PRDW
Consulting Port and Coastal Engineers

In association with:

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Cape Town Port Congestion and Efficiency Study

Study Report

REV.0

14 April 2021

Western Cape Government
Cape Town, South Africa

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CONTENTS

Page No

TABLES

Page No

FIGURES Page No

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ABBREVIATIONS AND TERMS

Abbreviation	Definition
CTCT	Cape Town Container Terminal
DEDAT	Department of Economic Development and Tourism
EoDB	Ease of Doing Business
FPT	A privately operated Multi Purpose Terminal in the port of Cape Town
PPECB	Perishable Products Export Control Board
PTI	Pre-trip inspection
Reefer	A refrigerated container allowing for the transport of heat sensitive goods. A reefer has a compressor but needs an external power supply. Reefers are plugged into power sources at container terminals, packing facilities and on-board vessels.
TOS	Terminal Operator System
TPT MPT	Transnet Port Terminals Multi Purpose Terminal in the port of Cape Town
TTT	Truck Turn Time. A measurement of how long external trucks spend interchanging containers at ports or terminals
TEU	Twenty-foot Equivalent Unit
TNPA	Transnet National Ports Authority
TPT	Transnet Port Terminals
WCG	Western Cape Government

1. INTRODUCTION

1.1 Background

The Port of Cape Town has been identified as an area of intervention by the Western Cape Government (WCG) in the Provincial Strategic Plan. The Department of Economic Development and Tourism (DEDAT) established a Port Ease of Doing Business (EoDB) Task Team to manage the WGC intervention in December 2019. The task team has already identified several priorities to reduce port congestion and made initial progress.

The DEDAT appointed PRDW to perform research into prioritised parts of the port logistics chain and subsequently make recommendations to improve port efficiency. The research focus is on priority two and three from the Task Teams seven priorities as listed below:

1. Data integration and management for improved efficiency
2. **Synchronisation of working hours and processes among agencies in the logistics chain**
3. **Facilitating improvements in truck flow and the development of a truck staging area**
4. Improved communication throughout the logistics chain
5. Port equipment augmentation to meet service level demand and to achieve best practices performance levels, including an adequate number of plug points for refrigerated containers.
6. Expediting upgrades to the local network hardware for the Terminal Operator System (TOS) software that is used to manage vessel and container movements.
7. Estimating the cost of doing business in the port and systematically reducing this cost.

This report documents PRDW's investigation into the task team priorities 2 and 3 as listed above.

1.2 Objective

At the study inception it was agreed by the project team that the objective of the study was as follows:

Mapping the container truck logistics chain to identify key points of congestion, the corresponding root causes, the determination of the congestion costs and the identification of opportunities for improvement.

1.3 Study Methodology

The study was undertaken over 12 weeks and was performed in the following three phases:

- Phase 1: Data Capturing, including:
  - Stakeholder engagement
  - Collecting existing data sets
  - Performing surveys

- Truck port waiting times (Supported by security camera footage)
- Empty container depot survey (Travelling time, waiting time)

- Phase 2: Data Analysis, to:
  - Map the macro logistics chain of the MPT and CT terminals
  - Identify bottlenecks last and first kilometre from gates
  - Document and map the empty container component of the port logistics chain
  - Estimate the cost of the inefficiencies that were identified
- Phase 3: Conclusions and Reporting
  - Propose a rigorous methodology for the determination of cost inefficiencies
  - Compile recommendations to improve port efficiency

1.4 Report Structure

Section 2 of this report includes a description of the container truck logistics chain. Section 3 includes a summary of stakeholder engagements. Documentation of agency work hours and opportunities for synchronization are included in Section 4. Analysis of data for supporting the quantification and root cause of congestion is detailed in Section 5. This is followed by the determination of congestion costs and a summary of the key points and root causes for congestion in Sections 6 and 7. Opportunities for improvement to help alleviate congestion and conclusions follow in Sections 8 and 9.

2. THE MACRO LOGISTICS CHAIN

2.1 Macro logistics chain overview

At a macro level the landside container logistics chain can best be illustrated with the aid of a flow chart as presented below in Figure 2-1.

In Cape Town almost all containers arrive or leave through the port terminals. In the case of imported containers, the majority are collected by a container transporter and hauled directly to an importer. Typically, the importer will destuff the container whilst the truck waits. Once destuffed the empty container is hauled to one of several empty container depots. This would typically mark the end of the transporters trip. A smaller proportion of the time (~20%) an import container may be taken to an unpacking facility, also referred to as a Container Freight Station. At the facility, the container will be destuffed for amalgamation with larger loads or distribution to smaller importers. Once destuffed the empty container will be dropped off at an empty container depot. Containers for export essentially follow the same process but in reverse. Due to demand surges and trade imbalances empty containers also need to be shipped to and from the port directly from the empty depots.

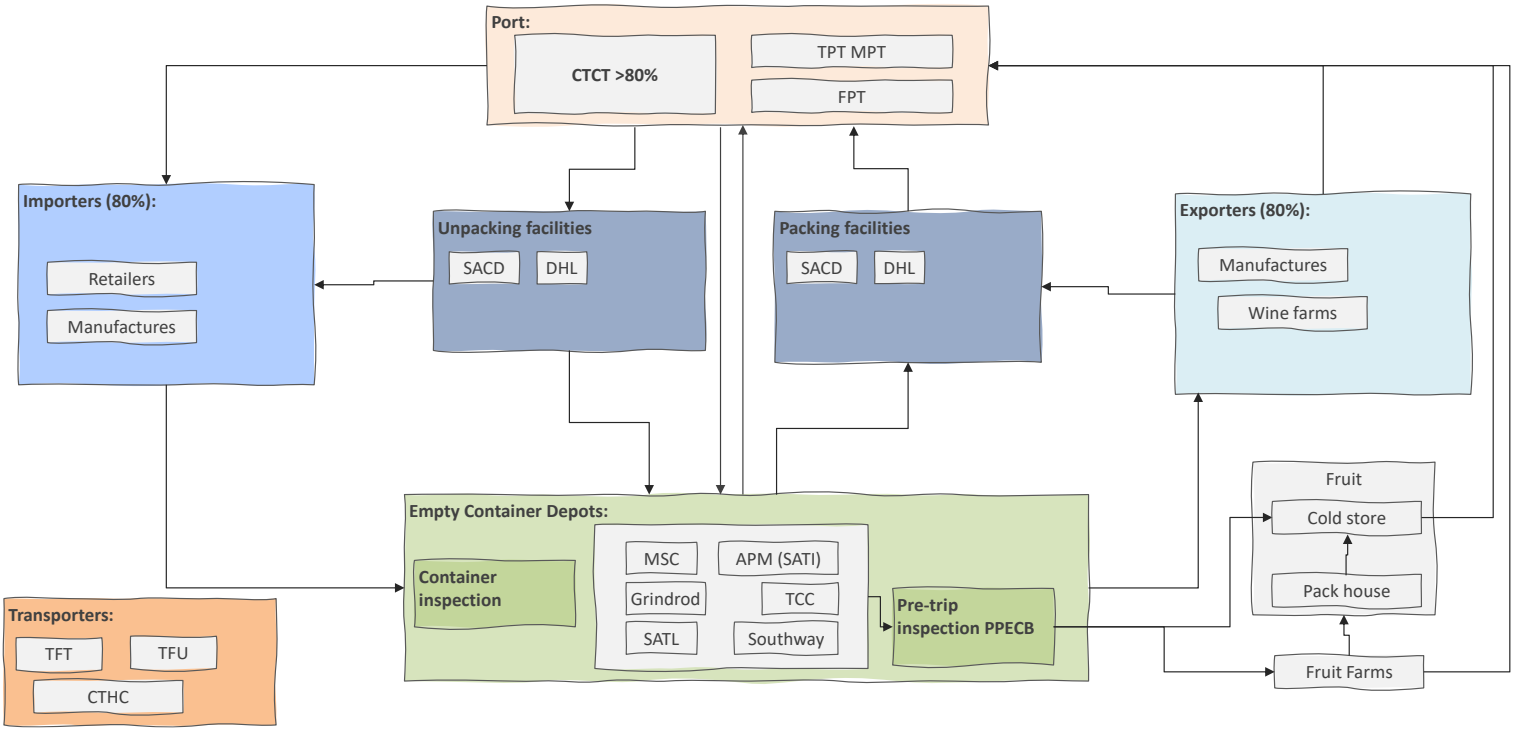


Figure 2-1: Macro logistics chain flow chart.

Hence there is a general continuity of volume in the container logistics chain. A similar number of imported containers, through the port terminals, is subsequently received by the empty depots. In turn a similar number are dispatched from the empty depots to the port for export. In most typical years imported and exported container volumes are similar. However, due to trade imbalances the ratio of full and empty containers varies.

2.2 The reefer logistics chain

In Cape Town, a large portion of export containers are reefers which follow a different logistics chain and are subject to additional processes. Before an empty reefer is collected from an empty container depot, the depot will prepare the reefer for repair (if required), cleanliness inspection and pre-trip inspection (PTI). The Container Depots contact the Perishable Products Export Control Board (PPECB) when they have sufficient prepped containers ready for inspection.

Shipping lines and Container depots are responsible for the following minimum requirements to ensure that valid equipment is presented for export:

- Depot condition and cleanliness (in terms of Food Safety Standards)
- Containers need to be closed 6 hrs before PPECB inspection (for progressive factors like taint etc.)
- External condition container (Valid CSC plate, registered number, undamaged, sound etc.)
- Internal condition container (Clean, dry, undamaged & taint free etc.)
- Pre trip details (Chilled or Frozen Mode or Both, in terms of correct functioning of cooling unit)
- Container validation for cleanliness and PTI is 60 days (must be re-inspected after 60 days)
- Cold Treatment Probe Calibrations (Cold Treatment approval validation is 30 days)

Once approved by the PPECB, the containers can go back into the stack as stock or released immediately as per request from the shipping line to various approved loading points, as per the booking by the exporter or Clearing and forwarding (C&F) agents.

The reefers are typically loaded at cold stores although sometimes citrus can also be loaded directly into reefers at farms. For the majority of fresh fruits types, the fruit is harvested, packed in a pack house and then chilled in a cold store where reefers will be loaded for onward export via the port terminals.

2.3 Empty container logistics and empty container depots

Empty containers are a fundamental and integral component of the container logistics chain. This can be inferred from the descriptions of the macro and reefer logistics chains above. An empty container is required at the origin of every full container and an empty container originates at the destination of every full container (van Eeden, 2018).

The consolidation of empty containers at empty container depots is a key component of the logistics chain. It allows shipping lines to check their containers for damage and provides low-cost storage for stock buffering.

The empty container depots in Cape Town are mapped below in Figure 2-2.

- In close proximity, within 3km, of the port the depots include:
  - SATL
  - Bidvest SACD
  - United Container Depots
  - MSC
  - TCC Container Services
  - South Way
  - Grindrod Intermodal
- Further afield, approximately 16km from the port, the depots are:
  - APM Terminals

- DCP Cape Town Depot
- Independent Container Repairs

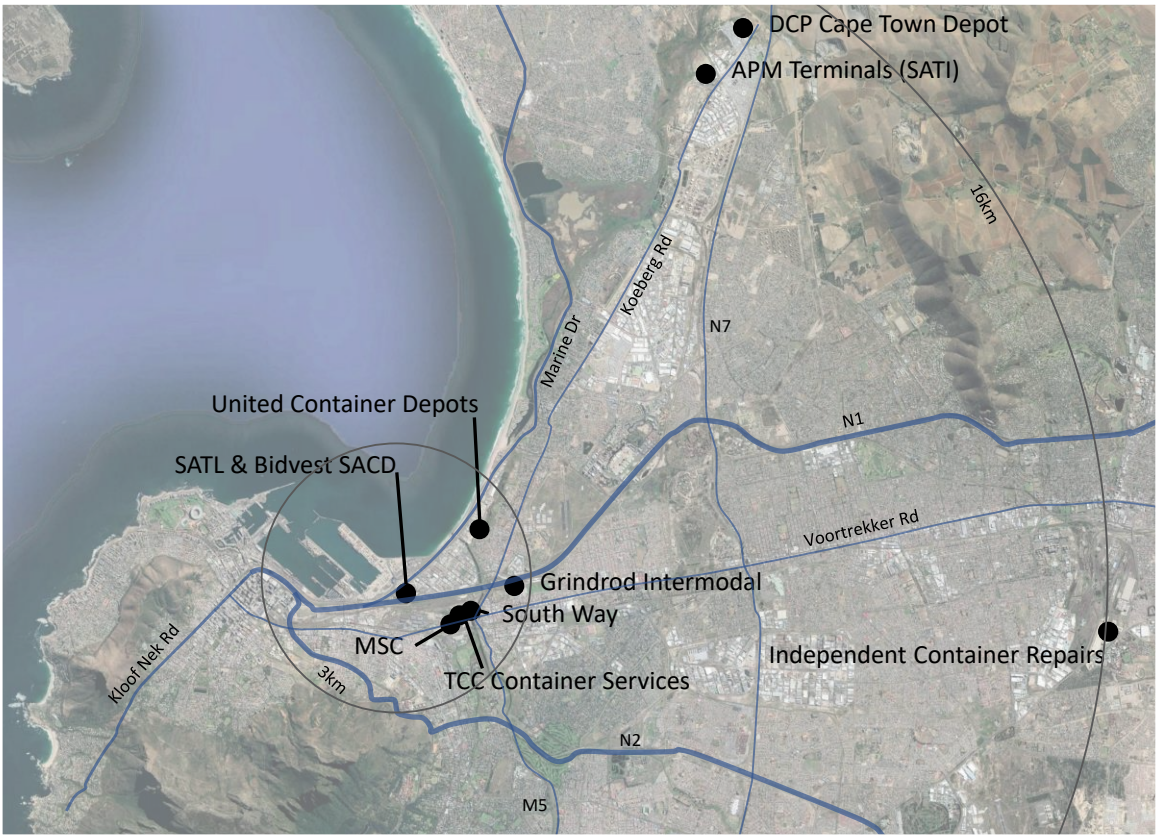


Figure 2-2: Cape Town empty container depots.

3. STAKEHOLDER INSIGHTS

3.1 Summary of engagements

This study has drawn on the insights provided by a wide range of industry stakeholders. A summary of the stakeholders is provided below in Table 3-1. Typical engagements included the following discussion points:

- An industry perspective on the macro logistics chain
- Discussions on:
  - The service provided by the entity
  - Congestion in the logistics chain
  - Operating times and synchronization of the logistics chain
- Data requests depending on entity as follows:
  - TNPA
    - Access to port security footage
  - Port Terminals and container depots
    - Gate data, throughput data and detailed terminal data
  - Transporters
    - Revenue and costs

The insights, data retrieved and data accessibility from these engagements have been instrumental in achieving the study objective.

Table 3-1: Summary of stakeholder engagements.

Category	Entity	Representative
Port Terminals	TNPA	Mpumi Dweba-Kwetana, Arshaad Fester
	TPT Container Terminal	Oscar Borchards, Ebrahim Salasa
	TPT MPT	Sipho Khanyile
Freight Forwarders	South African Association of Freight Forwarders (saaff)	Mike Walwyn
	Fresh produce export forum	Werner Van Rooyen
Container Depots	Maersk	Craig Kurten
	MSC	Brad Gower
	SATL	Bilal Manawar
	Bidvest SACD	Jerome Joseph
Transporters	Cape Town Harbour Carriers Association	Vernon Rawstorne
	Truckers for Unity	Nico Coetzee, Joubert Cilliers
	Truckers for Transformation	Derick Ongansie
City of Cape Town	City of Cape Town	Leigh Stolworthy

3.2 Anecdotal insights on congestion

In discussions with the container transporters there was unanimous agreement on the primary sources of congestion and the relative ranking. The sources are listed in order of severity below (from worst to least).

1. Port Terminals, in particular Cape Town Container Terminal (CTCT)
2. Empty Container Depots
3. City Traffic

Several reasons for congestion were raised with the project team during the study. The reasons are briefly described below. A more thorough, data supported analysis, and description of congestion is provided in Sections 5 and 6.

- Port Terminal
  - Port equipment – Insufficient quantity of container handling equipment, high level of breakdowns and associated low availability.
  - Congestion at specific stacks – Yard planning
  - Weather conditions, including high wind (predominantly in summer), fog and vessel surging (predominantly during winter)
  - Shift changes
  - IT and system failures
  - Poor communication – from the terminal to transporters resulting in transporters arriving at an already closed or heavily congested terminal.
  - Demand Surges
    - Last day stack surges
    - Vessel bunching specifically from weekly vessel runs e.g. South Africa Europe Container Service (SAECS)
- Empty Container Depots
  - Vessel bunching
  - Demand surges
  - Congestion from the port

4. SYNCHRONISATION OF THE LOGISTICS CHAIN

The primary agencies in the logistic chain and their typical working hours are illustrated in Figure 4-1 below. In addition to the working hours, idealized truck trip cycles are shown below to help visualise how the various agency working hours affect the transporters.

Cape Town Container Terminal typically operates two shifts between 06:00 and 22:00, although the terminal will accept reefers at night at certain times of the year.

When lining up the working hours and truck trips the most limiting agency is the import/export client. These clients only have staff available for container stuffing during working hours. This has a significant knock-on effect on the transporters, port terminals and empty depots as all operations get concentrated into peak hours.

Overtime costs and business practice, make it difficult to change stakeholder behaviour to reduce peak hour demand. There are however opportunities for consideration:

- Synchronisation of the fruit export industry
  - The fruit export industry experiences significant peaks and represents high volumes with a relatively small number of stakeholders. Thus, there is the opportunity to synchronize this part of the logistics chain to enable off peak operations. This could potentially be achieved by organisation rather than incentive. The stakeholders would include CTCT, the empty depots, transporters, and the cold stores.
- Influencing truck arrivals for the broader industry
  - Encouraging off peak operations is unlikely to gain traction without introducing incentives for the broader industry. The use of incentives, or peak hour fees, has been successful for some ports in restructuring demand to shift a large proportion of trips to off peak times. These schemes are described in more detail in Section 8.1.

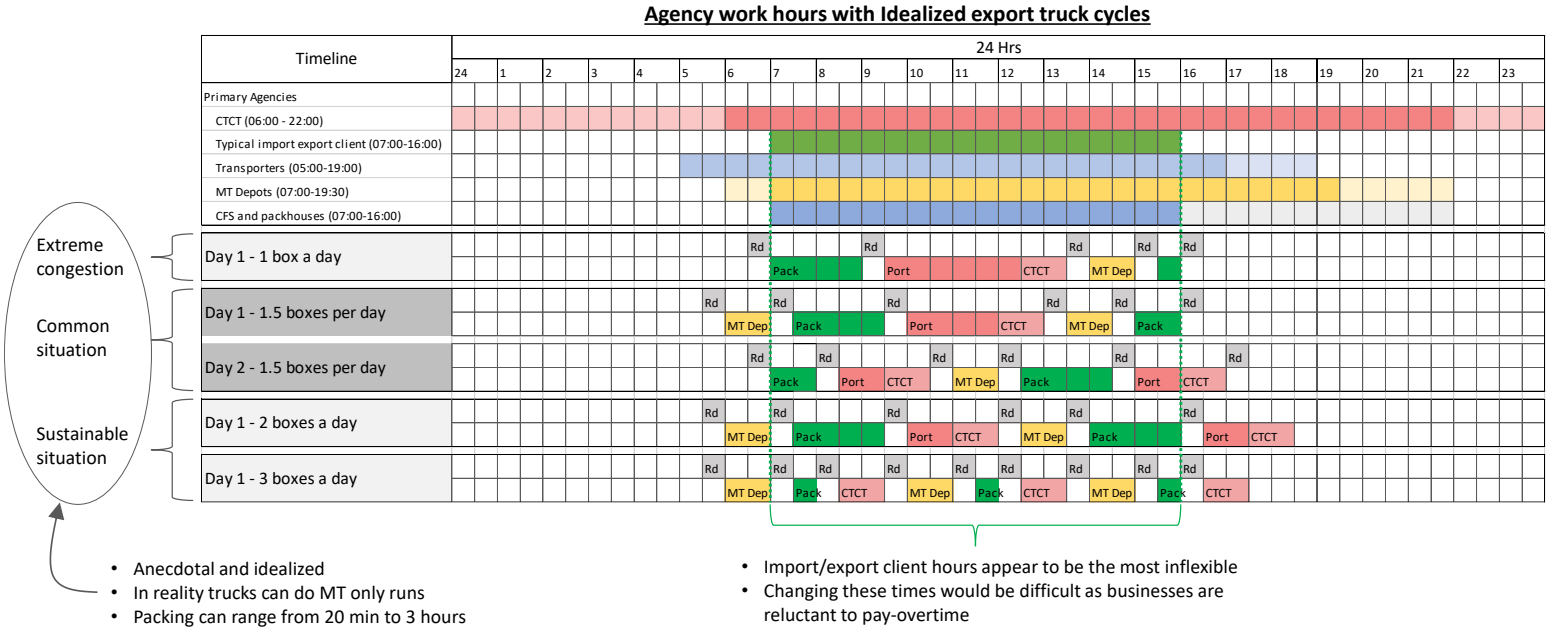


Figure 4-1: Agency work hours with idealized export truck cycles.

5. DATA ANALYSIS

5.1 Introduction

This section includes analyses of the available data with the objective of gaining an improved quantitative perspective on congestion at key locations. The three key congestion points assessed include:

- Cape Town Container Terminal (CTCT)
- Transnet Port Terminals Multi-Purpose Terminal (TPT MPT)

5.2 Empty container depots The port terminals in context

A split of all trucks visiting the port terminals which have container operations is provided in Figure 5-1. It is evident that CTCT has the largest market share of containers by a significant margin, it must also be appreciated that the majority of trucks visiting FPT and MPT are general cargo trucks not container transporters.

This is confirmed from indicative container throughput figures which show the terminal market share split by TEU numbers to be approximately 90%/9%/1% for CTCT/MPT TPT/FPT.

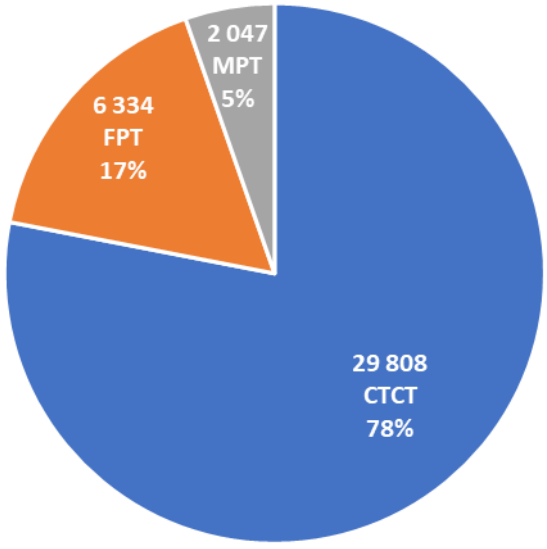


Figure 5-1: Split of all trucks per terminal in June 2019.

5.3 Cape Town Container Terminal

5.3.1 Introduction

CTCT is situated in Ben Schoeman Dock in the Port of Cape Town. Transporters that require access to the terminal need to pass through one of three port gates before entering through the terminal gate namely A-Check. The location of A-Check is annotated below in Figure 5-2. As the terminal has a small truck staging area congestion at the terminal results in extensive truck queues along Duncan Dock Road. Congestion is also experienced inside the terminal where trucks can queue waiting to be serviced.

To inform the identification, quantification, and root cause of congestion at CTCT. The following data sets were obtained for analysis:

- Queue length outside A-Check – Captured by analysis of several security cameras, as annotated in Figure 5-2
- TOS gate data – Provided by CTCT. The data included truck in and out times, container type.
- TOS berth utilisation data - Provided by CTCT. The data included vessel name, arrival and departure times. Berth names were not provided.
- A log of SMS's sent by CTCT to transporters to communicate terminal operation issues. The SMS range in detail at times identifying the cause of congestion and at other times not providing any detail.

It is noted that significantly more detailed data on the terminal was requested on several occasions to support the root cause analysis however the terminal was not able to provide it.

The following sections provide an analysis of the data.

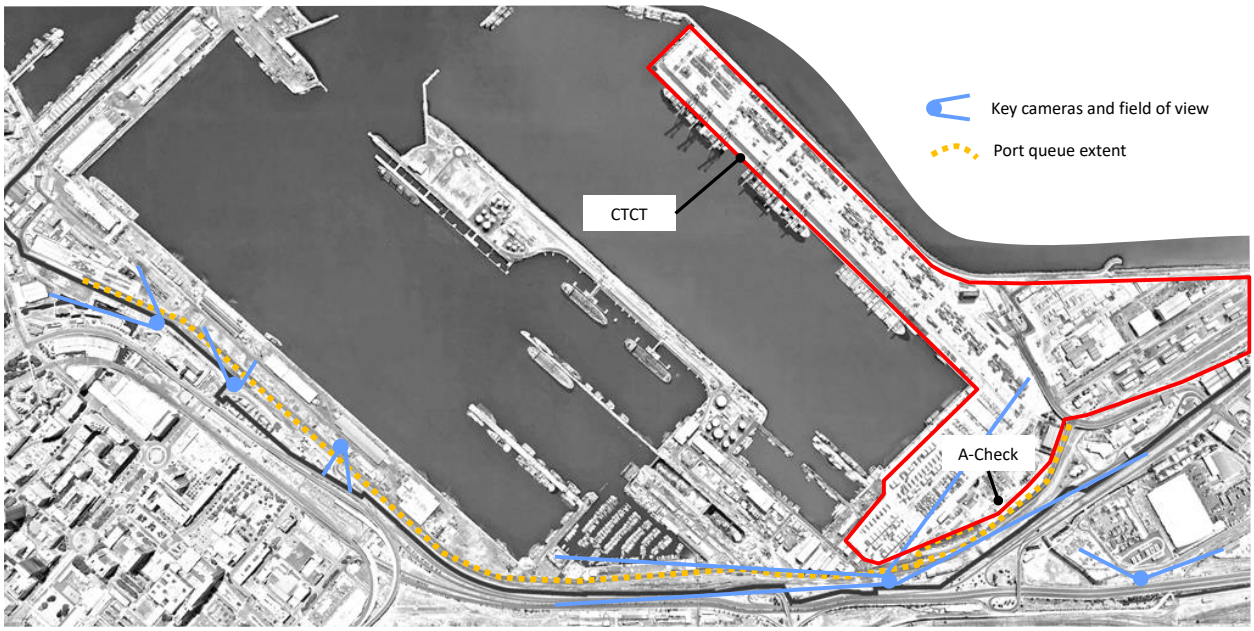


Figure 5-2: CTCT locality, entrance and typical queue location.

5.3.2 Landside assessment

5.3.2.1 Detailed gate, terminal, and queue characteristics

A detailed view of the data is shown below in Figure 5-3. The graphs show the number of trucks entering and leaving the terminal, every five minutes over a 24 hour period. These values are presented as blue and peach columns relative to the left y-axis. Relative to the right y-axis the number of trucks queued outside A-check and the number of trucks inside the terminal are presented in the black and red series. Daily graphs over the 30 day period of study are included in Annexure A.

By analysing the data at this level of detail several important insights may be obtained:

- **Truck congestion manifests both outside the gate (A-Check queue) and inside the terminal (Trucks in terminal)**
  - The prolonged queues outside the terminal are obvious indications of congestion. Inside the terminal only a portion of the queue is attributable to congestion as the trucks need to locate their container and be (un)loaded. It is the time beyond the target TTT, of 35 minutes per truck, that may be described as congestion.

- **The physical gate at A-Check is not a constraint but rather the number of trucks accessing the terminal as controlled by the terminal. This is presumably to limit congestion inside the terminal and keep Truck Turnaround Times in check.**
  - This is shown during some periods when significantly less trucks transit the gate even though there is a queue outside the gate. For example in Figure 5-3 on 2 February, there is a high gate volume (blue columns) between 06:00 and 08:00 however the gate volumes drop significantly between 08:00 and 11:00 even though trucks are queued outside. This is understood to be a terminal operating procedure which aims to limit the number of the trucks in the terminal to less than 100.
  - The actual gate capacity is high and can been seen to operate at more than 20 trucks every 5 minutes (240 trucks/hour). This is confirmed by previous sampling by HHO (HHO, 2019) where the average check-in time was 1 minute 22 seconds. For the gate's current 5 lane configuration this would equate to a gate capacity of 220 trucks/hour.

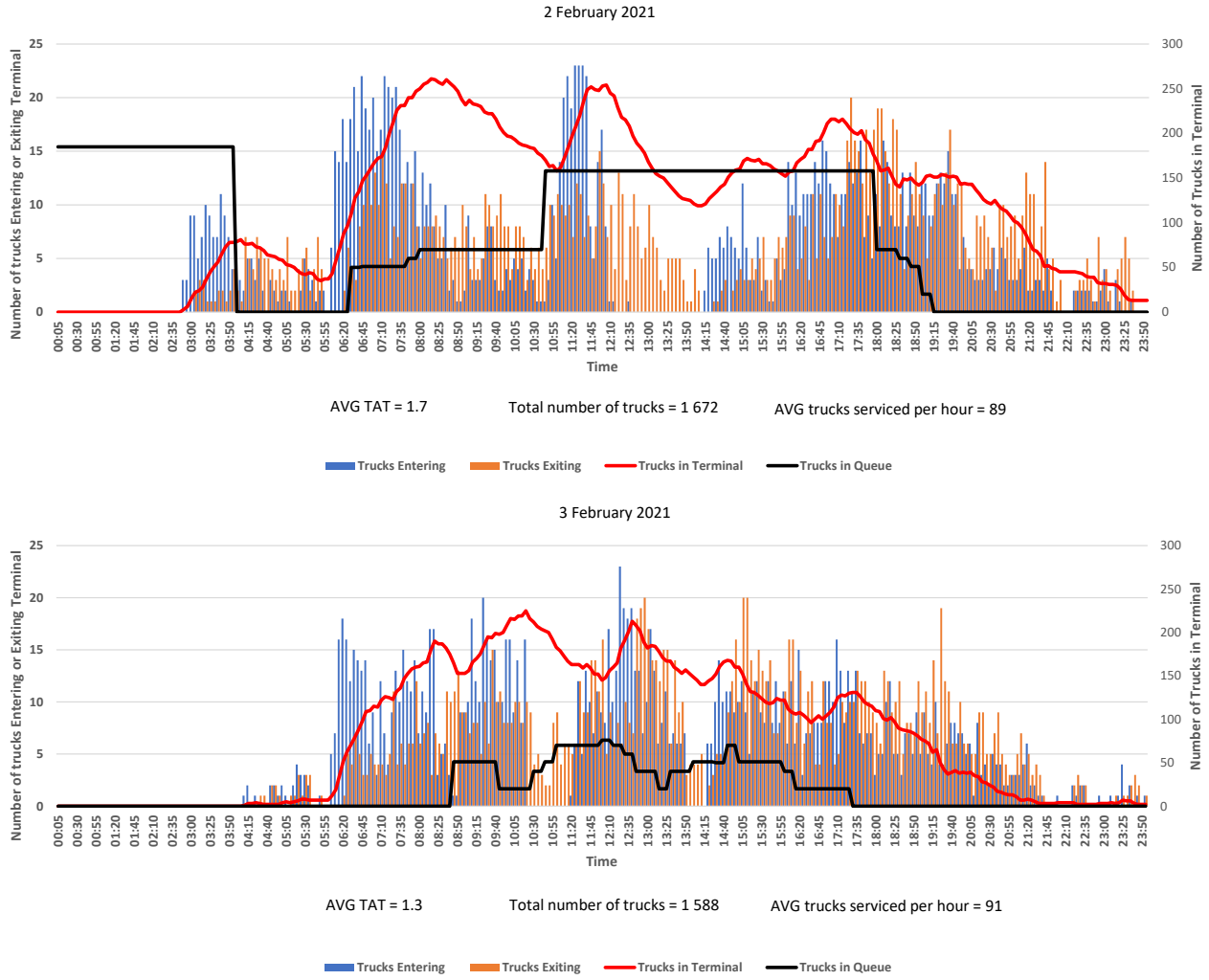


Figure 5-3: CTCT gate flows, A-Check queue and trucks in terminal.

- **The gate frequently closes for short periods during the day. In multiple cases this coincides with shift changes at 14:00**.

- This effect is most clearly visualized below in Table 5-1. The analysis shows the number of trucks entering A-Check, every 5 minutes between 13:00 and 15:00. Conditional formatting has been used to help highlight intervals when truck volumes are low. Only selected weekdays from the 31 day period are shown as it was found that on most weekends the trend is not apparent. Days affected by wind were also filtered out. Although not as consistent similar gate slow-downs were seen at 17:00 on several days during the period. Although these interruptions are relatively brief, they were seen on several days to have a significant knock-on effect on congestion. This manifested by either increasing the outside queue and/or by increasing the congestion inside the terminal as a result of the influx of pent-up truck demand. This was observable on:
  - February - 8, 9, 12, 16, 17, 19, 22 and March – 1, 2
  - A clear example of this knock-on effect occurred on 1 March as shown further below in Figure 5-4

Table 5-1: Shift change inefficiencies at CTCT, A-Check. Showing selected weekdays from the study period.

Time	February																Mar		
	Tu	We	Fr	Mo	Tu	We	Th	Fr	Mo	Tu	We	Th	Fr	Mo	Tu	We	Mo	Tu	We
	2	3	5	8	9	10	11	12	15	16	17	18	19	22	23	24	1	2	3
13:00	0	17	13	8	14	9	12	9	8	0	13	14	6	15	9	14	2	8	3
13:05	0	13	18	11	9	6	8	8	8	0	9	3	0	14	9	11	3	10	8
13:10	0	6	8	11	10	7	7	3	9	0	12	8	4	10	15	10	11	6	3
13:15	0	8	9	11	8	10	6	4	10	0	5	9	6	11	9	7	7	7	4
13:20	0	11	11	9	11	6	7	8	8	0	12	9	9	5	9	6	9	7	5
13:25	0	6	7	11	13	5	5	5	9	0	8	15	6	10	11	7	7	6	2
13:30	0	7	9	5	11	7	12	10	6	0	8	6	5	13	9	12	6	8	4
13:35	0	6	12	12	7	10	10	9	7	0	11	7	7	16	8	7	5	3	5
13:40	0	6	8	11	8	8	4	6	9	0	6	6	5	10	11	7	2	0	7
13:45	0	7	2	7	4	7	0	2	6	0	3	4	5	8	14	8	1	0	3
13:50	0	0	3	2	0	2	0	6	5	0	2	2	0	4	5	1	0	0	1
13:55	0	0	6	0	0	1	2	1	4	0	0	1	0	3	10	1	0	0	1
14:00	0	0	1	0	6	6	5	0	0	0	1	1	3	5	9	1	0	0	0
14:05	0	0	2	5	5	8	7	11	3	0	8	4	6	5	12	1	0	4	1
14:10	2	0	6	7	3	5	11	17	10	4	9	1	8	5	10	1	3	7	7
14:15	6	6	10	10	11	9	5	18	7	13	4	3	9	0	7	1	7	2	12
14:20	5	6	10	10	9	10	7	21	13	11	11	1	9	0	7	0	11	9	7
14:25	5	10	17	7	15	8	4	22	16	10	10	0	15	2	3	0	13	7	8
14:30	7	14	8	11	16	8	11	25	11	11	8	0	17	2	6	0	14	9	13
14:35	6	10	13	7	20	6	6	28	17	7	14	1	10	1	9	0	12	11	15
14:40	8	11	11	18	10	2	6	15	10	10	7	11	6	1	12	0	13	14	16
14:45	7	11	16	14	10	6	8	23	9	16	10	9	0	5	13	1	10	9	21
14:50	6	9	12	16	13	6	11	16	8	8	9	10	13	8	11	0	15	5	15
14:55	5	10	19	16	7	9	9	3	10	14	15	14	17	5	16	7	15	9	20
15:00	12	12	10	12	3	11	9	1	11	13	6	5	14	4	11	4	14	9	9

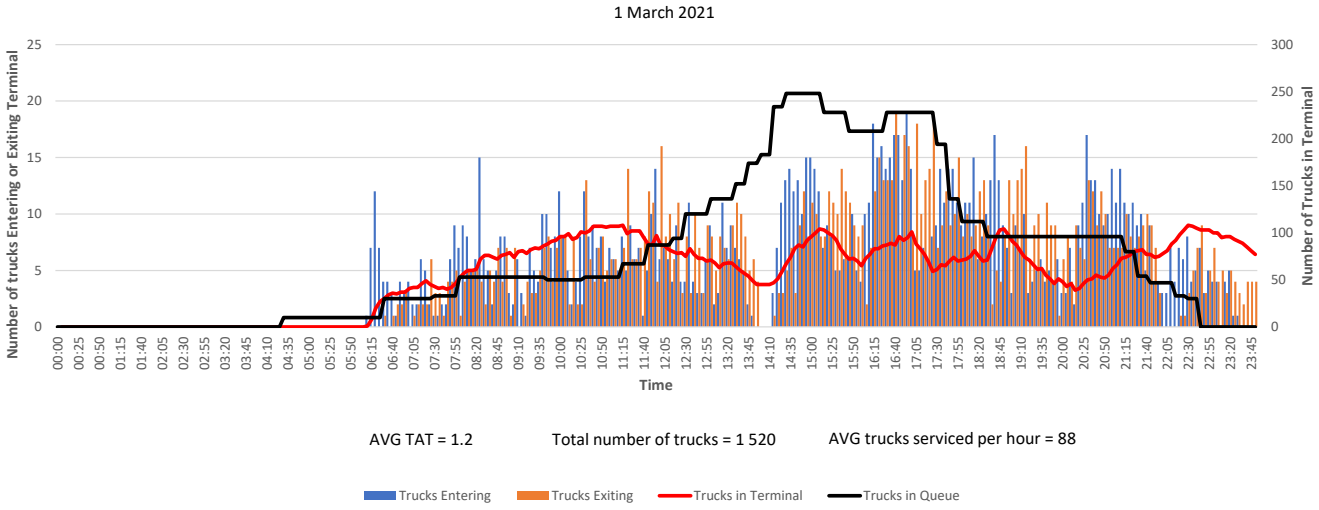


Figure 5-4: An example of the congestion knock-on effect created by an inefficient shift change at 14:00. After 14:00 both queues outside and inside the terminal surge.

5.3.2.2 Monthly gate, terminal, and queue characteristics

By viewing the data over a 31 day period more important trends can be visualised. The trucks entering A-Check every hour and the truck queue length outside A-Check are shown below in Table 5-2 and Table 5-3. Table 5-4 and Table 5-5 show the percentage of reefer trucks and percentage of empty trucks entering A-Check respectively. All the tables show values per hour over a 31 day period. In Table 5-2 and Table 5-3 an indication of high wind periods is identified by black outlines. These black outlines represent times when wind gusts are above 33km/h based in Windguru archive data (Windguru, 2021).

In this form the following insights are apparent:

- **High wind speeds have a significant effect on the functioning of the terminal.**
  - It can be seen that on the 1st and between the 24th to 27th of February the terminal was essentially shutdown due to high wind speeds. Throughout the month of February there are several other incidences when wind speed was associated with a gate shutdown and queue formation.
- **Terminal traffic is concentrated during the weekdays between 06:00 and 20:00**
  - It is clear that the terminal gate typically opens at 06:00. Night trucks are accepted on certain days and these are normally reefer trucks. This operation was confirmed in discussions with the terminal.
  - The terminal gate typically opens to all trucks between 06:00 and 22:00.

Table 5-2: Hourly trucks entering A-Check at CTCT from 1 February 2021 to 3 March 2021.

	Feb																												Mar		
Hours	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3
0	0	0	0	11	30	35	1	0	1	0	0	2	1	0	0	0	2	11	3	0	0	0	22	25	0	0	0	0	0	28	4
1	0	0	0	10	11	1	0	0	0	0	0	0	2	3	0	0	1	11	2	0	0	0	12	11	0	0	0	0	0	10	0
2	0	15	0	0	1	1	0	0	0	0	8	13	1	2	0	0	0	10	0	6	0	0	12	5	0	0	0	0	0	27	0
3	0	88	0	0	1	5	1	0	0	0	5	9	1	0	0	0	1	16	0	2	0	0	14	6	0	0	0	0	0	15	10
4	0	33	11	4	11	5	4	0	0	0	19	6	3	0	0	4	2	11	5	5	4	0	20	4	0	0	0	0	0	9	7
5	0	22	16	6	13	7	2	0	0	28	14	3	4	0	0	10	4	7	6	1	0	6	23	7	0	0	0	0	0	15	14
6	0	199	145	72	131	91	47	91	0	75	84	56	32	20	109	51	136	109	107	54	47	80	77	114	0	0	0	55	50	65	10
7	29	194	117	16	152	99	64	79	18	121	93	86	54	21	102	52	122	113	68	108	86	97	71	79	0	0	0	48	45	65	1
8	11	72	91	28	149	84	87	92	0	81	91	51	91	39	107	63	112	103	95	130	139	104	90	96	0	0	0	116	80	84	32
9	3	53	167	28	162	138	73	93	0	103	114	56	98	92	91	81	108	92	86	122	75	147	132	123	0	0	17	74	75	92	149
10	0	44	47	34	168	85	68	85	1	115	88	73	107	85	100	96	135	104	90	154	94	134	89	86	0	0	78	75	82	70	102
11	0	210	74	0	129	158	71	108	119	100	112	74	95	51	123	103	147	41	88	125	91	106	80	71	0	0	128	126	82	109	90
12	0	11	170	0	149	125	54	132	100	121	115	81	85	57	133	79	122	122	86	130	106	173	132	85	0	0	36	10	70	157	140
13	0	0	87	73	106	62	49	98	95	78	73	71	77	38	89	0	89	84	53	121	73	119	119	91	0	0	87	146	53	55	46
14	0	57	87	0	125	0	33	121	125	83	90	199	71	14	114	104	106	55	113	83	55	39	115	12	0	0	100	50	113	86	135
15	0	50	117	0	139	0	23	132	43	103	108	68	65	6	126	162	93	110	130	85	39	89	113	26	0	0	50	56	91	113	152
16	0	148	104	4	102	0	15	98	18	113	89	1	64	8	106	107	59	68	112	103	8	73	123	0	0	0	85	12	179	120	66
17	0	127	114	0	51	1	5	75	2	73	48	10	10	0	58	1	61	77	123	39	1	110	95	0	0	0	3	0	113	77	37
18	0	126	78	0	0	0	0	89	1	62	36	176	5	0	71	90	129	81	154	0	0	140	109	0	0	0	16	0	123	77	134
19	0	119	77	0	1	59	0	67	0	16	29	155	4	0	43	59	110	104	121	34	0	47	66	0	0	0	30	0	66	127	134
20	0	48	44	0	0	65	0	32	0	5	14	12	25	0	16	1	73	39	46	4	0	25	40	0	0	0	2	0	118	109	82
21	0	32	23	0	0	8	0	12	0	0	0	12	42	0	4	0	44	26	41	3	0	12	35	0	0	0	1	0	101	95	23
22	0	18	8	0	0	1	0	6	0	0	0	18	36	0	5	0	7	1	0	1	0	17	13	0	0	0	0	0	63	72	7
23	0	6	11	0	9	3	0	4	0	0	0	6	31	0	2	13	0	1	0	1	0	31	26	0	0	0	0	0	16	35	50
Total	**43**	**1672**	**1588**	**286**	**1640**	**1033**	**597**	**1414**	**523**	**1277**	**1230**	**1238**	**1004**	**436**	**1399**	**1076**	**1663**	**1396**	**1529**	**1311**	**818**	**1549**	**1628**	**841**	**0**	**0**	**633**	**768**	**1520**	**1712**	**1425**
AVG/hr	**3**	**89**	**91**	**15**	**92**	**57**	**35**	**83**	**31**	**73**	**70**	**71**	**57**	**25**	**82**	**62**	**97**	**78**	**89**	**76**	**48**	**89**	**88**	**46**	**0**	**0**	**37**	**45**	**88**	**93**	**79**
Max/hr	**29**	**210**	**170**	**73**	**168**	**158**	**87**	**132**	**125**	**121**	**115**	**199**	**107**	**92**	**133**	**162**	**147**	**122**	**154**	**154**	**139**	**173**	**132**	**123**	**0**	**0**	**128**	**146**	**179**	**157**	**152**
AVG TAT	**1.2**	**1.7**	**1.3**	**1.2**	**0.9**	**0.7**	**0.4**	**1.2**	**1.0**	**0.8**	**0.8**	**1.1**	**0.5**	**0.4**	**1.0**	**1.3**	**1.6**	**1.4**	**1.1**	**1.1**	**0.7**	**1.3**	**0.9**	**1.5**	**0.0**	**0.0**	**1.0**	**1.1**	**1.2**	**1.7**	**1.3**

Table 5-3: Hourly truck queue outside A-Check at CTCT from 1 February 2021 to 3 March 2021.

	Feb																												Mar		
Hours	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3
0	0	185	0	0	61	61	0	0	0	61	0	0	0	0	0	0	73	0	0	0	0	0	0	0	47	30	47	0	0	0	0
1	0	185	0	0	61	0	0	0	0	61	0	0	0	0	0	0	73	0	0	0	0	0	0	0	47	30	47	0	0	0	10
2	0	185	0	0	61	0	0	0	0	61	0	0	0	0	0	0	73	0	0	0	0	0	0	0	47	30	47	0	0	0	10
3	0	185	0	0	61	0	0	0	0	61	0	0	0	0	0	0	98	0	0	0	0	0	0	0	47	30	47	0	0	0	10
4	0	0	0	0	61	0	0	0	0	61	0	0	0	0	0	0	98	20	30	0	10	0	0	0	47	30	47	0	0	0	10
5	0	0	0	0	61	0	0	0	0	61	0	0	0	0	0	40	98	40	30	0	23	0	0	20	54	30	87	0	10	0	10
6	60	0	0	0	70	40	0	0	20	61	0	10	0	10	40	40	150	90	30	0	23	0	0	60	105	81	140	0	10	20	10
7	50	51	0	0	60	40	0	0	61	60	20	0	0	0	20	51	117	40	30	0	23	0	0	0	156	117	166	0	30	0	33
8	70	70	0	0	60	40	0	20	70	60	20	0	0	0	20	20	117	20	23	0	23	0	0	20	166	150	166	0	53	0	87
9	70	70	51	0	50	40	0	20	76	70	20	0	0	0	0	40	100	40	23	20	0	0	0	20	182	166	166	20	53	0	124
10	70	70	20	51	40	60	0	20	76	76	20	0	0	0	20	40	100	90	30	10	0	0	0	51	124	166	182	93	50	10	114
11	70	158	70	60	20	60	0	20	61	50	20	0	0	0	20	70	70	70	30	70	10	0	63	90	124	166	166	100	53	47	74
12	70	158	76	50	20	20	0	20	60	50	20	50	10	0	20	60	51	100	67	70	23	30	63	90	124	166	136	30	87	116	156
13	158	158	40	50	158	0	0	40	70	0	0	116	10	0	0	60	93	166	116	70	0	0	51	70	131	166	120	117	136	136	123
14	198	158	51	50	158	20	0	40	61	0	0	172	0	0	61	166	103	117	152	114	0	50	60	87	100	166	94	30	183	193	190
15	212	158	51	50	70	102	0	61	76	20	0	96	0	0	50	166	103	100	163	156	0	117	81	117	47	47	47	0	248	220	170
16	212	158	40	50	60	158	0	20	76	0	0	143	0	0	20	117	117	100	132	100	0	124	70	117	50	47	47	0	208	258	150
17	158	158	20	61	20	158	0	40	76	0	0	220	0	0	43	100	117	100	120	47	0	124	30	47	30	47	47	0	228	258	150
18	158	70	0	61	20	158	0	0	61	0	0	220	0	0	23	100	117	100	94	30	0	114	0	47	30	47	47	0	112	258	150
19	158	20	0	76	20	158	0	0	61	0	0	112	0	0	0	100	117	40	67	30	0	0	10	47	30	47	23	0	96	208	150
20	174	0	0	61	50	102	0	0	61	0	0	10	0	0	0	100	90	0	50	0	0	0	10	47	30	47	0	0	96	150	96
21	174	0	0	61	50	0	0	0	61	0	0	0	0	0	0	81	0	0	50	0	0	0	0	47	30	47	0	0	96	96	30
22	174	0	0	61	50	0	0	0	61	0	0	0	0	0	0	70	0	0	0	0	0	0	0	47	30	47	0	0	47	33	30
23	174	0	0	61	50	0	0	0	61	0	0	0	0	0	0	70	0	0	0	0	0	0	0	47	30	47	0	0	0	0	30
Total	**2410**	**2197**	**419**	**803**	**1392**	**1217**	**0**	**301**	**1149**	**813**	**120**	**1149**	**20**	**10**	**337**	**1491**	**2075**	**1233**	**1237**	**717**	**135**	**559**	**438**	**1071**	**1808**	**1947**	**1869**	**390**	**1796**	**2003**	**1917**

Table 5-4: Percentage of reefer trucks through A-Check at CTCT from 1 February 2021 to 3 March 2021.

Hours	Feb																												Mar		
	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3
0	0%	0%	0%	0%	100%	97%	100%	0%	100%	0%	0%	100%	100%	0%	0%	0%	50%	0%	33%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	100%	100%
1	0%	0%	0%	10%	100%	100%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%	100%	0%	100%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	100%	0%
2	0%	100%	0%	0%	100%	100%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	100%	0%	0%	100%	100%	0%	0%	0%	0%	0%	100%	0%
3	0%	99%	0%	0%	100%	100%	100%	0%	0%	0%	20%	11%	100%	0%	0%	0%	100%	0%	0%	100%	0%	0%	100%	100%	0%	0%	0%	0%	0%	100%	100%
4	0%	94%	100%	100%	91%	100%	100%	0%	0%	0%	16%	83%	100%	0%	0%	75%	50%	27%	60%	100%	100%	0%	100%	100%	0%	0%	0%	0%	0%	100%	100%
5	0%	100%	100%	100%	92%	86%	100%	0%	0%	100%	57%	100%	75%	0%	0%	100%	50%	57%	100%	100%	0%	0%	70%	57%	0%	0%	0%	0%	0%	100%	100%
6	0%	29%	18%	33%	31%	43%	30%	29%	0%	43%	19%	50%	34%	90%	17%	25%	21%	17%	21%	31%	30%	35%	22%	22%	0%	0%	0%	5%	12%	25%	80%
7	100%	29%	17%	63%	30%	43%	59%	37%	100%	40%	33%	49%	50%	86%	25%	15%	11%	12%	26%	33%	36%	48%	30%	42%	0%	0%	0%	19%	11%	57%	100%
8	91%	44%	34%	100%	35%	50%	49%	36%	0%	23%	38%	51%	33%	38%	31%	43%	13%	11%	24%	40%	35%	47%	43%	44%	0%	0%	0%	16%	29%	56%	47%
9	100%	85%	35%	93%	27%	30%	49%	27%	0%	31%	47%	71%	44%	48%	34%	28%	28%	25%	33%	56%	48%	46%	37%	57%	0%	0%	65%	41%	24%	38%	40%
10	0%	77%	23%	100%	42%	41%	37%	42%	100%	44%	39%	58%	53%	40%	35%	38%	24%	28%	32%	50%	53%	58%	47%	58%	0%	0%	41%	15%	21%	31%	47%
11	0%	28%	41%	0%	43%	43%	59%	46%	48%	45%	37%	68%	64%	82%	33%	45%	29%	51%	49%	56%	48%	45%	60%	37%	0%	0%	46%	7%	24%	43%	49%
12	0%	27%	38%	0%	37%	47%	54%	38%	60%	39%	30%	68%	71%	89%	38%	48%	22%	25%	44%	55%	46%	48%	55%	51%	0%	0%	25%	100%	26%	55%	61%
13	0%	0%	28%	99%	48%	58%	51%	38%	31%	44%	38%	92%	75%	82%	35%	0%	20%	23%	42%	46%	45%	67%	54%	49%	0%	0%	40%	23%	19%	27%	52%
14	0%	93%	44%	0%	43%	0%	61%	51%	36%	34%	39%	48%	77%	86%	41%	39%	25%	44%	45%	51%	36%	46%	50%	92%	0%	0%	44%	48%	55%	17%	67%
15	0%	84%	33%	0%	48%	0%	52%	56%	49%	29%	42%	53%	74%	83%	41%	41%	30%	33%	55%	44%	67%	62%	55%	100%	0%	0%	30%	25%	14%	58%	74%
16	0%	39%	36%	0%	24%	0%	87%	23%	100%	24%	42%	100%	95%	63%	38%	30%	42%	44%	52%	59%	38%	60%	42%	0%	0%	0%	78%	17%	60%	55%	62%
17	0%	28%	25%	0%	49%	100%	100%	47%	100%	25%	44%	40%	90%	0%	48%	0%	26%	39%	35%	92%	100%	54%	52%	0%	0%	0%	0%	0%	57%	16%	43%
18	0%	28%	38%	0%	0%	0%	0%	56%	100%	44%	64%	51%	40%	0%	58%	36%	19%	23%	66%	0%	0%	54%	60%	0%	0%	0%	100%	0%	58%	26%	88%
19	0%	25%	45%	0%	0%	98%	0%	39%	0%	38%	41%	90%	100%	0%	49%	59%	10%	18%	74%	100%	0%	51%	65%	0%	0%	0%	93%	0%	41%	57%	91%
20	0%	54%	50%	0%	0%	100%	0%	38%	0%	100%	50%	100%	100%	0%	44%	100%	5%	36%	57%	100%	0%	16%	68%	0%	0%	0%	100%	0%	86%	78%	88%
21	0%	75%	74%	0%	0%	100%	0%	58%	0%	0%	0%	67%	100%	0%	100%	0%	7%	35%	76%	100%	0%	50%	94%	0%	0%	0%	100%	0%	90%	86%	83%
22	0%	100%	100%	0%	0%	100%	0%	50%	0%	0%	0%	100%	100%	0%	100%	0%	0%	100%	0%	100%	0%	100%	100%	0%	0%	0%	0%	0%	100%	94%	100%
23	0%	100%	27%	0%	100%	100%	0%	75%	0%	0%	0%	100%	100%	0%	100%	85%	0%	100%	0%	100%	0%	100%	96%	0%	0%	0%	0%	0%	100%	100%	98%
	98%	46%	35%	72%	40%	53%	52%	41%	48%	37%	38%	62%	67%	64%	37%	39%	21%	25%	46%	52%	44%	52%	54%	51%	0%	0%	50%	21%	48%	54%	68%

Table 5-5: Percentage of empty trucks through A-Check at CTCT from 1 February 2021 to 3 March 2021.

Hours	February																												March		
	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3
0	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	95%	88%	0%	0%	0%	0%	0%	82%	100%
1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	90%	0%
2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	96%	0%
3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	100%	0%
4	0%	0%	45%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	85%	100%	0%	0%	0%	0%	0%	56%	0%
5	0%	0%	75%	0%	0%	0%	0%	0%	0%	18%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	26%	0%	0%	0%	0%	0%	0%	0%	21%
6	0%	0%	1%	3%	4%	0%	0%	2%	0%	0%	13%	14%	0%	0%	0%	0%	0%	0%	7%	2%	4%	9%	0%	2%	0%	0%	0%	0%	0%	0%	0%
7	0%	0%	3%	19%	7%	18%	30%	16%	0%	12%	23%	24%	6%	10%	17%	0%	0%	0%	15%	14%	6%	29%	15%	20%	0%	0%	0%	8%	0%	0%	100%
8	0%	0%	5%	0%	8%	24%	34%	13%	0%	9%	34%	24%	0%	10%	15%	0%	0%	0%	11%	12%	22%	36%	21%	26%	0%	0%	0%	5%	14%	1%	13%
9	0%	0%	3%	0%	8%	6%	8%	11%	0%	22%	41%	30%	11%	20%	12%	0%	0%	2%	15%	22%	31%	30%	14%	26%	0%	0%	0%	8%	21%	4%	2%
10	0%	11%	6%	0%	10%	12%	6%	7%	0%	30%	25%	10%	25%	11%	0%	0%	0%	4%	7%	24%	38%	25%	11%	30%	0%	0%	0%	4%	10%	16%	21%
11	0%	3%	4%	0%	9%	15%	8%	16%	0%	29%	27%	26%	22%	24%	2%	0%	0%	27%	16%	15%	25%	25%	16%	6%	0%	0%	2%	7%	6%	12%	21%
12	0%	9%	8%	0%	8%	16%	13%	6%	21%	22%	21%	33%	22%	37%	2%	0%	0%	7%	26%	20%	22%	8%	16%	7%	0%	0%	25%	20%	11%	6%	18%
13	0%	0%	8%	0%	8%	16%	14%	10%	6%	27%	30%	17%	35%	26%	0%	0%	0%	5%	21%	33%	34%	28%	10%	0%	0%	0%	5%	2%	0%	0%	11%
14	0%	9%	7%	0%	4%	0%	12%	7%	8%	18%	20%	10%	44%	43%	0%	0%	0%	11%	7%	30%	22%	23%	10%	25%	0%	0%	7%	14%	1%	12%	29%
15	0%	12%	15%	0%	14%	0%	9%	5%	40%	21%	32%	18%	40%	17%	0%	0%	0%	5%	10%	19%	62%	2%	19%	0%	0%	0%	12%	13%	2%	14%	21%
16	0%	3%	18%	0%	24%	0%	20%	0%	100%	15%	29%	100%	78%	13%	0%	0%	0%	4%	7%	12%	38%	19%	19%	0%	0%	0%	8%	0%	4%	3%	38%
17	0%	6%	11%	0%	6%	100%	0%	5%	100%	19%	31%	20%	20%	0%	0%	0%	0%	8%	19%	10%	100%	0%	24%	0%	0%	0%	0%	0%	15%	5%	32%
18	0%	16%	14%	0%	0%	0%	0%	1%	100%	35%	42%	5%	0%	0%	0%	0%	0%	12%	18%	0%	0%	11%	17%	0%	0%	0%	0%	0%	13%	1%	39%
19	0%	18%	27%	0%	0%	0%	0%	15%	0%	25%	21%	5%	0%	0%	0%	0%	0%	7%	7%	0%	0%	13%	29%	0%	0%	0%	0%	0%	33%	11%	22%
20	0%	44%	45%	0%	0%	0%	0%	6%	0%	80%	29%	0%	84%	0%	0%	0%	0%	18%	11%	0%	0%	0%	25%	0%	0%	0%	0%	0%	17%	16%	21%
21	0%	69%	57%	0%	0%	0%	0%	17%	0%	0%	0%	67%	88%	0%	0%	0%	0%	15%	5%	0%	0%	8%	49%	0%	0%	0%	0%	0%	17%	8%	83%
22	0%	100%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	97%	0%	0%	0%	0%	100%	0%	0%	0%	47%	23%	0%	0%	0%	0%	0%	35%	17%	86%
23	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	97%	0%	0%	0%	0%	0%	0%	0%	0%	100%	85%	0%	0%	0%	0%	0%	13%	54%	38%
	0%	9%	11%	2%	8%	11%	15%	8%	14%	20%	27%	15%	34%	20%	4%	0%	0%	6%	12%	18%	25%	20%	22%	19%	0%	0%	6%	6%	12%	13%	24%

5.3.2.3 Characterising the A-Check queue

To gain additional insight to the root cause of congestion at CTCT the A-Check queue has been analysed with the available data. The methodology included attributing the queue, at each time increment, to an identifiable reason when possible. The queue attributes are defined and identified as follows:

- Wind: As identified using a combination of terminal SMS's, Windguru archives and visual guides from security camera footage
- Gate Closure – Shift Change: Identified from the TOS gate data, coinciding with shift changes
- Gate Closure – Not specified: Identified from the TOS gate data, with no clear reason identified
- IT systems: Identified from terminal SMS's
- D-Block: Identified from terminal SMS's
- Container Handling Equipment: Identified from terminal SMS's
- Visibility : Identified from terminal SMS's

- No reason - Less than Terminal Capacity:
  - Identified as times when no reason as described in the above attributes was evident. In an attempt to identify overload conditions a terminal capacity definition was introduced. Two parameters were considered, the average number of trucks entering the terminal and the total number of trucks inside the terminal. These were set at 90 trucks/hr and 100 trucks, respectively. The typical achievable average number of trucks entering the terminal was determined from the A-Check gate data which calculated the average trucks/hr between 06:00 to 22:00 (See Table 5-2). The total number of trucks inside the terminal was determined from the terminal's general operating targets (HHO, 2019).
- No reason - More than Terminal Capacity
  - Similar to above but identifying when conditions were above the terminal capacity described above

The result of the queue attribute process is presented below in Table 5-6 and Figure 5-5. Whilst the analysis is not exact and limited by the available data the quantification of several important reasons for congestion is provided:

- **Approximately 30% of A-Check truck congestion is attributable to wind disruption at the terminal**
- **9% of the congestion is created by gate closures of which approximately half occur during shift changes**
- **4% is attributed to D-block (stack congestion) and IT system failure**
- **The remaining 54% of the truck waiting hours have no clear reason attributed to them.**
  - In an attempt to identify when this congestion may have been due to overload conditions the percentage has been divided into times when the terminal was above and below its current estimated capacity respectively. In this case the split is 24% and 30% respectively. Although this split is approximate it implies that high demand is not the only cause of congestion. When there is congestion below the terminal capacity other interruptions or delays are contributing to congestion this may include factors like container handling equipment failure or concentration of operations at limited stacks.

Table 5-6: Queue analysis for hourly truck queue outside A-Check at CTCT from 1 February 2021 to 3 March 2021.

	Feb																											Mar		
Hours	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3
0	0	185	0	0	61	61	0	0	0	61	0	0	0	0	0	0	73	0	0	0	0	0	0	0	47	30	47	0	0	0	0
1	0	185	0	0	61	0	0	0	0	61	0	0	0	0	0	0	73	0	0	0	0	0	0	0	47	30	47	0	0	0	10
2	0	185	0	0	61	0	0	0	0	61	0	0	0	0	0	0	73	0	0	0	0	0	0	0	47	30	47	0	0	0	10
3	0	185	0	0	61	0	0	0	0	61	0	0	0	0	0	0	98	0	0	0	0	0	0	0	47	30	47	0	0	0	10
4	0	0	0	0	61	0	0	0	0	61	0	0	0	0	0	0	98	20	30	0	10	0	0	0	47	30	47	0	0	0	10
5	0	0	0	0	61	0	0	0	0	61	0	0	0	0	0	40	98	40	30	0	23	0	0	20	54	30	87	0	10	0	10
6	60	0	0	0	70	40	0	0	20	61	0	10	0	10	40	40	150	90	30	0	23	0	0	60	105	81	140	0	10	20	10
7	50	51	0	0	60	40	0	0	61	60	20	0	0	0	20	51	117	40	30	0	23	0	0	0	156	117	166	0	30	0	33
8	70	70	0	0	60	40	0	20	70	60	20	0	0	0	20	20	117	20	23	0	23	0	0	20	166	150	166	0	53	0	87
9	70	70	51	0	50	40	0	20	76	70	20	0	0	0	0	40	100	40	23	20	0	0	0	20	182	166	166	20	53	0	124
10	70	70	20	51	40	60	0	20	76	76	20	0	0	0	20	40	100	90	30	10	0	0	0	51	124	166	182	93	50	10	114
11	70	158	70	60	20	60	0	20	61	50	20	0	0	0	20	70	70	70	30	70	10	0	63	90	124	166	166	100	53	47	74
12	70	158	76	50	20	20	0	20	60	50	20	50	10	0	20	60	51	100	67	70	23	30	63	90	124	166	136	30	87	116	156
13	158	158	40	50	158	0	0	40	70	0	0	116	10	0	0	60	93	166	116	70	0	0	51	70	131	166	120	117	136	136	123
14	198	158	51	50	158	20	0	40	61	0	0	172	0	0	61	166	103	117	152	114	0	50	60	87	100	166	94	30	183	193	190
15	212	158	51	50	70	102	0	61	76	20	0	96	0	0	50	166	103	100	163	156	0	117	81	117	47	47	47	0	248	220	170
16	212	158	40	50	60	158	0	20	76	0	0	143	0	0	20	117	117	100	132	100	0	124	70	117	50	47	47	0	208	258	150
17	158	158	20	61	20	158	0	40	76	0	0	220	0	0	43	100	117	100	120	47	0	124	30	47	30	47	47	0	228	258	150
18	158	70	0	61	20	158	0	0	61	0	0	220	0	0	23	100	117	100	94	30	0	114	0	47	30	47	47	0	112	258	150
19	158	20	0	76	20	158	0	0	61	0	0	112	0	0	0	100	117	40	67	30	0	0	10	47	30	47	23	0	96	208	150
20	174	0	0	61	50	102	0	0	61	0	0	10	0	0	0	100	90	0	50	0	0	0	10	47	30	47	0	0	96	150	96
21	174	0	0	61	50	0	0	0	61	0	0	0	0	0	0	81	0	0	50	0	0	0	0	47	30	47	0	0	96	96	30
22	174	0	0	61	50	0	0	0	61	0	0	0	0	0	0	70	0	0	0	0	0	0	0	47	30	47	0	0	47	33	30
23	174	0	0	61	50	0	0	0	61	0	0	0	0	0	0	70	0	0	0	0	0	0	0	47	30	47	0	0	0	0	30
Total	2410	2197	419	803	1392	1217	0	301	1149	813	120	1149	20	10	337	1491	2075	1233	1237	717	135	559	438	1071	1808	1947	1869	390	1796	2003	1917
Queue Attribute																															
Wind	2410	0	0	803	400	32	0	0	1096	315	0	337	0	0	0	280	0	0	0	0	0	0	0	444	1808	1947	990	0	0	0	0
GC Shift Change	0	325	25	0	55	0	0	16	35	0	0	67	0	0	9	69	41	99	61	0	0	29	0	55	0	0	0	0	108	127	79
GC Not Specified	0	39	49	0	0	0	0	0	0	0	0	0	0	0	14	172	632	45	32	50	0	74	0	0	0	0	234	72	0	0	116
IT Systems	0	0	0	0	0	723	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	74	0	0	0	0	0	0	0
D-Block	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	426	61	0	0	0	0	0	0	0
Machine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	169	0	0	10	0	0	0	0	0	0	0	0	0	0
Visibility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	143
Less than TC	0	1225	122	0	445	296	0	216	17	277	120	363	20	10	198	624	620	554	530	208	111	228	12	280	0	0	461	202	611	1116	1133
More Than TC	0	608	223	0	492	166	0	68	0	221	0	382	0	0	116	346	782	366	615	459	14	228	0	157	0	0	184	116	1077	760	445

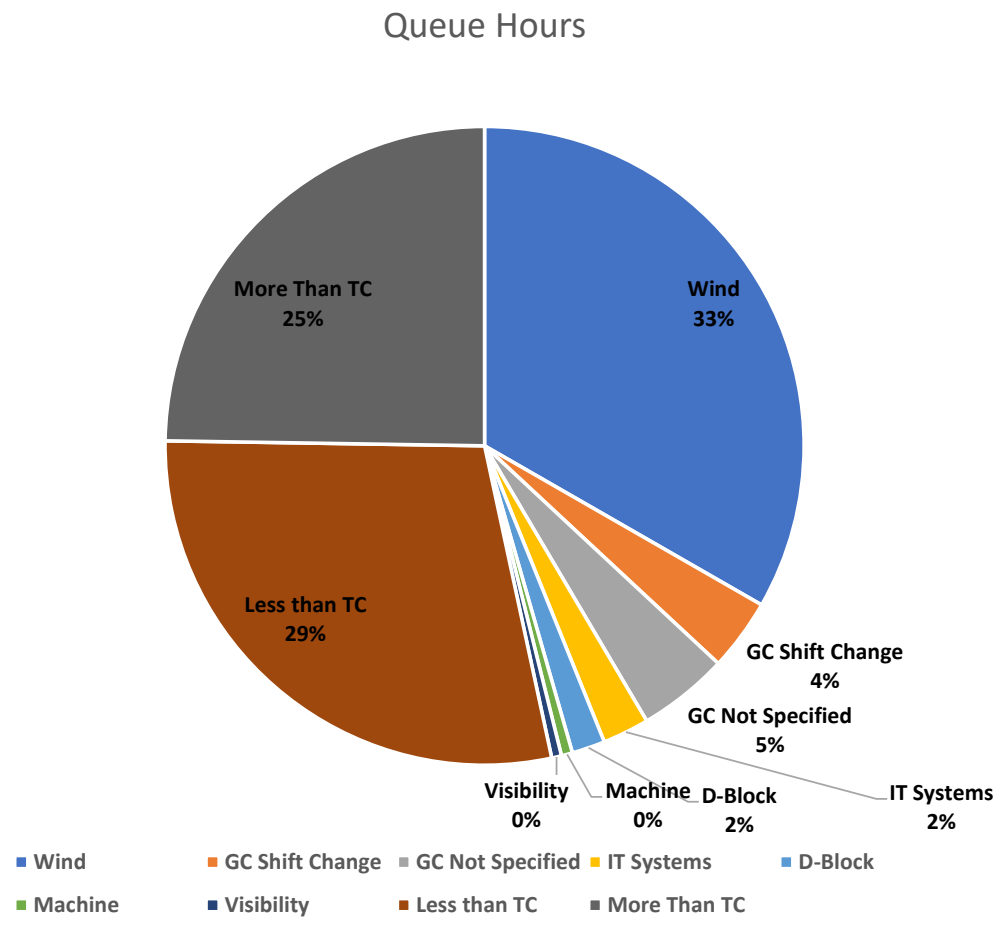


Figure 5-5: A-Check queue attribute distribution.

5.3.2.4 Truck Turn Times

Truck Turn Times (TTT) are a useful key performance metric which represents the efficiency of the container terminal yard. However, in the case of CTCT they are not completely representative as the terminal restricts terminal access resulting in the A-Check queue. So, CTCT TTT's are only partially representative. Nonetheless the TTT's have been calculated and shown as a series of histograms in Figure 5-6. The histograms are shown per gate for trips from 1 February to 3 March 2021.

The TTT values clearly show the terminal is not reaching its target performance which is defined as 35 minutes. These values indicate that there is congestion and queueing inside the terminal. Although not quantifiable, anecdotal reasons for the low yard productivity include:

- Insufficient yard equipment i.e. RTG's, straddle carriers and empty container handlers
- Equipment breakdowns

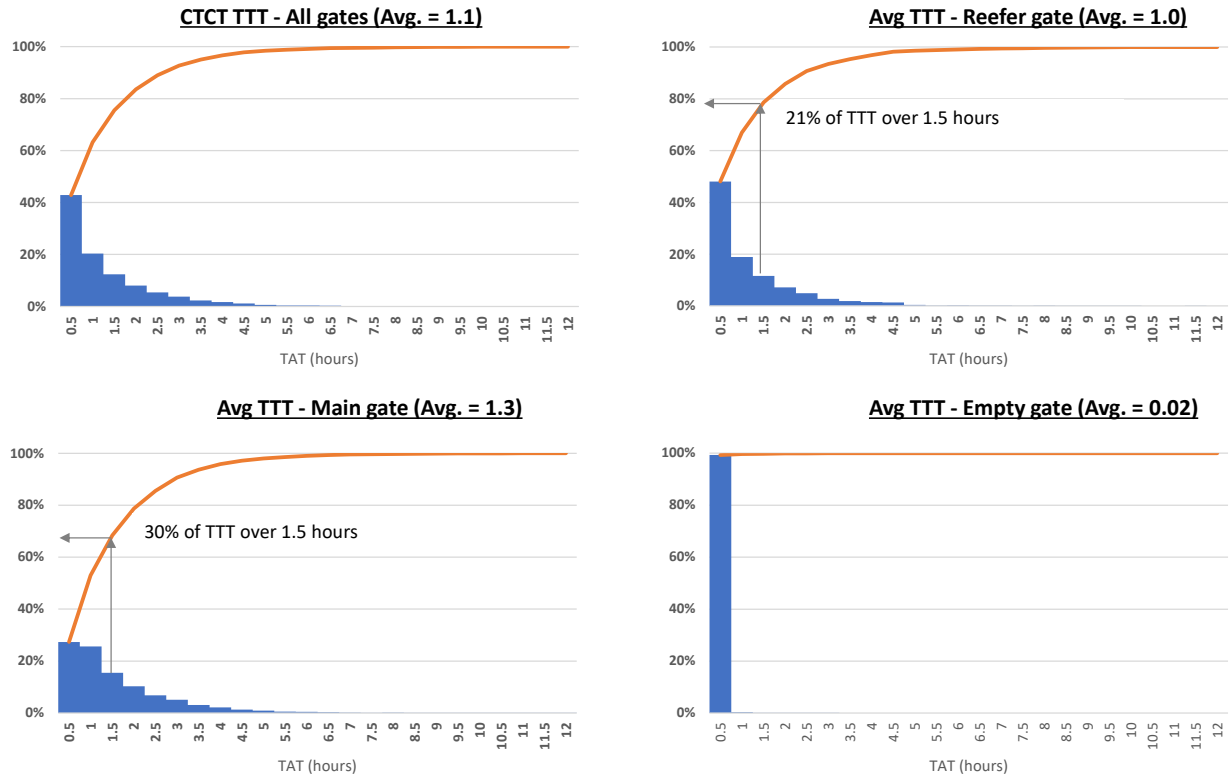


Figure 5-6: TTT histograms for 1 February to 3 March 2021 at CTCT.

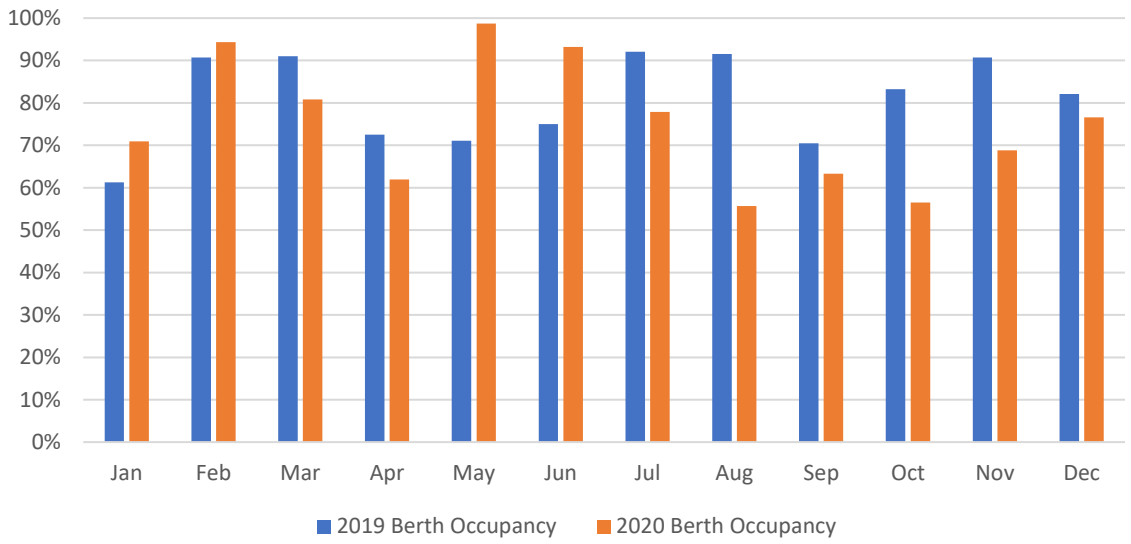
5.3.3 High level berth analysis

Berth occupancy figures for CTCT are illustrated below in Figure 5-7. These berth occupancy figures are calculated on the assumption that CTCT operates as a three berth facility which it predominantly does. However, it is noted that if the terminal operates as a four berth facility the berth occupancy figures would be lower.

International guidelines for the design of container terminals recommend a target berth occupancy of 60% for a three berth container terminal (PIANC, 2014). When these values are exceeded it indicates:

- High anchorage waiting times, associated costs and vessel bypassing.

- A terminal that has reached its capacity at current performance levels.



Year	Monthly Berth Occupancy												Annual AVG
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2019 →	61%	91%	91%	72%	71%	75%	92%	92%	70%	83%	91%	82%	**81%**
2020 →	71%	94%	81%	62%	99%	93%	78%	56%	63%	57%	69%	77%	**75%**

Figure 5-7: CTCT monthly berth occupancies for 2019 and 2020.

5.4 TPT Multi Purpose Terminal

5.4.1 Introduction

TPT Multi Purpose Terminal (TPT MPT) is situated in Duncan Dock in the Port of Cape Town. The location of the terminal entrance is annotated below in Figure 5-8. The terminal has no truck staging area so in times of congestion the trucks queue alongside Duncan Road as shown in the figure.

To inform the identification, quantification, and root cause of congestion at TPT MPT. The following data sets were obtained for analysis:

- Queue length outside the terminal – Captured by analysis of security cameras, as annotated in Figure 5-8
- TOS gate data – Provided by the terminal. The data included truck in and out times, container type
- TOS berth utilisation data - Provided by the terminal. The data included vessel name, arrival and departure times. Berth names were not provided.
- A log of SMS's sent by the terminal to transporters to communicate terminal operation issues. The SMS's range in detail at times identifying the cause of congestion and at other times not providing any detail.

It is noted that significantly more detailed data on the terminal was requested on several occasions to support the root cause analysis however unfortunately the terminal could not provide it.

The following sections provide an analysis of the data.

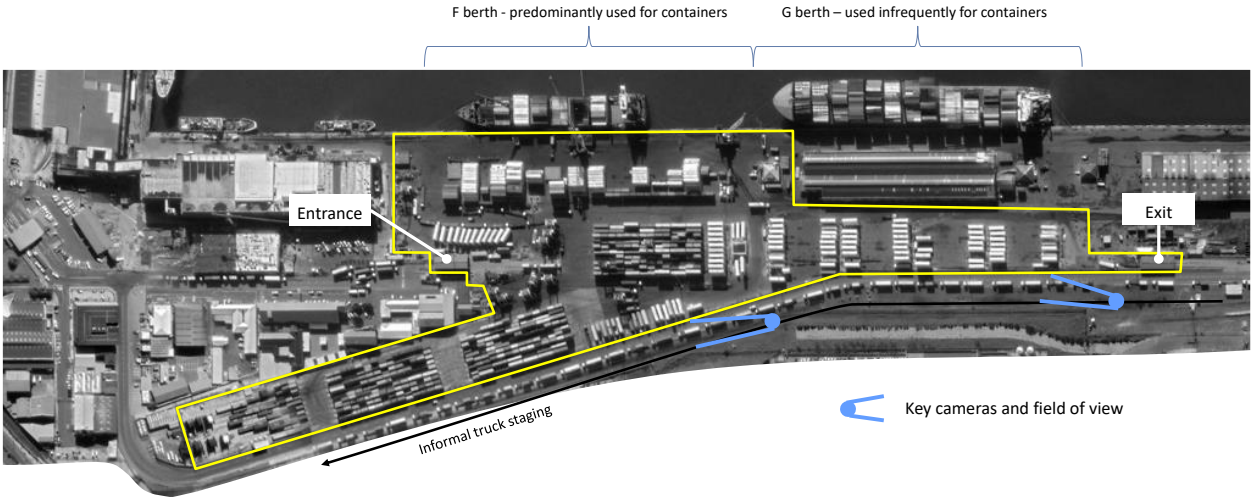


Figure 5-8: TPT MPT locality, entrance and typical queue location.

5.4.2 Analysis

The hourly trucks entering the terminal, trucks outside the terminal and the TTT's are presented in Table 5-7, Table 5-8 and Figure 5-9. In comparison to the equivalent data at CTCT it is immediately clear that the terminal is significantly smaller than CTCT and suffers from less congestion. The total number of trucks entering TPT MPT on most days is less than the number of trucks often entering CTCT in one hour.

From a truck queue perspective there were only five days with notable congestion. Based on review of the gate data, the terminal SMS's and Windguru data congestion has been attributed to these days as follows:

- Feb 4th – Probably wind but no terminal SMS

- Feb 9th– Probably wind but no terminal SMS
- Feb 10th– Probably wind but no terminal SMS
- Feb 13th- Appears to be a demand surge
- Feb 25th- Wind and confirmed with a terminal SMS

Inside the terminal the TTT values show significantly less congestion than CTCT. More than 80% of the time the TTT is below the target of 35 minutes.

Table 5-7: Hourly trucks entering MPT from 1 February 2021 to 3 March 2021.

	Feb																												Mar		
Hours	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	0	0
2	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	14	0	0
3	0	0	0	0	0	0	0	0	0	0	5	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	11	0	0
4	0	0	0	0	0	0	0	0	0	0	11	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0
5	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	1	0	0
6	12	7	9	10	9	14	14	8	9	7	3	5	2	0	4	1	3	0	4	2	1	6	7	7	15	6	9	3	7	0	1
7	19	22	17	9	4	23	4	13	9	1	8	12	11	3	7	5	2	9	6	2	1	8	18	9	15	13	5	17	6	2	1
8	23	17	7	21	14	33	4	22	19	6	21	8	29	4	7	5	11	2	18	7	2	4	16	10	29	0	13	14	13	0	11
9	21	19	16	24	6	22	5	15	11	3	31	8	29	20	18	5	16	3	9	17	11	21	24	7	35	0	14	20	13	4	8
10	8	17	27	22	20	26	2	12	6	10	15	7	22	8	19	2	4	7	13	10	8	11	23	18	7	10	18	3	9	4	15
11	25	17	22	21	24	22	3	23	31	15	27	11	29	13	21	8	11	6	16	23	8	6	25	13	35	28	11	16	21	18	6
12	10	17	21	16	21	28	18	21	25	13	40	10	49	8	30	0	7	3	6	21	8	8	32	17	32	15	10	26	19	15	7
13	4	12	20	19	11	12	24	25	21	19	24	8	33	1	23	0	15	3	6	11	12	12	19	17	21	16	6	11	15	3	8
14	24	5	20	22	26	0	4	29	14	15	22	8	23	4	18	2	13	15	6	7	2	11	23	27	28	8	26	10	20	10	8
15	27	11	41	31	10	0	21	36	13	8	22	9	35	2	12	0	6	16	13	20	11	13	13	19	26	23	17	28	20	17	10
16	22	5	19	26	17	0	13	29	20	16	20	9	6	5	27	1	4	6	7	10	2	23	15	22	18	6	30	19	15	14	5
17	2	4	10	35	5	0	0	27	17	11	10	4	3	1	15	0	5	15	3	0	4	17	16	18	3	13	17	11	12	12	5
18	11	4	12	18	12	0	0	17	6	14	12	10	0	0	23	0	0	17	5	0	0	10	11	24	3	1	6	0	10	15	3
19	9	6	10	28	4	13	0	27	8	17	5	5	0	0	27	0	2	32	4	0	0	11	25	8	0	9	5	0	15	5	1
20	5	1	5	6	4	12	0	16	24	21	13	5	0	0	7	0	2	17	3	0	0	4	9	3	1	23	14	4	2	4	4
21	5	0	2	0	1	0	0	14	4	3	0	1	0	0	1	0	1	5	2	0	0	0	1	1	0	17	14	26	1	1	0
22	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	14	0	0	0
23	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	23	0	0	0
Total	**227**	**164**	**258**	**308**	**188**	**205**	**112**	**352**	**237**	**179**	**304**	**141**	**271**	**69**	**259**	**29**	**102**	**156**	**121**	**130**	**70**	**165**	**277**	**220**	**268**	**189**	**224**	**290**	**244**	**124**	**93**
AVG/hr	**14**	**11**	**16**	**21**	**12**	**21**	**10**	**21**	**15**	**11**	**18**	**8**	**23**	**6**	**16**	**4**	**7**	**10**	**8**	**12**	**6**	**11**	**17**	**14**	**19**	**13**	**13**	**15**	**12**	**9**	**6**
Max/hr	**27**	**22**	**41**	**35**	**26**	**33**	**24**	**36**	**31**	**21**	**40**	**12**	**49**	**20**	**30**	**8**	**16**	**32**	**18**	**23**	**12**	**23**	**32**	**27**	**35**	**28**	**30**	**28**	**21**	**18**	**15**
AVG TAT	**0.2**	**0.2**	**0.3**	**0.3**	**0.3**	**0.4**	**0.1**	**0.3**	**0.6**	**0.5**	**0.3**	**0.3**	**0.3**	**0.5**	**0.2**	**0.3**	**0.1**	**0.5**	**0.3**	**0.3**	**0.1**	**0.1**	**0.2**	**0.2**	**0.1**	**0.4**	**0.4**	**0.1**	**0.2**	**0.3**	**0.3**

Table 5-8: Hourly truck queue outside MPT from 1 February 2021 to 3 March 2021.

	Feb																												Mar		
Hours	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	299	0	85	0	0	273	106	23	0	104	0	0	38	15	98	0	0	0	0	0	0	0	626	30	0	0	0	0

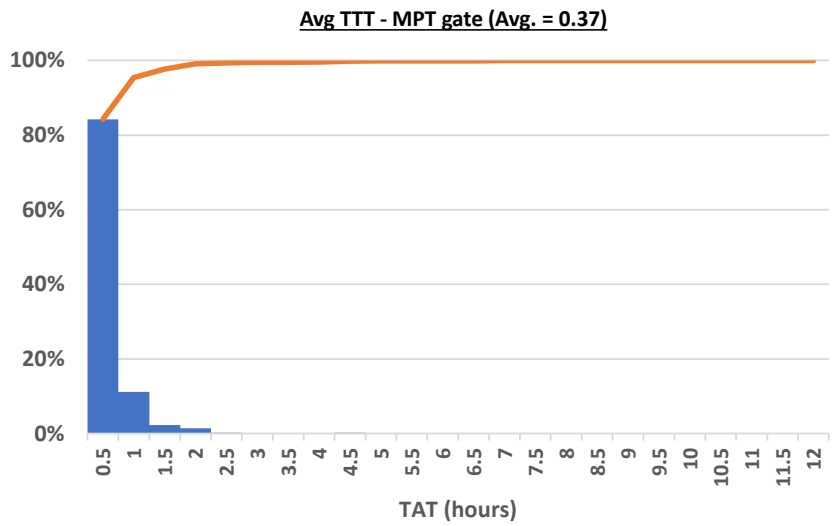

Figure 5-9:TTT histogram for 1 February to 3 March 2021 at CTMPT

6. DETERMINING THE COST OF CONGESTION

6.1 Preliminary estimate

The financial impact of congestion on the container trucking industry may be roughly estimated by quantifying the direct standing costs.

The truck stranding time, attributable to congestion, occurs at queues both outside and inside the terminals. Truck hours outside the terminals are represented by the total truck hours spent in the queue. Inside the terminal congestion is only attributable to time above the target TTT and hence is calculated as follows:

$$Total\ terminal\ truck\ congestion = Total\ truck\ time\ in\ terminal - (Number\ of\ trucks \times target\ TTT)$$

The direct standing hours may then be converted to a monetary value by multiplying the hours by a trucking standing cost. This is presented in Table 6-1. The supporting cost model for determination of the hourly rate is shown further below in Table 6-2.

Table 6-1: Estimated direct cost of truck congestion at CTCT and MPT – Over a 31-day period (1 Feb 2021 to 3 March 2021).

	Location of standing hours		Rate	Amount	Daily Average
	Outside terminal	Inside terminal			
CTCT	33 023	12 137	R 220	R 9 935 218	R 320 491
MPT	1 697	0		R 373 340	R 12 043
Total	34 720	12 137	-	R 10 308 558	R 332 534

Table 6-2 shows the assumptions made in quantifying the daily and hourly cost for running a container transporter truck. These inputs were determined through stakeholder engagements and price checking certain items.

Table 6-2: Cost model for truck running costs.

Item	Input cost	Qty	Rate	Amount/day
Fixed Costs (Based upon Second hand Equipment)				
Truck Depreciation Allowance	R 850 000.00			R602
Trailer Depreciation Allowance	R 250 000.00			R177
Term	60.00	MTh		
Interest	0.83%	per MTh		
Insurance		2.5%	R3 014	R75
License Fees		100%	R66	R66
Variable Costs				
Fuel (Idling)		14	R14	R199
Maintenance		1	R90	R90
Repairs		1	R151	R151
Sundries		10%	R440	R44
ESTIMATED TOTAL COST PER DAY (Excluding Driver)				R1 404
ESTIMATED TOTAL COST PER Working hours (10 hours) (Excluding Driver)				R140
Add Driver (R80/hr)				**R220**

6.2 Proposed rigorous methodology

Estimating the cost of congestion due to inefficiencies is complex as the terminal inefficiencies knock onto multiple stakeholders who incur direct costs and often loss of profits. A preliminary identification of costs to various key logistics stakeholders is summarised below in Table 6-3.

Table 6-3: A summary of congestion costs effecting logistics chain stakeholders.

		Logistics Chain Stakeholders					
		Shipping Liners	Port Terminals	Transporters	Exporters & Importers	MT Depots	Freight Forwarders
Cost Tiers	Direct Costs	-Demurrage costs -Standing costs	-Higher OPEX	-Standing costs -Additional planning	-Higher inventory costs	-Overtime costs	-Additional planning
	Lost Profits	-Lost volumes	-Lower volumes	-Less trips	-Time sensitive cargo misses market peaks -Spoilt goods		
	Third Party Costs	-Emissions	-Emissions	-Emissions			

It is proposed that the following approach is followed to quantify the costs:

- Research previous methodologies and methods of the valuation of congestion costs
- Report on findings
- Select preferred approach and develop model
- Determine the input costs of delay for each major player in the logistics chain
- Gather and analyze data to quantify standing times and profit loss
- Determine costs per stakeholder
- Consolidate findings and finalize cost model
- Draft report for review

7. SUMMARY: KEY POINTS OF CONGESTION AND THE ROOT CAUSES

Based on stakeholder engagement (Section 3) and a supporting data analysis (Section 5) three key points of congestion were identified in order of severity (from worst to least) as:

1. Port Terminals, in particular Cape Town Container Terminal (CTCT)
2. Empty Container Depots
3. City Traffic

Of the port terminals, Cape Town Container Terminal is by far the largest and most significant contributor to congestion. Over the 30 day period 96% (45 160 hours) of truck congestion hours were recorded at CTCT and 4% (1 697 hours) were recorded at TPT MPT. At CTCT there are two points of congestion which occur, outside A-Check, the terminal gate, and inside the terminal where trucks wait to be loaded or unloaded. At TPT MPT congestion was only recorded for trucks waiting outside the terminal.

Similarly at the empty depots congestion key points occur whilst waiting to enter and then within the terminal waiting to be serviced. However no data was available to quantify this.

The root cause of congestion at CTCT, determined from data analysis, may be broken down as follows:

- **Approximately 30% of A-Check truck congestion is attributable to wind disruption at the terminal**
- **9% of the congestion is created by gate closures of which approximately half occur during shift changes**
- **4% is attributed to D-block (stack congestion) and IT system failure**
- **The remaining 54% of the truck waiting hours have no clear reason attributed to them.**
    - In an attempt to identify when this congestion may have been due to overload conditions the percentage has been divided into times when the terminal was above and below its current estimated capacity respectively. In this case the split is 24% and 30% respectively. Although this split is approximate it implies that high demand is not the only cause of congestion. When there is congestion below the terminal capacity other interruptions or delays are contributing to congestion this may include factors like machine failure or concentration of operations at limited stacks.

Other causes of congestion at CTCT, anecdotally described, include:

- Port equipment – Insufficient numbers of equipment, breakdowns and low availability
- Poor communication – from the terminal to transporters resulting in transporters arriving at an already closed or heavily congested terminal

8. IMPROVEMENT OPPORTUNITIES

8.1 Overview

Reduction of container truck congestion at ports is a common problem which has been analysed in multiple studies. A useful overview of the various improvement opportunities in literature is provided by Lange, et al. (2017) in their paper, *Reducing truck congestion at ports – classification and trends*. The paper is based on an extensive literature review of 71 publications on waiting times at terminals and container transporter operations. Ultimately, they classify the means to reduce port congestion in the 8 categories described below in Table 8-1.

Table 8-1: Classification of means to reduce port congestion. Modified from Lange, et al. (2017)

No.	Means	Description/Example
1	improve traffic control	port authority point of view
2	improve cooperation in the port	between different stakeholders
3	improve truck scheduling	e.g. job sequence, organization
4	improve route finding	use of algorithms
5	influence truck arrivals	e.g. opening hours, incentives
6	improve Truck Appointment System	e.g. slot length, booking, rules
7	improve yard management	e.g. space allocation, equipment
8	other	e.g. decision support systems

Almost all of these means have application to aiding congestion at the port terminals and their relevance is unpacked below.

- Improved yard management
  - This is synonymous with improved terminal productivity and clearly has the potential to significantly reduce congestion. Based on anecdotal insights there are several areas which warrant further investigation:
    - Terminal equipment and Preventative maintenance
      - Previous studies have picked up that a large number of RTG's and straddle carriers are out of commission and have low availability. The terminal equipment requirements should be assessed and addressed if there are shortcomings.
      - Equipment availability and downtime has been raised by several stakeholders as an issue. A comprehensive preventative maintenance strategy and spare part inventory should be integral to the terminal's operations approach.
    - Yard planning
      - There have been instances when certain yard blocks get congested. Good housekeeping and a revised deck plan may help to avoid this.
    - Wind
      - Equipment should be fitted with anti-sway wind mitigation technology to enable higher wind thresholds.
    - Shift changes

- This has clearly been identified as a problem (Section 5.3.2.1). Shift change-over times need to be reduced by ensuring the relief shift is at the gate when the working shift ends.

- Improved traffic control
  - At CTCT traffic control is a major issue as the terminal's truck staging area is limited to approximately 60 trucks. With 250 trucks frequently waiting to access the terminal the overflow results in congestion along the main port road (Duncan Dock Road). Transnet is currently designing a new truck staging area as part of the Terminal Phase 2B Expansion project. The new truck staging and gate is expected to reduce the congestion along Duncan Dock Road. However, the truck staging area will not change the waiting times of trucks, it will just provide a designated area for the standing trucks. Whilst this is necessary from a safety and driver comfort point of view it will not reduce truck congestion.
- Improved cooperation in the port
  - This is an area that has in recent times improved significantly. The terminal holds weekly meetings with stakeholders and sends SMS's when there are operational problems. There is however opportunity for more transparency. A more established system which provides real-time information of key points of congestion at the ports terminals and empty depots will aid transporters to work around congestion as far as possible. It is noted that the need for this has already triggered the transporters to develop a prototype phone app to meet these objectives. The development and funding of a more comprehensive system supported by webcams is suggested as one opportunity for improvement.
- Improved truck scheduling, Truck Appointment Systems and Influencing truck arrivals
  - All these improvement means are similar in that the aim is to flatten demand peaks and spread out the demand on the terminal. CTCT congestion could certainly benefit from both a Truck Appointment System and Influencing truck arrivals if they are well designed and implemented. These interventions have been very successful in some cases and failed in others.
  - Influencing truck arrivals represents an opportunity for synchronization of the logistics chain. The technique has been successfully implemented by the Ports of Los Angeles and Long Beach which use the PierPASS OffPeak Programme to encourage night use. The programme resulted in the shifting of 30 to 40% of cargo to off peak times (Mobility, 2021). The scheme works by imposing a Traffic Mitigation Fee (TMF) on peak trips which is used to fund a night-time shift during which no fee is charged.
  - The Israel "Good Night" Programme provides another case study on influencing truck arrivals. This scheme paid an incentive for off-peak trips but has not had the success of the PierPASS OffPEAK Programme and resulted in only 7.9% of all trips arriving and leaving at night (Bentolila, et al., 2016).
- Improved route finding
  - Better access between the terminal, empty container depots and cold stores could reduce traffic congestion and lower transporter road time. In principle this is another potential improvement however the potential gains from the interventions mentioned above are probably larger.

8.2 Quick wins

Whilst the opportunities described above have significant potential to improve congestion in the short to medium term. There are several quick wins, identified in the data analysis, which may help in the immediate future:

- Shift changes
  - This has clearly been identified as a problem (Section 5.3.2.1). Shift change-over times need to be reduced by ensuring the relief shift is at the gate when the working shift ends.
- Night-time operations and catch-up gangs after wind delays
  - After significant wind delays there is significant pent-up demand the next day. In most cases there are also overnight queues. The terminal should proactively open at night as soon as the wind drops and allow all container types not just reefers. The next day should also be planned for as significant demand can be expected.
- Night shift delivery for reefers
  - As described in Section 4. The fruit export industry experiences significant peaks and represents high volumes with a relatively small number of stakeholders. Thus there is the opportunity to synchronize this part of the logistics chain to enable off peak operations. This could potentially be achieved by organisation rather than incentive. The stakeholders would include CTCT, the empty depots, transporters, and the cold stores.

9. CONCLUSIONS AND RECOMENDATIONS

This study has mapped the macro logistics chain of container trucks and in doing so identified key points of congestion, the corresponding root causes, determined the congestion costs and identified improvement opportunities.

It was found that the Cape Town Container Terminal was the principal point of congestion with queuing occurring both outside the terminal gate and inside the terminal. Empty container depots and traffic were identified as other lesser points of congestion.

The two primary root causes of congestion at the CTCT include: Wind induced downtime and insufficient terminal productivity. It was estimated that wind accounted for approximately 30% of truck congestion over the period. The remainder is attributable to terminal productivity which manifests as disruptions in terminal operations and times when the terminal cannot adequately service demand.

Some causes for the low terminal productivity could clearly be seen from data whilst many others can only be inferred from anecdotal sources. The negative impact of slow shift changes, gate closures and IT failure on gate productivity was clearly seen in the available data (accounting for 11% of congestion). However, the other reasons for low terminal productivity can only be inferred these include, high rates of equipment downtime and sub-optimal yard planning.

The direct cost of this congestion on the container transporter industry was estimated at R10 mil over the 31 day study period or an average of R330 000 per day.

Several congestion alleviation opportunities were identified and described these include:

- Improving the container terminal efficiency
- Introduction of Truck Appointment Systems
- Influencing truck arrivals – by using financial incentives
- Improved communication and transparency between stakeholders

Quick win opportunities included:

- Eliminating the delays experienced during shift changes at CTCT A-check
  - Shift change-over times need to be reduced by ensuring the relief shift is at the gate when the working shift ends.
- Pro-actively catching up with demand after wind delays at CTCT
  - Opportunities include fully staffed night-time operations for all container types and increasing gangs to cope with pent-up demand.
- Night shift delivery for reefers
  - The fruit export industry experiences significant peaks and represents high volumes with a relatively small number of stakeholders. Thus, there is the opportunity to synchronize this part of the logistics chain to enable off peak operations. This could potentially be achieved by organisation rather than incentive. The stakeholders would include CTCT, the empty depots, transporters, and the cold stores.

It is recommended that this initial investigation feeds into more detailed studies with the ultimate objective of reducing congestion in the container logistics chain. The next steps should include gaining a detailed understanding of CTCT, this would include:

- A diagnostic investigation of Cape Town Container Terminal
  - With scope including:
    - Operations review
    - Procurement process review
    - Human resource review
  - Detailed data access and terminal collaboration will be essential elements for this study.

Subsequently, with an in-depth understanding of CTCT, the longer-term congestion alleviation opportunities may be advanced along with any new insights.

ANNEXURE A | DAILY GATE DATA AT CAPE TOWN CONTAINER TERMINAL

FEBRUARY

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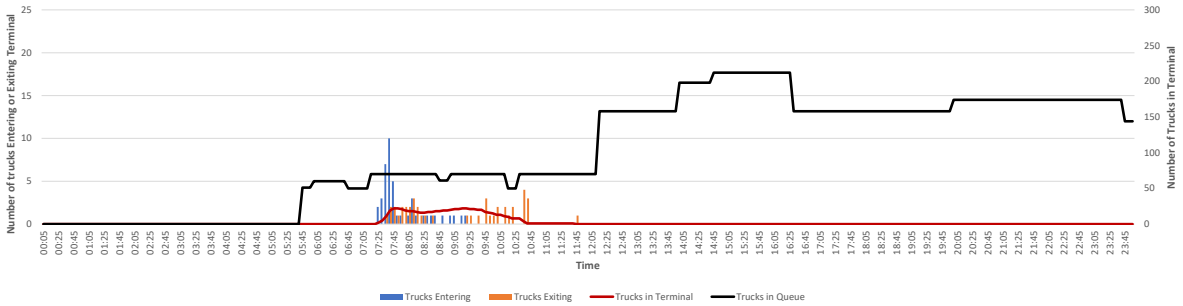

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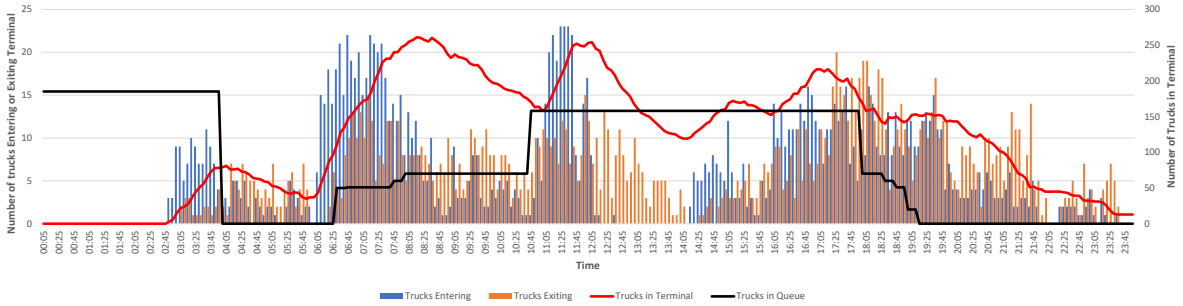

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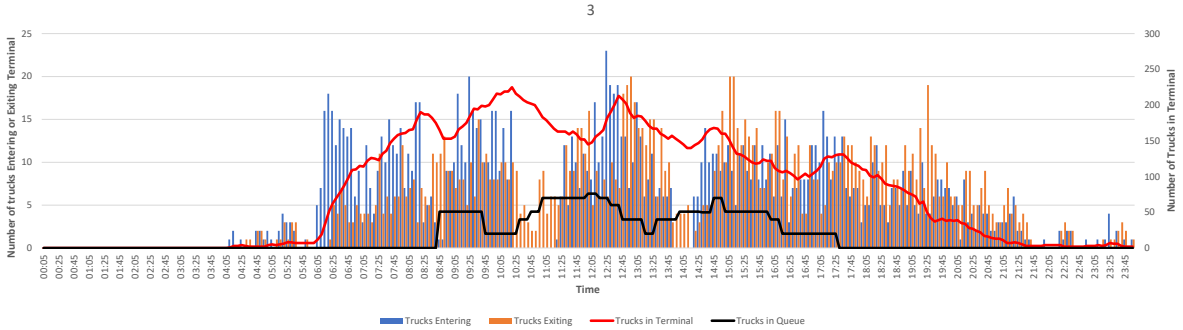

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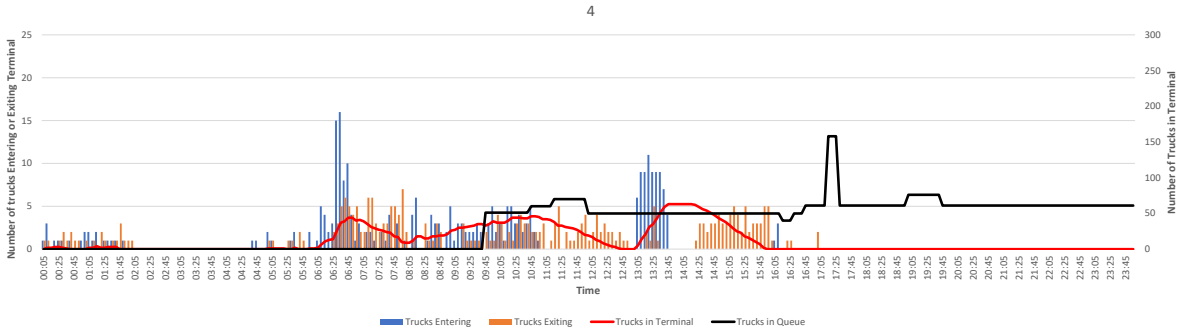

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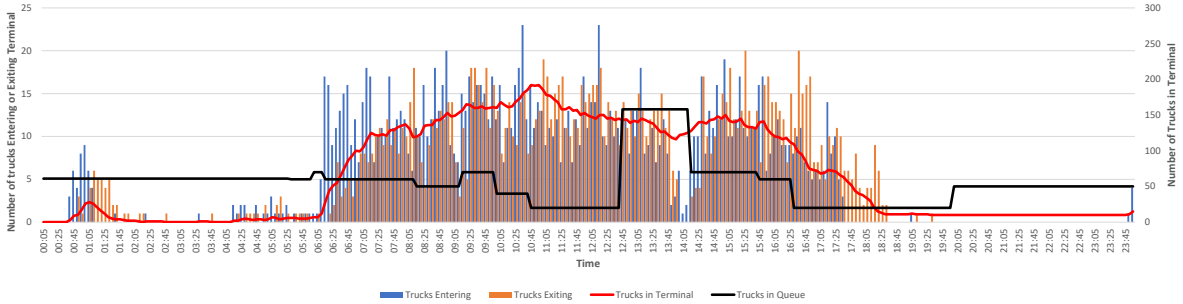

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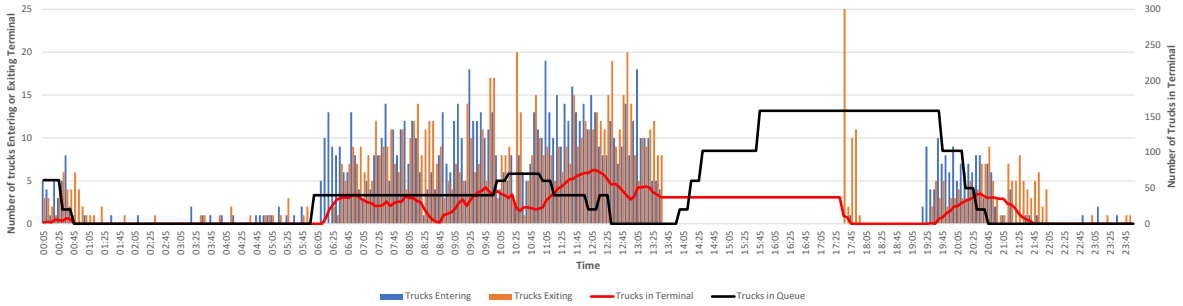

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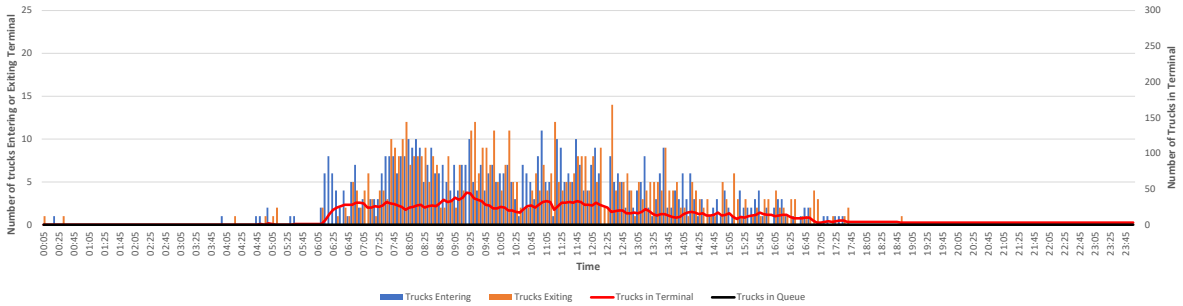

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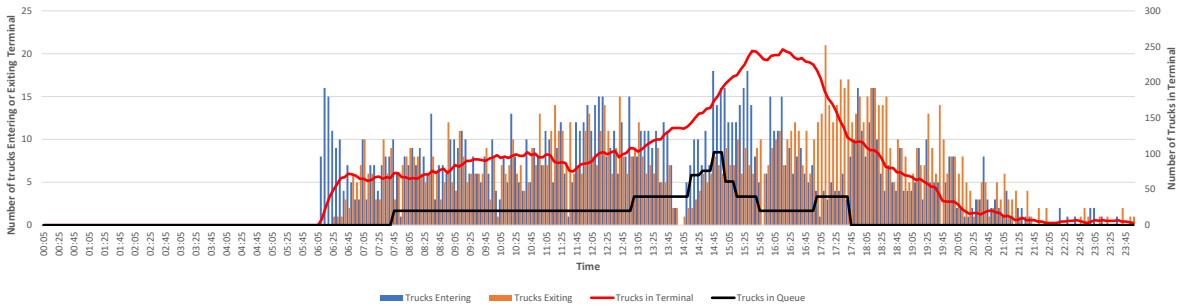

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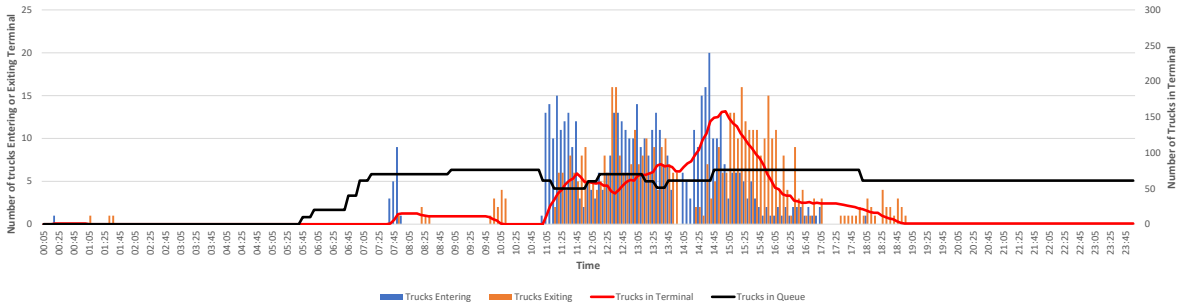

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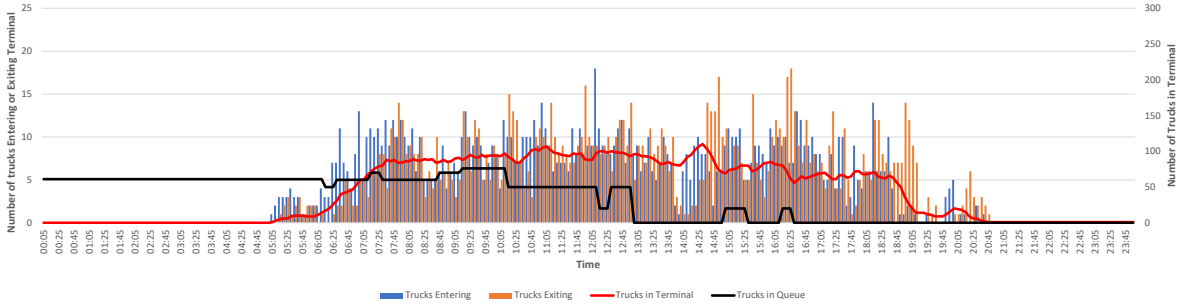

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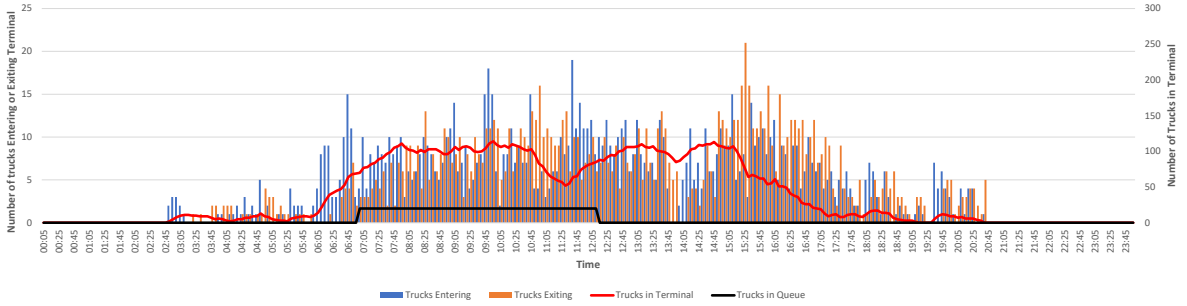

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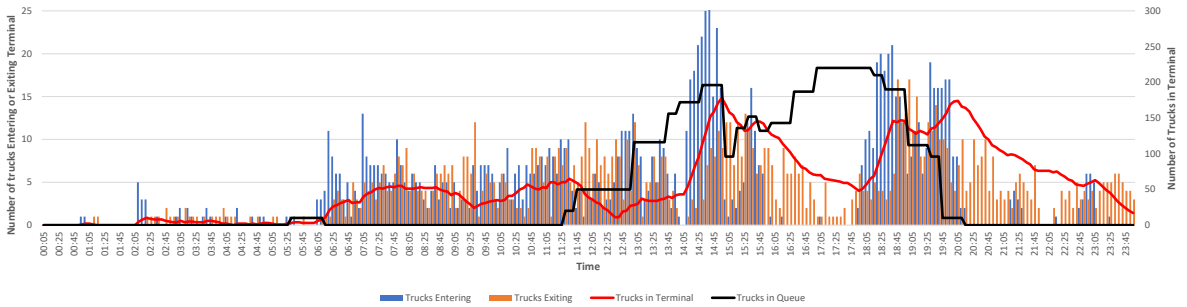

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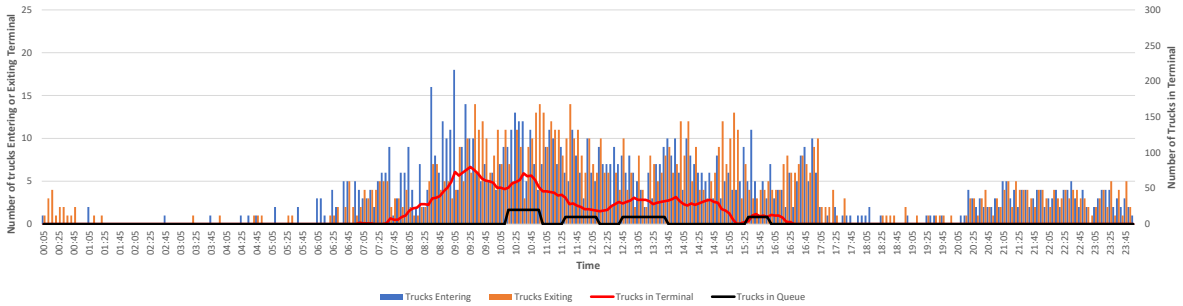

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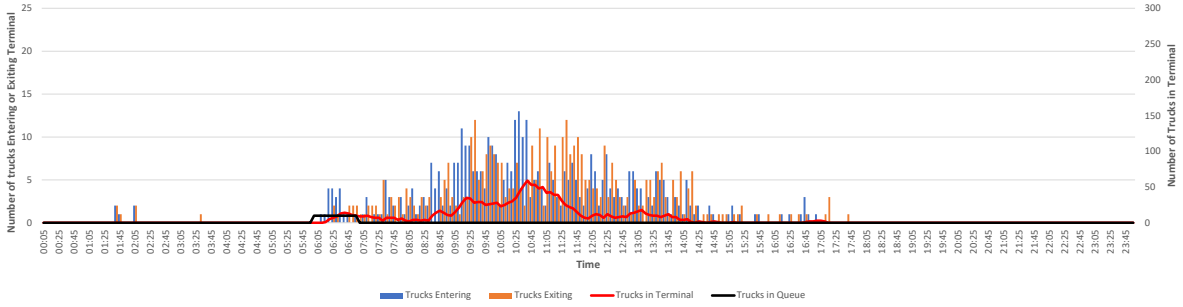

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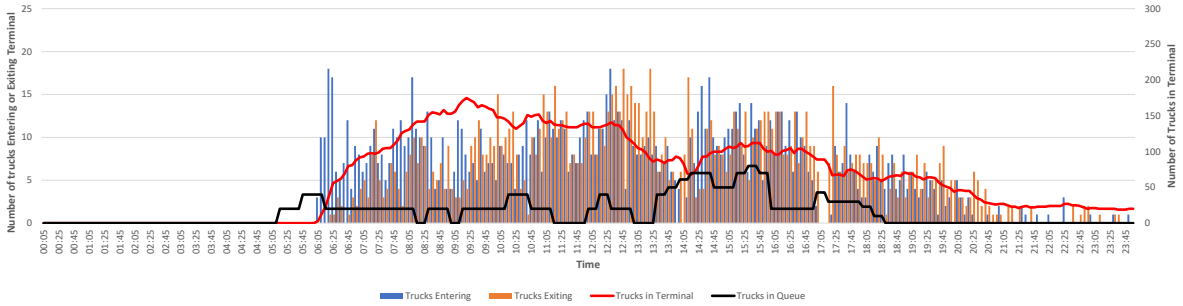

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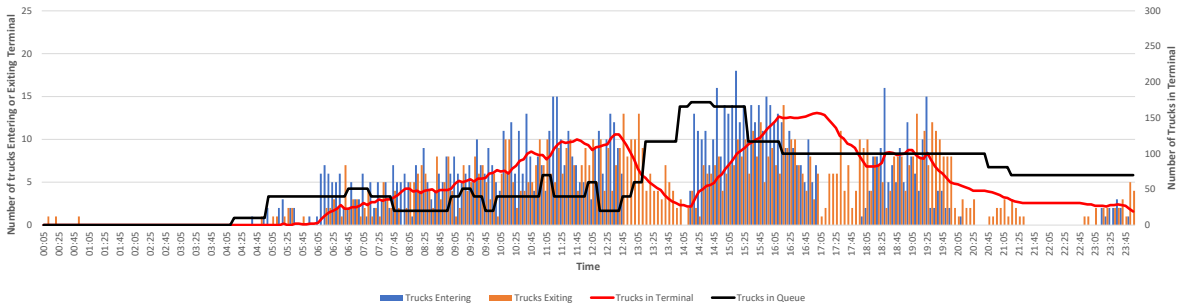

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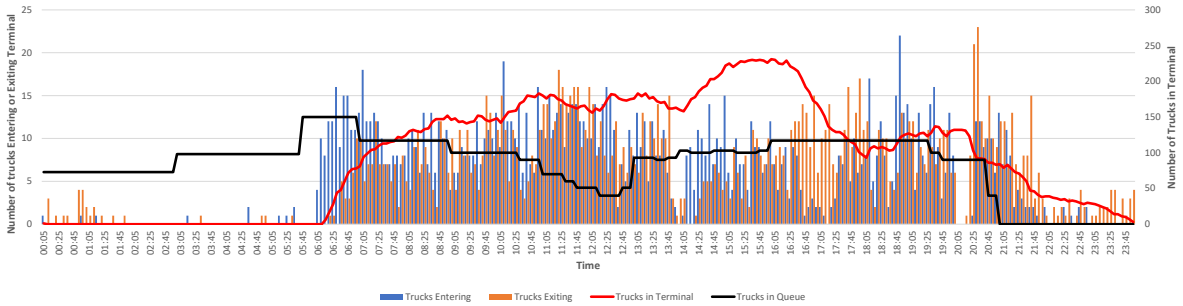

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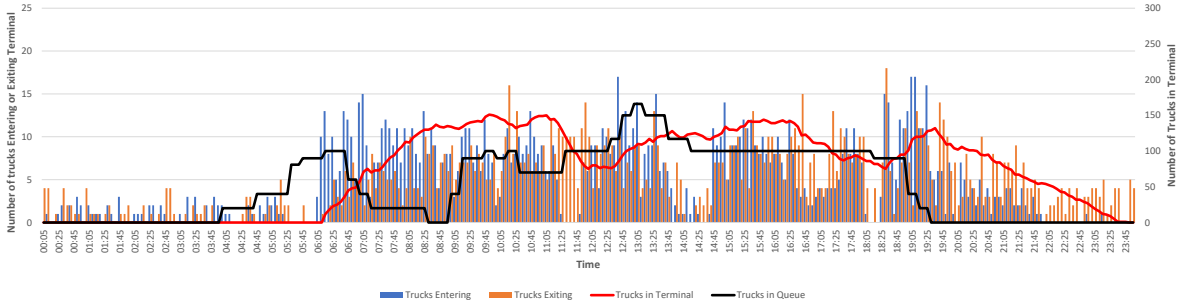

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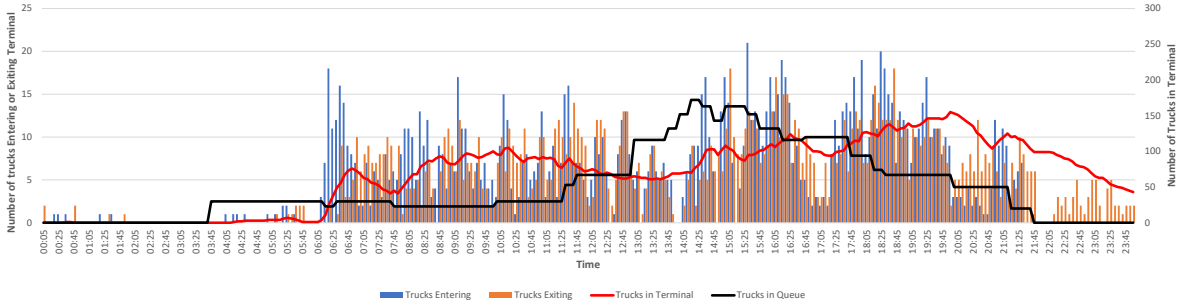

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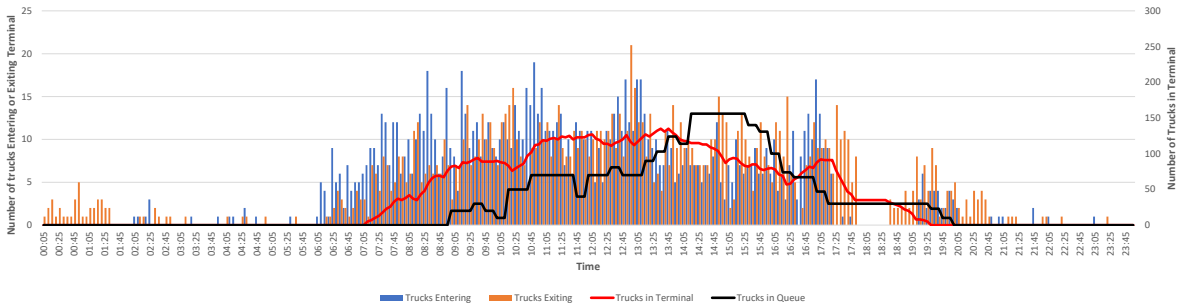

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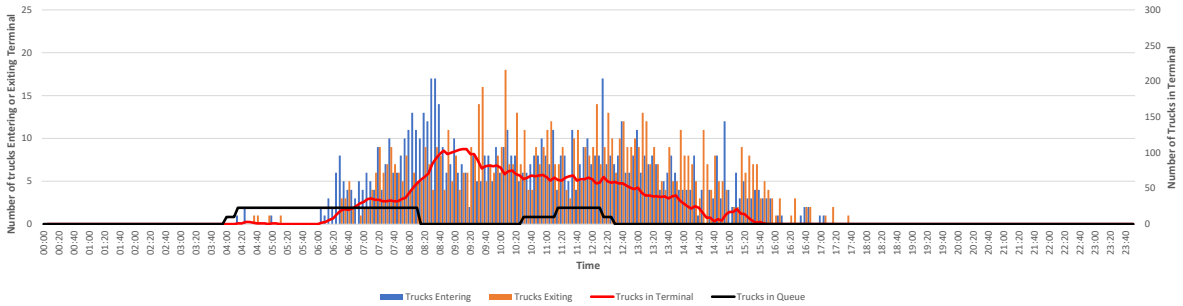

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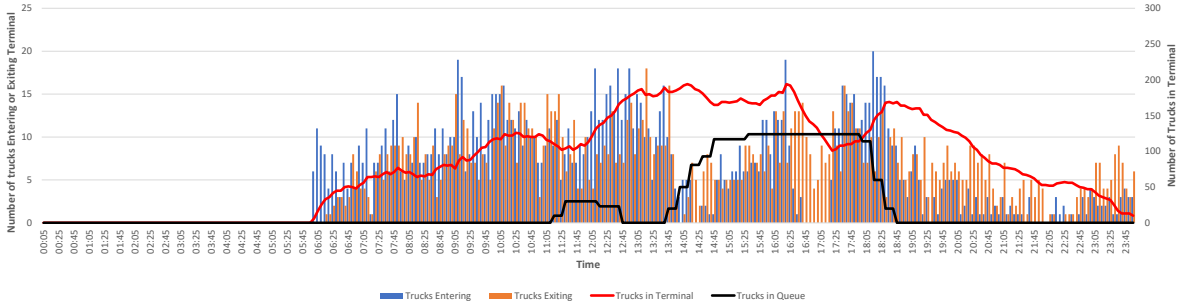

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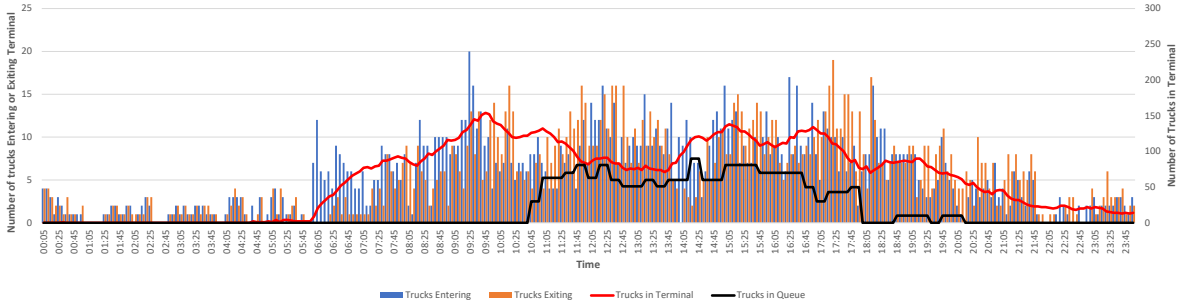

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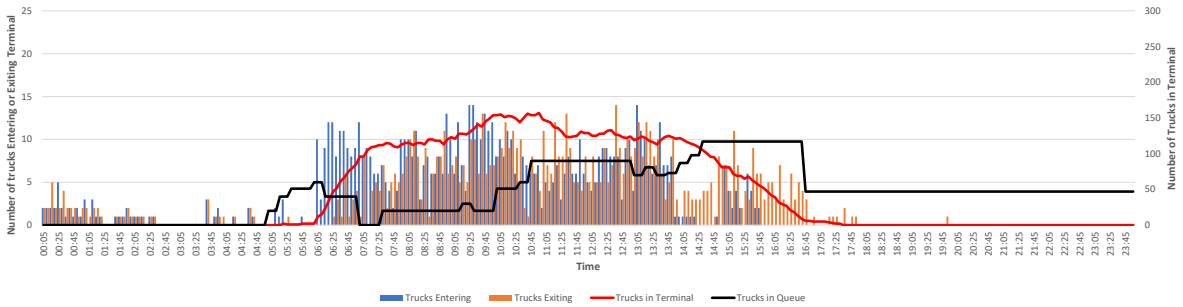
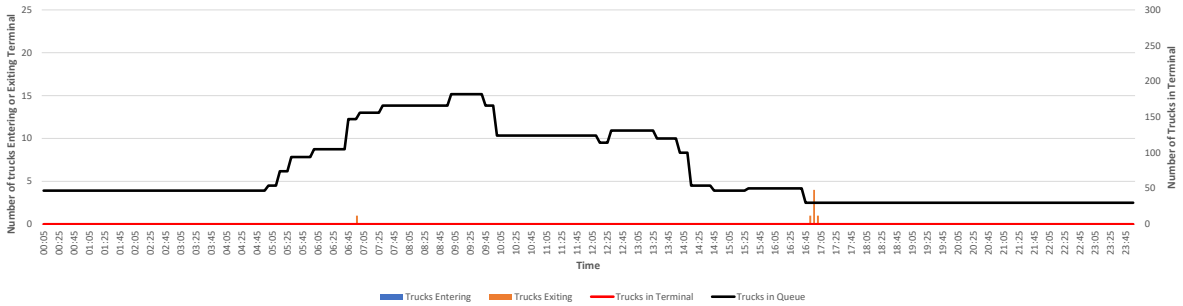


FEBRUARY

25



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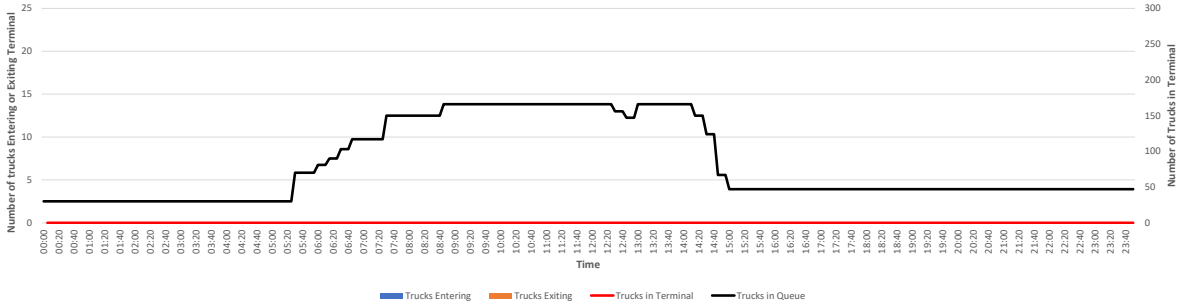

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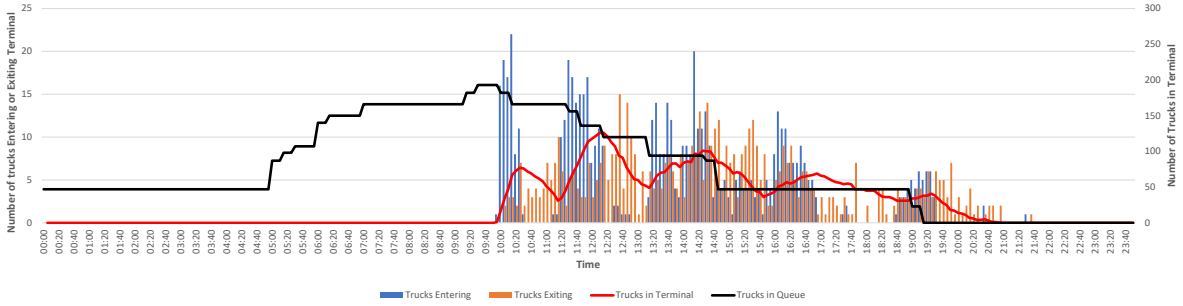

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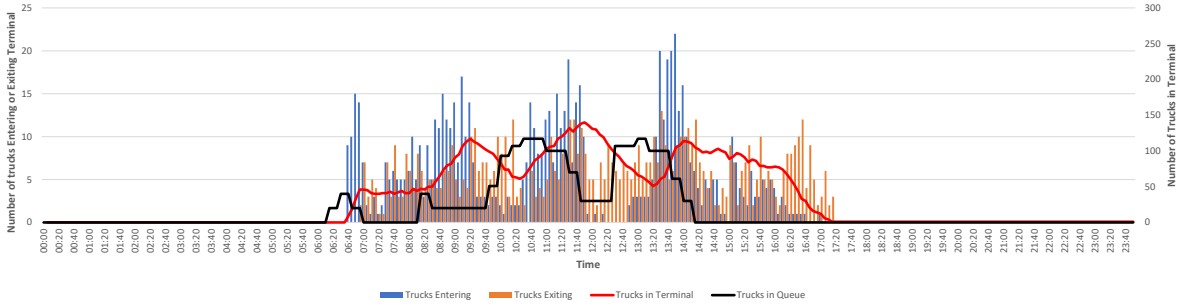
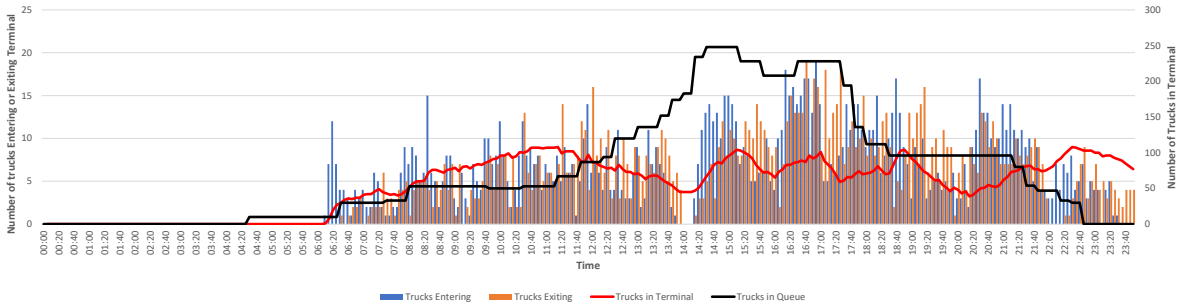
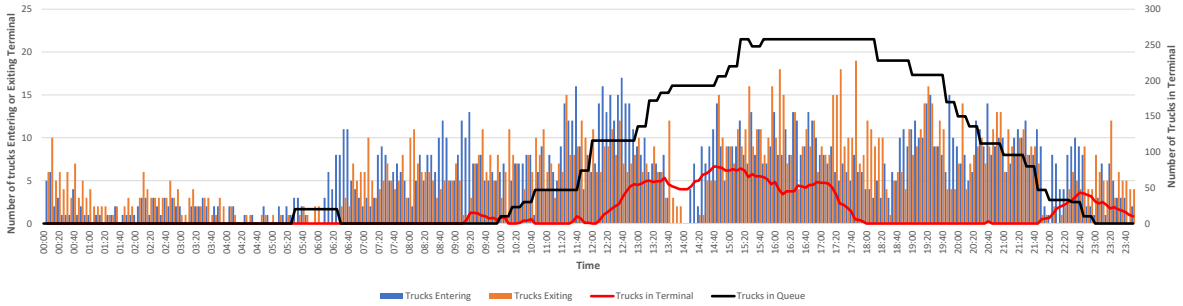


MARCH

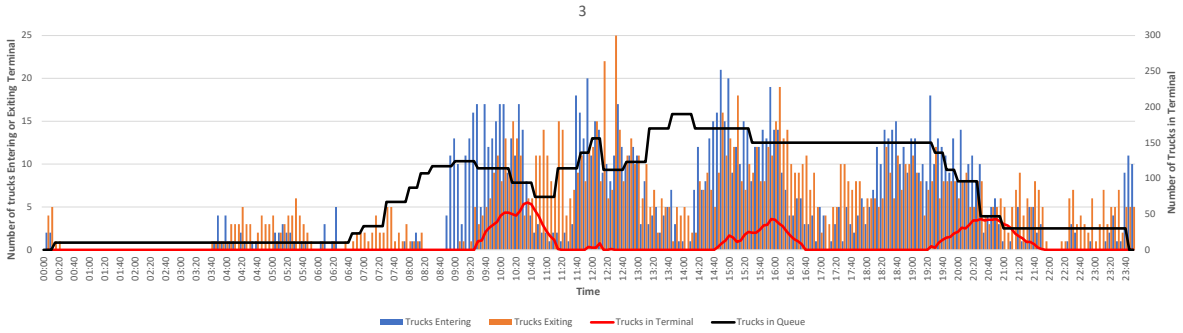
1


Number of trucks Entering or Exiting Terminal
Number of Trucks in Terminal
Time
Trucks Entering
Trucks Exiting
Trucks in Terminal
Trucks in Queue

2


Number of trucks Entering or Exiting Terminal
Number of Trucks in Terminal
Time
Trucks Entering
Trucks Exiting
Trucks in Terminal
Trucks in Queue

3


Number of trucks Entering or Exiting Terminal
Number of Trucks in Terminal
Time
Trucks Entering
Trucks Exiting
Trucks in Terminal
Trucks in Queue