SATISFYING CUSTOMERS BY IMPROVING AND CONTROLLING SERVICE QUALITY PERFORMED AT

TRANSNET

by

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Executive summary

Fast response is a major quality attribute in a competitive environment and TFR faces challenges of not delivering on time due to high variations in cycle time which has an adverse impact on customer satisfaction as well as impacting its competitive advantage in the market place. This problem is mainly caused by inefficiency in the operations which are mainly caused by the manual nature of the ITP system used to schedule trains and complexity that arises from congestion. Transnet (2012).Cycle time reduction should be the main focus at TFR within all improvement projects. Improving service quality can be achieved through a dedicated teamwork and integration with customers in every business process.

Problems faced at Capital Park were analysed and solved using DMAIC which is a problem solving process associated with six sigma and applying Lean six sigma tools such as time and motion study, variance analysis and simulation which aims at reducing variation in cycle time which will thus improve the service delivery process at TFR. Since service quality is linked to customer satisfaction, this project should then assist in outlining the link between service quality, customer satisfaction, customer loyalty and customer retention. Douglas (2013).The techniques will help in reviving the competitive advantage lost due to inefficiencies in the service delivery process, reduce the cycle time (variation), provide necessary quality control methods for continuous improvement and outline the importance of service quality.

TFR purchases approximately 10 telemeters (10* R33 000) every month for Pretoria yards but after two weeks Pretoria has a shortage of telemeters. These monthly expenditures can be avoided if every train can be coupled to a telemeter and no other train can use that telemeter.

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Abbreviations

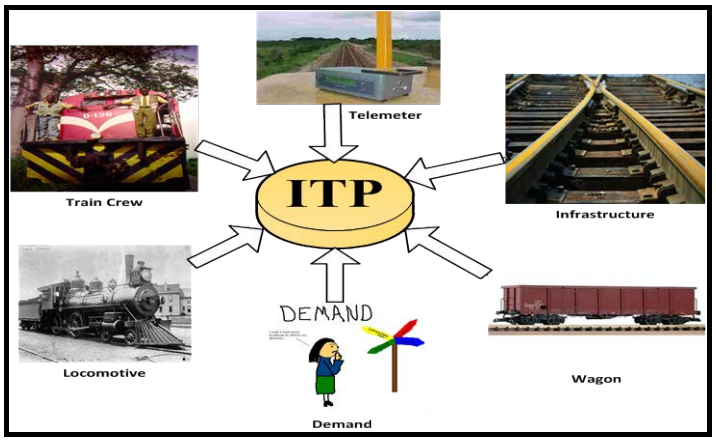
Table 1 – Abbreviations

TFR	Transnet Freight Rail
MT	Million Tons
DMAIC	Define, Measure, Analyse, Improve, Control
ITP	Integrated Train Plan
MTS	Master Train Schedule
RBCT	Richards Bay Coal Terminal
DMAIC	Define, Measure, Analyse, Improve, Control
YO	Yard Official
CTC	Certalite Train Control
RCA	Root cause analysis
Loco	Locomotive

1. Introduction and Background

Transnet is a leading logistics company delivering goods around South Africa with the declared aim of delivering integrated, efficient, safe, reliable and cost-effective services. It is fully owned by South African government and operates in five divisions that complement one another. TFR will be the division of focus for this project. It is the largest division of Transnet specialising in the transportation of freight. TFR has approximately 25 000 employees spread throughout the country. TFR uses a manual system named ITP to schedule trips requiring inputs as shown in Figure 1 below. The crew has to schedule trains based on three distinct train types mega, flexi and access and trips are made from MTS which has approximately 10 000 trips. Complexity due to congestion requires the ITP to re-plan trips manually leading to deviations from the plan. Transnet (2012)

Figure 1 – Manual train scheduling system



TFR has changed its operating strategy by setting up business units that will be commodity flow specific with the aim of improving the delivery of service to its valued customers. Future aggressive growth plans requires TFR to address the following:

- Convert cargo from road to rail
- Retain and grow existing business
- Reposition the TFR brand to a trusted, predictable service provider

2. Problem statement

TFR is not reaching targeted volume transported required to service the capital investment and also does not attain the required customer satisfaction due to amongst other, the inefficiencies in the service provided and the workflow within the organisation. Focusing on customer satisfaction, it is essential for an organisation to know the needs of their customers and know how to satisfy them in an economic, efficient and effective manner.

Service design teams in TFR spend most of their precious time designing schedules that specific trains should follow throughout but due to limitations in capacity and infrastructure, trains will not always travel as anticipated. TFR should be able to schedule trains that are required for the tons to be moved and the scheduling process should be feasible. Because of the infeasibility of the ITP, complex practical challenges occur and this causes deviation from the plan. Unplanned incidents such as derailments oblige trips to be re-planned, however due to the manual nature of ITP, deviation will still occur.

Currently Capital park yard is not performing as anticipated since most trains are cancelled due to an imbalance of resources and this strains TFR financially. Most trips are delayed due to amongst others, telemeter shortage, low employee morale and communication challenges. Delivering as promised is essential due to the competitive environment and efficiency cannot be improved if employees operate at will without stating reasons why the system design was not followed.

3. Project aim

The project aims to address the role and importance of service quality, the substance needed by TFR to be able to respond with a certain degree of certainty as well as making a significant contribution to reviving the organisation's competitive advantage lost in the market place due to ineffectiveness of the organisation. If the organisation does not satisfy customer needs, it leaves room for competitors to enter the market place and win over most of the customers not satisfied. The variation in train cycle time will be reduced by proposing methods for improving and controlling service quality. Due to the importance of customer service, there is an urgent need for the development of a framework that outlines the link between service quality, customer satisfaction, customer loyalty and customer retention.

With the use of DMAIC, time studies, MS Excel, Control charts and Simulation, the success of the project will help identify and verify root causes of variation, then improving the inefficiencies in the service delivery process so that cycle time is reduced. Reducing time spent on a specific activity improves the service quality and helps in capacity usage.

4. Project scope

The analysis of the system design will be conducted from a flow of container transport that runs from Kingsrest to Capital Park and this should precisely and clearly identify the gap between actual operations as compared to the design for a span of one month (November 2012). The incoming and outgoing of trains should be focused on in identifying the bottleneck in the process. Improving efficiency and operating at a lowest cost possible but without sacrificing the quality of the process is constantly one of the objectives of Transnet.

To meet the aim of this project, the following objectives are pursued:

- Study the yard operations at Capital park
- Identify the bottleneck in the process and outline the gap between design and actual cycle times for the container flow
- Understand the importance of service quality
- Propose methods for controlling the bottleneck and improve service quality

Deliverables

The main deliverables of this project are as follows:

- A plan of improving the throughput rate through effective use of capacity
- Improving the competitive advantage of the organisation in the market place
- Reducing dwell time within a trip
- Having well equipped crews whose abilities are not limited based on the locomotive type

5. Literature Review

According to Randolph (2009) a literature review assists in providing all relevant literature about the topic of study and helps in determining what is known and filling the missing gap.

Galvan (2006) describes a literature review to be essential for the following reasons

- Determining what is known about the topic
- Relating different contributions to the topic of study
- Understanding the relationship between what is published and the topic as well as finding sources that are contradictory

5.1. Service quality

TFR is not reaching its targeted volume transported required to service the capital investment and also does not attain the required customer satisfaction due to amongst other, the inefficiencies in the service provided and the workflow within the organisation. Focusing on customer satisfaction, it is essential for an organisation to know the needs of their customers and know how to satisfy them in an economic, efficient and effective manner.

Service design teams in TFR spend most of their time designing schedules that specific trains should follow throughout but due to limitations in capacity and infrastructure, trains will not always travel as anticipated. TFR should be able to schedule trains that are required for the tons to be moved and the scheduling process should be feasible. Because of the infeasibility of the ITP, complex practical challenges occur and this causes deviation from the plan. Unplanned incidents such as derailment oblige trips to be re-planned and due to the manual nature of ITP, deviation will still occur.

As is currently, TFR encounters challenges of trains taking longer than designed for and this affects the whole workflow and leads to problems such as customer dissatisfaction. Delivering as promised is essential due to the competitive environment and efficiency cannot

be improved if people still operate as they wish and not stating reasons why the system design was not followed.

5.2. Freight logistics solutions

TFR is a world class heavy haul freight rail company that maintains an extensive rail network across South Africa and connects with other rail networks in the sub-Saharan region, with its rail infrastructure representing about 80% of Africa's total as reported by Transnet (2012). TFR transports commodities such as automotive, containers, coal, grain, agriculture and fuel to mention a few for customers in industry based business segments such as mining and manufacturing. Gama (2011) addressed that TFR had started migrating its general freight business to a scheduled service that will adhere to a strict timetable replacing the current tonnage-based dispatching system where trains only depart when loaded.

Transnet moves crucial coal exports to the RBCT for movement to growing Asian markets and plays an important role in Africa's largest economy. Simelane (2011) reported that TFR is running without much excess capacity. Therefore better planning and scheduling tools are needed to effectively manage the scarce resources to handle rapidly increasing demand for railway transportation. The current tonnage-based dispatching system was aimed at minimising the total number of trains needed by maximising their size which disrupted the efficient utilisation of crews, locomotives and equipment. The new system, which will operate like an airline and will help TFR to deliver on time and improving TFR market share.

The planning of the new system will incorporate collaboration with customers and will provide measures essential to customers as well as eliminating unnecessary activities in the system. There are corridors already operating on the fixed-schedule model. TFR runs about 750 to 1000 trains daily and due to complexity, stronger teamwork will be required for successful implementation of the system. Gama (2011)

5.3. Customer relationship management

Figure 2 – Customer interface model

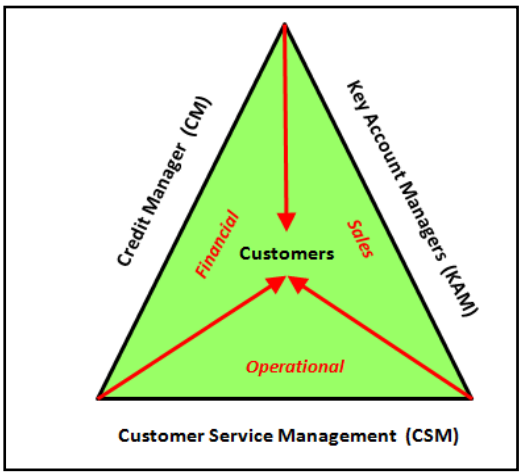


Figure 2above shows how employees should interface with customers at TRF. KAMs exchange sales information with customers and the customers should provide validated information about the volumes they would like to commit to as well as how often they will move freight based on their strategic plan for the next financial year. They were previously located at the sales and marketing department which caused a lot of confusion but are now decentralised based on each business unit and the strategy is to place them close to the customer for simplicity of operations.

CSM are operational people and they share operational information with customers since they inform customers on queries related to the status of the train or wagon such as has the wagons been placed, were they cleaned and are they of the correct type of wagon. CM in the finance department informs customers on payments, credit limit and ensure that necessary documentation is sent to the customer and is reflected on the system. Customers have a perception that they should always channel to the KAM for everything that goes wrong since they are the first people they interacted with and with that done, KAMs have to contact CSM or CM based on the customer's query and this overloads KAMs. Ideally the interface in Figure 2 above should be working accordingly for operational efficiency.

Types of interface at TFR

A one-one interface is the simplest way of interfacing. It usually occurs when a customer interfaces with one person from the organisation and the only problem with this type is that there is a lot of information that is channelled through the same people which is what is currently happening at Transnet taking into consideration KAMs. The organisation should initially start with a one-one interface and as the customer and the organisation move to a more mature state and become more comfortable with each other the interface should switch to a many-many relationship where the finance person from Transnet will communicate with the finance person from the customer and the sales person from Transnet is in touch with the logistics person from the customer side. The interface cannot be many-many from the word go since a customer who is basically in the process of starting a contract/business with Transnet cannot be enquiring from a multitude of people.

Figure 3 – One-One Interface

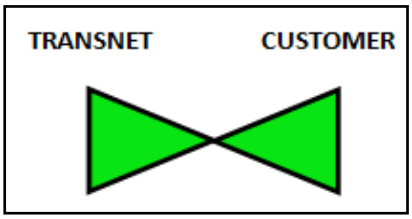


Figure 4 – Many-Many Interface

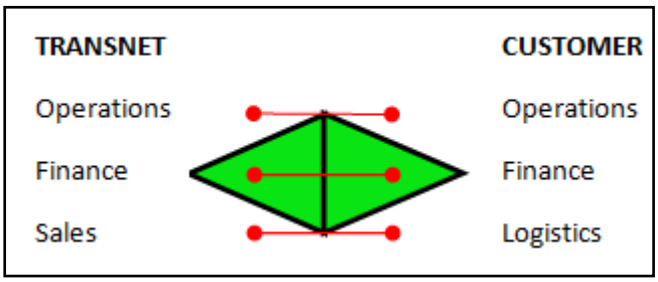
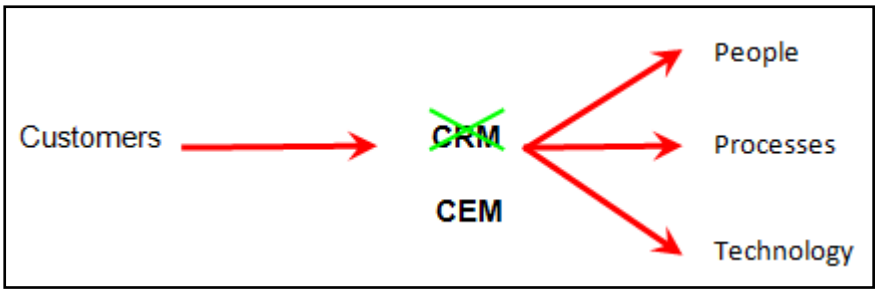


Figure 5 – Customer relationship management



Transnet had a division called CRM which focused its emphasis on the technology, it prioritised on technology as compared to people and the processes which caused even more havoc since implementing new technology such as SAP means the business processes have to be redesigned to align with SAP and also training of employees based on the technology. More focus was then placed on CEM as shown in Figure 5 above which focuses on the organisation as a whole. Between Transnet and the customer, there is a need for someone who will make sure that Transnet tailors its solutions to meet customers' needs and this can be achieved by aligning people, processes and the technology in such a way that Transnet is able to deliver.

5.4. Train scheduling process

5.4.1. ITP system

Transnet is currently using a manually operated system to schedule trains and complexity due to congestion forces trips to be rescheduled which results in deviation from the design or plan. There are a large number of trains that need to be planned for and as train trips are re-planned manually it affects the whole system resulting in delivering freight late affecting the relationship TFR shares with its customers. The daily train service plan helps in determining in advance the minimum train resources that need to be set aside to service market demand, defining the task that the National Operations Centre (NOC) have to perform and the process that the DTSP system follows to define the daily train service plan. To successfully schedule train trips, certain inputs are required.

5.5. Yard operations

The process flow of incoming and outgoing container trains at Capital Park is attached in Appendix B. Main focus in reducing the cycle time and improving efficiency will be based on yard operations. Trains cannot depart without a telemeter. A telemeter as shown if Figure 6 below is an end of train monitor system for use in air and vacuum braked trains. It measures pressure on the last wagon and transmits the information to the driver informing him if the reading moves beyond specific levels and this ensures safe trips and train operation. It is designed to be simple and work reliably on a 200 wagon train travelling at 120 km / h. Maraisand Van der Westhuizen (2010)

Figure 6– Telemeter

Benefits of using a telemeter

- Low Cost
- Portable System
- Long operating time on single battery charge
- Expandable system
- Detects possible brake system problems
- Monitors for train completeness
- Compatible with all telemeter rear units

5.6. Lean Six sigma

Montgomery (2013) describes Six Sigma as a company-wide improvement system with an aim of achieving required business success and customer satisfaction through continuous reduction of variation in every business process. This system will prove useful for TFR since reduction in cycle time variation will lead to service quality which will then lead to customer satisfaction and organisation excellence. Capital Park will be the area of focus for improvement. Lean manufacturing is a controlled process which identifies and eliminates waste in business processes at the right quality by making use of value stream to identify value and non-value adding steps in a process. Waste can be in a form of processes taking longer than planned, idle workers and human or machinery movement not adding value to the process.

Lean manufacturing focuses on efficient process flow as well as waste reduction while Six sigma focuses on process improvement and variation reduction. Lean Six Sigma is a blend of the two concepts, Lean reduces waste by breaking down processes and isolating waste from value and Six Sigma helps organisations reduce process variation and errors by using quality and statistical tools. Implementing Lean Six Sigma helps organisations obtain benefits of faster processes at a lower cost and higher quality. Oriel Matrix (2011).

According to Skalle and Hahn (2013) lean six sigma utilises DMAIC phases as shown in Figure 7 below similar to that of six sigma and it combines tools and techniques from lean and six sigma to produce required results. Lean six sigma eliminates process waste, reduces non-value adding processes which promotes business excellence. DMAIC methodology will be used as a toolbox in analysing and improving the process since the project focuses on improving the current business process. Quality support group (2012)

Figure 7 – DMAIC process steps

Through improved service, customers will be satisfied and will remain loyal for a long time which makes it easy for the organisation to retain them. Delivery of quality service is pivotal to retaining existing and gaining new business.

Benefits of Lean six sigma as compared to its predecessor are listed below:

- Improved quality and delivery
- Increased profitability
- Improved customer satisfaction
- Enhanced skills of employees
- Eliminate waste
- Reduce lead time
- Increase throughput

5.7. Assessment tools

5.7.1. Business process mapping and value analysis

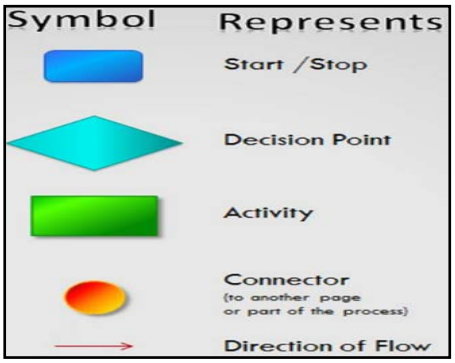
Jacka and Keller (2009) defined process mapping as a tool that allows assessors to get a better understanding of the process and helps to find ways in which the process can be successful as well as proving desired value to customers.

Benefits of business process mapping are as follows:

- Creates efficiency
- Analyse work being performed
- Provide enhanced customer service
- Provides modernization and improvement

This tool will help in the analysis of long cycle time activities on the current process. It will be employed at TFR by comparing yard activity durations, identifying activities that should be eliminated and activities that should be allocated the least and most time. It will also provide a method that will be used to estimate the execution time of the "Should-Be" process. Business process mapping allows for analysis of activities that add value to the overall process and such non-value activities that should be eliminated as well as identifying activities that should be performed first. Listed in Figure 8 below are symbols used in a construction of a business process map.

Figure 8 – Symbols used on a process map



5.8. Problem solving tools

5.8.1. Variance analysis (MS Excel)

Wright (2012) describes variance analysis as the analysis of the difference between the actual and planned behavior of a process. Variances are analysed and provide useful information for measuring efficiency of the system and improving overall performance. If actual train cycle time is less than the designed time then variance is favourable and unfavourable when actual cycle time is greater than design cycle time. According to Spafford (2003), it is performed so that managers learn or understand why financial fluctuations exist in the business. Due to the quantity of data to be analysed, MS Excel will be used for variance analysis.

Variance analysis is performed to know:

- The difference between actual and planned service times
- Reasons for the difference

5.8.2. Root cause analysis

It is a problem solving technique also known as an error analysis tool that identifies serious problems and traces them back to their origin with the main aim of reducing the likelihood of recurrence. Bowie, Skinner and De Wet (2012). The most effective solution should always be verified so that additional problems can be prevented. The 5 Whys' technique is used in the Analyze phase of the Six Sigma DMAIC methodology. It is a great Six Sigma tool that does not involve data collection. Wu A. W (2008). Root Cause analysis starts with asking questions to investigate the main cause of the problem and frequently asked questions are:

- Which process failed for the occurrence of the problem?
- Why did a specific event occur?

Benefits of performing root cause analysis / 5 Whys'

- Identifies the root cause of a problem
- Preventing reoccurrence of specific events
- Identifies long-term solutions
- Simplicity and ease of use

Step by step procedure of conducting RCA

- Define the underlying problem non-conforming to standards
- Investigate the root cause
- Propose action plans to reduce the likelihood of reoccurrence
- Implement proposed actions
- Verify and monitor the effectiveness of proposed actions

5.8.3. Time study

A time study is the analysis of the business process designed to improve efficiency by identifying activities in the process where time is wasted. According to wiseGEEK (2013) time studies can reduce waste and streamline the business process for faster operation to improve performance. The tool will be used to record the duration of each activity carried out in the yard/corridor which will be of assistance in timing the optimal completion for each activity and identifying unnecessary motion in activities.

5.8.4. Computer Simulation

According to Roberts & Nichols (1995), the use of computer simulation can be very beneficial in reducing the cycle time of business processes by allowing for evaluation of "what-if..." scenarios without the risk of experimenting on the actual process. Many simulation packages include animation so that the process can be viewed in action and allowing those with no previous knowledge of simulation to observe and understand the process. Computer simulation will be developed from the process map of the corridor and

this will be achieved by gathering data on the time (maximum and minimum times) required for each step in the process. Given the complex nature of a process, simulation modeling acts as one of the few approaches that can capture the dynamic nature of the process in a useful and realistic manner.

Fishwick (1995) defines simulation as an act of imitating or mimicking real behavior of a system by means of a model of an actual system executing the model on a digital computer and analysing the execution output. Studying a model instead of a real system is beneficial since:

- Can perform a wide range of ideas on a model
- Can make mistakes in a computer model that will not result in financial strain

Verification and validation of a model

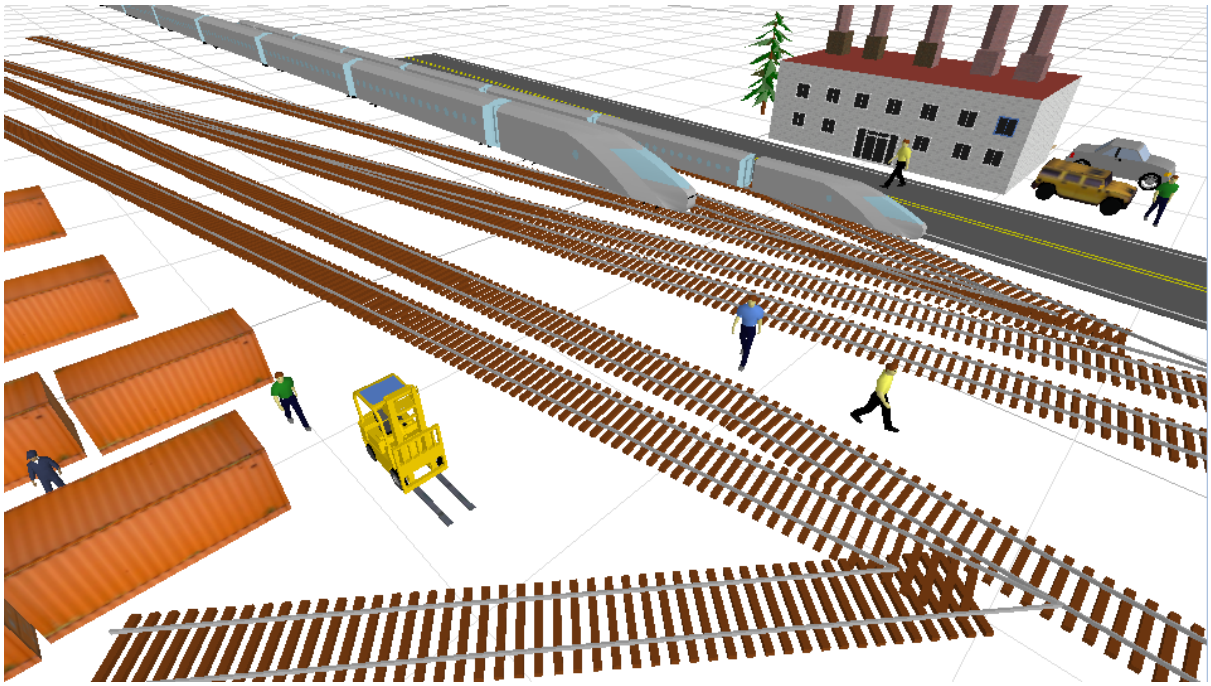
Verification of a model as defined by Kleijen (1993) is determining that a model performs as intended in a manner that the model has no errors and validation is concerned with determining whether the conceptual simulation model is an accurate representation of the system under study. Validation cannot result in a perfect model since it is a simplification of reality and the perfect model would be the real system itself

Benefits of simulation according to Pegden (2012) are as follows:

- It is easier, faster and cheaper to see the impact of change in the process, one can make changes to the model to test a wide range of ideas without disrupting the real system.
- Can conveniently separate the winning ideas from the losing ideas and optimize the business performance by validating proposed designs
- Due to its ability of providing an animated preview of a proposed change, one can graphically display key performance measures for the system
- Allows to fully account for variation in the business system and the impact that it has on the overall system performance.

6. Problem investigation

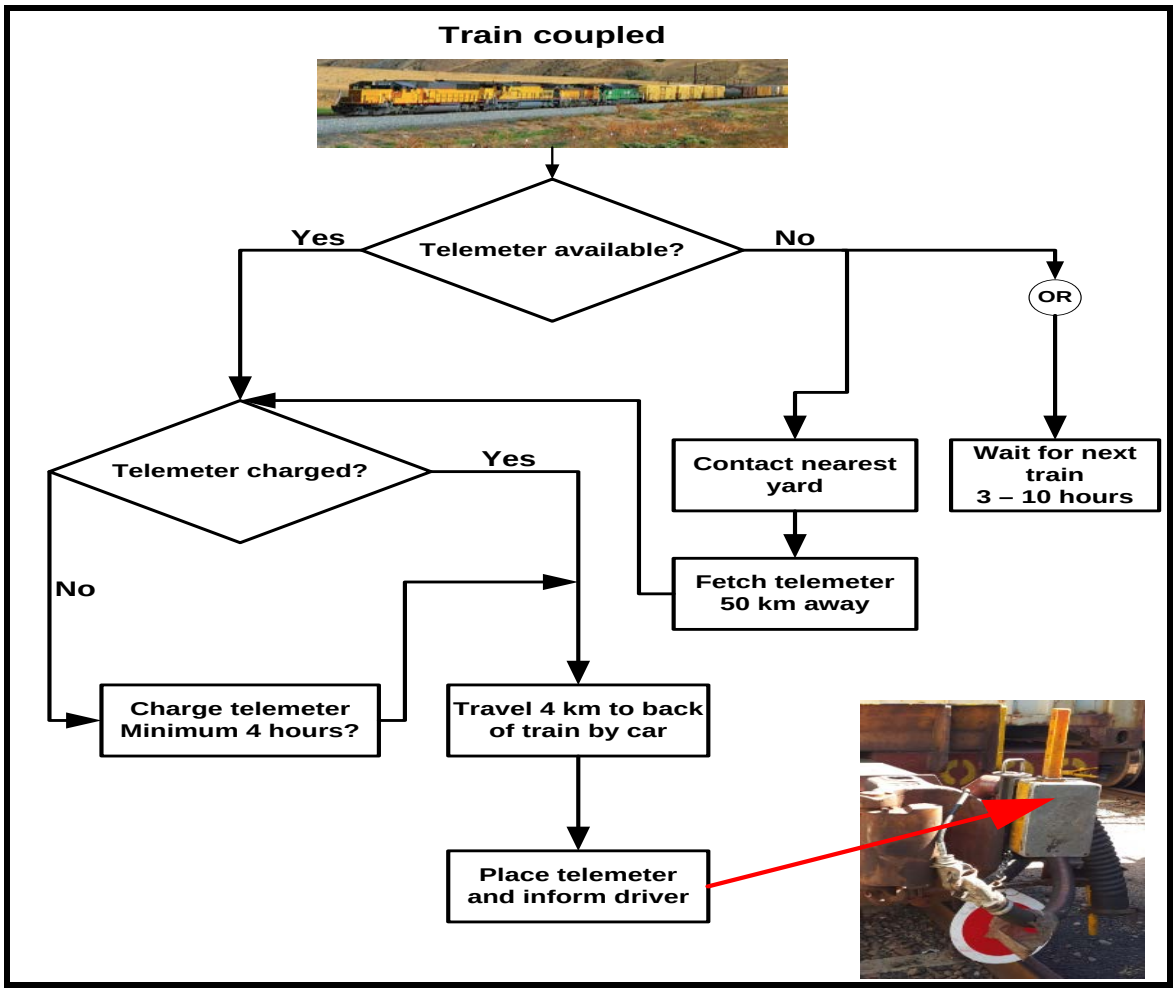
Figure 9 – Layout of Capital Park



Time studies were conducted at Capital Park for two weeks focusing on the process of incoming and outgoing trains and results revealed that the process has a bottleneck in placing a telemeter. Other activities within the same process do not require revamping but placing of the telemeter requires attention. It takes a minimum of 20 minutes and a maximum of 10 hours to place a telemeter on a train according to the process as shown in Figure 9 below. A train cannot run without a telemeter and currently there is an ineffective use of telemeters which leads to cancellation of planned trips and significant losses.

Process of placing a telemeter

Figure 10 – Process of placing a telemeter



Interviews

Yard officials

Most yard officials are not motivated to do their job at the level best and most blame is directed to management. Yard officials are considered the lowest in the company's structure yet their job is crucial to the company as a whole hence a feeling of appreciation is hindered. Most control rooms have old furniture and the paint is dull with no air conditioners which is a

necessity considering their long hours in the sun at the yard. Most do not have a voice to the company and growth is limited since it is difficult to access available positions for promotion.

Conclusion: Employee morale is very low and this is affecting productivity at Capital Park therefore management should consider reviewing their dissatisfaction

During induction, TFR should focus on educating all new employees about the business before they can show them all operations as well as alternatives they can follow if they want to grow in the industry of freight. TFR should believe that every employee is unique and they should all share the same goal and vision as the company.

Yard manager

Cancellation of trips and delays are caused by ineffective use of resources and employees not sharing one goal. All yards are trying to be on the top list of overall performance hence when a telemeter is available at a nearest yard, they do not inform one another. This view is wrong because they are all working for the company and every yard should consider the other as their internal customer and an injury to one is an injury to all. Most locomotives are 30 years old and this causes failures which delays trains from departing in time.

Conclusion: Optimise resource utilisation and train all employees to understand the nature of the business.

Daily train service plan

As shown in Appendix D most late departures and cancellation are due to lack of resources such as a telemeter and locomotives. This was investigated further to find the root cause and solutions that will reduce recurrence will be implemented. Table 2 below depicts reasons for train cancellations as extracted from the daily train plan on Appendix D.

Table 2 – Causes of weekly cancellations and late departure

Cancellations / Late Departures		
Description	**Cancellation**	**Late**
Crew rest		
Crew shortage		
Crew time expired		
Derailment	25%	
Eskom		
Loco failure		20%
Metrorail		
No loco		25%
Power failure		
Telemeters	30%	

7. Development of Methods, Tools and Techniques

7.1. Process map

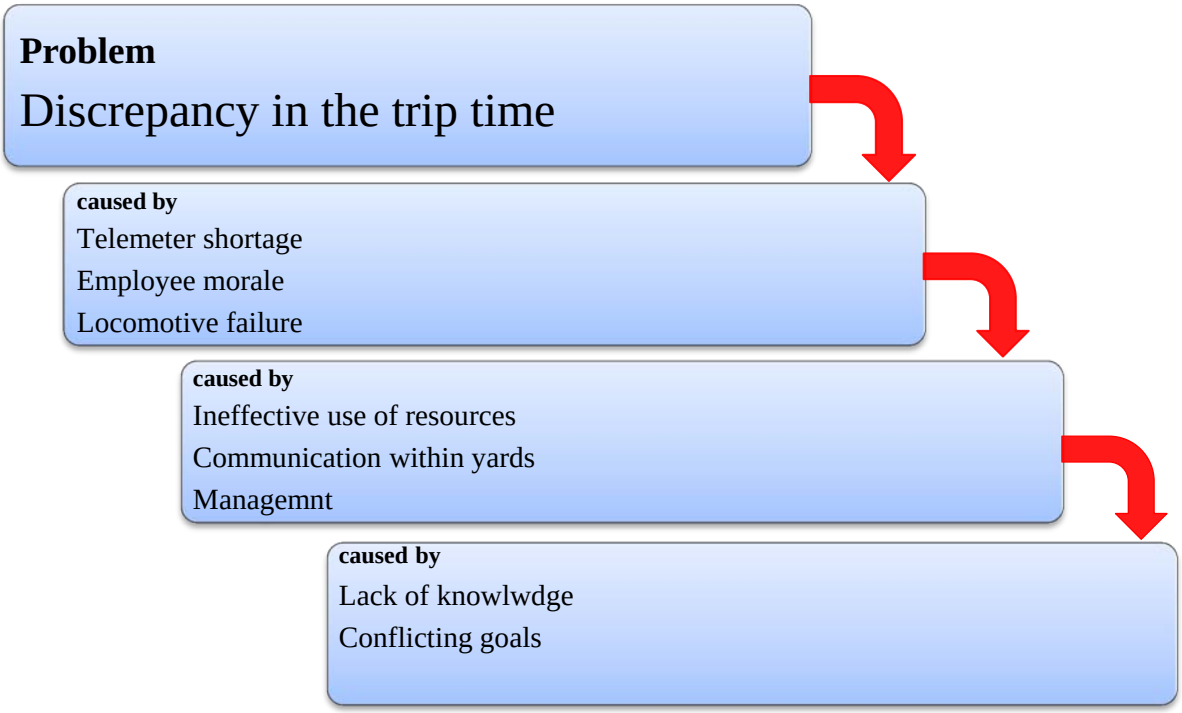
Due to limitations of time, the area of focus in improving service quality will be constrained to Capital Park yard for a flow of containers. The process map of the activities undertaken at the yard was obtained from interviews with yard master and the yard manager. The process map for incoming and outgoing container trains is as shown in Appendix B.

7.2. Variance analysis

Data for container transport for a span of a month was studied and analysed using Microsoft Excel to determine the bottlenecks of the system so as to point out trips in need of urgent improvement. Due to inefficiency in service delivery, trains are not delivering on time resulting in customer dissatisfaction as well as difficulty for TFR in retaining customers. The trip from Kingsrest to Capital Park was designed to take 19 hours but the actual operations are taking longer than the design time.

7.3. Root cause analysis

Major challenges faced at Capital Park are due to the ineffective use of resources, employee morale and communication between yards in a specific area. Communication plays a major role since when one yard has a free telemeter, they do not communicate with their nearest yard that should run a train on that day since each yard is trying to improve their performance forgetting that they have to work as one.



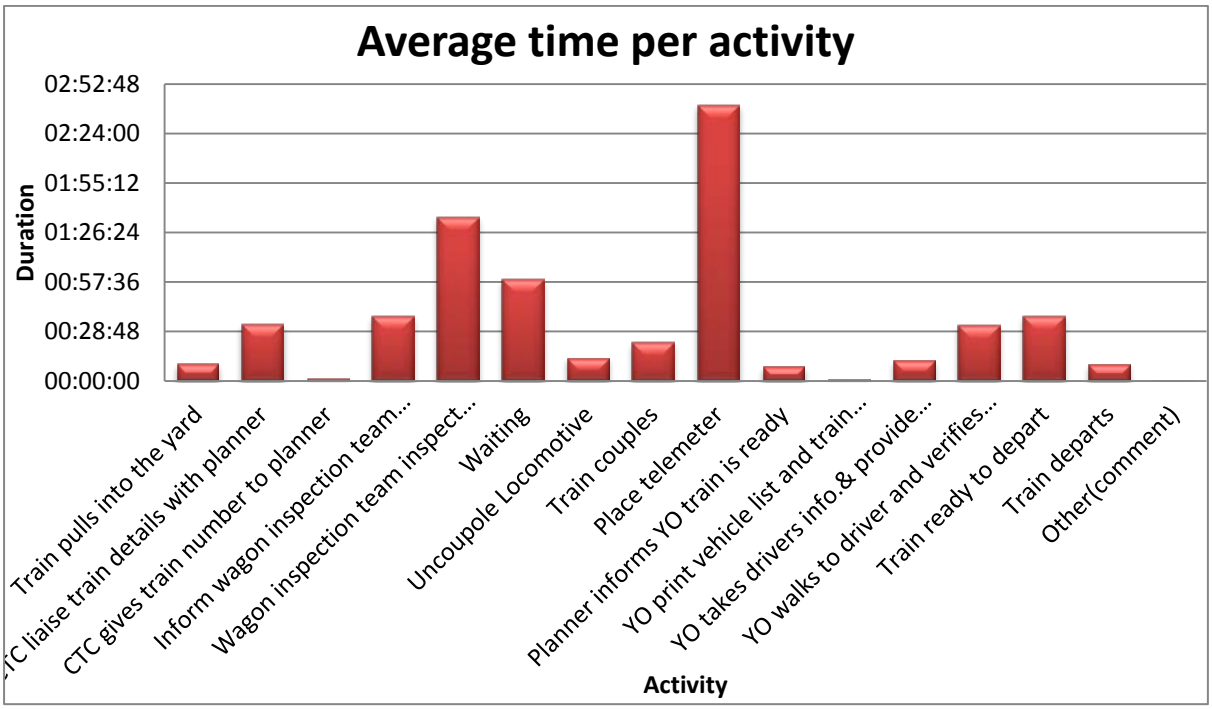
7.4. Time study

The following results were obtained from time studies conducted at the yard.

Table 3 – Time study results

TOTAL NO OF ACTIVITY OCCURRENCES ACTIVITIES	TOTAL TIME (INDIVIDUAL ACTIVITY)	AVERAGE TIME (INDIVIDUAL ACTIVITY)	AVERAGE TIME (INDIVIDUAL ACTIVITY) %
Train pulls into the yard	15:37:00	00:09:52	2%
CTC liaise train details with planner	04:36:00	00:33:13	6%
CTC gives train number to planner	02:34:00	00:01:37	0%
Inform wagon inspection team train is ready	12:34:00	00:38:15	7%
Wagon inspection team inspect wagons	07:37:00	01:35:45	18%
Waiting	22:03:00	00:59:24	11%
Uncoupole Locomotive	22:00:00	00:13:54	3%
Train couples	11:58:00	00:22:43	4%
Place telemeter	15:05:00	02:41:06	30%
Planner informs YO train is ready	13:43:00	00:08:40	2%
YO print vehicle list and train certificate	02:09:00	00:01:21	0%
YO takes drivers info.& provide vehicle list & train certificate	19:44:00	00:12:28	2%
YO walks to driver and verifies wagon numbers against vehicle list	03:50:00	00:32:44	6%
Train ready to depart	12:35:00	00:38:16	7%
Train departs	15:59:00	00:10:06	2%
Other(comment)	00:18:00	00:00:11	0%
TOTAL TIME		**08:59:36**	**100%**

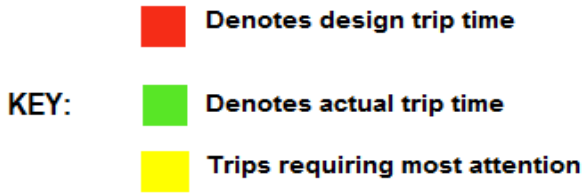
Figure 11 – Average time per activity



7.5. Simulation

The simulation model will be used as a validation and a verification tool. All alterative solutions will be simulated and this will verify the preferred solution on a basis of time reduction.

8. Data analysis



Kingsrest – Capital Park

Extracted from Design data

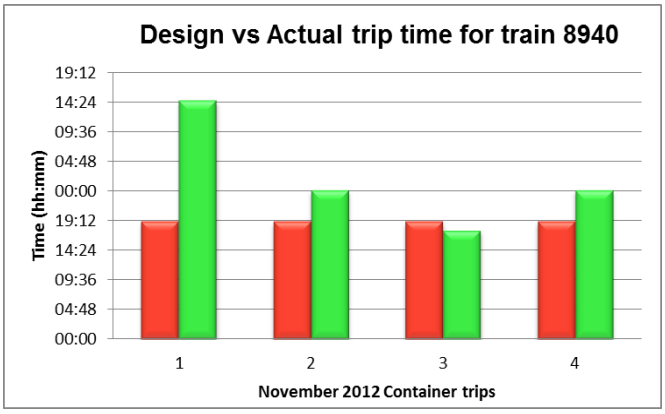
1. Forward Leg

- Kingsrest – Capital Park = 18 hours 59 minutes
  - Train arrival time = 16:44
  - Train departure time = 21:45

Table 4 – Actual trip times vs Design for Kingsrest to Capital Park using train 8940

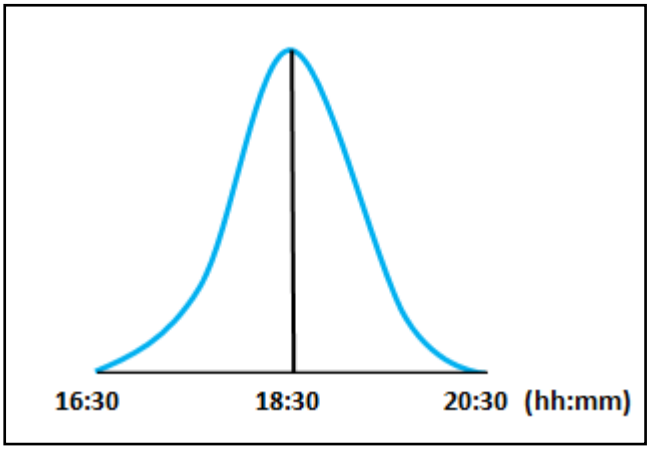
Trip Number	Actual Departure time	Actual Arrival time	Actual Trip time November	Design trip time
1	23:59	14:37	38:38	18:59
2	23:20	23:25	24:05	18:59
3	04:25	22:00	17:35	18:59
4	02:00	02:07	24:07	18:59

Figure 12 – Design vs Actual trip time for container transport using train 8940



This transportation flow using train 8940 is performing fairly well since almost all trips are very close to the design time. Only trip number 1highlighted in Table 4 above is off the design as it is taking twice the design time to transport containers and the main focus should be placed on it since it is the bottleneck of the flow. There is an acceptable margin of the trip time as shown in Figure 12 below. If everything is running perfectly, the train can be 2 hours early and also 2 hours late because of minor delays whereas the worst case scenario can be twice the planned trip time such as trip number 15 and this is due mostly to uncertainty and the nature of the rail business.

Figure 13 – Normal distribution for acceptable margins

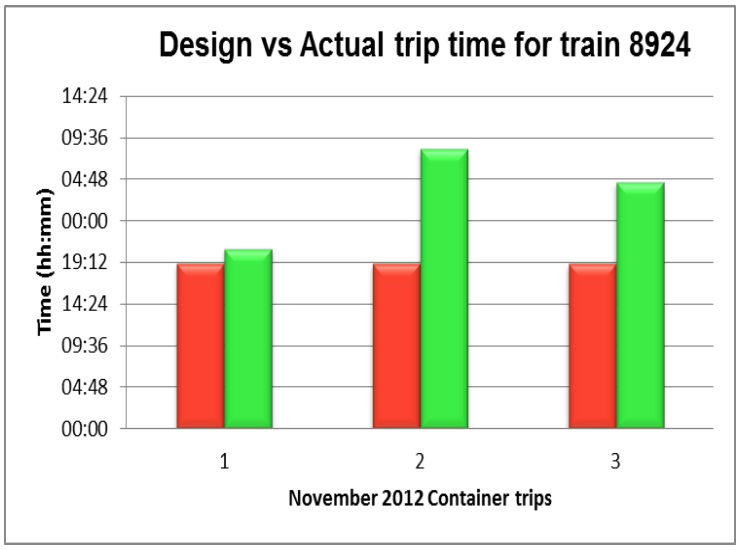


The maximum time disbursed on some trips is as high as 38 hours which is 2 times the design time and this might have been affected by several reasons that will be stated shortly. The minimum time is 17.5 hours which is 1.5 hours less when compared to the design time and this implies that the design time can still be reduced if operations are handled swiftly and also provides room for improvement from the current situation. The minimum trip time provides future hope for the company in that the design time can be further reduced in transporting goods safely and satisfying customers beyond their expectations.

Table 5 – Actual trip times vs Design for Kingsrest to Capital Park using train 8924

Trip Number	Actual Departure time	Actual Arrival time	Actual Trip time November	Design trip time
1	13:25	10:13	20:48	18:59
2	14:02	22:18	32:16	18:59
3	22:25	02:50	28:25	18:59

Figure 14 – Design vs Actual trip time for containers transport using train 8924



Transportation using train 8924 is lagging when compared to train 8940. The trips that need attention for this flow is trip number 2 and 3 since they are slightly off the design

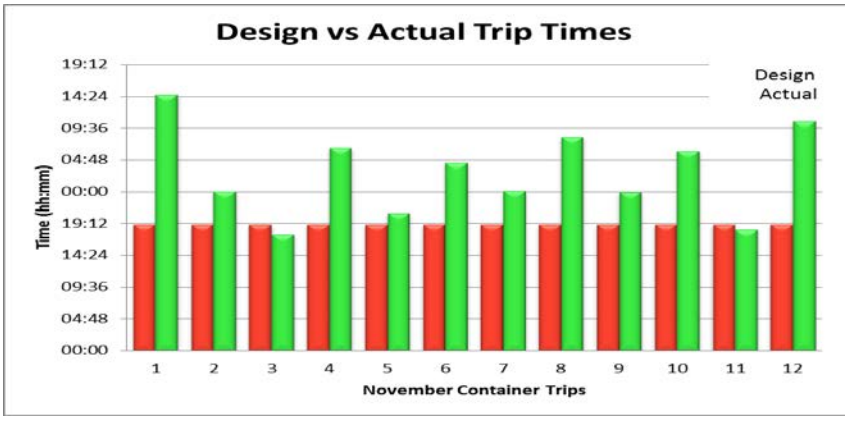
Table 6 – Forward Leg average for Kingsrest to Capital Park

Minimum Travel Time (hh:mm)	Maximum Travel Time (hh:mm)	Average Travel Time (hh:mm)	Average Departure time (hh:mm)	Average Arrival time (hh:mm)	Count Number of entries that made up the average	Verify Count
17:16	38:38	26:32	21:21	23:54	306	306

Table 6 above depicts the results obtained after analysing actual data in comparison to design data on an average basis for container transport and interpretation of the data simply shows that there is a large variance of approximately 7 hours (26:32-18:59). This could be attributed by many factors and amongst others is the book-off system currently used at TFR where workers are not paid overtime and if their working hours have lapsed while they are still on duty then they are given a right to stop the train anywhere even on the main line which disturbs the whole flow.

Most employees are not versatile, they are only trained to drive a specific train type and if a train arrives at Danskraal and the next driver supposed to take over is not there, they have to wait long hours until the appropriate driver arrives and this is where the workflow is disturbed hence trips take longer than planned. Reducing this variance by 5 or 4 hours will have positive impacts on the capacity usage, personnel working hours, delivery time and service which are some of the essential aspects TFR improves on a daily basis.

Figure 15 – Design vs Actual average trip time transport using containers



Listed below are some of the reasons affecting the train travel time

1. Ineffective use of resources such as telemeters and locomotives
2. Employee morale (operational employees)
3. Communication
4. Failure
    - Power failure of Transnet and Eskom
    - Cable theft
    - Derailment
5. Traffic due to unplanned incidents

The table that follows was used to rank different impact categories as well as the level of likelihood of the event reoccurring and Table 7 below shows the risk assessment matrix.

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IMPACT

Risk	**1**	**2**	**3**	**4**	**5**
Monetary	< R50 000	< R100 000	< R500 000	< R1 M	< R5 M
Reputational	Local negative media coverage	Minor negative media coverage	Major negative media coverage	National adverse media coverage	International adverse media coverage
Operational	Can recover immediately	Will take 6 months to recover	Will take a year to recover	Will take a number of years to recover	Threat to the Loyalty of the company

LIKELIHOOD

The likelihood of occurrence over a period of one month	**1**	**2**	**3**	**4**	**5**
	Highly unlikely	Unlikely	Likely	Highly likely	Certainty
	0 – 20%	21 – 40%	41 – 60%	61 – 80%	81 – 100%

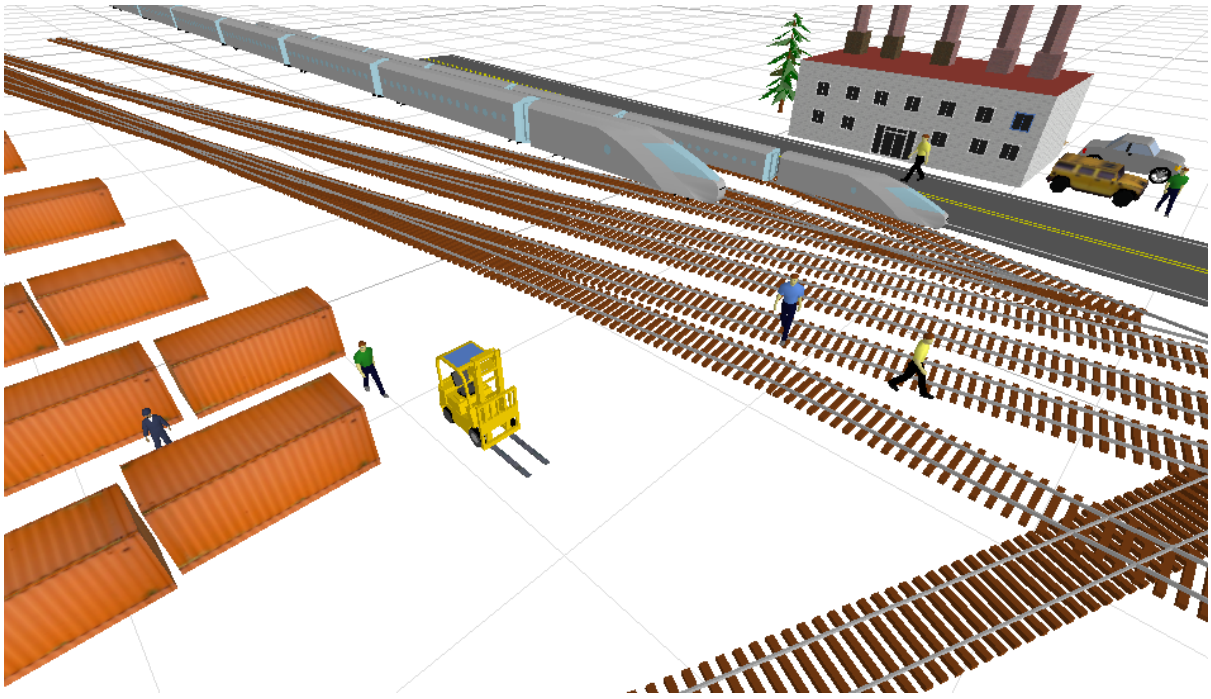
Table 7 – Risk assessment matrix

No	Event / Problem	Root Cause	Consequence	Impact and motivation	Likelihood and motivation
1	•Theft •Derailment •Safety of personnel	•Management did not implement adequate surveillance system to monitor the surroundings of the yard and ensuring protection •Demarcation clause within the security services	•Cables are stolen •Wagon repair equipments are stolen •Doing an incident investigation is a challenge •Loss of income (R1 M for one train)	**Operational Level 1** •The company incurs extra unplanned costs resulting in loss of income •Most trains are delayed and planned volumes are not moved •Customers are dissatisfied as a result of not meeting targets	**Level 3** If the company does not implement effective control measures to address effectively the causes noted, such events are likely to occur
2	•Cancellation of planned trips	•Telemeter shortage •Shortage of yard officials and yard foreman • Lack of required communication between yards • Instructions between management and operational workers	Planned tonnages cannot be executed effectively	**Reputational and Operational Level 2** •The company incurs unbudgeted expenses •Resources are not utilized effectively since most are idle • The whole flow should be re-planned which requires time	**Level 4** •This event is highly likely to occur unless management introduces an effective system to schedule for trips and ways to use telemeters optimally
3	• Low productivity, morale and concentration	• Work environment and ergonomics • Operational workers always seek for more	• Employees are not motivated to perform their duties at their level best since considered less important to the company • Employees seek employment elsewhere	**Operational Level 3** • Train will not depart in time since employees do not see the impact to a great extent and they will always be reluctant to new technology introduced in the company	**Level 5** It is certain for this event to occur unless management reviews feedback from employees as discussed in the weekly symposium

Shortcomings or deficiencies of design as compared to actual

- Not transporting what the train was designed to transport
- Some train numbers do not correlate
- Trips per week are not the same
- The design data does not designate the exact date of arrival and departure but only specifies the time of departure and arrival hence most things are pure assumptions
- Actual data does not take into consideration the personnel working, wagon type and locomotive quantity.

9. Alternative solutions



1. Resource optimisation

Problems currently faced because of the telemeter can be addressed by the following:

- Introduction of locomotives that come coupled to the front piece of the telemeter and it should go hand in hand with the back piece, meaning one cannot synchronise the back piece with any front piece.
- Telemeters just like wagons and locomotives should also have a telemeter code or number that is scanned before a train departs a specific yard and is sent directly to the control centre. Tracking telemeters will help reduce the shortage currently faced and theft since it costs the company R 30 000 to purchase one. A yard should be given a number of telemeters by code and responsibility thereafter. When there are no telemeters in that yard to run trains then the yard manager can trace where it is by using its code and when a train departs at Kingsrest, it should only depart with Capital Parks telemeter and the control centre can also notify the yard manager on telemeters available in the nearest yard.

2. Boost employee morale

Employee morale can create or prevent success of the company and observation of this can help improve productivity. Productivity in the workplace is directly linked to employee morale and the more employees are stressed and dissatisfied usually exerts strain on productivity and hold back the company from reaching its goals. Working in an operational environment can be very challenging regardless of gender hence the employer should try to improve the work environment since the quality of the work environment determines employees performance, motivation, dedication as well as productivity. The level of engagement between employees and management influences the inaccuracy rate of employees, teamwork with other employees and employees loyalty in the company. Leblebici(2012).The following key pointers can help boost employee morale according to Davis (2013):

- **Let the employees know they are appreciated** - regardless of the employees position in the company, management should treat everyone equally and always remind employees that they are valued. Morale of employees can be improved by stating simple words of thanks on a job well done. The company should remind all operational employees that they are valued in the company since their job is crucial and without their execution, trains wouldn't operate as planned
- **Realise that the work environment can affect performance** - brighten rest rooms and improve the lighting and ventilation in control rooms since this can help improve motivation and dedication. The furniture should not remain there for longer than anticipated.
- **Enhance communication between employees and management** - This will make employees comfortable to even make suggestions on how the work environment can be improved Listen to employees in Symposiums and know what their concerns are.
- **Offer financial incentives or other prices** - it helps employees to work towards a certain goal and also creates enthusiasm and this can reduce accidents in the workplace.

- **The company should be loyal** - do not threaten to retrench employees when the company is declining rather inform them that their jobs are safe as long as they continue working hard and also offer raises and promotion to those who deserve.
- **Revise the company's' mission** - make sure all employees are share one goal and vision and have the best interest of the company. Do not rule by intimidation but let the employees know that without them the company won't exist.
- **Provide employee perks** - this can be a braai or office picnics on an event when performance of the division improved. Recognise each accomplishment and also include employee of the month flyers.

3. Acquiring rail sold to Prasa back in 2006

10. Economic feasibility

The main objective of economic feasibility assessment is to determine positive economic benefits that the proposed solution will provide and includes identifying all benefits to be expected. Solutions can be provided to a specific problem but the company should know if they are worth investing in. The preferred solution should provide positive returns in terms of revenue. The table below provides costs involved with each alternative solution as well as quantifying the solutions against the initial project aim.

Since the system of tracking wagons already exist, it will not cost the company a lot of money but adding a telemeter section on the register book and on the software.

Table 8 – Cost analysis of resource optimisation

Suggestion	Event	Cost
1. Coupling a telemeter to a locomotive	• Couple old locos to old telemeters	• R200 000/ loco
2. Tracking telemeters with a code	• Hire an IT specialist	• R35 000 overall
3. Purchase new locos	• Purchase new locos	• R5 Million/ loco

Table 9 – Cost analysis of boosting employee morale

Suggestion	Event	Cost
1. Let the employees know they are appreciated	All notifications should be sent via email to all employees	R 0
2. Realise that the work environment can affect performance	Conduct an employee survey and improve ergonomics in the workplace	R 5000 / Yard
3. Enhance communication between employees and management	Provide yard managers with reliable phones	R 2000 / Yard
4. Offer financial incentives or other prices	Annual divisional bonuses based on improvement in performance	R 5000 / person
5. The company should be loyal	Guarantee job safety	R 0
6. Revise the company's' mission	Revamp the business model by hiring a specialist	R 30 000
7. Provide employee perks	Employee of the month notes and an end of month braai (each employee contributes)	R 200

Table 10 – Cost analysis of re-purchasing rail in Pretoria

Suggestion	Event	Cost
Re-claiming rail sold to Prasa	Re-claiming rail sold to Prasa	R 5 Billion

Preferred solution

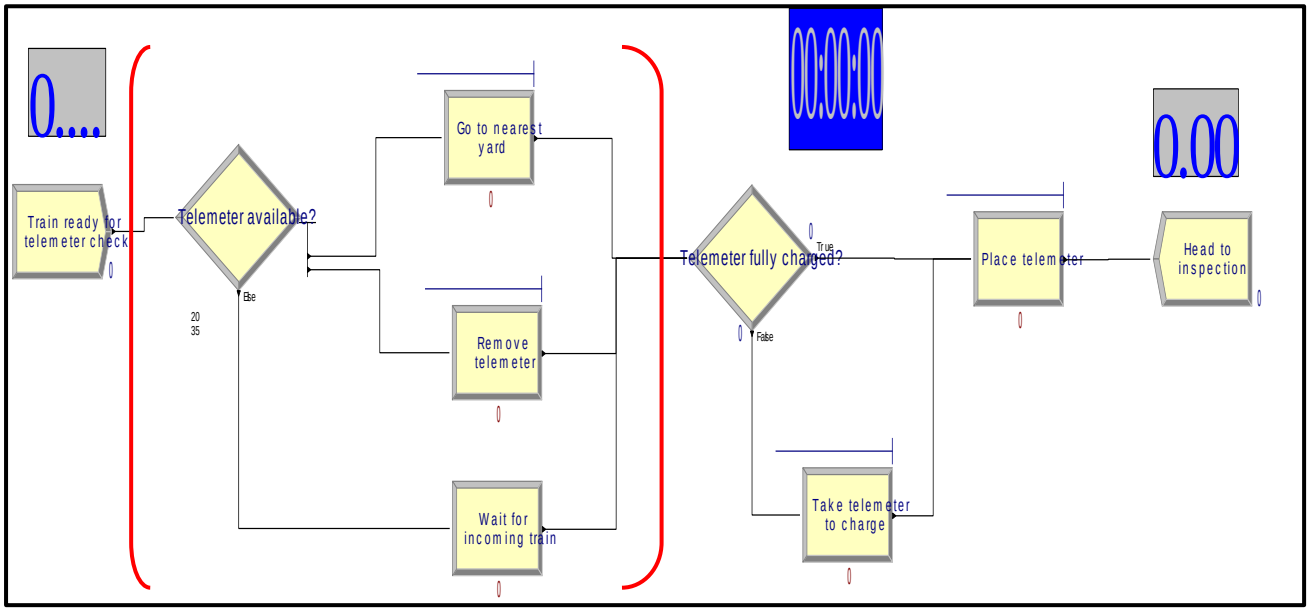
1. Boost employee morale on necessary categories
2. Resource optimisation , Option 1: Coupling a telemeter to a locomotive

Boosting employee morale has been known to revive most organisations, it is as simple as saying thank you for every improvement noticed even if it is small.

11. Solution Validation

The simulation conducted in ARENA validates that the proposed solution will benefit TFR positively and will also help reduce major problems faced not only in Capital Park but other yards as well. If the telemeter can be coupled to a locomotive, the total process of checking, charging and placing a telemeter will be reduced to a minimum of 30 minutes and a maximum of 5 hours as compared to the current minimum of 2 hours and a maximum of 12 hours.

Figure 16 – Current telemeter placing process



The difference between the current and proposed process is the area enclosed by red in Figure 16 above since it is not needed in the proposed process. A train will always arrive with a telemeter if the proposed process is implemented.

Figure 17 – Proposed telemeter placing process

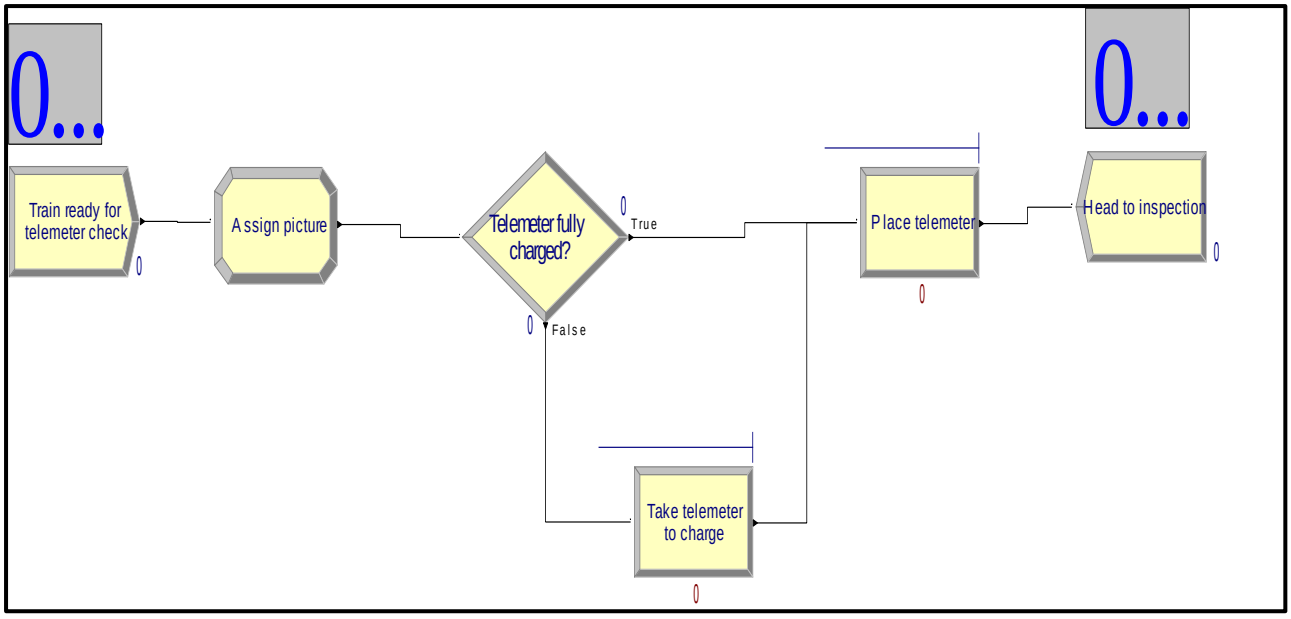
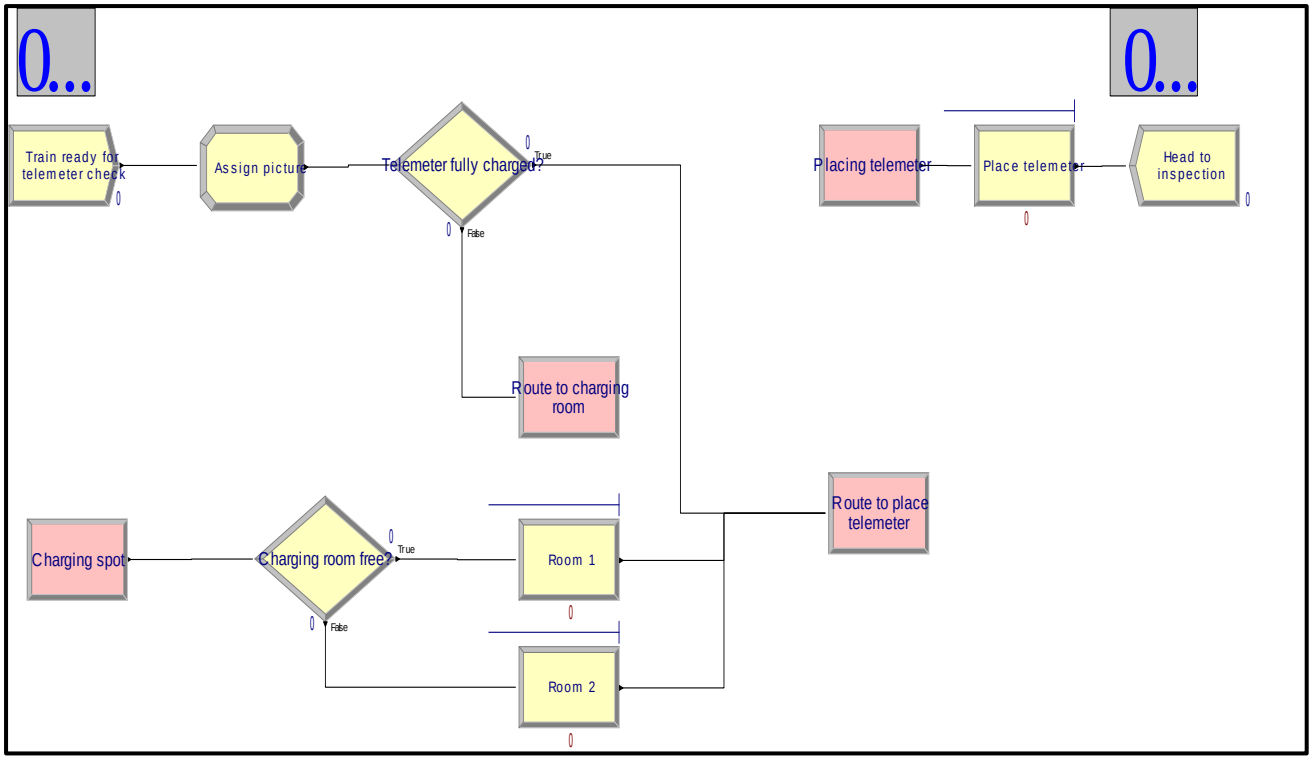


Figure 18 below was included to validate that if demand is increased and more trains are used, there will not be any queues at the charging room since an extra charging equipment can be purchased and this will not cost TFR alot of money.

Figure 18 – Proposed telemeter placing process (increased demand)



12. Conclusion

In any organisation, workflows cannot always be perfect but the variance should always be minimal and easily eliminated. TFR should always strive for excellence in the operations as well as providing quality in such operations since one small mistake has major impacts on the financial performance of the company and also question the loyalty of the company. Capital Park missed 50% of the planned performance targets and this resulted in a loss of millions and most cancellations and delays are due to amongst others imbalance of resources, low employee morale and communication problems. but nonetheless, change should be implemented. If TFR continues to operate as is currently, expenses will be more than revenues and there will be a possibility of operating at a loss as time goes by. Due to inefficiencies, TFR opens more doors for competitors to enter the market place and win over customers who are not satisfied with the service rendered by TFR. Transnet should consider repurchasing the rail network in Pretoria area that was sold to Metrorail in 2006.

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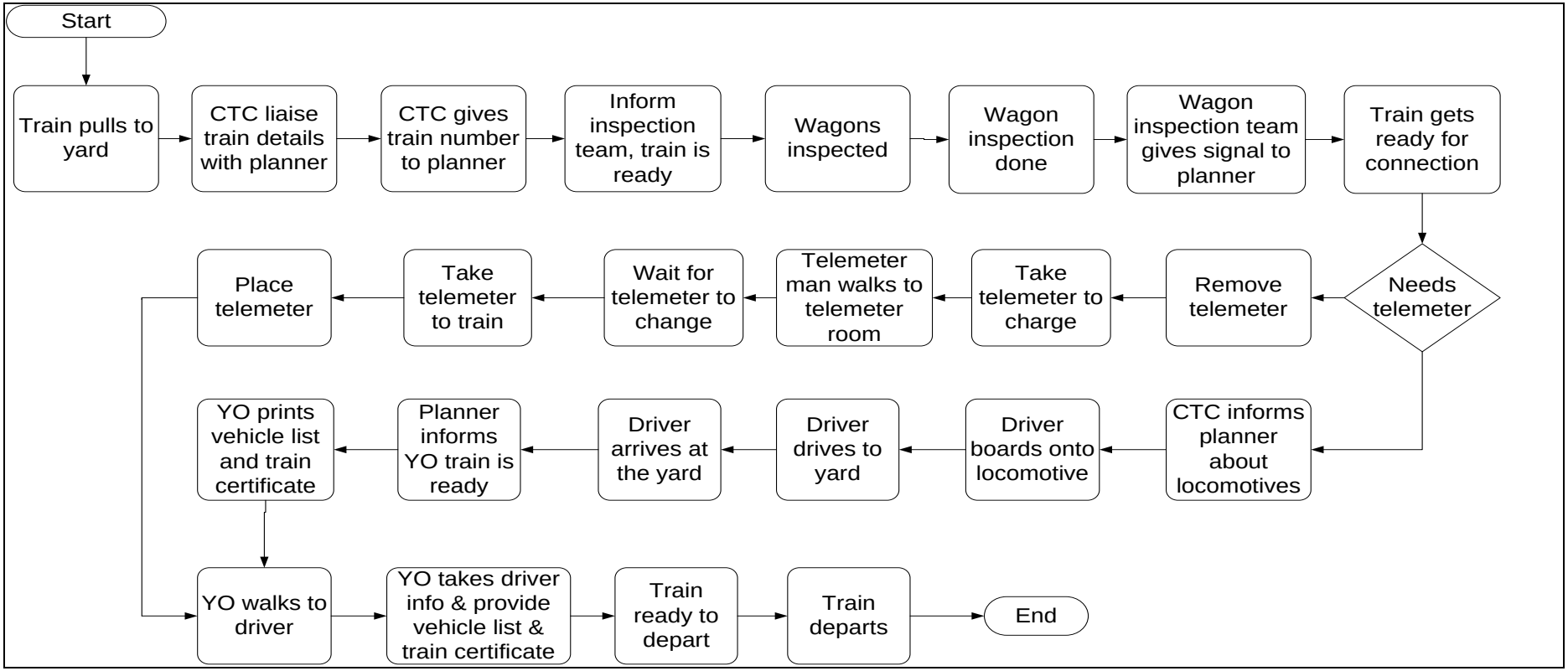
14. Appendices

14.1. Appendix A: Industry sponsorship form

14.2. Appendix B: Incoming and outgoing trains process flow



14.3. Appendix C: Time study

Shift	Day				Day				Day			Day				
Day Number	1				2				3			4				
ACTIVITIES	DURATION				DURATION				DURATION			DURATION				
Train pulls into the yard	00:37:00	00:01:00	00:01:00	00:18:00	00:03:00	00:01:00	00:01:00	00:01:00	05:01:00	06:35:00	00:01:00	00:01:00	00:02:00	00:01:00	00:01:00	00:01:00
CTC liaise train details with planner	00:01:00	00:26:00	00:01:00	00:01:00	00:02:00	00:01:00	00:01:00	00:01:00	00:07:00	00:02:00	00:01:00	00:01:00	06:35:00	02:55:00	00:01:00	08:29:00
CTC gives train number to planner		02:23:00														
Inform wagon inspection team train is ready	00:21:00		00:09:00	00:20:00	00:10:00	01:18:00	00:09:00	00:14:00	00:13:00	00:20:00	00:14:00	00:11:00	00:20:00	00:10:00	00:11:00	01:35:00
Wagon inspection team inspect wagons	02:35:00	08:23:00	00:23:00	00:14:00	00:35:00	01:26:00	00:23:00	00:54:00	00:20:00	00:29:00	05:54:00	01:21:00	00:08:00	01:07:00	01:21:00	02:29:00
Waiting	00:21:00	00:05:00	00:54:00	00:33:00	00:20:00	00:40:00	00:21:00	01:30:00	00:11:00	00:24:00	00:34:00	00:23:00	00:32:00	00:19:00	00:13:00	00:16:00
Uncoupole Locomotive								00:55:00			00:55:00	00:55:00	00:55:00		00:55:00	
Train couples	02:35:00		00:12:00	00:33:00			00:12:00	00:21:00	00:52:00	00:21:00	00:21:00	00:06:00	00:21:00	01:06:00	00:06:00	00:01:00
Place telemeter	04:30:00	00:30:00	06:10:00	10:05:00	12:25:00	06:26:00	00:50:00	01:20:00	07:50:00	09:01:00	03:35:00	00:30:00	00:50:00	09:48:00	12:00:00	04:05:00
Planner informs YO train is ready				00:23:00			00:15:00									
YO print vehicle list and train certificate				00:06:00			00:15:00									
YO takes drivers info.& provide vehicle list & train certificate				00:06:00			00:09:00									
YO walks to driver and verifies wagon numbers against vehicle list				00:06:00			00:09:00									
Train ready to depart	00:30:00			00:29:00	00:05:00		00:06:00	00:13:00	00:30:00	00:22:00	00:13:00	00:15:00	00:22:00	00:03:00	00:15:00	00:29:00
Train departs	00:38:00			00:10:00	00:10:00		00:20:00	00:13:00	00:15:00	00:09:00	00:13:00	00:25:00	00:09:00	00:05:00	00:25:00	00:03:00
Other(comment)			00:10:00													
TOTAL TIME	12:08:00	11:48:00	08:00:00	13:24:00	13:50:00	09:52:00	03:11:00	05:42:00	15:19:00	17:43:00	12:01:00	04:08:00	10:14:00	15:34:00	15:28:00	17:28:00

14.4. Appendix D: Weekly trip cancellation reasons

7-Day Plan	On ITP (10:00) (Yes / No)	Switched on BPB9 (Yes / No)	Actual Ran (Yes / No / Next	Reason for CANCELLATION	Reason for LATE	Schedule (S1 / S2 / S4 / S5 /	Vacuum / Airbrake /	Personnel Confirmed (Yes /	Train Origin	Train Destination	Scheduled Arrival Time	Actual Arrival Time	Difference (Minutes)	Arrived On Time / Late	Scheduled Departure Time	Actual Departure Time	Difference (Minutes)	Departed On Time / Late	Scanned / Typed /	Locomotives Planned	Locomotive Type Planned	Actual Locomotives Used	Actual Locomotive Type	Wagons Planned	Actual Wagons Moved	Loaded Wagons	Empty Wagons	Wagons Reserved	Wagons Unreserved	Total Tons Moved	Detailed Comments (eg. Cancellations, Delays, Locomotive Availablilty, Wagons (Un)Reserved)
8923	Y	Y	N	AD		S1	A	Y	CPK	KGX	19:35				20:25					3	18E										LOAD CLEARED LATE AND NO TELEMETER
8939	Y	Y	N	W		S1	A		CPK	KGX	10:45				11:48					3	18E										No load
8939	Y	Y	Y			S1	A	Y	CPK	KGX	10:45	10:53	08	L	11:48	13:15	87	L	S	3	18E	3	18E	34	34	34		34		1393	Due to waiting for Telemeter from WAO
8939	Y	Y	N	L		S1	A		CPK	KGX	10:45				11:48					3	18E	3	18E	42	42	42		30	12	2542	Derailment btn SYU & FTA
8923	Y	Y	N	L		S1	A		CPK	KGX	19:25				20:25					3	18E										Due to derail to clear T8946 @SYU
8959	Y	Y	N	J		S1	A		CPK	KGX	01:50				02:30					3	18E										Kombi to NCS due to lines closed with Accident @SYU
8939	Y	Y	Y			S1	A	Y	CPK	KGX	10:45	10:53	08	L	11:48	13:15	87	L	S	3	18E	3	18E	34	34	34		34		1393	Due to waiting for Tele Ex WAO Toms/569760
8959	Y	Y	N	V		S1	A		CPK	KGX	01:45				02:30					3	18E										NO LOCO'S
8939	Y	Y	N	Y		S1	A		CPK	KGX	10:30				11:48																Due to many trains in the section T8939 kombi 2 restart T8923/30 standing @Rooivlei to NCS

Cancellations / Late Departures

#	Description	#	Description	#	Description
A	Auxiliary Equipment	M	Defective Perway	Y	No Locos / Under Supplied
B	Trains Cancelled /	N	Departed following day	Z	No Product / Not Loaded
C	Description	O	Derailment / Collision	AA	Occupation / Emergency
D	Auxiliary Equipment	P	Empties Not Supplied / Late	AB	Other
E	Cancelled by Client /	Q	Eskom	AC	Power Failure
F	Client Busy Loading	R	Industrial Action	AD	Refused by Receiving
G	Crew Absent / X99 /	S	Insufficient Load	AE	Safety / Security
H	Crew Re-allocated	T	Late Release / Cleared Late	AF	Service Adjustment
I	Crew Rest	U	Loco / Crew / Train Arrived	AG	Telemeters
J	Crew Shortage	V	Loco Failure	AH	Train Service Not Adjusted
K	Crew Time Expired	W	Locomotive Distribution	AI	Trains Not Switched On
L	CTC / Signal Failure	X	Metro Rail	AJ	Unscheduled Trains