# Efficiency and low maintenance cost in wood handling

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**Summary**

This paper is a review of the application of thoughtful design to the reduction of maintenance costs in wood handling applicable to a pulp and paper industry. Emphasis is placed on those design criteria which can increase efficiency and reduce the maintenance cost, such as observability and accessibility, minimum surface exposure, proper surface protection and staindardization. Some less maintenance prove designs, have been recommended in place of conventional designs.

**Introduction**

Wood in different forms of 'Pulp-Wood" is the dominant raw material of the pulp and paper manufacturing industry. Most of the pulpwood is prepared from the section of trees varying from one metre-length to the full length of the tree and diameter varying from 10 cms. to 40 cms. and even more. The other raw materials used for the paper industries are grasses, bamboo, reeds, bagasse, rags, straws etc. etc.

The difficulty in procurement of softwoods and limited resources of bamboos have created increasing interest in the utilisation of hardwoods. Since in India we have the forest of hardwoods where no single species is available in one area, large scale plantations of Eucation of species have been raised envisaging the potentiality of wood as a raw material for pulp and paper industry. It is expected that we shall be having many more industries using hardwoods.

It is essential to develop the design of the equipment used in handling of logs and storage in such a way that these may reduce the cost of production. Much work is being done in India as well as in foreign countries to reduce these costs by devising new techniques and machines for economical and efficient transportation and storage of raw material.

The purpose of this paper is to highlight some of the ways by which the engineering judgement and ideas can be used in the design of pulpwood handling equipment and processing system to reduce the average cost of maintenance. There are many acts of neglect which can be very costly, the main is failure to take advantage of the opportunities to reduce maintenance cost and other costs through careful design.

**EFFICIENCY**

**(i) Proper equipment**

For an efficient operation of any part of a mill dealing with wood it is very essential that a proper type of equipment is utilised to feed the exact shape and size of the material e.g. the alignment is very important for the uniform grinding. So the length of the logs have to be maintained for a particular grinder as the chances are that the shorter logs may enter the magazine in the wrong direction causing disturbance to all other logs resulting in the inefficient operation of the grinding process. An over-length log will lock the enterance. Therefore, a proper equipment must be designed and employed for sorting of logs according to the necessity of the grinder. As its operation is concerned, the logs can first be aligned and kept parallel to one another with one end pushed against a vertical plate, so that all the logs are aligned at one end. The wood then can travels over an opening of increasing width first the short, then the normal and finally the over length logs fall into the appropriate chutes. The wood of correct length can then be conveyed to the grinder room while the balance of the wood may go to clipper. The proper sorting will surely increase the efficiency.

**(ii) Gear and moving parts**

The other factors to increase efficiency which are mostly over looked are the noise and vibrations mainly caused by the gears and other moving parts. The design engineer must consider not only the factors in design with relation to strength and economy, such as size, material, safety factor but he must also consider the dynamic response of the gears in their mounting with the influence of the system imposed on them and the excitation they can generate within the system. Optimum gears for minimum noise and vibrations should be designed. A

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very significant work is needed to be done to design proper gears considering gear types, tooth geometary, unit loading, bearing material, accuracy, surface finish, alignment, rotor imbalance in addition to the critical speads, lubrication etc. etc.

Air and water pollutions are the other indirect killers of efficiency. Proper control on these is very important to protect the workers from ill health.

**Maintenance**

In very general terms, maintenance is any operation required to keep the machine in proper running conditions throughout. There are two brand catagories of maintenance. One is called 'Preventive' and the other by various names including 'Emergency'. The term preventive implies forethought and it is usually regarded as including such items of work as the routine replacement of machinery parts having a more or less constant rate of weer, routine lubrication, surface protection and other, which experience indicates, will minimize the other types of maintenance.

Though there is no claim to eliminate maintenance operations, their costs can surely be reduced by new design concepts aimed at reducing maintenance. Although an endless list of maintenance operations can be compiled, for our purpose the following should suffice :

(i) Repair and replacement of machinery.

(ii) Surface protection.

(iii) Site maintenance.

We will now visualise each of these operations for what the design can do to reduce its cost.

**(i) Repair and Replacement of Machinery Parts.**

There are three major costs factors involved in any repair operation of machinery :

(a) Lost operating time.

(b) Repair labour.

(c) Repair parts and material.

These are supposed to have been listed in order of decreasing importance. There may be difference of opinion in the importance, but let us consider the order to be correct for now.

**(a) Lost operating time**

What factors are involved in the lost operating time i.e. the total time from operative stoppage to start up ?

First someone has to discover that the equipment has stopped, and inform the management. This usually is not time consuming. but if no care has been taken in the design phase to the need for good operator communication, it can take long time. In this age of advanced electronics gagets the poor communica) tion can be attributed to the failure of taking advantage of the existing facilities.

The next is observability and accessability. An engineer should design the equipment in such a way that the 'Breakdown Prove' or Jearout Prone' parts or system should be clearly visible and easily accessible. Much of .lost operating time' can be saved.

**(b) Repair labour**

This will be minimum if the parts used are standard and easily available in the market. The parts should be fitted in such a way that these could be replaced with convenience without involving bulky and costly equipment like welding or so.

**(c) Cost of the repair-parts or repair materials**

This cost is usually minor compared to the downtime and repair-labour. Here the designer can prevent the excessive cost by making sure that he does not design something that has to be made on special order or that is so exotic that original cost cannot be written off in expected productive life. All parts have to be divided by the number of units produced in the life of the part.

**(ii) Surface protection.**

There is an old slogan "Save the surface and you save All". As regards protection of steel structure and perticularly in pulp mill atmosphere, this is the most difficult goal to achieve. The maintenance cost can be reduced by careful preparation of the specification of paints and other coatings on the surface but the ideal will be to reduce the exposed surface itself. We have to select structural shapes and designs to minimise the ratio of surface to strength e.g. A pipe column of 14" outer diameter exposes half the surface to the elements that is exposed in a 14" square conventional column. Also a truss span for a conveyor is much more difficult to clean and paint then a rolled girder span of equal capacity.

**(iii) Site Maintenance**

It is of vital importance for the proper movements of the mobile equipment used. In turn such equipment should be selected which does

not spoil the site excessively. Equipment running on large rubber tires is generally preferred. The valuable drainage structures, ditch crossings, and drainage areas must be protected properly. Fire-protection lines should have adequate cover and hydrants and hose houses mut be well protected and regularly checked. It is very wise to keep an upto date plan of the yard area, showing all underground utilities clearly marked in bright colours for ready reference. The operator can thus easily become familier with the location of all underground facilities, thus decreasing the possibility of accidental damage. The conveyor should be such designed as to spill minimum of logs or chips while handling. All the grounds should be paved and the drainage slopes arranged properly for the operation. In the night a proper lighting system is a must to avoid costly accidents.

**Conclusions**

For more of efficiency and minimum maintenance cost the following vital points must be fully considered :

(i) Design for clear observability and easy accessibility of sensitive parts.

(ii) Optimum material should be used for maximum structural utility.

(iii) Always insist on standard parts and avoid unnecessary trouble of odd hour repairs.

(iv) Remember that any painted surface must eventually be repainted, so design for the minimum surface exposure and save money.

(v) Minimise the noise, water and air pollution for better efficiency of the men who manage the machines.