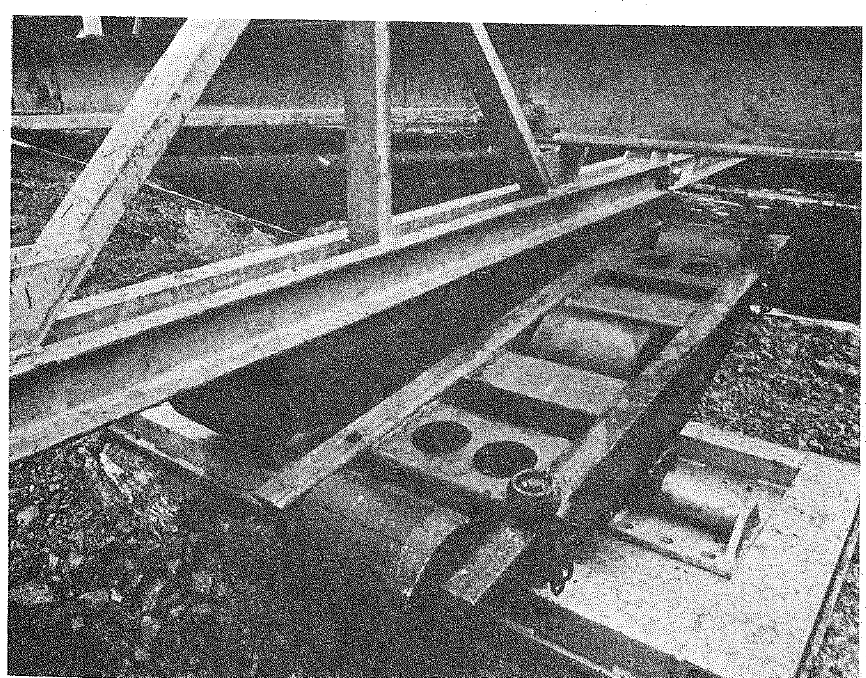

Figure 11.--Rocking rollers used for launching and landing Acrow Panel Bridge

Figure 12.--Launching nose cantilevering over stream Acrow Panel Bridge

Figure 13.--Completed quadruple-single Acrow Panel Bridge 80 ft. (24.38m) span

PROPOSAL FOR INCLUSION IN TIMBER SALE CONTRACTS

Since the use of the portable bridges is being proposed primarily for prevention of adverse impacts on water quality and fish habitat needs, the following provisions of FSM 2431.24-8 are considered applicable:

> When it can be determined that a temporary log stringer bridge cannot be constructed and removed without adequate control of erosion or adverse impacts on water quality and fish habitat needs, and that timber purchasers or prospective purchasers have the capability of constructing them, bridges of permanent materials can be authorized.

Portable bridges are determined to fall into this category. Available FR&T funds can be used to furnish permanent materials and construct bridges under Timber Sale Contracts. When it is not feasible to use FR&T funds, accepted industry practices (i.e., purchaser credit) may be utilized.

R-10 PILOT PROJECT

~~In order~~ to implement the use of portable bridges in R-10, a pilot project was proposed and funding approved in the add-on FR&T financing for FY-1977. Seventeen tentative sites were selected in the Tongass National Forest. All of the tentative sites are within the two existing 50-year timber sales on specified system roads. Suitable contract modifications will be required to accomplish the installation of portable bridges at these 17 sites. The following procedures have been developed to implement this pilot project.

Materials for the 17 bridges will be purchased under a contract administered by the Regional Office. The logistics of coordinating materials deliveries by several suppliers to five different camps on two long-term sales would be extremely difficult, to say the least. Because of this, it is proposed that all bridge materials be delivered (by the materials suppliers) to a central point, such as the GSA storage yard at Auburn, Washington.

The two timber purchasers, Louisiana Pacific-Ketchikan Division and Alaska Lumber & Pulp Company, periodically transport heavy equipment and machinery to their logging camps by barge. It is proposed to provide a suitable cost allowance in the long-term sales to allow the purchasers to handle the shipment of the bridge materials from the central storage yard to the bridge sites. They are much better able to coordinate timing, unloading, and transporting to fit their construction schedule with a minimum of delays and conflicts.

Installation costs will probably be slightly higher, but still in the same range as for native log stringer bridges. When temporary log abutments are used, their construction will be similar to that required for log stringer bridges, except that more care will be needed to construct the beam seats level. Installation costs should be allowed as a purchaser credit allowance in the timber sale.

Costs associated with removal, storage, and/or transportation to another site will likewise be somewhat higher than log stringer bridge removal costs. The removal and storage costs should also be allowed as a purchaser credit allowance in the timber sale.

Appendix A summarizes the estimated costs associated with the use of portable bridges.

ECONOMIC ANALYSIS

In most cases, for initial construction, the land manager must choose from a log stringer bridge, a "portable" bridge, or a permanent bridge. The manager should know, as well as can be estimated, the costs associated with each type of bridge so that he can determine how much fish habitat and water quality protection, as well as other constraints, are going to cost. Of course, other factors enter into this decision, such as transportation planning input, environmental concerns, and expediency.

The following comparison is presented to outline the present-worth method for comparing the costs. Other methods and assumptions may be equally valid depending on the particular conditions encountered. The assumptions used in this example will probably not be valid for any particular project.

ASSUMPTIONS

A number of simplifying assumptions have been made for this analysis. The basic comparison is made assuming that a 60-ft. (18.29m) bridge, either permanent, portable, or log stringer, will be needed at a different site every 7 years. For simplification, the sites will be assumed to be equidistant from one another, that a "new" permanent bridge or log stringer bridge will be required at a different site every 7 years, or that the original 60-ft. (18.29m) portable bridge will be moved from one site to the next every 7 years. The assumptions are as follows:

1. Service life of portable bridge is 35 years.

2. Service life of permanent bridge is more than 35 years.

3. No salvage value at end of 35 years.

4. Annual maintenance cost equals $200 for portable bridges and $100 for permanent or log stringer bridges.

5. A bridge will be needed for 7 years at a particular site, then the road will be closed.

6. Bridge stringer logs will not have a salvage value.

7. Permanent bridges will be left in place.

8. Log stringer or portable bridge will be removed at end of 7-year period. Logs will be discarded. Portable bridge will be removed, then installed at another site.

9. Safety characteristics (railing) not considered.

10. End product value of logs used for stringers equals $350/MBM.

11. Portable bridges.

    -- Initial installation cost equals $560/lin. ft. (.3048m) x 60 ft. (18.29m) = $33,600, including transportation and erection.

    -- Reinstallation cost equals $85/lin. ft. (.3048m) x 60 ft. (18.29m) = $5,100.

    -- Removal cost equals $59/lin. ft. (.3048m) x 60 ft. (18.29m) = $3,540, including transportation to the next site.

12. Temporary log stringer bridges.

-- Material cost = \$350/MBM x 20 MBM = \$7,000.

-- Installation cost = \$72/lin. ft. (.3048m) x 60 ft. (18.29m) = \$4,320.

-- Removal cost = \$28/lin. ft. (.3048m) x 60 ft. (18.29m) = \$1,680.

13. Interest rates = 0 percent, 6 percent, 10 percent, and 15 percent. The different interest rates were used to show the sensitivity to interest rate assumptions. The Bureau of Budget specifies that a rate of 6 percent be used to compare alternatives. The minimum attractive rate of return at financial institutions is 10 percent. Fifteen percent was also used as a sensitivity rate for comparison purposes.

14. Inflation of all costs was assumed at 2.5 percent per year.

The foregoing analysis could be refined by considering such additional factors as increasing scarcity of suitable native log stringers and/or other appropriate factors. However, based on the assumptions made for this analysis, the land manager could be shown the following conclusions:

1. For the 35-year time period, the present worth of the five bridges compare as shown in Table 4.

2. These costs can then be related to the environmental impacts, fish habitat and water quality protection concerns, safety considerations, etc., to allow a more rational decision-making process.

CONCLUSION

After completion and evaluation of the R-10 pilot project, future use of this type of bridge structure will be further defined. In the meantime, the following procedures are being used for the pilot project.

1. Bridge superstructures will be purchased under contract and delivered to a central storage area in the Seattle area.

2. Upon agreement with the purchasers, they will transport and install the bridges at the 17 proposed sites. Purchaser credit will be allowed for this work.

3. Should additional sites be identified which require this type of structure and none are available for reuse from the pilot project, available FR&T funds may be used to purchase the bridges. If FR&T funds are not available, purchaser credit may be allowed for the purchase, transportation, and installation of portable bridges. (See FSM 2431.24-8.)

Table 2.--Present worth calculations

60-Ft. Permanent Bridges	0%	6%	10%	15%
Initial Construction Annual Maintenance (7yr)	79,000 700	79,000 558	79,000 487	79,000 416
7-Yr. Subtotal	79,700	79,558	79,487	79,416
Construction -- Year 8 Annual Maintenance (7yr)	94,800 822	59,479 436	44,225 293	30,990 184
14-Yr. Subtotal	175,322	139,473	124,005	110,590
Construction -- Year 15 Annual Maintenance (7yr)	111,390 966	46,479 341	26,666 177	13,689 81
21-Yr. Subtotal	287,678	186,293	150,848	124,360
Construction -- Year 22 Annual Maintenance (7yr)	130,883 1,135	36,321 266	16,078 107	6,047 36
28-Yr. Subtotal	419,696	222,880	167,033	130,443
Construction -- Year 29 Annual Maintenance (7yr)	153,788 1,334	28,383 208	9,695 64	2,323 16
35-Yr. Subtotal	574,818	251,471	176,792	132,782
60-Ft. Portable Steel Bridges				
Initial Construction Annual Maintenance (7yr) Removal -- Year 7	33,600 1,400 4,160	33,600 1,116 2,767	33,600 974 2,135	33,600 832 1,564
7-Yr. Subtotal	39,160	37,483	36,709	35,996
Installation -- Year 8 Annual Maintenance (7yr) Removal -- Year 14	7,191 1,645 4,887	4,512 872 2,162	3,355 587 1,287	2,351 368 691
14-Yr. Subtotal	52,883	45,029	41,938	39,406
Installation -- Year 15 Annual Maintenance (7yr) Removal -- Year 21	8,449 1,933 5,743	3,525 682 1,689	2,023 354 776	1,038 162 305
21-Yr. Subtotal	69,008	50,925	45,091	40,911
Installation -- Year 22 Annual Maintenance (7yr) Removal -- Year 28	9,928 2,271 6,748	2,755 533 1,320	1,220 213 468	459 72 135
28-Yr. Subtotal	87,955	55,533	46,992	41,577
Installation -- Year 29 Annual Maintenance (7yr) Removal -- Year 35	11,666 2,669 7,929	2,153 416 1,032	735 129 282	203 32 60
35-Yr. Total	110,219	59,134	48,138	41,872

Table 3.--Present worth calculations

60-Ft. Temporary Log Stringer Bridges	0%	6%	10%	15%
Initial Construction Annual Maintenance (7yr) Removal -- Year 7	11,320 700 1,974	11,320 558 1,313	11,320 487 1,013	11,320 416 742
7-Yr. Subtotal	13,994	13,191	12,820	12,478
Installation -- Year 8 Annual Maintenance (7yr) Removal -- Year 14	15,961 822 2,319	10,014 436 1,026	7,546 293 611	5,218 184 328
14-Yr. Subtotal	33,096	24,667	21,270	18,208
Installation -- Year 15 Annual Maintenance (7yr) Removal -- Year 21	18,754 966 2,725	7,825 341 802	4,490 177 368	2,305 81 145
21-Yr. Subtotal	55,541	33,635	26,305	20,739
Installation -- Year 22 Annual Maintenance (7yr) Removal -- Year 28	22,036 1,135 3,202	6,115 266 626	2,707 107 222	1,018 36 64
28-Yr. Subtotal	81,914	40,642	29,341	21,857
Installation -- Year 29 Annual Maintenance (7yr) Removal -- Year 35	25,893 1,334 3,762	4,779 208 489	1,632 64 134	450 16 28
35-Yr. Total	112,903	46,118	31,170	22,351

Table 4.--Comparison of present worth for 35 years

	0%	6%	10%	15%
5 Permanent Bridges	574,818	251,471	176,792	132,782
5 Portable Bridges	110,219	59,134	48,138	41,872
5 Temporary Bridges	112,903	46,118	31,171	22,351

APPENDIX A

The following are estimated costs involved in (A) furnishing, (B) transporting, (C) installing, and (D) removing portable bridges.

A. Furnishing Materials

Table 1.--Portable bridge materials costs[1]

Description	Length	Hamilton "E-Z" Bridge (COR-10)		Acrow Panel Bridge (Galvanized)	
		14-Ft. (4.27m)	16-Ft. (4.88m)	Extra-Wide	Ultra-Wide
All structures designed for U-80 and U-102 loading with L-90 occasional overload.	30-ft. (9.14m)	$12,000	$12,500	---	---
	40-ft. (12.19m)	16,000	16,500	$25,300	$30,500
	50-ft. (15.24m)	21,000	21,600	30,600	36,800
	60-ft. (18.28m)	31,400	32,100	43,200	50,400
	70-ft. (21.34m)	38,500	42,200	50,100	58,300
	80-ft. (24.38m)	52,900	56,200	57,000	66,200
	90-ft. (27.43m)	---	---	79,800	90,100
	100-ft. (30.48m)	---	---	88,500	99,800

[1] *Estimated F.O.B. Seattle, as of January 1977.*

B. Shipping Costs for Base Year 1975 (from *Timber Sale Appraisal Handbook*).

900-hp (912.6mhp) tug	$ 1,100/day
600-ton (544.31t) barge	200/day
	$ 1,300/day
Estimated round trip to Seattle, 2 weeks	x 14
	$18,200/trip
Estimated 2 trips at approximately 400 tons (362.87t) each	x 2
Tug and barge total	$36,400
Load and unload crane at $750/day x 6 days (2-Seattle, 4-destination)	$ 4,500
Transportation - trucks for hauling - estimated 100 hrs. at $40/hr.	4,000
	$44,900

Total bridge length = 1,080 ft. (329.18m)

Average cost/ft. (.3048m) = $\frac{44,900}{1,080}$ = $41.57

Recommended allowance = $40/ft. (.3048m)

C. Installation Costs

1. 30-ft. (9.14m) portable bridge, temporary abutments.

Current temporary bridge allowance is $72.35 per lin. ft. (.3048m) -- (ALP Sale).

Assume that 2/3 of cost is in abutments.

(a) Abutments

Installation cost = $72.35 x 2/3 x 30 ft. (9.14m) =	$ 1,450
Additional material (planks, etc.) =	150
Subtotal, abutments	$ 1,600

(b) Superstructure

Installation (Hamilton-type)	
Crane - 1 day at $750	$ 750
Crew - 2 days at $350	700
Dump truck - 8 hrs. at $22.50	180
End loader - 8 hrs. at $21.00	170
Miscellaneous materials	150
Subtotal, superstructure	$1,950
Installation total 30-ft. (9.14m) Hamilton-type	$3,550

(c) Installation (Acrow-type)

Hydraulic crane - 16 hrs. at $35	$ 560
Crew - 3 days at $350	1,050
Dump truck - 8 hrs. at $22.50	180
End loader - 8 hrs. at $21.00	170
Miscellaneous materials	140
	$2,100
Installation total, 30-ft. (9.14m) Acrow-type	$3,700

2. 60-ft. (18.28m) portable bridge, temporary abutments.

Current temporary bridge allowance is $72.35 per lin. ft. (.3048m) -- (ALP Sale).

Assume 1/2 of cost is in abutments.

(a) Abutments

Installation = $72.35 x 1/2 x 60 ft. (18.12m)	$2,200
Additional materials (planks, etc.)	200
Subtotal, abutments	$2,400

(b) Superstructure

Installation (Hamilton-type)

Crane - 1 day at $750	$ 750
Crew - 2 days at $350	700
Dump truck - 8 hrs. at $22.50	180
End loader - 8 hrs. at $21.00	170
Miscellaneous materials	150
Subtotal, superstructure	$1,950

Installation total 60-ft. (18.12m) Hamilton-type	$4,350

(c) Installation (Acrow-type)

Hydraulic crane - 24 hrs. at $35	$ 840
Crew - 4 days at $350	1,400
Dump truck - 8 hrs. at $22.50	180
End loader - 8 hrs. at $21.00	170
Miscellaneous materials	110
Subtotal, superstructure	$2,700

Installation total, 60-ft. (18.12m) Acrow-type	$5,100

3. 100-ft. (30.48m) portable bridge

Current temporary bridge allowance is $72.35 per lin. ft. (.3048m) -- (ALP Scale).

Assume 1/2 of cost is in abutments.

(a) Abutments

Installation = $72.35 x 1/2 x 100 ft. (30.48m)	$3,600
Additional materials (planks, etc.)	200
Subtotal, abutments	$3,800

(b) Superstructure

Installation (Hamilton-type)

Crane - 32 hrs. at $35	$1,120
Crew - 5 days at $350	1,750
Dump truck - 8 hrs. at $22.50	180
End loader - 8 hrs. at $21.00	170
Miscellaneous materials	180
Subtotal, superstructure	$3,400

Installation total 100-ft. (30.48m) Hamilton-type	$7,200

4. Average costs

(a) Hamilton-type

30-ft. (9.14m)	at	$3,550
60-ft. (18.28m)	at	4,350
90-ft. (27.42m)		$7,900

$\frac{\$7,900}{90 \text{ ft.}} = \$87.78/\text{ft.}$ (.3048m)

(b) Acrow-type

30-ft. (9.14m)	at	$3,700
60-ft. (18.28m)	at	5,100
100-ft. (30.48m)	at	7,200
190-ft. (58.80m)		$16,000

$\frac{\$16,000}{190 \text{ ft.}} = \$84.21/\text{ft.}$ (.3048m)

(c) Recommended Average Installation

Cost = $85/lin. ft. (.3048m)

(d) Removal Costs

1. Hamilton-type

Crane - 1 day at $750	$ 750
Crew - 1 day at $350	350
Backhoe - 1 day at $200	200
Truck - 1 day at $360	360
Miscellaneous	140
Removal total, Hamilton-type	$1,800

2. Acrow-type

Hydraulic crane - 2 days at $280	$ 560
Crew - 2 days at $350	700
Backhoe - 1 day at $200	200
Truck - 2 days at $360	720
Miscellaneous	120
Removal total, Acrow-type	$2,300

3. Average removal costs

a. Average Acrow length = 80 ft. (24.38m)

$$\text{Average cost} = \frac{\$2,300}{80 \text{ ft.}} = \$28.75/\text{ft.} \ (.3048\text{m})$$

b. Average Hamilton length = 45 ft. (13.72m)

$$\text{Average cost} = \frac{\$1,800}{45 \text{ ft.}} = \$40/\text{ft.} \ (.3048\text{m})$$

c. Suggest average removal allowance of $36/lin. ft. (.3048m).

WASHINGTON OFFICE NEWS

CONSULTATION AND STANDARDS

Walter E. Furen
Assistant Director

WATER CONSERVATION IN FEDERAL FACILITIES

President Carter transmitted his *Water Policy Reform Message* to the Congress in June 1978. That message announced a broad set of policy initiatives, concentrating on four key problem areas:

1. Enhancing Federal-State cooperation.

2. Making the water project planning process more efficient.

3. Providing a new National emphasis on water conservation.

4. Increasing environmental sensitivity in water resources planning and management.

Actual implementation of these initiatives breaks down into many separate elements, each having very different needs. One of these elements (addressed in problem are #3) is water conservation in Federal facilities. The Forest Service, as the agency charged with the management of the lands from which a major portion of the Nation's water resources originate, should take the lead in conserving water and eliminating its nonessential use. This responsibility is especially significant in relation to the *Water Policy Reform Message* and the severe water shortages that recently affected a good portion of the Nation.

There are many measures that can be adopted, both as official policy and as personal commitment, to indicate our concern and willingness to participate. Some -- but certainly not all -- possible measures are as follows:

1. Curtail washing of vehicles.

2. Eliminate or curtail watering of lawns. The amount of water required for lawns can be reduced by using flood irrigation instead of lawn sprinklers. If flood irrigation is not possible, then lawn sprinkling at night or on a cloudy day will reduce water loss resulting from evaporation.

3. Install flow limiting devices on faucets and showers. A saving can be expected of about one-third for faucets and about one-half for showers.

4. Reduce the quantity of water stored in toilet flush tanks by adjusting the valve float or the placement of the water-filled container in the tank. Normally, a tank stores 4 gallons (15.14 liters) of water; a total of about 5 1/2 gallons (20.82 liters) is discharged in a single flushing. Some experimentation may be necessary to determine how much the tank capacity can be reduced and still provide for effective toilet flushings; however, it is reasonable to expect that 1/2 to 1 gallon (1.89 to 3.79 liters) of water can be saved per flush. Bricks or other similar objects should not be placed in the flush tank to displace water volume because they may deteriorate and damage the toilet mechanism or plumbing.

5. Store and reuse the water (and detergent) that is drained from an automatic clothes washer after the wash cycle. Reusing the water may save 25 percent of the approximate 25 gallons (94.63 liters) required for a complete cycle.

6. Curtail or eliminate the use of automatic dishwashers. Manual washing of dishes should save at least 50 percent of the 13 to 19 gallons (49.21 to 71.92 liters) of water used per day by the average household in their automatic dishwashers.

7. Check for and repair underground water pipe and plumbing fixture leaks. Leaky faucets, pipes, valves, etc., can waste large quantities of water over a 24-hour period.

Adoption of these items may cause some inconvenience, discomfort, and/or minor hindrances; however, as Forest Service employees, it is our responsibility to promote opportunities for the better use of existing water supplies.

TECHNOLOGICAL IMPROVEMENTS

Heyward Taylor
Assistant Director

LOW-VALUE TIMBER HARVESTING

Engineers from the Equipment Development Center and the Forestry Sciences Laboratory in Missoula, Montana have collaborated in the development of a bunching concept for two-stage cable yarding that would make low-value timber harvesting profitable.

Buncher Concept

A self-propelled, radio-controlled bunching vehicle would be used, efficiently bunching low-value timber into a corridor for later yarding with a simple grappler yarder. The buncher vehicle moves itself by powered sheaves along a suspended cable and contains a skidding winch to perform the bunching operation (Fig. 1). It can easily be positioned anywhere on the cable, where it remains fixed while skidding stems (Fig.2). In exceptionally difficult terrain, the cable can be elevated by intermediate supports, which the buncher can readily pass.

Engineers from the two organizations have designed, built, and proved the technical feasibility of a working model of the buncher vehicle.

Evidence from both foreign and domestic sources indicates that bunching before yarding can result in significant cost savings. However, bunching methods in difficult terrain are limited to skid-mounted or hand-carried winches that are cumbersome, slow, and potentially dangerous.

The buncher vehicle is much safer and easier to maneuver than a skid-mounted or hand-carried winch. Moreover, because it is elevated, workers do not have to install snatch blocks in trees adjoining the corridor to provide lift for the logs or stems.

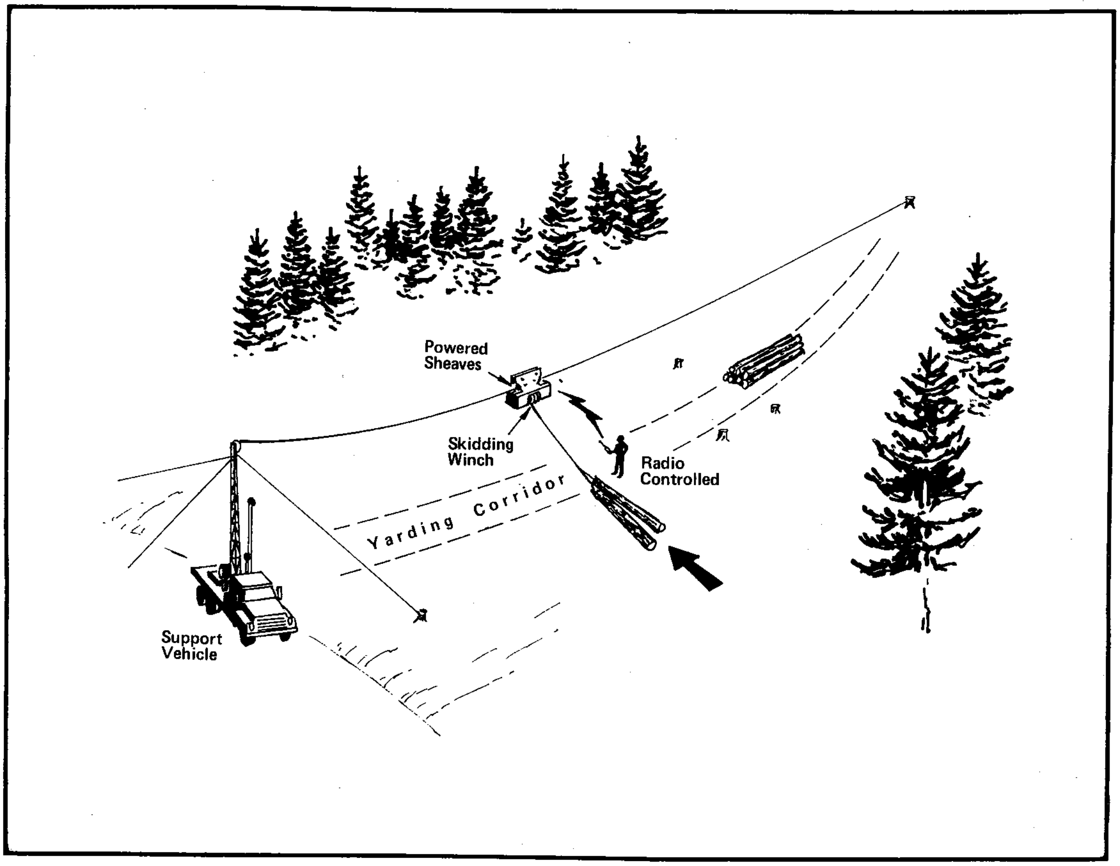

Figure 1.--A radio-controlled vehicle is used for bunching low-value timber.

Because the buncher can be moved at will, it can be manuevered along the cable to eliminate hangups and reduce damage to residual trees in partial cuts. This maneuverability also permits stems to be brought into and aligned with the corridor in neat piles, creating an ideal arrangement for later yarding. With the stems bunched in the corridor, a simple grapple yarder can then transport this material to the landing. The average number of stems per yarding cycle could be greatly increased due to bunching.

Cost Savings

Compared to multifunctional cable yarding systems, engineers working on the system anticipate doubling production rates without increasing daily costs, resulting in savings of 50 percent (Table 1).

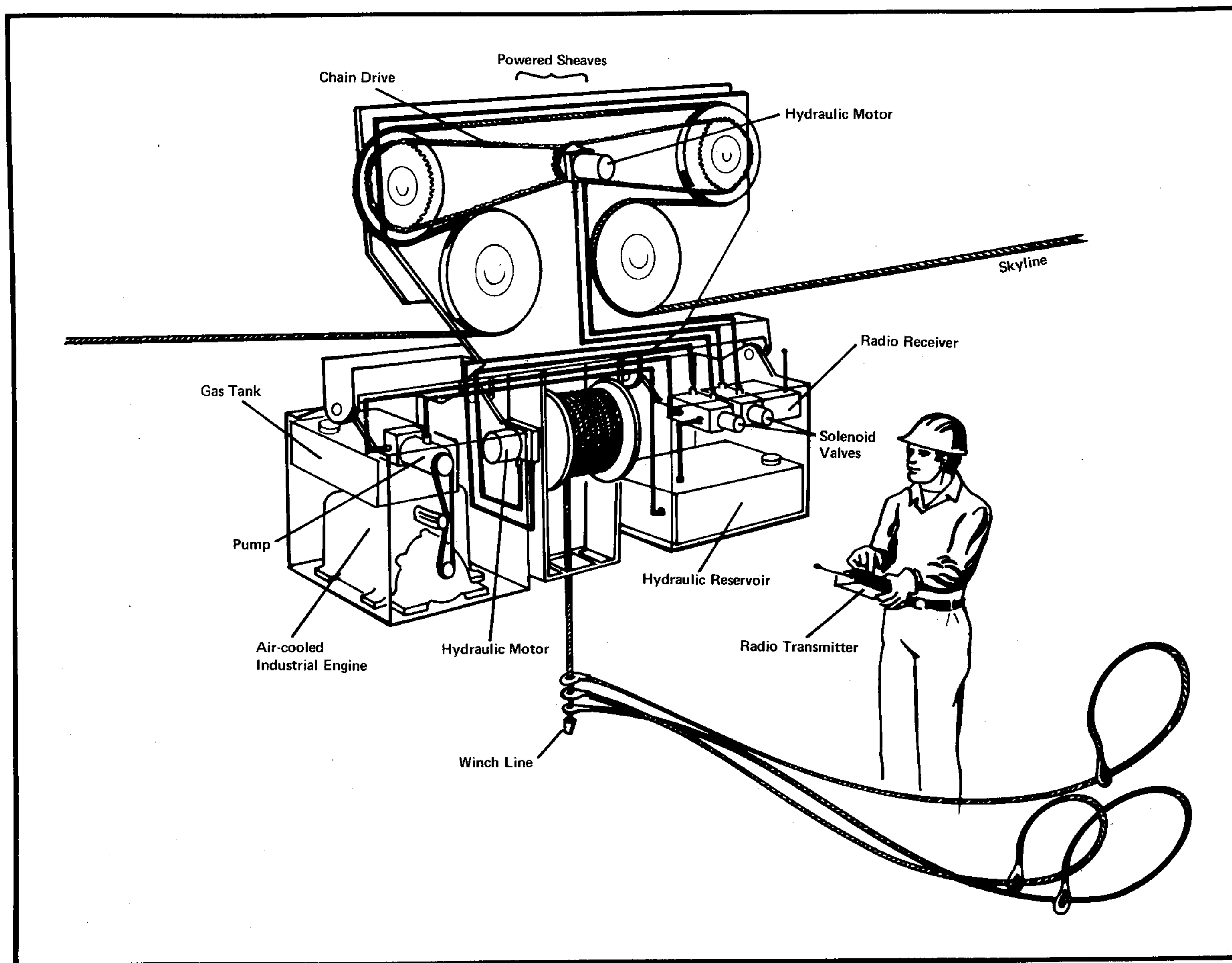

Figure 2.--Cutaway drawing of self-propelled, radio-controlled bunching vehicle

Table 1.--Multifunctional yarding costs vs. two-stage yarding costs.

Multifunctional Yarder	$200,000 ($400/day)	Buncher Vehicle Grapple Yarder	$50,000 ($100/day) $100,000 ($200/day)	= 25% reduction in machine cost
Labor	4-man crew ($600/day)	One 2-man crew One 3-man crew ($750/day)	(buncher) (yarder)	= 20% increase in labor costs
Daily Production	200 stems	400 stems		= 100% increase in stems at the landing
Cost/Stem	$5.00	$2.60		= 50% reduction in cost/stem

Applications

The bunching vehicle is designed primarily for bunching stems into a corridor for later yarding. It is this application that offers attractive cost savings in the selective cutting of low-value timber.

The bunching vehicle could be operated as a multifunctional yarder as well. One worker would be at the landing to unhook the logs, while the other would set chokers in the woods. Both workers would have radios to control the buncher during these separate operations. This application would not be advocated routinely, as it is doubtful it offers significant economic advantages over a multifunctional system. Nevertheless, situations may arise that make this capability beneficial.

In many situations, bunching and felling can be combined. While the trees are felled and the limbs removed by one worker, the second worker could bunch them. In this fashion, the common problem of stems being poorly aligned for skidding to the corridor is eliminated.

Finally, when bunching is completed in a corridor, the buncher vehicle could lay out a strawline for rigging the yarder.

There may be many other general transportation problems, unrelated to timber harvesting, that this concept could solve.

Objective

The objective of this effort is to achieve more efficient recovery of the wood resource by developing this buncher concept to a point where the buncher vehicle could be built and used with reasonable economic risk. The timeframe for this development will depend on the extent of the funding.

OPERATIONS

Harold L. Strickland
Assistant Director

As most of you are aware, the RPA Act of 1974, PL93-378, had a significant impact on the Forest Service road construction budget. This law, for the first time since the passage of the FR&T Act of 1964, requires the Forest Service, beginning in FY-1977, to get Congressional authorization prior to using purchaser credit for road construction. In essence, this ends the unlimited use of purchaser credit.

The law led to two major decisions:

1. OMB directed the Forest Service to include purchaser credit within the Forest Service constrained budget.

2. Congress determined that purchaser credit would be available for obligation only during the year for which it was appropriated.

These two decisions immediately placed a tremendous responsibility on the engineering organization. Engineers now have to estimate purchaser credit needs 2 years in advance, knowing that if they overestimate it will be at the expense of other program areas.

In FY-1977 and FY-1978, estimated purchaser credit needs exceeded actual needs by $50 million each year. And although there are a number of variables involved in accurately estimating purchaser credit needs 2 years in advance, the accuracy of estimates must improve because of the amount of money involved. Perhaps one way to improve the accuracy of estimates is to capitalize on the knowledge learned from small business turnbacks during the past 2 years.

Each time there is a small business turnback, the amount of purchaser credit available for a particular road -- had the purchaser elected to build it -- becomes a surplus. To reduce this surplus, perhaps we should review our 2-year history of small business turnbacks and use it to our advantage. As an example, if we estimate our purchaser credit needs to be

$20 million and our 2-year history indicates we can expect $5 million to $7 million in turnback work, our request for purchaser credit should be approximately $15 million. Of course, this is a calculated risk, but it may be one worth taking.

The intent of this article has been to make you more aware that purchaser credit is now an appropriated fund, just as FR&T has always been. As such, purchaser credit must be managed in the same way that we have always managed FR&T.

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