5.2.2 Basic information system requirements

Three aspects of an information system require some consideration before it is installed. These aspects are:

(i) *Format*

This implies the selection and design of the documents on which statistics are recorded at the various stages of processing.

Information that conforms to the requirements laid down in section 5.2.1 is in the most useful form if it is in writing. This way, information is available as a permanent reference and can easily be checked on.

There are three basic types of documents. These are:

Primary documents	- those documents that are completed during or immediately after a job has been done by the person who actually performed the job.
Secondary documents	- those documents that summarize the information gathered from the primary documents.
Tertiary documents	- those documents that draw conclusions from the secondary documents and relate what action is to be taken as a result of these conclusions, either to overcome problems or to take advantage of opportunities.

The primary documents, generally speaking, are generated from low down in the organisational hierarchy with the secondary and tertiary documents coming from somewhat higher up in the organisation. As the level from which the document originates gets higher, so there is a corresponding swing from the emphasis being on *quantitative data* to *qualitative reports*. This is because the environment changes from one of an 'observer' at the primary level to one of a 'decision maker' at the tertiary level.

Each document must therefore be designed to capture all the relevant and accurate information generated at a particular company level. They must be easily understood by the employee who have to fill them in and also provide space for written explanations of data where necessary.

(ii) *Flow*

Some thought must be put into who should receive each document and how long they can reasonably be expected to retain any particular type of document.

If this thought is not given to a system, bottlenecks will invariably develop because certain departments are overloaded with documentary information, resulting in other departments being starved of information. This is particularly prone to happen with primary documents where the amount of paperwork involved is highest.

Who receives what document depends on how the information contained on that document relates to an individual employee's responsibilities within the company.

(iii) *Frequency*

The number of times a completed document is required has a great bearing on the effort spent in producing it.

The frequency with which any document is called for should be geared to the usefulness of that report as a control and decision making mechanism.

Where very large fleets are involved, it is very often the manpower required to process the volume of statistics produced that becomes a point of concern. This is when there are benefits to be reaped from using a computer to process data quickly and efficiently.

5.2.3 Control information required

The information necessary to control a road transport operation generally revolves around the use of three of the company's major recources. These are:

(i) vehicles
(ii) drivers
(iii) money.

(i) Vehicle control information

The different categories of vehicle control information are listed in table 5.1.

(a) TIME based	- total available time
	- downtime hours
	- useful available time
	- actual working hours
(b) DISTANCE based	- kilometres travelled
	- preventitive maintenance programme
(c) WEIGHT based	- tonnes carried
	- actual payloads
(d) VOLUME based	- volume of fuel used
	- fuel consumption
	- oil consumption
(e) PERCENTAGE based	- % downtime
	- % availability

Table 5.1 Vehicle centred information

(a) Time based information

Total available time is an arbitrary policy decision used as the base for the amount of time that deliveries can be undertaken. For example, in a normal working hour, 5 day week operation the total available time will be taken as:

11 hours a day × 5 days a week = 55 hours per week

This base is used for determining how effectively a fleet of vehicles has been used.

Downtime hours are all the hours lost through the vehicles in the fleet not being able to carry out their function because of mechanical defects.

It is very useful to break this time up into the different components of downtime (e.g. breakdowns, punctures, accident repairs, servicing) in order to moniter the performance levels of each component.

Useful available time is the time a vehicle is mechanically ab'e to work within the 'total available time'. This is arrived at by the following equation:

(Useful available time) = (Total available hours) - (downtime hours)

Actual working hours are the hours a vehicle is physically engaged in delivery work.

(b) Distance based information

Kilometres travelled are the kilometres covered by a vehicle from the time a vehicle leaves the depot until the time it returns.

Preventive maintenance program is the schedule for preventive vehicle maintenance. Services are usually based on the kilometres a vehicle has travelled, hence its inclusion under this section.

(c) Weight based information

Tonnes carried is the total weight of goods carried in a given period of time.

This can be substituted for other units of payload for more specialized types of transport which do not use tonnes as a base unit.

Actual payloads are the weight of goods carried per vehicle on each individual delivery.

The units used here are the same as those used in the previous item.

(d) Volume based information

Volume of fuel used is the total number of litres consumed by the fleet in a given period of time.

Fuel consumption is the number of litres of fuel consumed per one hundred kilometres travelled for each individual vehicle in the fleet over a given period of time.

Oil consumption is the number of kilometres travelled for everylitre of oil added for each individual vehicle in the fleet over a given period of time.

(e) Percentage based information

% downtime is the downtime hours taken as a percentage of the total available time.

This is a useful measure of the mechanical state of the fleet and is also used for determining a reserve factor in the vehicle calculations described in chapter three.

% availability is the useful available time taken as a percentage of the total available time.

A useful check is:

(% downtime) + (% availability) = 100%

% vehicle utilization is the actual working hours taken as a percentage of either the total available time or the useful available time. The former ratio gives an overall utilization factor including downtime, whereas the latter ratio includes downtime and only looks at vehicle utilization of vehicles when the re mechanically able to work.

% capacity utilization is a measure of how effectively the company has utilized the carrying capacity, either volume wise or weight wise, of the fleet of vehicles.

This is derived from the comparison of actual payloads to the pre-determined maximum legal payloads of each vehicle in the fleet.

(ii) Driver control information

The different categories of driver control information are given in table 5.2.

(a) TIME based	- total paid hours
	- actual working hours
	- overtime hours
	- trip times
	- absenteeism
	- sick leave
	- injured on duty
(b) Percentage based	- % driver utilization
	- % driver turnover

Table 5.2 Driver centred information

(a) Time based information

Total paid hours are the number of hours, either at normal or overtime rates, that a company pays for during a given period of time.

Actual working hours are the number of hours in the total paid hours actually spent in productive work.

Overtime hours are those hours within the total paid hours that are paid at a higher than normal rate. If work is done on Sundays and paid public holidays, it is necessary to break the category up into two, since these days require a different rate for overtime earned on the remaining days in a month.

Trip times are the times it takes a driver to complete deliveries to individual customers.

Absenteeism, sick leave and *injured on duty* are all those man-days lost to the company for one or other of those reasons.

(b) Percentage based information

% driver utilization is the number of actual working hours taken as a percentage of the total paid hours.

This ratio shows how effectively driver time has been made use of.

% driver turnover is the number of resignations and discharges over a given period of time as a percentage of the total number of drivers employed by the company.

To avoid misinterpretation of the ratio it is necessary to qualify it with the length of service of those drivers that have resigned or been fired. It may turn out that it is only one or two positions that are giving any real cause for concern.

(iii) Monetary control information

The control information in this case is generally presented in the form of an income statement as shown in table 5.4.

All of the cost centres shown in table 5.4 were discussed in some detail in chapter four.

In conjunction with the balance sheet and the income statement, table 5.3 outlines some useful control information.

(a) RAND based	- revenue per vehicle
	- profit per vehicle
	- revenue per employee
(b) PERCENTAGE based	- net profit before tax to revenue
	- net profit before tax to capital employed
	- revenue to assets
	- fixed costs to revenue
	- variable costs to revenue
	- total costs to revenue
	- revenue earning assets to non-revenue earning assets

Table 5.3 Monetary performance indices

No explanation of individual indices will be entered into here as most of them are self explanatory.

Each index tells a story in its own right. It is therefore, up to the management to put together the entire picture from the indices mentioned above, as well as the control information

INCOME STATEMENT

For.....
(Month) (Year)

	Actual	Cents/Km	Cents/Km	Budget
Freight Revenue				
Sundry Revenue				
A. TOTAL REVENUE				
Operating Variables				
1.) Fuel				
2.) Salaries & Wages-overtime				
3.) Tyres				
4.) Travel and subsistence				
5.) Outside hire				
6.) Claims - provision				
7.) Manpower training				
8.) Cars and vans				
9.) Washbay				
10.) Other				
Maintenance Variables				
1.) Salaries & Wages-overtime				
2.) Materials				
3.) Outside work				
4.) Consumable stores				
5.) Accidents - provision				
6.) Other				
B. TOTAL VARIABLE COSTS				
C. CONTRIBUTION (A-B)				
Operating Fixed				
1.) Salaries, wages & benefits				
2.) Licences and permits				
3.) Insurance				
4.) Vehicle depreciation				
5.) Other				
Maintenance Fixed				
1.) Salaries, wages & benefits				
2.) Equipment depreciation				
3.) Other				
Administration				
1.) Insurance				
2.) Interest				
3.) Rent or amortisation				
4.) Salaries, wages & benefits				
5.) General overheads				
6.) Other				
D. TOTAL FIXED COSTS				
E. SALE OF ASSETS				
F. NET PROFIT / (LOSS)				

Table 5.4 Monetary centred information

mentioned earlier, and for them to come to grips with problems and opportunities.

A great deal of the control information discussed earlier can lead management to the source of problems and opportunities if, at the secondary document stage, information is accumulate according to

- job
- customer
- market segment
- individual vehicle
- vehicle type
- area
- driver

Table 5.5 gives a list of useful statistical breakdowns.

The accumulation of this data has a 'smoothing out' effect in that management deals with the overall situation rather than isolated incidents where variances occur. The isolated incidents can always be followed up by lower management.

5.2.4 Obtaining control information

(i) Vehicle control information

The prime source of this data is from calibrated measuring instruments of one sort or another. Examples are:

Clocks - measuring time
Scales - measuring weight
Odometer - measuring distance
Flow meter - measuring volume

	By Job	By Customer	By Market Segment	By individual vehicles	By vehicle type	By areas	By driver
Total vehicle available time			xxx	xxx	xxx		
Downtime			xxx	xxx	xxx	xxx	xxx
Actual vehicle working time	xxx	xxx	xxx	xxx	xxx		
Kilometres travelled	xxx	xxx	xxx	xxx	xxx	xxx	xxx
Preventitive maintenance program				xxx			
tonnes carried		xxx	xxx	xxx	xxx	xxx	
Actual payloads	xxx	xxx	xxx	xxx	xxx		
fuel used	xxx			xxx	xxx		xxx
Oil used	xxx			xxx	xxx		
Fuel consumption	xxx			xxx	xxx		xxx
Oil consummption	xxx			xxx	xxx		
Total paid hours							xxx
Actual working Hrs							xxx
Overtime hours	xxx						xxx
Trip times	xxx	xxx	xxx	xxx			xxx
Absenteeism							xxx
Sick leave							xxx
I.O.D.							xxx
% Downtime			xxx	xxx	xxx	xxx	
% Vehicle utilization	xxx		xxx	xxx	xxx		
% Capacity utilization	xxx	xxx	xxx	xxx	xxx		
% Driver utilization	xxx						xxx
Freight Revenue	xxx	xxx	xxx			xxx	
Operating Var.			xxx				
Maintenance "			xxx	xxx	xxx		

Table 5.5 Useful statistical breakdowns

Manual or mechanical recording of data from any of these sources will generate the data required in table 5.1.

It is important to establish early on whether or not the vehicle or the driver, or both, are to form the foundation of logging time. In a situation where a driver has his own allocated vehicle it is fairly simple either to log both driver and vehicle. Where the situation requires the alternating of drivers between vehicles, it becomes more complicated to log both resources as effectively. The first situation usually warrants a 'per day' log sheet for both vehicle and driver whilst the second situation calls for a 'per day' log sheet for the driver and a 'per trip' log sheet for the vehicle.

Whatever the final logging system used is, a very useful aid for the recording and verification of data is the tachometer. This instrument records mechanically on a tachograph chart (see exhibit 12) the following information:

- road speeds
- engine r.p.m.
- distance travelled
- engine running times
- vehicle travelling times

A tachograph chart has the advantages that it is tamperproof and a permanent and comprehensive record of the events taking place on a delivery.

To make the fullest use of any of the information that is forthcoming from the measuring instruments previously mentioned,

it is necessary to have pre-determined standards for each item being measured. Thus standards which are acceptable to the company are required for the following information listed in tabel 5.1:

- payloads
- fuel and oil consumptions
- % downtime and % availability
- % vehicle utilization

The standards are arrived at by drawing on both the historical and theoretical knowledge of the item under consideration, and coming at an optimal solution. The theoretical consideration must be brought in to check on assumptions and to eliminate biases that may exist in the historial data.

The standards for the remainder of the information on table 5.1 are the results of the previous equivalent periods.

Against these pre-set standards, actual performance levels are analysed and controlled.

(ii) Driver control information

The prime sources of data in this case revolve around a clocking in and out device and the tachograph charts mentioned under 'Vehicle control information'. In the absence of one or both of these pieces of equipment, manually recorded time or log sheets will have to suffice. The latter method is fraught with problems, particularly from a control point of view, and is to be avoided where possible.

Similar to that for 'Vehicle control information', pre-set standards are required in order to use actual performance levels as a control mechanism. The standards that are called for in table 5.2 are:

- overtime hours for individual deliveries
- trip times for individual deliveries
- % driver utilization
- % driver turnover

These standards are determined in the same manner as the standards for the 'Vehicle control' standards.

Exhibit 12 illustrates a standard trip time that is issued to a driver prior to his leaving the depot and the actual times which are obtained on analysis of the tachograph chart for that trip.

To complement this quantitative information, it is advisable to have a source of qualitative information by way of on-the-road supervision. Reports on job attributes such as standard of dress, courtesy on the road and with customers, documentation and general attitude all go towards measuring a man's worth to the company.

(iii) Monetary control information

Control information for this resource will come almost entirely from the generally accepted books of accounting (i.e. journals and ledgers) which ultimately lead to the drawing up of income statements and balance sheets.

These summaries of a company's financial performance are usually

only presented monthly or quarterly due to the amount of work required to produce these documents. Companies with sophisticated computer systems may be able to produce an income statement and balance sheet at a moments notice, however.

The information required to derive the control information shown in table 5.3 will come from the two summary documents mentioned above.

Pre-set standards are again required for effective control, as was the case for the previous control information. The standards will take the form of a budget which is compared with the actual financial statements either monthly or quarterly whichever is appropriate.

In view of the frequency intervals, it is quite useful to record:

(a) The units of large cost centre items as they are being incurred during the intervals. These units multiplied by an estimated cost, will give an indication of how costs are being controlled.

Fuel, tyres and overtime are examples of where this is useful.

(b) All purchases made in each cost centre as they are ordered. Purchases from outside companies must be made by means of and official company order only if this means of control is to succeed. Exhibit 14 is a sample of a cost centre control sheet.

(c) The accumulated sales as invoiced out give a useful indication of the state and activity of the market place a company is operating in. This is very often more meaningful if split up into the different market segments, if market segmentation is used.

5.3 COST AND OPERATIONAL INFORMATION RELATIONSHIPS

In making use of the control information that has been discussed in the preceding sections of this chapter, it is important that all information is kept in its correct context when it is being used for decision making purposes.

This section will be spent integrating much of the data discussed earlier into a larger overall perspective. Table 5.6 supplies the framework around which the discussion will be based.

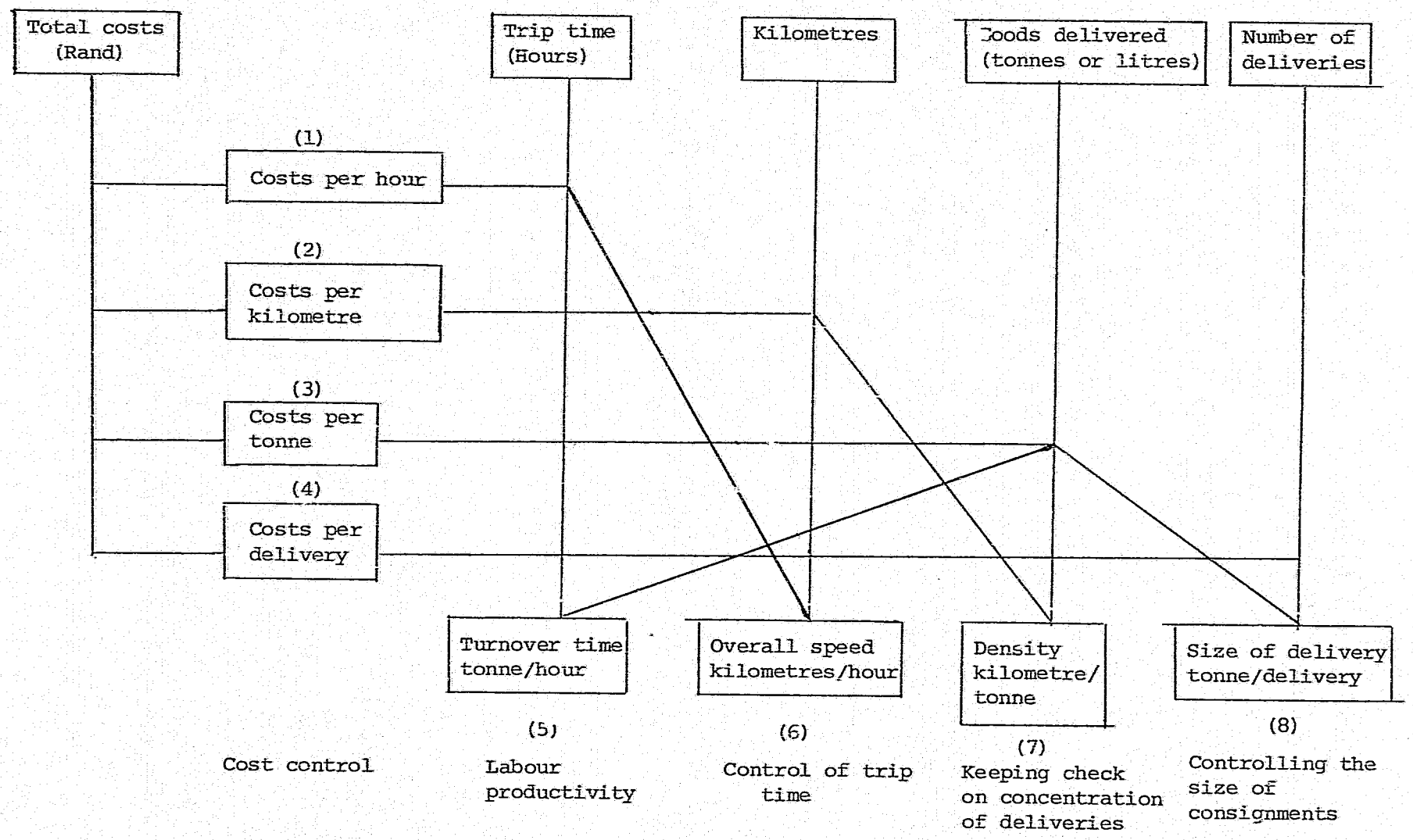
When discussing 'cost' in the following sections, reference is being made to the cost to the *operating* company and not to the ultimate purchaser of the goods or services.

5.3.1 Cost per hour

The hourly cost is the accumulation of all those costs that are consumed with time, and therefore, *refers basically to all fixed costs*. All of the cost centres covered earlier in chapter four under the headings of 'Operational fixed', 'Maintenance fixed' and 'Administration' fall within the scope of hourly costs in that they are costing the company money as time moves on, regardless of whether or not the vehicles are working.

Since all costs relevant to this section have a time basis, it

Table 5.6 Control of costs and performance in road transport



(Adapted from that presented by Dr. C. Verburgh in his series of unpublished lectures 'Practical Road Transport Management' Lecture 8).

is natural, therefore, that the control mechanism used to assess performance in this area should also have a time base. Hence, attention will be focused on the time based information of table 5.1 (for vehicles) and table 5.2 (for drivers) as well as the total fixed costs on table 5.4 for the control of the 'cost per hour'.

The ideal situation with hourly costs is to gain the maximum utilization of resources in the time they are available. Consequently, most of the units of performance refer to the hours utilized out of the hours available. High vehicle and driver utilization implies that there is little wasted time, effort and money on the part of these 'fixed' resources. For the remaining fixed assets, the ratio of fixed costs to total costs must be kept down to a reasonable minimum.

Figure 5.1 illustrates the effect of high fixed costs on the breakeven point.

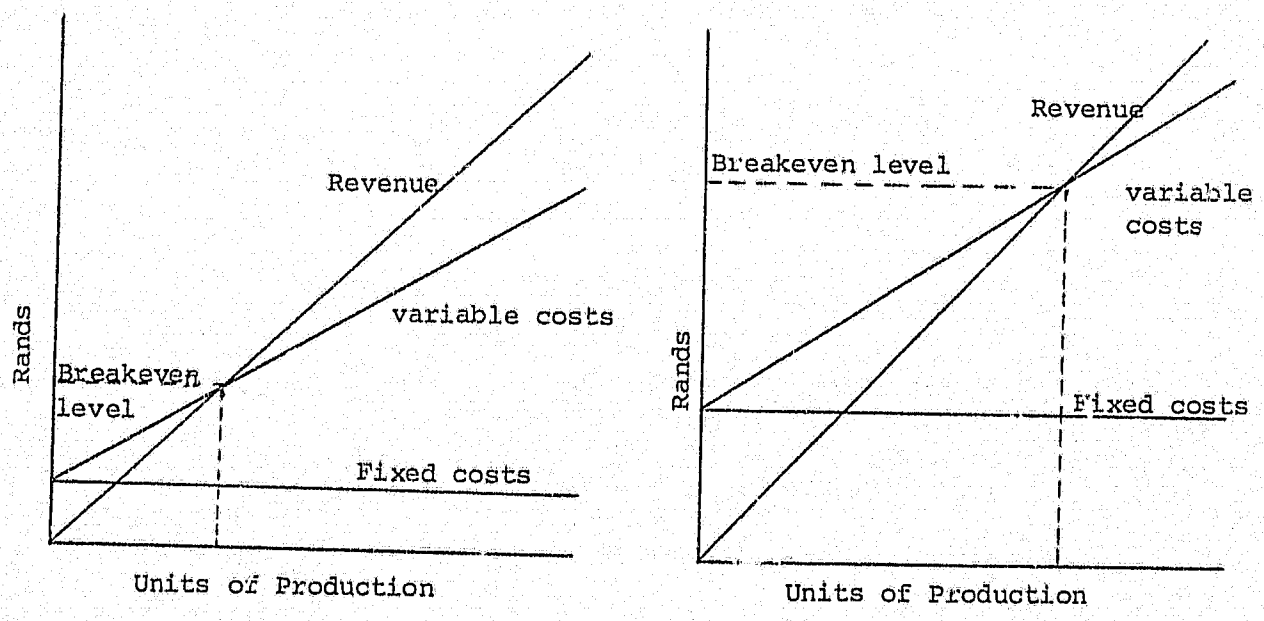


Figure 5.1 Difference in breakeven points with varying fixed costs

It can be seen that a variation in the fixed costs, assuming identical variable cost and revenue curves, is quite substantial. Thus, the higher the fixed costs, the more vulnerable a company becomes in the event of a downtown in its market.

When recovering these fixed costs from the customer, it is important that these costs are recovered over a vehicle's working hours and not over the total available time for the vehicle. Preventation maintenance, breakdowns and delays will always make it a physical impossibility to achieve 100% utilization, therefore this fact must be taken account of when costing.

5.3.2 Cost per kilometre

Since distance travelled is one of the principal units of productivity in a transport business (the other being 'tonnes delivered') the 'cost per kilometre' is very representative of the variable cost component of a transport operation.

The costs discussed under 'Operating Variables' and 'Maintenance Variables' are very much related to this section.

Control of these costs is achieved by relating the consumption rate of variable cost items to the amounts of kilometres travelled. Any unfavourable variances that are noticable on comparison with a predetermined standard must be followed up, either with an explanation or corrective action.

The objectives of controlling variable costs is to reduce them to a safe minimum per unit of production. Figure 5.2 illustrates the effects of low unit variable costs assuming the same fixed cost and revenue curves.

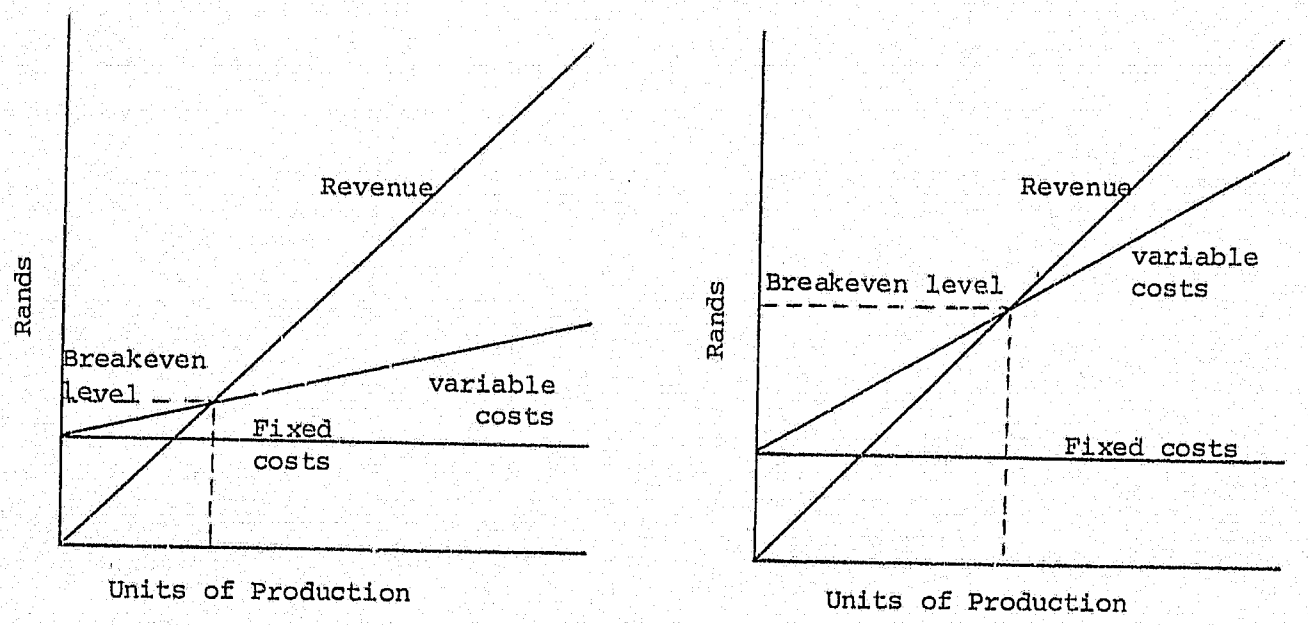


Figure 5.2 Difference in breakeven points with varying variable costs

It can be seen that the lower the variable costs, the more accessible the breakeven point becomes

When looking at these costs, it is wise to constantly monitor the price rates for high volume variable costs such as fuel, tyres and overtime, as undetected price increases can lead to serious profit erosion.

5.3.3 Cost per tonne

(N.B. this can be changed to read 'cost per unit payload for some of the more specialized types of transport not dealing in tonnes)

This cost relationship can be summarized for a particular job as being:

$$\text{(cost per tonnes} = \frac{\text{trip time} \times \text{(cost per hour)} + \text{kilometres} \times \text{(cost per kilometre)}}{\text{payload}}$$

The control of 'cost per hour' and 'cost per kilometre' have already been dealt with. The emphasis is therefore on 'payloads' in this section.

The control objective here is to maximise payloads, within technicial and legal constraints, thereby reducing the cost of delivering each unit of payload.

Vehicles that are underloaded result in lost revenue (if the rate is on a per tonne basis) as well as increasing the cost to deliver each unit of payload. Overloaded vehicles on the other hand run the risk of heavy traffic fines and at the same time punish the vehicle beyond its technical limits. As neither of these consequences are in the interest of the company, the optimal payload must be determined and every effort should be made to meet it.

5.3.4 Cost per delivery

The relationship covered here is the cost of a complete delivery, regardless of the number of delivery points stopped at during that particular delivery.

It may be summarized as:

$$\text{(Cost per delivery)} = \text{delivery trip time} \times \text{(cost per hour)} + \text{delivery kilometres} \times \text{(cost per kilometre)}$$

This is almost identical to the equation for 'cost per tonne' except that the 'payload' has been excluded.

Usually costings are worked out on a 'per delivery' basis

initially with a 'per tonne' rate being given in quotations for these transport types moving goods of uniform density. Since the estimated costs have been calculated from this equation, it is a useful exercise to check that the actual situation matches that used in the estimated situation. If variances exist, they must be corrected as soon as possible.

5.3.5 Turnover time

The relationship developed here (i.e. tonnes per hour) is useful for monitoring the drawing off, or arrival of product at a manufacturing or processing plant.

For example, if a pre-mixed concrete plant is capable of producing one hundred and fifty cubic metres of concrete an hour, it is useful to record the rate of flow of raw materials (i.e. sand, stone and cement) into the plant, and the rate of flow of concrete out of the plant.

Turnover time is primarily used when considering continuous flow type operations.

5.3.6 Overall speed

The number of kilometres covered per hour provides an indication of the average speed at which deliveries are achieved. It is not an average road speed, but an average inclusive of all stops and delays.

Such an index is useful for showing up problem zones, customers, drivers and vehicles. Once a low overall speed has been detected, a simple check with historical records will show if there are any common factors amongst the 'suspect' areas mentioned above.

The overall speed, once it is known, is a useful yardstick for estimating times of arrival and round trip times if needed quickly and approximately.

5.3.7 Density

The number of kilometres that have to be travelled to deliver one tonne of payload gives an idea of how close the delivery points are to the operating depot.

Large volumes being delivered whilst relatively few kilometres are travelled implies that the work is fairly localized. Low volumes relative to the amount of kilometres travelled implies longer distance work. The size of vehicle being used can effect this ratio so some time must be spent in deciding what is the optimal size of vehicle for a given set of working conditions.

On a multi-delivery route, an indication of the 'speed' of the delivery points can be gained from comparing this ratio with the kilometres between the depot and the centre of the delivery zone.

The objective of this relationship is to minimize the kilometres travelled, thereby reducing the variable costs, and maximising the tonnes delivered, hence increasing the revenue, within the limiting constraints imposed by the route.

5.3.8 Size of delivery

The ideal size of a delivery is for one full load to be delivered to each delivery point. This, however, is impractical in some lines of business, resulting in part loads having to be delivered. The objective is therefore to keep the size of part load deliveries up to their maximum.

There is a limit to the number of 'drops' that can be made economically on one single delivery run. This limit must be determined and the market made to accept these minimums.

5.4 CONTROL RELATIONSHIPS AMONGST THE TRANSPORT TYPES

In chapter four it was established, for a number of reasons, that the variable cost structures of the different transport types were related to the nature of the market they operate in and its associated environments. It is reasonable to assume, therefore, that there may be differences in the mechanism used to control costs and performance.

It will be assumed that the basic control data referred to earlier in tables 5.1, 5.2 and 5.4 are recorded by a company's recording system. This section will refer to the controls mentioned in table 5.6 .

5.4.1 Parcel delivery

This type of operation is basically an in-town, normal working hour, multidrop type of operation. The focal points for controlling this type of work must therefore be on:

(a) cost per delivery
(b) cost per unit payload
(c) overall speed
(d) density
(e) size of delivery

(a) takes account of the total fixed and variable cost components which must be recovered either directly from the customer or indirectly through the price of the goods being purchased.

(b) provides the rate for the recovery of transport costs from the customer.

(c) monitors the in-town travelling and the multidrop nature of this type of work. Delivery problem areas are soon highlighted by slow overall speeds.

(d) and (e) are specifically applicable to multi-delivery work and insure that the maximum amount of goods are delivered with the minimum running costs being incurred.

5.4.2 Bus service

The nature of this type of transport is again that of an in-town, multi-drop operation. Longer working hours and daily peak periods, however, cause this type of transport to differ slightly from the 'Parcel delivery' set up.

Control relationships will be centred around:

(a) cost per kilometre
(b) cost per unit payload
(c) turnover time
(d) overall time
(e) delivery density

(a) provides the base on which all fares are charged.

(b) an overall company performance index in that it measures the cost per passenger carried. Relating this to the fare paid per passenger indicates whether or not the entire operation is profitable.

(c) this is an index of the extent and timing of peak periods.

(d) serves the same purpose as for 'Parcel delivery'.

(e) the average distance travelled per passenger is useful for determining the economics of a route or service, very much in the manner that was used for the minimum size of deliveries.

5.4.3 'Ad hoc' flatbed

Since the type of work done here is of such a variable nature, it is difficult to monitor any one particular area other than the overall costs and the performance for individual deliveries.

Control is based around:

(a) cost per hour
(b) cost per kilometre
(c) cost per delivery
(d) overall speed

(a) is the base for fixed costs that have to be recovered.
(b) is the base for variable costs that have to be recovered.
(c) this is made up of (a) and (b) according to the equation given in section 5.3.4. Actual costs will be compared to the original estimated costs on the completion of a delivery.
(d) is an overall index of how quickly a job was completed.

5.4.4 Pre-mixed concrete

This operation is generally on a full load basis within a fairly localized area.

Control relationships, therefore, are based on:

(a) cost per unit payload
(b) turnover time

(c) overall speed
(d) delivery density

(a) is used as a basis for costing as well as measuring actual performance against budget.
(b) this gives the rate at which concrete is being drawn out of the pre-mix plant.
(c) again, this indicates the rate at which work is being done.
(d) the relative closeness of delivery points to the depot indicates how well the fleet will be able to cope with a days programmed deliveries. The longer the average distance get, the more time a vehicle requires to complete a delivery.

5.4.5 Containerized waste

As in the case of 'Ad hoc' flatbed work, the nature of the work can vary greatly. It is therefore necessary to use control relationships that are flexible enough to measure the performance of individual jobs.

These are:

(a) cost per hour
(b) cost per kilometre
(c) cost per delivery
(d) overall speed
(e) delivery density

(a) and (b) are indices for fixed and variable costs respectively.
(c) measures the performance level for each individual job.
(d) shows the rate at which work is being done.
(e) as for 'Pre-mixed concrete', provides a measure of how localized the work is to the depot.

5.4.6 Bulk transport

This work is long distance in nature catering for full loads only. Deliveries are usually to a limited number of regular customers, making it a relatively simple task to monitor cost and performance levels.

Control relationships centre around:

(a) costs per kilometre
(b) costs per tonne
(c) costs per delivery
(d) overall speed

(a) monitors the variable costs which become increasingly important in high kilometre work.

(b) forms the basis of the costing exercise, and is useful for highlighting payload problems.

(c) this is an overall cost of undertaking a delivery to a particular customer, a useful index for comparing actual costs with estimated costs when the number of customers are limited.

(d) is an indication, as previously mentioned, of the rate at which work is being done.

5.4.7 Abnormal loads

This type of work consist primarily of one-off jobs making it necessary to monitor performance according to individual jobs.

Control will revolve around:

(a) cost per hour
(b) cost per kilometre

(c) cost per delivery
(d) overall speed
(e) size of delivery

(a) and (b) measure fixed and variable costs respectively.
(c) indicates the performance level in individual deliveries.
(d) measures the rate at which work is done. This is important for abnormal loads since charges are usually made on an hourly basis.
(e) this is an index to monitor the vari ion in load size due to weight, volume or dimension constraints being a critical factor in this type of transport.

5.5 SUMMARY

The major portion of this chapter has been spent reviewing the most important information required in the performance appraisal of any road transport operation. The different information centres have been defined and discussed.

Some time has also been spent in discussing relationships between operational and cost statistics, and how these relate to the sample of transport types selected for the dissertation.

CHAPTER SIX

CONCLUSIONS

6.1 INTRODUCTION

This chapter will consist of short summaries highlighting the major points of interest that have been forthcoming from the discussions undertaken in chapters three, four and five as well as drawing conclusions on the specific objectives outlined in the Introduction (section 1.4).

These summaries are set out in the same sequence in which the topics appear in the study with separate conclusions being reached for each section.

6.2 MARKET FORECAST AND VEHICLE REQUIREMENT CONCLUSIONS

6.2.1 Market forecasts

The forecast market volumes form the foundation of the vehicle requirement calculations, and presumably, the entire costing or budget. Thus, all decisions relating to the correction of problem areas or the seizing of opportunities which come out of these calculations depend on the fact that the groundwork in determining the future volumes has been done properly.

There are three major sources of information on future market volumes as discussed in section 3.3. These are:

(i) *People* - their thoughts, comments and knowledge on the subject. Three categories of people are most relevant and these are:

(a) customers
(b) salesmen
(c) experts.

(ii) *Sample of customers' behaviour* - reactions from a market test of some sort is being referred to here.

(iii) *Customers' historical behaviour* - the past performance of individual customers or the complete market as measured by company sales.

It was established during interviews with the companies operating the different types of tranport, that the sources of information were different and depended on the nature of the market being considered. This is shown in table 6.1.

The sources are numbered in the order of their usefulness to the individual transport types as determined during the interviews. The reasons for these rankings are as follows:

1. People

(i) *Customers* - these are the most important sources for most transport types. This is because they are in the best position to know what their transport requirements for the future are. Parcel delivery and Bus service, however, have too many small customers to make this a practical source of information.

(ii) *Salesmen* - these are the next most reliable sources of information for most of the transport types and first in the case of Parcel delivery for the reasons stated in (i).

The Bus service and 'Ad hoc' flatbed did not use salesmen in their companies at all.

(iii) *Experts* -the use of outside experts was restricded to those types of transport where either social or engineering interests were present. The Bus service made use of statisticians and public transport consultants. Pre-mixed concrete and Bulk transport used experts in the building and road-making industries respectively. The Containerized waste category kept close to pollution control bodies and also to technical organisations concerning themselves with waste disposal and the recycling of waste material.

2. Market tests - this only really applied to two types of transport. Firstly, Parcel delivery when tests were being carried out on new products or pricing and packaging strategies. The results could have repercussions on the transport requirements. Secondly, the Bus service carried out test services from time to time.

3. Historical performance - this applied to all transport types with varying degress of importance. Most transport types could gain some idea of trends from looking at this information. Parcel delivery and the Bus service placed a great deal of faith in this information stating that their markets were relatively stable and they had little other information on which they could rely. (See 1.(i)) of this section. 'Ad hoc' flatbed had an unstable market, but few other sources of information. The remaining transport types all had several sources of information but used this one for isolating and checking on trends.

Source	Parcel delivery	Bus service	'Ad hoc' flatbed	Pre-mixed concrete	Containerized waste	Bulk transport	Abnormal loads
(1) People							
- customers			1st	1st	1st	1st	1st
- Salesmen	1st			2nd	2nd	2nd	2nd
- Experts		2nd		3rd	4th	4th	
(2) Market tests	3rd	3rd					
(3) Historical performance	2nd	1st	2nd	4th	3rd	3rd	3rd

Table 6.1 Relative importance and usefulness of information sources

6.2.2 Vehicle requirements

The following conclusions were arrived at for the specific objectives set out in the Introduction (see Chapter One, section 1.4.1).

(i) Factors influencing the optimal fleet size

These factors were found to influence the fleet size:

(a) volume of traffic

A single vehicle of a given size is only capable of a certain amount of work. When this limit is exceeded, additional vehicles become a requirement. Similarly, the case for a given fleet. That fleet has a limit to the volume of work that can be handled before additional capacity becomes necessary.

(b) certainty of future volumes of traffic

A sound business practice is to invest only in assets which are going to be used in the immediate or near future for the benefit of the company. This is particularly relevant when considering expensive capital equipment. It is important, therefore, to gear up with equipment only as far as there is work for that equipment to do. This means only considering that work due to come up in the future that has a reasonable probability of actually materializing for the purposes of vehicle requirement calculations. This way a company is 'investing' rather than

'gambling' on its future.

(c) payloads

Once the volume of work has been determined, the payload(s) of the vehicle(s) doing the work decides the number of trips required to move that volume of goods. The higher the payload(s), the less trips that have to be done, and therefore the less vehicles required to complete the work.

(d) trip times

The times a vehicle takes to deliver a load of goods to an area or customer influences the number of vehicles required to complete all the loads programmed for the fleet in a given period of time. If it is possible to reduce trip times within reasonable limits by either speeding up the handling methods used in loading and unloading vehicles or the average speed at which a vehicle is capable of working. The use of mechanized handling and of more powerful vehicles are respective examples of what can be done to improve trip times.

(e) loading and discharge times

Restrictions on the times available for loading or discharge of vehicles means that more vehicles are required to move a certain volume of goods than would be required if the times were unrestricted. This is because the vehicle idle time is considerably reduced in the latter situation.

(f) downtime

To undertake work, only working vehicles can be considered. Thus, because of the mechanical nature of the vehicles and its equipment, some cognizances must be taken of the fact that vehicles will not be available from time to time either because of (a) scheduled maintenance or (b) unscheduled maintenance. A reserve factor of vehicle capacity must be added to the fleet to take account of this therefore, and consequently affecting the size of the fleet.

(g) peaks

Irregular fluctuations, either on a daily, monthly or seasonal basis, in the market place calls for varying amounts of vehicle capacity.

(h) service levels

It is necessary, very often, in cases where there are either regular or irregular peaks in a market place (see item (g)), to pre-set the maximum service levels to which the company is prepared to go. This will mean limiting the number of vehicles in the fleet relative to a given level of work during the peak periods.

(i) ratio of prime movers to carrying units

In operations with excess carrying capacity (e.g. containers, semi-trailers) over the number of prime movers employed, the ratio of the number of prime movers required to service a given amount of carrying units can influence the fleet size substantially.

(j) special requirements

Work which requires a particular type of equipment not entirely suited for a company's general operation can increase the fleet size if the company accepts this work.

(k) cars and vans

The number of vehicles ancillary to running a transport operation, such as salesmen, supervisors and maintenance vehicles, although not part of the main fleets, can become a major consideration in fleet planning, particularly in larger organisations.

(ii) Which factors influencing fleet size the company has partial or complete control of:

Table 6.2 shows the control position of the company for each of the abovementioned influencing factors.

Influencing factors	Complete company control	Partial company control	No company control
(a) Volume of traffic		*	
(b) Certainty of future volumes of traffic			*
(c) Payloads		*	
(d) Trip times		*	
(e) Loading and discharge times			*
(f) Downtime		*	
(g) Peaks			*
(h) Service levels	*		
(i) Ratio of prime movers to carrying units		*	
(j) Special requirements	*		
(k) Cars and vans	*		

Table 6.2 Company control of factors influencing fleet size

The company has partial control over the *volume of traffic* in that it can use sophisticated marketing techniques to influence customers but the company cannot guarantee the *certainty of future volumes of traffic*, since the final decision rests with the customer, over which the company has no control.

In regard to *payloads*, the company can select the optimal vehicle, but it cannot always ensure that (a) full loads are carried *at all times* (because some work involves working with part loads only) and (b) the vehicle selected is able to negotiate restricted entrances and exits encountered in the market place, particularly on in-town work.

Trip times are controllable to the extent that delivery times can be brought into line with optimal and safe pre-set standard times for each delivery. This is achieved by eliminating unaccounted for and wasted time by delivery staff whilst they are engaged on deliveries.

It is rare for a company to control both the *loading and discharge times*. Usually it will only control one of them which puts the company at a disadvantage if it wishes to extend that time which it does not control in order to increase vehicle working hours.

Vehicle *downtime* can be minimized by the correct preventitive maintenance but it cannot be eliminated completely by the company. It is a case of having more downtime incurred of a preventitive nature in the depot with less out on the open road where considerably more time is required to get vehicles moving again.

Daily, monthly or seasonal *peaks* are largely a characteristics of the market, over which the company has very little control. Efforts may be made to educate the existing customers in better planning of their

transport requirements, but this usually has a limited effect since they are not interested in anyone else's problems. Even after a customer has been effected by a shortfall in vehicle capacity, through his own lack of planning, he will invariably place the blame fairly and squarely on the shoulders of the transport operator.

Service levels are levels which are set as a matter of company policy in order to provide guidelines for the internal planning and control of an operation. This factor is, therefore, entirely within the control of the company.

The *ratio of prime movers to carrying units* is dependent on the nature of the operation. The company can only control this factor the extent that it ensures that the utilization of both prime movers and carrying units are at the maximum possible.

If a job has *special requirements* necessitating specialized vehicles or equipment, it is completely at the company's discretion whether or not they get involved in that type of work.

The number of *cars and vans* a company operates is again at the company's sole discretion. Certain practical considerations with regards to the vans are called for, but the cars are usually either a job status symbol or else a system chosen as a matter of company policy for the allocation of cars to salesmen.

(iii) Differences amongst the transport type vehicle requirement calculation methods

(a) Parcel delivery - this type of transport was used as the example for describing the standard method of vehicle calculations to be used as a basis throughout this study. It is therefore completely straight forward with the only

noteworthy points being the low payloads and the restricted discharge times as determined by the market place.

(b) Bus service - this category of transport is completely non-standard since there is a continual variation in the size of the paylaods as well as the fact that a *regular* service between localized points is required.

The method used here, therefore, relies on service levels as the criterion on which vehicle requirements are based. Consequently it is a somewhat arbitrary method.

(c) 'Ad hoc' flatbed - the method used here is standard and as was used for Parcel delivery. A difference, which does not come across in the calculation, however, is that there is a great deal more uncertainty in the market volumes in this case by virtue of the nature of the market. This tends to undermine the validity of the calculations depending on the degree of uncertainty.

(d) Pre-mixed concrete - the method adopted here is completely standard.

(e) Containerized waste - In this case the standard method was used, but it was used twice. Firstly, to determine the number of each type of container required, and then secondly, to determine the number of prime movers need to keep those containers mobile.

It is important to keep separate totals for all specialized equipment in this type of transport if the company is to equip itself with the correct sort of containers and vehicles.

(f) *Bulk transport* - the method used here is completely standard.

A point of note is that this is primarily long distance work. This means, therefore, that equipment is tied up for long periods on individual jobs. If work that is plannned to come up does not materialize or else unanticipated work does present itself, the company can find itself with a vehicle surplus or shortfall respectively very quickly.

(g) *Abnormal loads* - it is possible to use the standard method of calculating here, but, as for 'Ad hoc' flatbed, the certainty with which future volumes can be predicted is extremely low. This makes the calculations of questionable value.

There is no substitute method that can be suggested for this category since without reasonably accurate volumes, it is virtually impossible to predict the number of vehicles required mathematically.

6.3 ROAD TRANSPORT COST CONCLUSIONS

The discussion in this section (i.e. Chapter four) were mainly directed at providing conclusions to the specific objectives as set out in section 1.4.2 of the Introduction (Chapter one).

(i) The most meaningful cost centres applicable to road transport

Table 6.3 shows the most useful cost centre breakdown as determined from interviews. Three categories are shown below:

(a). essential to all transport types - those cost centres which are vital if cost control is to be achieved.

(b) useful to most transport types - those less important cost centres that can either be grouped with a larger cost centre or kept as a separate entity in their own right.

(c) those of a specialized nature - cost centres which are particularly useful to certain types of transport.

Responsibility heading	Essential cost centres	Useful cost centres	Specialized cost centres
Operating variables	Fuel	Travel and subsistence	Crane hire
	Salaries and wages-overtime	Outside hire	Dumping fees
	Tyres	Claims-provision	Heating
	Manpower training	Cars and vans	Night out allowance
	Other	Washbay	Quality control
Maintenance variables	Salaries and wages-overtime	Accident provision	
	Materials		
	Outside work		
	Consumable stores		
	Other		
Operating fixed	Salaries, wages and benefits		
	Licences and permits		
	Insurance (vehicle)		
	Vehicle depreciation		
	Other		
Maintenance fixed	Salaries, wages and benefits	Equipment depreciation	
	Other		
Administration	Insurance		
	Interest		
	Rent/Amortisation		
	Salaries, wages and benefits		
	General overheads	Other	

Table 6.3 Relative importance of individual cost centres

It can be seen from table 6.3 that those cost centres which are not essential, are either of a more minor nature or else are recommended as a back-up to the other information used for decision making. All of these can be absorbed into bigger cost centres if necessary.

In the case of 'Maintenance variables' and 'Maintenance fixed' the essential cost centres may change if little or no work is done in-company. For example, salaries and wages (fixed and variable), materials and consumable stores may be removed with a corresponding increase in outside work.

The specialized cost centres refer only to the 'Operating variables' since this is where the different nature of each market or operation become most apparent. Once a characteristic of a market or operation leads to a significant amount of money being spent on a certain item, thought should be given to extracting this item out and putting it into a cost centre of its own.

(ii) The most significant 'Operating variable' cost centres

The most significant order of 'Operating variables' for the individual transport types was shown in table 4.4. In this section, the results shown on table 4.3 (on which table 4.4 is based) will be extended to the transport industry as a whole.

It must be noted here that, although the 'Operating variables' are only being looked at here, the 'Maintenance' and'Administration' costs are a very important part of a company's cost structure. Unfortunately it was only possible to carry out valid comparative studies on the 'Operating variables' because of the somewhat arbitrary nature of the other two headings.

The general order of importance across the sample of transport

types are found to be:

(a) *Fuel* - fuel counted for the major proportion of the variable costs for all the transport types, with the exception of one case. The percentage contribution varied from 59,4% to 17,3% with an average of 39.8%.

(b) *Overtime* - the second biggest contributor to the operating variables in five of the seven examples was overtime. The percentage contributions vary from 58,5% to 8,9% with an average of 23,1%.

(c) *Tyres* -the next largest contribution is tyres with percentage contributions varying from 21,4% to 3,9%. The average contribution is 12,5%.

(d) *Other* -different expenditure items of a specialized nature required by some transport types were allocated under this cost heading. This has inflated the significance of this cost centre somewhat and is not truly representative of the actual situation. For the record, percentage contribution varied from 24,4% to 3,8% with an average of 11,3%.

(e) *Cars and vans* - this category accounted for percentage contributions varying from 13,6% to 0,6% with an average of 5,2%.

(f) *Manpower training* -contributions ranged from 5,2% to 0,2% having an average of 2,8% for this cost centre.

The remaining 'Operating variable' cost centres are either of a specialized nature, and therefore only apply to certain transport types, or else make a very small contribution to variable costs. In both cases, it is dangerous to extend these results into other fields of transport as they are more than likely to prove invalid.

(iii) The predictability and control of cost centres

In this section the ability of the company to predict and control individual cost centres will be reviewed.

(a) *Fuel* -this cost centre is both predictable and controllable to a large degree. Fuel consumption can be calculated accurately for vehicle types without too much difficulty, but anticipating future fuel prices may be difficult.

Control on the purchase and drawing of fuel in the depot are relatively straight forward to control.

(b) *Salaries and wages - overtime* - for both the 'Operating' and the 'Maintenance' a certain amount of overtime is acceptable and predictable, but there is likely to be some that is quite unanticipated, particularly in the event of emergencies.

Most overtime can be controlled to within manageable limits by alert management.

(c) *Tyres* - like fuel, the consumotion rates of this item can be calculated mathematically, but the future cost of tyres is not always that predictable.

Tyres are controllable, by and large, either directly by the recording of tyre movement in the fleet or indirectly by such means as driver training.

(d) *Travel and subsistence* - this cost centre is predictable if the volume of work to be undertaken is known.

Control is easy to exert here.

(e) *Outside hire* - this is usually unpredictable and uncontrollable, since most times that a company is required to go to these lengths the cause is totally unanticipated. Only when a company has planned to seek outside help due to regular peaks is it of a predictable and controllable nature.

(f) *Claims and accident provisions* - both of these are reserves and therefore, pre-determined. Claims and accidents are usually the result of carelessness or else unfortunate circumstances, neither of which are predictable.

Control may be exercised indirectly by means of the correct training of staff.

(g) *Manpower training* - this is generally a pre-planned item, with the only unplanned training being that to replace staff who have resigned or been discharged. In the ideal circumstances, this latter category is almost non-existant.

Favourable working conditions and careful selection of personnel is the best method of controlling this area. This makes sure that most of the training done is retraining of current staff.

(h) *Cars and vans* - this is reasonably predictable. The historical costs of operating these vehicles are a useful guideline as to the average expected operating costs. Major mechanical repairs or price increases in fuel and tyres are the only aspects likely to change the situation.

The company can have a fairly tight control over these vehicles, either by making certain people responsible for individual vehicles or else logging all vehicle movements.

(i) *Washbay* - If approximate volumes of work are known, it is possible to predict the cost incurred in this type of facility. Where there are large washbay facilities concerned, care must be taken to estimating the future prices of the items used such as detergents, solvents, cleaning materials and boiler fuel.

Control must be exercised through someone being made responsible for this section.

(j) *Other* - this cost centre is, by and large, unpredictable in the cases of 'Operating variables', 'Maintenance variables' and 'Administration' but predictable in the cases of 'Operating fixed' and 'Maintenance fixed'.

Control is difficult here because of the great variety of incidental items falling under this category. Authorization by a responsible person before purchasing anything is probably the most effective control that can be applied in this case.

(k) *Materials and consumable stores* - these items are somewhat unpredictable, especially in the case of 'materials'. Those stores used on scheduled maintenance are predictable, but the greater proportion which is used on unscheduled maintenance is not.

Control is achieved in this case by the use of suitable ordering and stock control systems.

(ℓ) *Outside work* - as in the previous case, this is not very predictable in most cases. This is particularly true if most of the maintenance work is done outside the company.

The amount of control possible here will vary according to the company's dependence on 'outside work' for its maintenance requirements.

(m) *Salaries, wages and benefits* - this is predictable, since a company's personnel requirements are usually planned well in advance and they remain stable for long periods at a time. This applies to 'Operating', 'Maintenance' and 'Administration'.

Control of this cost centre is either through the resource utilization factors or else on the detection of surplus or deficiencies in staff requirements.

(n) *Licences and permits* - this is a pre-planned cost, and is therefore predictable.

Little or not control is required for this cost centre other than to see that the correct licences and permits are obtained on the due dates for the correct amount of vehicles.

(o) *Insurance* - for both vehicle and other insurance, the same comments as used for 'licences and permits' apply, except in this case, referring to insurance.

(p) *Vehicle and equipment depreciation* - the comments made under 'salaries, wages and benefits' apply here, except they refer to vehicles and equipment in this case and not people.

(q) *Interest* - this can be predicted provided a company is in a position to estimate future cash flows. If the cash flows are reasonably correct and there is no change in the going interest rates, an accurate prediction should be possible.

The financial statements are the control mechanism used in this case.

(r) *Rent or amortization* - this is entirely predictable and does not require any short term controls. The company should review the economics of its premises from time to time.

(s) *General overheads* - predicting these costs are difficult sometimes because of the many different items which fall under this heading. The degree of difficulty will depend on the number of items and the stability of their prices.

Control methods vary with the different items, but most of them lend themselves to control of one form or another.

6.4 CONTROL INFORMATION CONCLUSIONS

The specific objectives laid out in section 1.4.3. of the Introduction will be covered here.

(i) The basic requirements for an effective control system

It was found that there were four major considerations to be considered in the setting up of an effective control system. These were:

(a) The information itself

Two very important requirements have to be fulfilled before any information can be used in the decision making process. Firstly, it has to be *relevant* to the aspect of the company being controlled or reviewed. Secondly, it has to be *accurate* to within acceptable limits.

(b) The format

The design of the documents that go to make up the control system must record only that information which is required, and do it in such a way that it is understood by the people who are called upon to fill in the form.

It is noticeable that there is a swing away from the purely quantitative type format that is used lower down in the organisation to a more qualitative type of format as information moves up the organisation. The role therefore changes from one of an 'observer' to one of a 'decision maker' as mentioned earlier in the discussion.

(c) The flow

The flow of information vertically and horizontally through the organisation must be thought out carefully in order to ensure a continuous supply of useful information reaching those people who need it most.

(d) The frequency

The frequency at which a document should be produced should depend on its usefulness as a control tool. The more useful a document, the more frequently it should be produced.

Where very large volumes of data are involved, computerization can be the answer to quick and efficient processing.

(ii) What control information is required in road transport

The information requirements were found to be concerned with three of a company's most valuable resources

(a) vehicles
(b) drivers
(c) money

The control of the first two resources revolves around the utilization of time and capacity of each resource. The first step is to determine the time and capacity that is available for use under ideal conditions and then, secondly to compare this with the actual use obtained from both man and machine. This is applicable to both individual deliveries and to the accumulated monthly results.

Other control information that is kept on vehicles and drivers is related more to other control areas rathers than the two mentioned above. For example, tonnes delivered and kilometres travelled are an overall measure of market and fleet activity.

A more specific breakdown of the information to be collected on these two resources are shown in tables 5.1 and 5.2 in Chapter five.

The control information required to control the financial side of the business is basically measuring the ability of the company to make that money it either has or has borrowed grow. Hence

emphasis shown on tables 5.3 and 5.4 is on profit and the ratios of revenue to various types of costs. To assist in the location and correction of out-of-line costs, a number of different cost centres are used as outlined in the first part of section 6.3.

It is not felt necessary to repeat the information contained in tables 5.1, 5.2, 5.3 amd 5.4 as it can always be referred back to if the recommended control information is required to be looked at.

It was also found during the course of this study, that generally speaking, all the information required, particularly on the operational and maintenance side were freely available if the company was prepared to record and make use of it. On the financial side, the information was available, but only at infrequent intervals due to the length of time required to produce the income statement and balance sheet. This latter information must therefore have some sort of break-up system to maintain control in the intervals between the presentation of the financial statements. This it has in the operational and maintenance control information mentioned above.

(iii) Control in an overall company context

Throughout this dissertation the requirements and techniques available for controlling a business or department involving road transport has been discussed. It has been discussed by narrowing down aspects of the business into small specific areas which are easier to view in isolation.

It is important now, therefore, to mention that it is the company's or department's overall results which ultimately determine

the performance level of that company or department. Thus all the areas discussed earlier on must be kept in perspective by reviewing the picture as a whole. Not only must this be appreciation by the managers, where confrontations are usually more understanding and cordial, but also by those lower down in the organisation who tend to experience the most hardships because of lack of this correct perspective. Very often, individuals that are allocated responsibility areas find it difficult see that if they sacrifice a certain amount in their area, the company could make substantial gains in someone else's responsibility area. This insight is vital for all company employees, particularly those in charge of responsibility centres, if the company is to make the best use of its scarce resources.

Good communication channels and relationships are very important in this context. These must be developed as much as possible with particular importance being placed on giving both sides of the picture between different departments and responsibility areas.

Exhibit 1

MARKET CHARACTERISTICS

	Parcel delivery	Passenger transport	Flatbed 'Ad hoc'	Pre-mixed concrete	Containerized waste	Bulk transport	Abnormal loads
Ancillary or hire and reward	Ancillary	Hire and reward	Hire and reward	Ancillary	Ancillary	Hire and reward	Hire and reward
Seasonal or daily peaks	Seasonal	Daily	Seasonal and daily	Seasonal	Nil	Seasonal	Nil
Social responsibility	Average	High	Average	Average	High	High	High
Competition	High	High	High	Average	Average	Average	High
Time utilization	Normal Hrs	5a.m. to 11p.m.	Normal Hrs	5a.m. to 11p.m.	Normal Hrs	24 hour	Daylight Hrs
Charge* method	Included in price of product	Per km per person	Per tonne Km	Included in price of product	Hire + per Km	Per tonne Km	Variable
Order notice period	Good	Poor	Poor	Good	Good	Good	Good
Spread feasibility	Good	Poor	Poor	Good	Good	Good	Good
Part/Full loads ordered	Part	Part	Variable	Full	Full	Full	Variable

* This refers only to the most common method and not the only one

Exhibit 2

PRODUCT CHARACTERISTICS

	Parcel delivery	Passenger transport	Flatbed 'Ad hoc"	Pre-mixed concrete	Containerized waste	Bulk transport	Abnormal loads
Product	Frozen foods	Non-white passengers	General cargo	Pre-mixed concrete	Industrial waste	Bitumen	Machinery
Weight/volume constraint	Weight	Both	Both	Weight	Volume	Weight	Weight/volume or dimensions
Handling method	Conveyor and hand	Nil	Variable	Gravity loading self discharge	Hydraulic loading/ discharge	Gravity loading Pump discharge	Crane/Winch
Specialized equipment	Refrigerated or insulated vehicle	Passenger service	Nil	Mixer	Hydrualic equipment	Insulated Tanker + pump	Lowbed
Assistant(s) required	Yes	Yes and no	Yes	No	No	Yes	Yes

Exhibit 3

PLACE CHARACTERISTICS

	Parcel delivery	Passenger transport	Flatbed 'Ad hoc'	Pre-mixed concrete	Containerized waste	Bulk transport	Abnormal loads
Local or long distance	Local	Local	Local	Local	Local	Long distance	Local and long distance
Terrain	Fairly flat	Often hilly	Fairly flat	Often hilly	Fairly flat	Hilly	Hilly
Road conditions	Good	Good to poor	Good	Good to poor	Good to poor	Good	Good
Metropolitan conditions	Heavy traffic	Heavy traffic	Heavy traffic	Heavy traffic	Heavy traffic	Highway traffic	Highway traffic
Discharge access	Poor	Good	Good to poor	Poor	Good	Good	Good
Legal restrictions	Low	Low	Low	Low	Low	High	High

Exhibit 4

VEHICLE CHARACTERISTICS

	Parcel delivery	Passenger transport	Flatbed 'Ad hoc'	Pre-mixed concrete	Containerized waste	Bulk transport	Abnormal loads
Payload	Low	Low	Variable	Low	Low	High	High
Vehicle length	Short	Average	Variable	Average	Average	Long	Long
Common axle configuration	4 x 2	4 x 2	Variable	4 x 2 6 x 4	4 x 2 6 x 4	Multi axle	Multi axle
Fuel	Petrol or diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel

Exhibit 5

'MARKET', 'PRODUCT', 'PLACE' and 'VEHICLE' CHARACTERISTIC DEFINITIONS

1. Market characteristics

(i) Ancillary or hire and reward

An ancillary user of transport is a company which possesses its own vehicles for its own use and not as the means for its existence in business.

A company which operates for hire and reward is in business to sell its transport facilities and has no other means of support.

(ii) Seasonal or daily peaks

Seasonal or daily peaks imply irregular use of transport facilities either on an annual or a daily basis. In the case of ancillary users, it means irregular consumption of the goods delivered by those companies with the consequential fluctuations in the use of their vehicles.

(iii) Social responsibility

This implies the degree of consideration by any transport operator regarding the safety and well being of the general public. This becomes important with the product being carried and the size of vehicle being operated.

(iv) Competition

High competition in a product or transport market imply a need for increased cost awareness if a company is to be successful.

Competition can come about either by competitive products, competitive methods or excessive supply over demand. The latter can be caused by a fall off of the market or low market entry requirements.

(v) Time utilization

This is the time available out of a twenty four hour day, seven day week over which vehicles can be effectively utilized taking into account all market constraints and assuming 100% vehicle availability.

(vi) Charge method

This is the most common method of recovering transport costs and profit (if applicable) for each type of transport being considered.

(vii) Order notice period

The amount of advanced warning given before a job is to be undertaken has marked repercussions on the amount of equipment required and the time utilization possible from this equipment.

(viii) Spread flexibility

Spread flexibility refers to the amount of slack a vehicle operator has at his disposal in his scheduling. That is, from the time the consignee can take delivery until lost time is incurred due to non-arrival of his goods. This is not the same as notice period in (vii).

(ix) Part/full loads ordered

Noted here is, whether a full load is ordered when orders are placed or only a part load therefore necessitating the vehicle travelling at least a portion of its delivery distance under a part load.

2. Product characteristics

(i) Product

This is an arbitrary selection of specific products to give the study more body. Each product is one example of the type of products carried by each transport type.

(ii) Weight/Volume constraint

Whichever poses the limiting constraint on the amount a transporter can carry is listed under this heading.

(iii) Handling method

Handling method covers the method of loading and unloading of products.

(iv) Specialized equipment

This relates the specialized type of vehicle (if required at all) and ancillary equipment necessary to cope adequately with the loading, transporting and discharging of each product.

(v) Assistant(s) required

This indicates whether or not additional labour, other than the driver, is required with the vehicle to assist in loading or discharge. The general situation is being looked at here, the answer not necessarily representing all instances.

3. Place characteristics

(i) Local or long distance

Local deliveries are taken to be those deliveries done within a radius of 100 kilometres of the centre of Durban. Long distance deliveries are delivered undertaken further afield than the 100 kilometre limit, but within the borders of South Africa.

(ii) Terrain

Summarized here is the general types of gradients to be covered by vehicles. Industrialized and shopping areas tend to be situated in the flatter areas whereas residences, particularly in coastal areas are often situated in fairly hilly areas.

Inter-town travel is considered to have a fair amount of hilly areas. This is generally true in the Natal area.

(iii) Road conditions

Tar or cemented roads are considered to be good whereas gravel roads and building sites are taken to be poor. Certain roads, although tarred, in the non-white residential areas are also taken to be poor because of poor road maintenance.

(iv) Metropolitan conditions

This refers miainly to the traffic conditions experienced during deliveries.

City and suburban traffic is taken as being heavy while inter-town traffic is taken as being light.

(v) Discharge access

Generally off-loading points in shopping and residential areas tend to be poor because of narrow entrances, a lack of manoeuvring room and heavy traffic conditions.

Industrial discharge points are usually, although not always, better. Building sites can be particularly bad with narrow entrances, heavy traffic and poor site roads.

(vi) Legal restrictions

Ancillary users face no legal restrictions, other than licensing and road-worthiness, when putting a vehicle on the road.

Hire and reward operators are required to go to the local Road Transportation Board to obtain a motor carriers permit before they can commence business. Permits are not always easy to come by, particularly in the case of long distance work which is in direct competition with the South African Railways. The local, less lucrative work does not appeal so much to the Railways.

4. Vehicle characteristics

(i) Payload

This is the effective load by weight carried by the vehicle. Payloads generally tend to be low in local work because of traffic conditions and poor discharge point accesses. In certain cases they tend to be low because of the weight of specialized equipment necessary to handle a product (e.g. pre-mixed concrete and containerized waste).

(ii) Vehicle length

The same reasoning applies here as for payloads.

(iii) Common axle configuration

4 x 2 is a four wheeled vehicle with two wheeled drive.
6 x 4 is a six wheeled vehicle with four wheeled drive.

Multi axled units are either a mechanical horse drawing a semi-trailer or a rigid vehicle drawing an independent trailer.

(iv) Fuel

Either petrol or diesel is used to drive the vehicle. Petrol is only used for low consumption limited kilometre work because of its higher price relative to that of diesel.

Exhibit 6

TRANSPORT TYPE SUMMARIES

1. Parcel delivery

This category represents those companies that make use of road transport facilities for delivering goods from their factory or warehouses to their distribution outlets within a fairly localized area.

They are primarily ancillary users in that transport is not their reason for being in business. Their business is to manufacture or sell the products for which they are agents. This usually implies that they are in a reasonably competitive product market where they have to be careful of what and how much of their distribution costs they can charge their customers, particularly if the transport costs are included in the prices of the products.

Operating hours are usually limited to normal working hours by the customer working times. Operating conditions tend to involve considerable 'in town' driving amidst heavy traffic and with difficult accesses to many discharging points. This necesssitates the use of smaller low payload vehicles which offer greater manoevrability in congested conditions but at a higher unit payload delivery cost. The roads over which deliveries are carried out are good urban type roads with only reasonable gradients being encountered.

Frozen foods, packed in cardboard cartons, has been selected as the product to be carred by this type of transport for the purpose of this study.

2. Passenger transport

This category includes all privately owned local type bus services.

It does not include subsidized monopolies or long distance touring operations.

These services ate offered for 'hire and reward' in highly competitive but price controlled markets. Operators in this field experience abnormally high daily peaks as workers go to and from work with much quieter periods during the middle part of the day and in the late evening. Thus most of the time they operate with part loads only.

The social responsibility in this type of transport is high because of the number of lives these companies have at their mercy during an average working day.

Because of the specialized verhicle required in this market, an operator is restricted to this market for the life of his vehicle.

These vehicles generally operate in heavy urban traffic with a considerable amount of 'stop-start' driving on average to hilly type terrain.

Non-white passengers have been selected as the example of the type of transport for the purpose of this study.

3. Flatbed 'Ad hoc'

In this group, we include all transport operators who operate one or more general cargo vehicles for 'hire and reward' but on an 'ad hoc' basis. That is to say, they have no regular work as such, but rely on one-off irregular type work. Consequently this is a high risk business, since the work is in a highly fluctuating and competitive

market where price cutting and running at below cost prices (mainly through ignorance) are not uncommon.

There are few obstacles to entering the market provided operations are confined to a very localized area. Finances are generally available through hire purchase agreements and the South African Railways are not really interested in this very local type work, thereby making it relatively easy to obtain the appropriate motor carrier permits.

Good urban type roads in average to heavy city traffic are the commonest operating conditions in this case.

A general cartage contractor carrying anything from bagged chemicals to wooden crates is an example for this category.

4. Pre-mixed concrete

This category refers only to pre-mixed concrete suppliers who are classified as ancillary users by virtue of the fact that they are selling their product and not their transport. Various characteristics do, however, apply to tipper work, whether it be for 'hire and reward' or not.

This business can be seasonal in so far as it is directly related to the building industry which can be seriously affected by rain or any other form of inclement weather.

Competition does exist, although not in the form of other transporters in the Durban area, but in the form of an alternative method, namely site mixing.

Working times usually extend over a ten to fourteen hour day, five

days a week, with exceptional runs being undertaken on Saturdays. The operating conditions invariably consist of heavy traffic, good to poor roads and with poor accesses to sites.

The specialized nature of the equipment restricts the operator to this field of operation. It also reduces the effective payload of a vehicle quite considerably.

5. Containerized waste

This type of service covered here is all operations where there is more carrying capacity relative to the number of prime movers available, This could either be one rigid vehicle having more than one container or demountable body to service or else it could be one mechanical horse servicing more than one semi-trailer. For this study, the container example has been adopted with the product being industrial waste. Since waste disposal is the service being sold, this operation is that of an ancillary user.

Operating hours are mainly normal working hours, with good to poor roads being encountered. Very often dumping site roads are in an extremely bad state of repair.

Heavy 'in town' traffic is usual in this type of work since this is where effective waste disposal is most important.

Social responsibility depends on the product being carried. If it is loose light material, it should be covered to prevent spillage onto the road or surrounding environment. If it is a hazardous product, it should be secured in such a way to minimize the hazard.

Specialized hydraulic equipment is required for this operation. This does not restrict the products that can be carried, but it does restrict the useful payload of the vehicle.

6. Bulk transport

This transport type covers any operator who carries bulk 'flowable' products for 'hire and reward'.

The choice of bitumen as the product determines the nature of the operation to a large degree in that it accounts for seasonal peaks (because it is so tied in with road construction which is highly weather dependent); the high social responsibility (because of the products high temperature); the twenty four hour utilization (because of the high volumes used and also the problems associated with the cooling off of the product); and the highly specialized equipment (i.e. insulated tankers, often with heating and pumping equipment).

These vehicles operate on good inter-town roads with light traffic being experienced. Access to both loading and discharge points are good, therefore allowing the use of larger, high payload vehicles.

Entrance into this type of lucrative long distance work is severely restricted by the Railways and existing operators.

7. Abnormal loads

This transport type covers all operators who move ultra large (either by weight or by volume) loads for 'hire and reward'.

Social responsibility is extremely high for these operators because of the size and weight of their cargoes, often to the extent that they are only allowed to move during daylight hours. Usually all movement of abnormal loads on public roads is prohibited over the December-January period due to the volume of holiday traffic on the roads. Similarly on long holiday weekends.

Competition is high in this field of transport. Below fifty tonnes, competition stems from other private operators of abnormal load equipment, of which there are quite a few. Above fifty tonne, competition comes almost exclusively from the Railways. This latter market is a very one-sided affair due to the vast resources and influence of the Railways,

Legal restrictions are high should the load fall outside the allowable weight and dimension constraints laid down in the Road Ordinace. Approaches have to be made to each and every municipality through which the vehicle passes for their acceptance before any work can be carrued out. Route planning, therefore, is a most important part of the operation for this type of transport.

Exhibit 7

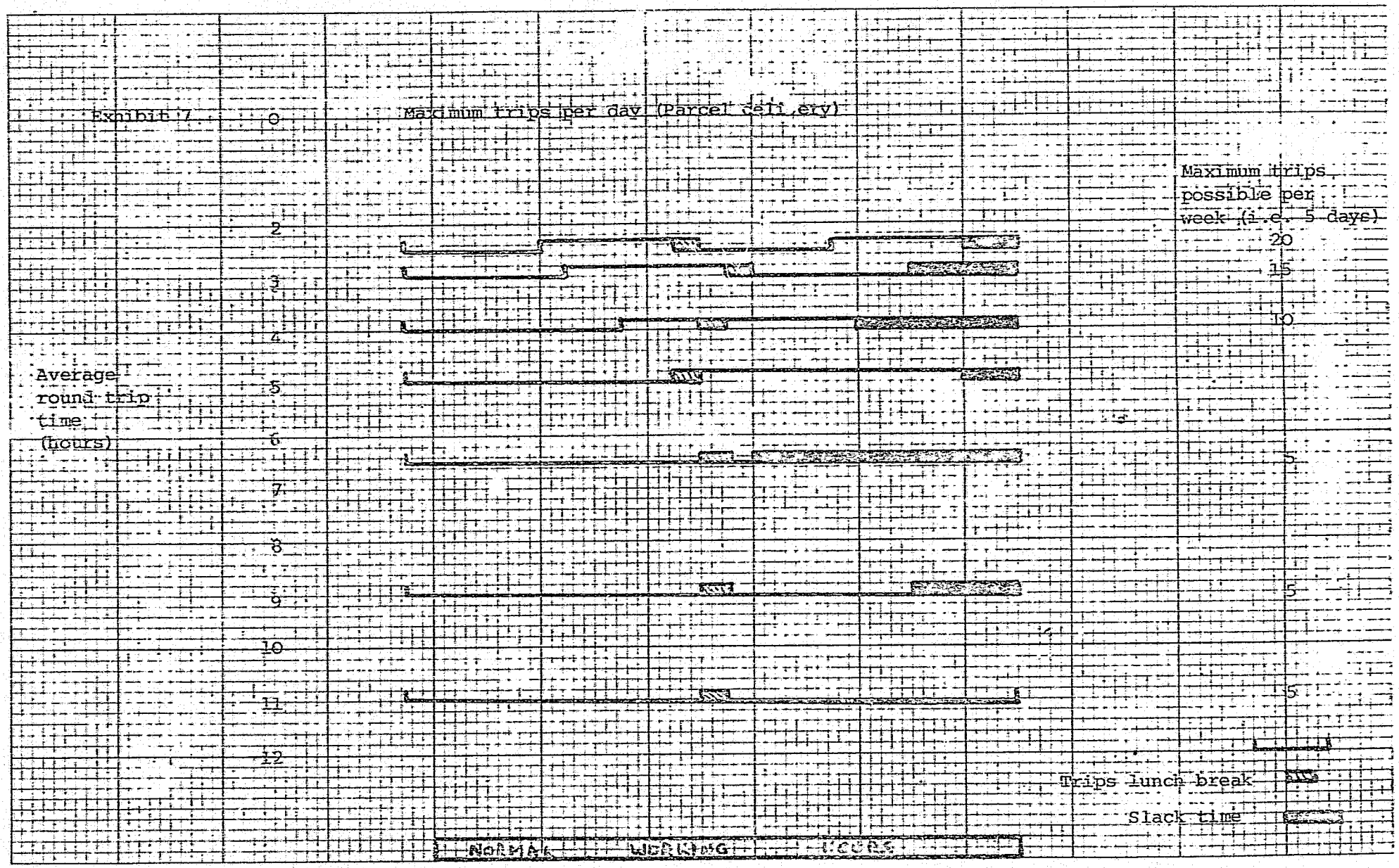
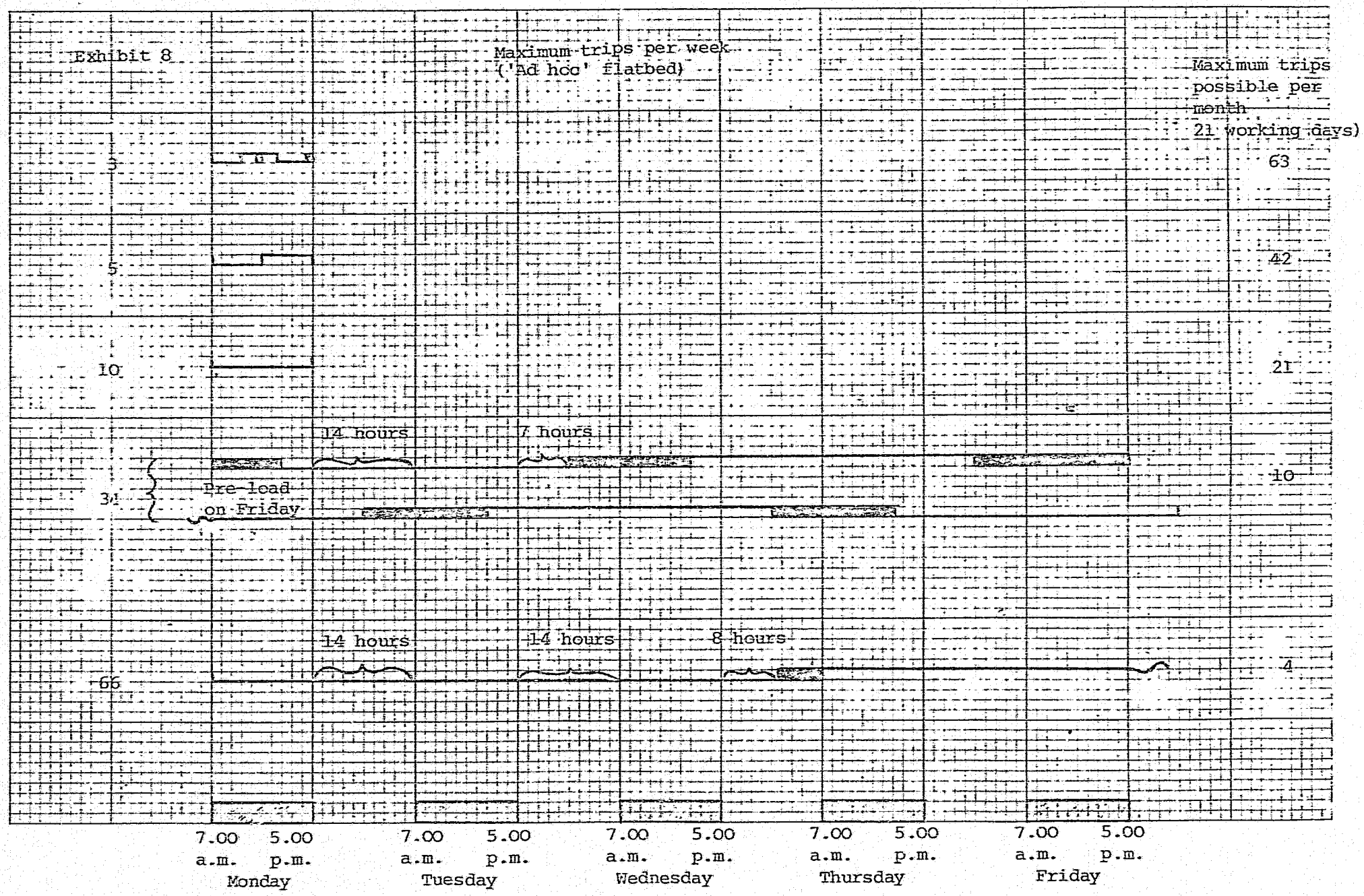

Maximum trips per day (Parcel delivery)
Maximum trips possible per week (i.e. 5 days)
20
15
10
5
5
5
Average round trip time (hours)
0
2
3
4
5
6
7
8
9
10
11
12
Trips lunch break
Slack time
NORMAL WORKING HOURS
5.00 a.m.
7.00 a.m.
9.00 a.m.
11.00 a.m.
1.00 p.m.
3.00 p.m.
5.00 p.m.
7.00 p.m.
Time available for delivery

Exhibit 8



Time available for delivery

Exhibit 9

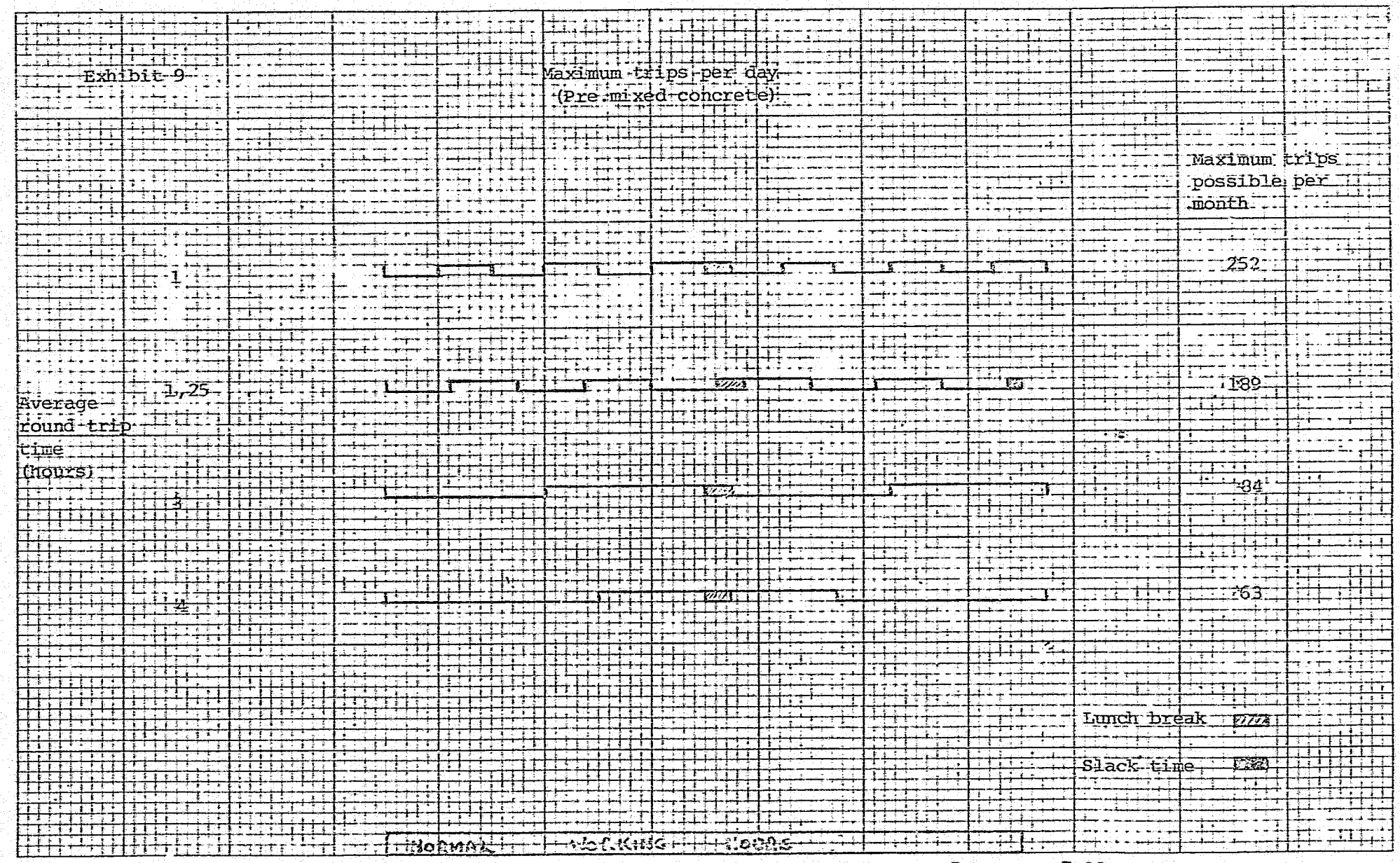

Maximum trips per day (Pre-mixed concrete)
Maximum trips possible per month
1
252
1.25
189
Average round trip time (hours)
3
84
4
63
Lunch break
Slack time
NORMAL
WORKING
LOADS
5.00 a.m.
7.00 a.m.
9.00 a.m.
11.00 a.m.
1.00 p.m.
3.00 p.m.
5.00 p.m.
7.00 p.m.
Time available for delivery

Exhibit 10

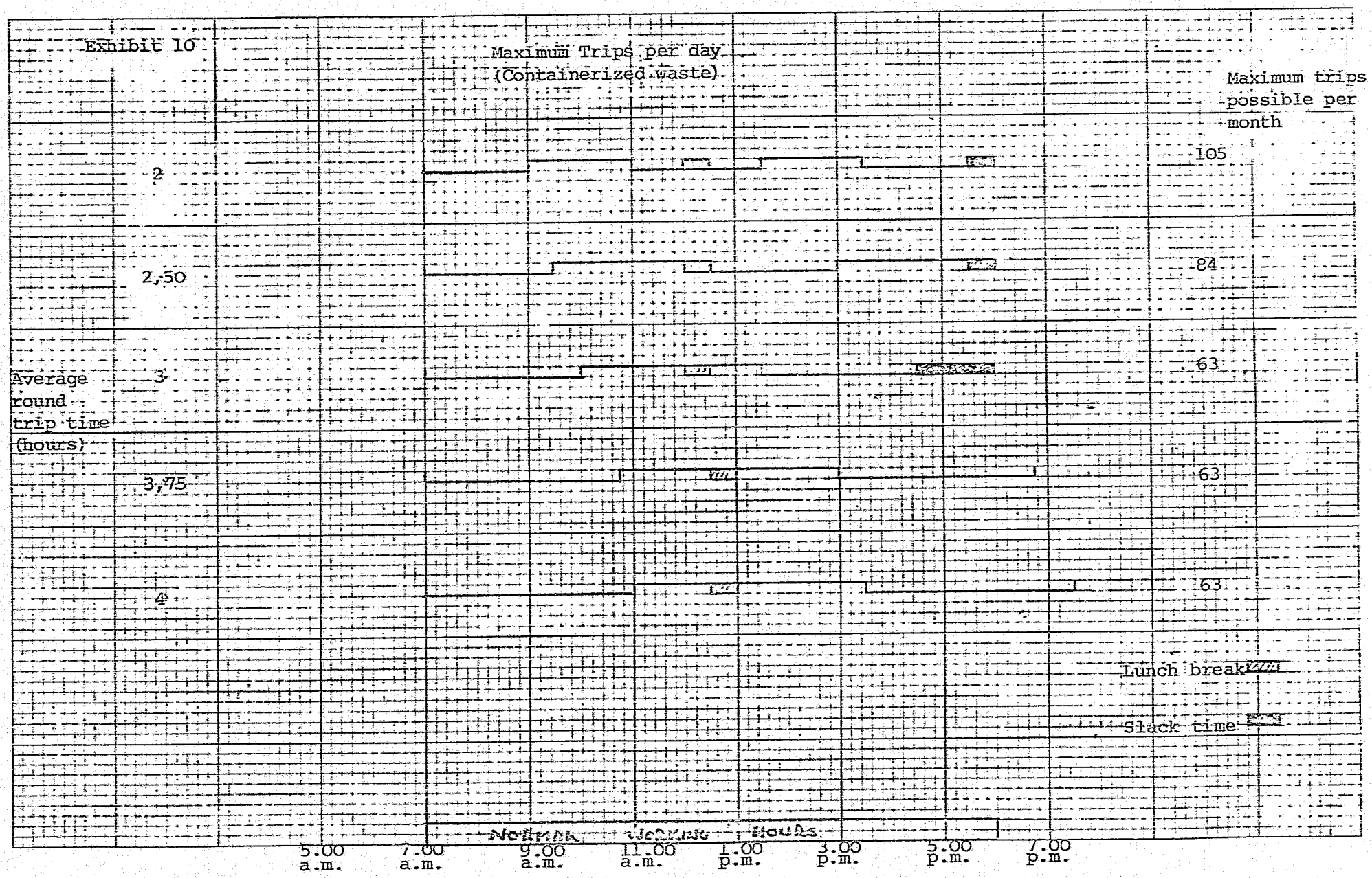

Maximum Trips per day
(Containerized waste)
Maximum trips possible per month
105
84
63
63
63
Average round trip time (hours)
2
2,50
3
3,75
4
Lunch break
Slack time
Normal working hours
5.00 a.m.
7.00 a.m.
9.00 a.m.
11.00 a.m.
1.00 p.m.
3.00 p.m.
5.00 p.m.
7.00 p.m.
Time available for delivery

Exhibit II

Maximum trips per week (Bulkt transport)

	Maximum trips possible per month
15	48
34 (No discharge 6pm to 6a.m)	17
Average round trip times (hours) 34 (No Sunday loading or discharge)	17
	31
99	7

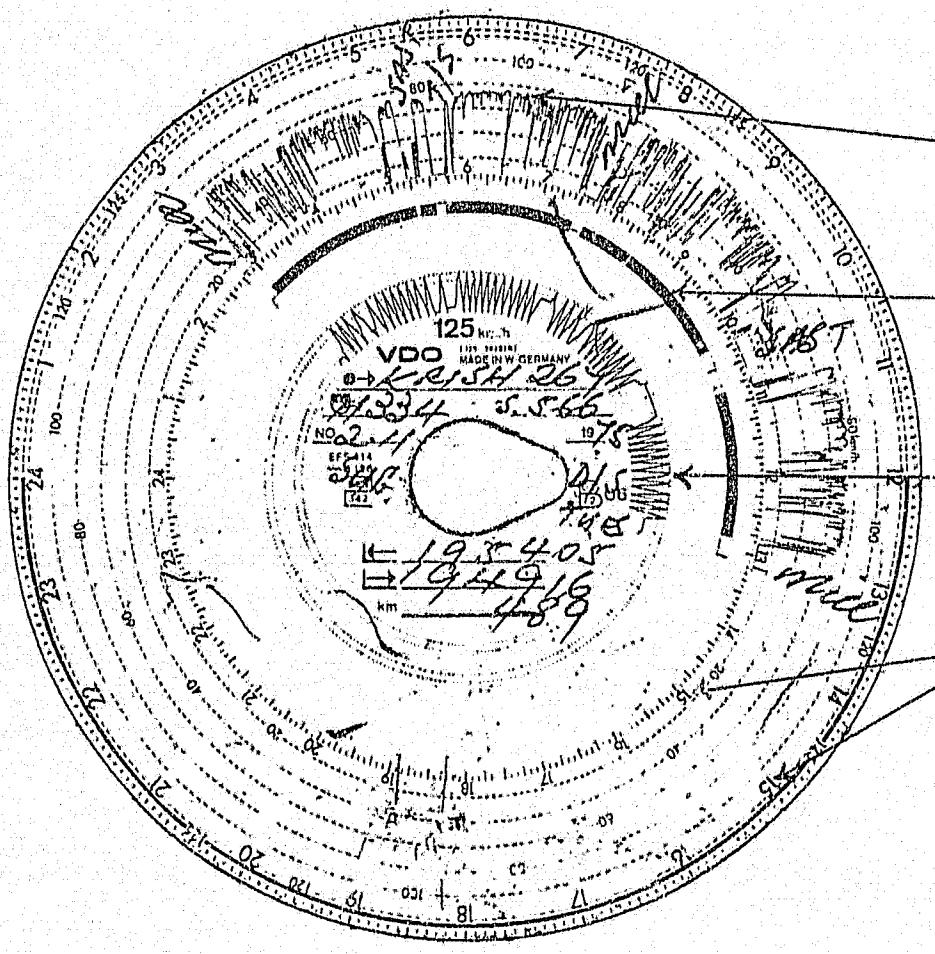
Slack time

Midnight

Sunday Monday Tuesday Wednesday Thursday Friday Saturday

Midnight

Exhibit 12 Tachograph chart information

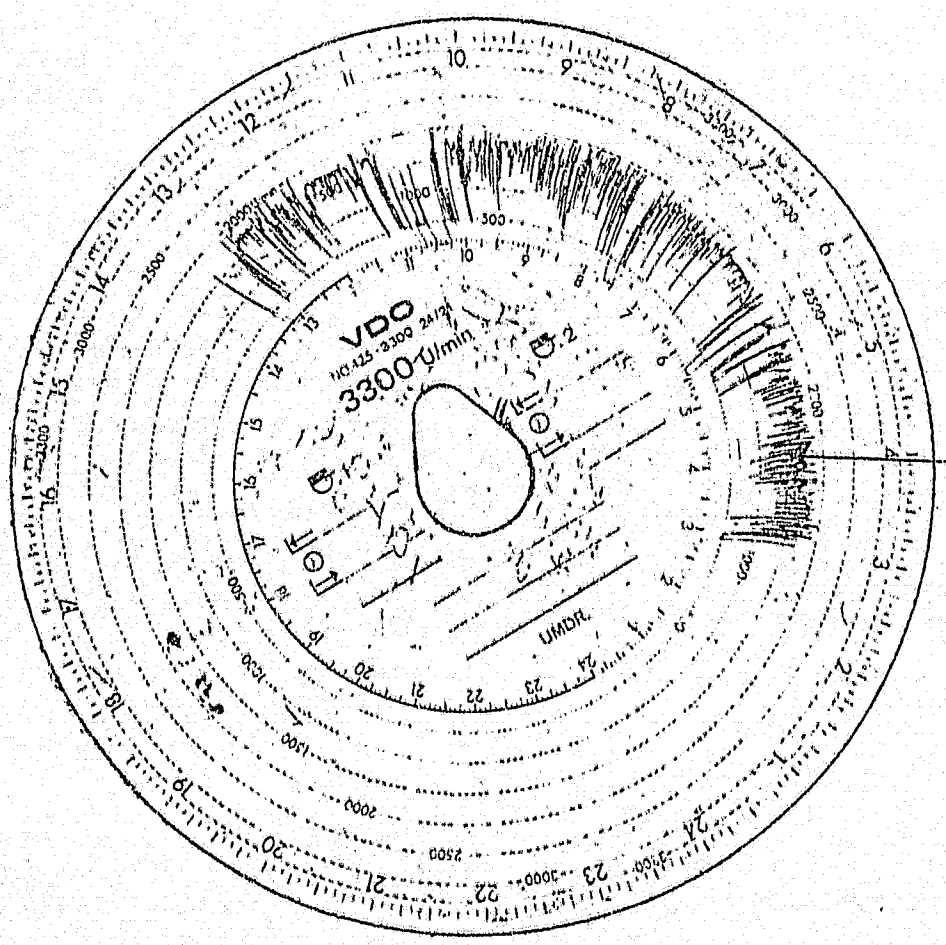


Road speeds and vehicle travelling times

Engine running times

Distance travelled

Time



Engine r.p.m.

Exhibit 13

[illegible]RTAGE COMPANY (PTY) LTD.

OPER[illegible]H DAILY LOG AND STANDARD SHEET

CARD CODE: 0 1

SHEET NUMBER: 6 7 4 3 2

FOR OPERATOR

DATE: 2 0 . 1 1 . 7 5 DAY: THUR

OPERATOR NO. 3 2 1 OPERATOR NAME: DAVID

HORSE NO.: H 1 0 0 4

S-TRAILER NO. S 5 0 4 OPERATOR SIGNATURE: David

Date Started	18/11/75
Time Started	12 | 00
Date Finished	20/11/75
Time Finished	12 | 30

Diesoline Drawn	Litres	Kilometre	Reading
DEPOT	463	FINISH	48640 Kms
EN ROUTE			
GARAGE NAME	FUEL COST	START	47058 Kms
TRUCK INN	242	TOTAL	1582 Kms
OIL DRAWN	LITRES		
DEPOT		MEALS CLAIMED	6
EN ROUTE		OVERTIME	28½
TRUCK INN			

FOR OFFICE USE ONLY

Card Code 0 2

Shift DAY

Area: 5

Condition Code F

Base: D

Operation: A2

Schedule: C.M

Checked by ..... (Pay Dept)

Normal Time	20	Hrs
Overtime	28½	Hrs
Sunday Time		Hrs
Night-Out Allowance	R	C
Meal Allowance	6	
Weekend Operating Hrs		Hrs

Exhibit 13
(continued)

CARD CODE Std: 0 3
Act: 0 4

SHEET NO: 6 7 4 3 2

TRIP NUMBER	1	2	3	4	5	6
DELIVERY NOTE NO.	33943					
UPLIFT POINT	MOBIL REF.					
UPLIFT CODE	043					
DESTINATION	HECTORSPRUIT					
DESTINATION CODE	179					
PRODUCT CODE	80/100					
PRODUCE CODE	A11					
CUSTOMER NAME	SMITHS CONST.					
CUSTOMER CODE	274					
PAYLOAD UNIT	TONNE					

	1 STD	1 ACT	2 STD	2 ACT	3 STD	3 ACT	4 STD	4 ACT	5 STD	5 ACT	6 STD	6 ACT
DRIVING TIME: DEPOT TO LOADING POINT	0.05	0.05										
LOADING POINT TO DEPOT	0.05	0.05										
DEPOT TO DESTINATION	15.00	13.15										
DESTINATION TO DEPOT	11.30	11.00										
LOADING POINT TO DESTINATION												
DESTINATION TO LOADING POINT												
LOADING TIME	0.45	0.55										
DISCHARGE TIME	2.00	2.10										
VEHICLE CHECK TIME	2.00	2.10										
GENERAL REST TIME	1.30	1.30										
SLEEP TIME	10.00	11.10										
ACTUAL PAYLOAD 24,720 KG	42.55	42.20										

DELAYS	TIME & PLACE	TO WHOM REPORTED	OPERATOR'S REMARKS (CARD CODE 65)	TIME & DATE REPORTED	TIME & DATE REPAIRED	DELAYS Hours	DELAYS Code
Breakdown							
Punctures	Newcastle	Mr Jacobs		4.45 p.m 20/11/73	6.00 a.m 20/11/73	1	30
Customer Delay							
Loading	Mobil	Mr Jacobs	Vehicle loading ahead	2.30 p.m - 3.25 p.m			
Discharge							
Bad Weather							
Accident							
Other							
Washbay							
Checkout	12.00 - 2.15 p.m	Mr Smith.					

CHECKED BY..... Transp. Senior..... (Std. Dept)

Exhibit 14 Cost Centre Record

Cost centre_____ Month_____197____

Date ordered	Item	Reference number	Quantity	Cost per item	Order No.	Invoice No.	Date received	Total purchase price	Cost centre accumulated total

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