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Achieving and maintaining inventory accuracy in a South African Mrp-ii environment

De Freitas, Paulo Jose Felix

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are kept inside a locked warehouse. Other castings, forgings and bar materials are kept in open yards (see figures 8.1 and 8.2).

The warehouse is equipped with eight aisles of standard pallet racking, serviced by three forklifts, and one order picker aisle serviced by two order picker machines. The order picker aisle is used as storage for all accessories and all small pump components. Two forklifts and an automatic band-saw machine serve the yards.

Besides Stores, the Material Handling department also includes the Despatch and the Goods Receiving areas. It is manned by 43 people, most of them in line functions, and a few in staff functions. The personnel in staff functions is involved with various Materials Handling projects and the Cycle Counting programme (see Appendix B for the organisational chart).

8.1 MATERIALS HANDLING PROJECTS

All product types in the warehouse, were initially stocked anywhere, but today the situation is much improved, with all related components located in the same general zone within the warehouse. The advantages of zoning are significant when one thinks of much shorter picking times and distances, (2), and specially, when cycle counting is done by block or area. The project for rezoning the finished components into their pump groups, took one year of part-time work to be completed. Recently, the same project has been done for the rezoning of raw materials in the open yard (see figures 8.1 and 8.2).

Other Projects were implemented with the purpose of organising the workplace or to improve materials handling, where the end result would always lead to higher stock accura

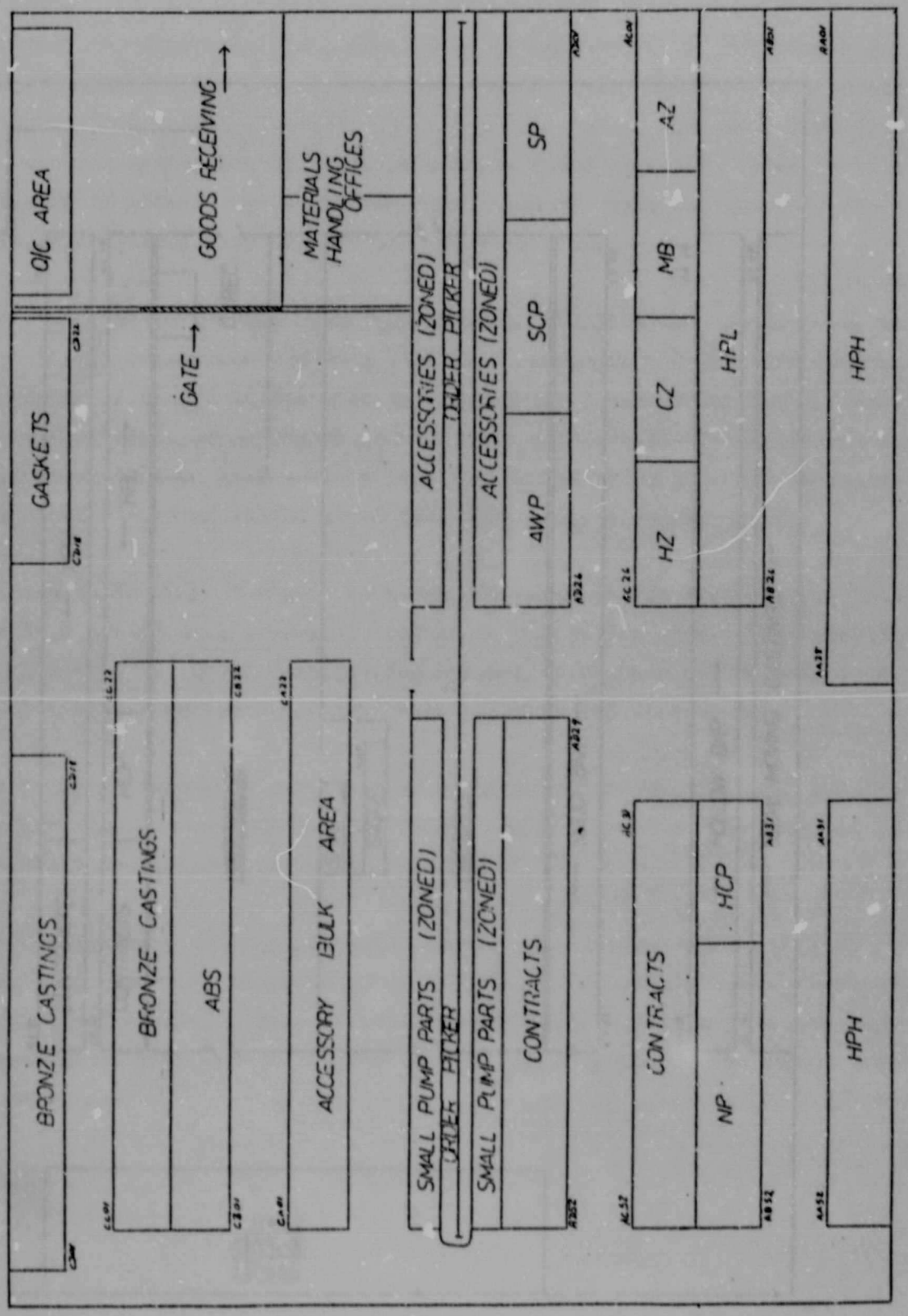


FIGURE 8.1: Warehouse Plan

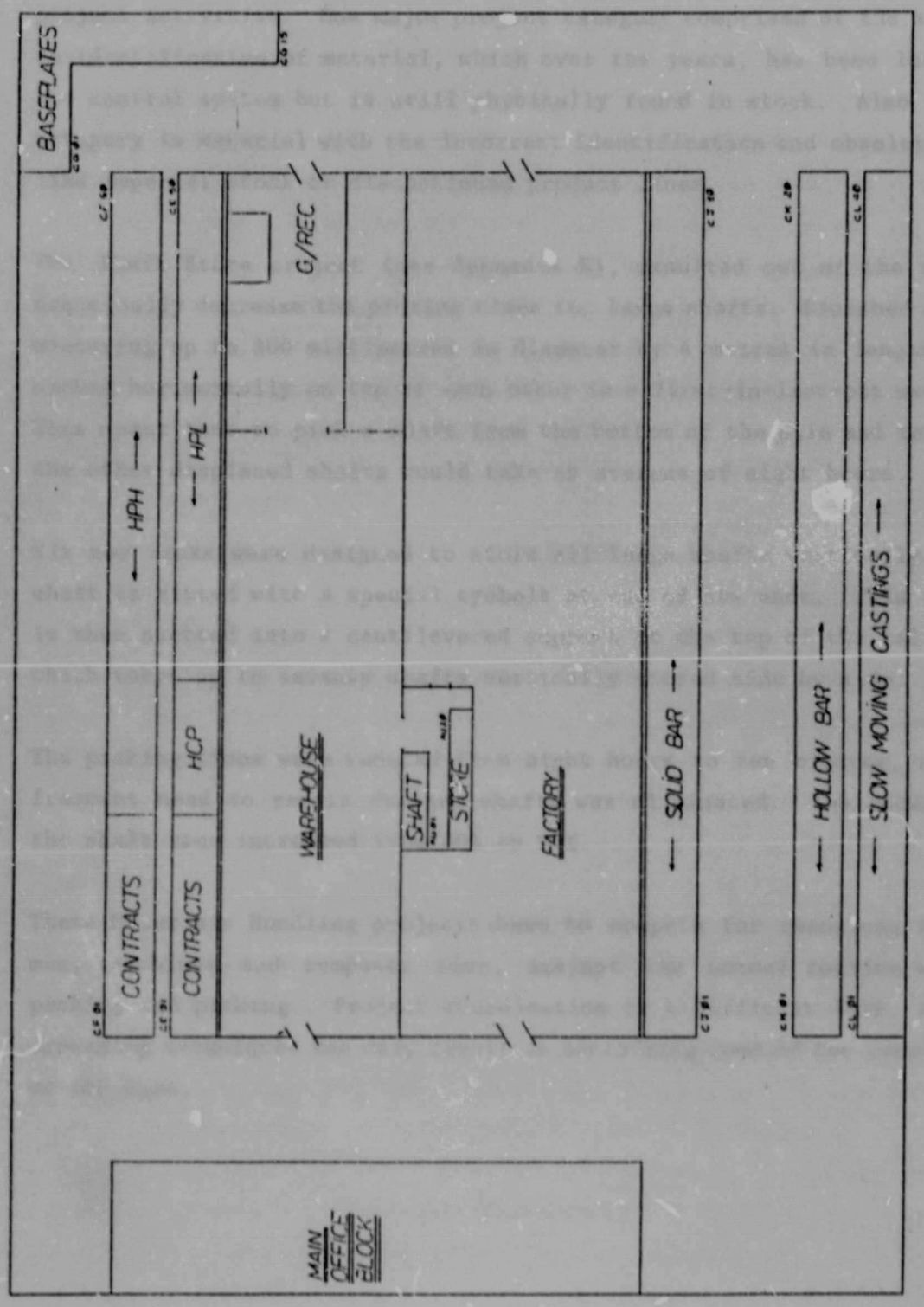


FIGURE 8.2: Open Stock Yard Plan

Appendix E shows the programme, used by the author to coordinate all project activities. One major project category comprised of the accurate re-identification of material, which over the years, has been lost from the control system but is still physically found in stock. Also in this category is material with the incorrect identification and obsolete stock like imperial stock or discontinued product lines

The Shaft Store project (see Appendix E), resulted out of the need to drastically decrease the picking times for large shafts. Finished shafts, measuring up to 300 millimetres in diameter by 4 metres in length, were packed horizontally on top of each other in a first-in-last-out sequence. This meant that to pick a shaft from the bottom of the pile and to repack the other displaced shafts would take an average of eight hours.

Six new racks were designed to store all large shafts vertically. Each shaft is fitted with a special eyebolt at one of its ends. This eyebolt is then slotted into a cantilevered support at the top of the tall rack, which takes up to seventy shafts vertically stored side by side.

The picking times were reduced from eight hours to ten minutes, and the frequent need to rework damaged shafts was eliminated. The accuracy of the shaft zone increased from 69% to 95%.

These Materials Handling projects have to compete for resources such as men, machines and computer time, against the normal routine work of packing and picking. Project coordination is a difficult task, as compromising techniques can only result in *satisfying some of the people some of the time*.

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9.0 TOOLS FOR A CYCLE COUNTING PROGRAMME

In chapter 7, section 7.2, under "Allocation of Responsibility", several reports, such as the cycle counting programme and the accuracy bar charts, were mentioned. These reports, and others, which fall under the responsibility of the cycle counting team, will be presented and analysed. All the reports that are to be discussed, were drawn up by the author to suit his specific operations, but their purpose is universal and should be used as "management tools" in the continuous task of cycle counting.

9.1 THE CYCLE COUNTING PROGRAMME

Figure 9.1 shows a chart which is used for scheduling counts for each area, since counting is done by geographical areas. The horizontal scale on top represents time in weeks, which in many industries is the most common unit of time used for planning. Planners often say that an item is due to arrive in week 8, rather than at the "end of February".

A count is done once or twice a week, although initially up to three or four counts had to be done weekly. As soon as the accuracy improves, the number of weekly counts decreases.

The cycle counting programme drives two people, firstly the auditor who knows when and where the next planned count is taking place. This is shown graphically by the symbol . Secondly, it drives the cycle counting reconciler or the reconciliation team. The symbol , shows when the task of reconciling the errors that were found during the cycle count, must be completed.

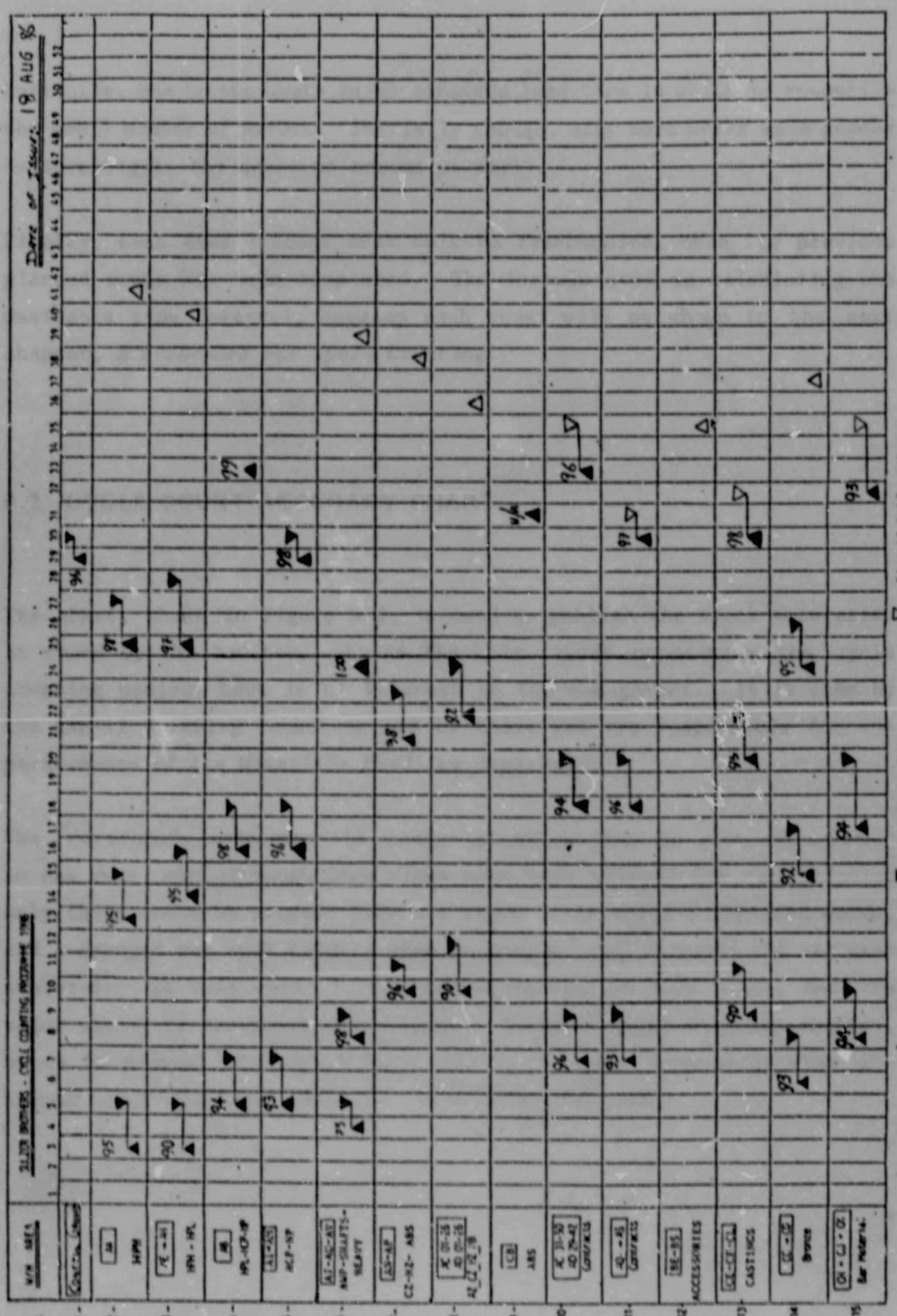


FIGURE 9.1: Cycle Counting Programme

Currently, one to two weeks is an adequate lead time in which to reconcile the small number of errors. Initially though, many more weeks were needed to investigate the cause of errors properly.

Finally, each area's count must only be rescheduled, once its previous planned count has been completed. The formula used in calculating the desirable time interval, between each count will be shown in the next chapter, *A Framework for Cycle Counting*.

9.2 CYCLE COUNT ACCURACY CHART

The chart, shown in figure 9.2, is used to publish the stock accuracies as found by the auditor. It is the only report concerning the cycle counting project that is of interest to top management. It is used by the MRP-II steering committee and by those who are responsible for the performance of the Materials Handling department.

The "coverage", indicates the number of times that an area was counted in one year, and although five times have been allowed for, in practice only three would be needed. Like a picture it is worth a thousand words, and a manager can spot trouble when he sees a "low" like the 75% for area number 6. In this case, a thorough investigation took place, and the major causes of error were identified. Remedial steps were implemented, so as to prevent the same errors from recurring. Eventually when the second count was done, the reported accuracy was 98%.

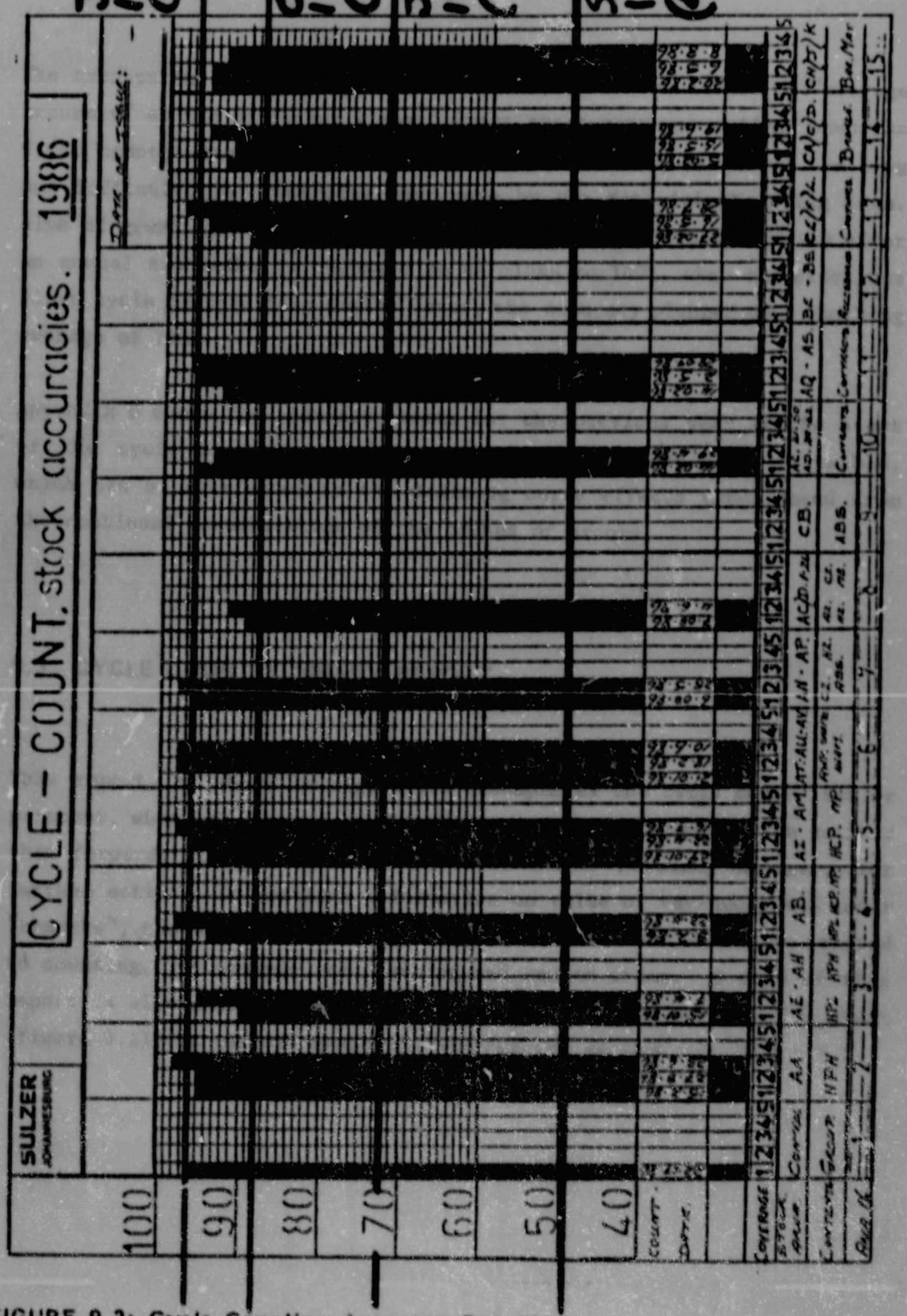


FIGURE 9.2: Cycle Counting Accuracy Bar Chart

The transparent film lying over figure 9.2, shows the levels of "average accuracy" at the different times. Great excitement was evident when the first counts with 90% accuracy were appearing, as a result of the long and difficult, yet rewarding work done by the Materials Handling team. Also of great interest is the fact that although the stock accuracy after an annual stocktake is supposed to be close to 100%, when the stock was first cycle counted four months later, the accuracy plunged to a shocking average of 72%.

Appendix D shows the accuracy charts for the previous year at the start of the cycle counting programme. Accuracy leaps are clearly visible, which can be attributed to the learning curve effects experienced from the continual rectification of the causes of errors.

9.3 CYCLE COUNT SUMMARY REPORT

This report, as shown in figure 9.3 accompanies the cycle count list or printout, where the errors are highlighted after each count. The auditor then forwards these documents to the Materials Handling manager, for further action. It contains information on value of variances and under "remarks", the auditor suggests actions on issues not directly related to counting, for example, bad packing and rusted items. A copy of this report is also distributed together with a copy of the accuracy bar chart (figure 9.2), to various heads of departments, as shown in figure 9.3.

SULZER BROS (SOUTH AFRICA) LTD.

SULZER

No. REF 17/86

Johannesburg.

From: CYCLE COUNTER Dept:

WH REF. 3

CYCLE COUNTING SUMMARY REPORT

LOCATIONS: AE 11 TO. AH 80 GROUP: AWP/SC/HP

Date: 7/4/86

Number of items counted: 566

Number of items incorrect 31

Number of items correct: 535

Percentage correct: 95%

Percentage error before reconciliation: 5%

Previous count: 40%

Participants/Distribution:

MATERIALS MGR.

MATL. HANDLING MGR.

STORES MGR.

Week:..... Count No: 2ND

Item	Text	VALUE
1	Physical balances LESS than computer.....13.....	- R 2087
	Physical balances in EXCESS of computer ..15..	+ R 2022
	(+/-)Deviation	- R 65
2	Material physically found - not on computer: 3	R 1143
3	Location Errors: NIL	

REMARKS:

FOUR ITEMS WERE INCORRECTLY MARKED BY INSPECTION.

All errors highlighted on 2nd count list.
Total reconciliation value: ..... R 1210

Copy to: GENERAL MANAGER
PLANT MANAGER

Enclosures: Graph Report

FIGURE 9.3: Cycle Counting Summary Report

9.4 RECONCILIATION FEEDBACK REPORT

As the name implies, the main purpose of this report done by the reconciliation team, is to provide feedback to the Materials Handling manager about all the causes of errors.

Figure 9.4 shows how the report can be presented. The most common causes of error are listed and have quantities and percentages entered against them. For each of these classes of errors, various comments can be given under the section called "remarks". Notice that the objective here, is to be able to pinpoint the most common error group and to furnish the names of those individuals directly responsible for the errors. Initially, this course of action is not to punish people, but rather to train them, again and again if necessary, until negligence is established.

9.5 STOCK ADJUSTMENT VOUCHER

This voucher,shown in figure 9.5, is filled in by the reconciler and then given to the Materials Handling manager, together with the Reconciliation Feedback Report. This voucher contains all errors which have not been reconciled. In other words, no evidence was found as to the reason for the errors behind these stock records, as far as the reconciler can ascertain.

The reconciler's efficiency can be determined from this report, since the number of entries also represents the percentage of errors which he could not solve. Therefore, a target for solved errors, say 80%, should be set for the reconciler. The voucher is then used to measure his efficiency level compared to the set 80%.

SULZER BROS (SOUTH AFRICA) LTD.		No. REF: /	Johannesburg. From: RECONCILER Dept:
WH. REF.	RECONCILIATION FEEDBACK REPORT LOCATIONS:_____ TO _____ GROUP_____		Date:

	QTY	%	TO: MATERIALS HANDLING MGR.
1. NUMBER OF CYCLE COUNT ERRORS			
2. NUMBER OF ISSUES NOT TRANSACTED			
3. NUMBER OF RECEIPTS NOT TRANSACTED			
4. NUMBER OF ITEMS WITH INCORRECT LOCATION			
5. NUMBER OF ITEMS UNIDENTIFIED			
6. NUMBER OF ITEMS FOUND, BUT NOT ON COMPUTER			
7. NUMBER OF ITEMS NOT FOUND, BUT ON COMPUTER			

Item	REMARKS	Action by

Copy to:	Enclosures:

FIGURE 9.4: Reconciliation Feedback Report

This technique ensures that the reconciler does not just give up on a problem, but persists in finding the causes of errors, thereby increasing managements' knowledge of leaks in the integrity of the inventory records.

The main use for the voucher, though, is to determine the value of stock that must be adjusted, in order to avoid these errors from being carried through to the next cycle count. In a company that is conscious about money, stock adjustments must not take place, unless they are absolutely necessary. Furthermore the adjustments must only be done by the Materials Handling manager, who is solely accountable for them.

After determining the value of the adjustments for each count, the manager must then correct them, or alternatively, if the total net value is greater than the allowable "ceiling" of say R5 000 per week, he must submit the voucher to his superior for approval.

No: _____ STOCK RECONCILIATION VOUCHER DATE __/__

	ARTICLE NUMBER	QUANTITY +	QUANTITY −	DESCRIPTION	LOC.	REMARKS	CYCLE COUNT REPORT NO	UNIT VALUE / TOTAL R
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								

	+R	−R	ΔR
Σ			
$\Sigma_{cum.}$			

REQUESTED BY _____ AUTHORIZED BY _____

FIGURE 9.5: Stock Adjustment Voucher

9.6 MONTHLY TROUBLE-SHOOTING MEETING

As a means of determining major error trends, individual feedback reports are not sufficient, so every month a meeting must be held to diagnose trends of inaccuracies common to a number of errors.

Everyone is involved and is given a chance to explain why their areas show these inaccuracies. They are also encouraged to propose methods for preventing these errors from recurring.

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10.0 A FRAMEWORK FOR CYCLE COUNTING

Although much has been written about cycle counting, little attention has been paid to giving the inventory manager real guidelines outlining just how much to cycle count and what intervals of time, in order not only to increase inventory accuracy, but also to evaluate the inventory system's integrity.

This chapter provides a framework which enables the inventory manager to reach preset accuracy goals, while balancing the cost of more cycle counts with the costs of analysing causes of error.

This framework is a summary of an article written by Parley S. Neeley of Ford Aerospace and Communication Corporation, which earned him the "Production and Inventory Management Best Article Award" at the 27th Annual International Conference held in Las Vegas(5).

After having read the article one year ago, the author immediately implemented the framework to his Cycle Count programme. It has since been proven to be a reliable formula for determining the number of counts needed over each area and the time gap that should be drawn into the programme until the next count on that area is due (see Figure 9.1).

10.1 FORCES ACTING WITHIN THE INVENTORY MANAGEMENT SYSTEM

Inventory systems will always accumulate errors over a period of time, specially if counter measures like cycle counting do not exist. If inventory accuracy is plotted against time, the graph will look like the one in figure 10.1.

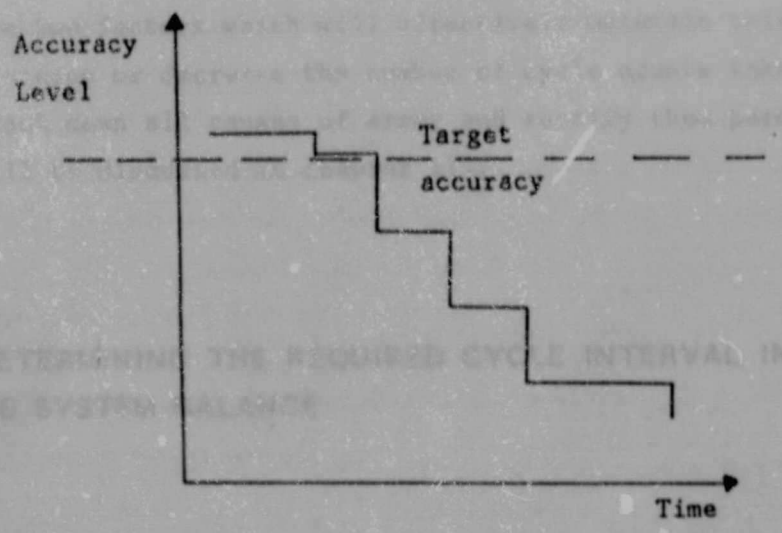


FIGURE 10.1: Accuracy Level Versus Time,(5).

Therefore, the sources of errors in the system tend to force the inventory accuracy down, while the opposing forces of cycle counts are pushing it up. Thus a balance must be reached between those two forces, such that the plot of accuracy levels versus time is maintained at a constant flat level, which in this case, is the level dictated by the MRP requirements of 98% (see Figure 10.2).

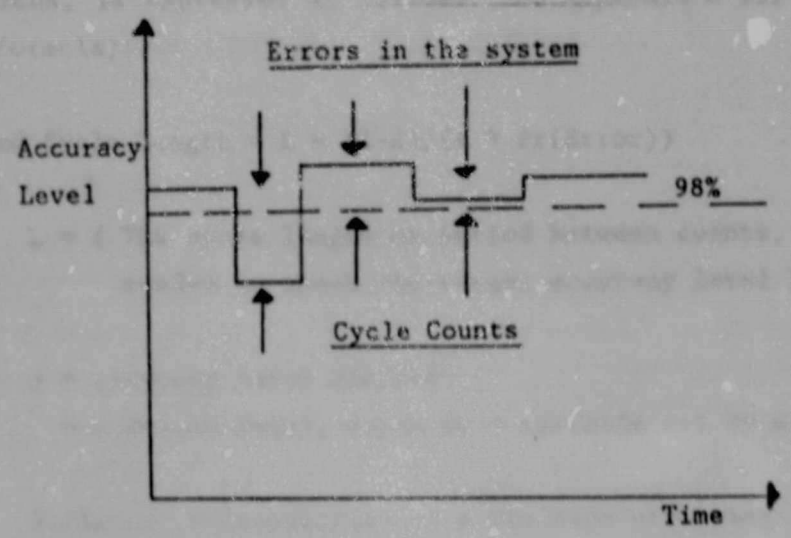


FIGURE 10.2: Ideal Balanced System,(5).

There are two factors which will effectively maintain this balance:

- Increase or decrease the number of cycle counts taken each day or week.
- Track down all causes of error and rectify them permanently (this will be discussed in chapter 11).

10.2 DETERMINING THE REQUIRED CYCLE INTERVAL IN ORDER TO ACHIEVE SYSTEM BALANCE

The first action mentioned above, corresponds to adjusting the probability that a variance in inventory records will be correct - that is, the more often counts take place, the higher the chances of catching a record in error and correcting it.

The second action, decreases the probability that a variance in the inventory records will occur during the cycle interval - that is, by correcting the cause, the error will not reappear.

The formula that calculates the required cycle length that will balance both forces, is expressed as follows (see appendix C for the derivation of the formula):

Required Cycle Length = L = (1-A)/(A * Pr(Error))

Where: L = (The cycle length or period between counts,
needed to reach the target accuracy level)

A = Accuracy level desired
= (Target level, which is a variable set by management)

Pr(Error) = Probability of a variance occurring
= (The chance that a part will lapse into
error (variance) during a given period)

10.3 ILLUSTRATION OF THE USE OF THE FORMULA

Take, for example, the typical cycle count summary report, shown in figure 9.3 of the previous section, where that data is as follows:

Number of Errors = X = 31

Time elapsed since last cycle count = Y = 11 weeks
(previous cycle length)

Number of items counted = Z = 566

So Pr(Error) = (X/Y)/Z = (31/11)/566 = 0.0049

and for a target accuracy level of 98% (0.98)

then "required cycle length" = L = 4 weeks

10.4 SETTING THE REQUIRED PARAMETERS

Accuracy level desired

If the cycle count programme has just been started for the first time, than the present accuracies may be as low as 60%, specially if the last annual stocktake was done one year ago. It would be ridiculous to set your target immediately to 98%, since the formula will just tell you to recount everything on the next day.

Unless you have many cycle counters and the accompanying resources such as time, this is not a practical approach.It is therefore suggested that

the target for the desired accuracy be set at around 80% and then from here increase the target in reasonable steps, every time an area is re-counted, until the desired accuracy has been reached according to the cycle counting method in use.

For a cycle counting method done according to the ABC classification, then use the following accuracy targets:

- 100% for "A"-class items - (expensive items cannot be allowed to be in error).
- 98% for "B"-class items.
- 95% for "C"-class items.

For a cycle counting method done according to stock types, then use the following accuracy parameters:

- 98% for finished goods and raw materials.
- 95% for accessories.

Probability of error, Pr(error)

Pr(error) can be expressed as:

$$\Pr(\text{error}) = \frac{(\text{Number of errors})/(\text{time lapsed since last count})}{(\text{total number of items counted})}$$

For the first time cycle counting is done, there is no way of knowing what the rate of error is, per week or per day, unless there is some kind of historical data available. So, either one estimates this probability for

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