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High volume materials distribution and control in the beverage and food industry in the Republic of South Africa

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The results found showed that it is definitely not worth the effort involved to try and route the trucks over distances that are shorter than the distances already travelled.

The most likely reason for this result is that these routes have been travelled by the distribution drivers over a period of several years. During this period the drivers themselves have established a network of the shortest routes possible.

5.7.3. Conclusion:

Unless the distributor has easy access to computer facilities attempts at establishing theoretical minimum routes is not worth the man-hours involved. Should, however, such facilities be freely available, a small improvement in the distances travelled could be made.

Various standard algorithms such as the travelling salesman algorithm could be used for this purpose (ref. 11).

(See chapter 5.15. for computerised distribution systems).

5.8. DEVELOPMENT OF AN ALGORITHM FOR LOADING, ROUTING AND SCHEDULING:

5.8.1. Using the Control Charts:

Once reliable set of control charts have been set up

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(see Figs: 5.6.2. and 5.6.3.) one can begin to load the available vehicles.

The maximum load on each truck is restricted by the weight and volume of those products (see ref. 18 for truck regulations and Fig: 2.8.5. for a diagram of an A frame truck).

As most trucks are palletised (see Fig: 2.8.5.) it is a fairly simple operation to actually load/off-load the truck - this being done by a forklift.

5.8.2. Determining each truck's load and route:

The following is a set of rules developed by the author for the loading of each truck. The rules were derived from the simulation of several weeks dry runs and it was shown that by following this set of rules maximum utilisation of the truck could be made for each route.

Rules for the loading of a vehicle:

Step 1 Identify Outlets - Each outlet must be identified by its:-

Position on a map
Mean average demand per drop
Method of payment
Loading facilities
Type of road
Preferred time of delivery
Urban/rural area

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FIG: 5.8.1.

A TYPICAL CUSTOMER CARD

CUSTOMERS NAME ADDRESS:		Account No.
MEAN SIZE DROP CASH OR CREDIT LOADING FACILITIES TYPE OF ROAD ROUTE NO. PREFERRED DELIVERY TIME URBAN OR RURAL AREA		CODE

Fig: 5.8.1. shows a typical customer card used for the purpose of recording the above information.

Distances between all outlets in a specific area or zone can then be set out in table form (see Fig: 5.7.1).

The initial work in collecting the information in Step 1 is fairly great but is needed if a controlled distribution program is to be undertaken.

Step 2 All large drops should be kept together.

This is because labour for your truck should be sized according to drop size (see Fig: 5.4.5.) and large trucks are better suited to large drops.

Step 3 If mean of drops is below 5 cases use 0 helpers
If mean of drops is below 15 cases use 1 helper
If mean of drops is below 50 cases use 2 helpers
If mean of drops is below 100 cases use 3 helpers
If mean of drops is above 100 cases use 4 helpers.

These figures were developed for deliveries of soft drinks in a typical semi-urban area (see graph 5.4.5) and should only be looked at as a rough guide. Each individual distribution centre would need to develop its own manning details.

At present most distributors in South Africa assign a constant labour force to their trucks. This practice is extremely wasteful as with small deliveries most of the time is spent on administration and thus the helpers are idle.

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Step 4 Keep trucks going to congested urban areas as small as possible.

Step 5 Attempt to load all trucks to their maximum capacity. If this cannot be done try using a smaller truck. Always begin loading on the largest trucks. Smaller trucks should be used for the routes and outlets "left over".

Step 6 Check number of empties to be returned, do not exceed the number of empty spaces allowable on the returning truck, if this occurs Step 5 will need to be redone.

Keep trucks away from congested areas between 6 am - 9 am and 3.30 pm - 6.30 pm.

Step 7 Check customer cards for delivery time restrictions.

Step 8 Check if truck type is suitable for the road type. Attempt to keep driver/labour constantly to a specific route. This is because the driver becomes familiar with the various customers, their problems and idiosyncrasies.

Remembering the information collected, route the vehicles via the shortest route.

Step 9 Attempt to utilise the whole working day and minimise all overtime.

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5.9. FURTHER STEPS TO REDUCE DISTRIBUTION TIME.

5.9.1. Driver's Administration:

Driver's administration made up to 13% of the total time involved at each drop (see table 5.4.4.). This could be reduced by:

5.9.1.1. Purchasing calculators for the drivers to increase the efficiency of adding, multiplying etc.

5.9.1.2. Making sure the drivers can always phone through to headquarters if a problem should develop.

5.9.1.3. Trying to ensure that the driver's crew is constant to make giving instructions easier.

5.9.1.4. Installing drop safes in the trucks so that the driver need not carry a large amount of cash and cheques with him.

5.9.1.5. Giving the drivers explicit instructions as to which empty products and crates are returnable and which are not.

5.9.2. Drivers helping to do physical loading:

By making full use of the driver during larger drops to help the workers on the truck to sort bottles and load the truck some considerable savings could be made.

5.9.3. Parking:

By making sure the driver can handle an articulated delivery vehicle properly considerable savings in time can be made.

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5.9.4. Several administrative personnel:

By training some of the driver's helpers to assist in the administration more than one outlet can be serviced from a single truck at one time. This is especially useful in central urban areas where outlets are very close together.

5.9.5. Fixing the route:

Keeping the driver's route fairly constant has the following advantages:-

5.9.5.1. The driver becomes familiar with the modus operandi of the outlet.

5.9.5.2. If the driver makes a promise he must keep this promise as he will be confronted by the outlet the following week.

5.9.5.3. Outlets tend to object to changing of drivers.

5.9.6. Sending second loads to the point where the driver has completed his first load.

This is a very good idea as it allows for a less educated driver to be used merely to shift the truck to the final delivery point of the trained driver's last drop of his first load. Considerable time is also saved because the driver does not have to return his truck to base.

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5.10. FLEET FLEXIBILITY:

Already it has been determined that large drops need a large labour force. By grouping the large drops together, thus allowing full use of the large labour force, it is also necessary to use a large delivery vehicle.

Similarly a series of small drops will be best handled by a small vehicle. This again emphasises the need to use small trucks for small deliveries. Furthermore, central urban area deliveries necessitate much smaller vehicles because of manouverability problems.

As a typical beverage distributor deals with a full range of deliveries (small and big) a similar full range of delivery trucks are needed. Trucks of 5 to 50 tonne payloads (4 pallet to 22 pallet) should thus be used to make up a distribution fleet. The mix of trucks will be made up according to the individual outlets sales data and operational area.

5.11. INCENTIVES - TO IMPROVE DISTRIBUTION:

The time study method of controlling the trucks also gives an ideal basis for incentive schemes. It should first be pointed out that drivers and their helpers should never be paid incentives for performing their normal daily duties. The first aim of the incentive scheme should therefore be to develop a method of justly determining the amount of work the driver and

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his helper have done above their required work level.

Both the driver and helpers should be on the same incentive scheme. This will prevent the helpers slowing down the driver and vice versa.

To overcome law complications which do not allow for a bonus system if no overtime is paid, it is necessary to guarantee that your bonus will be equal to or greater than the amount of overtime incurred.

With the implementation of the time control systems one can now easily rate the drivers/helpers and therefore pay incentives.

Incentive schemes can also be introduced on sliding scales that increase with the number of trips per day (to encourage drivers to return quickly to the factory). This system works well but with the time control method this should not be necessary.

Other good incentives include the selection of a driver of the month and a helper of the month. This type of award, (e.g. badge, blazer or tie) that is mainly aimed at status consciousness, has very good effects and can be used very well.

5.12. THE PERFECT TRUCK:

If one wants to obtain the maximum utilisation from one's distribution fleet, it is essential that the shape

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and size of the truck is correctly chosen. In view of the findings of the Driessen Reports, it has recently become even more important to chose the correct size vehicle.

Fig: 5.12.1. shows the basic limits allowed by law (ref. 18) for a distribution vehicle.

Furthermore, practical limits, loading zones and manouverability in congested areas reduce the size of town vehicles considerably. Haulers can, and should, however be used to their full capacity. In the case of delivery vehicles the ability to pick the required product off the truck for each customer is very important and it is thus not possible to use all the allowed space for stacking.

Fig: 5.12.2. shows a typical A frame delivery truck. The A frame truck has become universally accepted for customer deliveries. It offers the following advantages:-

Easy order picking.
Quick forklift access for loading/offloading i.e. fast turnaround.
Fairly stable load.
Easy case sorting in the trade.
Easy checking.

Disadvantages:

Approximately 30% of the volume wasted by A section of A frame.

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FIG : 5.12.1

MAXIMUM DIMENSIONS ALLOWABLE BY LAW

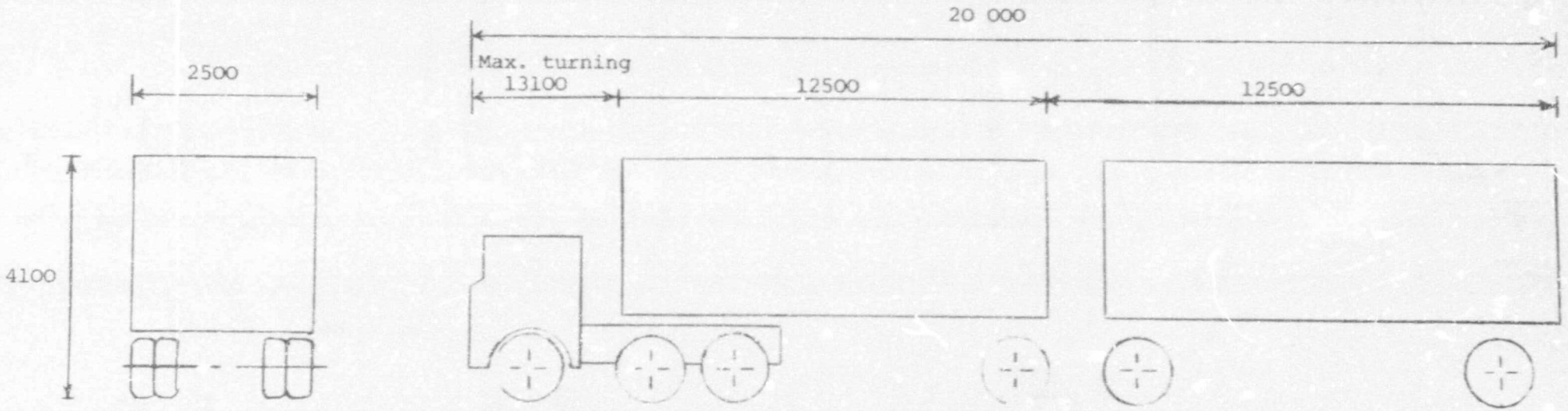
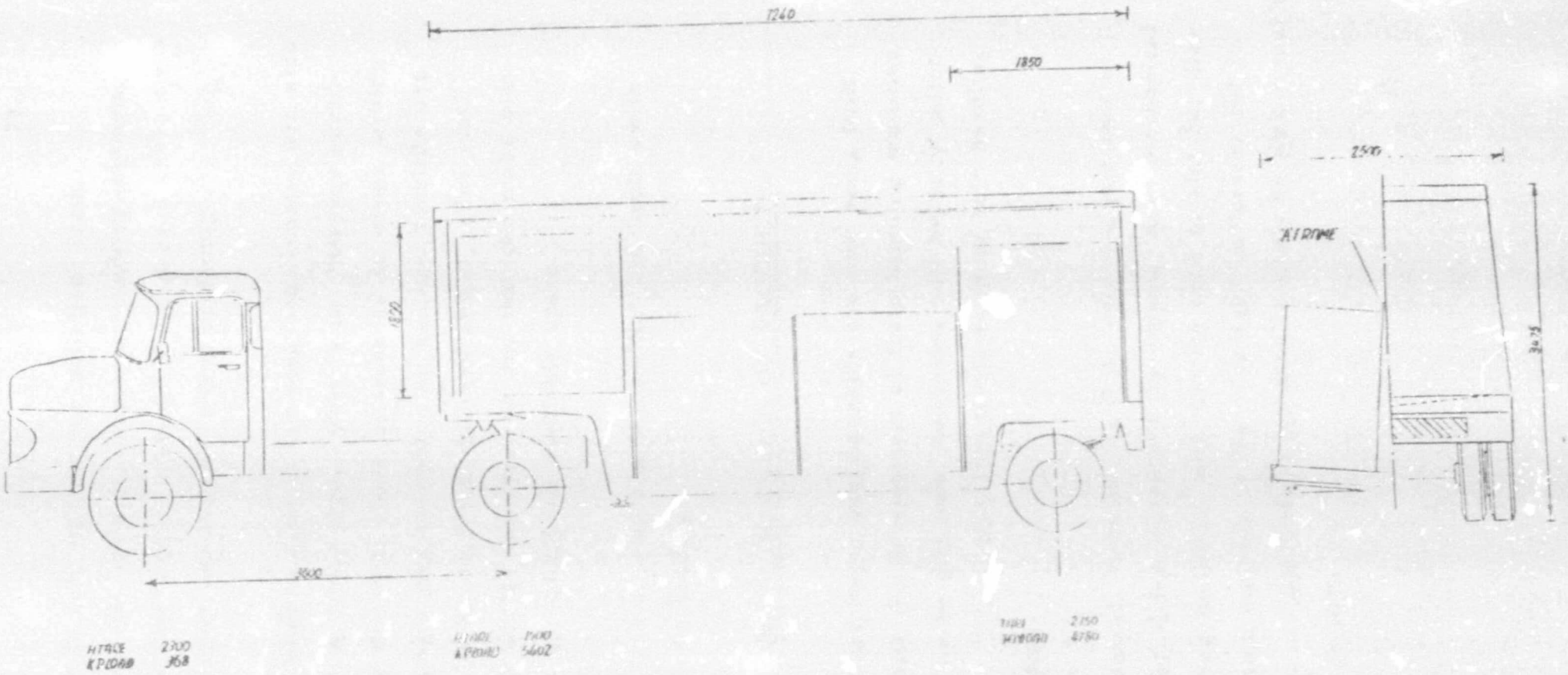


FIG : 5.12.2

EIGHT PALLET HAULER



Truck is only suitable for palletised loads.
Not suitable for fully automatic handling methods.
Loads can become unstable if not packed correctly - which may cause a great deal of damage.

Most haulers used in the beverage industry are also of the A frame type. This is not however necessarily the ideal shape of truck as no order picking advantages are necessary on haulers (forklifts are used on dispatch and delivery sides). The ideal hauler should therefore be one that can make maximum use of all the available space.

Fig: 5.13.3. shows a typical flat bed hauler with automatic loading.

5.13. MECHANICAL HANDLING OF PRODUCTS:

More and more supermarkets are now being built, and with the development of their handling facilities it is likely that their deliveries will be fully palletised. This means the development of bulk handling facilities.

At present, however, in S.A. only ± 2 per cent of all soft drink customers (by volume) have mechanical handling facilities, and thus we need to aim our distribution methods at the "average" customer, but in the future mechanical handling is likely to play a much greater part.

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The following are some likely developments in the area of mechanical handling of product to the customer.

5.13.1. The layered pallet:

Fig: 5.13.1. shows the system of the layered pallet. Here the standard case of product is completely eliminated and the product is delivered directly to the consumer in its final display form. Empties can be repacked on the layered pallet and the entire container returned to the factory.

Unfortunately, due to the weakness of the screw type thread on soft drink bottles there is a limit to the height to which one can pack the product.

5.13.2. Automatic materials offloading - The Omega System:

Due ot the high cost of labour, automatic systems of order handling have recently become very popular in U.S.A.

Fig: 5.13.2. shows the operation of the Omega type system.

Each cage shown here is a ready made up order for a particular customer.

The main disadvantages of the Omega system are:

Customer must have compatible loading ramps.

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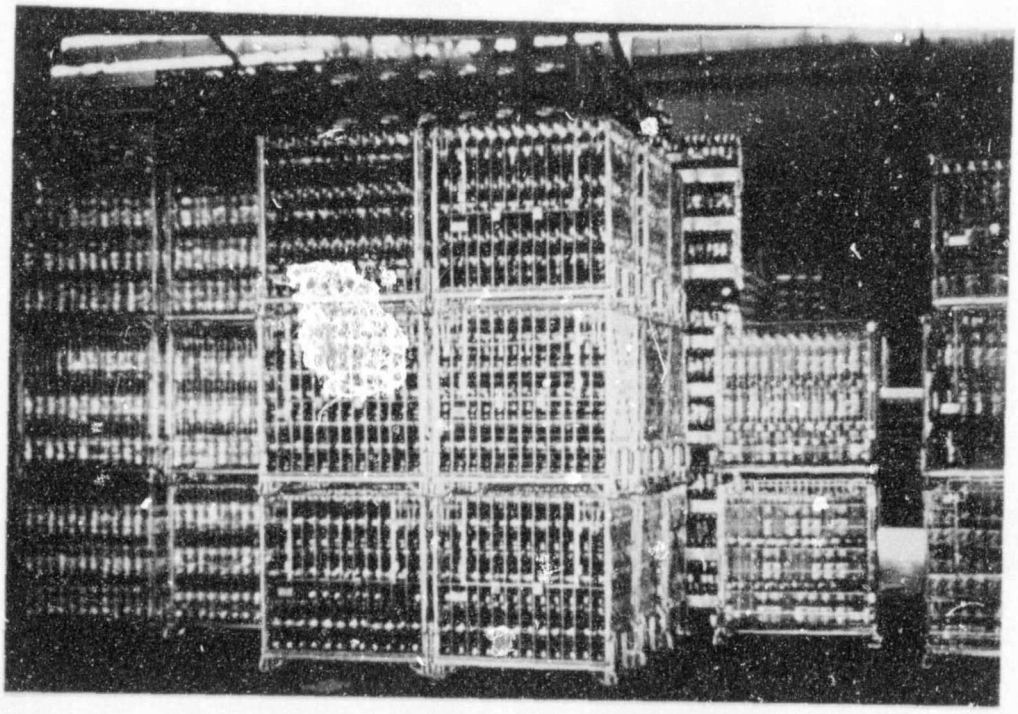
FIG: 5. 13. 1.

LAYERED PALLETS IN A FACTORY WAREHOUSE (FRANCE)



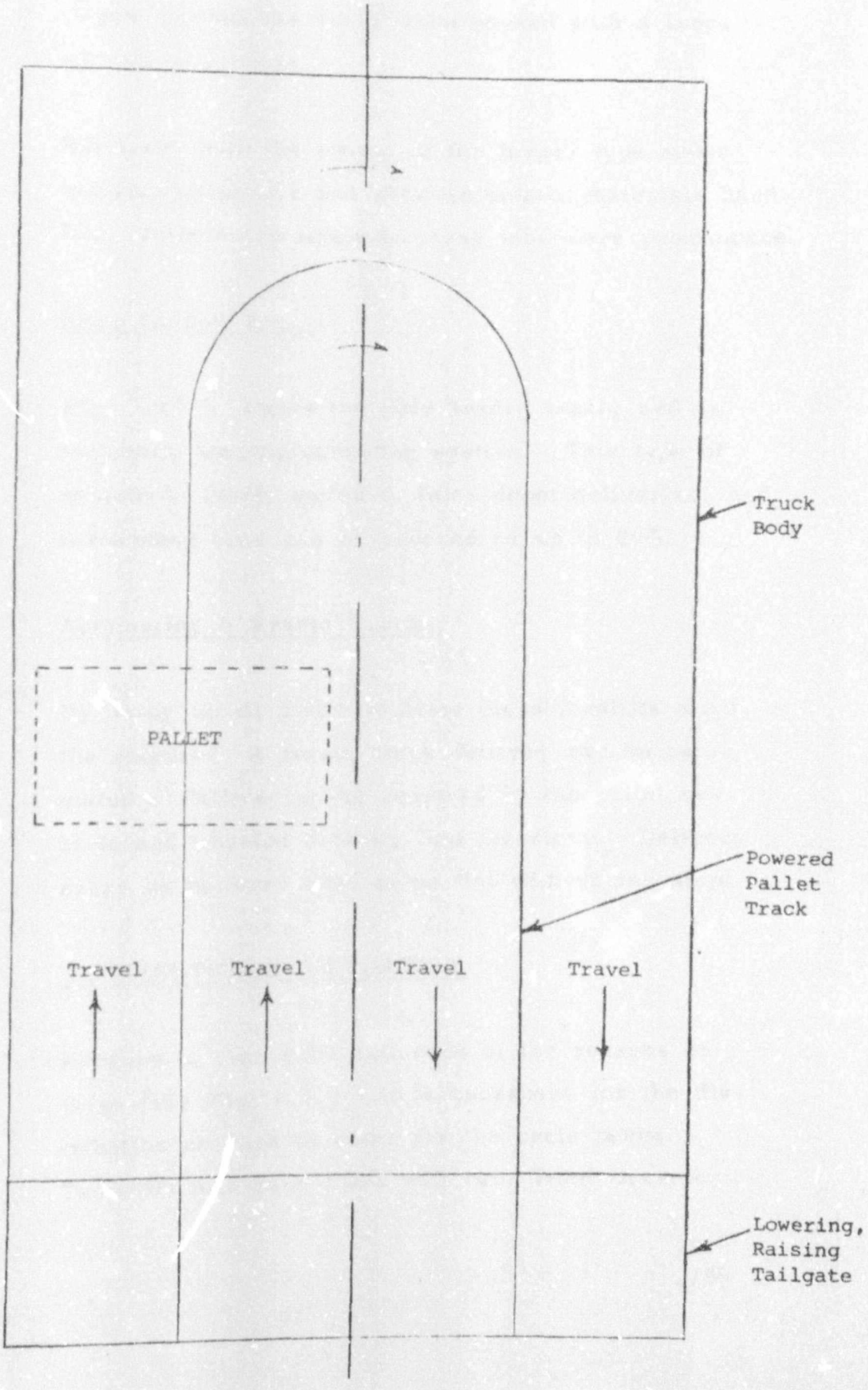
FULLS READY FOR SUPERMARKET



SORTING RETURNING EMPTIES

FIG : 5.13.2

THE "OMEGA" SYSTEM
OF PALLET HANDLING



Orders must be extensively pre-made before delivery. Very small customers (5 cases) are difficult to handle. Cages become too heavy when packed with a large amount of product.

However, with the advent of the larger type supermarkets automatic and semi-automatic materials handling systems are likely to come into more prominence.

5.13.3. Rear Loaded Truck:

Fig: 5.13.3. shows the rear loaded truck, and an automatic loading/unloading system. This type of vehicle is idealy suited to inter-depot deliveries, and turnaround time can be reduced by up to 80%.

5.13.4. Automating A Frame Trucks:

By using small pallet vehicles (hand forklifts etc.) the standard A frame truck delivery can be automated. Pallets can be removed by the pallet vehicle and wheeled directly into the store. Delivery areas do however need to be flat without any steps.

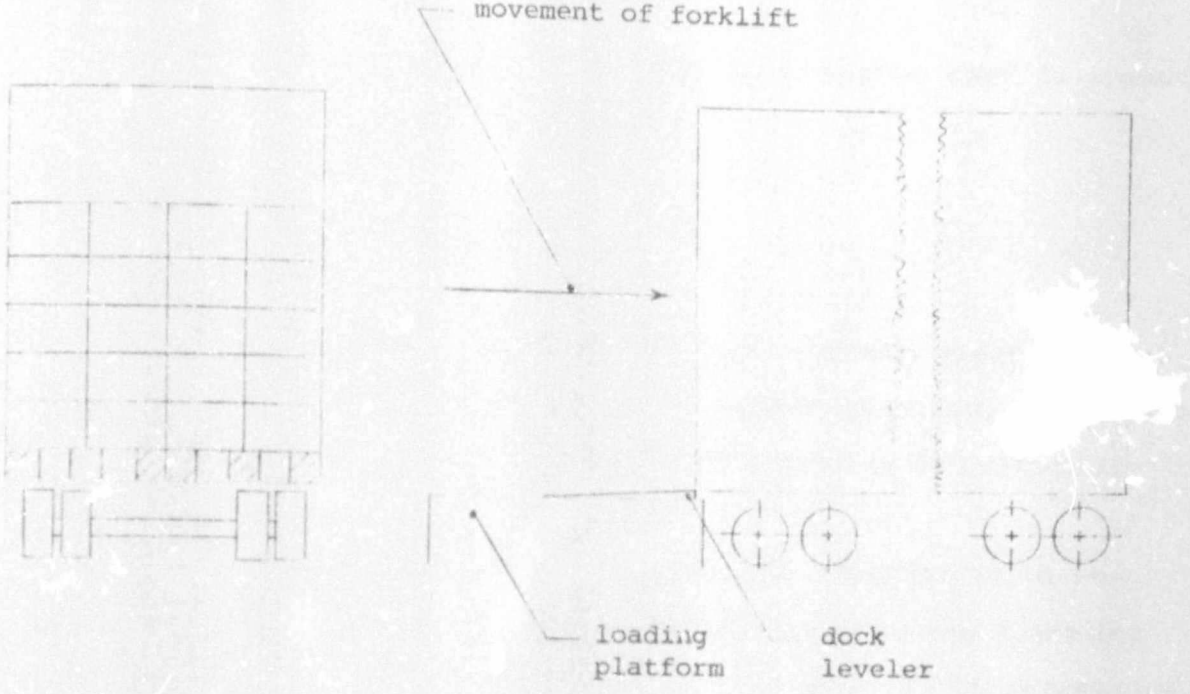
5.14 DISTRIBUTION FLUCTUATION:

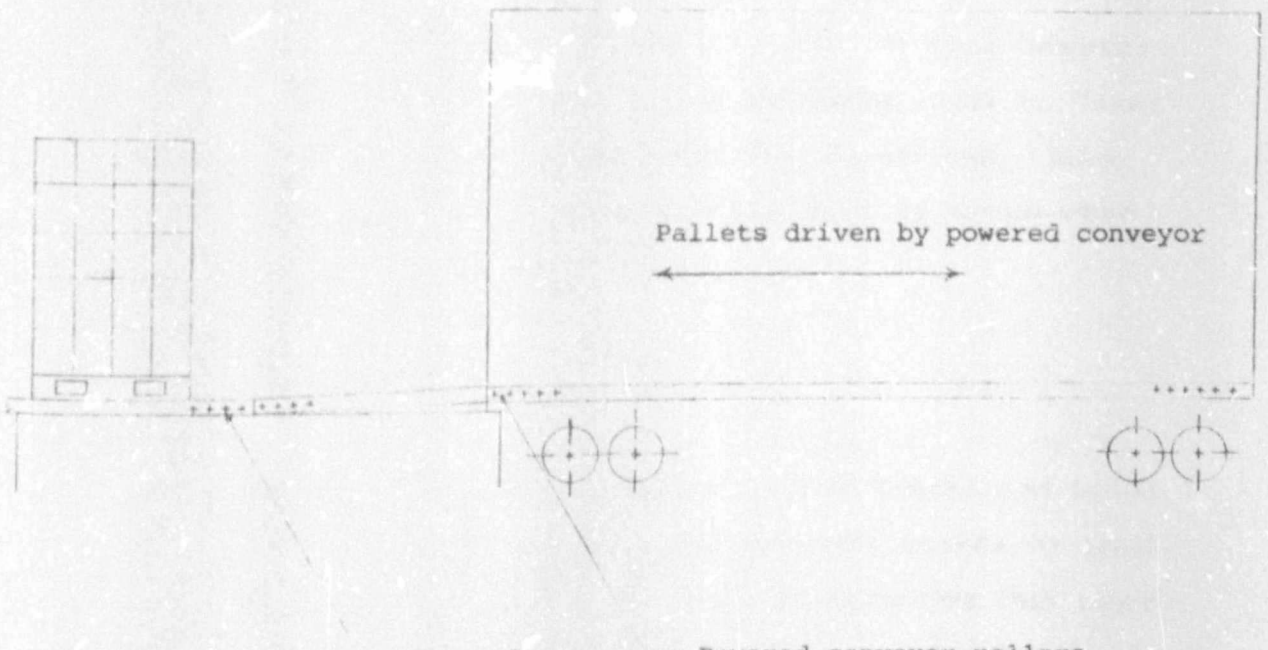
Because of the cyclic influence of the seasons on sales (see Fig: 4.1.1.) it is necessary for the distribution network to cater for the cycle peaks. Typically mid-June sales will vary from December

FIG : 5.13.3

REAR LOADED PALLETISED BEVERAGE TRUCKS

STANDARD REAR LOADED VEHICLE





REAR LOADED VEHICLE WITH SELF-POWERED CONVEYOR
LOADING AND UNLOADING

sales by as much as 8% and in holiday type areas (e.g. Durban) this fluctuation might even be greater.

The following are methods that may be used to smooth the peak season demand:

5.14.1. Using Trailers:

Peak season demand does not normally mean a great increase in the number of outlets serviced, but rather an increase in volume absorbed by each customer.

The simplest way to handle this situation is to enlarge the size of your vehicle by attaching a trailer to it and increasing the rate of delivery by increasing the labour force.

This simple concept is rather surprisingly used by very few bottlers in South Africa. It does however have a disadvantage in that the horse must be "overpowered" - enough to cater for the trailer. Manouverability is also difficult in built up areas when trailers are used.

5.14.2. Hiring Trucks:

Several firms are prepared to hire trucks and helpers over the peak season. Alternatively horses or trailers only can be hired. Ref. 10 examines this alternative in more detail and includes a cash flow analysis.

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5.14.3. Hiring vs Buying - The Multiple Trailer Concept: (see ref. 10)

Consider the beverage producer with a sales curve as shown in Fig: 5.14.3. As can be seen the peak season is only for a very short period - i.e. December. During this period many industries (e.g. the building trade and the steel works) show a trough in their operation. This means that if one could hire trucks from these people for the December period one could gear the beverage fleet, not for peaks, as is done at present, but for mid-season operation.

Enslin (ref. 10) shows that this is very feasible with cost savings up to R4 000 per annum per truck hired.

However a problem does arise due to the specialised nature of the beverage route truck - i.e. the A frame shape.

One method to overcome this problem would be to purchase extra A frame bodies (cost ± R6 000 ea.) and only hire the horses for peak season.

Besides the cost advantage of this approach, there is a further advantage, as the extra trailers may be used inside the warehouse for order "make-ups" i.e. orders for the next trip may be prepacked directly on the trailer and when the truck returns from its day's deliveries one can simply unhitch its semi-trailer and

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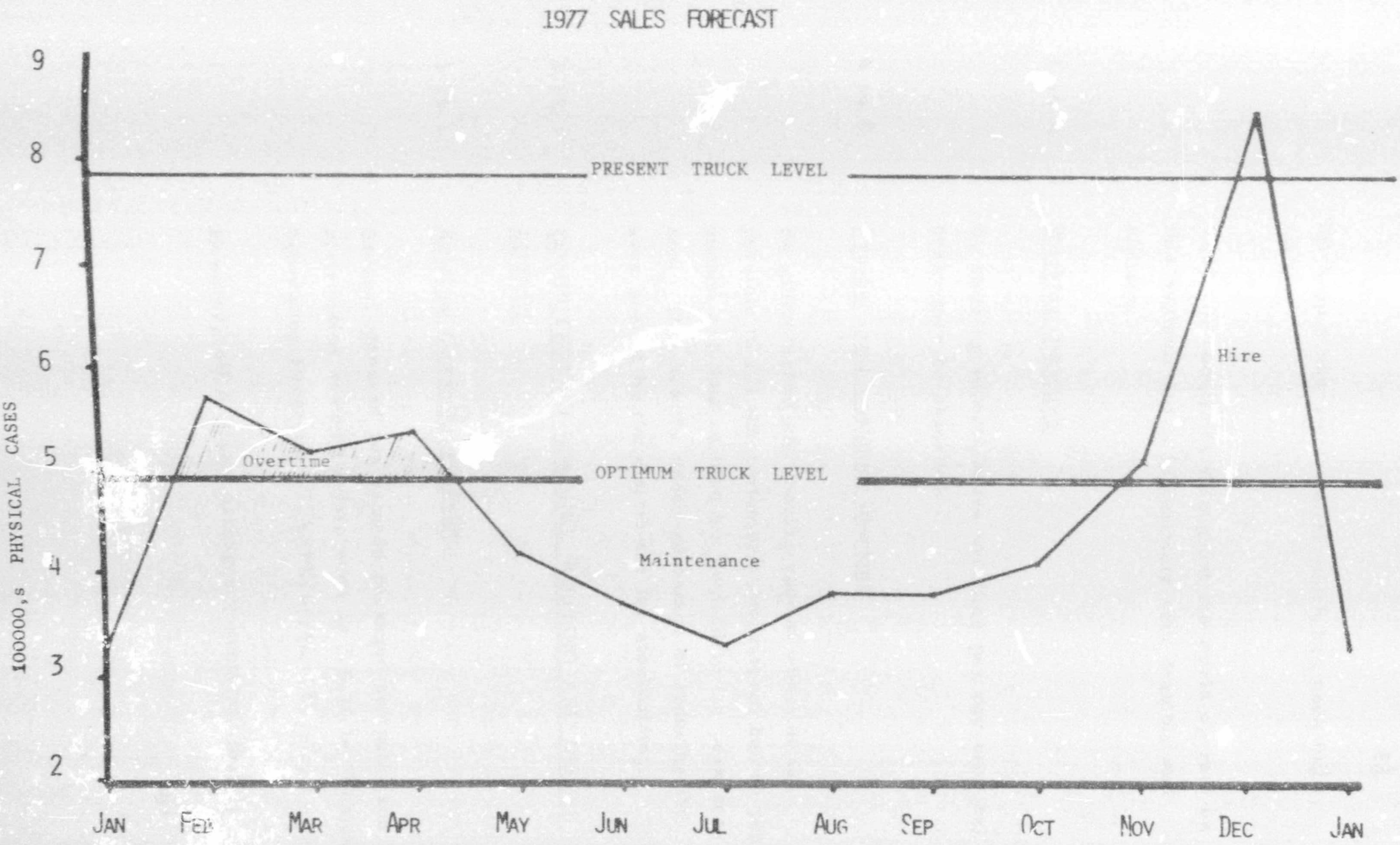
1977 SALES FORECAST
9
8
7
6
5
4
3
2
100000,s PHYSICAL CASES
PRESENT TRUCK LEVEL
OPTIMUM TRUCK LEVEL
Overtime
Maintenance
Hire
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN

hitch up a new semi-trailer which has been fully loaded.

Very few companies throughout the world operate on this system, but it is certainly very feasible and efficient.

5.14.4. Working Overtime:

By working several hours overtime per day seasonal peaks may be absorbed.

5.14.5. Pre-Seasonal Customer Stocking:

By giving credit and making special offers it is possible to fill the customer's store-room before peak season and thus cushion his demand in the peak season. This has the added advantage of reducing the area needed by the distributor for stockholding.

5.15. COMPUTERISED LOADING, ROUTING AND DISTRIBUTION.

5.15.1. Existing Computer Packages:

Several standard ready-made packaged computerised distribution systems exist, such as I.B.M.'s "Vehicle Scheduling Programme" (VSPX) - (ref. 12).

However, all of these packages concentrate mainly

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on minimising routes travelled, rather than on the control aspects.

Such scheduling programmes will however slot very well into the systems of control in Chapter 5.6. whereby an accurate system of simulation can be easily developed.

Most of the computerised loading systems (such as VSPX) start by loading the largest vehicle to its maximum - on the assumption that this will give you the best fleet utilisation.

The model developed in this Chapter however shows that vehicles should rather be loaded according to the drop size and area to be visited.

These ideas could easily be introduced into a computerised system.

5.15.2. Economics:

As the dimensions involved are large (10 000 outlets and 200 trucks to be loaded and routed each day) a computerised distribution system would need considerable capacity.

Such a computerised system would entail an estimated 80 - 100 minutes execution time on an I.B.M. System/360-50 computer (ref. 12).

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Furthermore considerable 'leg work' would be needed to set up such a system - especially in collecting a table of all the distances between outlets.

It is estimated that a fully computerised distribution system of this size would cost between R100 000 p.a. and R150 000 p.a. This would mean that such a system would need to justify a 5-10% distribution cost improvement (for a large company distributing ± 20 million cases per annum).

5.15.3. Theoretical development of a Perfect System:

Chapter 4.5.2. shows how to develop a linear program which would in theory give the perfect distribution system. However as is shown in that chapter, the cost of operating such a system on a computer is prohibitive.

CHAPTER 6

COST EFFECTIVENESS

6.1. DISTRIBUTION AS A COST CENTRE:

The main criteria in the measurement of the efficiency of a distribution system is the measurement of the costs incurred. Up to now we have mainly considered the actual control of the product rather than the various detailed costs.

The next logical step in this field is to develop distribution cost centres which will allow one to identify the areas of where one's costs occur and by identifying them we can thus control them.

A bald allocation of distribution costs over each case - e.g. 30c/case total cost - is plainly not sufficient.

One should be able to determine:-

6.1.1. The cost of each delivery to each customer - and thus determine the profitability of each sales transaction.

6.1.2. The cost incurred by labour involved.

6.1.3. Costs incurred by administration, personnel, documentation, computerisation etc.

6.1.4. The cost of the vehicles (depreciation, wear, repairs etc.) - i.e. fixed and variable costs.

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6.1.5. Costs of the fuel used.

6.1.6. Costs incurred by insurance, licensing, accidents.

6.1.7. Costs of in-plant transport - including labour, fork-lifts, space occupied, buildings and fuel used.

6.1.8. Costs incurred by the presellers - i.e. vehicles and salaries.

6.1.9. Cost of bottle sorting, case sorting etc.

It is not a good idea to take this process too far as a too detailed cost breakdown will cost a great deal of time in personnel and administration. However, a good accurate cost breakdown is management's finest method of distribution monitoring.

In order to achieve such an efficient cost breakdown it is best to establish an independent cost centre reporting directly to senior management. If we consider that the items mentioned in this chapter (6.1.1. to 6.1.9.) make up ± 25% of the total cost of the product (in the case of the soft drink industry) and up to 50% (in the case of the milk industry) it is well worth controlling these areas.

Typically the entire materials handling function, in a large factory, would amount to ± R10 million per annum. As can be seen a 5-10% cost improvement can mean a great deal in cash.

6.2. COST BREAKDOWN:

The following is a cost breakdown of a typical bev-

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