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7th International TOCPA Conference
23-24 May 2013, South Africa

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Applying Simplified Drum Buffer Rope to Minimize Events of Missed Rail Tanker Car cut-off times

LOVEN GOVENDER

Project supervision by GERHARD CARSTENS

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Loven Govender qualified as an Industrial Engineer at WITS University before joining Sasol as an EIT. After completion of several rotations in the areas of Procurement, Mining, Logistics, Reliability Engineering, High Capital Project Management and Refinery Operations. Currently in the department of Supply Chain Optimization Center of Expertise, his focus is on using approaches such as Operations Research techniques, Theory Of Constraints and Lean / six sigma to find dynamic solutions to resolve issues within the supply chain, whilst responsibly setting the direction for the practice of optimization at Sasol.

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Agenda

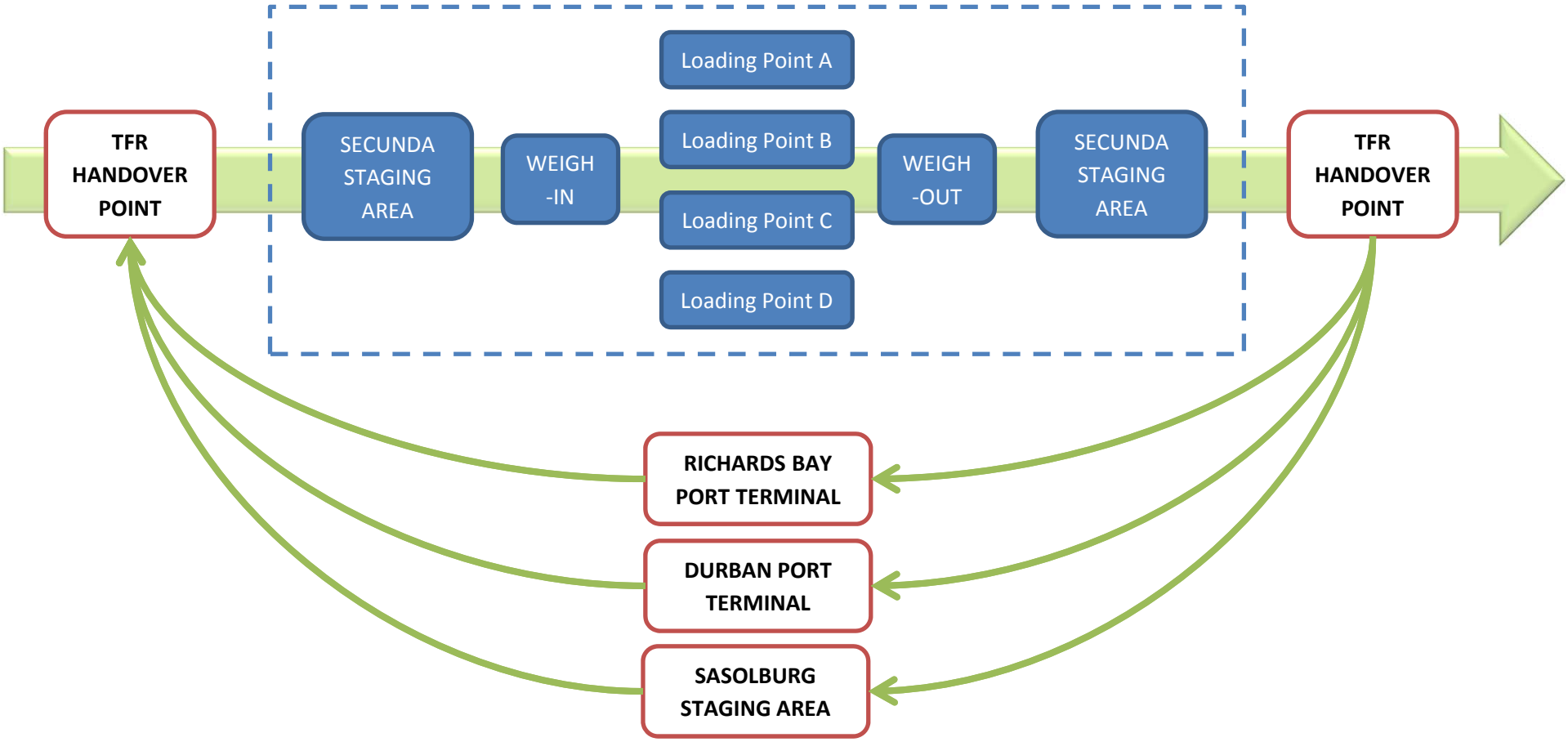
- Project Background
- Project Objective
- Definition of Victory
- Project Scope
- Project Approach
- Demonstration of Model
- Results from Test Run

Project Background (1)

- **Project Context**
  - Part of the larger Outbound Logistics Improvement Programme aimed at improving the activities of the newly formed centralised Logistics Operations Center (Secunda).

- **LOC Rail Environment**
  - Internal Rail Activities → Sasol Loading Gantries to Handover Point
  - External Rail Activities → Handover Point to Final Destination ex Secunda

Project Background (2)



Project Background (3)

- **Acronyms used:**

– LOC	- Logistics Operations Center
– JRMT	- Joint Rail Management Table
– BU	- Business Unit
– RTC	- Rail Tanker Car
– SLC	- Service Level Commitments
– NWB	- Next Weeks Business Plan
– TFR	- Transnet Freight Rail

Project Objective

- **Project Objective**
  - To significantly reduce occurrences of RTC missed-cut off time.

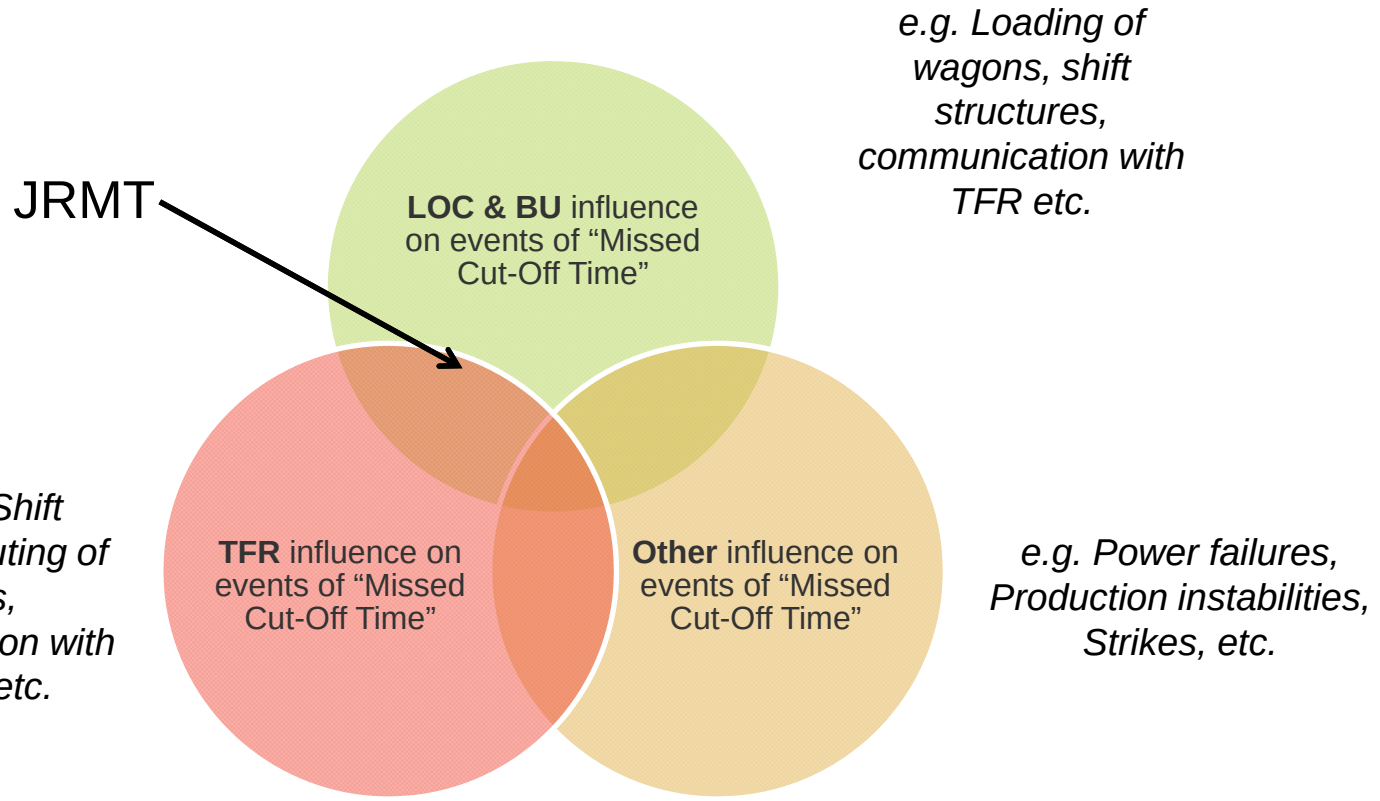
- **The Ultimate Aim**
  - To achieve improved Perfect Order Fulfillment and SLC targets.

Definition of Victory

- **Reduced frequency of RTC missed cut-off times in order to realise:**
  - Reduce Rail Operation Cost
  - Improved Customer Service (BU)
  - Increased Perfect Order Fulfilment
  - Improved internal turn-around-time of returning RTCs
  - Better geared to support future increased business throughput requirements

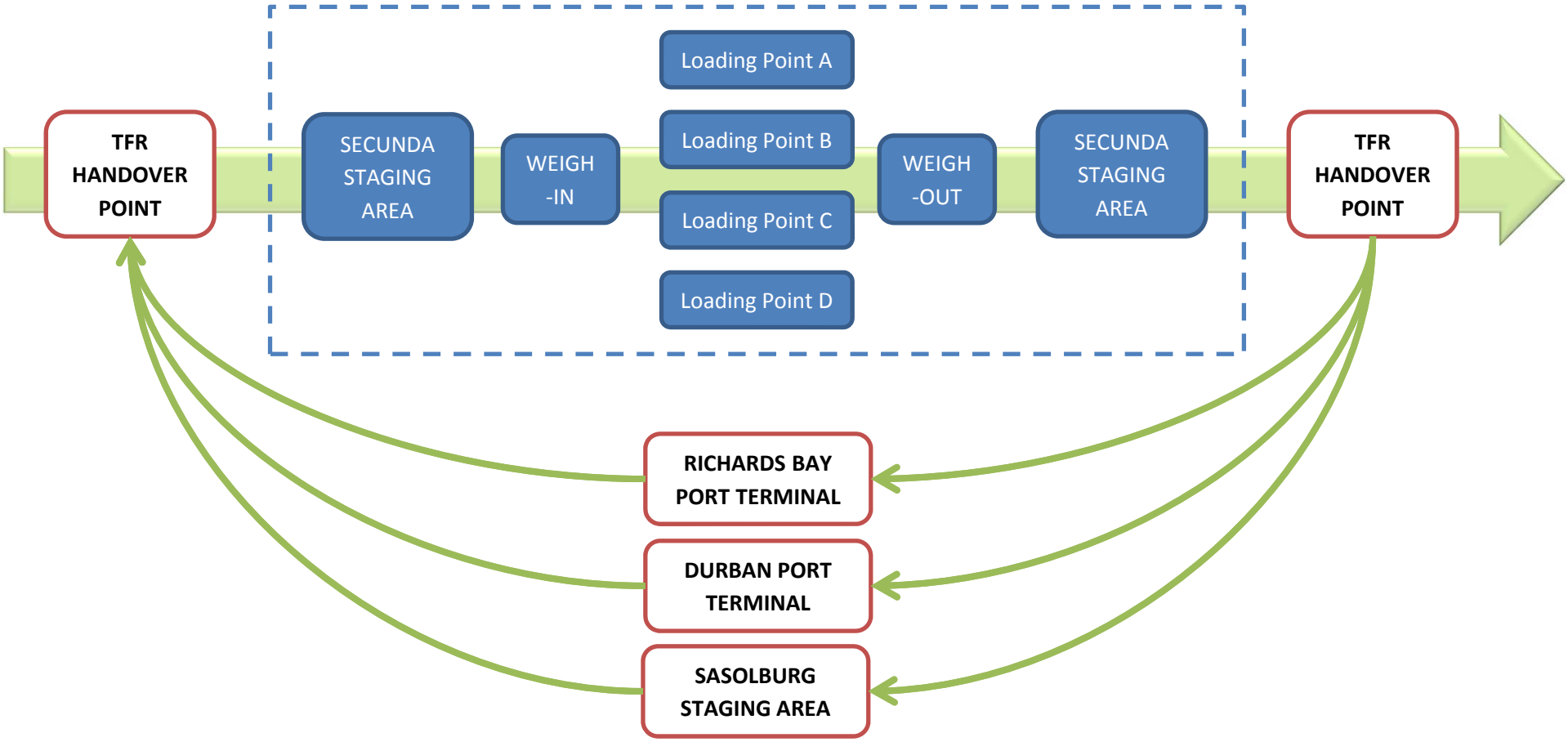
(Note. Only formal measurement: Frequency of missed cut-off times)

Project Scope (1)



- **The project will focus on the LOC & BU area of influence primarily; the impact of issues outside of this scope will be understood and actioned (if significant) through the relevant channels (e.g. JRMT)**

Project Scope (2)



Project Approach (High Level)

- **Phase 1** – Understanding the depth of the problem, identifying causes, prioritisation, assembling project team, estimated effort and timeline of project.
- **Phase 2** – Conceptual Design of alternative solution(s) from identified cause(s) (Paretto technique, developing of solutions)
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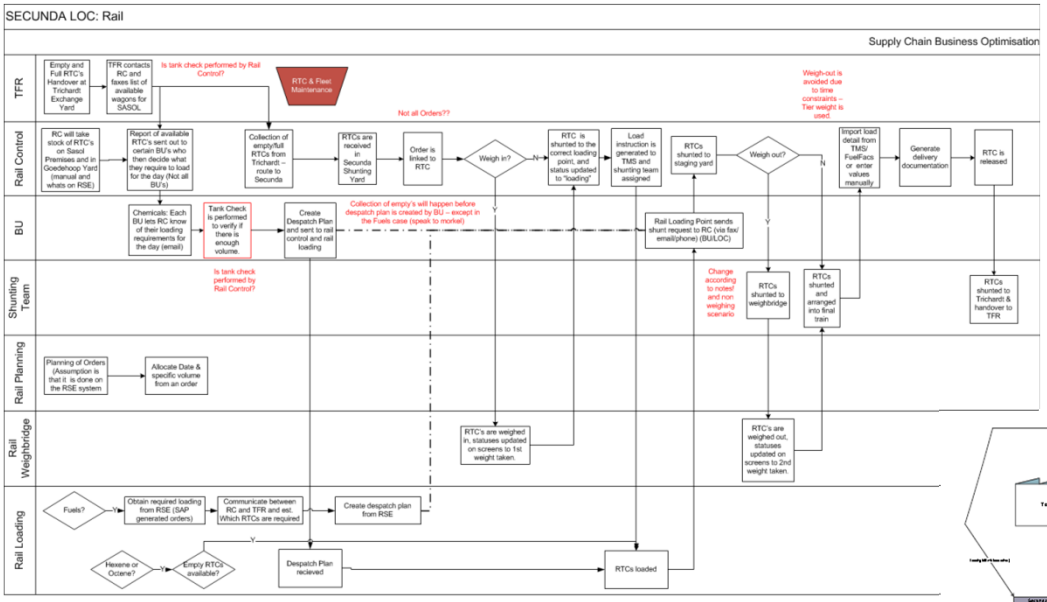
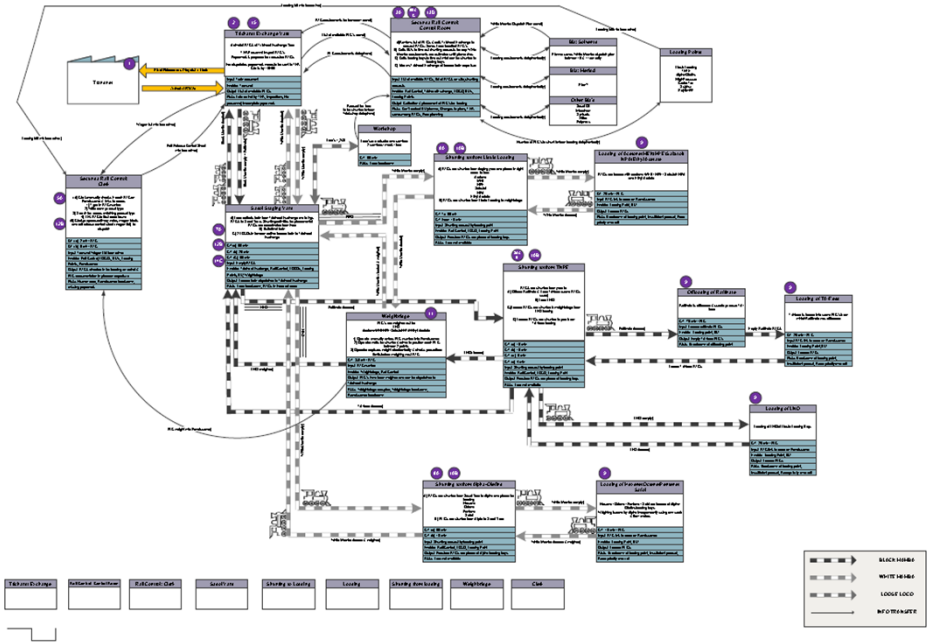
- ***Phase 5*** – Implementation
- ***Phase 6*** – *Close out & Handover (if applicable) – handover the processes, infrastructure, technology and people to the LOC, ensuring sustainability and continuous improvement is achievable.*

Phase 1 – Understanding (1)

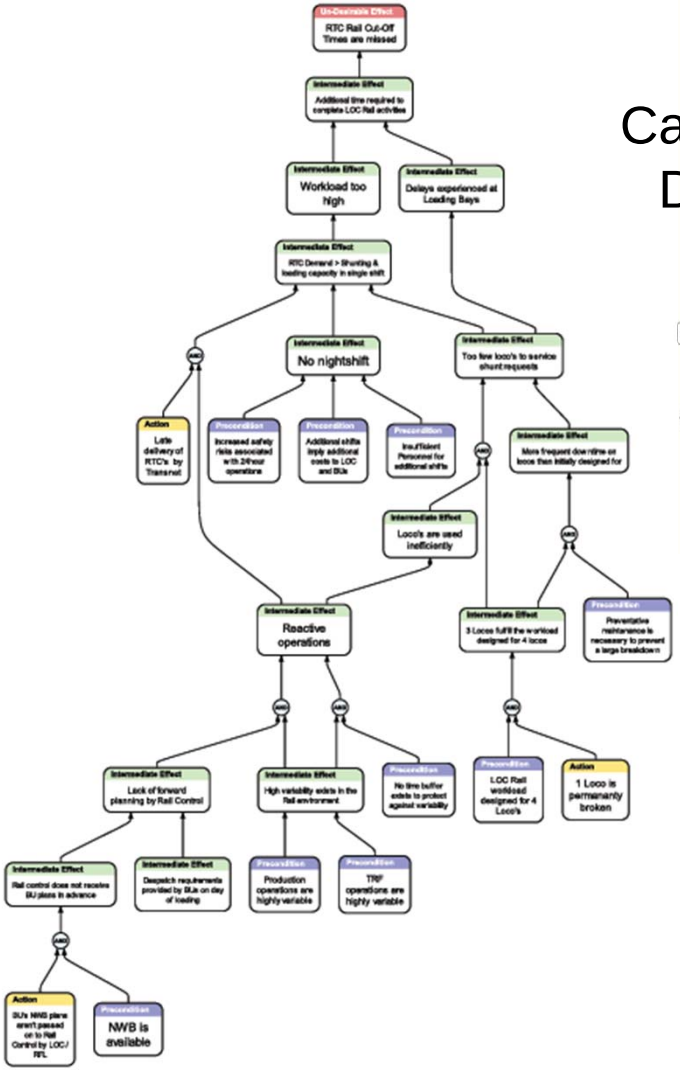


Information and Material Process Flow

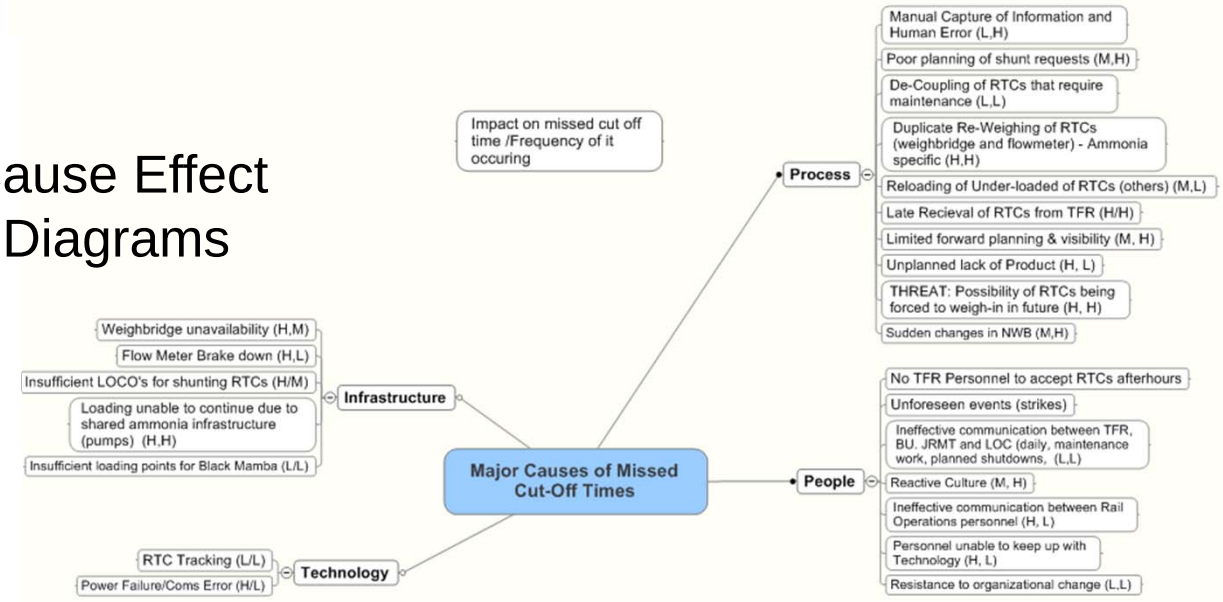


Current State Value Stream Map

Phase 1 – Understanding (2)



Cause Effect Diagrams



Prioritisation

Problems/Gaps	Impact	Probability	Priority	Delay Min	Delay Max	Avg Delay (min)	Cost to business
Reactive operations (lack of forward planning) contribute to delays	9	100%	9	120	180	150	
Late delivery of RTC's by Transnet	9	90%	8.1	180	240	210	
Too few loco's to service shunting requests	9	90%	8.1	120	180	150	
Single weighbridge only - availability issues causes delay	9	80%	7.2	60	120	90	
Manual nature of weighing process causes delay	8	80%	6.4	60	120	90	
Locos require maintenance	8	80%	6.4	60	90	75	
Flowmeter breakdown at loading points	9	70%	6.3	120	180	150	
Rearranging RTC's before shunting to loading & when building final train causes de	7	90%	6.3	60	120	90	
Lack of night shift causes delays	9	70%	6.3	180	240	210	
Control room can't contact BU planner for shunting requests in morning	9	70%	6.3	60	90	75	
Weighbridge breakdown	10	60%	6	120	180	150	
Late arrival of daily dispatch plan (White Mamba)	8	70%	5.6	60	90	75	
Changes to dispatch plan during the day	8	70%	5.6	60	90	75	
Manual information entry & order linking on Renaissance causes delay	8	70%	5.6	60	120	90	
Document preparation prior to dispatch causes delay	8	70%	5.6	40	60	50	
Renaissance offline	9	60%	5.4	120	180	150	
Incorrect RTC's sent to Primary Area by Trichardt Exchange	7	70%	4.9	60	90	75	
Unavailability of product	7	60%	4.2	180	300	240	
Pump infrastructure (road priority over rail) causes delays	5	70%	3.5	120	180	150	
Transnet's paperwork is not ready on time	3	20%	0.6	30	40	35	
					TFR Penalty Cost		

Score	Impact	Probability	Score
10	Catastrophic impact	Certain	100%
9	Huge impact	Extremely likely	90%
8			80%
7	Large impact	Very likely	70%
6			60%
5	Medium impact	Quite likely	50%
4			40%
3	Small impact	Very unlikely	30%
2			20%
1	Very small impact	Extremely unlikely	10%
0	No impact	Never	0%

Priority = Impact x Probability

Phase 1 – Understanding (3)

- **Prevalent barriers preventing RTCs returning to TFR on time & in full:**

1. Reactive Operations
    - *Lack of management of resources*
    - *Limited view of what is to be loading or despatching for the day*
    - *Queuing and Waiting time of RTCs at critical times*
2. Late Deliveries of RTCs
3. Insufficient Locomotives to service shunting requests
4. Delays due to unavailability of weighbridge
5. Manual nature of weighing process

Phase 1 – Understanding (4)

- **Reactive Operations:**

  - CAUSED BY: a Lack of Forward Planning
    - CAUSED BY: Rail Control not working of the NWB Plan
      - CAUSED BY: NWB Plan being unreliable and changing often
        - CAUSED BY: **Variability in the rail environment AND no buffer against this variability**.

Sources of variability in Rail Environment:

- *Production performance upstream*
- *Unplanned Breakdowns / Shutdowns*
- *Poor service delivery by Transnet*
- *Strikes*
- *Etc.*

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Phase 2 – Conceptual Design (1)

- **Rail Planning System design:**
  - NWB to be loaded onto planning table
  - System determines the amount of tankers per product based on master data and "Next Weeks Business" Plan (demand)
  - ACTUAL tankers that arrive on site loaded onto system
  - System populates the planning table based on Planning Rules
  - Rail Control & Rail Loading will be guided by the plan on the system

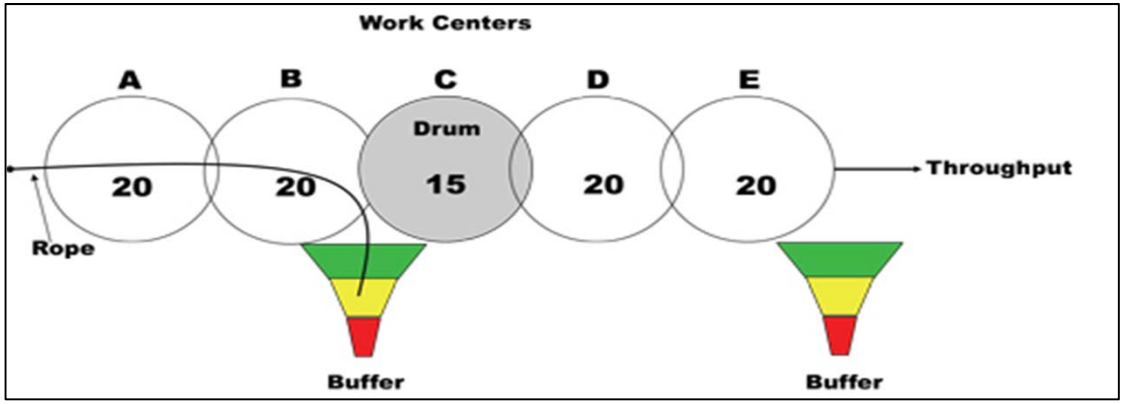
- **Will this system address the variability causing *Reactive Operations*?**

- **Using an unreliable plan to schedule loco's & shunting in advance will waste capacity:**
  - Loco's
  - Loading bays
  - Drivers & shunting teams
  - Weighbridge

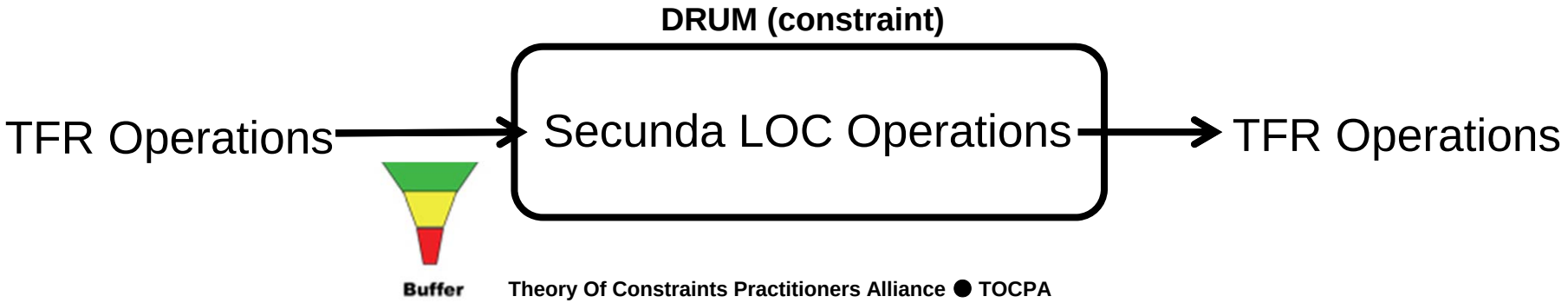
Simplified Drum Buffer Rope and Buffer Management Approach

Phase 2 – Conceptual Design (2)

- **Drum Buffer Management Approach**
  - TOC Drum Buffer Rope & Drum Buffer Management Approach



  - Adapted to Secunda Rail Environment



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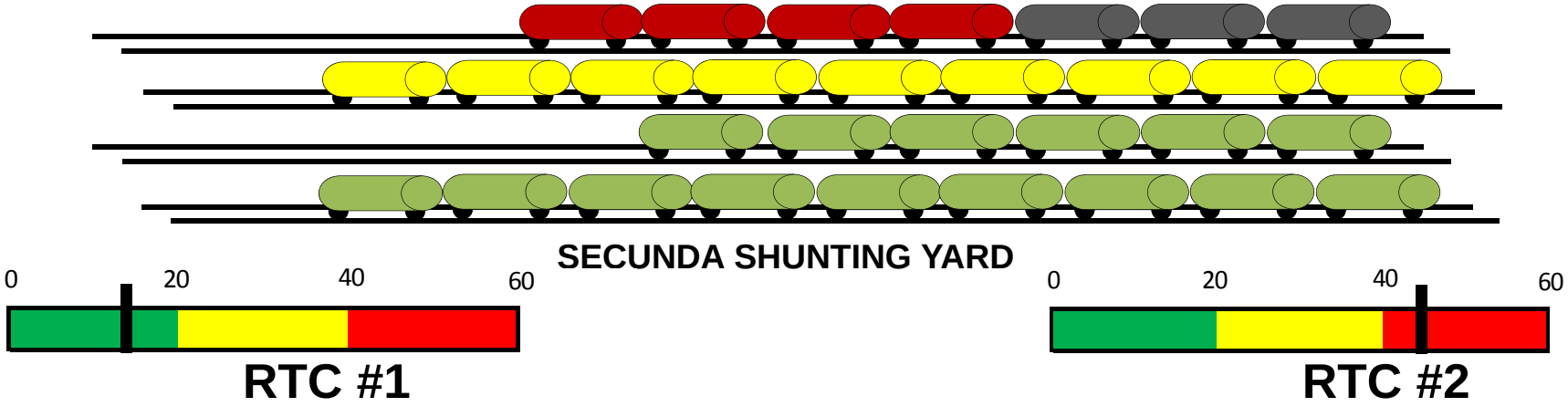
Phase 3 & 4 - Detail Design (1)



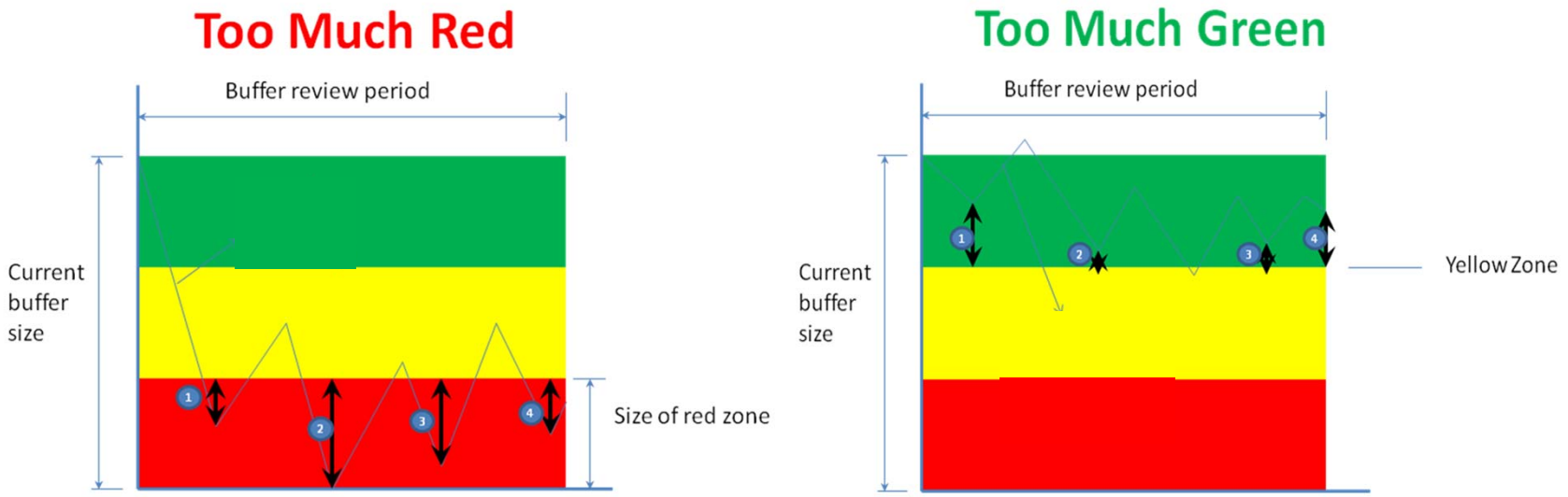
Priority Ranking	Implication
	RTC will already be missing cut off time (overdue) - focus on first. Assign all resources to these RTCs
	Do not focus on if there are BLACK priority RTCs requiring resources
	Do not focus on if there are RED or BLACK priority RTCs requiring resources
	Do not focus on if there are YELLOW, RED or BLACK priority RTCs requiring resources

Phase 3 & 4 - Detail Design (2)

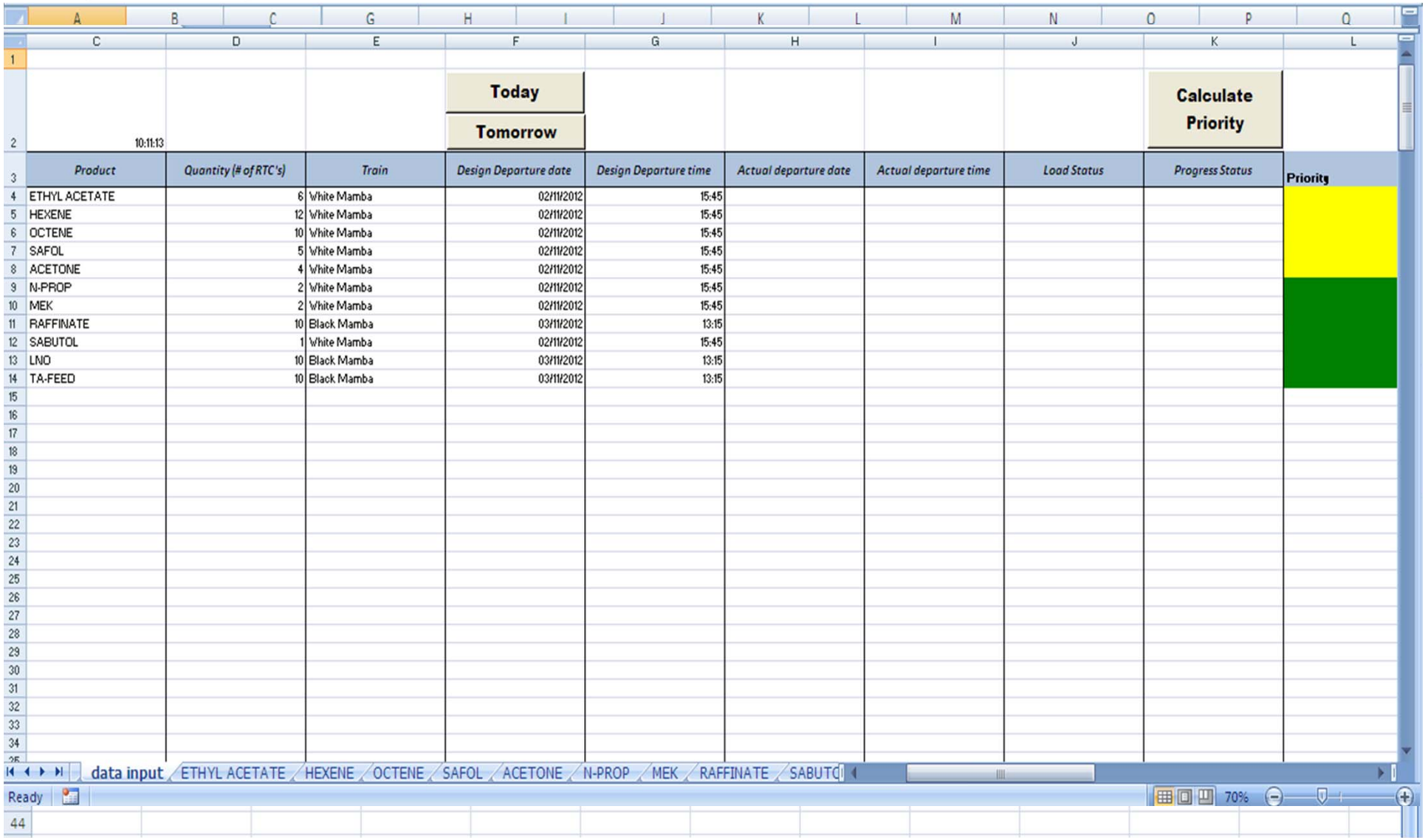
- The Buffer Management Tool will automatically record historical buffer penetration from the RTCs and manage the buffer over time.

- If history (over a review period = 1 shift cycle) indicates that the buffer spent most time in the RED zone – then the buffer will be increased

- If history (over a review period = 1 shift cycle) indicates that the buffer spent most time in the GREEN zone – then the buffer will be reduced



Phase 3 & 4 - Detail Design (3)



10:11:13

Today
Tomorrow
Calculate Priority

Product	Quantity (# of RTC's)	Train	Design Departure date	Design Departure time	Actual departure date	Actual departure time	Load Status	Progress Status	Priority
ETHYL ACETATE	6	White Mamba	02/11/2012	15:45					
HEXENE	12	White Mamba	02/11/2012	15:45					
OCTENE	10	White Mamba	02/11/2012	15:45					
SAFOL	5	White Mamba	02/11/2012	15:45					
ACETONE	4	White Mamba	02/11/2012	15:45					
N-PROP	2	White Mamba	02/11/2012	15:45					
MEK	2	White Mamba	02/11/2012	15:45					
RAFFINATE	10	Black Mamba	03/11/2012	13:15					
SABUTOL	1	White Mamba	02/11/2012	15:45					
LNO	10	Black Mamba	03/11/2012	13:15					
TA-FEED	10	Black Mamba	03/11/2012	13:15					

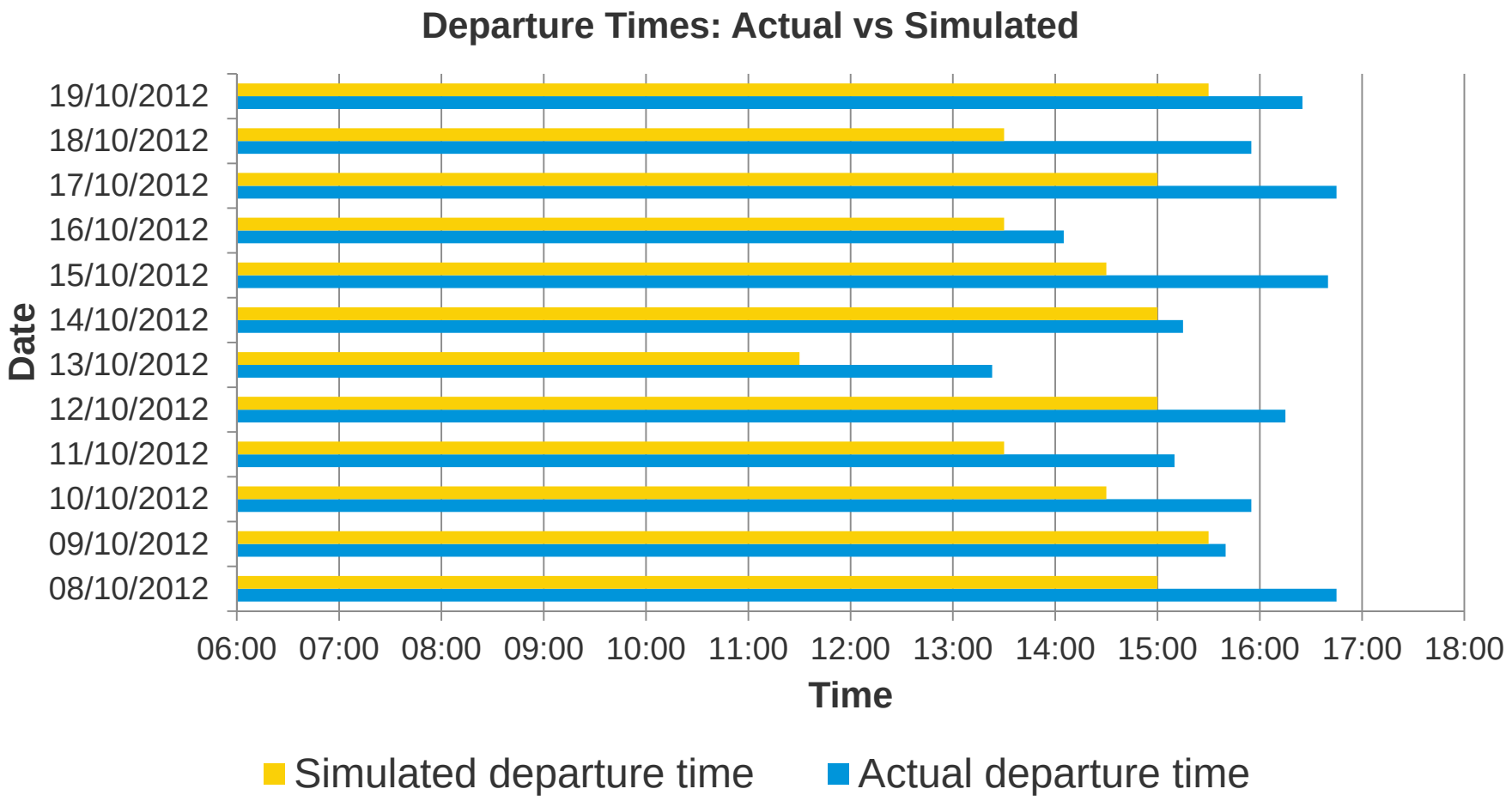
data input | ETHYL ACETATE | HEXENE | OCTENE | SAFOL | ACETONE | N-PROP | MEK | RAFFINATE | SABUTO

Ready

70%

Test Results (1)

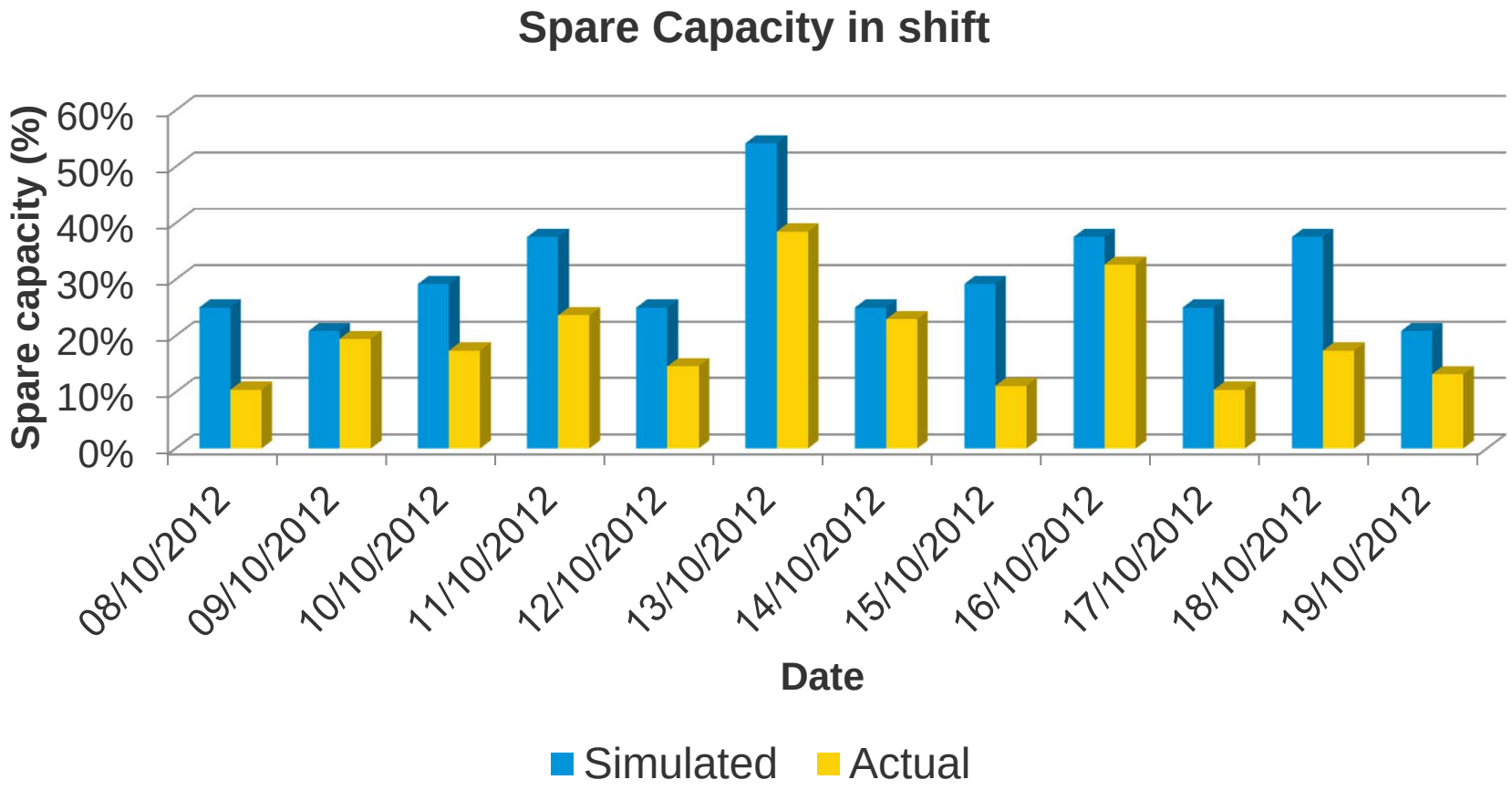
Average difference in departure time: 1h20min (15%)



Test Results (2)

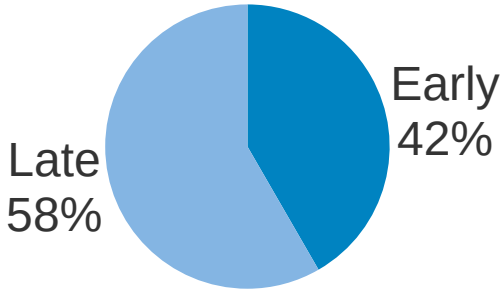
Simulated average spare capacity: 31%

Actual average spare capacity: 19%



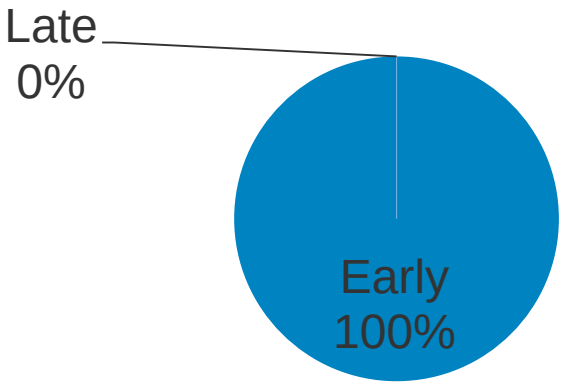
Test Results (3)

White Mamba: Actual train departure time



Average Time Early (min)	01:02
Average Time Late (min)	00:37

White Mamba: Simulated train departure time



Average Time Early (min)	01:25
Average Time Late (min)	00:00

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