SESSION 7

Paper No. (a)

OPERATING CYCLES - MAN/MACHINE RELATIONSHIPS

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INTRODUCTION

This paper examines the basics of materials handling and line balancing with particular reference to the logging situation. The materials being handled are trees and logs, and the line balancing relates to the work content within the bush work station, the hauling cycle, skidders, and loader work and how they match one another. To maintain a required level of production at the lowest cost, the bush supervisor should be very much concerned with improving efficiencies and minimising idle time or interference. This is constrained by the machinery he actually has, current gang strength, worker abilities and prevailing conditions. There are many different methods of moving logs from the stump to the truck. These methods vary according to terrain, tree size, tree characteristics, production requirements, environmental constraints and not the least, personal preferences of the gang supervisor.

In a factory situation, line balancing is usually more straightforward. Once set up, the system is more stable. In logging, a whole host of constantly changing circumstances prevail which interfere with any line balancing. The astute bush supervisor will endeavour to adjust his resources of manpower and equipment and modify methods to maintain line balance while retaining his required production level.

LINE BALANCE

The balancing of operations in terms of equal time for work stations and in terms of the time required to meet the desired rate of production is the problem of line balance. It is part and parcel of line production. The desired rate of production should be geared to the output potential of each work station. Perfect balance is rarely achieved even in a factory situation. There is always idle, or interference time occurring. It is often possible for an operator or worker to carry out non-routine jobs during these times. For example, refuelling, maintenance checks, planning ahead, safety aspects.

A good supervisor will ensure that this takes place rather than ineffective or non essential activity being done to pad the available idle time.

METHODS OF GETTING BALANCE

1. Improve the operation.

   Change the method or manpowering at bottlenecks or idle work stations.

2. Change machine speeds.

   This is limited in a logging situation. However machine speeds can be adjusted to some extent either mechanically or different operators

3. Stockpile material.

   This could be advance felling, fleeting or accumulating stems on skids for cutting to log length.

4. Diversion.

   Surpluses from some work stations be put aside, to be brought back in at a later time, eg, lunch break, Saturday's.

MECHANICS OF BALANCING

Balancing a production line involves establishing a relationship among:

(a) The rate of production
(b) The operations necessary and their required sequence
(c) The time necessary to perform each operation and preferably each element of operation.

These become pre-requisites. For the production line to be set up, it must be designed for a required rate of production and for it to operate as a unit, the operation times must allow the material to flow evenly. This necessitates a good appreciation of work content and related methods in each part of the operation. This is particularly so in logging, where awareness of what aspects interfere and either speed up or slow down various stages are a key.

In the factory production line situation, it is possible to fine tune the balance of the production line. We can see this in assembly plants, freezing works or product manufacturers where the operations are strictly sequential and repetitive, and the time to perform each task according to a well defined method is also well-known.

In the logging production line, a whole host of variables prevail e.g.

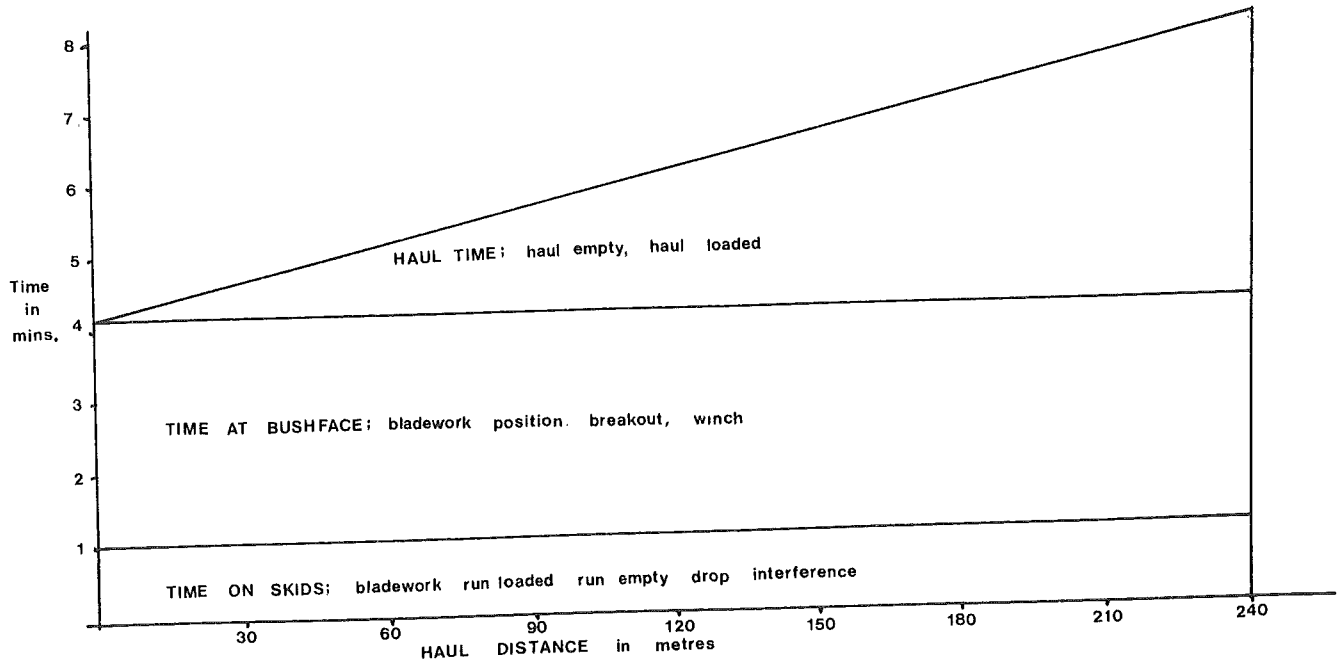
terrain is constantly changing
working conditions change - weather
- wet or dry ground conditions
- underscrub
- logging constraints
tree size and tree form is variable
haul distance changes

All these make it difficult to balance the logging production line for any length of time in detail. Generally the effect of a change of conditions away from a normal or average situation is to incur increased work content at one or more of the work stations which reflects increased delays and waiting (idle time) at all stages. The nett effect is a reduction in daily output.

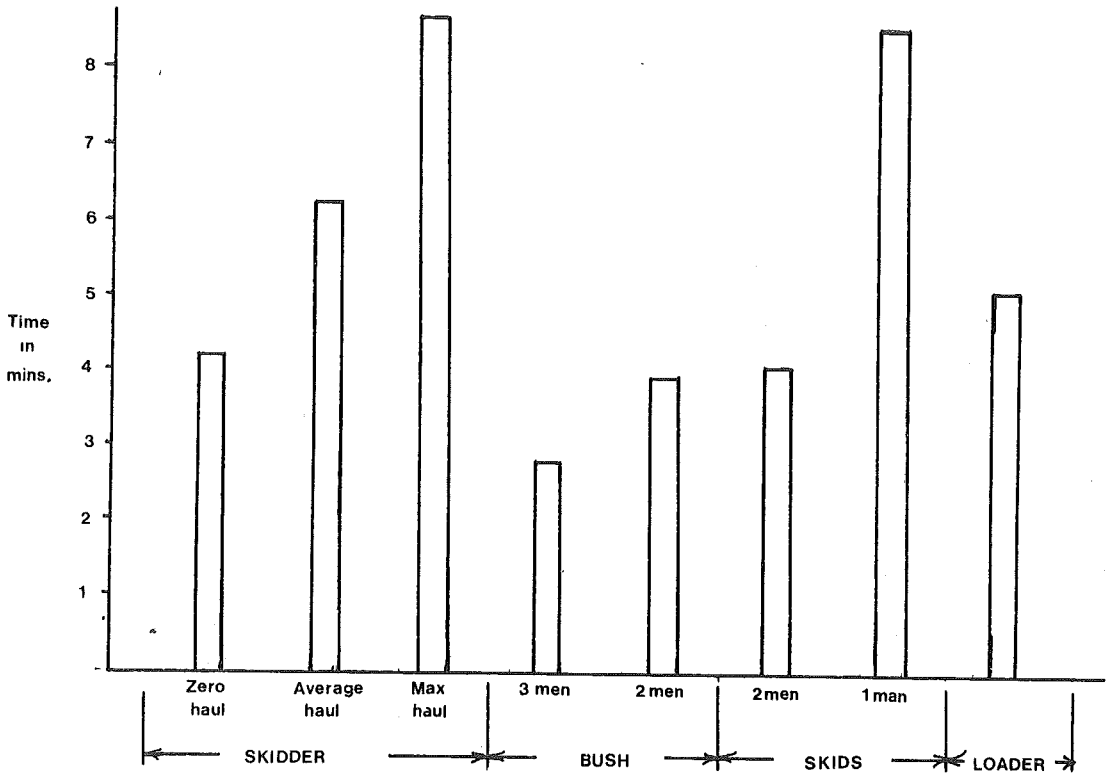
The aspect which has the most noticeable impact or disruptive effect on line balancing in logging is the haul distance. This is constantly changing in a gradual way from zero distance immediately adjacent to the skid to a maximum of 200-300m at the setting perimeter. A skidder speed of .065 min/10m empty and .110 min/10m loaded over a haul distance of 300m means a difference in haul times of 5.25 mins between the shortest and longest hauls. This is all idle or waiting time for everyone else at all the other work stations when the skidder is at maximum haul. In a gang of eight men where one is on the skidder, it follows that more than half a manhour is wasted each drag.

EXAMPLE 1

The following diagram shows graphically the increasing work content for a skidder with respect to changing haul distances.



This changing situation can now be related to the other work stations, i.e. bushwork, skidders, and loader/stacker.



COMMENTS

1. When the skidder is at zero haul distance, a 3 man bush team could complete their work easily for each drag. A 2 man bush team would just manage to prepare each drag in time for the skidder.

2. Similarly a 2 man skid team would be able to keep up but a one man team would delay the skidder and incur waiting time at the bush and with the loader.

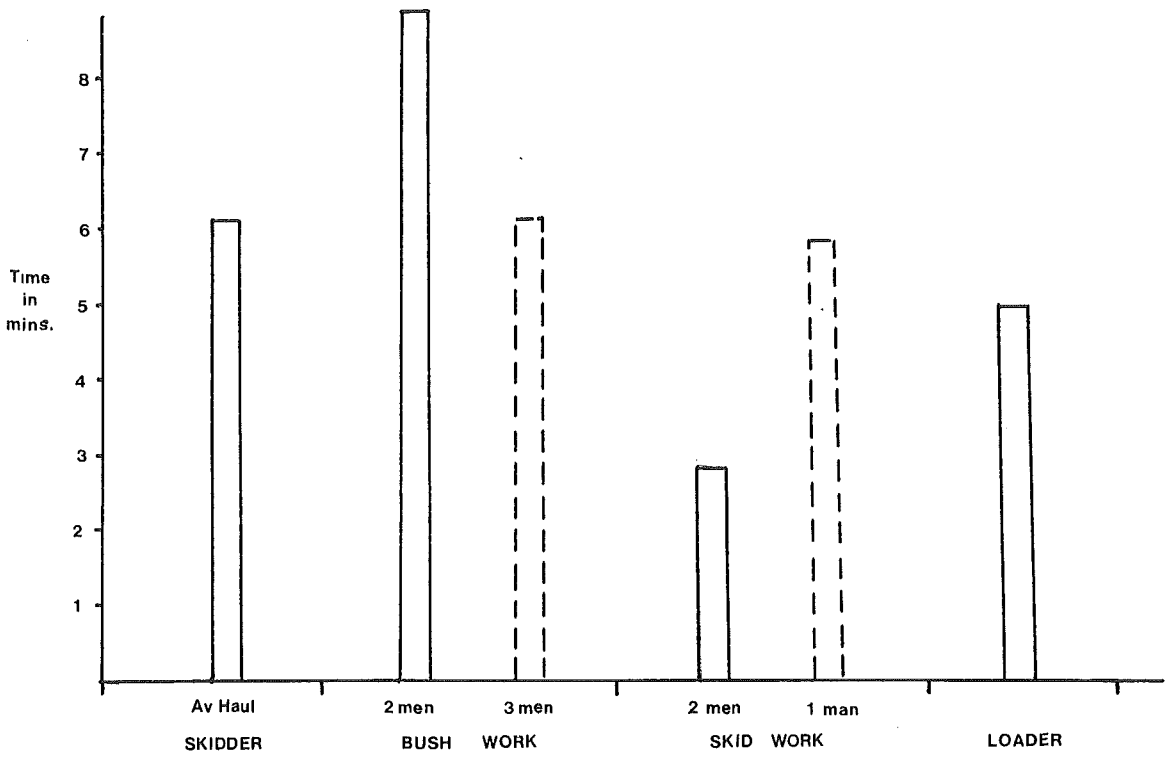
3. The loader would incur delays on the skidder too, at zero haul.

4. At average haul, a 2 man bush team, a 1 man skid team, and the loader would all be able to keep up with the skidder. In fact the total production line would be reasonably in balance.

5. At maximum haul significant periods of waiting time will be incurred by the bush, skids and loader. Even a 1 man bush team could keep up but that is inadvisable from a safety point of view.

EXAMPLE 2

This diagram graphically shows the effect on the skidder, the skiddies and the loader when extra work is done by the bush team. This could be for directional felling, hangups or stream protectio



Comment

1. The total work incurred by the 2 man bush team each drag, now exceeds all the other work stations and significant delays are being experienced by the skidder.

2. The dotted graphs show the effect of taking 1 man off the skids and putting him in the bush. The skidder is no longer delayed and the whole production line is more balanced.

CONCLUDING POINTS

1. The concept of production line balancing is very simple. The astute logging supervisor should be constantly aware of the mechanics of line balancing and be able to regularly adjust his manpower, equipment and methods to compensate for the changes.

2. Because the major equipment within a gang is constant i.e., one skidder and one loader, it is necessary that the manpowering is flexible and that the men are amenable to constant change.

3. The most important aspect which brings about production line imbalance is changing haul distances. As the haul distance increases, the work content for the skidder increases, generating additional waiting time for the bush team, skidders and loader. Adjustments in method such as alternating long hauls with short hauls can ease the

situation.

4. Other situations such as special felling requirements, stream protection, truck/loader interference, breakdowns, absenteeism, and poor methods require regular oversight and adjustment to maintain productivity and the all important daily production target.