

VI WORKING PAPER (1982, 4)

(プロジェクト終了にあたってプロジェクトの成果を要約してとりまとめたもの。
指導上の要点等が記述されている。)

Working Paper

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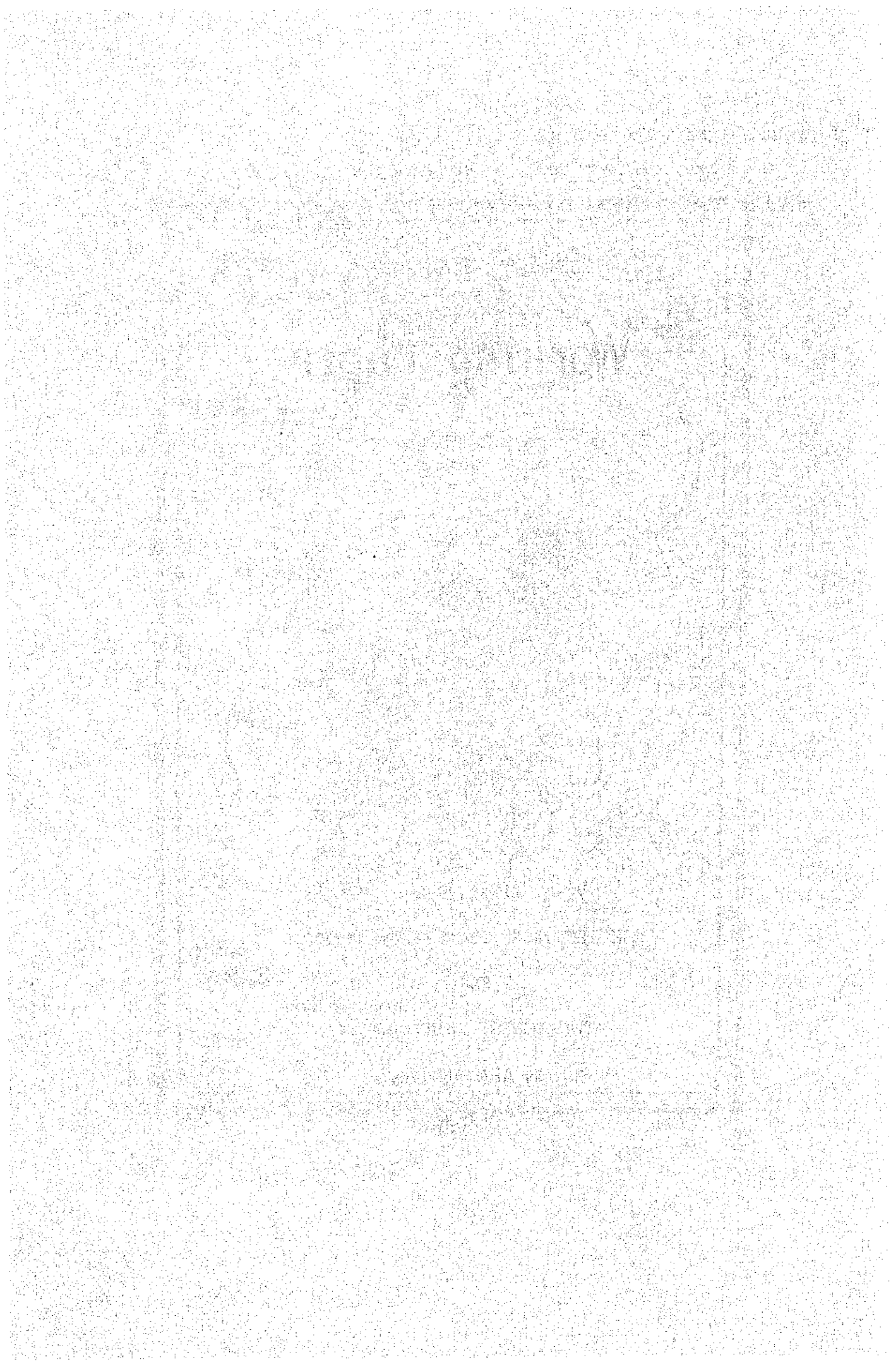
THE TECHNICAL COOPERATION PROJECT

FOR

THE FOREST DEVELOPMENT

IN ARAKAN RANGE

BURMA.



Preface

The Technical Cooperation Project for the Forestry Development in the Arakan Range in Burma would be completed as planned by end March, 1982. Our Japanese experts will return to Japan from Burma during the first week of August, 1982. Hence, the continuation and development of the results of this project will be performed by Burmese themselves.

This working paper has been compiled by Japanese experts, based on the experiences of this project as a book of reference for Burmese counterparts who are responsible for conducting the continuation and development of transferred techniques. I hope this working paper will furnish an important guide for promotion of transferred techniques by this project and will contribute to develop the forestry in Burma for the future. It is desirable that this book will be utilized widely not only by those who are in charge of the project but also by other people concerned.

I wish to express my sincere appreciation to those who participated in compiling this book, Burmese counterparts as well as Japanese experts.

April, 1982.

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I. TRAINING:

1. Basic Characters

At the Technical Co-operation Centre for the Forestry Development of Hill Forest, a total of 104 trainees have been trained, commencing from 1979, till March, 1982. 20 trainees attended the Logging Manager Course, 63 trainees attended the Logging Craftsman Course, while 21 trainees attended the Repair Craftsman Course.

Some of these trainees are assigned at Rangoon Okkyin Training Centre, some at the Bassein Model Operation Forest, and Workshop; while many of them are assigned in different agencies which does not concern with the cable logging works.

If we consider the scale of Timber Corporation, and the future cable logging works in the hilly regions, the number of trained personnels are not sufficient. To fulfill the plans and targets of the Timber Corporation, the present three training courses, i.e., Logging Manager, Logging Craftsman, Repair Craftsman courses should be continued in addition with Refresher Courses for old trainees. Thus, it is necessary to improve and develop the contents of Technical Co-operation Centre for the Development of the Timber Corporation.

2. Master Plan of the Training:

(1) Course of Training:

Logging Manager Course, Logging Craftsman Course, Repair Craftsman Course for new trainees will be continued; whilst there will be also Refreshing Courses for old trainees.

<u>Training Course</u>	<u>Trainee</u>	<u>Period</u>
Logging Manager	Dy: Manager	1 month
Logging Craftsman	T.R., C.O., Dr.	6 months
Repair Craftsman	Mech. G. I, II, III and helper	4 months
Refresher Course	old trainees	1 month

T.R. = Timber Ranger C.O. = Chaung Oak

Dr. = Yarder Driver

(2) The Training Materials:

The following list on the annex -- 1 -- is the text book for the training and the followings are list of audio-visible instruments :

a. The colour slide films

- (a) the safety work
- (b) the cable logging works
- (c) the road construction
- (d) How to drive the yarder
- (e) How to keep the safety work
- (f) The safety cable line operation
- (g) The safety knowledge in the forest work
- (h) The operational standard for cable logging operation

b. 8 mm Movie Films

- (a) Forestry in Japan
- (b) Pilot Forest
- (c) Kyoto and Nara
- (d) Handling of Wire Rope

c. Television video tape

- (a) Wire Splice
- (b) Assembly and Disassembly of Cable Logging System
- (c) Inspection and Safety Works
- (d) Chainsaw
- (e) Yarder Overhaul
- (f) Training facilities of Forestry Training Institute in Tokyo, Japan.

3. Logging Manager Course:

(1) The Training subject and its time table

	Subject	Period (50 minutes)		total
		theory	practical	
A.	Introduction of Forestry in Japan	3	-	3
B.	Introduction of Cable Logging in Japan	3	-	3
C.	Basic Knowledge of Cable Logging	6	3	9
D.	Planning of Cable Logging Set	18	-	18

<u>Subject</u>	<u>Period (50 minutes)</u>		
	<u>theory</u>	<u>practical</u>	<u>total</u>
B. Yarder and Cable Logging Apparatus	3	3	6
F. Wire Rope and Wire Splice	9	27	36
G. Working Standard and Safety Work	6	-	6
H. Assembly and Disassembly of Cable line	-	27	27
I. Inspection and Driving	3	6	9
J. Compass Survey	6	6	12
K. Forest Road Network Planning	6	3	9
L. Basic Knowledge of Chainsaw	3	6	9
M. Extraction Planning	3	9	12
N. Workshop Management and Forestry Machines	6	3	9
Total :-	75	93	168

(2) The Points of Training:

The trainees that had attended the Logging Manager Course are important officials of the agency, and at the same time they are the potential future leaders of the Timber Corporation.

Although the managers do not need to involve physically, they should work at the field as technical and management leaders, and systematically instruct Logging Craftsmen. Thus they should have proper knowledge of timber extraction, including cable logging, and forest road net-work planning and others.

Due to these conditions they should learn both actual training and also the theory of extraction for the cable logging works or forest road net-work planning.

A. Introduction of Forestry in Japan:

The briefing of the history and the view of forestry in Japan, e.g., outline of natural conditions, forest resources, forest administration, utilization and supply of timber, forest road construction, forestry management, national and private forest and others are introduced and taught to the trainees.

B. Introduction of Cable Logging in Japan:

The history of cable logging works in Japan is defined, and the relation between the best location for the cable logging and forest road network, the best cable logging system by the scale of timber and working arrangement are explained. Determining by these conditions or factors, there should be the best cable logging system among the Endless Tylor, Felling Block, Hoisting Carriage, Running Skyline, and Kumamoto System.

The Training materials, i.e., text books, slide films are necessary guidance for study.

C. Basic Knowledge of Cable Logging:

In order to understand the cable logging work, the following points should be emphasized.

a. Outline of Cable Logging System:

The cable logging system is constructed by the skyline in the air, with the help of some kinds of tree and blocks in which operating lines are driven by the yarder. It can carry heavy timbers from felling place to unloading deck.

By this method, it can carry heavy logs even in the place of severe ground condition. Thus, the trainees should thoroughly understand and have proper knowledge of cable logging materials, e.g., wire ropes, guide trees, blocks, interial angles, yarder setting, etc. And it is also, necessary to stress to the trainees that the team spirit or team-work is essential in the cable logging operation.

b. Yarder Apparatus:

The materials such as Skyline, Operating line, Head-tree, Tail-tree, Guide tree, Anchor tree, Carriage, Loading block, Saddle block, Heel block, Snatch block, Wire clip, etc., are necessary for cable logging. Hence, it is necessary to study the works, the characters, their proper usage, maintenance, daily checking, periodical checking and special points of attention.

c. How to use work sheet for the cable logging:

The meanings of the basic numbers, e.g., the maximum span, the maximum load, the central sag ratio, safety numbers should be properly understood. And also, the meaning and the calculation of the work sheet should be thoroughly studied.

d. The communication systems, such as the telephone, the flag, and the way of signing should be well trained, in order to keep mutual communication during the cable logging operation. The training materials such as text-books, slide films and Yarder models are necessary.

D. Planning of Cable Logging Set:

The method of calculation in order to know the necessary materials and matters such as the maximum load, maximum span, central sag ratio, slope of span, etc., should be taught. The training materials such as text-books are also necessary.

E. Yarder and Cable Logging Apparatus:

It is important to check, whether the basic condition of yarder, such as light weight, strong enough, moveable, easy handling or maintenance, are satisfactory or not; and whether the basic conditions of yarder and others for each cable logging systems are well designed or not. The structure of yarder, its daily check, the beginning and end checks, the checking points, the safety factor, structure and usage of wire rope, blocks, post trees should be thoroughly studied.

It will be trained by the educational materials, such as text-books, video tape and cable logging materials.

F. Wire Rope, Wire Splice:

The wire rope shares the most part in the cable logging system, and the improper selection and handling of wire rope affect badly to the entire cable logging works. The high degree of knowledge of wire rope is necessary.

a. The structure of wire rope:

The wire rope is constructed with a core, wire elements and strands. Many kinds of wire rope can be seen in the market by the number of wire elements, the lay of strands, the kind of core, the kind of materials or wire elements.

Among these, 6 x 7 lang lay rope for skyline, 6 x 19 ordinary lay rope for operating line are mainly used, due to characters of wire rope.

b. The handling of wire rope:

It is very important to handle with care, when the wire rope is being carried, or being preserved at the store house and when it is being operated. If the wire is damaged, by improper ways of handlings, even if it is a minor damage, the entire wire rope is considered to be weak. In transporting, unloading, maintaining, taking it out from the wire bobbin, seizing, installing to the yarder drums, the selection of wire rope for the intended purpose should be done carefully.

c. The safety check of wire rope:

If the wire rope is found unsatisfactory, it cannot be used for the intended purpose. In that condition, we should consider the rule of renewal of wire rope and the safety factor by the calculation. The grasp about the working condition of wire rope of renewal, if something is wrong, it should be promptly identified.

d. Wire Splice:

There are long splice and short splice. The long splice is mainly for skyline connection; whereas the short splice is mainly for operating line.

There is eye splice which is done by Makizashi, Warizashi, and by Modified Warizashi for sling rope.

The teachings Materials such as text-books, video tapes, tools and splice model are necessary.

G. Working Standard and Safety Work:

The cable logging system is widely spread out in the severe topographic conditions and workers work out of sight of each other. Thus, the working standard for handling and checking of wire rope and yarder apparatus, yarder driving, cable stretching work, extraction works, wire replacement work should be done under the rule, because of the danger of the work. From the angle of safety operation, it is natural that, sometimes accidents may occur, by severe working conditions. So it should be operated, in order to reduce the possibility of accident. It is very important to be attentive in operating, whereas, the complete understanding of working sign, physical conditions, like weather, topography, forest and workers' health conditions should also be highly considered.

The work-shifts of workers, forest fire, dangerous zones, parts which is prohibited to ride, usage of warning sign, the works on the tree and over-head, and the protected matters should be seriously considered.

The Teaching Materials, such as text-books, slide films, video tapes are also necessary.

H. Assembly and Disassembly of cable line in Okyiu Training Centre:

The trainees, should study the cable logging works by the video TV, slide films, photographs and model cable logging system, and then, they should assemble small size cable logging system, in order to learn the outline of the cable logging operation. In this lesson, trainees will have a basic idea of assembly, disassembly and driving of Endless Tyler, Hoisting Carriage, Running Skyline and Falling Block Systems.

In the model operation forest, actual training of Assembly, Disassembly and driving should be properly studied as the final phase of the training.

The Teaching Materials such as text-books, Video tapes, cable logging model are necessary.

I. Inspection and Driving:

a. Inspection:

Inspection is done just after assembly is completed. The first inspection is done by the check list, whether assembly conditions of skyline, operating line, yarder setting, block setting on the post area at the static condition are satisfactory or not.

The second inspection is done by the check list, whether the carriage is moved smoothly on the skyline or not; whether the wire ropes touch each other or not at the dynamic conditions without load.

The third inspection is done with $1/4$ of planning load by the check list.

The fourth inspection is done with planning load, whether smooth driving can be done or not.

The fifth inspection is done by the check list, whether the condition of yarder setting, skyline setting points on the tail and head-trees, running condition of the operating line on the blocks, the setting condition of anchor line, Daiwuko rope and snatch blocks are set properly or not.

If nothing is detected by these inspections, it can be considered, that the operation can be done for the first time. During the operation, the checking at the beginning and the end should be done. If something is wrong, it is necessary to stop the yarder driving at once, and check it.

b. Yarder Driving:

The yarder driver should drive the yarder by the signs which are sent by the signal men. Generally, it is very rare that the driver can see entire extraction area because of land conditions. It is therefore, driving the yarder only by judgements of yarder driver is extremely dangerous. The yarder driver should always quickly response to the signal.

The Teaching Materials, such as Text-books, slide films, video tapes for cable logging systems are necessary.

J. Compass survey:

a. Compass survey is a convenient method in bad location or in the forest, because of its simplicity. However, if the operator's degree of knowledge for handling the compass is low, the survey cannot be done precisely, due to the error.

The following are basic points for the precise compass survey:

(a) Compass needle can move horizontally. When compass is set at horizontal position, the compass needle should be horizontal too. If it is not horizontal, it should be adjusted by using the weight on the needle.

(b) Sensitivity of compass needle should be high. Comparing first needle indication with second needle indication, which the needle is shifted by the iron materials associated with, then take it off. If there is no difference, the Compass is working properly.

(c) ~~The stadia hair should be perpendicular to the plane which is formed by the tangent of spirit levels.~~ The compass-needle which indicate the magnetic pole; if iron or stone with iron or power line or thunder storm-infiltrated into the zone of the compass (local attraction), the compass may work improperly. These severe conditions are already predicted, the result should be checked carefully.

Some survey methods can be done by the compass.

They are mainly, Progression method, Radial line method and Intersection method. These methods can be applied depending upon the location and purpose.

For the progression method, the checking of the survey error is done by the means of the closing error, comparing the actual length between survey points with the length which is surveyed for the Radial and Intersection methods.

b. Field and Desk Works:

(a) Field Work

(i) Compass Setting

The compass should be set stable, and interference of outside circumstances should be as little as possible.

(ii) Survey point setting

The meaning and position of survey point, the combination of neighbouring survey points and survey efficiencies are the conditions for survey point setting.

(iii) Sight-line height setting

The both height of instrument and sight point on the survey pole should be the same.

(iv) Distance survey and measuring tape

The metre tape is used for the ordinary survey. The smallest reading unit is 10 centimetre or 1 centimetre. It depends upon the survey.

(v) Azimuth angle

Azimuth angle can be read upto 30 minutes on the dial of indication. However, compass is easily affected by the local attraction. Hence, during the survey, iron materials should be avoided around the compass.

(vi) Writing in the field note

There are many writing methods in the field note which depend on the survey methods. The azimuth angle, slope distance (in the field), vertical distance, horizontal distance (in the desk work) are written in principle.

(b) Desk Work

(i) Calculation

Vertical distance and horizontal distance can be obtained by the calculation or from the conversion table.

(ii) Local Attraction

It is necessary to check the local attraction and correct it by the rule, if it is in the survey datams.

(iii) Drawing

In the drawing, the survey error can be detected. If it is under the regulation, the error can be corrected, but if it is over the regulation, the survey should be repeated again.

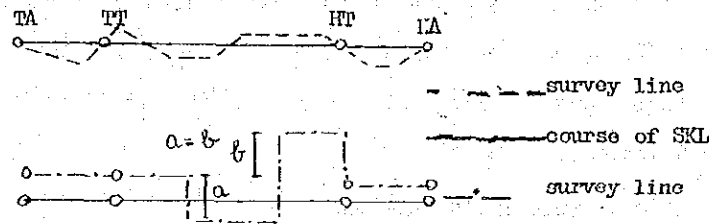
(iv) Area Calculation

There are two ways in which one is by dividing the map into some triangles or squares to calculate the area, another one is by using a planimeter.

c. Line Survey

The line survey is meant for the course of skyline for the cable logging. The profile, length of span and slope angle of skyline are necessary to design the cable logging system. Thus, the line survey should be done by considering those three factors. In this case it is not necessary to survey the details, and to set the survey point very accurately as line or line shown in figure.

These three factors can be shown by the drawings.



In this case, it is absolutely necessary to survey from the head tree anchor to the tail tree anchor; because the numbers, directions and setting height of guy line can be shown by the survey.

d. Forest Road Survey

There are line survey, profile survey and cross-section survey in the forest road survey. These surveys are done mainly by the compass, by the level instrument and by the survey poles respectively.

(a) The Line Survey

The number pegs are set every 20 metre from B.P. (beginning

point) along the centre line of the road. Sometimes, plus peg can be set in where location is changed greatly. The pegs where I.P. (inter-section point), B.C. (beginning of curve), M.C. (middle of curve), E.C. (end of curve) are put up in order to set the curve. The distance among the survey points, survey points of number, +, B.C., M.C., E.C., and I.P. should be horizontal for convenience.

(h) The Profile Survey

This survey is to calculate the total of earth work. Thus, high accuracy is necessary. The survey points of B.P. number, +, B.C., M.C., E.C. should be surveyed by the Level Instrument. If the location is simple and there is the number peg or plus peg near by, surveying of B.C., M.C., E.C. can be neglected.

(c) The Cross-Section Survey

It is necessary to survey the width of total road range. Generally, the survey poles are used, but sometimes the compass is used in the case of special location.

e. Area Survey

This is a survey to know the area where the Progression method is used generally. In the special case, the other methods, i.e., Intersection method and Radial line method are applied.

(a) The Progression Method

This is the most proper method for the compass survey. The Compass moves the survey points one after another, and thus, it is possible to survey F.S. (fore sight), B.S. (back sight) and check the local attraction.

(b) The Intersection Method

The unknown points are surveyed from the known two or three survey points by the azimuth angles.

The unknown point is shown at the intersection point of survey lines from the two or three known survey points. This method is not highly accurate and it is difficult to correct the errors.

(c) Radial Line Method:

This method can be applied in the place where every survey points can be seen from one compass setting point.

In order to check the survey error, it is necessary to compare actual length of each survey points with the length already surveyed.

The teachings materials * Text-books, slide films, Compass, survey poles, Level Instrument, and staffs should be available for the mentioned surveys.

K. Forest Road Net-Work Planning

a. The effect of forest road

Forest road is one of the prime factors to give a value to the forest in the forestry management. And it also plays a vital role in rural communication.

Burma is still lacking good forest road networks. That is why, the forest road should be planned by considering the value not only for forestry management but also for the development of the rural people.

In Burma, ideal forest road which is easy to maintain and strong for a disaster can be constructed, for forest and land are under controlled by the Government, and hence, it is easy to plan the ideal forest road route.

b. Classification of forest road

The forest road is classified as Arterial forest road; Branch forest road by the forestry management; Arrival forest road and Operating forest road by the function; First, Second, Third grade forest road by the structure.

c. The structure of forest road

The forest road has a rule, in which planning speed, road range, radial of curve, gradient, etc., are ruled. The drainage system is the most important factor, and it should not be overlooked.

d. Designing of Forest road

The forest road construction needs a lot of money; hence, it should carefully consider the designing of a road. It should be clearly known not only the road-workers, the quantity of earth work, structural matters, materials, machineries; but also the circumstances, topography, geological and forestry conditions, etc. The following are the basic orders of designing of forest road.

(a) Preparatory survey

The forest road route is designed on the map by the technical and economical point of views.

(b) Reconnaissance

It means to compare the actual conditions with the route which is designed by the preparatory survey.

(c) Preliminary survey

It is to survey the road route roughly which is planned in order to know the actual ground conditions and the best route way.

(d) The location survey

This is the basic and final survey for designing, hence high accuracy is necessary.

This includes line survey, profile survey, cross-section survey.

(e) The Drawings and Calculation

The quantity of earth work, structure, construction materials, machineries, workers are estimated by the drawing and calculation.

The knowledge of handling the Compass for line survey, level for profile survey, Handy level for reconnaissance and survey poles should be of high accuracy.

The teaching materials : such as text-books, slide films, survey equipments are necessary.

L. Basic Knowledge of Chainsaw

In Burma, there are a number of chainsaws, but the life of chainsaws are short, due to various troubles. This is caused not only by using it for hardwood, but also the incorrect sharpening of saw cutter.

Some troubles are caused due to the lack of beginning, and and periodical checkings.

a. Sharpening of saw chain

(a) it is necessary to make all blade length the same in order to arrange the height of cutter and saw kerf because of side and upper clearance of the cutter.

(b) The height of the depth gauge should be the same and if it is not of the same height, the cutter cannot work smoothly.

(c) Although 55 degrees of top and side blade angle is standard, it had better little over 55 degrees of blade angle (blunt blade) in Burma, because the chainsaw is mainly used for cutting hardwood.

(d) The gutter of chainsaw bar should be clean, for oil is supplied through the gutter.

If it is dirty, oil cannot be supplied; and hence, the top of the bar and saw chain are easily damaged.

b. Daily Check: (Beginning and end check)

The looseness of the screw should be checked, and cleaning up the engine cover, the air filter and the bar gutter should be done as a daily check in order to keep safety work and avoid the troubles of the chainsaw.

H. Extraction Planning

The costing in timber production is mainly in the extraction; the reduction of forest revenue and expenditure is easily affected by the efficiency of extraction. In other words, the main point of extraction is how to extract the timber efficiently, effectively and economically.

The efficiency of timber extraction mainly depends upon its method.

The timber extraction can be hampered by the various physical conditions; such as bad weather, bad road condition, trouble of machineries, etc. If the extraction is hindered in a step, the entire extraction should not be stopped. For this case, surplus timber should be kept at each key step.

At the same time, an annual time table, flow of timber to markets, quantity of timber products should also be planned.

N. Workshop Management and Forestry Machinery

The important points of mechanization are :-

- (1) Increase of productivity,
- (2) Decrease of the product cost.
- (3) Improvement and Standardization of quality.

It is important to keep high rate of machine operation and to maintain it. For this reason, the organization and operation of workshop, supply and maintenance of spare parts, and service network with engineers are of utmost importance.

4. Logging Craftsman Course

(1) <u>Training subjects and its time table</u>	<u>D A Y</u>		
	<u>Theory</u>	<u>Practical</u>	<u>Total</u>
A. Introduction of forestry in Japan	0.5	-	0.5
B. Basic Cable Logging Work	3.0	-	3.0
C. Physic for cable logging work	1.0	-	1.0
D. Planning of cable logging set	4.0	-	4.0
E. Yarder and cable logging apparatus	1.5	-	1.5
F. Wire rope	2.0	-	2.0
Wire splice	-	19.0	19.0
G. Working standard and safety work	1.5	-	1.5
H. Assembly and disassembly of cable logging set	-	43.5	43.5
I. Inspection and driving	-	16.0	16.0
J. Compass survey	2.0	3.0	5.0
K. Basic knowledge of road construction	1.0	2.0	3.0
L. Basic knowledge of chainsaw	1.0	3.0	4.0
Total :-	17.5	86.5	104.0

(2) The Point of Training:

The actual training should be the basic point, more than the indoor training, because the trainees should work mainly in the forest. Although the training subjects are duplicated to the subjects of Logging Manager Course, there should be modified as actual training.

A. Introduction of Forestry in Japan

The idea is the same as Logging Manager Course

B. Basic Cable Logging Work

The idea is the same as Logging Manager Course

C. Physios for Cable Logging Work

The basic knowledge of dynamics, electricity, hydraulics, and their adaptation should be taught because of their degree of knowledge

D. Planning of Cable Logging Set

The idea is the same as Logging Manager Course

E. Yardor and Cable Logging Apparatus

The idea is the same as Logging Manager Course

F. Wire rope and Wire Eplice

The idea is same as Logging Manager Course

G. Working Standard and Safety Work

The idea is the same as Logging Manager Course

H. Assembly and Disassembly of Cable Logging Set

The actual assembly and disassembly trainings are done by the small cable logging system in the Okkyin Training Centre, after studying the details of cable logging by the models or video tapes. All trainees should be trained the basic cable logging systems of assembly and disassembly; for example : Endless Tylor, Falling Block, Kumamoto, Hoisting Carriage, High Load, Running Skyline systems. The trainees will be leaders of the field work in the future; and hence, actual training should be thoroughly done.

After the training at Rangoon Okkyin Training Centre, all trainees should continue their training at the model operation forest to learn the actual cable logging work, so as to broaden their scope and field of knowledge.

I. Inspection and Driving

The idea is the same as the Logging Manager Course.

J. Compass Survey

The idea is the same as the Logging Manager Course.

K. Basic Knowledge of Road Construction

The idea is the same as the Logging Manager Course

L. Basic Knowledge of Chainsaw

The idea is the same as the Logging Manager Course.

(3) On-the-Job Training (O.J.T.)

The trainees of the Logging Craftsman Course are practical workers in the forest, and they are direct receivers of transferred techniques. Thus, they should have the knowledge and actual works of Cable Logging as part of extraction work, in order to decide and instruct their subordinates what to do at once.

All trainees should participate on-the-job training in the model operation forest. For this, whether the trainees can participate the O.J.T. or not should be considered as a basic condition. The purpose of O.J.T. is to learn the actual cable logging works rather than timber production at first and they should be trained the basic cable logging system, for example : Endless Tyler, Falling Block, Hoisting Carriage Running Skyline, Kumamoto, High Lead System and combination of Cable Logging Systems, so that they will have a lot of experiences in this field.

5. Maintenance and Repair Craftsman Course:

(1) Training subjects and Time table

At the beginning of this section, it should be noted that in order to determine the training subjects and items and to set a training standard, ~~it depends on the scholastic abilities or mechanical experiences~~ of trainees.

a. Classification of training in the course

~~Basic training~~... consists of mainly lectures, e.g. mechanical fundamental knowledge, ~~mechanical engineering,~~ structure and function of internal combustion engine, etc. About two months are suitable for the period.

~~Practical training~~... consists of more practices and fewer lectures in the Base Workshop, ~~mainly integrating practice~~ into maintenance and repair of medium size vehicles with teaching how to handle shop equipment and tools.

Also two months are adequate for the period.

~~On-the-job training~~... is made up of actual mechanical service works in the Base Workshop, Service spot and operation sites.

Even in this period, when the necessity arises all or some of OJT trainees should be given supplementary training.

At the early time of this period, OJT trainees are to be installed in the sections of workshop according to their capabilities and adaptabilities, and learn the specialities of works such as engines, injection pumps, chassis, machinings, weldings, electricity, etc.

Thinking over these arrangements, some two years are fit for the period.

b. Subjects and standard days (6 hours/day) of training course
(basic and practical).

	Subjects	Contents	Standard Lecture	days practice
1.	General explanation	<ul style="list-style-type: none"> . History of forest machine . Machinery maintenance control in forest production works 	3.0	—
2.	Safety control	<ul style="list-style-type: none"> . Safety control against dangers in shop and field. . How to cope with accidents 	1.5	—
3.	Workshop management	<ul style="list-style-type: none"> . Organization and duties . Machinery control . Data collecting system of machinery expenses. 	5.5	—
4.	Periodical maintenance	<ul style="list-style-type: none"> . Significance of periodical maintenance . How to make periodical maintenance program and service items of each machine. 	3.5	4.0
5.	Parts and materials control	<ul style="list-style-type: none"> . Control of spare parts, fuel and lubricants, workshop materials, equipment and tools 	2.5	—
6.	Mechanical measurement	<ul style="list-style-type: none"> . Basic knowledge about measuring units and mechanical measurement 	4.0	—
7.	Shop equipment and tools	<ul style="list-style-type: none"> . Structure and handling of equipment and tools for maintenance and repair services 	5.0	5.0
8.	Electricity	<ul style="list-style-type: none"> . Basic knowledge of electricity . Structure and repair of electrical devices of machine 	5.5	4.5

	Subjects	Contents	Standard Lecture	days practice
9.	Hydraulics	<ul style="list-style-type: none"> • Basic knowledge of hydraulics • Structure and repair of hydraulic devices of machine 	2.5	2.0
10.	Materials of machine	<ul style="list-style-type: none"> • Metal and non-metal, basic parts, and fuel and lubricants for machine 	3.5	—
11.	Iron works and welding	<ul style="list-style-type: none"> • Structures of arc and gas welding sets • Practice with arc and gas welding sets 	2.5	4.0
12.	Diesel engine	<ul style="list-style-type: none"> • Structure and function of Diesel engine 	4.0	2.5
13.	Fuel injection system	<ul style="list-style-type: none"> • Structure and function of fuel injection system 	3.5	2.0
14.	Lubrication system	<ul style="list-style-type: none"> • Effect of lubricating oil • Structure and function of lubrication system 	1.0	1.0
15.	Cooling system	<ul style="list-style-type: none"> • Kinds of cooling system • Structure and function of cooling system 	1.5	1.5
16.	Machines for forest production and forest road construction	<ul style="list-style-type: none"> • Structure, function and maintenance of, Forest production machines; yarders, logging tractors, chainsaws, etc. • Forest road construction machines; bulldozers, rollers, dump trucks, jaw crusher, etc. 	9.0	11.0
17.	Others	<ul style="list-style-type: none"> • Review tests and evaluation tests, etc. 	5.5	—
Total (101.0 days)			63.5	37.5

It is necessary to repeat that to get a good result of training, subjects and training days should be arranged to vary depending on the comprehension of trainees.

Also, to carry out the training course smoothly and effectively the importance is to select trainees with equal capabilities.

In the case of difficulty to select alike trainees, however, it is advisable to grasp the abilities of whole and respective trainees by carrying out a preliminary test.

(2) Points of Training:

Enough training materials and audio-visual equipment at Okkyin Training Centre, and necessary data and reference books for machines at Bassein Base Workshop should be utilized effectively for the course.

a. Utilization of Practical Hand Book:

"Practical Hand Book for Maintenance and Repair" is under the final stage of preparation, which covers material from general fundamental knowledge for mechanical service works to management of workshop.

This book is compiled suitably to the training text for Maintenance and Repair Craftmen Course.

b. Points to Training Items:

Subject and Item	Points	Materials
1. General explanation		
(1) Development of machinery	<ul style="list-style-type: none"> . Explanation of machinery development with various examples from using natural energy to internal combustion engine 	<ul style="list-style-type: none"> . So far no materials
(2) Forestry and mechanization	<ul style="list-style-type: none"> . General explanation about the forestry domestic and international. . Forest production, works and mechanization comparing traditional way to mechanized way. 	<ul style="list-style-type: none"> . 8 m/m films about Japanese forestry. . Video tapes. . Lecturer forest specialist.
2. Safety control		
(1) Dangers of field works and countermeasures	<ul style="list-style-type: none"> . Dangerous cases in field service works and countermeasures against them . How to cope with accidents 	<ul style="list-style-type: none"> . Hand book . Handling manuals of equipment and tools
(2) Dangers in shop works and countermeasures	<ul style="list-style-type: none"> . Dangerous cases in workshop service works and countermeasures against them 	<ul style="list-style-type: none"> . Hand book . Handling of shop equipment and power tools . Fire extinguisher
3. Workshop management		
(1) Workshop role and its organization	<ul style="list-style-type: none"> . Role of workshop in forest production works . How to organize workshop . Sections of workshop and their duties 	<ul style="list-style-type: none"> . Hand book
(2) Machinery control	<ul style="list-style-type: none"> . Guidance to machine operators for handling, operation, daily check, lubrication. . Preparation of machinery ledger, service records . How to grasp running and expenses data of machines 	<ul style="list-style-type: none"> . Hand Book . Daily check form . Machinery ledger and record book.

Subject and Item	Points	Materials
(3) Shop equipment and tools	<ul style="list-style-type: none"> . Classification and handling of shop equipment, common tools, special tools . Alloting equipment and tools to workshop, service spot, service truck. 	<ul style="list-style-type: none"> . Hand book . Master catalog of shop equipment and tools . Special tool catalog.
4. Periodical maintenance		
(1) Significance of periodical maintenance	<ul style="list-style-type: none"> . Difference between maintenance and repair . Significance and effect of programmed services. 	<ul style="list-style-type: none"> . Hand book . Operation manuals.
(2) Preparation of periodical maintenance program	<ul style="list-style-type: none"> . Preparation of periodical maintenance program according to running hours and kilometage such as daily, weekly, monthly, 6 monthly, yearly, etc. for several machines. 	<ul style="list-style-type: none"> . Operational manual. . Periodical maintenance forms
5. Parts and materials control		
(1) Store control	<ul style="list-style-type: none"> . Parts and materials control system or ordering, receiving, arranging and issuing. . Totalling of issued parts and materials for each machine . Explanation of necessary forms and stock card system. 	<ul style="list-style-type: none"> . Hand book . Control forms
(2) Classification of controls	<ul style="list-style-type: none"> . Parts and Materials control consists of stock-taking, control, quality control, overhaul control, stock quantity control, purchasing and issuing control. 	<ul style="list-style-type: none"> . Hand Book
6. Mechanical measurement		
(1) Measurement system	<ul style="list-style-type: none"> . Measurements of metric system, British system, American USCS system and Burpese customary system. 	<ul style="list-style-type: none"> . Hand book

Subject and Item	Points	Materials
(2) Units and conversion	<ul style="list-style-type: none"> • Converting one unit system to the other • Preparation of unit conversion table. 	<ul style="list-style-type: none"> • Hand book
(3) Engine and measurement	<ul style="list-style-type: none"> • Calculation of speed, pressure, work and engine output with basic measuring units. 	<ul style="list-style-type: none"> • Hand book • Reference books
7. Shop equipment and tools		
(1) Common hand tools	<ul style="list-style-type: none"> • Make-ups and handlings of common hand tools; screw-drivers, hammers, pliers, wrenches, etc. 	<ul style="list-style-type: none"> • Hand books • Tool set
(2) Cutting tools	<ul style="list-style-type: none"> • Make-ups and handlings of cutting tools; chisel, file, punch, drill, hacksaw, taps and dies, etc. 	<ul style="list-style-type: none"> • Hand books • Tool set
(3) Shop equipment	<ul style="list-style-type: none"> • Structures, functions and handlings of shop equipment; steam cleaners, car washers, hydraulic jacks, hydraulic presses, chain blocks, electric drills, valve refacer, washing stands, etc. 	<ul style="list-style-type: none"> • Hand tools • Manuals of shop equipment
(4) Measuring tools	<ul style="list-style-type: none"> • Structures and handling of measuring tools; vernier calipers, micrometers, rules, straight edges, thermometers, feeler gauges, dial indicators, etc. 	<ul style="list-style-type: none"> • Hand book • Measuring tools
8. Electricity		
(1) Bases of electricity and magnetism	<ul style="list-style-type: none"> • Principles of electrical and electro-magnetic generation, current, voltage, resistance, magnetic field electro-magnetic induction. 	<ul style="list-style-type: none"> • Hand book
(2) Electrical symbols and circuit	<ul style="list-style-type: none"> • Electrical symbols, types of circuits and electrical calculations 	<ul style="list-style-type: none"> • Hand book • Typical electrical circuit of a vehicle.

Subject and Item	Points	Materials
(3) Battery	<ul style="list-style-type: none"> . Principle of chemical accumulation, structure of battery, maintenance of battery. . Handling of battery testers, hydrometers. 	<ul style="list-style-type: none"> . Hand book . Battery measures
(4) Starter motor	<ul style="list-style-type: none"> . Structure, function and dis-assembling of starter motor . Trouble shooting of starting system 	<ul style="list-style-type: none"> . Hand book . Starter motor
(5) Charging system	<ul style="list-style-type: none"> . Structures, functions and dis-assemblies of generator, alternator, regulator . Trouble shooting of charging system 	<ul style="list-style-type: none"> . Hand book . Generator, alternator, regulator
9. Hydraulics		
(1) Hydraulic system	<ul style="list-style-type: none"> . Physical principle of hydraulics . Structure and function of hydraulic devices; hydraulic pump, valve, cylinder, filter 	<ul style="list-style-type: none"> . Hand books
(2) Hydraulic symbols and circuit	<ul style="list-style-type: none"> . Drawing of hydraulic circuit with symbols . Hydraulic calculation 	<ul style="list-style-type: none"> . Hand book
(3) Hydraulic tester	<ul style="list-style-type: none"> . Structure and handling of hydraulic tester . Trouble shooting of hydraulic system 	<ul style="list-style-type: none"> . Hand book . Manual of tester
10. Mechanical materials		
(1) Fuels and lubricants	<ul style="list-style-type: none"> . Specifics of products by fractionating crude oil 	<ul style="list-style-type: none"> . Hand book
(2) Metal and non-metal materials	<ul style="list-style-type: none"> . Properties and utilization of iron, non-ferrous metal, alloy, plastics, rubber, etc. 	<ul style="list-style-type: none"> . Hand book
(3) Fasteners	<ul style="list-style-type: none"> . Kinds and utilization of bolt, nut, rivet, snapping, pin, lock, etc. 	<ul style="list-style-type: none"> . Hand book

Subject and Item	Points	Materials
(4) Bearings and seals	<ul style="list-style-type: none"> . Mechanical friction . Kinds of bearings; friction bearing and roller bearing . Properties of seals; oil seal, seal ring, gasket, packing. 	. Hand book
11. Iron Works and welding		
(1) Iron works	<ul style="list-style-type: none"> . Types and utilization of round steel, bar, stool sheet, angle steel, steel plate, I beam, H beam. . Practice of iron works; cutting, pressing, etc. 	. Hand book
(2) Gas cutting and welding	<ul style="list-style-type: none"> . Structures and handling of gas cutting and welding set; acetylene and oxygen cylinders, pressure regulators, rubber hoses, cutting welding torches glasses, etc. 	. Hand book
(3) Arc Welding	<ul style="list-style-type: none"> . Structure and handling of arc welding set; arc welder, primary and secondary codes, holder, earth clip, gloves, helmet, etc. . Kinds of electrodes and their adaptability 	. Hand book
12. Diesel engine		
(1) Classification of engine	<ul style="list-style-type: none"> . Internal and external combustion engine, and modern engine. 	. Hand book
(2) Property of Diesel engine	<ul style="list-style-type: none"> . Property, principle and utilization of Diesel engine 	. Hand book
(3) Cylinder head valves, cam-shaft	<ul style="list-style-type: none"> . Structure, function and troubles of cylinder head valves, camshaft 	. Hand book
(4) Cylinder block, cylinder liner	<ul style="list-style-type: none"> . - do - 	. " "

Subject and Item	Points	Materials
(5) Piston, piston ring, connecting rod	. Structure, function and troubles of cylinder head valves, camshaft	. Hand book
(6) Crank shaft bearings	. -- do --	. " "
13. Fuel injection system		
(1) Fuel system	. Structures, functions and troubles of fuel system, (excluding injection pump); fuel tank, filter, delivery pipes, nozzles.	. Hand book
(2) Classification of injection pumps	. Kinds, structures and functions of various injection pumps	. Hand book
(3) In-line injection pumps	. Structure, function and practical disassembling of in-line injection pump	. Hand book
(4) Delivery type injection pump	. Structure and function of delivery type injection pump	. Hand book
(5) Governor	. Kinds, and structure and function of injection pump governor	. Hand book
14. Lubrication system		
(1) Works of lubricants	. Works and effects of lubricants in machine	. Hand book
(2) Lubrication system	. Structures, functions and trouble shooting of lubrication system; oil pan, oil pump, filter element, coil cooler, bypass valve, oil gallery	. Hand book
15. Cooling system		
(1) Classification of cooling system	. Difference between open cooling system and closed cooling system . Structures and functions of water cooling system; water pump, cooling fan, radiator, thermostat, oil cooler, water jacket. . Trouble shooting.	. Hand book

Subject and Item	Points	Materials
16. Machines for forest production and road construction.		
(1) Yarder	<ul style="list-style-type: none"> • Structure and function of yarder • Specification and adjustment standards of Y-12, Y-32, Y-52 • Points of disassembly for Y-32, Y-52 • Periodical maintenance 	<ul style="list-style-type: none"> • Hand book • Shop manuals and parts catalogs of Y-32, Y-52
(2) Logging Tractor	<ul style="list-style-type: none"> • Specifications, structure and function of logging tractor 	<ul style="list-style-type: none"> • Hand book • Shop manual and parts book T-50
(3) Bulldozer	<ul style="list-style-type: none"> • Specifications, structure and function of bulldozer 	<ul style="list-style-type: none"> • Hand book • Shop manual and parts book of D60-A6
(4) Dump truck	<ul style="list-style-type: none"> • Specifications, structure and function of dump truck 	<ul style="list-style-type: none"> • Shop manual and parts book of TDS-40
(5) Chainsaw	<ul style="list-style-type: none"> • Specifications, structure and function of chainsaw 	<ul style="list-style-type: none"> • Operator manual and parts book of CS-1001VL
17. Others		
(1) Examination, etc.	<ul style="list-style-type: none"> • Review tests for every week • Evaluation examinations twice; intermediary examination and synthetic examination. 	

6. Refresher Courses for the Logging Managers and Logging Craftsmen:

(1) The Object of the Training

The trainees who do not participate in the O.J.T. or the trainees who have long time completed the training, but need the theoretical, reorientation and actual training again, in order to refresh their knowledge of cable logging experiences, at least once after a prescribed period of years. This must be the main object of the course, so that the cable logging gradually widespread and applied throughout Burma.

(2) The Subjects of the Training

Actual participation and practical work should be stressed in this training. The followings are the training subjects :-

a. Logging Manager Course

- (a) Basic Knowledge of Cable Logging
- (b) Yarder and Cable Logging Apparatus
- (c) Wire Rope
- (d) Wire Splice
- (e) Working Standard and Safety Work
- (f) Assembly and Disassembly of Cable Line
- (g) Inspection and Driving
- (h) Forest Road Net-work Planning
- (i) Planning of Cable Logging

b. Logging Craftsman Course

- (a) Basic Cable Logging Work
- (b) Physics for Cable Logging Work
- (c) Planning of Cable Logging Set
- (d) Yarder and Cable Logging Apparatus
- (e) Wire Rope
- (f) Wire Splice
- (g) Working Standard and Safety Work
- (h) Assembly and Disassembly of Cable Logging Set
- (i) Inspection and Driving
- (j) Basic Knowledge of Chainsaw.

II.

MANAGEMENT OF THE MODEL OPERATION FOREST

1. Working Plan:

The management of the Model Operation Forest which is located in the Chaung Tha Reserved Forest in Bassein should be enforced intentionally by making an annual plan in advance. After the conclusion of this project, the Model Operation Forest should be managed as upto the present, so to speak it consist of not only the on-the-Job Training of Cable Logging Operation but also the management of the various stages of logging operation.

The working volume of the annual plan is satisfactory by considering on the basis of the results in 1981. Logging systems should be practised by suitable systems and should be increased the production by effective working from year to year.

Following table shows the results of cable logging in 1981 (a calonder year) and can be referred for making the annual plan.

2. On-the-Job-Training:

On-the-Job Training at the Model Operation Forest should be continued after this project also. It is obvious that this training is the training which is held after training at the Okkyin Training Centre, and this purpose is to deliver the skillful logging technicians. Therefore, we have to select excellont trainees, and set up suitable lessons and terms.

On-the-Job Training should be carried out not for effective product but for studying logging techniques and safety working first.

The terms of the O.J.T. had better be taken more than one year at least.

The trainees of the O.J.T. should be attended as many as possible, therefore, we have to consider for selecting the trainees from this view point.

3. Working Systems at the Model Operation Forest:

The working systems at the Model Operation Forest should be considered from both sides, training of basic logging techniques and development of logging techniques. There are many working methods in each working process and working systems can be selected from the combination of the following methods.

RESULTS OF CABLE LOGGING AT THE MODEL OPERATION FOREST IN 1961

Assembled months	Compartment	Cable Logging System	Span m	Sag ratio	Planning Load Kg	Yarder	Skylino	Logged volume m ³	Logged volume per day	Remarks
1	25	Endless Skylon	310	0.04	2,000	Y-32E	24 m	176	11.7	
4	24, 25	"	360	0.05	"	"	28	253	2.9	
5	"	"	470	0.04	3,000	Y-52E	"	272	3.5	
9	25	"	420	0.05	"	"	"	249	5.1	
9	24	"	380	"	"	"	"	178	5.9	
9	"	"	230	"	2,000	Y-32E	24	69	9.6	
10	"	"	220	"	"	"	"	35	5.8	
12	28	"	607	"	3,000	Y-52E	28	495		Continues
12	"	"	650	"	3,000	Y-52E	32	700		Continues with tractor
3	25	Hoisting Carriage	380	"	2,000	Y-32E	28	189	9.0	
6	"	"	330	"	3,000	"	"	193	6.7	
8	"	"	390	"	2,000	"	"	178	7.7	
11	"	"	570	"	3,000	"	32	453		Continues
1	25	Running Skylino	150	"	"	Y-52E	E.L.L. 18	86	7.2	
5	"	"	190	"	2,000	"	"	45	9.0	
5	24	"	130	"	"	"	"	241	11.0	
6	"	"	300	"	"	"	"	193	8.4	
7	"	"	250	"	"	"	"	127	11.6	
8	25	"	210	"	"	"	"	137	6.0	
9	"	"	290	"	"	"	"	115	3.7	
12	"	"	250	"	"	"	"	200		Continues
								4,584		

(1) Felling and Bucking:

All of the felling and bucking should be done by chainsaw. Generally, the chainsaws are tended to expect large-sized ones, but smaller-sized ones can be advisabled for the handling sake. According to the felling trees conditions of the Project area, the large-sized chainsaws (bar length 32 inch, piston displacement 100 cc) are very few and the majority are taken by one class smaller-sized ones (bar length 26-28 inch, piston displacement for 80 cc).

It is necessary that the sharpening of saw chain should be done especially for the hardwood. The troubles of chainsaw are mainly caused by using incorrect saw chain, and this is also affected to the efficiency of chainsaw. Therefore, it need to continue the training about handling of chainsaw and sharpening of saw chain.

(2) Logging and Transportation Systems:

Working season can be divided to rainy season and dry season, and the working systems in these areas should be changed from time to time depend on the seasoning condition.

In the rainy season, the forest area constructed all weather forest road can be used because of the possibility of transportation by trucks. Logging can be done by yarder system or animal skidding so that it is impossible by tractor skidding. One of the effective method in the rainy season is the combination logging system, so to speak, first process skidding by yarder or animal and then transporting by yarder. (This is called the pre-skidding and cable transporting system).

In the dry season, we can both skid and transport easily so that truck and tractor can be travelled by only construction of the road surface. As one of combination system, pre-tractor skidding and cable transporting system is an advisable system because the Model Operation Forest is adopted to the selective cutting method. We have tried this combination system so successful that you should transfer this to the other forest by improving these techniques.

(3) Cable Logging Systems:

Selection of the cable logging systems have to be considered to the land features, logging volume, span length, cutting type, etc.

The major systems for the future can also be considered to the same systems which are adopted for the O.J.T., Endless Tyler, Hoisting Carriage, Kumamoto Endless, Felling Block, Running Skyline, High Lead. We have to practice these basic systems with developing and improving in order to adapt to the forest.

Wire Ropes using at present are from 24 to 32 mm diameter for Skyline, but it should be changed the skyline of Running Skyline System to the 16 mm from the 18 mm because of the balance of other materials such as blocks and yarder.

Guide blocks can be chosen three types, 7 inch, 9 inch, 12 inch according to the tension.

On assembling, we should practice the established process in advance such as the survey under the skyline and the calculation of the safety factor.

III.

DEVELOPMENT AND IMPROVEMENT OF TECHNIQUES

1. Basic Items:

In this project, the transferred techniques are mainly based on the cable logging system. At the Model Operation Forest in Chang Tha Reserved Forest, we have been developing the cable logging techniques based on the standard techniques in order to adapt to those forest conditions.

In the transfer of the techniques, at first, the techniques should be adapted to the conditions of the transferred area. On the other side, we have to make efforts to develop and improve the basic techniques as it should be adapted to the transferred conditions. Both are very important things for expecting the success of this project.

For the development and improvement of the cable logging techniques, we have to consider the following conditions which are closely related not only cable logging but also timber extraction section, from felling to transportation

(1) Topographic Conditions:

Topographic conditions must be investigated to the land features and soil conditions. Land features are around the following items, mountain or hill forest area, slope conditions and stream conditions. Soil conditions are geological structure, stickness of soil and etc. These conditions are related to choose the logging methods such as animal skidding, tractor skidding, yarder skidding, and to decide the construction of forest road.

(2) Climatic Environment:

The conditions of temperature and rain fall influenced on the working environment of forest workers and also the possibility of animal skidding, tractor skidding and transportation by truck.

(3) Forest Type:

In this item, there are three species, tree size, volume per unit area which are connected with the productivity of timber extraction.

(4) Type of Cutting Systems:

For the mechanization of timber extraction, this is very important. When we draw up the plan of working systems, we must consider whether clear cutting system or selective cutting system is suitable on that defined area.

2. Felling

(1) Felling Methods:

The volume of felling should be harmonized with the productivity of logging. Especially for the mechanization of logging, mechanical efficiency should be considered from the point of view of the economical production. We must pay attention not to stop the logging by the delay of felling. On the other hand it is not suitable to fell so early because of keeping freshness of timbers. For this reason, the felling method concerning with the mechanical logging should be done by chainsaw. This also can be contributed to keep the safety working and improved the working conditions.

(2) Felling Technique:

Felling technique by chainsaw, before everything else, should be done safety first. Felling by chainsaw is very effective method, but there are many examples of serious accidents. Generally, the felling workers of this country need more knowledge and experience about chainsaw. Therefore, it is important to practice the training for felling by chainsaw. In this training, the trainee should be trained how to decide the felling direction, how to make the undercut and backcut, and how to use the cutting wedge etc.

(3) Choice of Type of Handling of Chainsaw:

The choice of chainsaw type and length of saw bar should be decided considering the average size of felling trees. If it is used by very long saw bar it will cause not only hard handling but also easily damage to saw bar. Handling of chainsaw must be done correctly in accordance with the instruction manual published by makers. Especially, most workers are not so interested about the proper method of sharpening the sawchain that they should be taught these factors by preparing the exact times. This is useful for the productivity of felling and the prevention of chainsaw troubles.

3. Logging

(1) Logging Systems:

Logging Systems should be decided according to the investigation of concerning basic items as follows :

As it is very clear to divide the climate conditions into two parts, rainy season and dry season ranging over whole area in Burma, we can divide the logging systems into the following basic patterns.

	Slope Condition.	Logging Systems
R a i n y	Gentle Slope (average 5 10°)	Animal Skidding
	Medium Slope (10°" 15°)	Yarder Skidding Yarder Pre-skidding + Yarder Transportation Animal Pre-skidding + Yarder Transportation
	Steep Slope (more than 15°)	Yarder Skidding Yarder Pre-skidding + Yarder Transportation
D r y	Gentle Slope (1°" 10°)	Tractor Skidding
	Medium Slope (10°" 15°)	Tractor Skidding Yarder Skidding Yarder Pre-skidding + Yarder Transportation Tractor Pre-skidding + Yarder Transportation
	Steep Slope (more than 15°)	Yarder Skidding Yarder Pre-skidding + Yarder Transportation.

(2) Technical Problems of Yarder Skidding:

The conditions of the forests, which yarder skidding is being operated in the Model Operation Forest and is going to transfer in near future, are both hill forest area, hardwood forest type, selective cutting system. In those forest conditions, the problems of yarder skidding are followings:

- (A) According to land feature, the long span length of Skyline is difficult to assemble.
- (B) According to selective cutting system, the lateral yarding is not so easy
- (C) According to the reasons of (A), (B), the yarding volume from one skyline cannot produce so much.
- (D) Because of heavy logs, the planning payload must be taken a large figure.

The above problems are the demerits for the effective skidding by using yarders. Therefore, in transferring of yarder techniques, we have to develop and improve in order to cover these demerits.

As it is one of the effective logging systems, the combination of other logging systems to yarder (we call Pre-skidding) has been tried. This is the system which the lateral skidding can be done by animal, tractor or yarder to the skyline as the first process and these logs are transported by another yarder as the second process. Using this system, we can recover from the low productivity in these forests above mentioned. In case of (D), the planning payload should be as much as possible within safety factor of skyline.

To get the proper safety factor with heavy logs, we can adjust the skyline as follows:

- (a) To make the sag-ratio large by stretching the skyline loosely.

This is an easy and light method, but the looser the skyline stretches the more difficulty of moving the carriage. In this view point, the sag-ratio (S_0) should be used within 0.05.

- (b) To shorten the skyline span length.

This method is depend on land feature conditions, and it will decrease the logging productivity.

- (c) To use the big diameter skyline or high tensile grade skyline.

In case of using the big diameter skyline, assemble and disassemble become hard working and net payload is not so increase because of its own weight.

As above mentioned, it is very difficult to resolve these problems technically. Therefore, we have to pay attention to the following details:

- (i) On assembling, we have to choose the suitable land feature in order to smooth driving. That is to say, we should choice

the downhill logging as much as possible.

- (ii) In order to lighten the weight of the logs, it is necessary to keep the felled logs in a certain period for the natural seasoning.

- (iii) The calculation of safety factor should be done by using the correction coefficient from the first time. Safety factor of the skyline should be calculated with the safety factor closing 2.7 as long as it is not below 2.7

- (d) ~~The~~ necessary to improve the operating technique for the sake of smooth driving.

4. Transportation:

(1) Importance of Transportation:

The mechanized and effective timber extraction is not only logging but from felling to transportation. And these process have to be carried out with the same productivity, otherwise the effective process are influenced considerably from the ineffective process.

This means that the transportation system should be mechanized in the same way of other process such as felling and logging.

Modernized timber extraction in Burma will be contributed to promote the timber export. In such a case it is very important to supply these timbers in large quantity and in fresh condition. Therefore, it require that timber extraction should be mechanized from felling to transportation because of marketing.

(2) Methods of Transportation:

Generally, there are three methods using by truck, railway and river.

In the first process of timber transportation it is convenient to transport by truck using forest road. Forest road is necessary not only for timber transportation but also for forestry management. Especially, the main forest road should be considered to this point for construction. Operation road which is used in rainy season should be constructed as the gravel road for travelling by truck. The main point is to get the gravel in cheap price and in large quantity.

Operation road using in dry season is simple enough, and it is only necessary making road base by bulldozer. At present 6 Ton Hino Trucks are being used, it should be investigated to introduce larger sized trucks such as 11 Ton class or trucks for the exclusive use of timber transportation.

The river transportation by rafting should be changed to by barge ships for the effective sake. On the other hand, it should be investigated to construct saw mills on the way of the transportation because of profitable selling.

IV. Transferring Logging Techniques:

1. Necessity of Transferring

The Model Operation Forest was established at the present place after due consideration of the conditions such as the background, the facilities of transportation, convenience and facilities for performing O.J.T. and the other domestic situation. As a natural result, Model Operation Forest has been used in a right way for the training purpose and it should be utilized in the same way successively. But, from the pure technical point of view, the present area can not be said to be the most suitable place for transferring the Cable Logging techniques due to the following reasons:

- a) a long spanned and cable sagging type of system is hard to be assembled because of the hill forest.
- b) Logging volume per one cable is rather small due to the forest type and selective cutting, consequently, productivity is low.
- c) Large sized equipments are necessary for logging because the dominant species are heavy and big.
- d) Other logging methods such as animal logging and tractor logging are also applicable.

Since Burma is rich enough in forest resources including undeveloped mountainous forests there should be a considerable area of forest where the cable logging system could be applied effectively, in other words in which the other logging methods are in-applicable.

Cable logging techniques should be transferred more usefully in such the forest from now on. About hundred (100) technicians have been trained during the project period, and they are expecting the place where they can display their technique. A number of equipments and materials by Japanese Grant Aid are expected to arrive Burma within the fiscal year 1981. The amount will be more than the total equipments which provided during the period of technical co-operation project. Most suitable forest for further technical transferring should be selected partially because of utilizing the equipments in full notion.

2. Designs for transferring:

In case the designing the transferring plan of cable logging techniques to the other areas, preliminary survey on social and technical conditions related with the area should be done in advance. Though necessary items for survey to be implemented are mentioned in Article 3. "Development and Improvement of techniques", the contents of techniques have to be decided after studying those conditions.

Here shown two model designs of technical transferring for future reference assuming various conditions in the area.

(1) Model Design 1. (Assuming the islands, Tenasserim)

Factors

(a) Topographic conditions

land features	hill forest with medium slope (10-15°) and with many folds.
soil conditions	planosol. sand stone, seashore

(b) Climatic Environment

tropical rain forest.

(c) Forest Type

hardwood

average mean volume $333\text{m}^3/\text{ha}$.

(d) Type of cutting system

Selective Cutting System

mean weight of biggest class log 3 tons.

mean breast height Diameter 90 cm.

Transferrable Techniques:

(a) Felling :

Due to forest type of hardwood, chainsaw has to be used for felling in order to perform mechanization of logging. Middle sized chainsaw with displacement 75 cc, bar length 65 cm (26 inches) should be used in view of the mean breast height diameter of trees to be cut, and several number of big sized chainsaw with displacement 100 cc, bar length 75 cm. (30 inches) are to be supplementary use for big trees.

(b) Logging :

Regarding the logging system, yarder skidding or yarder pre-skidding

combined with yarder transportation should be employed taking the factors of land feature and climatic environment into consideration, in the area with gravel road in the rainy season.

In the dry season, yarder skidding and tractor logging should be better in the area with working road not paved with gravel.

3 tons yarder and 5 tons yarder are both useful, and 9 tons wheel type tractor is desirable.

Endless-Tyler System, Hoisting Carriage System are to be used for ordinary logging and as for pre-skidding purpose, Running skyline System and Highload System are advisable.

For the transportation purpose, Endless Tyler system is most suitable.

Forest road will be constructed near the mountain ridge, so that almost all the logging systems are apt to be the uphill logging, then consequently, the load become big. This is the reason why attention must be paid much for assembly and operation. Especially in case of Running Skyline System, the cable must be assembled to the downhill skidding. Skidding to the bottom of valley by pre-skidding is desirable. The most effective system would be the method which is performing pre-skidding by tractor in the dry season and transportation by yarder in the rainy season.

Planning load is 3 tons, and 26-28 mm wire is for main cable of ordinary cable logging system, 16 mm wire for main cable of Running Skyline System.

c) Transportation :

Transportation of logs is done by trucks on islands, then carry it by barge to the port temporarily constructed near the market.

d) Forest Road :

For forest road construction, 16 tons Bulldozer, dozer shovels, back hoes, dump trucks and jaw crushers are to be used. Forest road is classified Main Road and operation road, and the former is to be all weather road with gravel pavement.

e) Repair and maintenance :

A service station at Base camp, for repairing and maintenance is necessary.

The station with minimum equipment, spare parts and mechanic would

play an important role for checking and easy repairing and also as a base for spot service.

(2) Model Design 2. (Assuming the Pine forest, Chin State)

Factors

(a) Topographic Conditions

Land features mountain forest Area
Steep slope (15° — 25°)

Soil Conditions Sandy clay and conglomerate

(b) Climate Environment Sub Tropical and Temperate climate

(c) Forest Type Pine Forest
mean volume $400\text{m}^3 / \text{ha}$

(d) Type of Cutting System

Strip clear cutting system
mean breast height diameter 50 cm.
mean volume of full stem length 1.0 m^3

Transferable Techniques

(a) Felling :

Due to the forest type and the purpose of mechanization of logging, chainsaw has to be used for felling. Rather small sized chainsaw, with displacement about 50 cc, bar length 40—50 cm (16—20 inches) should be mainly used from a view point of the size of trees, and middle sized chainsaw with displacement 75 cc, bar length 65 cm are to be supplementary use.

(b) Logging :

Cable logging system by yarder is most useful in the area of mountain forest with steep, broad and long slope. 3 tons yarder will be enough for logging and, as for logging system, Endless Tyler, Hoisting Carriage, Falling Block and Tyler are to be main systems. In case of pine forest, density is high near the ridge, so that logging by pre-skidding will be effective. For pre-skidding purpose, Running Skyline System and High Lead System are suitable. As span length between head tree and tail tree become long, combined logging of pre-skidding and cable transportation is frequently necessary. In the uniform forest of pine, strip clear cutting

system is usually applied, and logging is advantageous when the total volume of a tree is about one cubic meter (1 m^3). Planning load; 1 ton, skyline rope's size; 24-26 mm (for Running Skyline 12-14 mm), LFL; 14 mm, EL; 12 mm, HDL 12 mm, are standard dimensions for the system.

c) Transportation :

Logging truck will be used mainly, and cable way transportation to be supplementary.

d) Forest Road :

For forest road construction, 16 tons Bulldozers as a main equipment, dozer shovels, back-hoos, and dump trucks are to be used. The standard of Main Road is to be all-weather type road with gravel pavement.

Cost of road construction will be rather cheap in this area, because gravel is available near the site.

e) Repair and maintenance :

Service station has to be established at the Base camp.

V. MANAGEMENT OF WORKSHOP

This chapter is intended to provide the counterparts and their successors who are or will be in charge of the workshop with a conceptual and practical guide to manage it themselves, continuing to run the project after the termination of the Four Year (1978-1982) JICA Forestry Project.

As for the education and training of mechanics on forest machinery, it goes into the details in the chapter "I. Training, 5. Repair Craftsman Course".

The gist herein mentioned could mostly be adaptable to the heavy machinery workshop management even in the other types of mechanized undertakings.

1. Situation of JICA Base Workshop

In 1978, the construction of JICA Base Workshop main building was set up aimed at the effective maintenance and repair services for yarders, logging tractors, bulldozers, dump trucks and other heavy machines relating to the log extraction works and forest road construction which are indispensable equipment for the technical transfer of the cable logging system as the main theme of this project.

The function and facilities in JICA Base Workshop could be conceivably matched with the static workshop under the nation-wide service network plan of Engineering Department, Timber Corporation.

After the Base Workshop construction, in 1980, the Service spot was built in Shaw Rya in consideration of the distance and transportation between the Model Operation Forest and the JICA Base Workshop. Its equipment can function equally in the Field Workshop of the above mentioned plan.

Thereafter, thanks to the grant-aid signed in 1981, a service truck with 3 ton crane will soon be available. Providing it with the field service tools, this service truck can act as a mobile workshop of the plan.

Thus the equipment and facilities for maintenance and repair system will soon be completed.

Note: Meaning of Words

* Maintenance means programmed services for machines and it is to be divided into two parts; one is periodical checks and services which are mainly made up of lubrication services. The other is overhaul services.

* Repair means unprogrammed services for unexpected troubles on the machines which hinders the normal flow of production or construction works.

2. Basic Knowledge of Workshop Management

1) Principle of Workshop Management

In managing the machinery as well as the workshop, what we must remember in order to carry out the mechanized works well in production undertakings are :

1. Increase of production speed,
2. Decrease of production cost,
3. Improvement of product quality.

In other words, it is meaningless if we employ machines in production processes ignoring these three points.

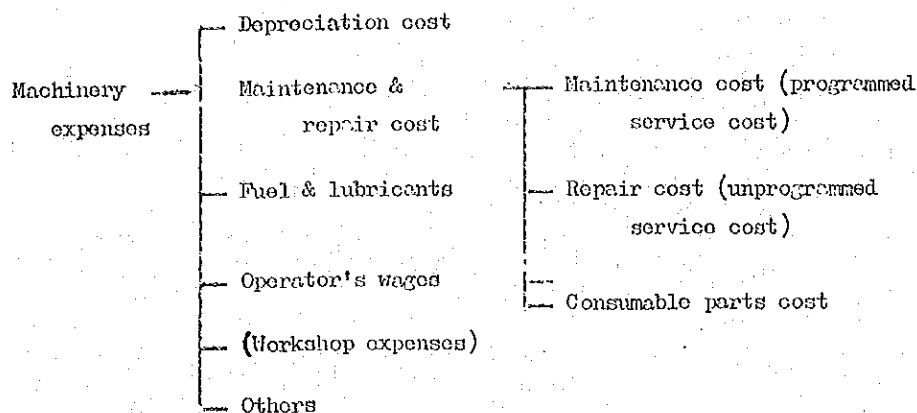
It is the workshop that keeps the machines in an effective condition which play a role as hardware in mechanized production processes.

2) Cost Consciousness in Workshop Management

Let us study the decrease of production cost which is one of the three purposes for mechanized operation and which is influenced mostly by machinery expenses.

The production cost in a mechanized operation consists commonly of managing costs, labour wages and machinery expenses.

Following is a break-down of the machinery expenses:



Note: The reason that the item "Workshop expenses" is in parenthesis is that in other accounting ways the workshop expenses are taken in by the cost of maintenance and repair.

According to the analysed data about dam constructions and mechanized public works in Japan, the maintenance and repair cost of machinery (including spare parts cost and repair wages) stands, depending upon the quality of machinery management, at 16.7% in the bad and 6.7% in the good of overall costs in dam constructions, and 26% in the bad and 16% in the good of overall costs in mechanized public works.

From these data, it is clear that the most important and influential factor required to reduce the entire cost is a machinery maintenance control.

We cannot find another factor in accounting more varied and changeable than the factor of machinery expenses.

Machinery expenses in the mechanized forest production works which are considered to take a major part of whole production cost compared to other mechanized undertakings, have a great influence upon the decrease of production cost.

It is not over-emphasized that those who manage the machinery as well as workshop in the forest operation should strive to reduce machinery expenses through analyzing them statistically and scientifically which can contribute finally in reducing the production cost.

3) Bottleneck of Machinery Management

Following is the citation from the opinions of a research worker into the mechanized construction works in Japan.

(1) The mechanization does not bear its full fruit such as economical advantages in operations, because responsible persons who are short of knowledge concerning machines consider them separately from construction works. Then they are unconsciously increasing the machinery maintaining expenses by treating the machines badly and shortening its lifespan.

Also, there are many cases where periodical maintenance is disregarded or where the advantage of investing in equipment for repair shops in operation sites is neglected.

(2) There is not enough data to estimate machinery expenses for compiling a budget.

It is difficult to make a sound budget because of various ways of dealing with the expenses of machines and not based on the actual data in the maintenance and repair. Consequently the estimate or budget of construction undertaking is made up without a sound base especially in the aspect of machinery expenses.

(3) The responsible persons never take measures to utilize scientifically the basic statistics of records such as log books and service reports which are necessary and useful data for applying to mechanized construction plans and also for promoting the efficiency of works.

They never examine the records and its statistics which are prepared through troublesome procedures and they file them apart from the planning of operation processes.

(4) Unskilful operators are handling machines, for there are few training institutions where they are trained on how to operate and maintain the construction machines.

Many cases have been noticed where a greater amount of repair cost was required caused by the careless handlings and wrong operations of valuable machines.

In various places, even though the efficiencies of machines have been developed and the capacities have been increased, such machinery management as working ratios are lessened by poor machinery controls and construction costs become meaninglessly larger.

We should not forget that "Most of the works are done by the machines".

3. Organization of Workshop

Mentioned below is a present chart of the JICA Base Workshop which shows a sectional organization.

* Workshop Organization Chart

Head	Division	Section	Number of personnel	
Chief of Workshop	Office		3	
	Store	Spare parts	2	
		Tools	1	
	Maintenance & Repair	Engine	3	
		Chassis	4	
		Machining	2	
		Electrical	3	
	Service spot	Periodical maintenance & Minor repair	4	
	Total of actual personnel as of March 1982			21

Number of personnel who are installed in each section should be flexibly arranged in consideration of working capabilities of mechanics and On-the-job trainees.

In this organization, it will be necessary to increase the personnel; one assistant chief, one clerk who classifies and totals the maintenance and repair expenses for each machine, and several mechanics in Service spot to form a patrol service team (the team whose duty is to perform periodical maintenance in the working sites with a service truck).

* Duties of each section

1) Office

(1) Planning of maintenance services.

To make up the service program for periodical maintenance and overhauls, discuss thoroughly about it with the production control division.

(2) Issuing the service orders for maintenance and repairs.

Totalling and analyzing the service reports.

Actually we are using the service order forms in which working data and used spare parts and materials are available, it is, however, recommended to modify the form to get the maintenance and repair cost which consists of labour charges and parts and materials cost.

(3) Permission of parts issue.

This should be done by the chief or the assistant chief or the responsible foreman.

(4) Preparing and filing of machinery ledger, service records and

and reference books (operator's manual, overhaul or shop manual, parts catalog, etc.) for each machine.

2) Store

(1) Filing of invoices and packing lists.

Inspection of received parts and materials.

(2) Arranging and stocking of received parts and materials for

each machine

(3) Issuing of parts and materials with indent forms.

Totalling of the amount of issued parts and materials for each machine

(4) Stock taking (inventory)

It is advisable to take stock twice a year.

(5) Preparing the list of spare parts and materials necessary

for the next year.

(6) Controlling of heavy duty tools, precision tools, special tools

and common tools.

3) Maintenance and Repair

* Engine Section

- (1) Services which require precise and high technical skills like maintenance and repairs of Diesel engines, fuel injection pumps, torque converters, hydraulic control systems, etc.

Taking into account of further deterioration on the machines, it is required to reinforce this section with a larger number of more qualified mechanics.

* Chassis section

- (1) Services of power trains (e.g. clutches, transmissions propeller shafts, final reduction gears or differential gears, steering systems, etc.), brake systems, suspensions, tire repairs, steam cleaning, etc.

* Machining section

- (1) Iron processing works by latho machine, drilling machine, etc.
- (2) Iron processing works by oxygen and acetylene gas cutting set and arc welding set. Should the above works No. (1), (2) be done under the service order forms.

* Electrical section

- (1) Preparing distilled water and dilute sulphuric acid for batteries and charging batteries.
- (2) Repair and testing of generators, starters, other electrical devices.
- (3) Tuning up of petrol engines on electrical ignition system coordinating with Engine section.

4) Service Spot

- (1) Performing periodical maintenance according to the maintenance scheme.

Arranging the periodical maintenance service data

- (2) Servicing minor repairs done at the Service Spot and heavy services such as major repairs or component overhauls done in Base Workshop.

Thus, the points of workshop management are to sectionalize the organization clearly and to help personnel understand their own duties distinctly.

4. Itemization of Workshop Management

1) Maintenance and repair control

(1) Personnel control

Basing on the above-mentioned organization chart, it is important to guide the personnel to become specialists of a post, to enlighten them on technical knowledge and skillfulness, and to prepare well the technical books related to machinery services.

Issuing the service order forms from the workshop office to every works especially maintenance and repair works which are done by mechanics, let them enter service results in detail on the service order forms.

Then we can get the data about maintenance and repairs for each machine as well as imbue them with a sense of responsibility for works.

(2) Shop equipment and tools control

On noticing uneffectiveness of equipment layout in the workshop, relayout of the equipment should be carried out without hesitation so that we might get good results which refreshes the working conditions.

The responsible persons who manage the workshop should pay attention to introduce new equipment or tools, and to replenish tool sets which mechanics use or tools in the tools room.

(3) Periodical maintenance control

The persons who manage the workshop must perform periodical maintenance without fail, recognizing the effect and importance of them in order to reduce frequency of troubles and consequently to improve the working ratios of machines.

Recall that manufacturers are producing modern and sophisticated machines expecting the owners to carry out the periodical maintenances well. !!

2) Spare Parts and Materials Control

(1) Quality control of spare parts and materials (including fuels and lubricants)

It is necessary for the person in charge of a workshop as well as responsible store keepers to pay much attention not to issue the spare parts and materials of bad quality or wrong standard.

(2) Proper quantity control of spare parts and materials

Store keepers in charge should arrange to keep the proper quantity of each item in stock to avoid short-stock or dead-stock through studying such factors that necessary quantity depends upon; the degrees of machinery deterioration, the working conditions of machines, the lead times which are periods between orders and receptions.

As one of the ways to ease this arrangement, following is a classification of sparesparts in stock;

- A. Consuming parts... which are consumed and issued very frequently or periodically
such as; oil filter elements, air cleaner elements, fan belts, gaskets, oil seals, rubber hoses, tires, track shoes, cutting edges, track rollers, injection nozzle tips, sprocket teeth, etc.
- B. Common parts... which are commonly replaced and have no possibility of dead-stock
such as; clutch discs, brake linings, head gaskets, water pumps, thermostats, oil pressure gauges, regulators, generators, starters, batteries, heater plugs, clutch pressure plates, transmission shafts and gears, hydraulic and lubricating pipes, gauges on instrument panel, lamps and bulbs, universal joints, track links.
- C. Overhaul parts... which are mainly changed on overhaul in several years

such as; intake and exhaust valves, pistons, piston rings, liners, overhaul gasket kits, crankshaft and conrod bearings, camshaft bearings, valve springs, oil pump gears, hydraulic control overhaul kits, etc.

D. Reserved parts... which are rarely replaced, of which lead times are very long or of which availability is difficult. They have, however, much possibility to become dead-stock such as; cylinder heads, cylinder blocks, timing gear covers, connecting rods, flywheels, crankshafts, pulleys, camshafts, timing gears, push rods, rocker arms, intake and exhaust manifolds, injection pump assys, transmission cases, propeller shafts, radiators, etc.

3) Machinery Operation Control

We are generally apt to regard a machinery control as maintenance and repair control of machinery. This misunderstanding is grave specially for a responsible person in the workshop of forest production project.

Responsible persons in a workshop should not only have a narrow view to get good result in repairing machines, but also have a wide view to contribute to the decrease of production cost through good performances of periodical maintenance services, thus declined frequency of machine troubles, drop of unservicability, consequently better result of workability of machines.

4) Utilization of Feed-back system in a workshop:

Feed back system is a system which originates from technology, which has been adopted to political economy, and which is utilized for organization control in management.

Feed-back means such actions that causative factors are modified by the effect product.

Electrically speaking, the system is to get stable activities through such repetitious actions as orders are transmitted (input) in one circuit, and to modify orders, the effectivenesses of results (output) are continuously transmitted in the other circuit to an automatic regulator.

The orders from the workshop office are transmitted (input) to each section of Base workshop and Service spot by service order forms, and service reports as performed effect (output) are returned to the office, and a clerk (automatic regulator) in charge of totalling and analyzing service reports, reports the result to the workshop chief, and he, basing on the result, will issue the new orders modified to get better results.

(1) Safety Work for a Cable Logging System:

From the view point of respecting human life, safety in every work must be esteemed firstly.

In forest work, working condition is not well, so that labour accidents occur frequently. In addition to such situations, as timber extraction is a operation which handles large and heavy logs, serious accidents such as death occur unfortunately. Cable logging system can apply to every topographical conditions with the effective productivity. On the other hand, the cable logging system includes dangerous points, so that in operation the cautions must be taken as much as possible.

Advancing the mechanization of forest labour, it is necessary to take into consideration of not only productivity but also safety.

In case of saying about safety working, there are two factors. The first one is about safety of equipments and machines, and the second is about safety operation of workers. Safety working will be achieved by performance of those two factors.

The cable logging system is a way of transporting logs by the long skyline stretched from a head tree to a tail tree. If the skyline will be broken on the way, it may occur a serious accident. Therefore, in order to avoid serious accident we should take care of the small damage of cable logging apparatus which may cause large and unexpected failure.

In order to set up cable logging system, strict inspection of using machine and equipment as well as safety assembly is necessary. Safety working is influenced by the knowledge, technique and volition of workers. Proper education and training about safety for workers must be performed.

For three years during implementation of this project, namely from April 1979 to March 1982, on the Okkyin Training Centre and the Model Operation Forest, cases of accident concerning cable logging are in the list.

Checking from this list, it is obvious that accidents are occurred due to a little carelessness and ignorance. As it was the first experience, for inventing the new techniques only for three years, the number and content of those accidents, can define not to be so much. For the future, in view of increase of production and deterioration of equipments sufficient cautions for safety must be taken.

(2) Improvement of Equipment:

Naturally, the machines and materials are going to be damaged because of long using. If those are used without take care of this fact, serious accident may occur. In order to prevent the accident, daily check and periodical inspection are necessary. Before the installation of cable logging, cable logging apparatus such as daizuko ropes, blocks etc. must be checked, thoroughly.

If unseizable materials such as fatigue wire ropes, damaged blocks are found, these must be renewed and repaired.

After the assembly is completed, necessary inspections must be performed thoroughly. At first, tension of the skyline should be checked whether the tension is right as the design. It had better be used vibration wave method on account of this inspection. After this inspection, fixed inspection items need to be conducted. Next, trial run of the carriage should be performed and then improper points are found, actual operation must be done after improvement.

During the logging operation period, regular daily check and periodical check need to be performed. Generally after troubles have broken out the inspection or repair trends to be carried out. But in order to prevent the accidents or troubles of machine and apparatus the prior check is very important.

Mentioning the concrete case, all the guy lines of Okkyin Training Centre have been checked and the unsafe guy lines were renewed in July 1981. In future, those guy lines should be checked periodically and if required we should change the guy lines without any delay.

(3) Safety Training:

There are group guidance and individual one in safety training, and each training is divided into two ways which are lecture in the room and practical guidance in out-door. In future not only group safety training at Training Centre but also proper individual training must be enforced.

The persons who are not trained for safety, are slow and careless in action and they are going to meet accidents easily. Usage of the projector, video cassett recorder are effective for the safety training. The practical training is performed in the Okkyin Training Centre and the Model Operation

Forest.

The points which is to be emphasized as to guidance are as follows:-

- (i) Proper handling and inspection of machines and materials
- (ii) Arrangement of working and confirmation of working environment
- (iii) Performance of a correct process of working
- (iv) To keep out under the skyline and in the area of interior angle under the operation.
- (v) To take care of over tension in hooking and logging operation
- (vi) Signal must be sent clearly and confirmed it surely
- (vii) Avoid of working alone apart from others
- (viii) Helmet must be always put on
- (ix) To appoint a group leader for one set and his instructions must be obeyed.

ACCIDENT OCCURRED IN THIS PROJECT:

No.	Date, Time,	Sufferer age	Place	Situation of accident	Suffered part	Term of cure	Cause of accident
1.	9th March 1930 2:30 P.M.	Timber Ranger 37 years old.	Chung The (R.F.) 24. Compartment No.3 Cable line.	Under the operation of lateral yarding, at the moment of extracting a log (2.5 ton) by winding up the LFL, attaching a rope to the hook, the HBL happened to hang a stump and then suddenly free from the stump with high tension and hit the sufferer's thigh.	Thigh	One month	When the accident happened, the sufferer was out of the danger zone. But the accident was occurred because of hanging the HBL to a stump unexpectedly.
2.	9th July, 1979 2:30 P.M.	Chung Oak 38 years old	Osbyin T.C.	The sufferer was training to drive the yarder - 12. He tried to put back a wire rope which got out off the drum without stopping the engine and he pinched his fore-finger in pinion gear of the secondary drum.	Forefinger	One month	The reason why L.F.L. got off was excessive rolled volume and incorrect fleet angle. Doing such a work, it is necessary to stop an engine or to take off at least the main clutch.

Accident occurred (Contd.)

No.	Date, Time	Sufferer's age	Place	Situation of accident.	Suffered part	Term of cure	Cause of accident.
3.	25th March, 1960	Helper of Chainsaw man. 25 years old.	Chaung Tho 24 compartment No.3 Cable line	As the sufferer had a few knowledge of cable logging techniques, he got into the operation site without permission and stopped over the H.F.L. when the HBL started to wind up, the HBL lifted his body to the air and fell down to the ground.	Thigh	Twenty days.	As the sufferer was a helper of chainsaw man and had a few knowledge of cable logging technique he did not understand about the dangerous area.
4.	23rd August 1960 15:30 P.M.	Deputy Manager 36 years old.	Chaung Tho 24 Compartment site - HNS	On inspection of cable line, the sufferer found out that L.F.L. hanged the branch of tree in the middle of the span. Then he climbed up the stacking logs of six metro height and ordered to move the carriage to and fro to the driver. L.F.L. was successfully taken off from the branch but he thought that LFL was cut on the way, then he jumped down himself from the timber stacking and his waist bone suffered.	Waist bone.	Two months	If he stayed on the timber stacking he will be struck by L.F.L. He did not select the safety place on the inspection of cable line.

The List of the Text Book

	E.	B.
1. Illustrated book for safety cable logging operation	0	
2. A brief of cable logging in Japan	0	0
3. Endless tyler system at Okyiu T.C.	0	
4. A collection of cable logging systems	0	
5. Disassembling of cable line	0	
6. Operational standard of Yarder operation	0	0
7. Wire splice for cable logging	0	0
8. Wire rope	0	0
9. Operational standard of tractor logging and transportation	0	0
10. Yarder dynamics	0	
11. Characteristic of hydraulic and its equipments	0	
12. Essentials of inspection	0	0
13. Electricity	0	
14. Work sheet for cable stretching planning	0	0
15. Extraction planning	0	0
16. Port	0	
17. Road construction planning	0	0
18. Curve setting	0	
19. Compass survey	0	0
20. Basic knowledge of a cable logging	0	0
21. Endless tyler system	0	
22. Falling blok system	0	
23. The hoisting carriage	0	
24. Running skyline	0	
25. Handling of chain saw	0	0
26. Handling of bush cutter	0	0
27. Text book for log transporter supervisor cable.	0	
28. Text book for repair craftmen course	0	
29. Hand book for planning of cable logging	0	
30. Yarder and cable logging apparatus	0	
31. Saw chain setting	0	0
32. Kumamoto endless system	0	
33. Introduction to tractors in forest works	0	
34. Outline of forestry in Japan	0	
35. How to sharpen the saw chain	0	
36. Hand book for cable logging expert	0	
37. Plane table survey	0	
38. Theodolite survey	0	
39. Level survey	0	

Note: E. English.
B. Burmese.

EXPERTSFirst Despatch:

Name	Period		Designation
	From:	To:	
Hitoshi Kato	16-4-78	15-4-80	Chief Adviser
Osamu Takada	18-6-78	17-6-80	Logging expert
Hisaharu Hayashi	25-7-78	24-7-80	Extraction Planning expert
Fumio Asaka	25-7-78	24-7-80	Cable Logging expert
Norimi Saijo	25-8-78	24-8-80	Cable Logging expert
Takeo Oda	3-8-78	2-8-82	Workshop expert
Susumu Sakamoto	16-4-78	15-4-82	Liaison Officer

Second Despatch:

Name	Period		Designation
	From:	To:	
Eigo Deguchi	3-4-80	6-8-82	Chief Adviser
Hiroshi Masuko	10-6-80	9-6-82	Logging expert
Mitsuo Morisawa	15-7-80	14-7-82	Extraction Planning expert
Masami Kon	15-7-80	14-7-82	Cable Logging expert
Kensuko Hata	7-8-80	6-8-82	Cable Logging expert

LIST OF COUNTERPARTS

Sr. No.	Name	Date of Birth	Education Background	Previous Post	Assignment to Project	Remarks
1.	U Aung Naing	30-12-38	B.Sc. (Forestry)	Dy. Manager	Head Qr., Rangoon	
2.	U Zey Meik	5-5-48	"	"	Bassein, Bhamya	
3.	U Win Myint	21-7-42	"	"	Training Centre, (Mkyin)	
4.	U Bo Lay	12-1-40	Burma Forest	"	H.Q. (Rangoon).	
5.	U Tinn Tun	20-9-43	B.Sc. (Forestry)	"	Bassein, Chauungtha	
6.	U Chit Han	11-6-44	"	"	T.O. (Mkyin)	
7.	U Mai Lwin	24-12-39	A.G.T.V.	Dy. Mgr. (Engineer)	"	
8.	U Lay Win	27-6-45	B.Sc.	Dy. Manager	H.Q. (Rangoon)	
9.	U Hla Min Oo	20-2-46	B.Sc. (Forestry)	"	T.O. (Mkyin)	
10.	U Nay Win	14-2-44	B.E. (Auto)	Dy. Mgr. (Engineer)	Bassein Workshop	
11.	U Oo Myint	12-2-44	B.Sc. (Forestry)	Dy. Manager	Bassein	
12.	U Hyo Thein	3-7-44	B.Sc. (Forestry)	"	Bassein	
13.	U Kyar Aye	8-7-46	H.S.F.	Timber Ranger	T.O. (Mkyin)	

TRAINING IN JAPAN

Sl. No.	Name	Rank	Subjects			Year	Remarks
			Observation of Forestry Situation	Extraction Planning	Forestry Machinery		
1	U Hla Pe	General Manager (Extraction)	/			1978 (March) 1981 (Oct.)	} Senior Course } Duration 3 weeks to } 1 month.)
2	U Min Kyi	Divisional Manager	/			1978 (Aug.)	
3	U Thein Shwe	Manager (Extraction)	/			1979 (Sept.)	-"
4	U Than Win	" (Office)	/			1980 (Sept.)	-"
5	U Oak Soe	" (Headquarters)	/			1981 (Oct.)	-"
6	U Aung Naing	Dy. Manager (Ext.)	/	/		1978 (March)	Junior Course (Duration 3 months)
7	U Zaw Weik	Dy. Manager (Ext.)	/	/		1978 (March)	
8	U Min Myint	Dy. Manager (Ext.)	/	/		1978 (Aug.)	-"
9	U Bo Lay	Dy. Manager (Ext.)	/	/		1978 (Aug.)	-"
10	U Than Tun	Dy. Manager (Ext.)	/	/		1979 (Sept.)	-"
11	U Chit Han	Dy. Manager (Ext.)	/	/		1979 (Sept.)	-"
12	U Mai Lwin	Dy. Manager (Eng.)	/		/	1979 (Sept.)	-"
13	U Nay Win	Dy. Manager (Ext.)	/			1980 (Sept.)	-"
14	U Hla Min Oo	Dy. Manager (Ext.)	/	/		1980 (Sept.)	-"
15	U Nay Hin	Dy. Manager (Eng.)	/		/	1980 (Sept.)	-"
16	U Oo Myint	Dy. Manager (Ext.)	/			1981 (Aug.)	-"
17	U Myo Thein	Dy. Manager (Ext.)	/	/		1981 (Aug.)	-"
18	U Kyaw Ayo	Timber Ranger	/	/		1981 (Aug.)	-"

TRAINING PLAN

Particulars	1978			1979			1980			1981			1982		Total Trainees	
	6	9	12	3	6	9	12	3	6	9	12	3	6	9		12
Logging Manager (A)				4/6-1 (5)	5/12			4/21 A-2 (5)	5/30			4/20-6/5 (10)	A-3			20
Logging Craftsmen (B)				6/11 B-1 (18)	11/23			6/16 B-2 (15)	11/30			6/22 B-3 (15)	11/11	11/16-3/26 B-4 (15)		63
Boiler-Craftsmen (C)				11/19				C-1 3/28 (5)	6/2 C-2 (10)	9/27		9/28 C-3 (6)	1/31			21
Total Trainees	0	0	0	28	28	0	30	31	15	15	104					

Note: B-1, C-1 : On the Job Training.

EQUIPMENT LIST

Annex - 6.

Items	1978	No.	1979	No.	1980	No.	1981	No.
Equipment of teaching concern.	8 mm projector with film	1	Survey level TS-2	2	C.H.P.	3	Colour Video TV Set SL-3000	1 Set
	Slide projector with film	2	Movie film 8 mm	4	Colour Video TV Set.	4	Screen projector SL-C7 (Video)	1 Set
	Colour Video TV set	1	Treadolite M-20F	2	Colour printing kit.	1		
	Survey Compass	3			Hypsometer (Blumc-Leiss)	4		
	Stereo scope MS-27	2						
	Encyclopedia	1						
Equipment of Transport concern	Motor Boat FC-27	1	Motor Boat with Outboard engine (passport-17)	1	Tank truck	2	Motor Cycle 98 cc	1
	Toyota Land Cruiser PJ-40 LV	2	Yamaha Plastic boat FC-41	1			Motor Cycle 125 cc	1
	Station Wagon FX35L	1	Microbus (Mazda)	1				
	Outboard Engine M2544	1	Mitsubishi Jeep HL-38	3				
			Toyota High-Acc	1				
			Mitsubishi dolica star wagon	1				
			Outboard engine 55 ANL	4				
Office Equipment	Copy machine PF 730	1	Gory machine SP-100GS	1				
	Refrigerator SR 1101	3	Refrigerator	4				

I t e m s.	1978	1979	1980	1981	No.
Others.	Radio telephone JEV 225T 3 Radio telephone JEV 621R 1	Radio telephone JSB 58 3 " " JHV 621R 3 Inter Phone Talk-3 3 Automatic Voltage Regulator 1	Radio telephone JEV-225T 2 " " JEV-620T 6 Testing Equipments 3 F-Counter etc. 3	Automatic Voltage Regulator 1 Fire Extinguisher 1 set	1

ANNUAL AID OF EQUIPMENTS

Items	1978	No.	1979	No.	1980	No.	1981	No.
Equipment of Extraction concern	Yarder Y12 EB	1	Yarder Y-52E	3	Chainsaw CS-1001VL	15	Traction T-50	2
	Yarder Y12 E	1	Yarder Y-32EA	2	Chainsaw CS-452 VL	4	Chainsaw CS-750VL	20
	Yarder Y52 E	1	Traction T-50	1	Wire rope ϕ 34, 32, 30 mm	2600 _m	Bush Cutter	3
	Wire rope (ϕ 28, 18, 16, 12, 8 m/m.)	12500 meter	Wire rope (ϕ 16, 14, 12, 10, 8 m/m.)	24,000 meter	Wire rope 16, 10, 14 mm.	3000 _m		
	Traction T-50	1	Wire rope 24, m/m	2,000 _m	Tension meter (T-5)	1		
	Chainsaw CS1001VL	2	Wire rope 12, 10 m/m.	2,000 _m				
	Chainsaw CS 702VL	1	Chainsaw CS-1001VL	18				
	Steel tower	2	Chainsaw CS- 750VL	2				
			Bush Cutter SRM-401	5				
			AWG carriage 5 ton	3				
Equipment of forest road construction concern	Bull dozer D60A-6	1	Dump truck T5D40	2	Vibration loader SW90	1	Rock drill TY-16	1 set
	Bull dozer D6D	1	Back hoe M507Q	1	Angle loader D60A-6	2	Belt Conveyor SE20-100-7M	3
			Shovel dozer 955L	1				
			Air Compressor PDR125	1				
			Jaw crusher 1610	1				
			Belt conveyor SE20-400	1				
			Rockdrill TY-16	1				

I t e m s	1978	No.	1979	No.	1980	No.	1981	No.
Equipments of Workshop concern	Air Compressor GS107ADA-1 Diesel generator DCA-355 Electric Welder AC-D230E Tap-dice set M320 Steam Cleaner 800 Chain block CD-5 Garraze jack Battery charger	1 1 1 1 1 1 2 1	Hydraulic press 60t Steam cleaner CW-250K Electric welder Gas welder Drill machine DDA300 Valb sheet grinder VSG-1000 Valb refacer NB-145 Diesel generator SDM40	1 1 1 1 1 1 1 1	Water supply equipments. Power pack 40AERL Garraze jack M300 H Oil Jack 5 ton Oil Jack 10 ton Hydraulic press HF-300 Chain block 2K-2 Electric welder ATSS 5-150 Gas cutter GS-10 Battery charger Engine generator EG-1000E	1 1 2 2 2 1 1 1 1 1 3 1	Scare parts	1 set

RESULTS OF TRAINING
(MODEL OPERATION FOREST)

No.	Date	Component	Cable system	Spars (a)	Central sag ratio	Planned Load (kg)	SCL	IFL	IFL 1	HEL	HEL 2	Yarder	Workdays	Working period (day)	Harbour extraction (m ³)	Daily extraction (m ³)	Cost of Unit (Kest.)
1-1	79-9	22	endless trolley	700	0.05	3,000 kg	28	16	14	14	18	Y-32B	5	74	169	3.5	5
2	80-1	25	"	190	"	"	"	"	"	"	"	"	"	40	212	10.0	5
3	24-25	3	"	500	"	"	"	"	"	"	"	"	"	43	221	9.9	5
4	24	24	"	300	"	"	"	"	"	"	"	"	"	33	312	17.2	21.15
5	24-25	7	"	600	"	"	"	"	"	"	"	"	"	103	750	9.7	30.39
6	7	"	hoisting carriage	340	"	"	"	"	"	14	16	Y-32B	"	43	284	10.9	28.07
7	12	"	endless trolley	530	"	"	"	"	"	14	12	Y-32B	9	70	680	14.1	22.59
8	9	"	hoisting carriage	330	"	2,000	"	"	"	14	14	Y-32B	7	45	216	7.2	39.87
9	9	24	endless trolley	240	0.04	"	24	"	12	10	13	"	5	35	154	10.3	"
10	12	25	hoisting carriage	220	0.05	"	28	"	14	14	16	"	8	38	169	8.5	40.47
11	81-1	"	endless trolley	300	0.04	"	24	"	12	10	14	"	7	24	176	11.7	31.52
12	3	"	hoisting carriage	380	0.05	"	28	"	14	14	16	"	"	40	189	9.0	28.15
13-1	80-6	24	hoisting carriage	210	"	3,000	"	"	18	"	14	Y-32B	"	17	141	20.1	10.60
2	6	"	hoisting carriage	210	"	"	"	"	"	"	"	"	"	19	152	12.7	12.66
3	7	"	"	210	"	"	"	"	"	"	"	"	"	23	212	12.5	18.71
4	8	"	"	250	"	"	"	"	"	"	"	"	"	37	339	11.3	17.13
5	10	"	"	130	"	"	"	"	"	"	"	"	"	26	156	0.7	10.76
6	11	"	"	190	"	"	"	"	"	"	"	"	"	19	120	12.0	"
7	11	"	"	230	"	2,000	"	14	16	"	16	Y-32B	7	24	130	8.1	33.30
8	81-1	"	"	150	"	3,000	"	16	10	"	"	Y-32B	"	22	86	7.2	45.60
2-1	5	"	"	190	"	"	"	"	"	"	"	"	"	17	45	9.0	45.00
2	5	24	"	130	"	2,000	"	"	"	"	"	"	"	34	241	11.0	19.05
3	6	"	"	300	"	"	"	"	"	"	"	"	"	29	193	8.4	21.61
4	7	"	"	250	"	"	"	"	"	"	"	"	"	17	127	11.6	20.79
5	8	25	"	210	"	"	"	"	"	"	"	"	"	31	137	6.0	21.45
6	9	"	"	290	"	"	"	"	"	"	"	"	"	40	115	3.7	46.82
2-1	6	"	hoisting carriage	230	"	3,000	28	"	14	12	14	Y-32B	"	52	793	6.7	38.75
2	8	"	"	350	"	2,000	"	"	"	"	"	"	"	49	178	1.7	34.44
3	4	24-25	endless trolley	360	"	"	"	"	"	"	"	"	6	115	253	2.9	50.56
4	5	"	"	410	0.04	3,000	"	"	"	"	"	Y-32B	7	110	272	3.5	32.35
5	9	25	"	420	0.05	"	"	"	"	"	"	"	"	63	249	5.1	27.49
6	3	24	"	380	"	"	"	"	"	"	"	"	"	65	178	5.8	43.65
7	9	"	"	290	"	2,000	24	"	12	"	"	Y-32B	"	20	169	9.0	"
8	10	"	"	220	"	"	"	"	"	"	"	"	"	10	35	5.3	"
TOTAL :													1,320	7,125	7.9	185.2	

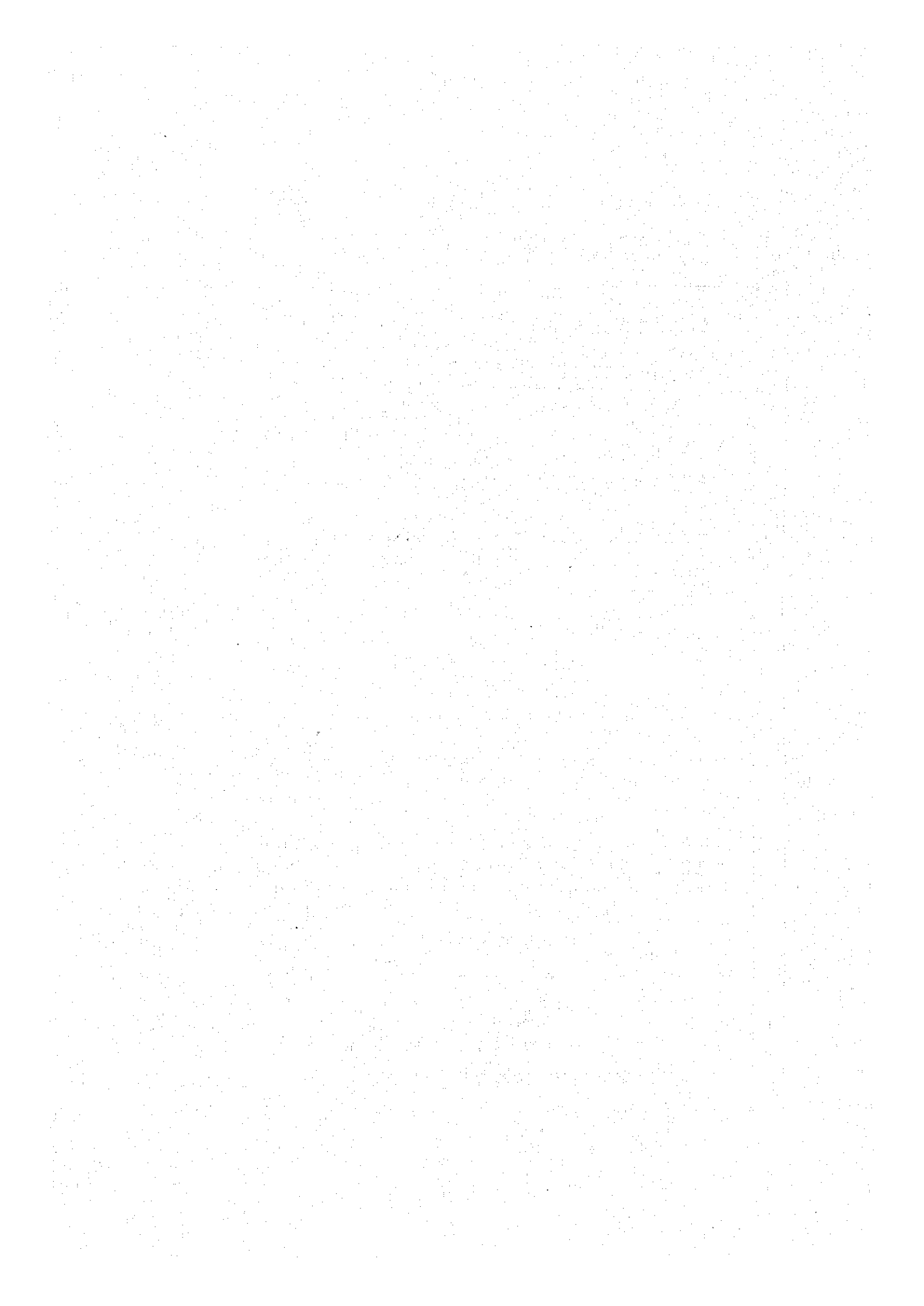
NOTE : 1. In training

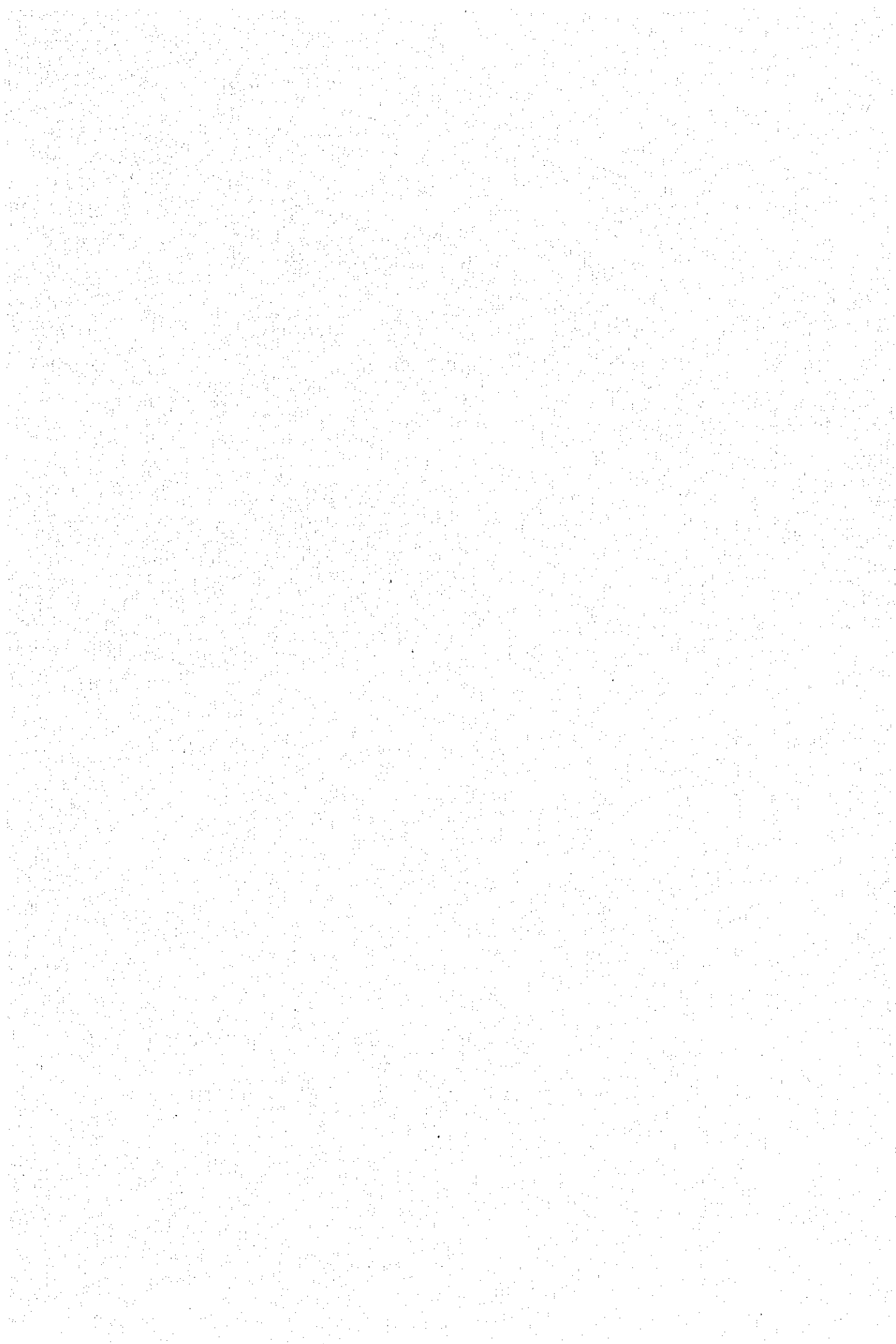
(MODEL OPERATION FOREST)

WORKING PROGRESSIVITY

No.	Date of assembly	Component	Skyline system	Span (m)	Control Sag ratio (kg)	Planned Load (kg)	Yarder	Manpower	Shift hrs (day)	assembly (day)	contract- (day)	disassembly (day)	total timber (m ³)	fuel wood (m ³)	total (m ³)	daily ex- traction (m ³)	Cost of Unit (Rs/mt)
1-1	79-9	22	Radious tylon	700	0.05	3,000	Y-32E	7	3	17	48	6	74	169	169	3.5	7
2	80-1	25	"	190	"	"	"	"	3	12	21	4	40	212	212	10.0	7
3	24-25	24	"	500	"	"	"	"	3	12	23	5	43	227	227	9.9	7
4	5	24	"	300	"	"	"	7	2	10	18	3	33	265	265	17.3	21.15
5	7	24-25	"	600	"	"	"	"	2	18	77	6	103	695	750	9.7	30.39
6	7	"	Existing Carriage	340	"	2,000	Y-32E	"	3	12	26	2	43	244	244	10.9	28.07
7	12	"	Existing tylon	530	"	3,000	Y-32E	9	3	15	48	4	70	537	600	14.1	22.59
8	9	"	Existing Carriage	330	0.04	2,000	Y-32E	7	2	10	30	3	45	195	216	7.2	39.67
9	9	24	Radious tylon	240	0.04	"	"	7	4	14	15	2	35	154	154	10.3	7
10	12	25	Existing Carriage	220	0.05	"	"	8	5	10	20	3	33	169	169	8.5	40.47
11	81-1	"	Radious tylon	300	0.04	"	"	7	5	10	15	4	34	176	176	11.7	31.99
12	3	"	Existing Carriage	380	0.05	"	"	"	5	10	21	4	40	139	169	9.0	20.15
1-1-1	80-5	24	Running Skyline	210	"	3,000	Y-32E	"	2	7	7	1	17	124	141	20.1	19.80
2	6	"	"	210	"	"	"	"	2	3	12	2	13	124	20	12.7	13.86
3	7	"	"	210	"	"	"	"	2	2	17	2	23	170	42	21.2	18.11
4	8	"	"	250	"	"	"	"	2	3	30	2	37	283	56	33.9	17.13
5	10	"	"	130	"	"	"	"	2	4	18	2	26	136	20	15.6	18.76
6	11	25	"	190	"	"	"	"	1	6	10	2	19	120	120	12.0	7
7	11	"	"	230	"	"	Y-32E	7	2	4	16	2	24	130	130	8.1	33.30
8	81-1	"	"	150	"	"	"	"	3	5	12	2	22	86	86	7.2	40.00
2-1-1	5	"	"	190	"	2,000	"	"	5	5	5	3	12	35	45	9.0	45.00
2	5	24	"	130	"	"	"	"	5	4	22	3	34	241	241	11.0	19.05
3	6	24	"	300	"	"	"	"	2	3	23	1	29	193	193	8.4	21.61
4	7	"	"	250	"	"	"	"	1	2	11	3	17	127	127	11.6	20.79
5	8	25	"	210	"	"	"	"	2	3	23	3	31	137	137	6.0	24.45
6	9	"	"	290	"	"	"	"	1	6	31	2	40	115	115	3.7	46.92
2-1	6	"	Existing Carriage	330	"	3,000	Y-32E	"	2	15	29	6	52	193	193	6.7	38.55
2	8	"	"	390	"	2,000	"	"	1	13	23	3	40	150	178	7.7	34.16
3	4	24-25	Radious tylon	360	"	"	"	6	4	16	33	7	115	253	253	2.9	92.36
4	5	"	"	470	0.04	3,000	Y-32E	7	4	15	77	14	110	272	272	3.5	42.39
5	9	25	"	420	0.05	"	"	7	1	10	49	3	63	249	249	5.1	37.49
6	9	24	"	380	"	"	"	"	2	30	30	3	65	176	176	5.9	43.65
7	9	"	"	230	"	2,000	Y-32E	7	2	3	7	3	20	65	69	9.0	7
8	10	"	"	220	"	"	"	"	-	4	6	-	10	35	35	5.0	7
TOTAL										500	6702	387	7.52	7.9	29.48		

Note: P = Training.





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