The Use of the Scale Model In Sawmill Planning

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INTRODUCTION

Mill planning is apparently an afterthought in the minds of most sawmill operators. Where other industries have spent many thousands of dollars designing more efficient plant layouts, the lumber industry has just allowed its mills to grow. This has resulted in cramped working conditions, poor lighting, and a jumble of chains that are like a crossword puzzle.

Working conditions in most mills are very poor. The inadequate lighting, the close spacing of machinery, and the general confusion that reigns is conducive to poor efficiency and a high rate of accidents. Poor planning undoubtedly adds greatly to the high rate of accident insurance carried by mills as well as to time lost through accidents.

Labor turnover is very high in sawmills, higher than in most other industries. A great deal of this can be traced to the poor working conditions in the mill itself. Sawmill work is no more monotinous than any other type of mill work, yet employees get tired of it more quickly. Why? Because of the close spacing of machines, the lack of adequate lighting, and noise. Who wishes to work in a dark dingy mill when one can work in a place that is comparatively clean and well ordered?

Better planning would increase the efficiency of the plant as well as the efficiency of the employee. The

handling of the material by hand could be nearly eliminated as it is in some well-planned mills. An example is the Weyerhaeuser Mill at Longview. Labor is too expensive and unpredictable at the present time to be used when machines will do the work as well. The handling of one piece of material twice can be eliminated by proper planning of the material route through the mill.

Increased efficiency of the workman himself will also result from the better working conditions provided in the well-planned mill. Good lighting facilities will pay for themselves in lessened fatigue and resulting layoffs from headaches. Noise is another factor that can be reduced. Rats subjected to a constant noise slowly go beserk; their behaviour is highly unpredictable. This same thing takes place in mills where high-pitched saws constantly fill the air with noise. This increased efficiency of the employee will also pay off in fewer accidents and greater production. Well-planned and well-kept latrines with plenty of hot water will also add to the workmens' efficiency.

Costly additions should be planned in advance so that special bracings or footings can be placed in the mill during the original construction. This would remove the necessity of long shutdowns due to changes in production. With the present high profit margin, no mill can afford to shut down for any appreciable length of time.

Many of these faults could be eliminated if the management could visualize them before the mill was con-

structed. This is where the scale model proves its efficacy. If more of our sawmills used a scale model in planning the mill, their production and labor troubles would be greatly reduced.

SELECTION OF PLANT EQUIPMENT FOR SCALE MODELS

Many of the large manufacturing plants have turned to the use of scale models of the mill for planning and other purposes. These models are made to any scale, depending upon the desired completeness of the model. Many of them are very complete, even to the details of wiring where that is one of the main points involved. Others show only the layout of the plant and the flow of material.

These models are used originally in planning the mill layout; after the plant is completed, they are used in planning any changes of machinery, or the routing of new material through the plant. Several other uses are also brought to light under different circumstances. Among these are explanation of changes to foreman, orientation of new employees or employees not familiar with that part of the layout, and explanation of the plant layout to outsiders.

Previous to the construction of the scale model, the size and type of machinery to be used must be determined. This depends upon several factors. Among them are the amount to be cut per day, available market, and the type of logs to be cut. The latter is the most decisive item.

Mill operators seem to be quite hazy as to why they use a certain size edger, or just why they have certain types of machines in their plant. This is something that is left up to the men who make it their business to design

mills, and they did not gain their knowledge through text-books. Most of it was gained through years of experience in and about sawmills. They are quite reluctant to pass on what they have gained in the way of knowledge.

One of the factors that affect the plan of the mill is the matter of market; that is, what is the mill going to be able to sell. Is there a market for rough lumber, or is it to be shipped in cants as in the export trade. The mill may have a strong demand for common lumber as in a farming district. On the other hand furniture factories or other manufacturing plants may want an altogether different product. In each case there would be a need for different types of machinery and different sizes, although the mills might be cutting the same board footage per day.

The main factor is the grade of logs to be cut. This will not only determine the type of machinery to be used, but also to a large extent the type of material that will be marketed by the plant. If the logs are of a uniform type and a uniform product is to be produced, (the type of product might be determined by the available market) machinery that is capable of producing many uniform products at a low cost would be installed. This, as in the case of the gang headrig, would be a good supply of number two logs of a medium diameter, coupled with a market for common lumber and joists, planks, and other two-inch dimensions. On the other hand this equipment would be exceedingly wasteful of high-quality logs with a large

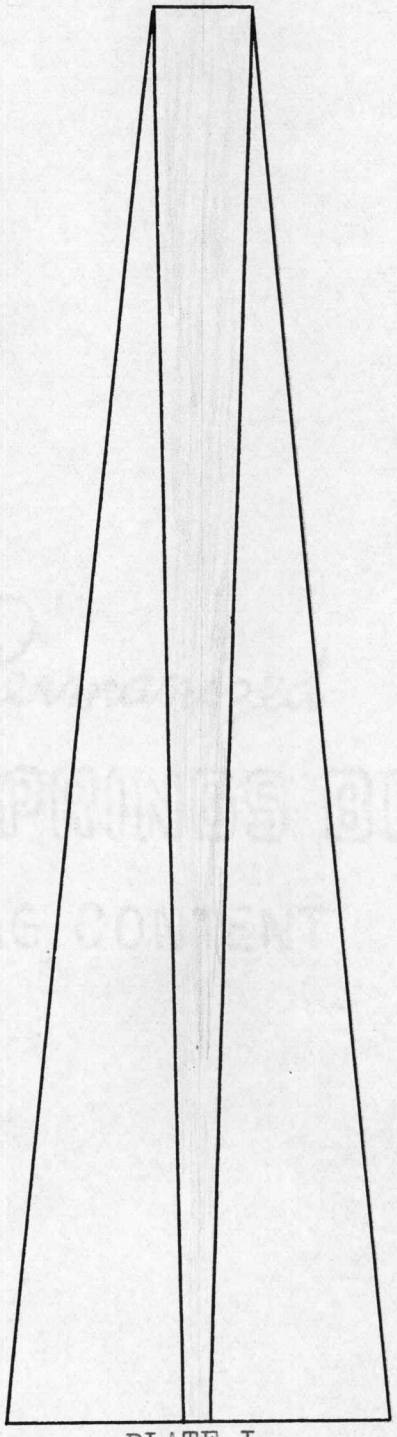


PLATE I

Schematic Diagram of Knot Area in a Tree.

Lumber Grade Recovery By Log Grade
From Douglas Fir*

Lumber grade	Average Value f.o.b. mill Jan '48	No. 2 Peeler 36"	No. 3 Peeler 24"	No. 2 Sawmill logs				No. 3 Sawmill logs			
				36"		24"		24"		12"	
				Coast	Cascade	Coast	Cascade	Coast	Cascade	Coast	Cascade
B & Btr.	130	20.0	15.0	2.5	11.0	2.5	8.5		2.5		
C Select	125	27.5	28.0	22.5	27.0	15.0	19.0	5.5	4.0	5.0	1.0
D Select	115	3.0	4.0	1.5	2.0	1.5	2.5		0.5		0.5
Sel. Struct.	75	19.0	24.0	16.5	13.0	29.0	22.0	22.5	16.0	28.0	16.0
Sel. Merch.	72	4.0	6.0	13.0	5.5	21.5	8.0	13.5	4.0	33.5	5.5
No. 1 Com	67	9.0	10.5	14.0	15.0	15.5	19.0	33.5	26.5	22.5	34.5
No. 2 Com	61	8.0	5.0	20.5	13.5	10.0	11.5	17.0	26.0	7.0	31.0
No. 3 Com	50	7.5	5.5	7.5	8.5	4.5	7.0	7.0	15.0	3.5	10.0
No. 4 Com	-	2.0	2.0	2.0	4.5	0.5	2.5	1.0	5.5	0.5	1.5

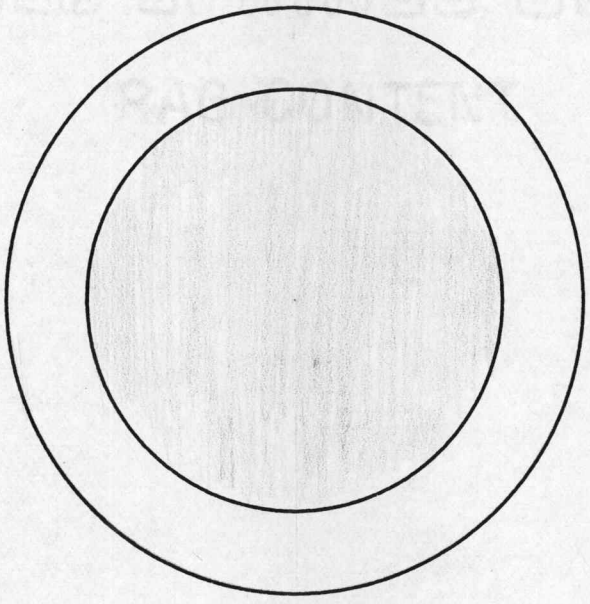
PLATE II

* Matson, E. E., "Lumber Grade Recovery From Southern Interior Oregon Type Douglas Fir," Timberman, Vol. XLIX, p. 51 (April, 1948).

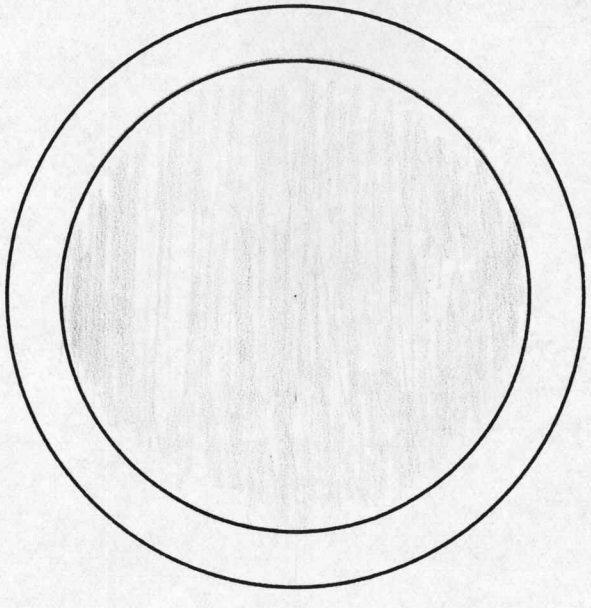
amount of clear material. In this case a bandmill with its accompanying narrow kerf and selective cut ability would replace the gangmill. A combination of both types of machines could be had where there is a large variety of logs and material to be marketed in which case the bandmill could be used as a slabbing mechanism while other machinery took up the other operations in sequence.

The peculiar construction of the tree poses a unique problem in cutting. The fact that flat material must be cut from round, tapered logs is the basis for many of the problems of production. Each log poses as a new problem, which must be solved rapidly by the sawyer. When a tree grows, it puts on clear material as illustrated by Plate I. The core of the log contains the poorer material; that is, material that contains most of the knots. The shape of this core is somewhat like an inverted tree, with the narrowest portion situated at the butt and widening as it approaches the top. It is this type of growth that necessitates the use of a great variety of equipment in the mill. If the log was uniform throughout, uniform equipment would be found in each and every mill.

Plate II serves to show the type of material that is cut on the average from certain grades of logs. As the grade of the log decreases, so does the quality of the material produced. This has a marked effect upon the type of machines used to cut the log and the time that is spent in making the cuts. Due to the great difference of



No. 1 Sawmill Log
50% B and Better



No. 2 Sawmill Log
25% B and Better
or 65% No. 1 Common

PLATE III

price between the clear and the common material, more time and money can be expended in the extraction of the material from the log where a large amount of the high-grade material is present. Much of the lower-grade material barely pays its way on the market. Where the material is to be shipped any distance, only the higher grades of common lumber can be shipped. A strong local market might make the cutting of low-grade material from the log profitable. However, in most cases this material would call for as little processing and handling as possible. Only high-grade material can afford to be handled through several machines.

Material is cut from the log as illustrated by Plate III. The grades proceed inward, with the clear being layed on the outside as the branch line goes higher up the bole of the tree. The machinery of the mill is designed to open up the log and remove the material as efficiently as possible. The headrig in a small mill may be used to cut up the log into the nominal sizes to be used. In this case practically all of the work of cutting the log goes on in the first operation, while the rest of the machines just apply a few finishing touches. Although this is the cheapest method where machinery cost is considered, it is the least efficient in the long run as far as actual production is concerned.

Actually, in the larger mills, the work of the headrig is more in the form of an opening up of the log than

a cut-up operation. In this case a bandmill is very efficient, because of its high speed in the cut and its trueness of product. The logs are opened up, first by slabbing off the bark, and then removing the clear, either in the form of boards or in the form of larger cants according to the grade of material being cut and the processing machinery following the headrig.

If the logs being cut are number two or lower, the headrig might consist of a gangsaw, that will saw all of the logs up into four-inch or less material. In this case the product is usually lower in value than the clears that are gained by the regulation headrig, but the cost of removing them from the log is very much lower. If the logs are sound and of a fairly uniform grade and size, this method of sawing has definite advantages.

Much of its advantage comes from the small amount of equipment that is needed to follow the headrig. This usually consists of an edger and perhaps a vertical resaw for cleaning up material marked by the grader. The gang-mill edger does not have to be a large "bull edger" that is found in most mills. There large edgers are very wasteful due to the heavy saw kerf that they take as they go through the material. The edger could be of the fourty-eight inch size as long as it was of the high-speed type. The material that it cuts would be thin, but it would have to be able to handle every stick of wood that came from the headsaw. This makes the edger as important as the

headrig itself. This and a small vertical resaw would be all the equipment needed.

On the other hand, a bandmill cutting the same material and the same amount per day would need to have more or heavier equipment behind it. If the material was cut up on the headrig, large cants would probably be removed from the interior of the log, necessitating a heavy "bull type edger" to handle it. A large variety of material from one-inch to twelve inches in thickness might be fed through the same machine. It would have to be of a large size with a variable speed feed to make it at all efficient. Actualy, this condition should not exist in a mill if it is to remove material efficiently; that is, in the shortest length of time with the least loss of material. Certain other machines would be added that would relieve the strain on the edger, and allow the headrig to proceed as an opening-up operation and not as a processing procedure.

This is done by adding such machines as a gangsaw followed by a small edger. These saws handle the cants of a given type of material. Various vertical resaws are added later on in the operation. However, this type of saw usually shows up in the remanufacturing process. In an operation where high-quality logs are being cut in which the salvage of clears might be a great saving, a horizontal resaw is added. This saw is used also in separating good material from center cuts that contain

a large degree of taper. It is usually used to clean up the material and to salvage clear material that would otherwise be wasted.

To put all of these pieces of machinery together, let us assume that we have material of optimum quality to be cut, and that we have a market that will take everything that we can produce. Such a market exists at present, but the log supply will not correspond to these qualifications. The logical place to start out is with the headrig. We would make this a bandmill, capable of taking our average size log without undue turning and jockeying into place by the sawyer. A ten-foot bandmill would do the job nicely.

To follow this size headrig with machines of low capacity would be highly undesirable, and considering the logs to be cut we should have every type of equipment. The main edger would be directly behind the headrig. It would be used in cutting up material that could best be taken care of by a machine that could separate good material from poorer stock. In this way material that might otherwise be degraded could be salvaged. Due to the fact that it mist handle material of quite large size, an 8" by 96" size probably would be needed. Material from it would either be discharged directly onto the chain feeding the trim saws, or if in large cants, might be carried through to gangsaws in the rear.

Parallel to the edger would be the horizontal resaw. This expensive piece of machinery can only be used where the material being cut is of high grade, and its salvage value will be large. It is generally used for the removal of bark from clear material slabbed off by the headrig. It is primarily an instrument of salvage. In actual operation it allows the sawyer to slab heavily without fear of the loss of valuable material. These slabs are sent down the main rollcase and then across to the resaw. After they pass through the machine, they go directly to the edger. This material would be wasted if it were not for the horizontal resaw. The high-speed headrig would probably not slow down to remove it carefully and salvage the material. In any case the material would have to pass through the edger twice to remove the bark from the edges. This machine speeds up the operation of the headrig and removes part of the load from the edger. The size of headrig and edger needed to turnout a given quantity of material can materially be reduced by the addition of a horizontal resaw.

Following the edger and horizontal resaw is the gangsaw. Its function in the mill is similar to the gang headrig. In other words, it is used to handle material of a uniform quality. Where a large quantity of clear is obtained, it may be used to cut vertical grain flooring and other high-grade material. Its cutting is done from cants that are slabbed off by the headrig. The gangsaw

probably speeds up production more than any other machine. It is designed primarily for rapid cutting. Where there is a large amount of material of two types, such as clear cants and cants to be cut up into common boards, two gangsaws may be used, each one set up to cut a certain type of material. Efficiency is not only gained through the use of thin blades that cut a narrow kerf.

The gangsaw is usually followed by a small edger that trims up the material as it leaves the saw. A small vertical resaw is usually located in some such way that material may be sent back to it by the graders. This is done only if the material can be raised considerably in grade by further processing. Trouble comes in excess handling of material that is not of high enough quality to support handling charges.

This fairly well covers the reason for the use of different types of equipment. The sizes of the individual machines depend upon the ideas of the men who are planning the mill. These usually are based upon experience, the type of material that is being cut, the men who will handle the machines, and the market that is to be supplied. Here the combinations of sizes and numbers of machines is innumerable and the whys and wherefores of their choice would take a book to cover. This should be sufficient to explain the reasons for the machines in the model that accompanies this paper as an illustration of a scale model mill. In this model placement of machines is the primary

illustration. No attempt is made to show the detail of the mill other than in respect to machine placement, and the type of machines used. In actual use, more detail would probably be shown; namely, conveyors, motor locations, and trash disposal methods.

PLANT ARRANGEMENT THROUGH THE USE OF SCALE MODELS

In the planning of the mill, a model serves to point out more clearly to those involved, the details of the lay-out. Many people cannot visualize what the plant is like by reading the blueprint. By being able to visualize what the layout is, any errors in judgment as to the placing of machinery and to space left between machines can be eliminated. This better use of space can well reduce the cost of the construction and make it possible to erect a better structure.

A picture is worth ten thousand words. The model acts as a picture upon which the employees can show why they would not approve of a change, or the employer can explain why he is going to make a change and how it will be to the advantage of the employee. This situation is advantageous to both the employer and the employee.

Changes in the process can more easily be seen by the employee. If it necessitates his relearning his job, he will do it more readily if he can see where the change is to his benefit as well as to the benefit of the mill. If he thinks it is just a wild scheme, he is immediately opposed to it. Despite the fact that we live in a fast-moving world, people taken as individuals are opposed to anything that necessitates a change in their regular mode of activity. Changes thoroughly explained to the employee may lessen labor disputes through misunderstanding of what is happening. The employee must be shown that the change will not cause him to put forth extra effort or lessen his

chances for employment. Lack of security is the employees' greatest fear. That is why many people take comparatively low-paying state jobs in preference to more lucrative private positions.

Improved working conditions can be gained by the employer through the use of models. It is much easier for him to see the position of the worker who is going to stand between two machines that are placed too close together with a model than if someone states the distance between the machines. Other things such as the distance to the latrines or water fountains can also be noted at a glance. Time spent in running between these two points adds up in a heavy cost to the employer. If he can visualize the situation he will probably see clear to correcting it before the union itself gets on his neck.

When the workman himself comes up with some suggestion as to how things should be done, he probably does not know how to read a blueprint, but he could show with the aid of the model what he thinks would improve the setup. Whether it is a suggestion as to how something should be done or as to why something is wrong, the model will aid in putting his idea over. On the other hand, why that idea is not going to be used could easily be explained without his thinking that his employers were just a bunch of "fatheads" who do not want to learn from an employee. This creates a bad situation, because this same man may come up with a very good suggestion later on which he would

not bring to the attention of the management. The man who does the job can be looked upon as an expert in his work and could well be a font of information for the men planning the layout.

Plants using the model have found that placing it where the employees could have easy access to it has stimulated their interest in the plant. This has aided in the establishing of good feeling between the management and labor. Suggestions are gotten from them when all other methods had failed to gain any ideas.

By placing the model before the foremen, they can see just what the things are going to be like in their departments. Any changes in the method of production can be explained to them, and they can make their plans to cope with them before any difficulty arises. Suggestions as to possible difficulties that might be taken care of before the plant is built can be pointed out by the foremen as they study the layout of their department and its orientation to the other departments of the mill. This may also aid in explaining the reason for the performance of an operation in some way that may be considered wrong by the foreman but is necessitated by the way the previous department or following department is operated. It tends to eliminate, "Why don't they do thus and so in the other department?"

The use of the model also tends to eliminate the projects that result in failure because most of the dif-

ficulties can be spotted before the operation has been begun. In this case working scale models will soon bring out any difficulties in the operating procedure that is to be installed. It will eliminate that "I could have told you so," that proves so irritating to employees and foremen alike. There would be no excuse for one of the men to say that he had no opportunity to express his opinion on the subject or to show what was wrong. This being able to take part in the actual planning aids the men in feeling that they are an integral part of the plant. This also aids in efficiency and in the reduction of labor turnover that always plagues the sawmill executive.

Models can aid in the reduction of labor turnover and labor disputes by aiding management and labor in seeing each other's needs. Often the men that plan sawmills plan them for production without thought for the convenience of the men who are to work in them. The latter should be given primary consideration in the planning of any place of work. Satisfied workmen and high production go hand in hand. The man behind the machine is now known to be as much a part of the production time as the machine itself. Proper working conditions are as essential as proper maintenance of equipment.

In some mills such basic things as latrines have been left completely out of the picture. The planners never considered what it might cost the mill in hours lost just

through the lack of convenient toilet facilities. In one such plant where the latrine is located completely across the mill from the place of work, a great deal of time is lost. One of the foremen estimated that five minutes per man per day were lost just through this situation. The plant employs approximately eighty men. This would add up to 80 x 5 ÷ 60 or 6.66 man hours per day lost. If the average hourly wage was $1.40, the total amount would be approximately $9.32 per day. This would be enough to pay for the full-time services of one man. Not only should these facilities be convenient, but they should be kept clean. If they are to be used, they should be in good condition. The men would rather go out beside the mill than to use a foul-smelling latrine.

This lack of sanitary facilities, coupled with the fact that the floor of the mill was cement, was the basis for many complaints and the cause of a high labor turn-over. This in itself is very expensive to the mill as well as wasteful of the workers' ability. The floor was not covered with wood and after eight hours of standing, the employees' feet were extremely sore. This situation could be remedied by the use of wooden floor coverings, but this was not done. Consequently, in the three months that I worked at this particular plant, thirty-five men came and went.

Smoking is a very dangerous activity around a highly combustible plant such as a sawmill or planing mill. This is recognized by the management of most mills and is

handled by many conspicuous "No Smoking" signs throught these premises. Anyone who is caught smoking is promptly dismissed. This action is sanctioned even by the union. They realize that a fire would destroy their chance of a livelihood. Many plants have done nothing to modify the situation by providing safe smoking spots, although this would do much to improve employees' satisfaction with their jobs. The fact that some of the managers ignore the signs and walk through the plant with a lighted cigar, adds to the resentment of the employees.

A well-planned smoking room, conveniently located for workmen, will reduce this point of friction to a minimum. This, together with a system of relief for the men, adds much to the enjoyment of their work. These same smoking rooms can also serve as a place for the personnel to eat and relax during the noon hour. At the Medford Corporation mill in Medford, the manager has incorporated this idea in the mill plan. Smoking rooms are conveniently located in such a position that they do not create a fire hazard. They are equipped with stoves and tables on which the men eat. This plant is known for the good morale of the men who are employed there. The men swear by it and work hard to keep their position in the plant. In contrast to this is the plywood plant at Albany where there are no facilities for eating, and the men must either eat on the floor or go out to their cars. There is much complaining on the part of the men due to

this situation.

How does this tie in with mill planning through the use of scale models? The worker can show the manager where these facilities would be the most convenient for him. With the use of a model this could easily be done without a lot of bandying of words. On the other hand, reasons why these facilities could not be placed in certain places could be brought to light by the management. This is not written as a condemnation of management, but to point out the fact that much of the mill planning up to the present time has been strictly for production due to overwhelming machine power. Now that the period of conservation of raw materials is being entered, management may be committing a gross error by overlooking the convenience of the employees. The man who works at the machine may very easily be the source of many helpful ideas to management, if he is allowed to state them. The scale model will help him to express himself. This will also help the men who are doing the planning to see just what he does have to offer.

Some method of heating the plant should be incorporated in the plans. If the men spend their time trying to keep warm, they cannot expect to be efficient in their work. If the climate is mild, this could be accomplished by the use of baffles to keep the direct sweep of wind from the plant. In other cases exhaust steam from the power plant could be used to supply heat to the mill.

This is a point that seems to be overlooked in most mills. The temperature can be low as compared with home room temperature, but it should not be so low that the employee has to wear bulky clothes to keep warm. These clothes limit his movement and could easily be a direct cause of accidents.

Noise is reduced in some of the more modern plants by the use of baffles that confine the noise of one piece of machinery to its own immediate vicinity. This helps reduce the general amount of noise that tends to lessen the employees' efficiency through constant strain on the nerves. Nervous disorders and poor mental attitudes of the employee may result from excessive noise.

Lighting in sawmills is usually poor. Light is good around grading tables and around a few of the main machines, but in general it is poor, and gives the employee the feeling of working in a cave. Gloomy working conditions produce gloomy workers, and their work is apt to reflect this attitude. Accidents due to lack of sufficient light are probably many, but the manager still does not see clear to improve these conditions.

These are just a few of the main points that cause friction between the employee and the management. In these times when friction between these two is already high, any little point can lead to costly labor difficulties in the plant. During other periods, the increase in the efficiency of the individual employee would repay

the employer for the installation of these conveniences. The use of a model mill will aid in gaining beneficial ideas from the employees.

OTHER USES OF SCALE MODELS

There are other uses for scale models besides in planning. Individually they may not be much, but collectively they carry a great deal of weight.

Orientation of new employees is carried out more quickly by the use of a model than in any other way. It shows the whole thing to him without being boring. Most men are interested in models. A model just naturally draws his interest, either in the way that it is constructed or what it represents. If the job is neatly done, he is favorably impressed, and is more likely to have a more open opinion of the company as to being progressive in its views. This can really be impressed upon the man by the explanation of things that will interest him, such as the positioning of machines for more space, better lighting, reduction of noise, and the position of latrines and drinking fountains.

The relationship of his job to the other jobs in the mill is also demonstrated. This aids in explaining why his job should be done in a certain way and the difficulties encountered if it is not done in this manner. An employee will not consciously hurt the employer under normal conditions. If he is shown where he does do damage by certain actions, he is not so apt to do them, expecially if he knows that they can be checked. With a feeling of being a part of the organization he will do better work from the start. Many of the large automobile concerns started this idea by having tours through the plant for the employees on company

time. This aids in their connection between their job and other jobs in the process.

Factors involved in safety can also be shown the new employee, things that he must look out for in the plant and practices that are dangerous. Precautions taken in this way may help reduce the loss of time by accidents. If the new employee knows what to look out for he is not likely to get into trouble. Methods of disposal of waste and keeping the area in general clean can be explained. Showing why this is a necessity may also aid in getting this done satisfactorily. An employee is not dumb. If he is given a substantial reason for doing something, he will probably do it well and without grumbling or gripping. The new employee likes to feel that the management is very interested in him and any special pains taken in showing him the layout will impress him. Here also is an idea for the employer. Place the name of the employee on a marker by the machine that he operates. In this way the names of the men who are working can easily be learned by association with their job. A boss who can call an employee by his name and know the job that he is doing is rated high in the opinion of the men who work for him. This can be found in the plant of Medford Corporation at Medford, Oregon. The manager of the plant worked up through the mill and even after he became the "big boss," retained contact with the men. To them he signifies the shrewdest lumberman in the locality, while one of the other top managers

has no respect of the men because he does not get down to their level. The former man will continue to get the respect of the men under the most trying circumstances, because they feel that he knows their individual problems and will not forget them.

Many times the necessity of explanation of the plant layout to outsiders comes up. When these occasions arise, a model of the plant is a great aid. Once again the guide need not fear that the visitor will lose interestin what he is saying. A model will hold interest where nothing else will. If intricate detail has been used in construction, it can be explained by pointing out to the subject what care was taken in the creation of the model. He learns whether he intended to or not. Such educational methods were found very practical by the armed forces in the education of large bodies of men in a hurry.

Insurance men can be shown certain factors such as the position of water supplies, trash disposal units, and facilities for employee smoking that will be of vital interest to him in making up his estimate of the rate of insurance. Anything that may be of special interest to the company such as special fireproofing can also be pointed out to him before a trip is taken into the mill itself. On the other hand, he can more readily make his suggestion as to why certain rates must be high due to certain hazardous conditions. These suggestions can then be transferred to the board of executives and explained to them. Certain

not so obvious defects may be overlooked by the inspector if his attention is diverted by the use of the model to other points. It is a point in salesmanship that a person only sees what you show him. This applies to a lot of other things.

Safety inspectors can be shown the hazardous areas in the plant, and what has been done to avoid accidents. Some of the places that are difficult to reach in the plant can be shown to him without his going to the exact spot to see. This reduces time lost by workmen who must get out of the way during the inspection of the machines. His suggestions can easily be explained to the plant engineer so that he can design guards that will fit the specifications called for and reduce the hazard that existed. The inspector could easily explain the setup used by other mills in the reducing of the hazards to workmen by the use of the model. Thus improvements might be gained from a rather unexpected source.

Just plain visitors could be explained the layout before they were shown through the mill. Any questions that might arise could be answered before the mill itself was entered. The noise within the mill practically puts a stop to any conversation so explanation of operations should be kept to a minimum. After the tour the guide could again bring the party in contact with the model and answer any questions that might have arisen in the minds of the party while they were in the mill proper. The model itself would

act as a stimulus to remind anyone of a question that he was going to ask about a particular operation. This would be a boon to college students trying to draw a flow diagram of the mill.

The model will replace the use of blueprints, if it is to scale and accurate. Changes could more readily be made than in any other form of plan. No redrawing is necessary when a model is used. They are so constructed so that each piece can be picked up and moved to some other place. In fact, that is the idea of the construction. Changes can be made as quickly as they are thought of instead of spending hours on the drawing board. Most layouts are made on a large piece of some type of wallboard that will readily take a sharp, pointed object. The models are equipped with pointed appendages on the bottom so that they can be quickly placed in position on the board. If conveyors are similarly equipped, the whole model can be rearranged in a matter of minutes. Laid off to scale, the exact affect upon the mill arrangement can be shown by the change. Expensive drafting operations are reduced in this way.

The model must be kept constantly up to date. If it is allowed to fall behind mill changes, it is not of any use. This would necessitate the designation of a certain employee to see that all changes are shown on the model. If properly taken care of, the model will show the exact position of every machine in the mill at all times. Marked-over blueprints will not have to be resorted to to explain

the situation in the mill at any given time. It will already be shown clearly and completely by the model itself. It is interesting to note that the large concerns that have instituted the use of the models have not abandoned them.

The use of a scale model w uld not be needed in a very small mill, or one that is not to be permanent. A small mill is not complicated to the point where any change is obvious and that the needs are not easily seen. These mills cannot afford to make changes in the layout just for better employee relations or for a little more production. Employee efficiency is not a paramount problem with them, especially where the owner can cover the plant regularly and see how each employee is doing.

However, where a small mill expects to be permanent, a scale model may aid in the laying out of the plant so that expansion can be made without the usual growing pains that means a shutdown for a period of time. In other words, there are two major factors that decide whether a mill would be aided by the use of a scale model in planning. One is the original size of the mill, whether it is intricate enough to demand something besides a blueprint, and the other is the question of permanency. A permanent small mill may use a simple model in planning for future expansion as the need arises.

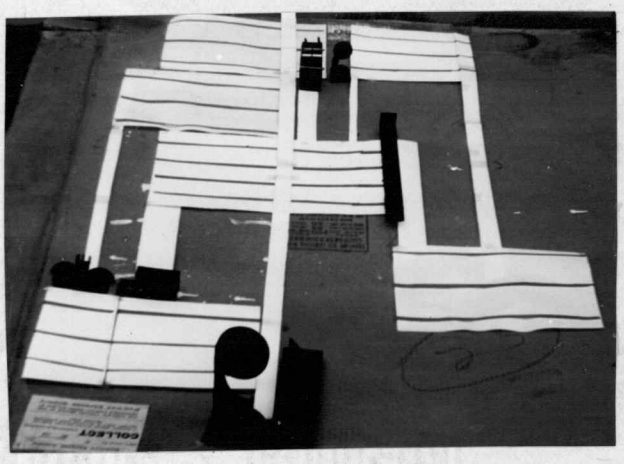


PLATE IV

Front
1. Bandsaw
2. Carriage
Left
1. Horizontal Band resaw
2. Edger
Center
1. Trimmer saws
Rear
1. Gangsaw
2. Vertical Band resaw

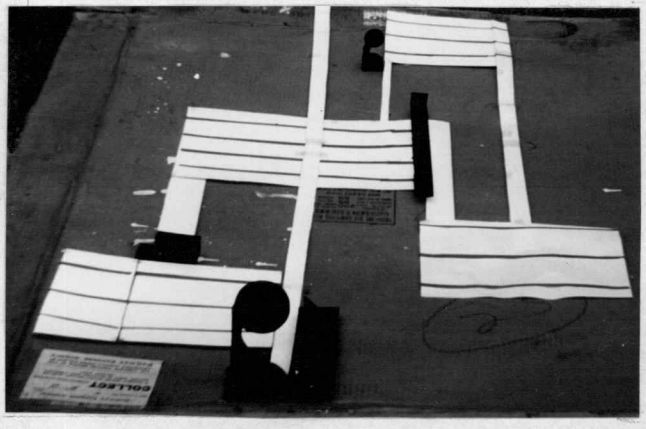


PLATE V

Front
1. Bandsaw
2. Carriage
Left
1. Edger
Center
1. Trimmer saws
Rear
1. Vertical Band resaw

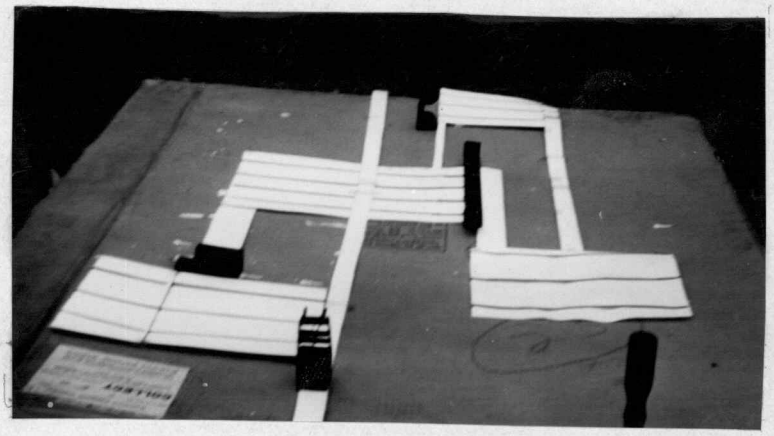


PLATE VI

Front
  1. Gangsaw
Left
  1. Edger
Center
  1. Trimmer saws
Rear
  1. Vertical Band Resaw

MERCHANTABLE LOG GRADES

GRADE	SCALING DIAMETER	LOG LENGTH	LUMBER GRADE PRODUCED	RING COUNT	SLOPE OF GRAIN	REMARKS
DOUGLAS FIR LOG GRADES						
Sawmill Logs						
1	30"	16'	50% net scale B or Better	8 per inch	30"-35" Diam - 1" 36"-50" " - 1½ 50"-60" " - 2 61" Plus - 2½	Old Growth only
2	12"	12'	25% net scale B or 65% No. 1 Com. or equivalent value	No minimum	Moderate	
3	8"	12'	50% No. 2 Common	No minimum	No minimum	
Peeler Logs						
1	30"	16'	50% Clear uniform colored veneer	8 per inch	Same as No. 1 sawmill	A good No. 1 sawmill. Must be peelable. 90% log surface free of visible knots
2	30"	16'	35% clear uniform colored veneer	8 per inch	3" per lineal foot	Must be peelable. 75% log surface clear
3	24"	16'	Material suitable for cores and backs	No minimum	No minimum	Must be peelable. 50% log surface clear
WESTERN HEMLOCK LOG GRADES						
Sawmill Logs						
1	24"	16'	35% gross scale B or Better	No minimum	No minimum	
2	14"	12'	65% gross scale No. 1 Common	No minimum	No minimum	
3	8"	12'	50% gross scale	No minimum	No minimum	
Peeler Grade						
1	24"	16'	50% B or Better	8 per inch	No minimum	Must be peelable

PLATE VII

THE USE OF THE SCALE MODEL IN SAWMILL PLANNING

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