IMPROVEMENT IN UTILISATION OF INTERNAL AND EXTERNAL LOGISTICS IN HALL LONGMORE

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Executive Summary

In Operations research that maximizes process utilisation is one of the key factors in creating and maintaining a business or process at an optimal and profitable level. Minimization of unnecessary costs as well as time wastages will assist in achieving maximum outcome.

The on-site trucks, used as inter-plant transportation, are vastly underutilised and monthly fixed amounts, paid per truck, are being wasted when trucks are stationary. It means that salaries are being paid for no work done for a number of days per month and no profitable work comes from this. There are various reasons for delays such as slow production, breakdowns, loading crews that aren't ready, weather, paper-work and others that were investigated. The workers to work ratio is also out of balance. This can also be seen as a form of under-utilisation as the trucks aren't being used to their full potential. Investigation into the current situation and understanding limits and delays was done to solve this problem.

There are no official records of truck usage or a tracking system currently available here. Thus time studies in comparison to other logistics companies will be done for better insight into how to handle the situation. Transporting of pipes from site to consumer also seems to be a problem area. There is a truck per customer and every customer doesn't need a delivery every day. This brings up the question of under-utilisation of the equipment.

Looking at the entire transport system, these findings will have a tremendous effect on the overall outlook on the transport services, not only on how to utilize it in a more efficient way but will have a significant positive impact on the company.

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Introduction and Background

Hall Longmore, a wholly owned Murray & Roberts company, began manufacturing welded steel pipes in 1924. The company paved the way for the development of a major engineering enterprise, which today is the largest operation of its kind south of the Sahara, exporting to more than 30 countries around the globe.

Utilisation, in a company which thrives on timing and process flow, is of the utmost importance. To be able to satisfy deadlines and reach targets for customers is what makes Hall Longmore the success it is today and improving on this aspect to further exceed the customer's expectations will only take this company to elevated heights.

Hall Longmore has two main sites of operation, one in Wadeville and the other in Duncanville. This study will only be done at Wadeville as better access can be gained here and as similar processes are being used, the solution can be applied to both sites.

Wadeville has three main plants and various stock areas between which transport takes place. Trucks, fork-lifts and cranes are used for transport where cranes are for transport within the plants, forklifts are for short distances in stock yards and the trucks are for transport in between plants and for external transport. Trucks will be the mode under investigation.

The on-site trucks are permanently rented trucks and paid for with a monthly price of approximately R100 000 per month, which includes driver fees, diesel and maintenance. It has been found that there is no way of tracking the exact utilisation of these trucks and how money is being wasted by this and whether it's possible too many trucks are being used. Also the transporting ability of each truck will be investigated. This will bring to light whether the transporting capabilities are the cause of under-utilisation. The delays are caused for various reasons out of control by the drivers, yet knowing more or less how many breakdowns are expected, how many pipes that need transport and so forth will not only reveal the short comings of the company but also on how the transport services can work with the current problems and work more effectively to reduce costs. A close study on this could be an enormous advantage, not only financially but also show problems that can be dealt with in the manufacturing processes of the company.

The transport from site to stockists is another area that for which management requested an investigation in. There are six stockists and six delivery trucks. A single truck is allocated to a stockist. This is where the question of under-utilisation is brought up. Not every company needs a delivery per day, and even if it had been this way, some of the companies are literally five minutes away. How is it possible that these trucks are utilised to their full ability? Investigation into this problem might reveal the unforeseen reasons or a reveal possible enormous utilisation improvement and cost saving opportunity.

Project Aim

The aim of this project is to improve utilisation, using operations research and other methods. To be able to improve in every area of transport here trucks are being used, internal and external. To look for areas to save time and minimise unnecessary costs.

Project Scope

The first part of this project will be to gather the data where current records are unavailable. The information will then be used to make assumptions and ultimately to develop a workable solution. Available information will assist in realizing the exact shortcomings of the utilisation of the trucks and interviews with foremen, truck drivers, labourers and engineers to find the main reasons why loading areas aren't always on time and ready for the trucks to receive the pipes.

The second part is to go through the data and identify which are the main problem areas that can be worked on to have the greatest impact on improvement of the current system in use. There will also be research done into other logistic companies to see how the financial situation might change if current agreements with external transporting companies changes.

The third part will be to find feasible solutions to solve the main problems found and to find the best way to implement them.

Literature Review

In the literature review there are comparisons between measurement identifications and methods of tracking and gathering data. The focal point of the report is the optimal utilisation of the on-site transportation trucks.

Some of the methods of gathering information were:

- Discussions
- Observations
- Internet
- Journals
- Previous Studies

During the study, three main areas were under investigation:

- Supply chain management
- Performance measurement systems
- Tracking and monitoring systems

Supply-Chain Management

The definition of supply chain management (SCM), according to Wikipedia is "is the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers (Harland, 1996). [1] Supply Chain Management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption (supply chain)."

Another definition notes that a supply chain is the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the end customer. In other words, a supply chain consists of multiple firms, both upstream (supply) and downstream (distribution), and the end customer.

Two other definitions of supply chain management that seem relevant are:

- By Monczka, Trent, and Handfield (1998): SCM requires traditionally separate materials functions to report to an executive responsible for coordinating the entire materials process. It requires joint relationships with suppliers across multiple tiers.

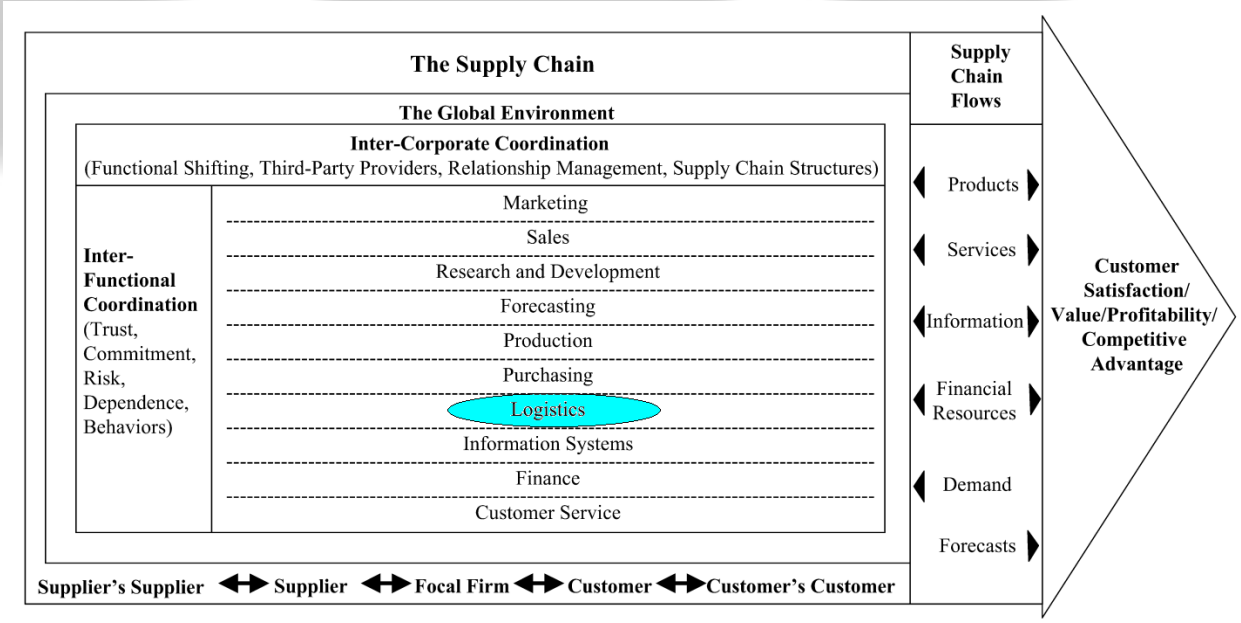
SCM is a concept; *"whose primary objective is to integrate and manage the sourcing, flow, and control of materials using a total systems perspective across multiple functions and multiple tiers of suppliers."*

- Houlihan (1988): the differences between SCM and classical materials: "*1) The supply chain is viewed as a single process. Responsibility for the various segments in the chain is not fragmented and relegated to functional areas such as manufacturing, purchasing, distribution, and sales.2) Supply chain management calls for, and in the end depends on, strategic decision making. "Supply" is a shared objective of practically every function in the chain and is of particular strategic significance because of its impact on overall costs and market share. 3) Supply chain management calls for a different perspective on inventories which are used as a balancing mechanism of last, not first, resort. 4) A new approach to systems is required—integration rather than interfacing."*

In other words, the philosophy of supply chain management extends the concept of partnerships into a multi-firm effort to manage the total flow of goods from the supplier to the end customer. Thus, SCM is a set of beliefs that each firm in the supply chain directly and indirectly affects the performance of all the other supply chain members

Figure 1 below is a model of SCM:

Figure 1. Supply Chain Management



Logistics is a very influential factor in the supply chain of this company. When attempting to improve this, it is crucial to investigate and improve every affecting aspect within the different departments. Understanding the entire process will greatly assist in the minimising delays within the supply chain. This will aid in realising unknown factors that affect the utilisation of the trucks. In any supply chain, just improving a single part won't improve the entire system. Thus improving of timeliness of production deliveries and other departmental flaws will ultimately help improve utilisation of trucks.

Looking at what was said in the above SCM details three main areas of implementation:

1. An approach to viewing the supply chain as a whole, and to managing the total flow of goods from the supplier to the ultimate customer;
2. An orientation toward cooperative efforts to synchronize and converge intra-firm and inter-firm operational and strategic capabilities into a unified whole.
3. Customer focus: to create unique and individualized source of customer value.

Possible solutions for the problems identified during the study will be designed. They will also be presented to the management to be approved.

Performance Measurement Systems

The initial idea on what type of measurement to choose was just to arrive at the site and visually interpret what need to be measured. Setup a basic form the truck driver has to fill in and do the study from that. Yet after doing further research into the topic of performance measurement systems it became clear that it's a lot more complicated than it seemed.

A. T. Kearney developed a typology measuring the relative sophistication of logistics management approaches used by the physical distribution departments of companies. The typology lists four stages of evolution. It starts at the most basic to the final stage where full integration in terms of sophistication and information management occurs.

- **Stage 1:** These are small companies where measurements express the simplest of terms to achieve their goals. Using information mostly from the financial and standard accounting departments. Using data already available is efficient when avoiding duplication. When the relevance of these measurements comes into question is where the problem occurs. Are the measurements both sufficient and appropriate? Small companies' are not interested in more complicated systems.

- **Stage 2:** Here the companies have grown in size and intelligence. The use of simple measure of distribution and productivity to evaluate performance begins to

take place. These measures are still 'reactive' and the diagnosis produces no more useful strategies, e.g. 15% cut in across the board expenditures. Labour saving technology is used by these companies.

- **Stage 3:** These companies are seen as 'pro-active' and have come to such a point that meaningful goals for the operation can be set. The sophistication and performance measurements are very high.

- **Stage 4:** Here the companies involved have largely integrated systems across different departments, such that logistics can inter-act with them. These types of companies integrate performance with financial data and are able to balance departmental goals.

Understandably some companies don't have the needed resources to undertake sophisticated and extensive analysis of operations, but Hall Longmore is a multi-million rand company and can invest in this. Integration and sophistication is the ultimate goal in a company of this calibre.

Most known performance measurement ratios reflect an accounting or management-science orientation to identify inputs with outputs in some measureable form (number of loads, kilometres driven ect.). However the problem with this is variables taken may not allow measurements to give results that can be compared to all aspects of inputs and outputs. Thus unanswered problems are being solved by flawed information. This is why the selection of performance measurement criteria and establishment of performance measures is so important.

Measurement error is another problem and involves two main aspects, namely:

1. **Data Collected incorrectly**: This is mainly accredited to human error. This can be corrected with regular auditing.

2. **Assigning Contribution**: It is essentially difficult to separate contributions made in tasks where direct efforts are not easily identifiable. Giving credit to your transportation department for meeting the needs of the customer in a timely fashion, for example, is often difficult seeing that there are so many departments involved. The inventory department could've failed in having the needed product available and a quick reaction of the order processing and shipping areas to resolve the problem might not have been measured. This makes the process seem functional when in actual fact an un-identified problem isn't being investigated.

This is part of the problem at Hall Longmore. The logistics department is under investigation because of failure to deliver pipes, yet lack in production is one of the causes that loading is delayed. The fact that loading teams aren't ready when needed causes deliveries to be late, which slows production. Looking at the bigger picture it is a vicious cycle continually repeating itself.

Equally important are the assumptions underlying the evaluation of a performance measure against a "benchmark" or industry standard. In some companies having a low customer service level is a way for selling the product at a lower price. Yet at Hall Longmore the mission statement assures only the best quality pipes available as well as 100% satisfied customers. Seeing as these pipes are used in transport of high risk products (gas and oil ect.) high level of service will always be the goal and should be taken seriously.

All of the above demonstrates that good measurements should cover all aspects of the process and minimize measurement error. Here is a list, called Landy's list, of five practical considerations to keep in mind when developing a measurement system:

1. Establish the problem and its context.
2. Identify attributes that the firm wishes to evaluate (inputs and outputs).
3. Analyse how the measures are obtained. Look at existing scales in terms of validity, reliability and meaningfulness. The undetermined nature of a measure requires scrutiny.
4. Unsatisfactory measures must be replaced. New measure need to be indentified and fulfil the criteria.
5. When measure is satisfactory, cost-benefit analysis should be performed to assess the cost of using the measure against usefulness.

The major transportation measures are labour, costs, equipment, and energy and transit time. Individual companies must determine if the typical performance measure is appropriate for their own needs. A number of sources of variation also may complicate measuring the performance (vehicle sizes, types as well as load sizes and types which vary loading times). Using standard measure to compensate for unevenness makes the data more meaningful for comparison purposes

Since the deregulation improved flexibility, the potential for improving transportation performance has increased considerably. These changes caused transportation to be viewed in terms of what can be accomplished. These days the company's entire distribution system may improve overall performance. The use of cost curve analysis highlights the advantageous areas that may be identified and retained.

In this study, the utilisation of the trucks being used for the inter plant transport are the main concern. Looking at how much a truck is being used through the day, compared to the amount of loads that need to be moved and investigating the causes of delays.

Several reasons for delays have been identifies thus far:

1. **Production**:
    (a) Unexpected breakdowns in the plant (which is a delay that will always occur).
    (b) Defects on the pipes (the pipes have to be removed off the production line and sent for rework before they can be loaded again.
2) **Loading crews**: the crews aren't at their post when loading needs to take place.
3) **Batch Inspection**: the quality checks for the pipes are done in batches and loading doesn't start until check is complete.
4) **Weather**: loading cannot take place if it rains badly. It makes the loading too unsafe and it's suspended until conditions are favourable.
5) P**aperwork**: after pipes are loaded, the paperwork that need to be handed in for the company to be able to send the pipes are incomplete. Either the inspection papers or the release papers aren't correct.

The on-site trucks are permanently rented trucks and paid for with a monthly price of approximately R100 000 per month, which includes driver fees, diesel and maintenance. Thus in this study, having to monitor how strenuous the working conditions are for the drivers and trucks isn't of any concern. A study could be done on how it will compare to have own trucks on site as appose to rented truck. To see if it is really cheaper to rent a truck, but that is not part of this study.

Looking at what type of measurement is needed is the most important factor as it complies with the five steps of Landy's list for developing a measurement system. The problem has been established and the attributes to evaluate is stated above. The way in which the measures will be obtained and rated (against the criteria) is in the next section of this document Tracking and Monitoring systems). The cost-benefit analysis follows:

Looking at the utilisation of the transport trucks the following was found to be true:

- The more time wasted when transporting between plants, the slower the production of pipes can be.
- If the production is slowed down the targets cannot be met.
- This in the end means unhappy customers.

Thus time wasted is directly proportional to cost per unit made. The more time is wasted, the higher the cost per unit is, because the trucks get paid a fixed salary. Stationary trucks mean wasted money.

The current target is to send out 25 loaded trucks per day. With the current size of pipes (610mm) there are 8 pipes per load. Thus the current export rate needed is 200 pipes per day. If utilisation can be improved to such an extent that it in turn improves the production level to 25+ loads per day, the customer expectations can be exceeded and satisfaction is improved. Using time as a measurement is the correct measurement to use in this situation to reach the goals needed.

Tracking and Monitoring Systems

Many approaches to position tracking require that the user's environment be equipped with sensors or beacons. Tethered position and orientation tracking systems have attained high accuracy for up to room-sized areas using magnetic, ultrasonic, and optical technologies, including dense arrays of ceiling-mounted optical beacons. Alternatively, sparsely placed infrared beacons can support tether less positional tracking over an entire building at much lower accuracy.

The two choices which were investigated were a manual form of monitoring and an electronic tracking system.

- The manual way: Hand every driver a form (record sheet) which they are required to complete constantly.

  The form contains the following information:

  a) Name, surname and employee number.
  b) Date.
  c) Time stopped.
  d) Time in the move.
  e) Loading time,
  f) Unloading time.
  g) Number of loads
  h) Size of load.
  i) Reason for delay if any

  The driver is expected to record every movement made on this sheet. Every time they are sent for loading, from what time to what time they do nothing, how long the loading takes and if there is a delay, what the cause is. However, this is a very flawed manner of gathering data as the human error is a very big factor here. Inaccurate readings and miscommunication will make this form of data capturing inaccurate.

- The automated way: An electronic tracking system can be installed into every truck and monitored via computer and tracked using a GPS (Global Positioning System).

  A method very commonly used these days for monitoring and tracking of mobile services uses a Radio Frequency (RF) transmitter. This apparatus can be used to monitor up to 50 different aspects of a vehicle other than its current position. It can monitor from daily vehicle overviews, fuel profiles and location stops to driver performance per trip, driver fatigue and the three most important ones of load monitoring, weekly utilisation analysis (of the vehicle) and monthly driver utilisation. ComTech is the company with the most comprehensive satellite tracking system in the market right now. The product that was under investigation was the Power Track. The information is logged and stores every 15 seconds. With a continuous data collection system like this a very comprehensive fleet management database can be produced. The standard pack only has driver identification, vehicle immobilisation, accident sensor and digital and analogue inputs. To receive extra monitoring systems expansions have to be bought depending on what needs to be monitored (up to 8 digital, 8 analogue and 8 temperature inputs can be added on one expansion board). The expansion also allows for development of interfacing hardware models. This allows the Power Track hardware system to integrate into almost any hardware aboard today's high-tech transport vehicles. To add any driver input into the database, for example, reasons for a delay, there is a Vehicle Input Events by driver function that can be added.

Table 1 below illustrates some of the decision making advantages and disadvantages of these two choices.

Table 1. Advantages and disadvantages

Measured Attribute	Paper Sheet	Electronic Monitoring Systems (Power Track)
Reliability	Varies (human error)	Always
Accuracy – Times Taken	Inaccurate	Precise
Loads Recorded	Precise	Precise
Movement Records	Inaccurate	Accurate
Cost	R20/day	R2000 – over R20 000
Reasons for Delays	Easily recorded	Easily recorded

Conceptual Design

Steps that will be followed during this project:

- Gathering of data will take place using the monitoring system chosen to best suit the job.
- Data will be analysed to seek out problem areas.
- Identifying problem areas in the truck utilisation because of slack of drivers will be taken up with the logistics company the trucks are rented from (Target).
- Identified problems in the production area will be further analysed to find the causes of the problems.
- Design feasible solution for presentation to management of possible improvements.

All of the steps above follow each other chronologically. The gathering of data can take up to a month. Checking and going over the information received from the monitoring systems. Charts will be setup, out-of-control-points identified and stabilized. When creating an accurate solution, a stabile process is a requirement. The solution will be based on the data collected from the process and constructed. It will be presented to the management and it will be their decision on what to do with the findings.

Conclusion of Literature Review

Looking at the three different areas of investigation, the recommendations are:

1. Using of supply chain management techniques.
2. Time as the performance measurement.
3. Radio Frequency and GPS technologies as the monitoring system. This will be subject to acceptance of the project by the relevant service provider.

Using the views, opinions and suggestions of a supply chain manager and using the information in the database as gathered, problem areas can be identified, investigated and solved using various engineering techniques.

Using time as the performance measurement encompasses most of what needs to be measured for purposes of this project (truck utilisation). The recording of reasons for delays will serve to have variables for the solution when presenting the possible improvements to management.

The RF/GPS method was chosen because of its diversity and accuracy in the field of mobile monitoring. It will give the most detailed perspective on what happens with the trucks on-site. This is the most efficient and effective mode of data gathering for this type of project.

Achieving the objectives as set out above will result in the optimal utilisation of transport at Hall Longmore which in turn will have a positive impact on productivity and costs. This will ultimately have a positive impact on the profitability of the company.

Data Capture and Analysis

Internal Transport

More research was done with regards to the effectiveness of internal transport at Hall Longmore. The research revealed a mistake in the initial decision when choosing the performance measurement variable. Time is an insufficient manner of accurately measuring the correct utilisation for these trucks. The trucks are never overly stationary. The ratio of workload to workers is the problem. There are too many workers for the work available. Thus volume per truck has been identified as a much more reliable and correct measurement variable. The following explains the working of the current system. The second paragraph portrays possible improvements:

Current system

In the past the company used tractors with a trailer with a maximum capacity of 15 tons to move 8 pipes per load from the manufacturing plant to the coating plant. These tractors and trailers served the purpose at the time as pipes with a diameter of 508mm were transported between the two facilities. Recently the manufacturing plant was upgraded to manufacture pipes with a diameter of 610mm. This not only increased the size of the pipe but also the weight which in turn created a challenge for the transportation of pipes between facilities as only 3 pipes per load could be accommodated. It was realised that the carrying capacity of the tractor and trailer system was limited. My investigation further revealed that the tractors were not strong enough to cope with the additional weight.

Based on my initial instructions from the customer I was tasked to investigate he underutilisation of the transport system between the two mentioned facilities and provide management with possible cost effective solutions. I have realised that time as a performance measurement alone would lead to the wrong conclusion and that I have to use the capabilities/specification of the equipment and finance as additional performance measures.

Possible Improvements

A possible solution to the problem was found from a completely different field of the transport industry. We have identified aeroplane transport tractors, called Dezi's as a possible solution to replace the existing tractors. These tractors are immensely strong and they have air-brakes with an outlet which could be connected to the power air-brakes of the trailer. This solution requires an upgrading of all trailers to carry the increased load and the reconfiguring of the loading space to accommodate more pipes at a time. The estimated cost to upgrade a single trailer is estimated at R 50,000-00 per unit. This will equip the trailer with air-brakes, stronger truck suspension and axels to increase the loading capacity. The air-brakes, as an additional feature which does not exist on the current trailers in use, will improve the safety of the equipment used and more specifically because much heavier loads will be carried uphill once the trailers have been upgraded. The fact that the trailers will be equipped with brakes will also decrease the maintenance on the tractors braking system.

Based on the specifications supplied by the supplier of the Dezi's, the equipment is more than sufficient for the job at hand. Dezi's could also be rented at a cost of approximately R51,000-00 per Dezi per month which is substantially lower than what the company is currently outlaying for transport to move pipes between the two facilities. Based on my analysis and calculations the company could save as much as R 4,919,981.76 per annum, a saving which could be regarded as substantial. The first year only R 4,519,981.76 will be saved, after subtracting the initial cost.

It would be possible to increase the number of pipes to be transported by employing the Dezi's and upgrading the trailers and in doing so it will eliminate the possibility of bottlenecks in its entirety.

Table 2 and Table 3 below provides the reader with a comparison of the expected cost savings which could be obtained by implementing the proposed solution as appose to continuing on the old basis. These figures are based on exact figures obtained from the company's internal records and from suppliers of equipment.

Table 2. Equipment Available

Current Transport

Mode of Transport	Number of vehicles	Initial Cost	Monthly Cost			Yearly Cost	Weight Limit (ton)	Pipe Carrying ability (11.6 mm)		
			Rent	Maintenance	Total	Total		273	508	610
Current Tractor	4			2747.56	2747.56	32,970.75	15			
Current Trailer	8			8000	8000	96,000.00	15	11	8	3
Current Truck	5		461,000		461000	5,532,000.00	30	22	8	6
Current Total						5,660,970.75				

Table 3. Possible Equipment Improvements

Possible Improvement

Mode of Transport	Number of vehicles	Initial Cost	Monthly Cost			Yearly Cost	Weight Limit (ton)	Pipe Carrying ability (11.6 mm)		
			Rent	Maintenance	Total	Total		273	508	610
Dezi	4		51,001.52	2,747.56	53,749.08	644,988.99	80			
Upgraded Trailer	8	400,000.00		8,000.00	8,000.00	96,000.00	30	22	8	6
Total						740,988.99				

Local Deliveries

Hall Longmore does not only manufacture for specific projects but also supply various other businesses locally and abroad with product, most of which is long standing customers. They supply the following official stockists of their product on a monthly basis with product namely Mining Pressure Systems (MPS); AIG; Robor; ABEYLA; MacSteel Wadeville and MacSteel Tube & Pipe. Hall Longmore also has an agreement with these stockists to deliver pipes elsewhere in South Africa should it be required. Transport is required to comply with these agreements but when transport is not used for the aforementioned purpose the trucks are used to move stock to and from the RAM stockyards and the Hall Longmore Duncanville site. These trucks are sent out on a daily basis.

Deliveries

The first area of data gathered was the amount of deliveries done the past year to every stockist. Analysing this data would help get a perspective of the productivity of the trucks in use. Using averages will eliminate the probability of just recording a slow or busy month, but to get an overall view of what is expected from these trucks in an average month. In Table 4 below are the average deliveries per stockist for a month:

Table 4. Deliveries

Stockists		Average per Month	
		Loads	Tons
ROBOR:		8.67	130
AIG:		6.25	77.5
	HRS	4.50	50
	HMT	0.83	12.5
	AC	1.92	28.75
	QTS	5.42	78.75
MPS:		38.17	533.75
MACSTEEL:	WADEVILLE	5.75	86.25
	TUBE & PIPE	2.17	32.5
ABEYLA:		19.67	278.75
COMPANY USE:	RAM	19.17	281.25
	DUNCANVILLE	21.42	318.75
OTHER:	GEA	0.75	11.25
	SASOL	0.33	5
ROBOR:		8.67	130
AIG:		6.25	77.5

(Refer to Appendix A for more detail)

From the table it can be deducted that not every stockist is as busy as the other.

- The average deliveries per month are between 22 - 23 deliveries per month per truck.
- This is one delivery per truck per day.

Based on the information above and taking into account that there are four full working days a week with eight working hours a day and every Friday, the fifth working day with only five working hours; it seems that the trucks are extremely under-utilised.

Distances

Every stockist's location adds to the utilisation factor as it takes different times to get to different places. In Table 5 below are the distances to the stockists:

Table 5. Distances

Stockists		Estimated travel time two way by truck (min)	Estimated loading and unloading time (min)	Estimated waiting time until truck returns (min)	Monthly Requirement (min)
ROBOR:		90	45	180	1560
AIG:		75	45	165	1031.25
	HRS	105	45	195	877.5
	HMT	15	45	105	87.5
	AC	15	45	105	201.25
	QTS	15	45	105	568.75
MPS:		63	45	153	5839.5
MACSTEEL:	WADEVILLE	15	45	105	603.75
	TUBE & PIPE	57	45	147	318.5
ABEYLA:		15	45	105	2065
COMPANY USE:	RAM	30	45	120	2300
	DUNCANVILLE	117	45	207	4433.25
OTHER:	GEA	30	45	120	90
	SASOL	210	45	300	100
Total					20076.25

(Refer to Appendix A for more detail)

In the table above the average monthly time spent on deliveries per company are set out. In the total row is the total amount of time needed per month to complete all the deliveries. This is much less than the time available to complete the deliveries. The time spend to load and unload have been taken in consideration in determining the abovementioned values.

Costs Involved

Hall Longmore is a company that has long been in the business of making pipes (since 1924). Through the years they have built up many contacts through past business relationships. Currently the three trucks are being rented at an extremely low price.

After interviewing the head of the logistics department about the prices they pay monthly it was found that it is impossible to get a cheaper price. The company renting the trucks let Hall Longmore use the older trucks on their yard. They still function at 100%. They are just out of date. Buying a truck and maintaining it would cost more. Table 6 below depicts all costs involved:

Table 6. Costs

Costs

Loads From 1 June 2009-31 May 2010	Average Deliveries per truck	Cost Per truck	Fees Per delivery (R)	Money made/lost per truck	Money made/lost per month
1620	22.5	38333.33	1275	9645.83	57875

As it shows in the table there is a delivery charge which covers part of the monthly truck rental. Stockists are charged R85 per ton for deliveries. Based on current market rates it will be recommended that this rate should be increased in line with the going rate in the market. Based on an average of 25 tons per month the company is making a ‘loss” of approximately R57, 875-00 per month on all 6 trucks which could be reduced if the delivery rate is increased to more acceptable levels.

Factors that come into Effect

Looking at the data compiled, it seems as if the trucks are vastly under-utilised. The problem is that the only way to get any type of model or idea of utilisation is to use a perfect situation as basis of analysis. Using the abovementioned figures we have arrived at an utilisation of 37.68% which seems to be very low. However, the following and mostly uncontrollable factors should be taken into account to arrive at a more realistic picture:

- Traffic.
- Queues at the customer
- Queues at Hall Longmore.
- Insufficient unloading capacity at point of destination.
- Time of day.
- Lunch and tea breaks.

Descriptions:

- **Traffic:** Depending on the trucks destination and time of day it leaves the yard, it will be possible to determine with some accuracy the additional time required to reach its destination.

- **Queues at the customer:** The customer is one of the biggest factors that negatively impact utilisation statistics. The investigation revealed that in most instances where a truck arrives at its destination there is a queue and the truck has to wait its turn to be offloaded. It has happened that it was necessary for drivers to sleep over as a result of this scenario.

- **Queues at Hall Longmore:** Pipes have to be moved between the plants on site (from the ERW to the coating plant). This creates queues. If the crane is busy loading a truck to take pipes to the coating plant, again the truck has to wait its turn to be loaded resulting in further delays.

- **Insufficient unloading capacity at point of destination:** Another factor that influences the utilisation of trucks. Some of the customers only have one crane. This means that even if there isn't a queue and more than one truck is sent to the site simultaneously, the trucks have to wait in a queue for each other to be unloaded. Also these businesses have to load and unload their own trucks which normally take priority. If they are busy with their own pipes they have no way of attending to our trucks. Thus they have to wait again.

- **Time of day:** Business hours are between 07:00 and 16:00. Thus, when a truck comes back from its destination between 14h00 and 15h00 it is not possible to send them out again on the same day. This also impacts the amount of hours that are available negatively.

- **Lunch and Tea breaks:** Based on Labour Law principles it is required to give all staff, including truck drivers, sufficient time for lunch and tea breaks. This has become the norm and it is rare to find a truck driver not making use of their lunch and tea breaks.

Penalty Fees

Consideration was given to implementing a penalty fee mechanism to the customer was another idea researched. To force the customer to unload the delivery trucks first, even if they are busy with their own trucks. After doing further research into this idea and asking the current more experienced employees about their point of view it seemed an unlikely endeavour. As these are the customers that are supplied daily and which are depended on as the basis of income, it does not seem wise to threaten them. As previously mentioned, some of the stockists have limited resources at their disposal, for loading and unloading. This is one of the biggest problems because every crane doesn't pick up every size pipe. This means that if the stockists are forced to stop with their unloading, to load our trucks, it will cause unnecessary time wastage for them. They will have to change crane pickups, look for forklifts that aren't busy and completely stop their own production. This is an awful amount of work, and is completely unjustified. This will only irritate the customer into moving to a supplier that will be more understanding and easier to work with.

Calculations

As there are so many factors that have an effect on the final answer, it is difficult to find a mid-way to find an accurate answer. During the holidays studies were done with the drivers. Driving with them and timing their daily activities. Their lunch times, tea breaks and actual driving times. The time wasted by the traffic, customer queues and loading capabilities and the queues at Hall Longmore. All of these were observed and an average for each has been worked out to be able to calculate the utilisation more accurately.

Compensations

Taking every factor into account the following numerical values have been given to each effecting factor (Refer to Appendix B):

- Traffic:
  i. This delay too small and will be left as negligible.

- Time of day:
  i. The times travelled during peak hours are negligible. The trucks often leave early in the morning and any time driven after three o'clock doesn't have any effect on the outcome.
  ii. The daily schedule of eight hours, or five hours on Fridays, working time per day can be reduced by an hour. No truck arriving within that last hour will be sent out and thus this time cannot be utilised and will be deducted from the available time.

- Lunch and Tea breaks:
  i. Lunch breaks have a small insignificant effect on the utilisation. The hours available will be deducted by 15 minutes per day.

- Queues at the customer:
  i. It was found that some of the businesses (MacSteel and MPS) are regularly busy. At these companies the trucks are regularly delayed, sometimes up to a day. An average waiting time of two hours will be added to the estimated delivery time of these companies. This will compensate for possible twenty-four hour delays.

- Insufficient loading capacity at point of destination:
    i. Seeing as these companies aren't very busy the size of the loading bay doesn't have a big enough effect on the end result and will not be changed.

- How busy Hall Longmore is:
    i. As Hall Longmore has many different tasks to complete at a time, there is hardly ever a delay substantial enough to make any changes to the times available.

Results

In Table 7 below is the results of the calculations after the compensations have been added.

Table 7. Results

Stockists		Estimated loading and unloading time (min)	Estimated waiting time until truck returns (min)	Monthly requirement (min)	Minutes Available Monthly for 6 Trucks (min)	Average Monthly Utilisation
ROBOR:		45	180	1560	45990	3.39%
AIG:		45	165	1031.25	45990	2.24%
	HRS	45	195	877.5	45990	1.91%
	HMT	45	105	87.5	45990	0.19%
	AC	45	105	201.25	45990	0.44%
	QTS	45	105	568.75	45990	1.24%
MPS:		165	393	14999.5	45990	32.61%
MACSTEEL:	WADEVILLE	165	345	1983.75	45990	4.31%
	TUBE & PIPE	165	387	838.5	45990	1.82%
ABEYLA:		45	105	2065	45990	4.49%
COMPANY USE:	RAM	45	120	2300	45990	5.00%
	DUNCANVILLE	45	207	4433.25	45990	9.64%
OTHER:	GEA	45	120	90	45990	0.20%
	SASOL	45	300	100	45990	0.22%
Total				31136.25	643860	67.70%

(Refer to Appendix A for more detail)

Looking at the average amount of deliveries done per truck per month (22.5), it clearly shows that every truck, on average, has one delivery per working day and every second truck does one extra delivery in a month. This means that when some trucks are sent on long deliveries and spend long periods on the road, the other trucks do more than one delivery at closer stockists to catch up the other trucks missed days of delivery. On some days, some trucks even do up to 3 deliveries. It all depends on 'the luck of the draw' on that day.

Deliverables

With the completion of this project the following will have been achieved:

- A detailed data-base of the current utilisation of the internal trucks usage.
- An overview and a description of the main problems associated with transportation of pipes in between plants.
- Solutions and ways of implementation to improve utilisation of internal and external transportation.
- A detailed report as to whether the company should outsource or keep the activity in house.
- A report on local delivery utilisation to better understand the current situation.
- Possible solutions to improve local delivery utilisation.

The implementation of the solutions to be gained will not only has a financial advantage but will also improve the overall productivity and image of the company.

Project Plan

Activities

1. Compile data, using this method, on internal truck movements.
2. Conduct interviews with foremen, labourers, truck drivers and engineers about problems perceived that delay loading.
3. Identify the biggest problems which cause delays.
4. Collect data on identified problems using time studies, interviews and available records where possible.
5. Collect data on amount of loads, distances travelled and average tonnage transported monthly.
6. Create most cost effective plan for external transportation.
7. Using data, information gained and various handbooks on operations research I will brainstorm possible solutions.
8. Choose the most likely to succeed and cost effective solutions.
9. Present solutions to management.
10. Present most cost effective plan for local delivery transportation.
11. Gather information about improvements and data about unforeseen effects.
12. Develop the best solution, with implementation plan and records of results to come for the improvement of utilisation of transportation using trucks internally and externally.

Resources

- Volkswagen Golf
- Computer and Software solutions
- General problem solving capabilities
- Engineers, foremen, truck drivers, logistics managers, dispatch controllers, sales managers and a CEO.
- Internet
- Operations Research Handbooks
- Stationary
- Knowledge gained from previous vacation work

Budget

Table 8 below depicts all personal costs involved in creating the report:

Table 8. Budget

Activity	**Predicted Costs**
Travelling (135km/trip with 15 trips)	R 4000
Meals	R 1000
Research (internet)	R 200
Stationery	R 50
Printing and Binding	R 350
Total	**R5600**

Conclusion and Recommendations

Conclusions

Supply Chain Management:

Analysing the entire system, transport (internally and externally) is one of the areas where under-utilisation was the most apparent. The production and coating processes are all newly upgraded but no adjustments were made to the mode of transport and the effectiveness of the existing transport infrastructure was not properly investigated.

Performance Measurement Systems:

The first decision of just using time as a performance measurement was an error. After more in depth research, equipment capabilities and finances became a part of the study.

- Equipment capability has been identified as the main contributing factor to bottlenecks that appeared after the upgrading of the plant and not so much the underutilisation of the transport infrastructure.
- From a financial perspective, the cost of hiring additional trucks increased the cost of transport tremendously which has a very negative impact on profitability of manufacturing in general.

In the later part of the investigation, time and money (financial impact) was used as two additional variables to measure performance whilst racking and monitoring were also used but to a lesser extent.

All trucks used for deliveries to customers are equipped with a tracking system for safety and insurance purposes. The information gathered by the tracking system was compared with the information in the driver's daily logbook and timesheets and it was possible to draw realistic conclusions from the information so gathered. This revealed areas of possible improvement which could lead to an improvement in the utilisation of these trucks.

Internal Transportation:

As described in the document, the current transport system is not necessarily under-utilised but does not have the capacity to do the job at hand effectively. This resulted in additional transport being employed at a huge cost to the company.

- Equipment capabilities improve greatly. Replacing the current tractors with the Dezi's and upgrading the trailers will make an immense difference. The stronger Dezi's will be able to pull the heavier loads with ease. The fact that it uses air-brakes and has an outlet for air-brakes for the trailer will dramatically increase the safety factor. The upgraded trailers will have the ability to carry much heavier loads, and be able to transport sis 610 millimetre pipes. The production needs will be met with a minimal amount of trips.

- As the Dezi's will have enough capability to continuously load and unload pipes at the needed rate, the trucks will not be needed. This will have an enormous impact financially. The companies sign 5 year contract when renting transportation. Thus a total of R 22,199,908.80 will be saved the first 5 years.

Taking into account all the information presented, improvements suggested will, theoretically, be the most effective choice.

External Transportation:

The compiled data presents a clear picture of under-utilisation in the current system, compared to an ideal situation. Investigation revealed many obstacles, some of which aren't taken into account by management. Every negative factor identified has either a little or significant effects on the utilisation. However, the sum total of all these identified factors is a major impact on the underutilisation of external transport.

As per our calculations, the percentage went from 37% to 67% if we take the so called "uncontrollable" factors also into account. This is still an unacceptable percentage and measures should be implemented to get the utilisation up to at least 80% to 85% which will allow for a sufficient margin to cater for unforeseen eventualities.

Recommendations

Internal Transport

a. Enter into an agreement to hire Dezi's to replace the existing fleet of tractors.

b. Sell the tractors as soon as possible unless it could be used elsewhere on the plant effectively.

c. Upgrade the trailers to be able to increase its capacity from 15 tons to 30 tons and make the necessary adjustments to be able to carry a larger number of the bigger pipes.

d. Cancel the hiring of additional trucks.

External Transport

e. Reduce the number of trucks from six to five.

f. Incentivise the drivers on a basis of number of pipes delivered per kilometre per month.

   The following principle could be used:

   Implementing an incentive bonus scheme based on the following formula should have a positive impact not only on driver behaviour but a commitment to perform better:

   Maximum distance of the furthest destination/Distance actually travelled = factor * number of pipes transported = score. The sum total of scores for the month will give an indication of true productivity.

g. Incentivise the customer by providing them with a discount of say 0.5% on order value if the trucks are unloaded within a certain period of time from time of arrival at its destination.

IMPACT OF RECOMMENDATIONS

Internal Transportation

Replacing the current tractors with the Dezi's and upgrading the trailers will make an immense difference. The stronger Dezi's will be able to pull the heavier loads with ease. The fact that it uses air-brakes and has an outlet for air-brakes for the trailer will dramatically increase the safety factor. The upgraded trailers will also have the ability to carry much heavier loads, and be able to transport sis 610 millimetre pipes. The increase in capability will be sufficient to handle the current volume of product.

The biggest impact will be from a financial perspective where the company will save as much as R 22 million over a 5 year period if they enter into 5 year rental contracts with the suppliers of the equipment. The upgrading of the trailers could be partly funded by the sale of the tractors whilst the real cost of upgrading the trailers is insignificant compared to the possible savings.

External Transportation

a. Incentives for Truck Drivers

Incentivising drivers will have a positive impact on driver behaviour and productivity as money is undoubtedly a large motivating factor for improved performance in general. It is a known fact that drivers do have some influence at the site of the customer and have ways and means to influence those responsible for unloading trucks to give them preference. Drivers will also be more aware of the impact stoppages and other breaks might have on their incentives. It must be kept in mind that driver safety and those of other users of the road should always be a prerequisite and should be an integral part of any measurement system of this nature.

b. Incentive for Customers.

The cost of underutilised trucks in comparison of giving the customers a discount on order value if they ensure that trucks are unloaded within a specific period of time is a worthwhile exercise which should be considered. Care should be taken that the discount is not perceived by customers as an automatic discount on order value which could easily become a "habit". By closely monitoring the situation the company could give the customer a rebate as a "gesture of goodwill" for unloading trucks within a specific period of time after arrival at the destination.

It is recommended that both the aforementioned incentive schemes should be implemented and monitored on a trial basis for three months. This will allow for a more informed decision to be taken and also provide some opportunity to make adjustments if necessary. No incentives will be paid out over this period but the information gathered will be used and analysed to ascertain whether this is a feasible recommendation.

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Appendix A

Data for Utilization Model

IDEAL MODEL

Stockist Company		Loads per month from 1 June to 31 Mei																					
		2009														2010							
		June		July		August		September		October		November		December		January		February		March		April		Mei	
		Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons
ROBOR:		5	75	3	45	9	135	10	150	18	270	3	45					2	30	14	210	9	135	31	465
AIG:		9	135	3	45	1		5		3		14	210	1		8	120	3		7	105	9	135	12	180
	HRS			4	60			1	15			27	405			8		6		8	120				
	HMT																					1	15	9	135
	AC	3	45			1	15	2	30	6	90					3	45	2	30	1	15			5	75
	QTS	8	120	1	15	3	45	14	210	13	195	12	180	2	30			3	45	1	15	5	75	3	45
MPS:		62	930	47	705	53	795	27	405	32	480	63	945	31	465	74	1110	2	30	12	180	29	435	26	390
MACSTEEL:	WADEVILLE	8	120	9	135	4	60	7	105	16	240	1	15					4	60	9	135	3	45	8	120
	TUBE & PIPE	2	30			7	105	4	60	2	30	2	30							1	15			8	120
ABEYLA:		28	420	38	570	35	525	22	330	15	225	14	210	13	195	11	165	5	75	1	15	36	540	18	270
COMPANY USE:	RAM	58	870	40	600	6	90	12	180	4	60	10	150	5	75	2	30	35	525	38	570	15	225	5	75
	DUNCANVILLE	1	15	14	210	23	345	21	315	6	90	23	345	2	30	20	300	80	1200	50	750	3	45	14	210
OTHER:	GEA			2	30	1	15	1	15			1	15							2	30	1	15	1	15
	SASOL																			2	30			2	30
TOTALS		184	2760	161	2415	143	2130	126	1815	115	1680	170	2550	54	795	126	1770	142	1995	146	2190	111	1665	142	2130

Data for Utilization Model

IDEAL MODEL

Stockist Company		TOTALS		Avarages per month		MAX	MIN	MAX	MIN	Estimated travel time one way by car (min)	Estimated travel time two way by truck (min)	Estimated loading and unloading time (min)	Estimated waiting time until truck returns (min)	Monthly requirement (min)	Minutes Available Monthly for 6 Trucks (min)	Average Mothly Utilization needed
		Loads	Tons	Loads	Tons	Loads	Loads	Tons	Tons							
ROBOR:		104	1560	8.67	130	31	0	465	0	30	90	45	180	1560	53280	2.93%
AIG:		75	930	6.25	77.5	7	0	105	0	25	75	45	165	1031.25	53280	1.94%
	HRS	54	600	4.50	50	8	0	120	0	35	105	45	195	877.5	53280	1.65%
	HMT	10	150	0.83	12.5	9	0	135	0	5	15	45	105	87.5	53280	0.16%
	AC	23	345	1.92	28.75	6	0	90	0	5	15	45	105	201.25	53280	0.38%
	QTS	65	975	5.42	78.75	14	0	210	0	5	15	45	105	568.75	53280	1.07%
MPS:		458	6870	38.17	533.75	74	2	1110	30	21	63	45	153	5839.5	53280	10.96%
MACSTEEL:	WADEVILLE	69	1035	5.75	86.25	16	0	240	0	5	15	45	105	603.75	53280	1.13%
	TUBE & PIPE	26	390	2.17	32.5	8	0	120	0	19	57	45	147	318.5	53280	0.60%
ABEYLA:		236	3540	19.67	278.75	38	1	570	15	5	15	45	105	2065	53280	3.88%
COMPANY USE:	RAM	230	3450	19.17	281.25	58	2	870	30	10	30	45	120	2300	53280	4.32%
	DUNCANVILLE	257	3855	21.42	318.75	80	1	1200	15	39	117	45	207	4433.25	53280	8.32%
OTHER:	GEA	9	135	0.75	11.25	2	0	30	0	10	30	45	120	90	53280	0.17%
	SASOL	4	60	0.33	5	2	2	30	30	70	210	45	300	100	53280	0.19%
TOTALS		1620	23895											20076.25	745920	37.68%

Data for Utilization Model
Model with compensations

Stockist Company		Loads per month from 1 June to 31 Mei																					
		2009														2010							
		June		July		August		September		October		November		December		January		February		March		April		Mei	
		Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons	Loads	Tons
ROBOR:		5	75	3	45	9	135	10	150	18	270	3	45					2	30	14	210	9	135	31	465
AIG:		9	135	3	45	1		5		3		14	210	1		8	120	3		7	105	9	135	12	180
	HRS			4	60			1	15			27	405			8		6		8	120				
	HMT																					1	15	9	135
	AC	3	45			1	15	2	30	6	90					3	45	2	30	1	15			5	75
	QTS	8	120	1	15	3	45	14	210	13	195	12	180	2	30			3	45	1	15	5	75	3	45
MPS:		62	930	47	705	53	795	27	405	32	480	63	945	31	465	74	1110	2	30	12	180	29	435	26	390
MACSTEEL:	WADEVILLE	8	120	9	135	4	60	7	105	16	240	1	15					4	60	9	135	3	45	8	120
	TUBE & PIPE	2	30			7	105	4	60	2	30	2	30							1	15			8	120
ABEYLA:		28	420	38	570	35	525	22	330	15	225	14	210	13	195	11	165	5	75	1	15	36	540	18	270
COMPANY USE:	RAM	58	870	40	600	6	90	12	180	4	60	10	150	5	75	2	30	35	525	38	570	15	225	5	75
	DUNCANVILLE	1	15	14	210	23	345	21	315	6	90	23	345	2	30	20	300	80	1200	50	750	3	45	14	210
OTHER:	GEA			2	30	1	15	1	15			1	15							2	30	1	15	1	15
	SASOL																			2	30			2	30
TOTALS		184	2760	161	2415	143	2130	126	1815	115	1680	170	2550	54	795	126	1770	142	1995	146	2190	111	1665	142	2130

Data for Utilization Model
Model with compensations

Stockist Company		TOTALS		Avarages per month		MAX	MIN	MAX	MIN	Estimated travel time one way by car (min)	Estimated travel time two way by truck (min)	Estimated loading and unloading time (min)	Estimated waiting time until truck returns (min)	Monthly requirement (min)	Minutes Available Monthly for 6 Trucks (min)	Average Mothly Utilization needed
		Loads	Tons	Loads	Tons	Loads	Loads	Tons	Tons							
ROBOR:		104	1560	8.67	130	31	0	465	0	30	90	45	180	1560	45990	3.39%
AIG:		75	930	6.25	77.5	7	0	105	0	25	75	45	165	1031.25	45990	2.24%
	HRS	54	600	4.50	50	8	0	120	0	35	105	45	195	877.5	45990	1.91%
	HMT	10	150	0.83	12.5	9	0	135	0	5	15	45	105	87.5	45990	0.19%
	AC	23	345	1.92	28.75	6	0	90	0	5	15	45	105	201.25	45990	0.44%
	QTS	65	975	5.42	78.75	14	0	210	0	5	15	45	105	568.75	45990	1.24%
MPS:		458	6870	38.17	533.75	74	2	1110	30	21	63	165	393	14999.5	45990	32.61%
MACSTEEL:	WADEVILLE	69	1035	5.75	86.25	16	0	240	0	5	15	165	345	1983.75	45990	4.31%
	TUBE & PIPE	26	390	2.17	32.5	8	0	120	0	19	57	165	387	838.5	45990	1.82%
ABEYLA:		236	3540	19.67	278.75	38	1	570	15	5	15	45	105	2065	45990	4.49%
COMPANY USE:	RAM	230	3450	19.17	281.25	58	2	870	30	10	30	45	120	2300	45990	5.00%
	DUNCANVILLE	257	3855	21.42	318.75	80	1	1200	15	39	117	45	207	4433.25	45990	9.64%
OTHER:	GEA	9	135	0.75	11.25	2	0	30	0	10	30	45	120	90	45990	0.20%
	SASOL	4	60	0.33	5	2	2	30	30	70	210	45	300	100	45990	0.22%
TOTALS		1620	23895											31136.25	643860	67.70%

Appendix B

Time Studies

Time Compensations

Destination		Time in minutes [GAINED (-)/LOST]				
		Traffic	Queues at the customer	Queues at Hall Longmore	Insufficient Capacity	Lunch and tea breaks
1	ROBOR	6	20	30	5	20
2	ABEYLA	-5	15	-45	6	5
3	RAM	13	0	20	0	22
4	MPS	-5	35	5	0	13
5	MACSTEEL (WADEVILLE)	2	120	15	0	0
6	MPS	12	30	-45	0	8
7	MPS	-8	40	15	0	14
8	HRS	17	10	12	5	20
9	DUNCANVILLE	20	0	5	0	23
10	MACSTEEL (WADEVILLE)	-2	1080	8	0	0
	AVERAGES:	5	135	2	1.6	12.5