SHEET 2

DAILY OPERATIONAL RETURN

Date 1-2-84 | No Days Worked this Month 0

Line Number	Flavour	Size	Time Start	Time Finish	Net Bottling Time	No bottles (Meter)	Cases	Physical Count to Stock	Ex Trade	BREAKAGES Washer	Other	Filler	Other	Total	Tests	Rejects	% Breakages	Total Man Hours	Total cases per Man Hour	Rated Capicity of m/c mul. by net Bottling time	
1	C	L	8.00	5.50	6.00	38000	3166.6	3166	66	–	–	22	–	68	30	26	0.15	97.5	32.5	48000	
Total																					
Brought Foreward																					
Month to Date																					

SYRUP

Flavour	Phys. Usage	Theor. Usage	Over/Under	%Over/Under
Coke	6030	5937,5	92.5	1%
Fanta				
Sprite				
Total				
Prought Forward				
M.T.D.				

CROWN INVENTORY

	O/Stock	Received	Total	Closing Stock	Physical Usage	Theoretical Usage	Over/Under	%
Coke	[illegible]							
Fanta								
Sprite								
Total Today								
Brought Forward								
M.T.D.								

SEAL INVENTORY

Coke	50	0	50	62.5	7.5	38000	[illegible]	[illegible]
Fanta	50	0	[illegible]	50	–	–	–	–
Sprite	50	0	[illegible]	50	–	–	–	–
Total Today								
Brought Forward								
M.T.D.								

BREAKDOWN ANALYSIS

	LINE 1 Today	Brought Forward	M.T.D.	LINE 2 Today	Brought Forward	M.T.D.
WASHER	–					
PROPORTIONER	–					
FILLER	0,5					
CAPPER	0,67					
OTHER						
TOTAL	1,17					

CO_2, CAUSTIC, B-OIL

	O/Stock	Received	Total	M.T.D. Closing	Physical Usage	Theoretical Usage	Over/Under	% Over/Under
CO_2	4000	–	4000	3699	301	280,3	20,7	7,3
B-Oil/Coal								
Caustic								

SUMMARY OF RESULTS

	Today	Brought Forward	MTD
Productivity efficiency	49%		
Total cases/man hour	32		
Total cases produced	3167		
Total % breakages	0,15		

LOST TIME ANALYSIS

Line No.	1	2
Tot. Bottling Hrs	7.5	
STD. Allow	1.0	
Actual Bot. Time	6.5	
Change Overs	–	
Breakdowns	1.75	
Other Stops	0.75	
Net. Bot. Time	6.00	
Mach. Util.	62%	
Mach. Effic.	79%	

SUGAR INVENTORY

O/Stock	KG. Used	Flavour	Theoretical Usage	Over Usage	%
Total					
Brought Forward					
M.T.D.					

Prepared by Roy. Blg Checked by Eric Blg

Checked by Eddie Blg

REMARKS

Low utilisation today due to mechanical problems and filler operator damaging his foot at lunch time.

2.4.4. One then goes to the lost time analysis.
The total number of bottling hours is found from sheet 1A, i.e. how many hours at work that day.

In this example answer = 15.5 hours - 8.0 hours
= 7.5 hours

2.4.5. The standard allowance is the time set aside for lunch i.e. this is a standard set amount of time which will remain constant daily. The workers are not paid during this time. In our example this standard allowance is 1 hour (lunch only).

2.4.6. Actual bottling time = total bottling hours - standard allowance.

2.4.7. The rest of the lost time analysis can be obtained from the graph on sheet 1A and has been transcribed according to the values on this example.

2.4.8. The net bottling time can be obtained by subtracting the changeovers, breakdowns and other stops from the actual bottling time.
In this example the net bottling time would be
6,5 - 1,75 - 0,75 = 4.00.

2.4.9. One can now go back to the main section of the D.O.R. sheet and fill in the net bottling time.

2.4.10 The number of bottles from the meter refers to the fulls meter and can be found from subtracting the fulls meter readings on sheet 1A.
In this example this reading will be 38 000 - 00 000
= 38 000.

2.4.11. The breakages and tests can be found by using the mass to bottles conversions in conjunction with the information from sheet 1A.

In this example the conversion of the mass of glass would be as follows:

42 Kg Litre Glass = 46 bottles

20 Kg Litre Glass = 22 bottles

2.4.12. The tests and rejects may also be obtained from sheet 1.

2.4.13. The % breakage is equal to:

$$\frac{\text{Total number of bottles broken}}{\text{Total number of bottles (meter)}} \times 100$$

In our example this would be:

$$\frac{68}{38\ 000} \times 100 = 0{,}0018 \times 100 = 0{,}18\%$$

2.4.14. The total number of man hours can be calculated by the following:

Total man hours = actual bottling time x number of persons working on line.

The number of persons working on the line can be found from the workers time-cards and should include the line foreman, filler operator and line workers (packers, unpackers, etc). It should not include the maintenance staff, forklift drivers, production managers etc.

In the example the total man hours would be:

Total man hours = 15 x 6.5 = 97.5

One can also convert the man hours to paid man hours by multiplying the number of hours worked by each man by their rate of earnings, i.e. to get cases per paid man hour.

../105

2.4.15 The total cases per man hour can be calculated from the following:

$$\text{Total cases per man hour} = \frac{\text{Cases produced (To Stock)}}{\text{Number of man hours}}$$

In this example the total cases per man hour would be:

$$\text{Total cases per man hour} = \frac{3\ 166}{97.5} = 32.47$$

2.4.16. Machine Utilisation.

$$\text{Machine utilisation} = \frac{\text{net bottling time}}{\text{actual bottling time}} \times 100$$

i.e. the ratio of the amount of time our machine worked compared to the time it had available for work.

In this example:

$$\text{Machine utilisation} = \frac{4,00}{6,50} \times 100 = 0,615 \times 100 = 62\%$$

2.4.17. Machine Efficiency

$$\text{Machine efficiency} = \frac{\text{No. of bottles produced (fulls meter)}}{\text{Rated capacity of machine x net bottling time.}}$$

i.e. the production capability of the machine compared to what the machine is actually producing.

In this example:

$$\text{Machine efficiency} = \frac{38\ 000}{12\ 000 \times 4.00} = 0,79 \text{ or } 79\%$$

2.4.18. One can now calculate the productivity efficiency where:

Productivity efficiency = Machine utilisation x Machine efficiency.

i.e. This is the total efficiency achieved.

In this example:

Productivity efficiency = 0,62 x 0,79
= 0,49 or 49%

The productivity efficiency is filled in under "Summary of Results".

The rest of the items can now also be filled in under "Summary of Results".

2.4.19. Breakdown Analysis

All information for the breakdown analysis can also be obtained from sheet 1.

In this example the major breakdowns came from the filler and capper.

2.4.20. Syrup Usage.

Here we work on the fullowing principle:

The ratio of syrup to water is 5.4 : 1 for all soft drinks. Therefore, if we take the number of litres product counted by the fulls bottle counter and divide this by the correct ratio we will have the theoretical quantity of syrup used.

In this example we have:

38 000 x 1 litre products counted by the fulls counter.

This means that we have:

$$\frac{38\ 000}{(5.4 + 1)} = \frac{38\ 000}{6,4} = 5\ 937,5 \text{ litres of syrup.}$$

Now we can list the amount of syrup used (theoretical).

The physical syrup usage is found from the amount of syrup drawn from stock.

From sheet 1A we can see how much syrup we drew from stock.

In this example we made 6 000 litres of syrup.

The over/under usage is found by subtracting the theoretical usage from the physical usage.

In this example we have:

6 000 - 5 937,5 = 62,5 under usage.

To convert this to a percentage figure:

$$\text{\% over/under} = \frac{\text{Physical Usage - Theoretical Usage}}{\text{Physical Usage}}$$

In this example:

$$\% = \frac{62,5}{6\ 000} = 0,01 \text{ or } 1\%.$$

It should be noted that there should at no stage be an over-usage. If you do have an over-usage of syrup there is something radically wrong with the method of syrup manufacture. The syrup under usage should be between 0,2 - 1,0% depending on the length of run and machine used.

../108

2.4.21. Crown/Seal Inventory

The crown/seal inventory information may be gathered from sheet 1 and the crown store.

Let us assume for this example you have 50 boxes (x 5 000 seals) in each box as opening stock in each flavour on the first day of this month. (This is unlikely but is assumed for this example).

It should be noted that the crowns were counted as fractions of a box and that we have an under usage of crowns. This is because we only took a rough estimate of how many crowns are in the box. Under theoretical usage of crowns we count the actual number of crowns used.

The over/under usage in this example is calculated as follows:

$$\frac{\text{Physical usage x no. seals in box - number of fulls made}}{\text{Physical usage x number of seals in box}}$$

i.e. $$\frac{7\frac{1}{2} \times 5\ 000 - 38\ 000}{7\frac{1}{2} \times 5\ 000}$$

$$= -1,3\%$$

The fact that we estimated that there was a half a box left will be balanced out over the whole month of such estimations.

2.4.22. Sugar Inventory

Let us assume we have an opening stock of 500 bags of sugar

i.e. 500 x 25 Kg. = 12 500 Kg.

Now armed with the information that

1 litre of syrup has 0,677 Kg. sugar,

we can easily calculate the theoretical usage of sugar. The theoretical usage of sugar is thus-

Theoretical usage = no. litres made x amount of sugar per litre.

In this example:

Theoretical usage of sugar = 6 000 x 0,677
= 4 064.5 Kg.

Let us say we drew 160.0 bags of sugar, i.e. 163 x 25 = 4 075 Kg. of sugar.

The over/under usage would then be:

Over/under usage = Actual usage - Theoretical usage.

In this example:

Over/under usage = 4 075 - 4 064,5 = 10,5 Kg.

To convert to % we then divide by the actual sugar usage,

i.e. $\% \text{ Usage} = \dfrac{\text{Over/Under Usage}}{\text{Kg. Used}}$

i.e. $\% \text{ Usage} = \dfrac{10,5}{4\ 075} = 0,26\%$

2.4.23. CO_2 Usage

The CO_2 0/stock can be read from the weight gauge on the bulk supply tank. (Similarly CO_2 received and physical usage and closing stock).

The theoretical usage can be found from the following information:

Size	Kg. CO_2/Case
200 ml	0,034 050
300 ml	0,052 386
1000 ml	0,088 527

Therefore, if we produce -

38 000 bottles of litre product we should use -

$$\frac{38\ 000 \times 0,088\ 527 \text{ Kg. of } CO_2}{12}$$

$= 280,3$ Kg. CO_2

The physical usage is:

Physical usage = Total - Closing Stock

In our example 4 000 - 2 699 = 301 Kg.

Over/under usage = Physical usage - Theoretical usage

Over/under usage = 301 - 280,3

= 20,7 Kg.

$$\% \text{ Over/under} = \frac{\text{Over/under usage}}{\text{Theoretical}}$$

$$= \frac{20,7}{280,3} = 7,3\%$$

2.4.24. Boiler Oil (B/Oil)

Here the theoretical usage can be found from manufacturers' ratings or a controlled standard set up by the bottler.

This can also be related to cases produced,

i.e. Relationship of oil used to cases produced.

The O/stock, amount received, total, MTD closing can all be obtained from the level of the fuel reservoir.

The rest of the items are worked out in the same way as the CO_2.

2.4.25. Caustic Usage

Again we can set up a theoretical usage here that is related to the number of cases produced. This can be found by monitoring the usage of caustic over a given period. The other items are measured by counting how much caustic goes in and out of the caustic store - in the same manner as the calculating of the CO_2 usage.

2.4.26. Total, month to date (MTD) and brought forward (B/F).

TOTAL

This is merely the total of all items in the rows,

e.g. in the column marked "No. Bottles (Meter)" - say we have the following:

Line	Flavour	No. of Bottles (Meter)
1	X	10 000
1	Y	13 000
2	Z	32 000
2	X	28 000
TOTAL		83 000

i.e. The total was merely an addition of the individual items.

This does not apply if the total is a ratio.

BROUGHT FORWARD

This is the MTD value from the previous day. This is then simply transcribed into the following day's "Brought Forward" column,

e.g.

Monday - 1.4.78.

Line No.	Flavour	No. of Bottles (Meter)	
1	X	10 000	
1	Y	13 000	
2	Z	32 000	
2	X	28 000	
TOTAL		83 000	
B/F		00 000	1st day of the month
MTD		83 000	

Tuesday - 2.4.78

Line No.	Flavour	No. of Bottles (Meter)
1	X	25 000
1	Y	20 000
2	-	
TOTAL		45 000
B/F		83 000
MTD		128 000

In this case, the MTD figure is simply the addition of the Total and B/F.

MONTH TO DATE (MTD)

Type 1

If we are considering MTD of straight forward numbers,

i.e. Net bottling time, number of bottles, cases, physical count to stock, breakages, tests, rejects, total man hours etc.

then the MTD figure is simply obtained from the following:

MTD = B/F + Total

Type 2

If we are considering MTD of a ratio,

i.e. Cases/Man hour, % Breakage, % Over/Under Usage and Productivity Efficiency then MTD is calculated by adding the B/F and Total constituent parts and performing the required operation on these constituent parts,

e.g. Say we have the following:

Line No.	Flavour	Physical Count of Cases to Stock	Man hours worked	Total Cases per man hour
1	X	10 000	37	270
1	Y	12 000	38	315
2	Z	15 000	32	469
2	P	20 000	40	500
TOTAL		57 000	147	388
B/F		400 000	1 000	-
MTD		457 000	1 147	398

Let us assume we brought forward 400 000 cases of product and 1 000 man hours worked -

When it comes to calculating the MTD total number of cases per man hour, one cannot simply add the B/F figure and Total figure as this would give a ridiculous result.

i.e. YOU CANNOT ADD RATIOS

in this case out ratio is

$$\frac{\text{Physical count to stock}}{\text{Man hours worked}}$$

one can however add the constituent components, i.e.

add Total + B/F man hours = MTD man hours.

add Total + B/F cases produced = MTD cases produced.

To calculate the TOTAL cases per man hour, one does as follows:

../114

Total cases per man hour = $\frac{\text{Total count to stock}}{\text{Total man hours}}$

$= \frac{57\ 000}{147} = 387,8$

NOT 270 + 315 + 469 + 50

The brought forward figure in this case is of no use as it is useless bringing forward another ratio.

The MTD figure is calculated by taking the individual constituents making up the ratio, i.e. in this example:

MTD cases per man hour = $\frac{\text{MTD cases to stock}}{\text{MTD man hours worked}}$

MTD cases per man hour = $\frac{457\ 000}{1\ 147}$ = 398,4 cases/man hour

One would proceed in the same manner for all ratios, % etc.

Type 3

In order to calculate the MTD productivity efficiency, one uses the following formula:

MTD Productivity Efficiency = (B/F Productivity Efficiency
x Number of days worked this month (excluding today)
+ Productivity Efficiency today)

Divided by: Number of days worked + 1

e.g. say we are now on the 6th working day of the month and we know -

../115

Productivity Efficiency MTD on 5th day = 0,5

Productivity Efficiency Today = 0,8

Today's MTD Productivity Efficiency $= \dfrac{0,5 \times 5 + 0,8}{5 + 1}$

$= 5,5$

This method can also be used to calculate the other MTD data.

2.5. GRAPHS

2.5.1. The following data should be graphed on a daily basis:

(a) Productivity efficiency.

(b) Total cases/man hour.

(c) Cases produced.

(d) Total % breakages.

2.5.2. The following data should be graphed on a monthly basis:

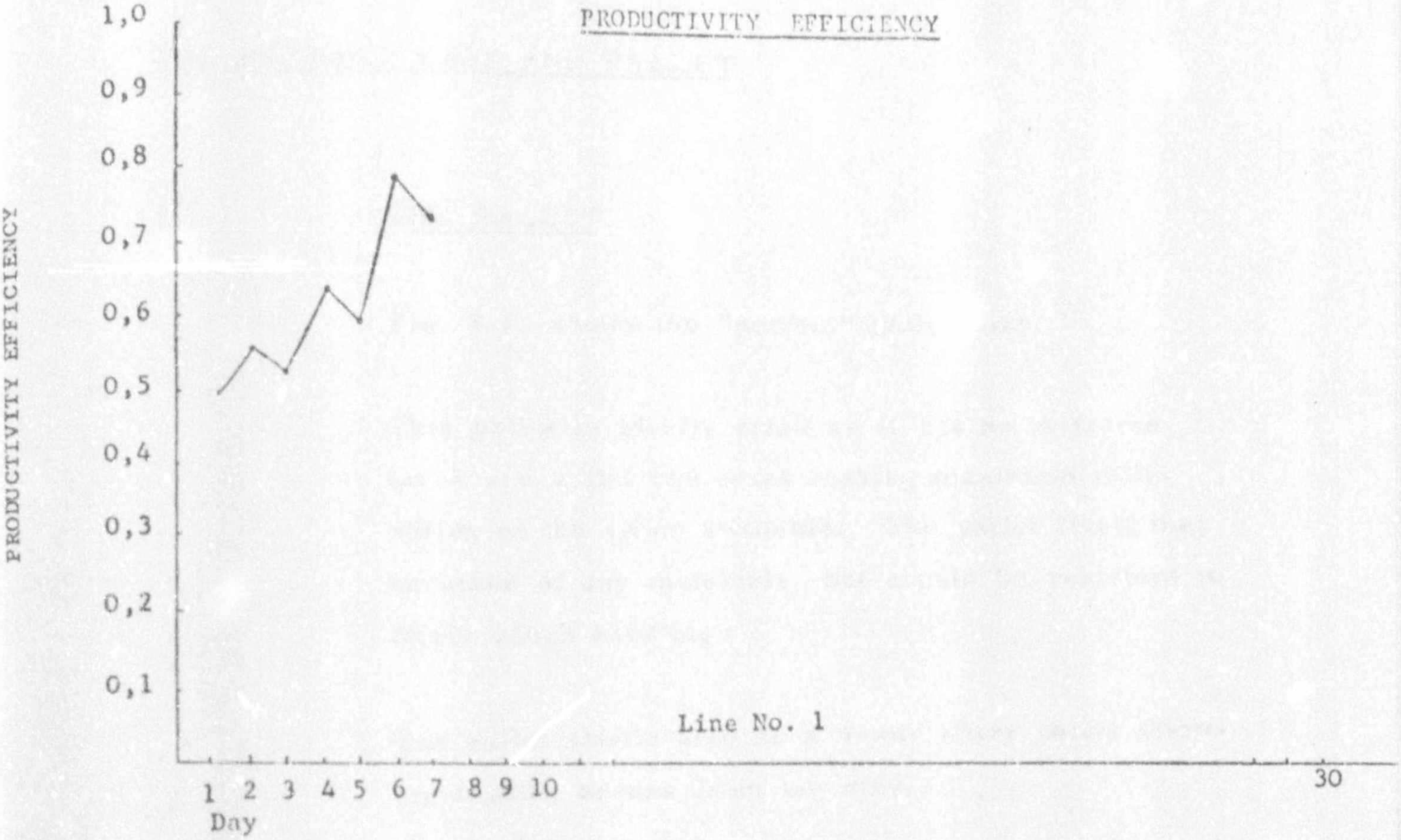
(e) MTD (end of month) Productivity efficiency.

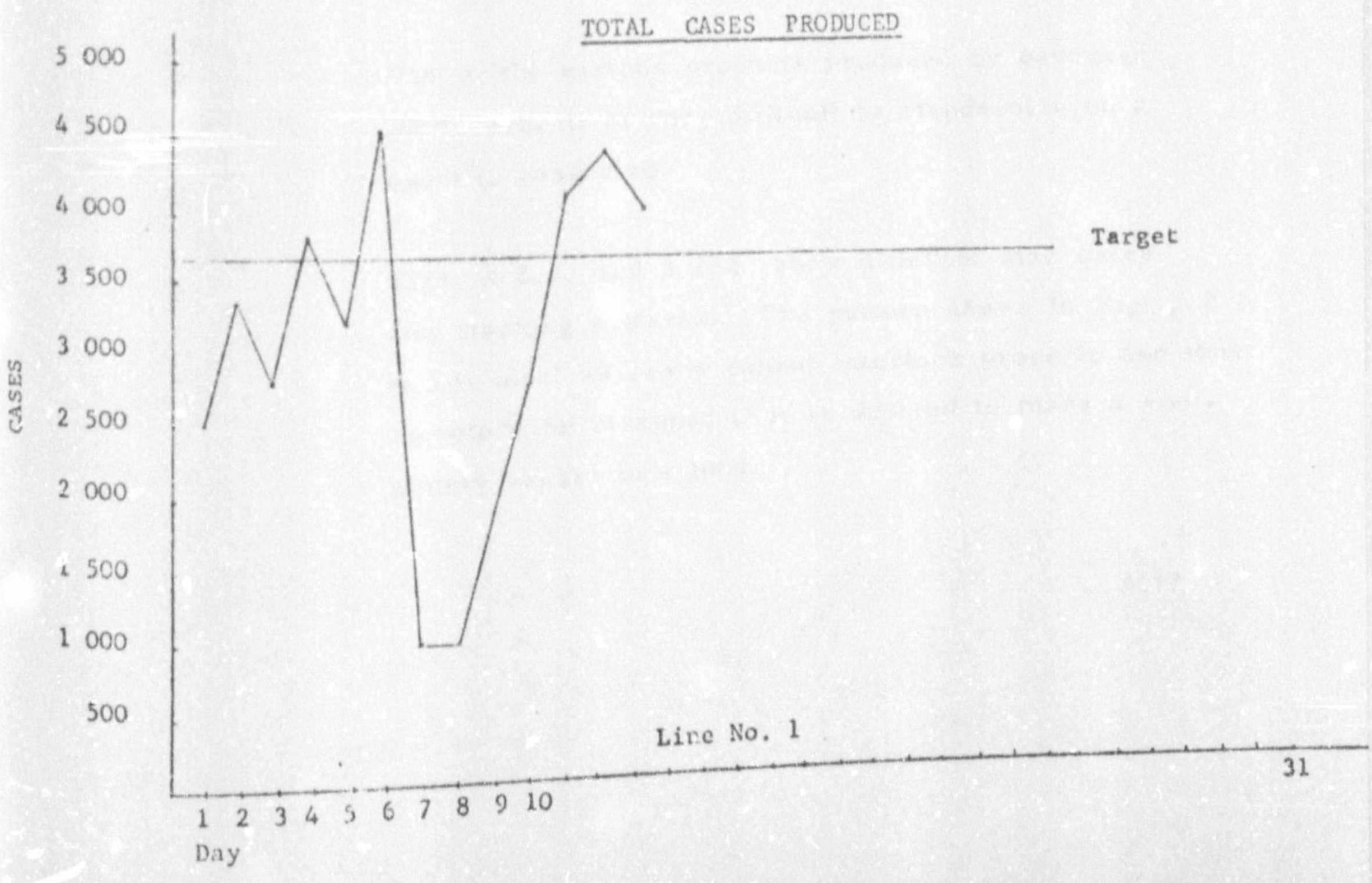
(f) MTD (end of month) Total cases/man hour.

(g) MTD (end of month) Total cases produced.

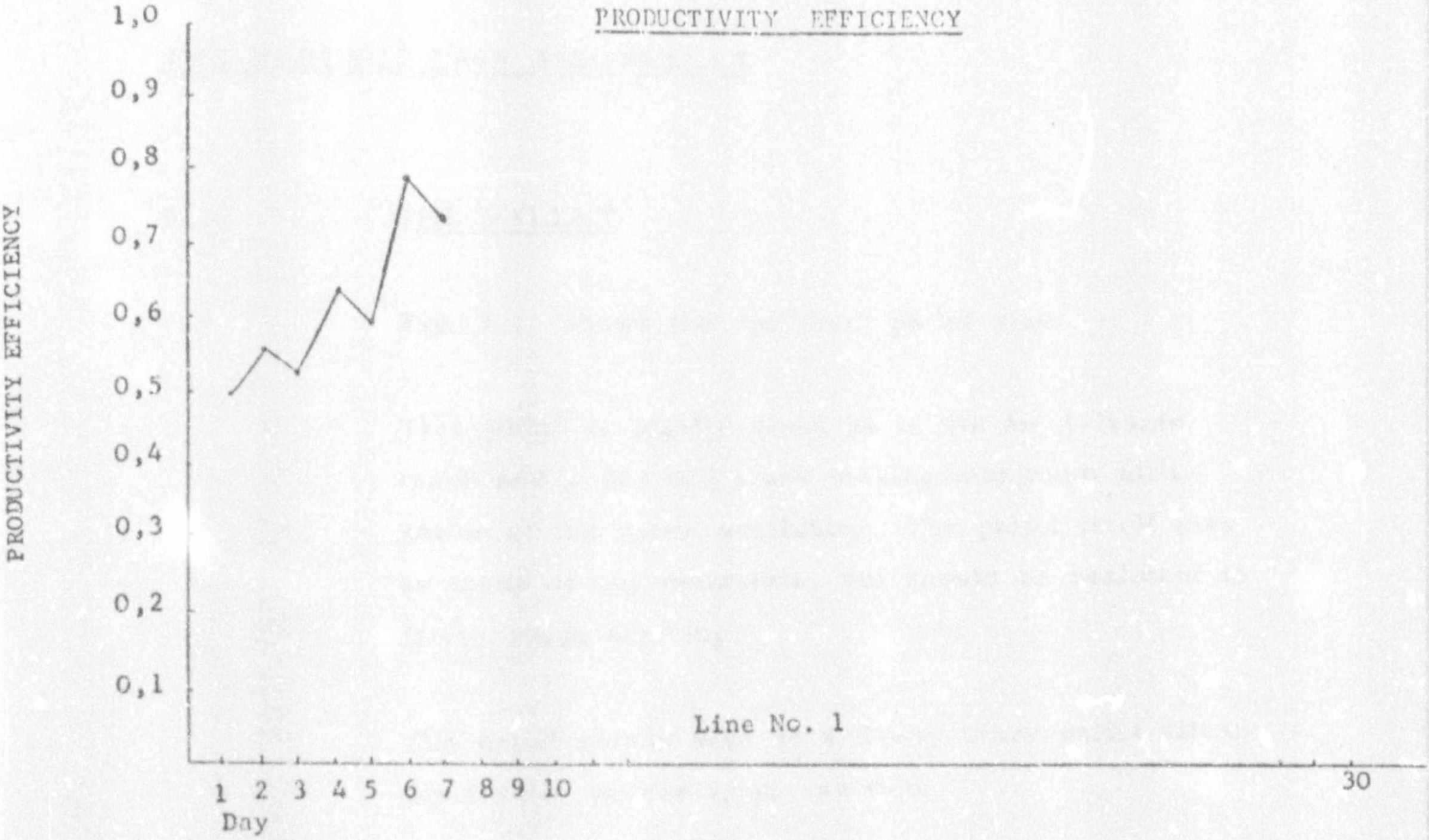
(h) MTD (end of month) Total % breakag

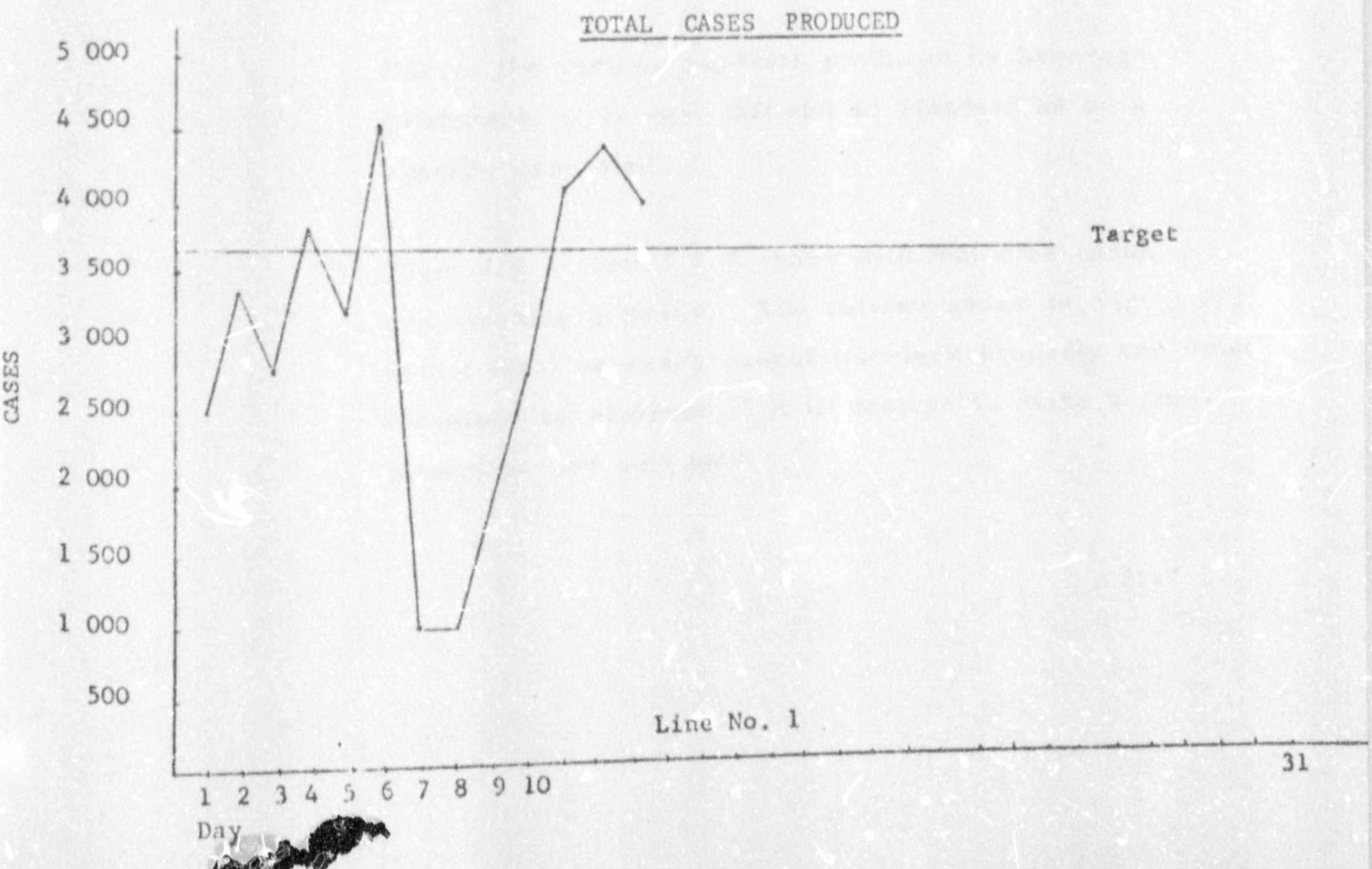
EXAMPLE


PRODUCTIVITY EFFICIENCY
PRODUCTIVITY EFFICIENCY
1,0
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
Line No. 1
1 2 3 4 5 6 7 8 9 10
30
Day


TOTAL CASES PRODUCED
CASES
5 000
4 500
4 000
3 500
3 000
2 500
2 000
1 500
1 000
500
Target
Line No. 1
1 2 3 4 5 6 7 8 9 10
31
Day

EXAMPLE


PRODUCTIVITY EFFICIENCY
PRODUCTIVITY EFFICIENCY
1,0
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
Line No. 1
1 2 3 4 5 6 7 8 9 10
Day


TOTAL CASES PRODUCED
CASES
5 000
4 500
4 000
3 500
3 000
2 500
2 000
1 500
1 000
500
Target
Line No. 1
1 2 3 4 5 6 7 8 9 10
Day

APPENDIX 3

THE PERFECT CASE AND PALLET

3.1. THE PALLET

Fig: 3.1. shows the "perfect" pallet size.

This pallet is ideally sized as it fits an A-frame truck and a flat bed truck making maximum utilisation of the space available. The pallet itself may be made of any materials, but should be resistant to fairly rough handling.

The pallet should also be a 4-way entry pallet allowing forklift access from any side.

3.2. THE CASE

Due to the various products produced by beverage producers, it is very difficult to standardise on a specific case size.

Figs: 3.2.1. and 3.2.2. show different size cases and stacking patterns. The pattern shown in Fig: 3.2.1. is not ideal as cases cannot interlock properly and must therefore be strapped if it is desired to make a completely secure unit load.

FIG : 2.1.

DEVELOPMENT OF THE PERFECT PALLET

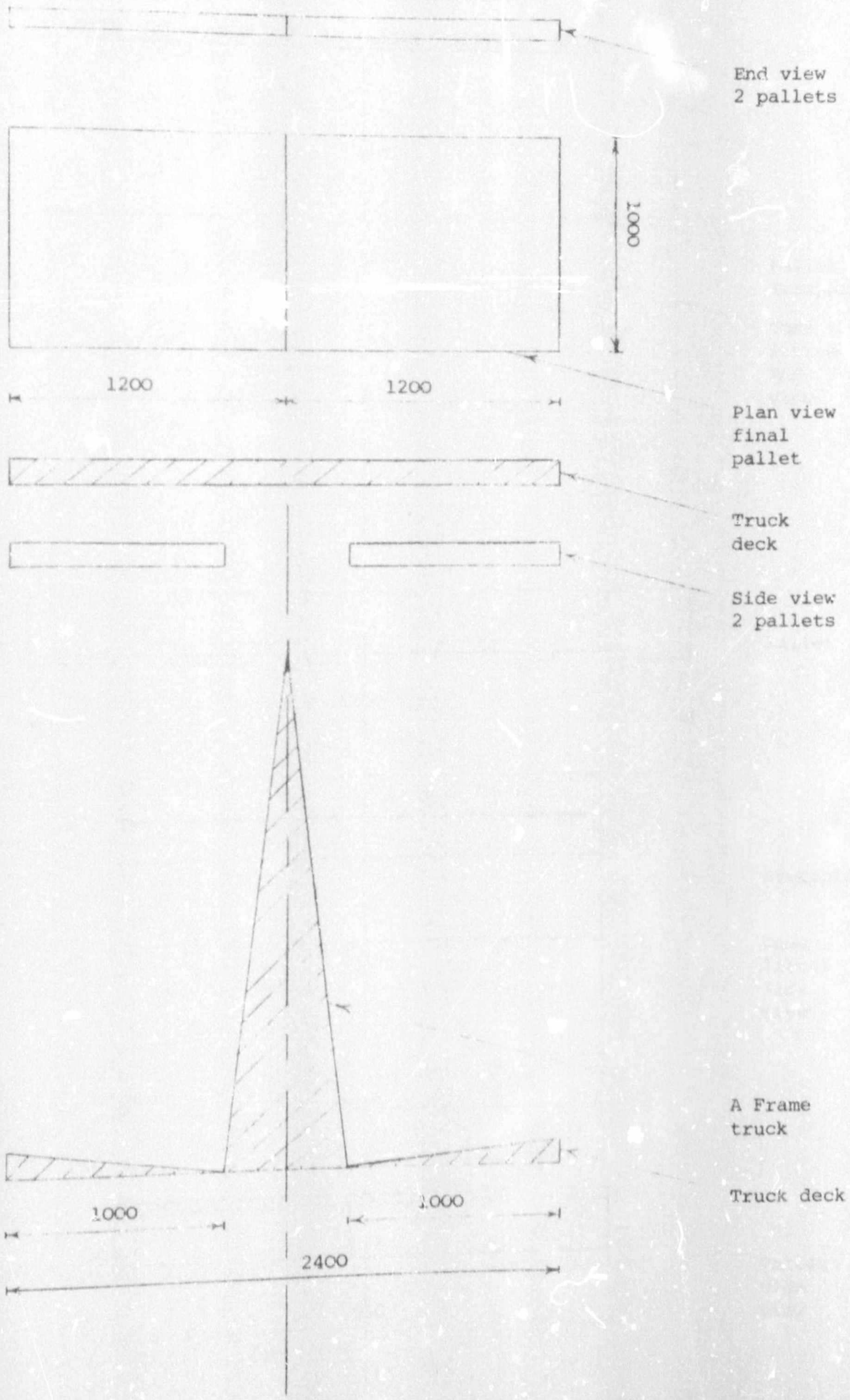
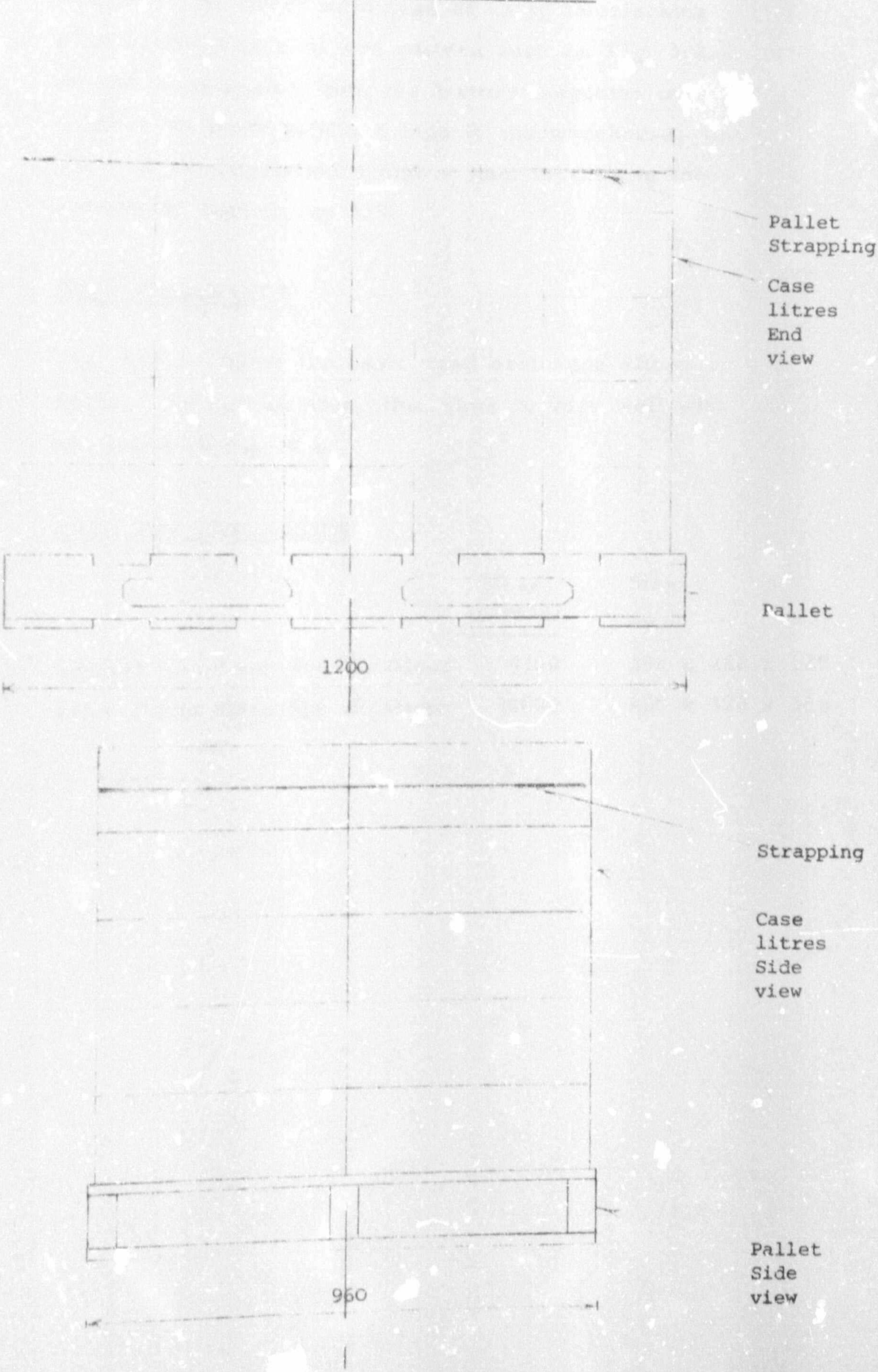


FIG : 3.2.1.

TYPICAL 4 WAY ENTRY PALLET

WITH 50 CASES OF 12 LITRE BOTTLES EACH



The pattern shown in Fig: 3. 2. 2. is much more secure and stable. This pattern is often used in stacking boxes (such as cans) and bottles in the beer industry. An added advantage of using interlocking plastic crates in a secure pattern such as Fig: 3. 2. 2. is that dispensation from the factory inspector may be obtained to stack pallets 4 high in the warehouse, instead of the regulation 3 high - thus increasing the warehouse capacity by 33%.

3. 3. ROAD ORDINANCE

Fig: 3. 2. 3. shows the basic road ordinance allowances. As can be seen, this slots in very well with the pallet in Fig: 3. 2. 1.

3. 4. CASE SPECIFICATIONS

	Mass (grams)	Size
Typical Can/Case Specifications	9300	396 x 268 x 120
Litre Bottle Case Specifications	30000	420 x 320 x 365

FIG : 3.2.2.

AN INTERLOCKING PALLET LAYOUT

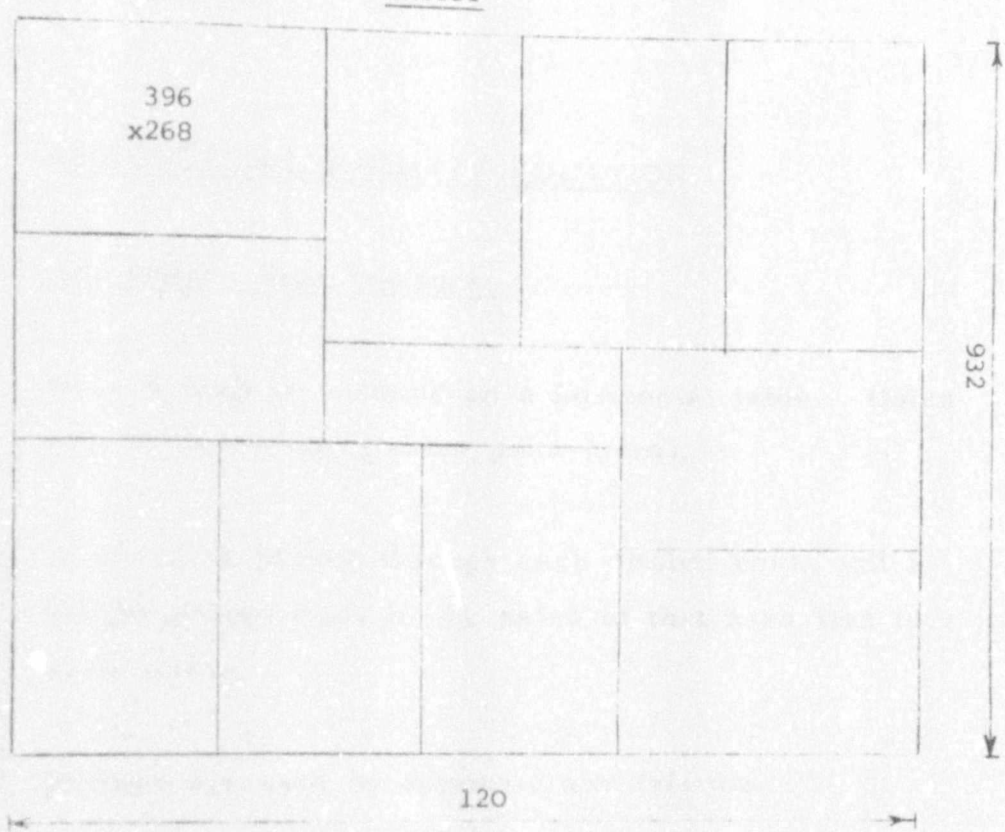
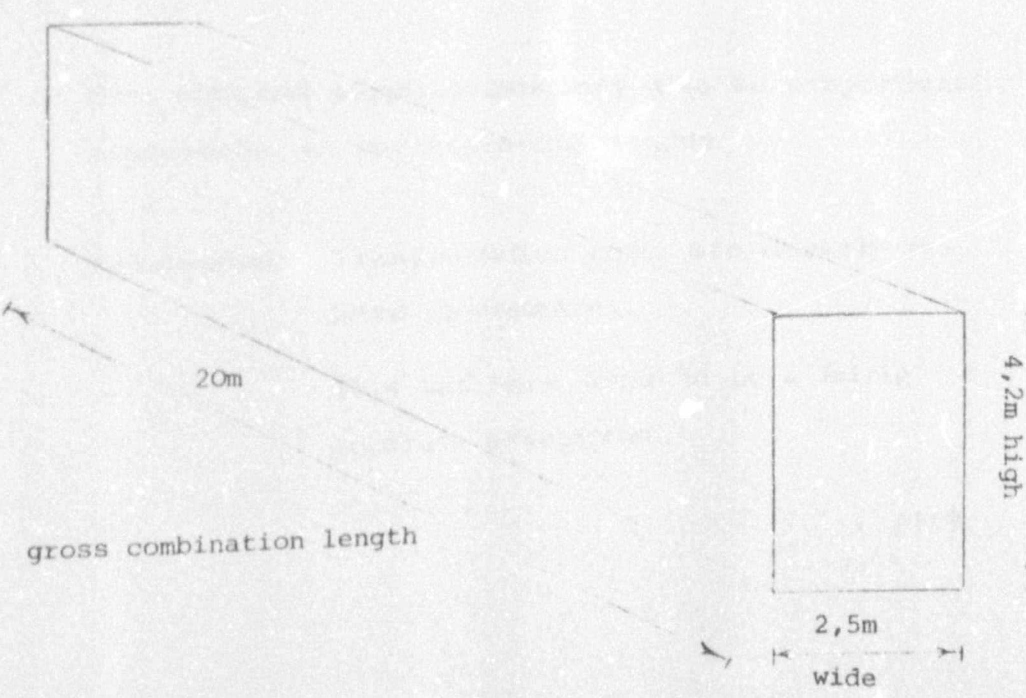


FIG : 3.2.3.

TRUCK SIZES ALLOWED BY LAW SHOWED AS A BLOCK



APPENDIX 4

METHODS OF POSITIONING OF PRODUCTION FACILITIES
(see references 11 and 15)

4.1. THEORETICAL FACILITY LOCATION

4.1.1. The moving knot analogue:

Here a map is mounted on a horizontal table. Holes are drilled at each sales point (area).

A string is passed through each drilled hole, and a weight proportional to the sales of that area tied to each string.

Pulleys are used to eliminate any friction.

The various strings are then knotted together on top of the table. Each weight will then find its own position and the knot should come to rest at the optimum theoretical site.

Raw material supply points may also be proportionally represented by corresponding weights.

Assumption: Transportation costs are linearly related to distances.

This has been found to be a fairly accurate assumption.

4.1.2. Arithmetic mean market centre:

Each distribution outlet is identified on the map.

A set of x and y axes are then placed on the map and the mean x distance and the mean y distance can easily be calculated.

A weighted mean (according to demand at the outlets) may also be calculated.

The intersection of y - mean and [illegible] mean will give the geographical centre of the market.

4.1.3. Simulation:

Here one tries to locate the best site for the plants by choosing a particular site and then simulating a given period of distribution.

In most cases it is best to simulate on the basis of time taken to complete deliveries or total cost incurred by deliveries.

An alternative site may then be chosen and the entire simulation repeated. In this way one can eventually find the best site available.

Simulation is usually used when the input data is too complicated to try and use standard algorithms or analytical methods.

../120

4.1.4. Linear programming: (see reference 11).

As we have assumed that transportation costs are linearly related to distances, straightforward linear programming may be used for distribution centre location.

Several simplified versions of linear programming may also be used for the location of the "perfect site", these include:

The Simplex method
The Transportation method
Integer Programming
(see reference 11)

Once we have determined a theoretical best placing - this area can be investigated for a practical site. Usually the theoretically best placing will only give a guide as to where to look for your distribution site. All practical aspects must then be considered.

Once this is done, the various alternatives (usually 2 or 3) can be evaluated directly by calculating the detailed costs of transport to the market.

4.2. OTHER CRITERIA AFFECTING DISTRIBUTION/ PRODUCTION FACILITY LOCATION

4.2.1. Cost of land.

4.2.2. Raw material supplies; distances.

4.2.3. Municipal and other services e.g. water, electricity.

4.2.4. Labour availability - skilled and unskilled.

4.2.5. Labour cost, fluctuations and standards of living.

4.2.6. Space available, expansion in future.

4.2.7. Actual physical characteristics of land and site.

4.2.8. Rates and taxes.

4.2.9. Pollution controls and other factories in vicinity.

4.2.10. Road access, freeway, main routes, congestion.

4.2.11. Railway access.

4.2.12. Commercial services (banks, post office, telephone etc).

4.2.13. Industrial services (factories, spares, fuel etc).

4.2.14. Community services (hospitals, schools, shops, police etc).

4.2.15. Government policies - decentralisation proposals etc.

4.2.16. Municipal policies - water treatment etc.

4.2.17. Competitors in vicinity.

4.2.18. Weather characteristics - rain, snow, hail, heat.

4.2.19. Product characteristics (e.g. shelf-life, susceptibility to pollution etc).