TIME STUDY TECHNIQUES FOR LOGGING SYSTEMS ANALYSIS

David F. Gibson and

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INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION
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U.S. Department of Agriculture
Ogden, Utah 84401
Roger R. Bay, Director

THE AUTHORS

DAVID F. GIBSON is Associate Professor, Industrial and Management Engineering, Montana State University. For the past 2 years, he has been working cooperatively with the Intermountain Station's Forest Engineering Research Unit at Bozeman as a Research Industrial Engineer under the Intergovernmental Personnel Act. He holds B.S., M.S., and Ph.D. degrees in Industrial Engineering from Purdue University.

JOHN H. RODENBERG is an Industrial Engineer with Weyerhaeuser Company in Klamath Falls, Oregon. He is engaged in planning and analysis of timber harvesting activities. From 1972 to 1974, he was a Research Engineer in the Department of Industrial Engineering/Computer Science at Montana State University working with Intermountain Station on logging systems studies. He holds a B.S. in Industrial and Management Engineering from Montana State University and an M.B.A. from the University of Denver.

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ABSTRACT

Analysis of logging operations generally entails data gathering. Frequently, these data are in the form of elemental time studies. Prior to collecting such data, operations must be explicitly defined and broken into events. Also, an efficient manner of recording and processing the data must be designed. The USDA Forest Service research work unit of Intermountain Station at Bozeman, Montana, has been engaged in recent years in a comprehensive logging systems analysis study. Together with other research work units, this unit has developed, field tested, and refined a system to gather time and motion study data on logging operations. Techniques and forms employed for certain types of operations are presented in this publication. Forms for other types of logging operations are to be issued as appendices to this publication.

INTRODUCTION

For several years, the USDA Forest Service research work unit FS-3701 located at Bozeman, Montana, has been working on a comprehensive study of logging systems. The objective of the program has been to develop (utilizing the systems approach) an analytical model together with accompanying methodologies for evaluating alternative timber harvesting systems, given a set of parameters such as timber characteristics, terrain features, and management objectives. Figure 1 illustrates the major functions of the research effort.

In order to obtain the information necessary to analyze logging systems, operations were defined, data were collected, and computer analysis was undertaken. These activities are represented by blocks 4, 5, and 6 in figure 1. Block 4 illustrates the five basic subsystems being studied: roadbuilding, felling and bucking, skidding/yarding, loading, and hauling. Detailed flow process charts and work element descriptions have been or are being developed for each subsystem. A site-terrain classification scheme has also been devised to categorize the equipment and physical characteristics in which each subsystem operates. Data are collected and then entered into an information storage and retrieval system as shown in block 5 of figure 1, and further detailed in figure 2. The system involves eight levels of data processing:

Level 1: Data Acquisition

Level 2: Data Codification

Level 3: Data Transcription

Level 4: Creation of Data Files

Level 5: File Acquisition

Level 6: Data Manipulation

Level 7: Computation and Analysis

Level 8: Generation of Output.

This handbook addresses itself to the first two levels of processing: acquisition and codification of data. Specifically, it presents part of a standardized data collection system developed by RWU FS-INT-3701 in conjunction with other research stations. Illustrated herein is the use of standardized time study forms for a typical logging situation: mechanized felling, skidding with a rubber-tired skidder, and loading. Forms, together with flow process charts and other accompanying material that would be necessary to collect information on these operations, are presented. The forms for other types of operations are to be released as appendices to this publication.

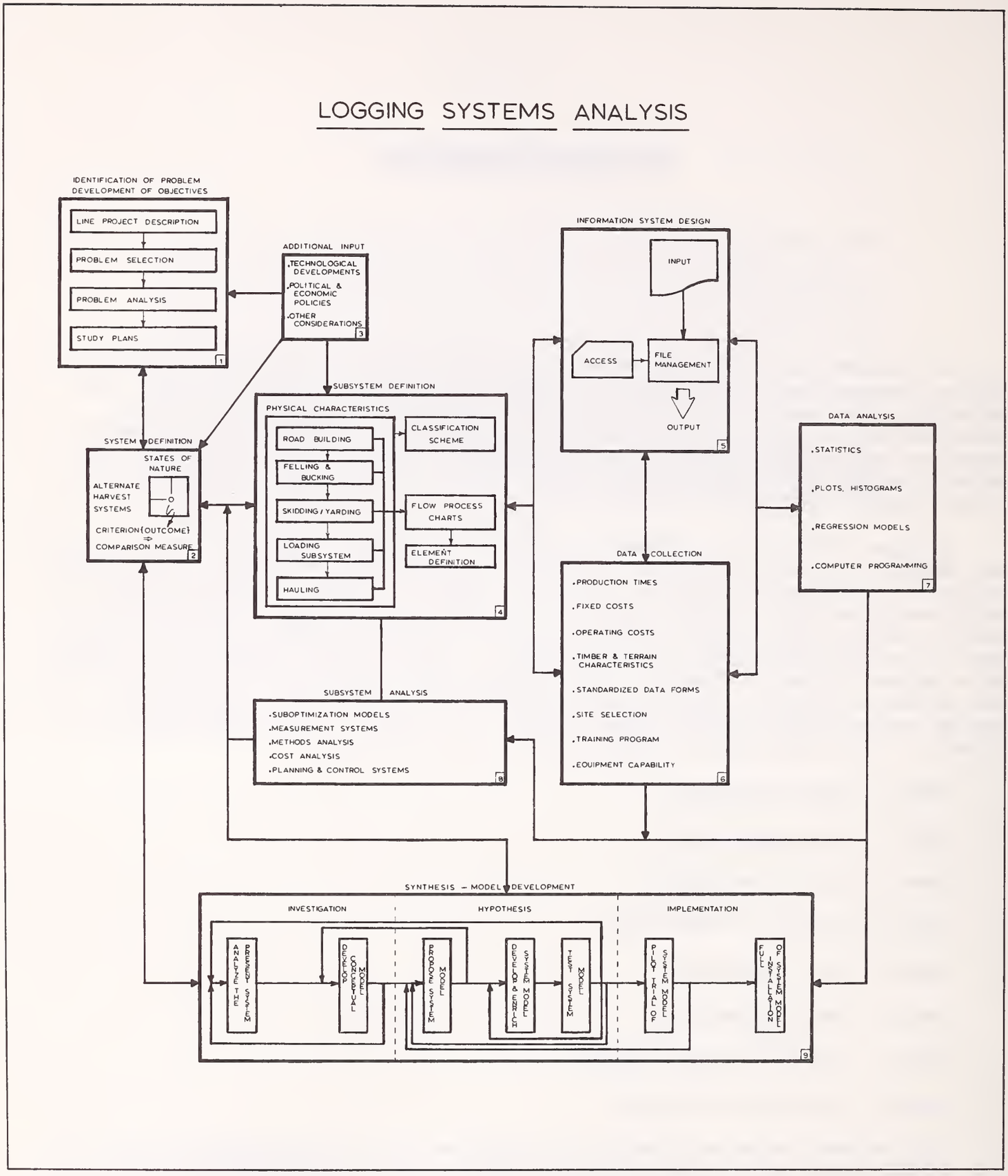


Figure 1.--Logging systems analysis.

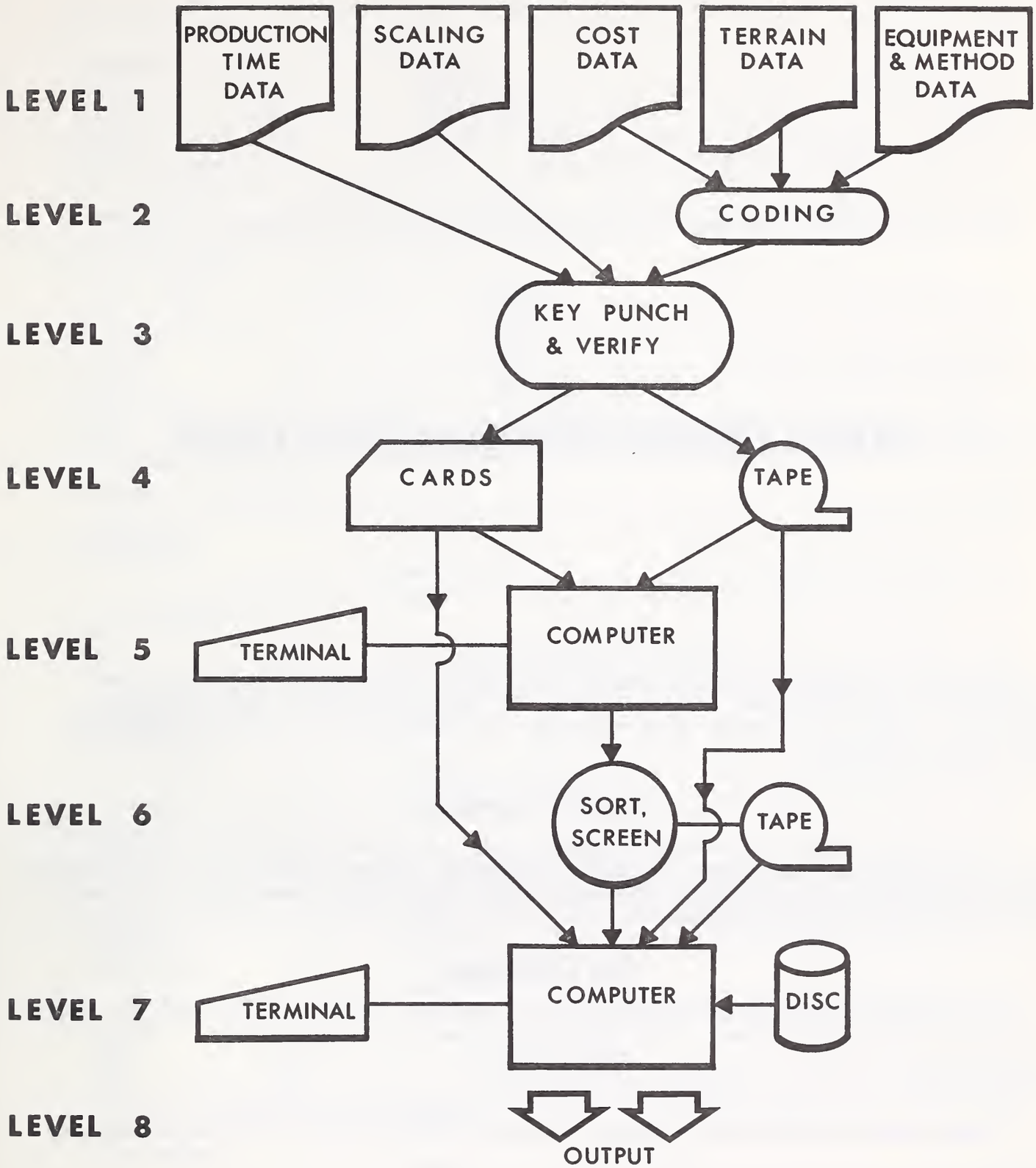


Figure 2.--Information storage and retrieval system.

SITE-TERRAIN INFORMATION FORM

Figure 3 illustrates the Site-Terrain Information Form, which is designed for observing and recording data concerning site and terrain conditions of any logging subsystem. Entries fall under three headings: site description, site conditions, and subsystem information.

Site Description

Enter three-digit code number adjacent to the subsystem (logmaking, skidding, etc.) being observed. Each code number is unique for a given location and date. Codes may be generated by starting with any three-digit number and incrementing by one each time a new code number is required.

Site Conditions

Site conditions are rated according to a numerical rating system. Check or circle the appropriate rating number on the information form, as defined below.

Surface Type

Surface type is rated on the degree to which surface obstructions hamper activity.

Ratings:

1. Little slash, downtimber, stumps, brush, or rocks; little or no detouring or maneuvering of men or equipment necessary.

2. Some slash, downtimber, stumps, brush or rocks; moderate detouring or maneuvering of men or equipment necessary.

3. Heavy slash, downtimber, stumps, brush, or rocks; excessive detouring or maneuvering of men or equipment necessary.

SITE/TERRAIN INFORMATION FORM

SITE DESCRIPTION

Logmaking _____ Location
Skidding _____ Timber Sale _____
Yarding _____ Forest _____
Loading _____ Type of Cut _____
Hauling _____ Contractor _____
Data Collection Date _____ Start Time _____ Stop Time _____

Comments _____

SITE CONDITIONS

	Rating				
Surface Type	1	2	3		Comments _____
Surface Condition	1	2	3		Comments _____
Operator	1	2	3		Comments _____
Landing	1	2	3	4	Comments _____
Deck	1	2	3	4	Comments _____

Temperature _____ degrees Elevation _____
Wind _____ velocity _____direction Precipitation _____ amount _____ form

SUBSYSTEM INFORMATION

Logmaking Comments _____
Crew Members
_____, Comments _____
_____, Comments _____
Saw or Feller
Make _____ Type _____ Equipment Owner _____
Model _____ Size _____ Payment (Method & Amount) _____

Skidding/Yarding Comments _____
Crew Members
_____, Comments _____
_____, Comments _____
_____, Comments _____
Skidder or Yarder
Make _____ Type _____ Equipment Owner _____
Model _____ Size _____ Payment (Method & Amount) _____

Loading Comments _____
Crew Members
_____, Comments _____
_____, Comments _____
Loader
Make _____ Type _____ Equipment Owner _____
Model _____ Size _____ Payment (Method & Amount) _____

Hauling Comments _____
Crew Members
_____, Comments _____
_____, Comments _____
Truck and Trailer
Make _____ Type _____ Equipment Owner _____
Model _____ Size _____ Payment (Method & Amount) _____

Figure 3.--Site-Terrain Information Form.

Surface Condition

Surface condition is rated on the degree to which existing surface conditions hamper activity.

Ratings:

1. Soil dry, firm; little or no loss of traction to men or equipment.

2. Soil slightly wet, soft; moderate loss of traction to men or equipment.

3. Soil very wet and muddy, loose; excessive loss of traction to men or equipment.

Operator

Operators are rated on the basis of observed performance. In a one-man operation, obviously there is only one operator to be rated. In a crew operation, such as a skyline yarding system, the crew performance must be rated collectively. The term "performance" is a combined measurement of motivation, skill, and experience.

Ratings:

1. Above-average performance.

2. Average performance.

3. Below-average performance.

Landing

Landings are rated by estimating the degree to which skidding, yarding, or loading subsystems are affected by landing area characteristics.

Ratings:

1. Spacious landing area. Neither decking nor loading is hampered by any features of the landing.

2. Adequate landing area. Either decking, loading, or both, are occasionally hampered to a moderate degree by a small or poorly arranged landing.

3. Limited landing area. Either decking, loading, or both, are continually hampered to a high degree by a small or poorly arranged landing.

4. Not applicable to these observations. (For example, landing rating would not be applicable to logmaking subsystem.)

Deck

Decks are rated on the effect that the deck arrangement and structure have on decking and loading.

Ratings:

1. Deck has all logs even at the end and parallel to each other. Greater care and time would be required to construct a deck of this type. Such a deck permits the loader to operate with maximum speed in picking and sorting logs.

2. Deck has some uneven log ends and not all logs are parallel. Generally, less time would be consumed in decking, but the loading operation would be slowed somewhat.

3. Deck has practically no log ends even and the logs are jackstrawed. Such a deck is generally the easiest to construct, but the most difficult and time-consuming from which to load.

4. Not applicable to these observations. (For example, deck classification would not be applicable to logmaking subsystem.)

Temperature

Record noon-hour temperature in degrees.

Wind

Record wind velocity and direction.

Precipitation

Record precipitation amount and form.

Elevation

Record site elevation as given on available area maps.

Subsystem Information

Record information as indicated for the subsystem being observed.

Example

To illustrate use of the Site-Terrain Information Form, consider figure 4. A mechanized felling operation was to be studied on the Targhee National Forest in northeastern Idaho. The equipment employed was a Beloit Harvester, which can fell, limb, top, and bunch trees. Information relating to site description, site conditions, and subsystem information is documented on the form as shown.

SITE/TERRAIN INFORMATION FORM

SITE DESCRIPTION

Logmaking 197
Skidding
Yarding
Loading
Hauling
Location
Timber Sale Clear Creek, Unit #3
Forest Targhee National Forest
Type of Cut Selective
Contractor Idaho Mills, Inc.
Data Collection Date 5/9/74 Start Time 7:30 a.m. Stop Time 3:30 p.m.
Comments Beloit broken down previous two days

SITE CONDITIONS

	Rating			
Surface Type	(1)	2	3	Comments
Surface Condition	(1)	2	3	Comments
Operator	1	(2)	3	Comments Operator 3 weeks on job
Landing	1	2	3 (4)	Comments
Deck	1	2	3 (4)	Comments

Temperature 68 degrees Elevation 3400 ft
Wind 0 velocity 0 direction Precipitation 0 amount form

SUBSYSTEM INFORMATION

Logmaking Comments Trees marked for felling
Crew Members
B. Wiley, Operator, Comments 3 wks on job, trained @ Beloit Hdq.
, Comments
Saw or Feller
Make Beloit Type Equipment Owner Idaho Mills
Model 14 Size Payment (Method & Amount) $5/MBF straight

Skidding/Yarding Comments
Crew Members
, Comments
, Comments
, Comments
Skidder or Yarder
Make Type Equipment Owner
Model Size Payment (Method & Amount)

Loading Comments
Crew Members
, Comments
, Comments
Loader
Make Type Equipment Owner
Model Size Payment (Method & Amount)

Hauling Comments
Crew Members
, Comments
, Comments
Truck and Trailer
Make Type Equipment Owner
Model Size Payment (Method & Amount)

Figure 4.--Completed Site-Terrain Information Form--felling.

MECHANIZED FELLING DATA FORM

Flow Process Chart

Consider figure 5, which presents a flow process chart of a mechanized felling and logmaking operation. A flow-process chart graphically defines the sequential order of elements that comprise one cycle of a particular operation. Understanding the flow process chart is essential if the observer is to accurately time and analyze an operation. In the case of mechanized felling, five elements have been defined as constituting one cycle of the operation. These five elements were defined to facilitate analysis of the effect of various independent variables on the operation. Beginning and ending points of each element are defined to indicate the precise interval of time that is to be recorded for each element.

Figure 6 illustrates a typical mechanized felling operation. The analyst gathering time study data must stay close to the equipment. He must constantly move with the equipment in order to record the element times, while simultaneously keeping a safe distance from the operation.

FLOW PROCESS CHART

SUBJECT CHARTED LOGS BY _____
SUBSYSTEM MECHANIZED LOGMAKING
METHOD USED SHEAR OR FELLER WITH LIMBER AND BUNCHER

CHART SYMBOL	ELEMENT DESCRIPTION	ELEMENT BEGINNING & END POINTS
0	Logs Located as Trees in Woods	
1	Equipment Travels to Next Position	Buncher Releases Tree on Ground. Tracks (or Wheels) Stationary.
2	Angular and Extensional Positioning of Vertical Mast	Tracks (or Wheels) Stationary. Vertical Mast in Position and Stationary at Tree.
3	Limbing Apparatus Limbs and Tops Tree	Vertical Mast in Position and Stationary at Tree. Limbing Apparatus Stationary.
4	Butt Shear Severs Tree	Limbing Apparatus Stationary. Tree Severed.
5	Tree Length Placed on Ground	Tree Severed. Buncher Releases Tree on Ground.
6	Logs Located as Tree Lengths on Ground	

Figure 5.--Flow process chart--mechanized felling.

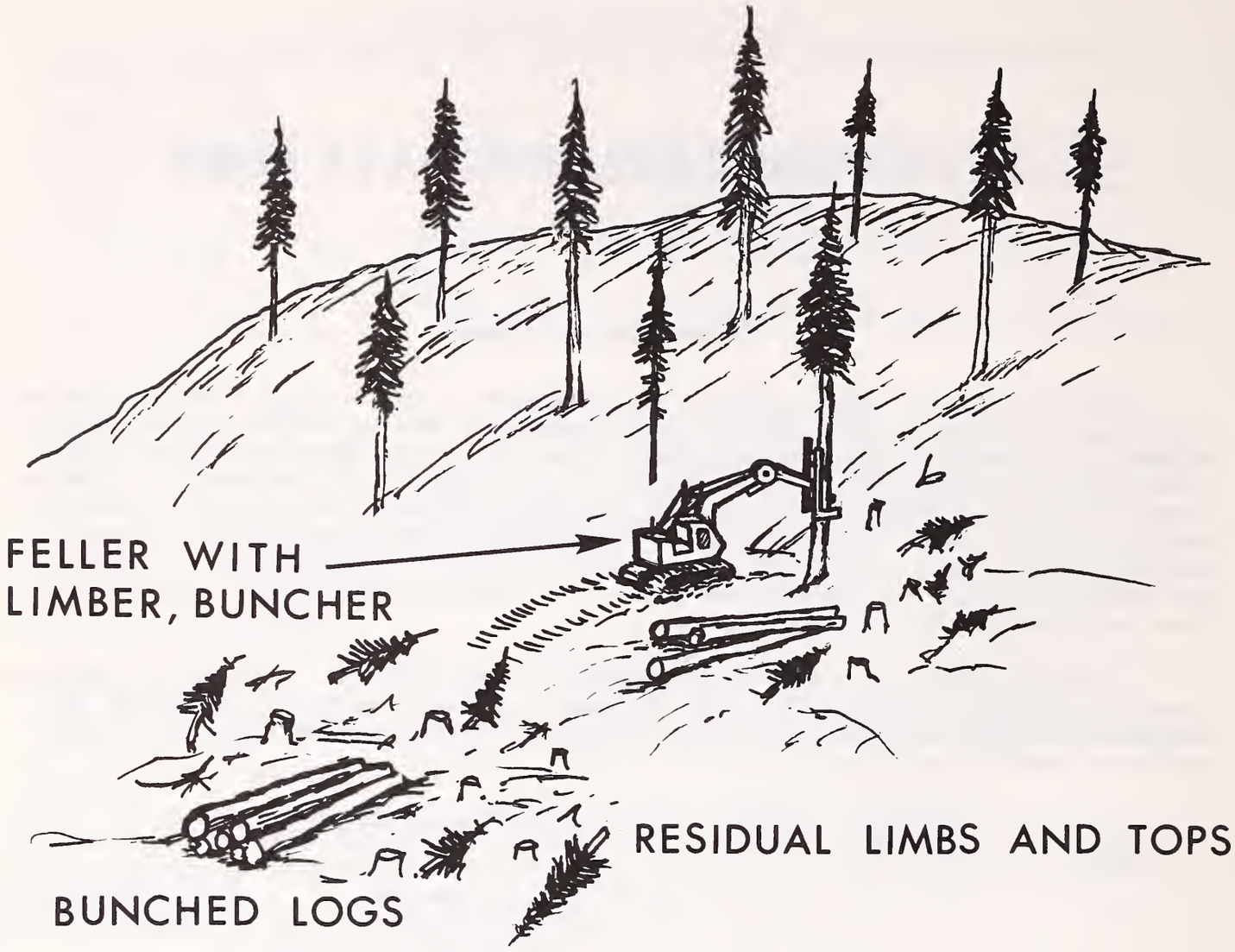


Figure 6.--Mechanized felling operation.

Form Entries

Figure 7 presents a copy of the Mechanized Felling Data Form. The form is designed with 80 columns for entries. Thus, data can be keypunched directly from completed forms. This eliminates the need to transcribe data from observation forms to keypunching forms. A detailed explanation of entries appears later. Two documents are referenced for use in relation to the form: the Site-Terrain Information Form that has already been presented, and the code sheet. A comprehensive coding system for entries such as equipment, method, and foreign elements will be published as an appendix to this document.

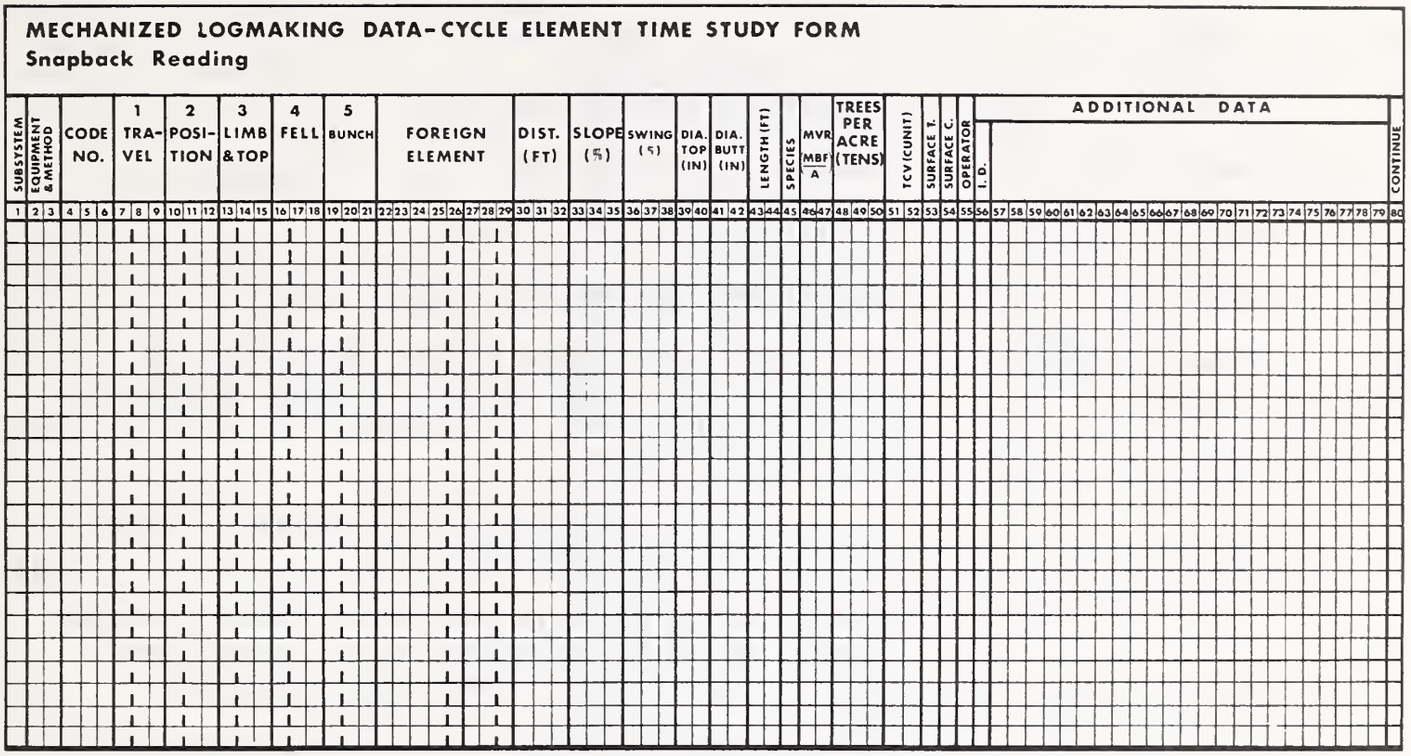


Figure 7.--Mechanized Felling Data Form.

Entries made in columns 1-6 (inclusive) and 45-55 (inclusive) will most likely be repeated for a considerable number of turns. Thus, it is necessary only to make one entry at the beginning of each time-study sheet; new entries are required only when information in these columns changes.

Column	*Entry*	*Explanation*
1	Subsystem	One-digit entry identifies subsystem; per code sheet.
2-3	Equipment and Method	Two-digit entry identifies method used to accomplish subsystem function and also brand name and model used (per code sheet).
4-6	Code Number	Three-digit entry to identify observations and that matches with code number on Site-Terrain Information Form.
7-9	Travel	Enter three digits representing time taken to perform element as defined on Flow Process Chart. Enter time to nearest one-hundredth of a minute. Enter decimal portion to right of dashed line; enter whole number portion to left of dashed line.

Column	*Entry*	*Explanation*
10-12	Position	See explanation for col. 7-9.
13-15	Limb and Top	See explanation for col. 7-9.
16-18	Fell	See explanation for col. 7-9.
19-21	Bunch	See explanation for col. 7-9.
22-29	Foreign Element	As a group, the columns present information on foreign elements that occur. A foreign element is defined as an element that does not occur regularly on each cycle. Enter single digit in col. 22 to identify foreign element type (per code sheet). Enter a single digit in col. 23 to identify regular element in which a foreign element occurred (see numbers above regular elements on Data Form). Enter up to three digits in col. 24-26 representing time elapsed in the regular element (entered in col. 23) when the foreign element began. Record time to the nearest tenth of a minute. Follow procedure for entering times described in col. 7-9 explanation. Enter up to three digits in col. 27-29 representing time duration of foreign element. Record time to the nearest tenth of a minute.
30-32	Distance	Enter maximum of four digits representing distance the equipment travels from one tree to another. In other words, the distance covered during the travel element, when the equipment location changes. A zero distance is entered when only positioning is necessary, and equipment location is unchanged.
33-35	Slope	Enter maximum of three digits representing slope between two successive trees that are harvested. If the equipment travels uphill, slope is positive; downhill travel, slope is negative. No slope is entered when only the positioning arm moves from one tree to another.
36-38	Swing	Enter maximum of three digits representing degrees in the arc that is described by movement during the Bunch element. In other words, the angle that the tree length is transferred from the stump to the bunch on the ground.
39-40	Diameter Top	Enter maximum of two digits representing top diameter of tree length if tree is topped, or minimum merchantable diameter if tree is not topped.
41-42	Diameter Butt	Enter maximum of two digits representing stump diameter.

Column	*Entry*	*Explanation*
43-44	Length	Enter maximum of two digits representing finished tree length if tree is topped, or merchantable length if tree is not topped.
45	Species	Enter single digit (per code sheet) representing species of tree processed during current cycle.
46-47	Merchantable Volume Removed (MVR)	Enter maximum of two digits representing merchantable volume of timber (expressed in thousand board feet per acre) being removed from sale unit observed.
48-50	Trees Per Acre	Enter maximum of three digits representing the total number of trees (expressed in tens and including trees harvested and unharvested) located on the sale unit observed.
51-52	Total Cubic Volume (TCV)	Enter maximum of two digits representing volume, expressed in hundreds of cubic feet (CUNIT), of timber located on sale unit.
53	Surface Type	Enter one digit classifying the surface type as outlined on the Site-Terrain Information Form.
54	Surface	Enter one digit classifying the surface condition as outlined on the Site-Terrain Information Form.
55	Operator(s)	Enter a one-digit rating of operator(s) performance as outlined on the Site-Terrain Information Form.
56-79	Additional Data	Available for additional data. Entries explained in next section.
80	Continue	An entry in the continuation column indicates that data pertaining to the current line of entry are continued to the next line in the data-gathering form. Any numeric digit, other than zero, may be entered in the continuation column. The continuation line will contain data only in the additional data field.

Explanation of Entries in Additional Data Columns on Mechanized Logmaking Data Form

Explanation of Entries in Additional Data Columns on Mechanized Logmaking Data Form

Additional data columns are used to record data pertaining to an observation when the prescribed columns of entry are not sufficient.

Column	*Entry*	*Explanation*
56	Identification (I.D.)	Enter one digit (per code sheet) to identify reason that continuation was necessary.
57-65	Foreign Element	When I.D. = 1, enter the second foreign element for that observation according to previous foreign element instructions. Other data pertaining to additions are entered according to defined conventions (i.e., the entry made in columns 57-XX will depend upon the I.D. entry in col. 56.)

More than one foreign element (or other type of data) can be given in columns 57-79. Once the I.D. number is read, the computer is keyed to the number of columns to be read. After reading data related to the first I.D. number, the computer checks the next column for another I.D. number. For example, columns 57-79 have the capacity to accommodate data related to two foreign elements. Further, if columns 57-79 are used to capacity, additional data can be accommodated in the additional data columns of the next line. In such a case, a numeric entry is made in column 80.

Mechanized Logmaking Data Example

Consider figure 8, which shows the Mechanized Felling Data Form with sample entries. Two cycles of mechanized felling are covered in order to illustrate the use of all columns. Subsystem, Equipment and Method, and Code No. entries are written in columns 1 through 6. These entries need not be made for each line, but should be made whenever a change occurs.

Upon releasing a log on the ground, a Beloit Harvester travels 10 feet to another position in 0.10 minute. The slope of travel is 10 percent uphill. When travel is completed, positioning of the vertical mast requires 0.18 minute. The tree is limbed and topped in 0.30 minute. The shear fells the tree in 0.10 minute. The bunching element requires 0.29 minute, and the tree length is moved through an angle of 45°.

No travel is required to the next tree to be cut, thus no entry is required under Travel. Positioning requires 0.20 minute. Upon completion of positioning, the operator leaves the machine running and dismounts, consuming 2.0 minutes for personal delay, a type 4 foreign element. Upon remounting harvester, the tree is limbed and topped in 0.20 minute, and felling requires 0.05 minute. The tree is bunched in 0.35 minute, while being transported through a 45° angle.

MECHANIZED LOGMAKING DATA-CYCLE ELEMENT TIME STUDY FORM
Snapback Reading

SUBSYSTEM	EQUIPMENT & METHOD	CODE NO.	1 TRAVEL	2 POSITION	3 LIMB & TOP	4 FELL	5 BUNCH	FOREIGN ELEMENT	DIST. (FT)	SLOPE (%)	SWING (°)	DIA TOP (IN)	DIA. BUTT (IN)	LENGTH (FT)	SPECIES	MVR MBF/A	TREES PER ACRE (TENS)	TCV (CUNIT)	SURFACE T.	SURFACE C.	OPERATOR I.D.	ADDITIONAL DATA	CONTINUE
1	2 3	4 5 6	7 8 9	10 11 12	13 14 15	16 17 18	19 20 21	22 23 24 25 26 27 28 29	30 31 32	33 34 35	36 37 38	39 40	41 42	43 44	45	46 47	48 49 50	51 52	53	54	55	56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79	80
1	30	1 7 1	1 E	1 2	3 0	1 0	2 9		1 0 + 1 0	4 5	4 1	2 4	0 1										
				0 7	2 0	0 5	3 5	4 3 F 2 1 0		4 5	5 1	2 5	0 1										

Figure 8.--Mechanized Felling Data Form with sample entries.

SKIDDING DATA FORM

On the timber sale used to develop this handbook, skidding was done by means of a rubber-tired skidder equipped with a grapple--John Deere Model JD 540-A Skidder equipped with a John Deere Model 3605 Grapple.

It was desired to analyze the skidding subsystem to determine effects of independent variables on skidding cycle time. As in the felling subsystem, initial conditions were documented using the Site-Terrain Information Form. It should be noted that a different copy (as opposed to using the one completed for the felling operation) of the form was used because data such as site conditions, observation day, observer, and other information may have changed. Also, note that a separate form would be completed for each skidder observed. Figure 9 shows a copy of the completed form.

SITE/TERRAIN INFORMATION FORM

SITE DESCRIPTION

Logmaking _____
Skidding 235
Yarding _____
Loading _____
Hauling _____
Data Collection Date 6/12/74

Location
Timber Sale Clear Creek Unit #3
Forest Targhee National Forest
Type of Cut Selective
Contractor Idaho Mills, Inc.
Start Time 8:30 a.m. Stop Time 3:30 p.m.

Comments _____

SITE CONDITIONS

	Rating				
Surface Type	1	(2)	3		Comments
Surface Condition	(1)	2	3		Comments
Operator	1	(2)	3		Comments
Landing	(1)	2	3	4	Comments
Deck	(1)	2	3	4	Comments Small decks, simultaneous loading

Temperature 78 degrees Elevation 3400 feet
Wind 0 velocity — direction Precipitation _____ amount _____ form

SUBSYSTEM INFORMATION

Logmaking — Comments _____
Crew Members
_____, Comments _____
_____, Comments _____
Saw or Feller
Make _____ Type _____ Equipment Owner _____
Model _____ Size _____ Payment (Method & Amount) _____

Skidding/Yarding — Comments _____
Crew Members
Bob Martin, Comments Average Operator (according to contractor)
_____, Comments _____
_____, Comments _____
Skidder or Yarder
Make John Deere Type _____ Equipment Owner Gyppo - Martin
Model JD 540-A Size _____ Payment (Method & Amount) $.25/log

Loading — Comments _____
Crew Members
_____, Comments _____
_____, Comments _____
Loader
Make _____ Type _____ Equipment Owner _____
Model _____ Size _____ Payment (Method & Amount) _____

Hauling — Comments _____
Crew Members
_____, Comments _____
_____, Comments _____
Truck and Trailer
Make _____ Type _____ Equipment Owner _____
Model _____ Size _____ Payment (Method & Amount) _____

Figure 9.--Completed Site-Terrain Information Form--skidding.

Flow Process Chart

Once the time-study observer has gained familiarity with rubber-tired skidder operations, he can examine the flow process chart. The time-study form developed for skidding can be used for both choker and grapple operations. Consider figure 10 which is the flow process chart for skidding with chokers. Eight elements are involved in skidding with chokers. Elements 2, 3, and 4 may be repeated in a cycle if the skidder must travel to more than one location for logs. Figure 11 shows the flow process chart for skidding with a grapple. Note that this is basically the same as the flow chart presented in figure 10 except that elements 3 and 6 have been eliminated.

FLOW PROCESS CHART

SUBJECT CHARTED LOGS BY _____
SUBSYSTEM SKIDDING
METHOD USED CHOKERS

CHART SYMBOL	ELEMENT DESCRIPTION	ELEMENT BEGINNING & END POINTS
0	Logs Located in Woods	
1	Skidder Travels Unloaded from Deck to Logs in Woods	Skidder starts moving toward woods Operator dismounts skidder, or setter starts to hook chokers
2	Choker(s) Hooked to Log(s)	Operator dismounts skidder, or setter starts to hook chokers Operator remounts skidder, or setter completes setting last ch.
3	Logs Winched Free	Operator remounts skidder, or setter completes setting last ch. Skidder starts movement
* 4	Skidder Travels Partially Loaded to Next Location for Log Pick Up	Skidder starts movement Operator dismounts skidder, or setter starts to hook chokers
* 2	Choker(s) Hooked to Log(s) and to Winch Mainline	Operator dismounts skidder, or setter starts to hook chokers Operator remounts skidder, or setter completes setting last ch.
* 3	Logs Winched Free	Operator remounts skidder, or setter completes setting last ch. Skidder starts movement
5	Skidder Travels Loaded from Woods to Deck	Skidder starts movement Operator dismounts skidder, or deckman begins to unhook ch.
6	Choker(s) Unhooked from Log(s)	Operator dismounts skidder, or deckman begins to unhook ch. Operator remounts skidder, or deckman finishes unhooking ch.
7	Skidder Decks Log(s) at Landing	Operator remounts skidder, or deckman finishes unhooking ch. Skidder starts moving toward woods
8	Logs Located at Landing	
* NOTE:	These elements may be repeated and will exist when several stops are made to pick up logs.	

Figure 10.--Flow process chart--skidding with chokers.

Figure 11.--Flow process chart--skidding with grapple.

FLOW PROCESS CHART

SUBJECT CHARTED LOGS BY _____
SUBSYSTEM SKIDDING
METHOD USED GRAPPLE

CHART SYMBOL	ELEMENT DESCRIPTION	ELEMENT BEGINNING & END POINTS
0	Logs Located in Woods	
1	Skidder Travels Unloaded from Deck to Logs in Woods	Skidder starts moving toward woods Grapple begins movement to pick up log(s).
2	Grapple Loaded (May be concurrent with skidder back in movement)	Grapple begins movement to pick up log(s). Skidder starts forward movement
* 4	Skidder Travels Partially Loaded to Next Location for Log Pick Up	Skidder starts forward movement Grapple drops partial load
* 2	Grapple Reloaded	Grapple drops partial load Skidder starts forward movement
5	Skidder Travels Loaded from Woods to Deck	Skidder starts forward movement Grapple drops log load at deck
7	Skidder Decks Log(s) at Landing	Grapple drops log load at deck Skidder starts moving toward woods
8	Logs Located at Landing	
* NOTE:	These elements may be repeated and will exist when several stops are made to pick up logs. Elements are numbered to correspond to columns on Skidding Data Form.	

Form Entries

Figure 12 presents a copy of the Skidding Data Form. The form is constructed from a standard 80-column computer coding sheet. Entries can therefore be directly transcribed to cards via keypunching.

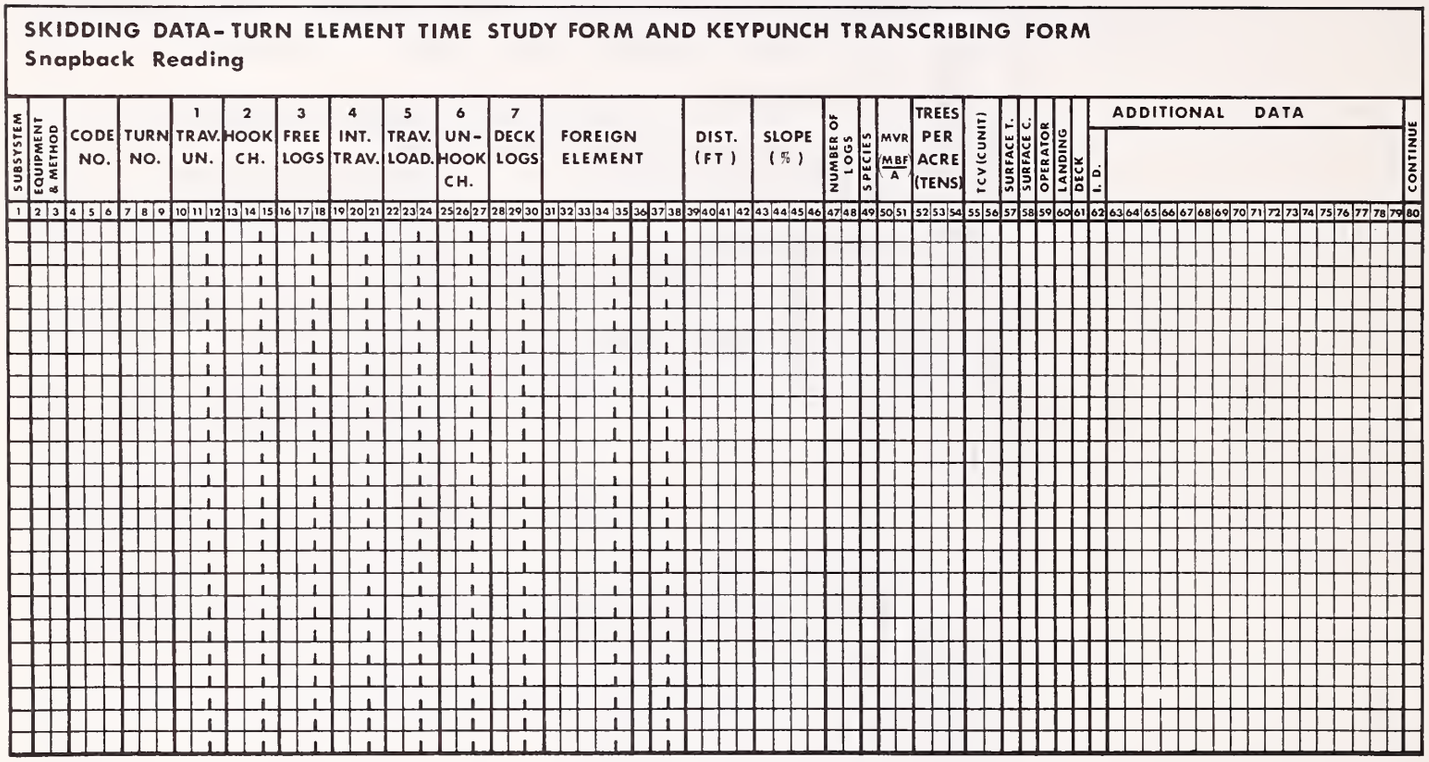


Figure 12.--Skidding Data Form.

An explanation of entries on the form follows. A turn or cycle consists of a number of elements as defined on the flow process chart. When some of the elements are repeated within a turn, data are entered on the mainline (first line of the turn) and on sublines (lines following the mainline). Generally speaking, the mainline contains data applicable to the whole turn, and the sublines contain data pertaining to repeated elements of the turn. In cases where one line of entries is all that is required, the terminology "last subline" would refer to the mainline. When timing a skidder with a grapple, column 16-18 and 25-27 are not used, and column 13-15 are used for loading the grapple.

Column	*Entry*	*Explanation*
1	Subsystem (Mainline)	One-digit entry identifies subsystem; per code sheet.
2-3	Equipment & Method (Mainline)	Two-digit entry identifies method used to accomplish subsystem function and also brand name and model used; per code sheet.

Column	*Entry*	*Explanation*
4-6	Code Number (Mainline)	Three-digit entry to identify observations and that matches code number on Site-Terrain Information Form. It is important that a code number be unique to a particular study location and date.
7-9	Turn (Mainline)	Three-digit entry identifying the turn being observed. (Number turns consecutively for any given code number.)
10-12	Travel Unloaded (Mainline)	Enter three digits representing time taken to perform element as defined on flow process chart. Enter time to nearest tenth of a minute. Enter decimal portion to right of dashed line; enter whole number portion to left of dashed line.
13-15	Hook Chokers (Mainline)	See explanation for col. 10-12. Enter on mainline time for hooking logs at first location the skidder stops.
13-15	Hook Chokers (Subline)	See explanation for col. 10-12. Enter on sub-line time for hooking log(s) at successive locations of the turn.
16-18	Free Logs (Mainline)	See explanation for col. 10-12. Enter on mainline time for freeing log(s) at first location of the turn.
16-18	Free Logs (Subline)	See explanation for col. 10-12. Enter on subline time for freeing log(s) at successive locations of the turn.
19-21	Intermediate Travel (Mainline)	No entry; drop to first subline when this element first occurs.
19-21	Intermediate Travel (Subline)	See explanation for col. 10-12. Enter on first subline time for first intermediate travel of the turn. Enter on successive sublines intermediate travel times.
22-24	Travel Loaded (Last Subline)	See explanation for col. 10-12. Following the subline where entry was made for the last repeated element, enter time for travel loaded. This entry is on the last subline.
25-27	Unhook Chokers (Last Subline)	See explanation for col. 10-12. Enter on last subline time for unhooking chokers. Enter on mainline if there are no sublines.
28-30	Deck Logs (Last Subline)	See explanation for col. 10-12. On last subline enter time for decking logs. Mainline is used if there are no sublines.

Column	*Entry*	*Explanation*
31-38	Foreign Element (Mainline & Subline)	As a group, the columns present information on foreign elements that occur. A foreign element is an element that does not occur regularly on each turn. Enter single digit in col. 31 to identify foreign element (per code sheet). Enter a single digit in col. 32 to identify regular element in which a foreign element occurred (see numbers above regular elements on Data Form). Enter three digits in col. 33-35 representing time elapsed in the regular element (entered in col. 32) when the foreign element began. Follow procedure for entering times described in col. 10-12 explanation.
39-42	Distance (Mainline)	Enter three digits in col. 36-38 representing time duration of foreign element. Record time to nearest tenth of a minute. Enter maximum of four digits representing distance traveled from deck to location where first log(s) are hooked. In other words, enter distance covered during travel unloaded element.
39-42	Distance (Subline)	Enter distance covered by first intermediate travel on first subline. On successive subline enter subsequent intermediate travel distances.
39-42	Distance (Last Subline)	Enter distance traveled from location where last log(s) are hooked to deck. In other words, enter distance covered during travel loaded element.
43-46	Slope (Mainline)	Enter slope (percent) from deck to general log location. Assuming the observer to be at deck, enter a positive slope when logs are skidded uphill toward deck, a negative slope when logs are skidded downhill toward deck.
47-48	Number of Logs (Mainline & Subline)	Enter the number of logs hooked on the same line used to record Hook Ch. (hook chokers) time.
49	Species (Mainline & Subline)	Enter digit (per code sheet) representing species of logs hooked on the same line used to record Hook Ch. time.
50-51	Merchantable Volume Removed (MVR) (Mainline)	Enter maximum of two digits representing merchantable volume of timber (expressed in thousand board feet per acre) being removed from sale unit.
52-54	Trees Per Acre (Mainline)	Enter maximum of three digits representing the total number of trees (expressed in tens and including trees harvested and unharvested) located on the sale unit observed.

Column	*Entry*	*Explanation*
55-56	Total Cubic Volume (Mainline)	Enter maximum of two digits representing cubic foot volume expressed in hundred of cubic feet (CUNIT), of timber located on sale unit.
57	Surface Type (Mainline)	Enter one digit classifying the surface type as outlined on the Site-Terrain Information Form.
58	Surface Condition (Mainline)	Enter one digit classifying the surface condition as outlined on the Site-Terrain Information Form.
59	Operator(s) (Mainline)	Enter a one-digit rating of operator's performance as outlined on the Site-Terrain Information Form.
60	Landing (Mainline)	Enter one digit classifying the landing area as outlined on the Site-Terrain Information Form.
61	Deck (Mainline)	Enter one digit classifying the deck as outlined on the Site-Terrain Information Form.
62-79	Additional Data	Available for additional data. Entries explained in next section.
80	Continue	An entry in the continuation column indicates that data pertaining to the current line of entry are continued to the next line on the data-gathering form. Any numeric digit, other than zero, may be entered in the continuation column. The continuation line will contain data only in the additional data field.

Explanation of Entries in Additional Data Columns

Additional data columns are used to record data that cannot be entered in the prescribed columns.

Following are additional data column entries for Skidding Data Forms:

Column	*Entry*	*Explanation*
62	Identification (I.D.)	Enter one digit (per code sheet) to identify reason that continuation was necessary.
63-70	Foreign Element	When I.D. = 1, enter the second foreign element for that line according to previous instructions.
63-XX		Other data pertaining to additions are entered according to defined conventions (i.e., the entry made in columns 63-XX will depend on the I.D. entry in col. 62.)

More than one foreign element (or other type of data) can be given in col. 63-79. Once the I.D. number is read, the computer is keyed for the number of columns to be read. After reading data related to the first I.D. number, the computer checks the next column for another I.D. number. For example, columns 63-79 have the capacity to accommodate data related to two foreign elements. Further, if columns 63-79 are used to capacity, additional data can be accommodated on the next line. In such a case, a numeric entry is made in column 80.

Choker Skidding Data Example

An example of the use of the Skidding Data Turn Element Time Study Form follows. The skidding situation is illustrated in figure 13, and form entries are illustrated in figure 14.

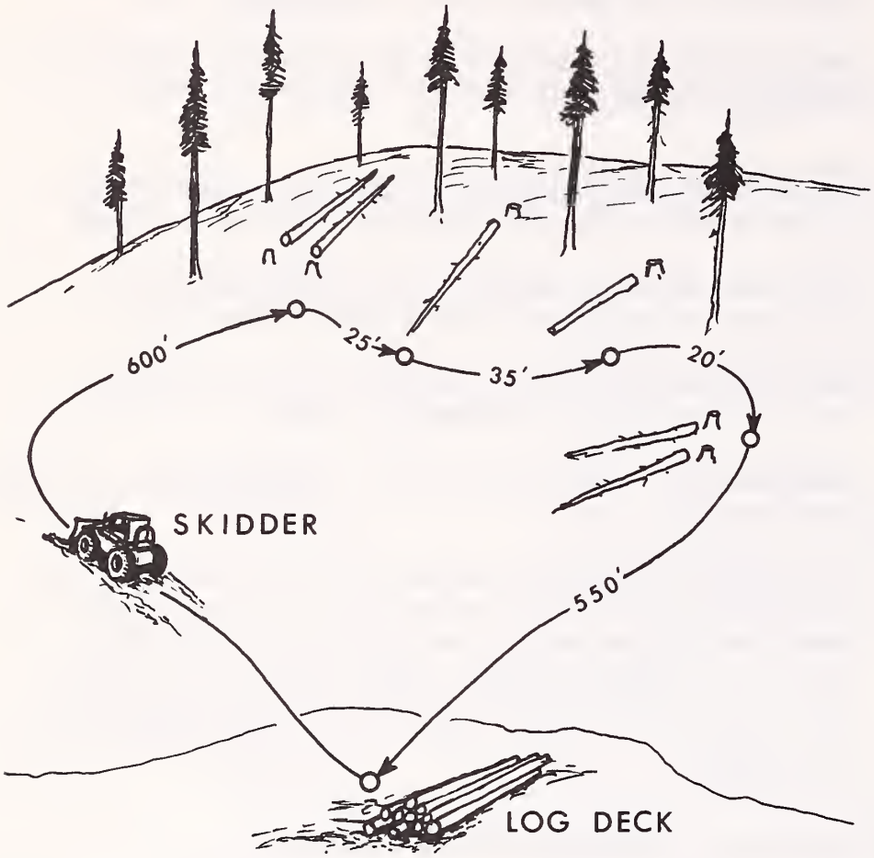


Figure 13.--Skidding operation--chokers.

SKIDDING DATA-TURN ELEMENT TIME STUDY FORM AND KEYPUNCH TRANSCRIBING FORM
Snapback Reading

SUBSYSTEM	EQUIPMENT & METHOD	CODE NO.	TURN NO.	1 TRAV. UN.	2 HOOK CH.	3 FREE LOGS	4 INT. TRAV.	5 TRAV. LOAD.	6 UN-HOOK CH.	7 DECK LOGS	FOREIGN ELEMENT	DIST. (FT)	SLOPE (%)	NUMBER OF LOGS	SPECIES	MVR MBF/A	TREES PER ACRE (TENS)	TCV (CU/IT)	SURFACE T.	SURFACE C.	OPERATOR	LANDING	DECK	ADDITIONAL DATA I. D.	CONTINUE
1	2 3	4 5 6	7 8 9	10 11 12	13 14 15	16 17 18	19 20 21	22 23 24	25 26 27	28 29 30	31 32 33 34 35 36 37 38	39 40 41 42	43 44 45 46	47 48	49	50 51	52 53 54	55 56	57	58	59	60	61	62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79	80
2	1	0 1 2 5	1 7	3 2	1 7	1 3					3 2	0 0	1 7	6 0 2	- 3 0	2	1	2 8	5 4	5	5	3	2	2	1 1 1
					1 7	1 0	1 3							2 5		1 1									
					1 7	1 0	1 4							3 5		1 2									
					1 7	1 2	1							2 0		2 1									
					1	1	1	2 8	1 6	1 7	2 6	1 4	5	5 5 0											

Figure 14.--Completed Skidding Data Form--chokers.

Subsystem, Equipment and Method, and Code No. have been entered in col. 1 through 6. These entries need not be repeated for each line of entry, but may be made only when a change occurs. On the 17th turn, the skidder leaves the deck and travels 600 feet in 3.2 minutes to a location where the first logs are picked up. The operator dismounts and, before he begins hooking chokers, incurs a foreign element of type 3, which lasts 1.9 minutes. He then hooks chokers on two logs of species 1, which take 0.7 minute. After remounting the skidder, he winches the logs free in 0.3 minute, and travels 25 feet to another log in 0.3 minute. Hooking this log of species 1 takes 0.7 minute. Again the operator remounts. No time is required to free logs, and he travels 35 feet in 0.4 minute for additional logs. One log of species 2 is hooked in 0.7 minute. Once again, after remounting, no winching is necessary, and he travels 20 feet in 0.1 minute to two more logs of species 1. Hooking time is 0.9 minute. Freeing logs requires 0.2 minute, then the skidder heads for the deck, traveling 550 feet in 2.8 minutes. At the deck, the operator dismounts, and begins to unhook the six logs in the load. When 0.4 minute has elapsed, the operator incurs a type 2 foreign element which lasts for 0.5 minute. He then resumes unhooking chokers, which has a net duration of 0.6 minute. The operator remounts the skidder and decks the log load in 0.7 minute. Col. 50 through 56 contain volume information obtained from cruise data.

Grapple Skidding Data Example

An example of the use of the Skidding Data Turn Element Time Study Form for grapple skidding follows. The example is illustrated in figure 15, and entries on the form are illustrated in figure 16. It should be noted that columns 16-18 and 25-27 are not used, and that columns 13-15 are used for loading the grapple.

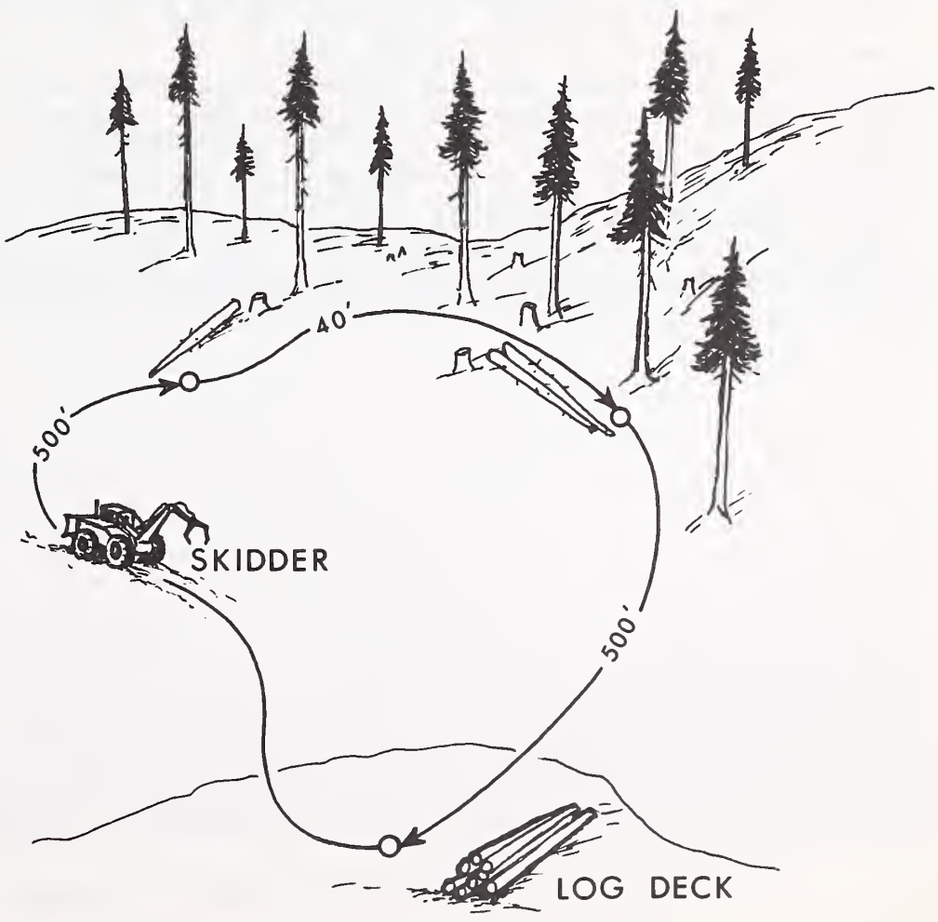


Figure 15.--Skidding operation--grapple.

SKIDDING DATA-TURN ELEMENT TIME STUDY FORM AND KEYPUNCH TRANSCRIBING FORM
Snapback Reading

SUBSYSTEM	EQUIPMENT & METHOD	CODE NO.	TURN NO.	1 TRAV. UN.	2 HOOK CH.	3 FREE LOGS	4 INT. TRAV.	5 TRAV. LOAD.	6 UN-HOOK CH.	7 DECK LOGS	FOREIGN ELEMENT	DIST. (FT)	SLOPE (%)	NUMBER OF LOGS	SPECIES	MVR (MBF/A)	TREES PER ACRE (TENS)	TCV (CU/UNIT)	SURFACE T.	SURFACE C.	OPERATOR	LANDING	DECK	ADDITIONAL DATA I. D.	CONTINUE
1	2 3	4 5 6	7 8 9	10 11 12	13 14 15	16 17 18	19 20 21	22 23 24	25 26 27	28 29 30	31 32 33 34 35 36 37 38	39 40 41 42	43 44 45 46	47 48	49	50 51	52 53 54	55 56	57	58	59	60	61	62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79	80
2	2	0 1 8	3	1 2	1 9	1 4						5 0 0	-2 5	1	1	2	8	5	3	4	8	1	2	2	1	1	2
						1 1	3				2 4 2	1 6 4 0		2	1											
								1 1 8		1 1 0		5 0 0														

Figure 16.--Completed Skidding Data Form--grapple.

A skidder leaves the deck and travels 500 feet in 1.9 minutes to a location where a log is to be picked up. The grapple is opened and begins descending as the skidder backs up to a log of species 1. It takes 0.9 minute to load the grapple. The skidder moves (intermediate travel) to pick up two logs of species 1 that are 40 feet away. When the skidder has moved for 0.2 minute, the log is jarred loose from the grapple and then is retrieved, which is entered as a type 2 foreign element, taking 0.6 minute. Upon resuming intermediate travel, the skidder reaches the next logs in 0.1 additional minute. Straddling these two logs, the grapple drops the single log and then picks up all three logs in 0.7 minute. The skidder then returns 500 feet to the deck in 1.8 minutes and deposits and decks the load in 1.0 minute. Volume entries are obtained from cruise data. Subsystem, Equipment and Method, and Code No. entries have been made in col. 1 through 6. Slope is negative because logs are skidded downhill toward the deck.

SCALING DATA FORM

The measurement of scaling information is generally an integral part of a study of logging operations. In the study of some logging subsystems such as logmaking and loading, scaling data is entered directly on the appropriate time-study form (e.g., Mechanized Felling Data Form and Loading Data Form, respectively). However, scaling data cannot be included on the time-study forms of subsystems such as skidding mainly because space on the forms is limited. Such data are recorded on the Scaling Data Form (fig. 17). This form is adapted from a standard 80-column keypunch sheet and has the capability of recording the dimensions of up to 12 logs per load or turn.

Form Entries

An explanation of entries on the Scaling Data Form follows.

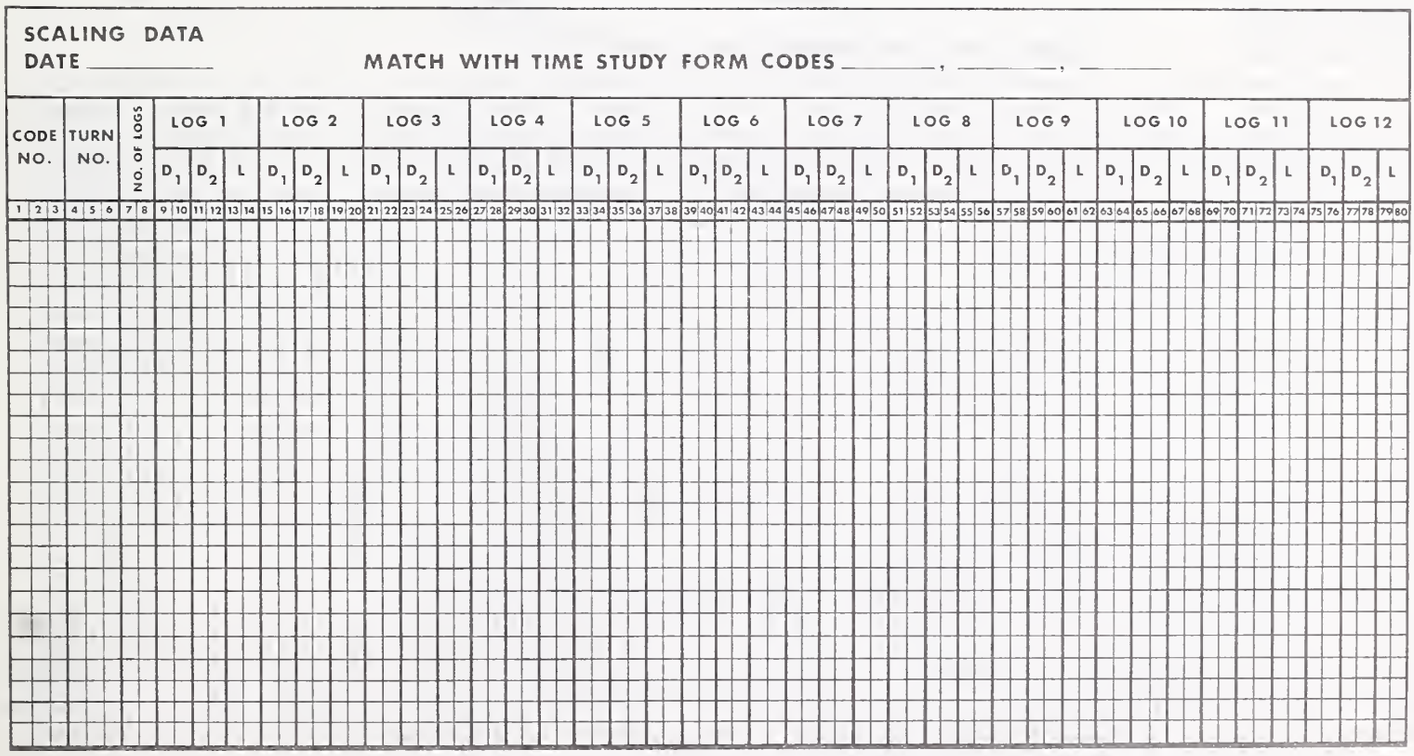


Figure 17.--Scaling Data Form.

Column	*Entry*	*Explanation*
1-3	Code Number	Three-digit entry to identify operation being observed. Entry matches with code number on the appropriate Site-Terrain Information Form and the appropriate time-study form. This entry need only be inserted once and thereafter only when a change occurs.
4-6	Turn Number	Entry to identify the turn being observed. Turns are numbered consecutively for a given code number and correspond to the turn number on the appropriate time-study form.
7-8	Number of Logs	Enter the number of logs in the turn.
9-80 (12,6-digit fields)	Log Scale	As a group, these columns record information pertaining to log size. Data for each log will fill six columns. The data consist of small and large end diameters in inches, D1 and D2 respectively, each allotted up to 2 columns and in addition the log length, L, expressed in feet also allotted up to 2 columns.

Scaling Data Example

Figure 18 is an example of how entries are made on the Scaling Data Form. The entries correspond to the three logs skidded in the example recorded in figure 16. Here the code number was 185 and the turn number was 12. The sizes of D1, D2, and L for each log are then shown as they would be recorded for the three logs in the order that they were picked up by the skidder.

SCALING DATA
DATE 6/10/74 MATCH WITH TIME STUDY FORM CODES 185, _____, _____

CODE NO.	TURN NO.	NO. OF LOGS	LOG 1			LOG 2			LOG 3			LOG 4			LOG 5			LOG 6			LOG 7			LOG 8			LOG 9			LOG 10			LOG 11			LOG 12		
			D_1	D_2	L	D_1	D_2	L	D_1	D_2	L	D_1	D_2	L	D_1	D_2	L	D_1	D_2	L	D_1	D_2	L	D_1	D_2	L	D_1	D_2	L	D_1	D_2	L	D_1	D_2	L	D_1	D_2	L
1 2 3	4 5 6	7 8	9 10	11 12	13 14	15 16	17 18	19 20	21 22	23 24	25 26	27 28	29 30	31 32	33 34	35 36	37 38	39 40	41 42	43 44	45 46	47 48	49 50	51 52	53 54	55 56	57 58	59 60	61 62	63 64	65 66	67 68	69 70	71 72	73 74	75 76	77 78	79 80
185	12	3	19	20	32	14	18	32	10	14	16																												

Figure 18.--Completed Scaling Data Form.

LOADING DATA FORM

The loading equipment used in the example timber sale is a hydraulic heel-boom loader (Prentice 600B). A time study is to be made to determine how independent variables and subsystem interactions affect the loading operation. As in the two other subsystems presented, initial conditions were documented on a Site-Terrain Information Form as shown in figure 19.

SITE/TERRAIN INFORMATION FORM

SITE DESCRIPTION

Logmaking _____
Skidding _____
Yarding _____
Loading 250
Hauling _____
Data Collection Date _____

Location
Timber Sale CLEAR CUT UNIT #3
Forest TARGHEE NATIONAL FOREST
Type of Cut Selective
Contractor IDAHO MILLS, INC.
Start Time 9:00 a.m. Stop Time 4:00 p.m.

Comments _____

SITE CONDITIONS

	Rating				
Surface Type	1	2	(3)		Comments _____
Surface Condition	(1)	2	3		Comments _____
Operator	1	(2)	3		Comments _____
Landing	1	(2)	3	4	Comments _____
Deck	1	(2)	3	4	Comments _____

Temperature 85 degrees Elevation 3400 ft
Wind 0 velocity — direction Precipitation 0 amount — form

SUBSYSTEM INFORMATION

Logmaking Comments _____
Crew Members
_____, Comments _____
_____, Comments _____
Saw or Feller
Make _____ Type _____ Equipment Owner _____
Model _____ Size _____ Payment (Method & Amount) _____

Skidding/Yarding Comments _____
Crew Members
_____, Comments _____
_____, Comments _____
_____, Comments _____
Skidder or Yarder
Make _____ Type _____ Equipment Owner _____
Model _____ Size _____ Payment (Method & Amount) _____

Loading Comments _____
Crew Members
BILL LARSEN (OPERATOR) Comments _____
_____, Comments _____
Loader
Make PRENTICE Type _____ Equipment Owner IDAHO MILLS, INC.
Model 600B Size _____ Payment (Method & Amount) $5.50/OPERATING HOUR plus $8.00/day

Hauling Comments _____
Crew Members
_____, Comments _____
_____, Comments _____
Truck and Trailer
Make _____ Type _____ Equipment Owner _____
Model _____ Size _____ Payment (Method & Amount) _____

Figure 19.--Completed Site-Terrain Information Form--loading.

Flow Process Chart

Figure 20 is the flow process chart for a loading operation. The chart shows the elements or steps required to transfer logs from a deck to a truck trailer. Four elements constitute one loading cycle. Note that the chart applies equally to loading with either a grapple or tongs (which must be set by hand). Also note that certain elements may be combined or omitted as explained on the chart. Figure 21 illustrates a typical loading situation. Since the loader and trailer generally remain stationary throughout the loading operation, the observer has little difficulty finding a good, but safe, vantage point from which to collect data.

Form Entries

A copy of the Loading Data Form is given in figure 22. As in the case with the Mechanized Felling Data Form and Skidding Data Form, the Loading Data Form is constructed so that data can be directly transcribed to cards via keypunching.

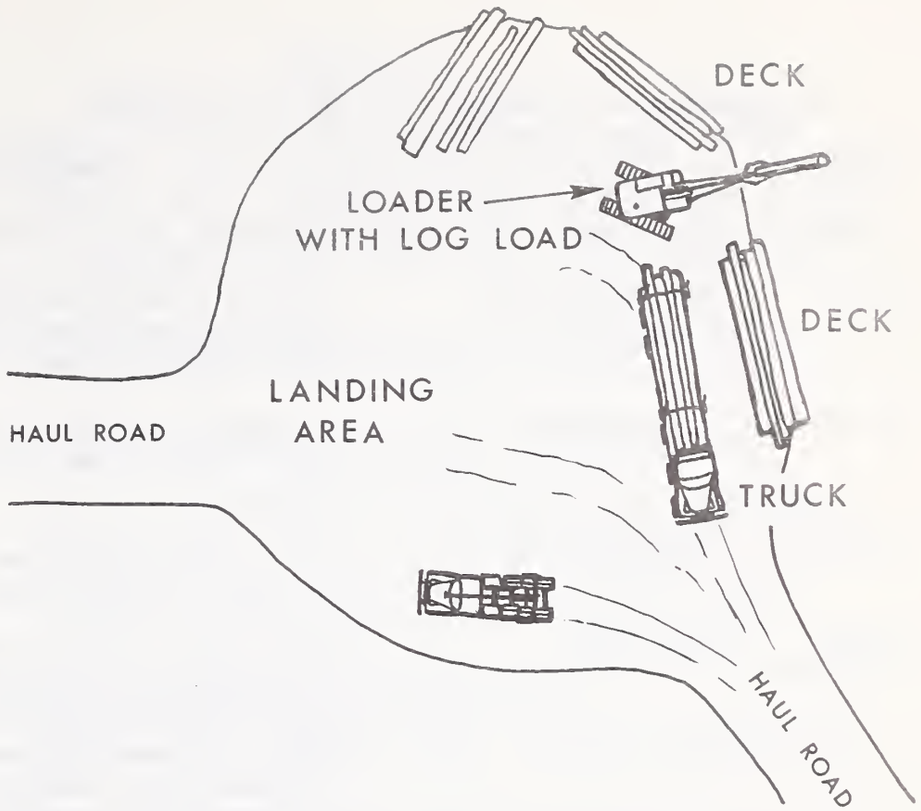
FLOW PROCESS CHART

SUBJECT CHARTED LOGS BY _____
SUBSYSTEM LOADING
METHOD USED _____

CHART SYMBOL	ELEMENT DESCRIPTION	ELEMENT BEGINNING & END POINTS
0	Logs Located at Deck	
1	Sort Log(s) (Combined Inspection and Movement)	Grapple attached to preliminary log load Grapple attached to final log load
2	Move Loaded	Grapple attached to final log load Grapple disengaged from log load.
3	Bump Logs	Grapple disengaged from log load. Boom & grapple begin movement toward deck
4	Move Unloaded	Boom & grapple begin movement toward deck Grapple attached to log load
6	Logs Located on Truck	
NOTE:	1 and 3 may be omitted;	
	i.e., may not exist, on some cycles. Also when tongs are used 1 will be replaced by 1,	
	the operation of setting tongs.	

Figure 20.--Flow process chart--loading.

Figure 21.--Loading operation.



LOADING DATA- TURN ELEMENT TIME STUDY FORM AND KEYPUNCH TRANSCRIBING FORM
Snapback Reading

SUBSYSTEM	EQUIPMENT & METHOD	CODE NO.	TRUCK LOAD	1 SORT LOGS (HOOK TONGS)	2 MOVE LOAD	3 BUMP LOGS	4 MOVE UN.	FOREIGN ELEMENT	NUMBER OF LOGS	SPECIES	SLOPE (%)	SURFACE T.	SURFACE C.	OPERATOR	LANDING	DECK	ADDITIONAL DATA	CONTINUE
1	2 3	4 5 6	7 8 9 10	11 12 13	14 15 16	17 18 19	20 21 22	23 24 25 26 27 28 29 30	31 32	33	34 35 36 37	38	39	40	41	42	I. D. 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79	80

Figure 22.--Loading Data Form.

An explanation of entries on the form follows:

Column	*Entry*	*Explanation*
1	Subsystem	One-digit entry identifies subsystem; per code sheet.
2-3	Equipment and Method	Two-digit entry identifies method used to accomplish subsystem function and also brand name and model used; per code sheet.
4-6	Code Number	Three-digit entry to identify observations and that matches with code number on Site-Terrain Information Form.
7-10	Truck Load No.	Up to a four-digit entry to identify load of logs. If possible, use truck driver's Load Slip No.
11-13	Sort Logs	Enter three digits representing time taken to perform element as defined on flow process chart. Enter time to nearest one-hundredth of a minute. *Note:* if tongs are used instead of a grapple, these columns can be used to record the time required to set tongs as, generally when tongs are used, sorting is usually not required.
14-16	Move Loaded	See explanation for col. 11-13.
17-19	Bump Logs	See explanation for col. 11-13.
20-22	Move Unloaded	See explanation for col. 11-13.
23-30	Foreign Element	As a group, these columns present information on foreign elements that occur. A foreign element is defined as an element that does not occur regularly on each turn. Enter single digit in col. 23 to identify foreign element type (per code sheet). Enter a single digit in col. 24 to identify regular element in which a foreign element occurred (see numbers above regular elements on Data Form). Enter up to three digits in col. 25-27 representing time elapsed in the regular element (entered in col. 24) when the foreign element began. Record time to the nearest tenth of a minute. Enter up to three digits in col. 28-30 representing time duration of foreign element. Record time to the nearest tenth of a minute.
31-32	No. of Logs	Enter digits representing number of logs loaded on truck during that particular cycle.
33	Species	Enter digit (per code sheet) representing species of log(s) loaded.

Column	*Entry*	*Explanation*
34-37	Slope	Enter percent slope from loader to truck being loaded. In most cases, this slope will be zero or nearly zero. A negative slope is recorded if the truck is at a level below the loader; positive slope is recorded if the truck is at a level above the loader.
38	Surface Type	Enter one digit classifying the surface type as outlined on the Site-Terrain Information Form.
39	Surface Condition	Enter one digit classifying the surface condition as outlined on the Site-Terrain Information Form.
40	Operator(s)	Enter a one-digit rating of operator's performance as outlined on the Site-Terrain Information Form.
41	Landing	Enter one digit classifying the landing area as outlined on the Site-Terrain Information Form.
42	Deck	Enter one digit classifying the deck as outlined on the Site-Terrain Information Form.
43-79	Additional Data	Columns for additional data. Entries explained in next section.
80	Continue	An entry in the continuation column indicates that data pertaining to the current line of entry are continued to the next line on the data-gathering form. Any numeric digit, other than zero, may be entered in the continuation column. The continuation line will present data only in the additional data field.

Explanation of Entries in Additional Data Columns for Loading Data Forms

Additional data columns are used to record data pertaining to an observation when the prescribed columns of entry are not sufficient.

Following are additional data column entries for Loading Data Forms:

Column	*Entry*	*Explanation*
43	Identification (I.D.)	Enter one digit (per code sheet) to identify reason that continuation was necessary.
44-51	Foreign Element	When I.D. = 1, enter the second foreign element for that line according to previous instructions.
44-XX	Scaling Data	When I.D. = 2, enter scaling data concerning logs loaded during that cycle. Such an entry requires six digits for each log as follows: (1) two digits for the small diameter in inches, (2) two digits for the large diameter in inches, and (3) two digits for the length in feet. The number of logs loaded is entered in col. 31-32. Other data pertaining to additions are entered according to defined conventions (i.e., the entry made in col. 44-XX will depend on the I.D. entry in col. 43).

When tongs are used and unhooking is required, this time can be recorded either in the additional data columns or as a foreign element, depending whether or not this element is required by the equipment (i.e., tongs are not designed to release automatically) or not, respectively.

More than one foreign element (or other type of data) can be given in col. 43-79. Once the I.D. number is read, the computer is keyed for the number of columns to be read. After reading data related to the first I.D. number, the computer checks the next column for another I.D. number. For example, columns 43-79 have the capacity to accommodate data related to five foreign elements. Further, if col. 43-79 are used to capacity, additional data can be accommodated on the next line. In such a case, a numeric entry is made in col. 80.

Loading Data Example

The following is an example of a use of the Loading Data Form. Example entries are shown in figure 23.

Subsystem, Equipment and Method, and Code No. entries have been made in col. 1-6 and are the same for each cycle. On the eighth cycle, the grapple attaches to a log and sorts this log to a side deck in 0.18 minute. Then another is picked up and moved to the trailer, constituting the move-loaded element, in 0.20 minute. The log is released on the trailer, but bumping is required which lasts 0.05 minute. Scaling data pertaining to the log are entered in col. 44-49. Upon initiation of grapple movement toward the deck, the loader operator incurs a personal delay, or a type 4 foreign element, which lasts 3.5 minutes. The operator remounts loader and moves the grapple unloaded from trailer to deck in 0.09 minute.

Other entries on the line, such as species, surface type, etc., are entered per the Site-Terrain Information Form. As noted on the explanation narrative of the Loading Data Form, entries in col. 1-6 and 34-42 generally need only be made once on each sheet unless changes in these data occur.

LOADING DATA-TURN ELEMENT TIME STUDY FORM AND KEYPUNCH TRANSCRIBING FORM
Snapback Reading

SUBSYSTEM	EQUIPMENT & METHOD	CODE NO.	TRUCK LOAD	1 SORT LOGS (HOOK TONGS)	2 MOVE LOAD	3 BUMP LOGS	4 MOVE UN.	FOREIGN ELEMENT	NUMBER OF LOGS	SPECIES	SLOPE (%)	SURFACE T.	SURFACE C.	OPERATOR	LANDING	DECK	ADDITIONAL DATA I.D.	CONTINUE
1 2	3	4 5 6	7 8 9 10	11 12 13	14 15 16	17 18 19	20 21 22	23 24 25 26 27 28 29 30	31 32	33	34 35 36 37	38	39	40	41	42	43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79	80
3	0	1 2 5 0 0 5 7		1 8	2 0	0 5	0 9	4 4 6 0 3 5	1 1			0	3	1	2	2	2 1 3 2 0 4 0	

Figure 23.--Completed Loading Data Form.

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Gibson, David F., and John H. Rodenberg
1975. Time study techniques for logging systems analysis. USDA For. Serv. Gen. Tech. Rep. INT-25, 32 p. (Intermountain Forest and Range Experiment Station, Ogden, Utah 84401.)

The USDA Forest Service research work unit of Intermountain Station at Bozeman, Montana, has been engaged in recent years in a comprehensive logging systems analysis study. Together with other research work units, this unit has developed, field tested, and refined a system to gather time and motion study data on logging operations. Techniques and forms employed for certain types of operations are presented in this publication. Forms for other types of logging operations are to be issued as appendices to this publication.

OXFORD: 524.41, 311, 301.
KEYWORDS: data recording methods, logging operations analysis, time study method.

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Headquarters for the Intermountain Forest and Range Experiment Station are in Ogden, Utah. Field Research Work Units are maintained in:

Boise, Idaho
Bozeman, Montana (in cooperation with Montana State University)
Logan, Utah (in cooperation with Utah State University)
Missoula, Montana (in cooperation with University of Montana)
Moscow, Idaho (in cooperation with the University of Idaho)
Provo, Utah (in cooperation with Brigham Young University)
Reno, Nevada (in cooperation with the University of Nevada)


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