

**REDUCING THE PROCESS TIME OF CUSTOMS CLEARANCE OF  
FULL CONTAINER LOAD (FCL) AT THE COLOMBO HARBOUR  
USING A MULTI-MODAL TRANSPORTATION SYSTEM**

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Research report submitted to the  
Department of Transport & Logistics Management,  
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This is to certify that the Research Report on

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Has been accepted by the Department of Transport & Logistics Management,  
University of Moratuwa, in partial fulfillment of the requirements of the  
Master of Business Administration in Logistics & Supply Chain Management

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.....02.09.2021.....

Date



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Student

.....02.09.2021.....

Date

## DECLARATION

I certify that the Research Report does not incorporate without acknowledgement, any materials previously submitted for a degree or diploma in any University, and to the best of my knowledge and belief it does not contain any material previously published or written by another person, except where due reference is made in the text.

.....

K.S Wijesinghe

199176X

09<sup>th</sup> July 2021

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## **LIST OF ABBREVIATIONS**

TEU - Twenty Equivalent Unit  
CICT - Colombo International Container Terminal  
JCT - Jaya Container Terminal  
SAGT - South Asian Gateway Terminal  
HS – Harmonized System  
PLC – Public Limited Company  
UPB– Unaccompanied passenger baggage  
RCT - Rank Container Terminal  
CusDec – Customs Declaration  
WCO - World Customs Organization  
ASYCUDA – Automated System for Customs Data  
SLC - Sri Lanka Customs  
GL 1 – Grayline 1  
GL 2 – Grayline 2  
HRC – High Risk Cargo  
NCT – New Container Terminal  
CRT - Central Railway Terminal  
Kmph – Kilometers per hour  
EFC – Export Facilitation Centre  
RFID - Radio Frequency Identification

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## EXECUTIVE SUMMARY

The container traffic in Colombo Sea port and suburbs is a major issue for Sri Lanka Customs in their process of releasing cargo with a minimum time frame. The research is mainly focused on how to reduce the container traffic and lead time of customs clearance process using a multimodal transportation system. The chapter 01 gives a brief introduction about Sri Lanka Customs, Colombo Sea port and further focus regarding the objectives of the research including the justification and limitations. The chapter 02 will discuss regarding the background of the research topic as how the role of Sri Lanka Customs has been changed from the collector to a facilitator. It also briefs about the facilitation provided by Sri Lanka Customs to its customers at the moment and still why it takes a significant number of hours to release a container based on the time release studies conducted by Sri Lanka Customs itself.

How the research is going to be carried out, is discussed in the chapter 03. The secondary data from the ASYCUDA system will give the basic statistics for research and several theoretical concepts will be used to analyze the data and design the models. The methodology of the research is simply elaborated in this chapter using several statistical parameters such as probability distributions. Chapter 04 is allocated for the literature review. Though it is difficult to find literatures related to customs clearance process and multimodal transportation, the literature review is basically focused on the customs lead time of different countries in the world and rail-road hybrid transportation models.

Chapter 05 is consisted with analyzed data with interpretations. The secondary data collected from the ASYCUDA system are analyzed using several statistical methods and gives a basic idea regarding the issues of the current clearance process, especially in transportation. It also gives a general idea about the existing capacities of Sri Lanka Customs and a real time picture of the customs clearance process. The expected solutions for the issues identified by the analysis are given as an expert idea in the chapter 06. It will discuss about the possible ways to overcome the current issues and what are feasibilities.

Research design is introduced in the chapter 07 as where the railway terminal should be established, how many train movements required, what is the capacity of the cargo trains, what is the ideal speed of the train should be etc. And also it will show the graphical representation of

the central railway terminal and road network design inside the port. The processing times for each level are calculated and gives a summarized information regarding the reduced lead time of the customs clearance process.

The final two chapters are allocated for the conclusion and the recommendations of the research. The lead time of the customs clearance process can be reduced by 25% by this multimodal system and it is suggested to implement the system after a feasible study with few other recommendations.

## Chapter 01

### INTRODUCTION

The island of Sri Lanka is situated in the middle of the world's largest and major shipping line which is called as the sea silk route. It has been the main shipping lane for cargo ships from Southeast Asia to Europe through the Middle East since ancient times. Sri Lanka has become a place of great demand in the maritime sector due to the unique location in the Indian Ocean.



Figure 1: Sea Silk Route

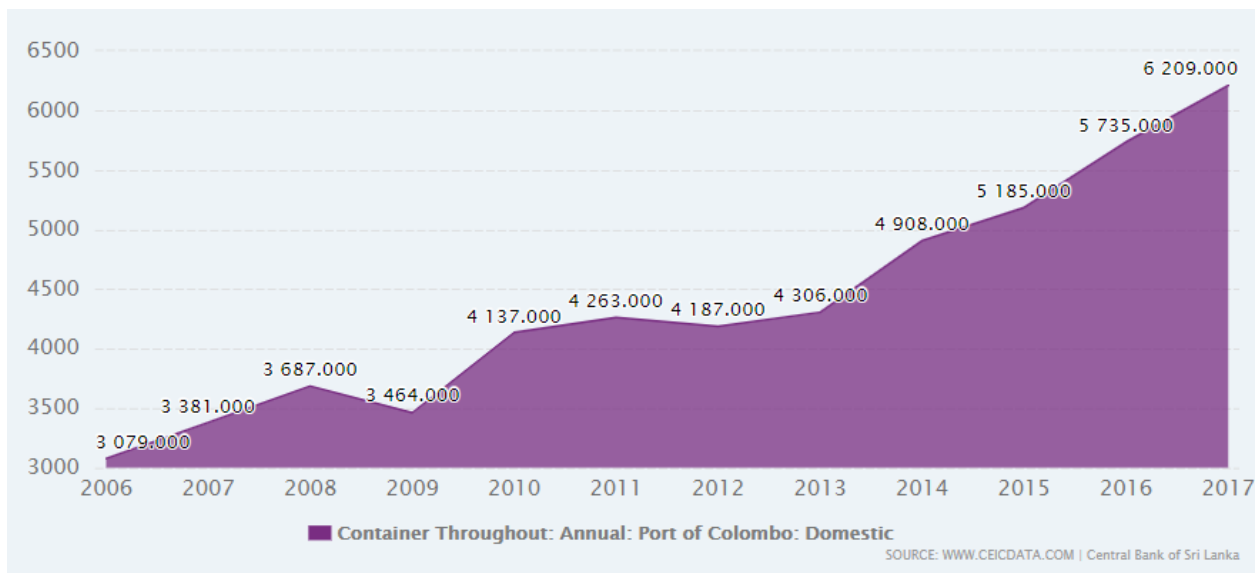
Sri Lanka has several seaports around the country, including few natural harbors.

Trincomalee is the largest natural seaport in Sri Lanka, and it is being currently used especially for Naval activities and bulk cargos. Hambantota is the only seaport which was built using the inland of the country. The ownership of Hambantota seaport is with the Chinese government for next 99 years and it is only used for vehicle importations at the moment.

#### 1.1 Colombo Sea Port

Colombo seaport is the main maritime hub in Sri Lanka where most of the importations & exportations are carried out and It is included within the 25 busiest seaports in the world. The handling capacity (number of TEUs) of the Colombo port has dramatically increased by a significant value over the past few years due to the new infrastructure developments of the port especially with new terminals.

The port of Colombo is currently handling more than 7.2 million TEUs annually and it is expected to handle 10 million TEUs annually with the expansion of East & West terminals by 2025. The existing Colombo International Container Terminal which is called as CICT is the only deep-water terminal in entire South Asian region which could accommodate large cargo vessels.



Graph 1: Sri Lanka's Colombo Port TEU Volume

Due to the stated facts, the busyness of the Colombo port has been increased by several parameters such as number of TEUs handling, number of vessels births, number of vehicle movements over the last decade.

The Colombo Sea port is consisted with three major terminals along with new developing one as follows,

- 1) Jaya Container Terminal (JCT) which is only active state-owned terminal under the operations of the Sri Lanka Ports Authority. The depth of the terminal is 12-15m which could enable to handle only the small ships.
- 2) South Asian Gateway Terminal (SAGT) is the only terminal in the Colombo Sea port which is owned by a private entity of Sri Lanka. Jhon Keels Holdings PLC has 85% share holding of the terminal and it is 16m in depth which could handle small to medium size vessels.
- 3) Colombo International Container Terminal (CICT) has the largest deep-water terminal in the entire South Asian Region at 18-23m which could accommodate the largest cargo vessels in the world.
- 4) East Container Terminal (ECT) is a newly developing terminal under the administration of Sri Lanka Ports Authority and the depth is similar to CICT as 18-23m.

Apart from the terminal operators, there are several other state and private entities are providing services inside the port premises such as Sri Lanka Customs, Department of Immigration and Emigration, Sri Lanka Navy, Dockyard PLC, etc. Although there are so many entities inside the port, Sri Lanka Customs is the only authorized party for clearance of imports and exports in the port. Thus, Sri Lanka Customs has been providing its services over the last two centuries being the oldest state organization in the country.

## **1.2 Sri Lanka Customs**

Sri Lanka Customs is one of the oldest customs administrations in the world with over 200 years of history. The evidence of the existence of the customs is gone to over 2000 years back in Godawaya which is today called as Hambantota port. The traditional Customs service has emerged centuries ago in the ancient times with the initiation of cross border transactions. Sri Lanka Customs Department has formally established in 1809 by the Colonial rulers as one of the pioneer state organizations in the country. Customs administration is powered by the Customs Ordinance of No.17 of 1869 with amendments.

“The stone inscription existing at the Godawaya temple provides probably one of the oldest evidence on Customs duties in the entire world. Ancient internal port had functioned from 2nd Century AD to 12th Century AD at Godawaya in Southern Sri Lanka near the mouth of the Walawe River. This inscription had been made by King Gajabahu (114-136AD) and states that he had ordered the donation of duties collected at the port to the Godawaya Temple for its maintenance.”

### **Vision**

To become the best customs administration In South Asia

### **Mission**

The Sri Lanka Customs is dedicated to enforce revenue and social protection laws of the state while facilitating the trade with the objective of contributing to the national effort and in due recognition thereof

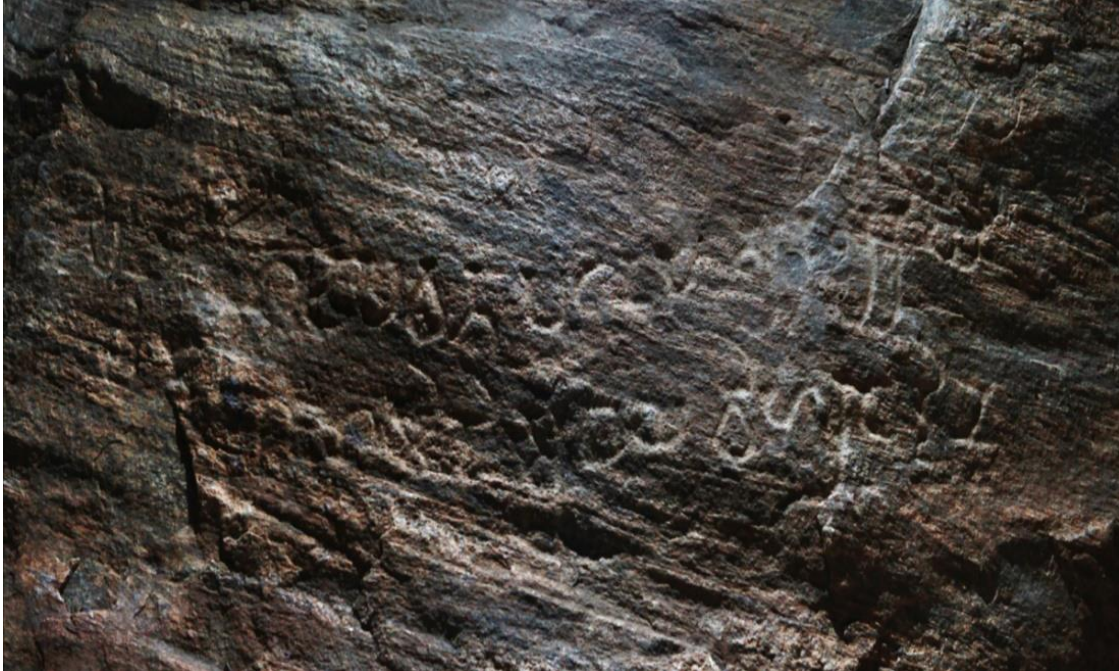


Figure 2: Godawaya Stone Tablet (112-13 CE)

As a developing country and mostly depending on the revenue collection of Customs, objectives of Sri Lanka Customs, however, can be diverged from objectives of Customs of developed countries. Hence, main objectives of modernizing Sri Lanka Customs should be focused on upgrading the country from the level of developing to the developed and following five objectives are set out accordingly:

1. Revenue collection
2. Protection of the Society, environment, and national heritage
3. Security across the entire supply chain
4. Protection of economic interests of the country
5. Economic development through international trade

Sri Lanka Customs is administered under a Director General along with five other Additional Director Generals through five major clusters as follows.

- 1) Human Resources Management Cluster
- 2) Revenue & Services Cluster
- 3) Corporate Cluster
- 4) Enforcement Cluster
- 5) Regional Cluster

There are 29 Directorates under these 5 clusters and over 2000 employees are actively working with customs at the moment. The hierarchy of the Customs is as follows,

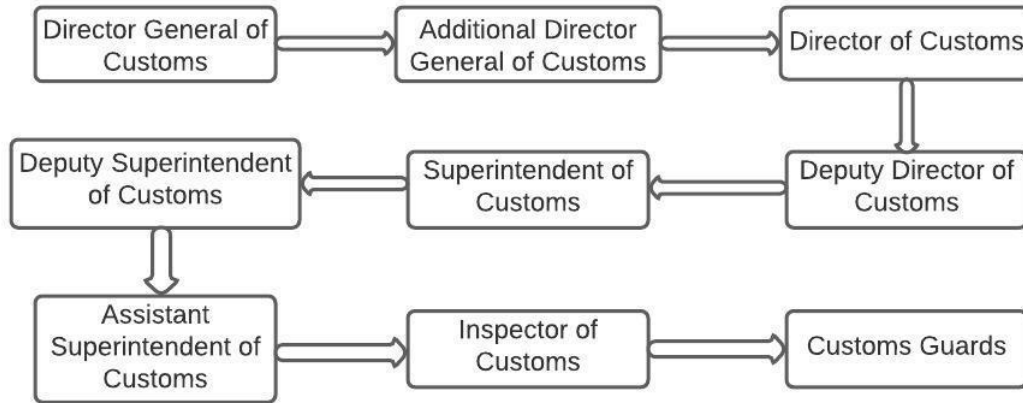


Figure 2a: The hierarchy of the Customs

Several positions of the Customs are regularly filled by the Sri Lanka Administration Services as well. Apart from this, there are other employees who are working at Customs are from the joint services as follows,

- 1) Public Management Assistants (PMAs)
- 2) KaryalaKaryaSahayaka (KKSs)
- 3) Drivers

Being the principal collector for the state, Sri Lanka Customs is responsible for collecting more than 50% of the country's tax revenue.

Table 1: Estimated Revenue, Actual Revenue and Difference/ Rs. In Billions

Year	Estimated	Actual	Difference	Actual/Estimate
2018	1,067.87	919.04	(148.83)	86%
2019	1,089.11	797.85	(295.52)	73%
2020	646.34	641.76	(4.58)	99%

According to the table 1, the revenue has been dropped over the last few years and the following reasons are identified.

- 1) Easter Attack in April 2019
- 2) Covid pandemic and lockdowns
- 3) Policy decisions by the government

The Customs administration is occupied at several places around the country across the borders, especially at airports and seaport and all the activities are monitored and functioned through the headquarters at Pettah.

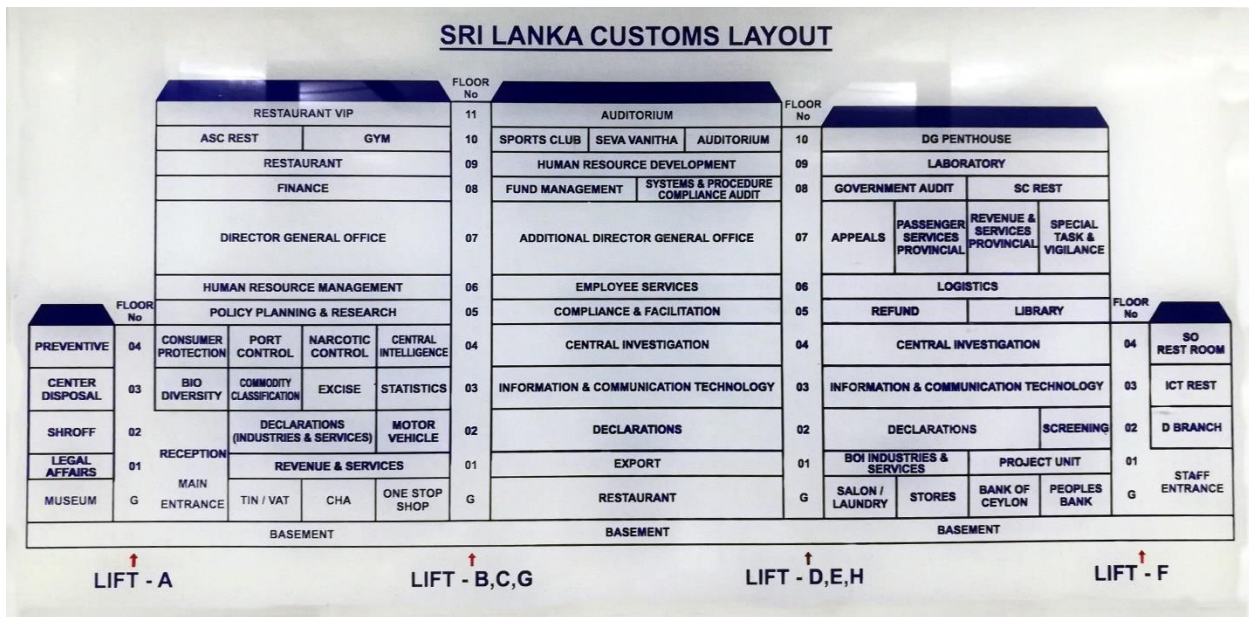


Figure 3: Customs Headquarters Layout

### 1.3 Aims and Objectives of the research

#### 1.3.1 Main objective

To introduce a multimodal transportation system in order to reduce the time taken for transportation in the customs clearance process

### **1.3.2 Sub objectives**

- 1) To emphasize how many hours are wasted unnecessarily for transportation
- 2) To determine the capacities of the existing examination yards
- 3) To generate some extra money and reputation for government institutes like Sri Lanka Ports Authority and Sri Lanka Railway.
- 4) To get the maximum utilization of the existing resources inside the port
- 5) To identify the loopholes of the process in order to enhance the efficiency, aiming towards the facilitator role guidelines given by the WCO.

### **1.4 Justification for the Research Topic**

As it is clearly shown, this is a very practical scenario where findings and the innovative models proposing by this research would directly impact on the process of the customs clearance process as well as the enhancement of the hub operations inside the Colombo port. This will directly impact on the all the three terminal operations (CICT, SAGT & JCT) and mutually benefitted all the parties such as Sri Lanka Customs, Sri Lanka Ports Authority, Sri Lanka Railway and most importantly the consignees. The research could definitely address the issues stated in the literature review and eliminate the gaps mentioned. The implementation of the recommendations of this research would generate revenue for Sri Lanka Railways and some extra revenue for Sri Lanka Ports Authority and eventually increases the entire state revenue.

### **1.5 Scope of the Research and its Limitations**

The research is based only on the transportation and examination centre's processes because one of the previous studies was conducted on the customs documentation and its internal processes. There may be few recommendations regarding the improvements of some customs processes internally, but not focused very much in those areas since it has been already discussed. More focused on the new model on transportation, port structures and innovative model of examination yards and its process. The research will only address the issues at Colombo port and FCL cargo. The cost factor will not be discussed in this study hence the scope of the research is only based on the time factor. The cost factor of this study will be a different study area for future researchers in case of any feasibility identification.

## Chapter 02

### PROBLEM IDENTIFICATION

#### 2.1 Background of the Problem

World merchandise trade has been growing faster than world output. World trade to output ratio was nearly 20 percent in 1960 and it has been increased to over 50 percent in 2008, even though there is a trade slowdown in recent years. There are three main factors which explain the growth of world trade: First and foremost, the costs of trade have fallen dramatically. Costs of transportation, communication and currency exchange, and tariff rates have substantially fallen over the past 20 years. Secondly, there is a considerable productivity growth in the tradable goods compared to the non-tradable goods. Thirdly, when the income per head increases, consumers spend more on manufacturing goods than on basic foods and clothing opening avenues for product differentiation and diversification.

With the expansion of merchandise trade, the role of the Customs has been changed. It has become a big challenge to Customs administrations to handle the increasing trade volume with limited resources they have. As a solution, risk-based management has been introduced for Customs management system, transforming the role of a Customs officer from the “gate keeper” to the compliance manager. Since the trade is directly linked with economic development, there is a considerable demand for trade facilitation in order to promote the frictionless trade motion. On the other hand, threats from the terrorist movements raised the necessity to strengthen the supply chain security. Balancing its responsibility between facilitation of trade and strengthening the control measures, Customs plays complicated and vital role in global supply chain today. Being a part of global supply chain, Sri Lanka Customs (SLC) cannot deviate from the international trade environment. Time to time, the SLC also had to change its procedures and regulations in accordance with the changes took place in the international trade environment.

International trade can be considered as the heart of the global economy. Any shortage or failure in international trade makes most of the countries helpless. The most recent example is the Covid-19 incident where countries stopped exporting and importing stuff which makes huge vacuums in supply chain, resulting a major global economy downward after the World War II. Customs and border control play a huge role in facilitating the world trade. The main objective of the custom is boarder protection in most of the countries. But it is quite deviated here in Sri

Lanka, where our main objective is revenue (tax) collection. According to the World Customs Organization (WCO) latest guidelines, the role of a customs officer has been shifted from protector to a facilitator. The traders think customs is a barrier for world trade, which discourages the new entrants of businesses. Because of this, customs organizations are supposed to provide effective and efficient services for traders, merchants in order to make the custom clearance process smoother and more transparent.

Therefore, Sri Lanka Customs have already started providing such facilitation for their customers such as,

1) Green channel

exemption of examination of distinguished companies who has a good track record

2) ASYCUDA System

An online platform for customs proceedings which is developed under the guidelines of WCO's single window concept

3) Bonding facilities

Goods importing without tax for re-exporting processes

Export processing zones

4) Export Facilitation Center

5) 24 hours hotline for any custom inquiries

It is a long-time discussion that time taken to release a container is considerably a larger number of hours even though the above-mentioned services are being provided. (ASYCUDA System) Releasing time is a key parameter in customs processes where almost all the container terminals inside the port release containers from their terminals within half an hour. But it still takes sometimes more than a day to release from customs custody depend on the nature of the cargo (red channel and high risk).

Physical examination of imported cargo, in order to verify the accuracy of the imported cargo along with the Customs Declaration made by the importers is a vital task performed by Customs

administrators throughout the world. Since the port of Colombo does not contain enough facility to carry out the physical examinations within the port premises, physical examination of imported containers is carried out at the container yards outside the port. Therefore, such containers should be transferred from the Colombo port to examination yards, which is leading to a heavy container overload in cargo exit gate in port of Colombo. This is the main troublesome activity for importers which causes unnecessary delays, expenses and wastage. Therefore, it is vital Sri Lanka Customs to ensure the increase of efficiency in managing container traffic in the port of Colombo in order to smooth flow and free movement of cross border transactions.

## **2.2 Statement of the Problem**

It is a usual scenery to be seen of long queues of containers in afternoon sessions to midnight inside the port waiting to leave the port for hours. Lorry drivers are wasting so many hours inside their lorries without moving a single meter sometimes. The public may have even seen the mourning of these people several times through the medias.

It is a normal procedure to undergo examinations for any type of importation after clearing initial stages of the process such as a declaration to customs (CusDec), Tax payment, Valuation and so on. The very first step is that the importer has to declare in the ASYCUDA system inserting a CusDec what he has imported and pay the applicable duties & levies. After that he should go to a place called “Long Room” which is one of the branches of Sri Lanka Customs where the initial appraisals are taken place such as the applicable duties & levies are correct, the applied HS codes are relevant. Examination process is taken place at following yards and none of them is located inside the port. All of these terminals are handled by the private sector and none of them is belong to the state.

- 1) RCT (Rank Container Terminal) – Orugodawatta
- 2) Gray line 1 – Orugodawatta
- 3) Gray line 2 – Thotalanga

It is just the 7km away from the port and only 4km away from the NCT gate (New Container Terminal gate, the exit for FCL) but still it takes more than five (05) hours to reach there due to

the heavy traffic jam in the road and huge number of containers per day in queues. The route is given through one of the major roadblocks (Grandpass) in Colombo. Grayline 02 is also located in similar distance but somewhere towards Thotalanga. The next possible reason for this heavy congestion is the capacity of these examination yards. It usually takes atleast four (04) hours for a full examination and only few containers could be checked simultaneously. The rest of them have to be in idle for hours until they are checked and that may be another reason for these long hours of waiting times.

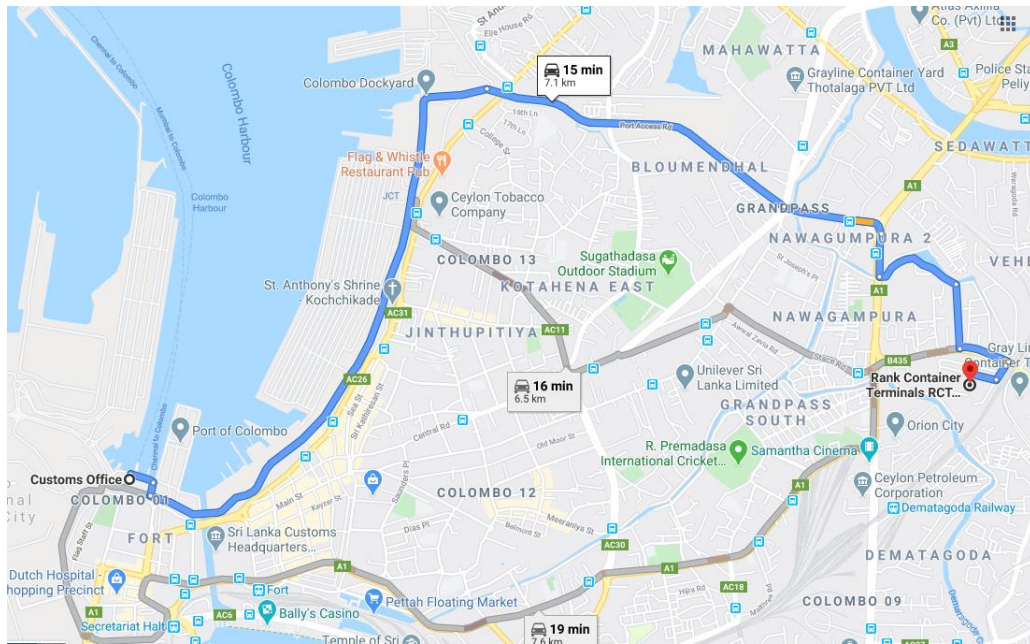


Figure 4: The route map from Colombo port to RCT & Grayline 01, Orugodawatta

Usually, 2000 containers (FCL) are released from the Colombo port every day (except weekend) and atleast half of them undergo the examination process as an average figure. There are few a channels (methods) of examinations as follows,

**1) Green** – Exempted from Examinations

Based on the good track record maintained over the years, some consignees are given this privilege as they could release their cargo without undergoing any examination process. (fast track)

**2) Yellow** – Panel Examinations (Random)

These are some random checks through the container. Not examining the entire cargo, but taking any random samples from different places of the consignment and check.

### **3) Red – 100% Examinations**

The cargos are fully examined by one by one which have been identified as high risk, especially coming from countries like Pakistan, Iran, Brazil.

### **4) Bonding& BOI – Directly to Bonding warehouses& BOI Facilities**

This type of cargos is not examined at the examination centres. They are directly transported to bonding warehouses & BOI facilities under customs supervision, which are located most probably in BOI zones and then only do the verifications.

### **5) Out panel – Examination at consignee’s warehouses**

**6) UPB – Unaccompanied passenger baggage containers** are examined at the respective UPB warehouses such as Trico, Colombo Shipping Lines.

Still 900-1100 FCLs are examined everyday in examination yards and the rest of them are going through the green channel, bonding etc. Every consignment must go in the queue in order to leave the port irrespective of the channel of examination they put in. It follows the rule of first come, first serve (FCFS). The ones who came early goes early. The existing transportation model and the locations/capacities of examination centres consuming a huge time of the clearing process which creates a bad impression about Sri Lanka Customs and inconvenience for the consignees. It is a mandatory requirement to facilitate the world trade minimizing the existing turbulences according to the guidelines of the WCO. Therefore, implanting a better multimodal transportation model both inside and outside the port with other considerable factors would be an ideal thought.

## **2.3 The Problem Identification**

According to the Time Release Study conducted by Sri Lanka Customs, it was taken 28 hours to release an FCL (Full Container Load) in 2014. From that 28 hours, 5.4 hours were taken for the transportation of containers from port to the examination yards. It is 18% of the entire clearing

time.

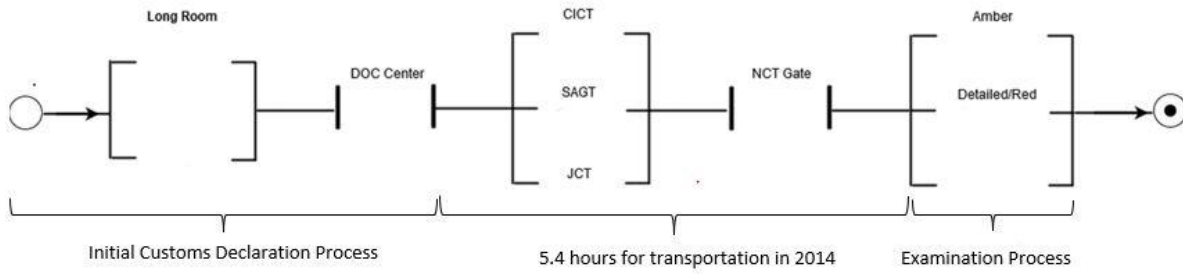


Figure 7: Time consumed for the transportation of the Customs clearance process in 2014

However, the total clearing time of customs clearing process has been decreased to 16 hours and 29 minutes from 28 hours by 2018 according to the Time Release Study conducted by Sri Lanka Customs again in 2018. The main reason for this improvement is the ASYCUDA system introduced in 2016. Most of the manual processes of the customs clearance process have been automated by the ASYCUDA system which enables to reduce the processing time by a considerable amount of time. And also, the enhancement of the human resources during those years in the Customs became a major reason for this improvement as well.

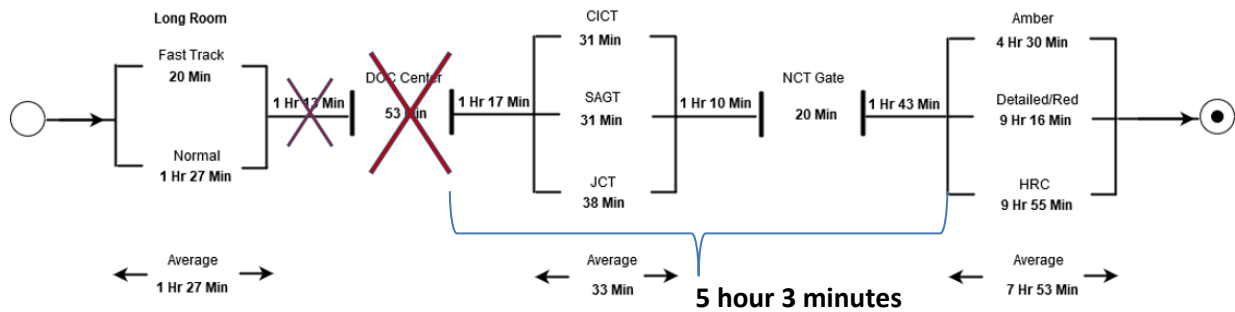


Figure 8: The closed loopholes in the customs clearance process by 2018

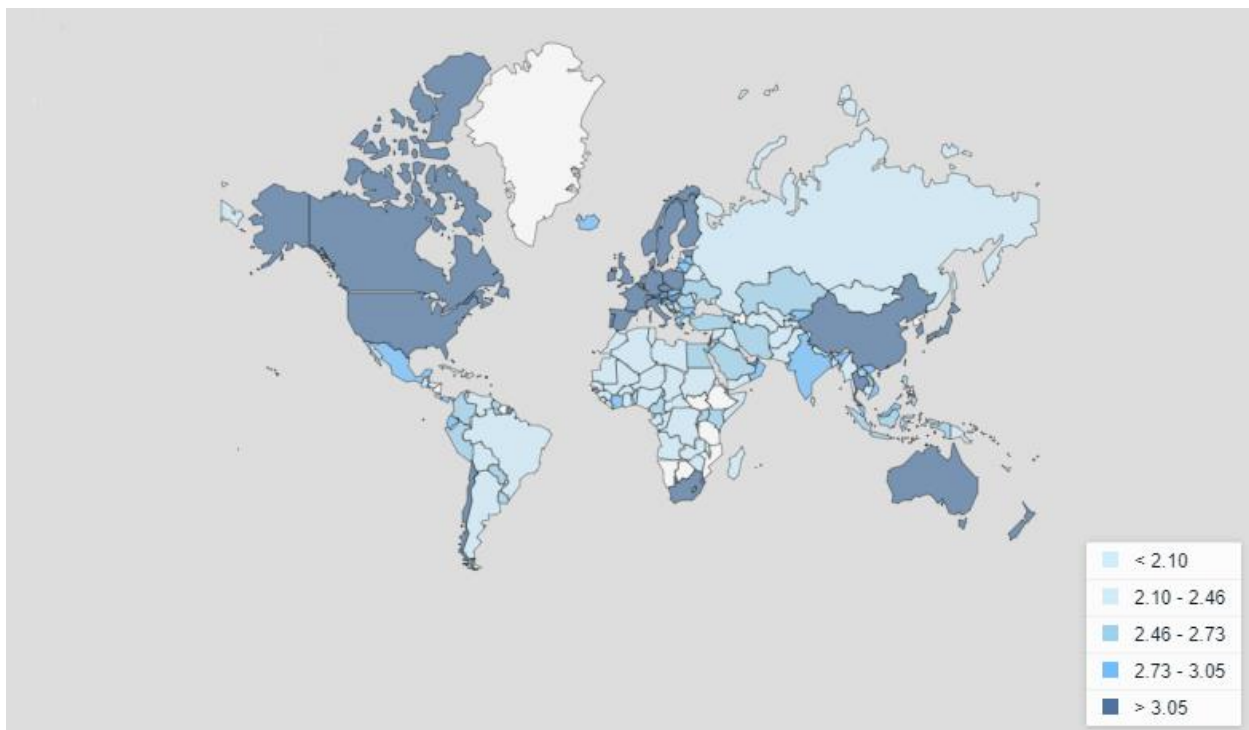
But it is still a questionable fact remaining where transportation of containers from port to the examination yards remains 5 hours, even though the entire clearing time was reduced by 11 hours. The accuracy of this data may have deviated by now since the data is collected before 2018. Therefore, let's analyze the current data in order to verify the current situation of the Customs Clearance Process.

## Chapter 03

### LITERATURE REVIEW

The time taken to release a cargo in 2014 is 28 hours in Sri Lanka (Study et al., 2014) and it has been reduced to 16 hours and 29 minutes in 2018. (*Sri Lanka Customs*, n.d.)(*(No Title)*, n.d.-a)As per the statistics published by Indian Customs, average release time for import containers is almost 3 days . (Nehru et al., n.d.) According to the Time Release Study (TRS) conducted by the Australian Customs and Boarder Protection Service, the average time to release FCL is just 0.1 days in 2016.(Government Department of Home Affairs, 2016). The average sea cargo releasing time by the US Customs and Boarder Protection is 39 hours. (*(No Title)*, n.d.-b)

Customs clearance usually takes less than 24 hours but it sometimes it can more than a day or may be even few days based on the goods to be inspected. (*All About Customs Clearance, A Guide By Crowley Logistics*, n.d.)According to the Logistics performance index: Efficiency of customs clearance process, Sri Lanka's position is in somewhere middle with 2.58 points with respect to the customs clearance process.(1=low to 5=high) (*Logistics pserformance index: Efficiency of customs clearance process (1=low to 5=high) | Data*, n.d.)

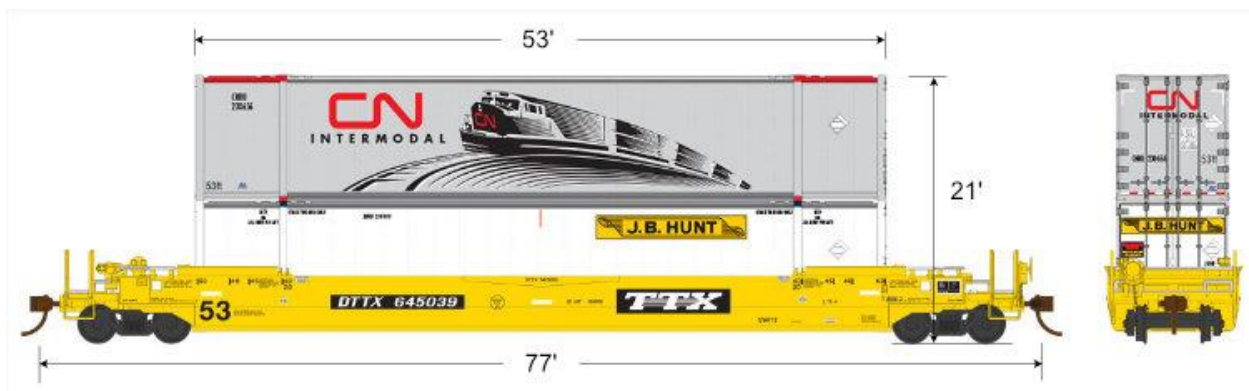


The shareholder engagement is necessarily required for the efficient and effective supply chain management in different levels. Customs inspection should be effectively carried out at the

boarders in order to minimize the obstacles in the cross-border transactions. Customs logistics should not be collided with the international supply chain practices in a way that it will demotivate the stakeholders especially importers. The modern customs practices are more concerned towards the facilitating the legitimate trade and align with the international supply chain norms (Jablonskis & Petersone, n.d.)

According to a survey conducted on truck freight carriers in United States of America, most of them were interested in rail freight carriers. The multimodal concepts have been used to identify the characteristic behavioral of the models and it was recognized the willingness for the trail freight carriers. It also could be identified the collaboration in between the truck and rail multimodal freight where it can enable the mechanism for the rail-truck hybrid model. The merge of both of these two freights could reach the expected yields of the freight transportation. (Guo & Peeta, 2015)

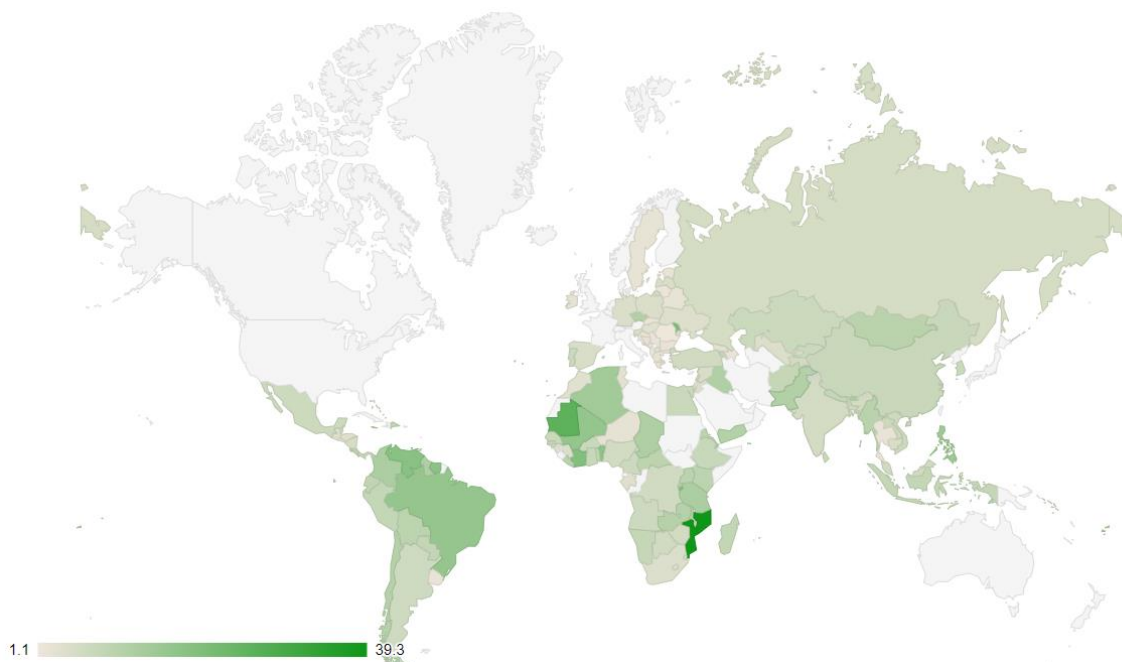
The average length of a freight train can be somewhere in between 140 feet to 10,000 feet or may be in other words 1.9 miles. But, there are few incidents where a freight train marked its maximum length over 3.4 miles with closer to 300 well cars. (*How Long is a Train? Freight, Passenger. Maximum Allowed Length?*, n.d.) The maximum speed of a freight train could reach can be more than 100 Kmph in Indian railways and it is usually somewhere 26 Kmph in average and it can be increased up to 70 kmph on Dedicated Freight Corridors. (*freight train: Trial run of double-stack freight train conducted on Rewari-Madar section - The Economic Times*, n.d.)



The generalized length of a well car is 40 ft (12.19 m), 48 ft (14.63 m) and 53 ft (16.15 m). These well cars are designed to use either a single stack or double stack method. A well car is capable of carrying up to 54,000 kgs or in other words 54 tons at once. Usually, a similar length

of containers is stacked one on one and sometimes smaller containers are stacked on the bigger ones in well cars which means 20 feet containers are put on the 40 feet containers in the rail transportation or vice versa. The double-stack method is the most widely used stacking method in railway transportation in the world.(*Well car - Wikipedia*, n.d.)

The following map shows the average clearing time of the customs clearance process of each country by days. The color of the map indicates the value of each country has. Darker color means the number of days taken is higher and lighter means less days. The highest number of days taken to clear the goods is Mozambique, with a value of 39.30. The country with the lowest value in the world is Romania, with a value of 1.10. Sri Lanka lies somewhere in the 1/3<sup>rd</sup> position of the rating parameter with grey and light green mixed color.(*Average time to clear exports through customs (days) by Country*, n.d.)

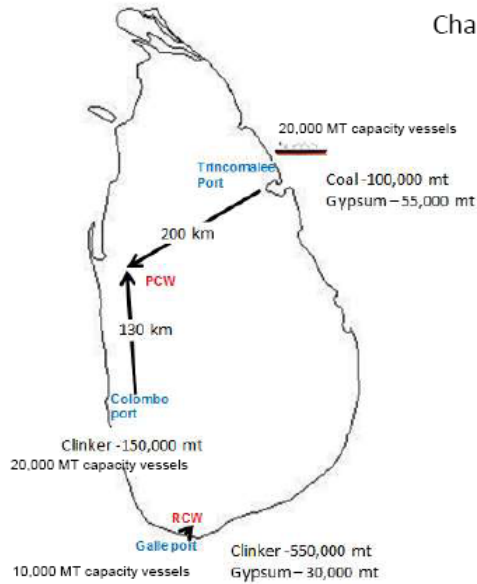


### 3.1 Siam City Cement Innovative Inbound Logistic Strategy

## Challenges in Previous Import Shipping Model

How to cater the growing demand???

### Previous Model



Challenges to cater the growing demand:

- **Galle port draft restriction** and number of berths available in the port
- Less excess **clinker availability** in closed regional countries
- Growing **road traffic** in Colombo and suburb
- Increasing trend of no. of **road accidents** in the country
- **Spillages** in open transportation

## Sourcing- Market Outlook for Clinker

Majority clinker & cement surplus is from Vietnam, Korea, China & Japan

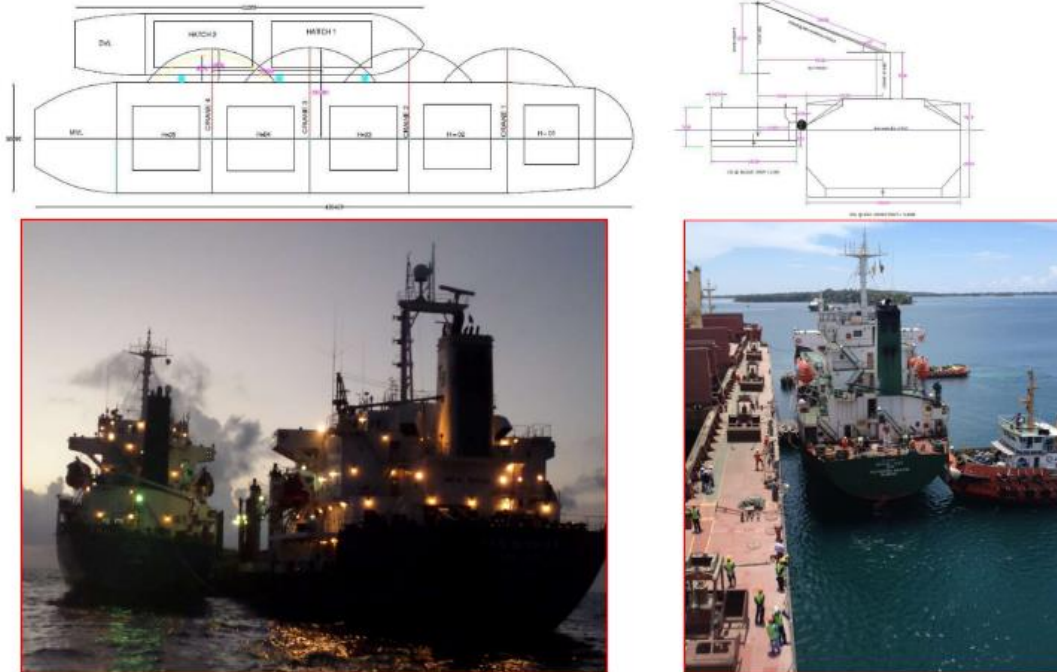


- SCCCL imported 65 % of its clinker requirement from East Coast India previously
- Excess clinker in India is getting limiting and potential future sources are located in far away counties like in Thailand, Vietnam and China

# Implementation of Ship to Ship Operation

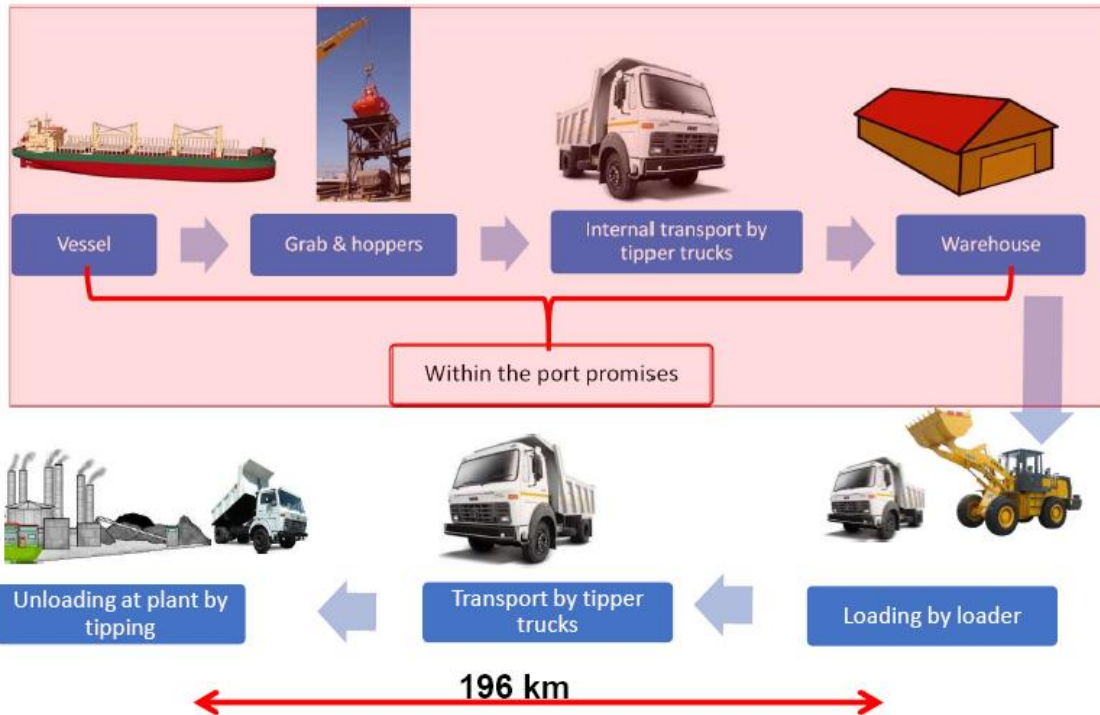
30 supramax vessels handled up to now

- Use supramax size mother vessels to Port of Trincomalee and double bank in mid sea with daughter vessels



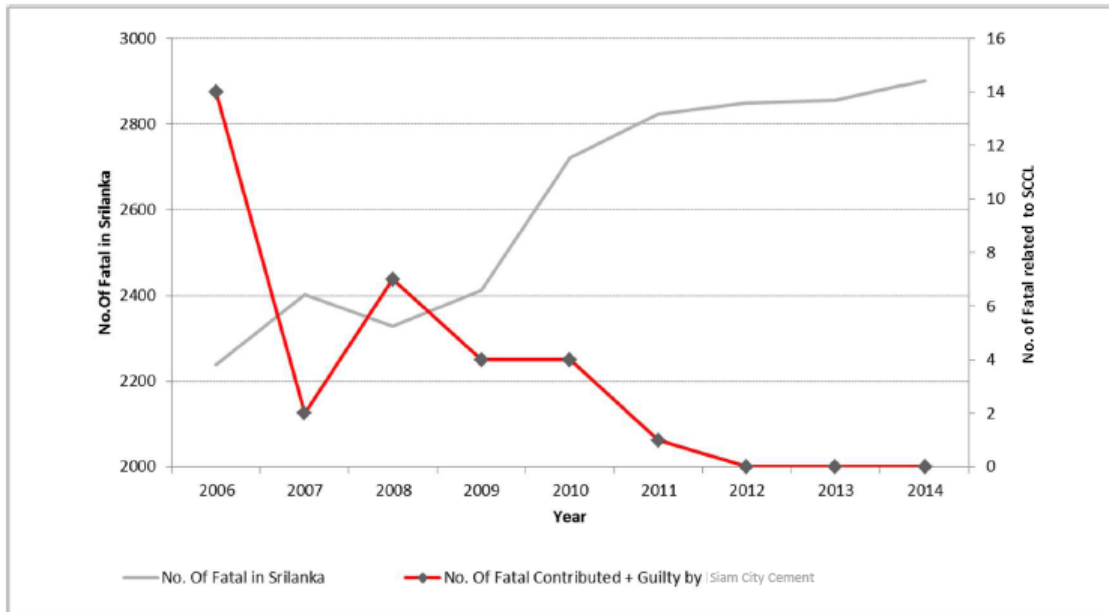
## Previous Process from Port of Trincomalee to Puttalam Plant

Road transport of materials ~ 200 km one way



# High Road Safety Risk

Growing traffic on the roads resulted fatalities



- Increasing trend of road accident in Sri Lanka while SCCL is in declining trend

## Trials to Use Rail & Container Boxes

Investing time and \$\$\$ for workable solution



Truck transport over train beds



Using modified self discharging container



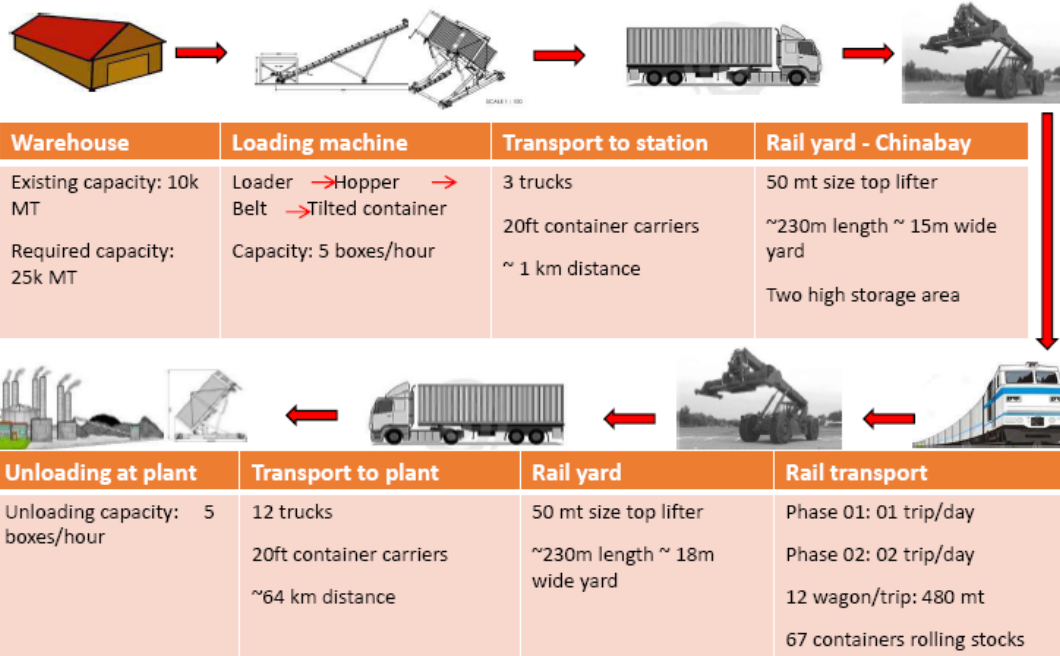
Tilting container by using cranes



Unloading and loading container by Bobcat machine

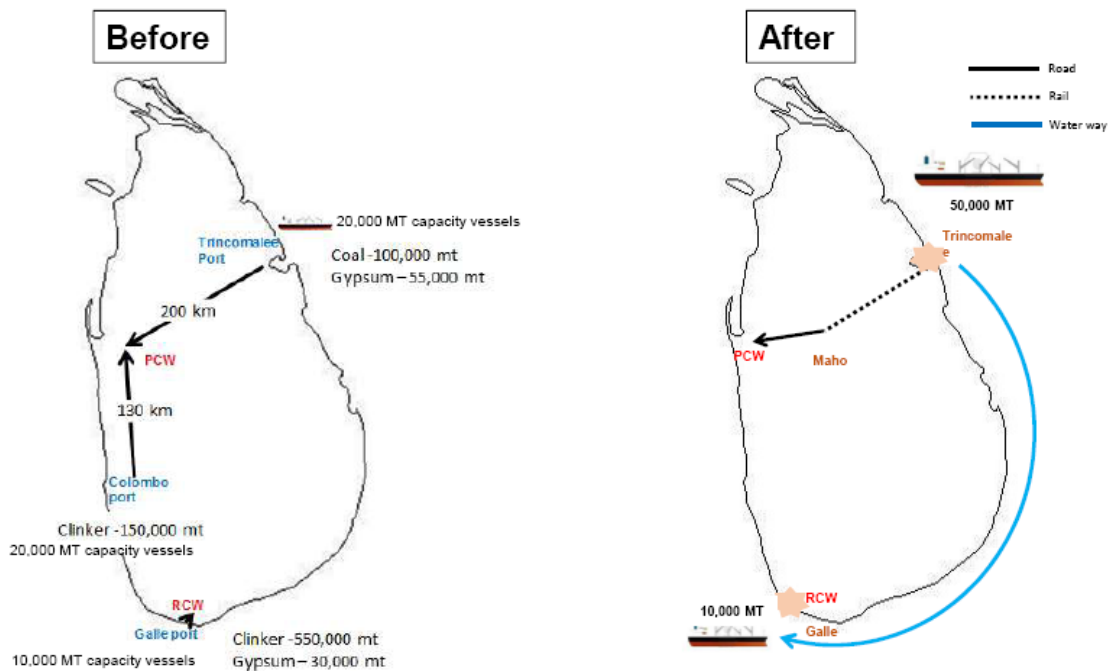
## Rail – Road Hybrid Model

Improve safety and compliance in land transport



## Innovative Logistics Solutions

Ship - Ship operation & Rail - Road Hybrid transportation



## Benefits of New Inbound Logistics Model

### Beating the challenge with innovating logistics



Video

- Fulfill the material supply requirements to cater growing cement demand by using existing infrastructure of the country
- Reduce risk exposure
  - 3 mil km (Loaded) → 0.8 mil km (Loaded)
  - 200 spot trucks → 15 dedicated vehicles
  - 400 drivers & helpers → 54 drivers & helpers
- Saving LKR XXX million per annum
- Fully covered and dust free transportation
- CO2 emission in vessel movements reduced by 10-11% and in road transportation reduced by 17%
- Generate revenue to SL government while utilizing their assets such as railway and ports

## Chapter 04

### METHODOLOGY

The secondary data from the customs system (ASYCUDA) will be used throughout in this research. The innovative multimodal transportation model (expert idea) would initially introduce, and it will be compared with the existing mode of transportation and examination mode/process. The time consumed in each level of the existing process will be calculated and discussed through the facts based on the previous studies (TRS by Sri Lanka Customs in 2014 & 2018) and the data collected from the system. And the new time laps in the innovative modal will be estimated by using relevant data. The comparison of both in terms of the quantitative and qualitative will indicate a better understanding about the newly proposed multi transportation model. The new innovative multimodal concept will be included some new road network concepts which will be a rail-road hybrid model.

Since there is a railway terminal included in the model, the location of the terminal will be calculated using a following methodology. The capacities (number of TEUs handling per year) of each terminal will be considered as the demand function and the virtual locations of the terminals will be identified by the simple scale graphical representation of the Colombo Sea port map.

#### 4.1 Centre of Gravity Method

- ▶ The Centre of Gravity Method is used for locating single facilities that considers existing facilities, the distances between them, and the volumes of goods to be shipped between them.
- ▶ This methodology involves formulas used to compute the coordinates of the two-dimensional point that meets the distance and volume criteria stated above.

$$C_x = \frac{\sum d_{ix} V_i}{\sum V_i} \quad C_y = \frac{\sum d_{iy} V_i}{\sum V_i}$$

Where:

$C_x$  = X coordinate of centre of gravity

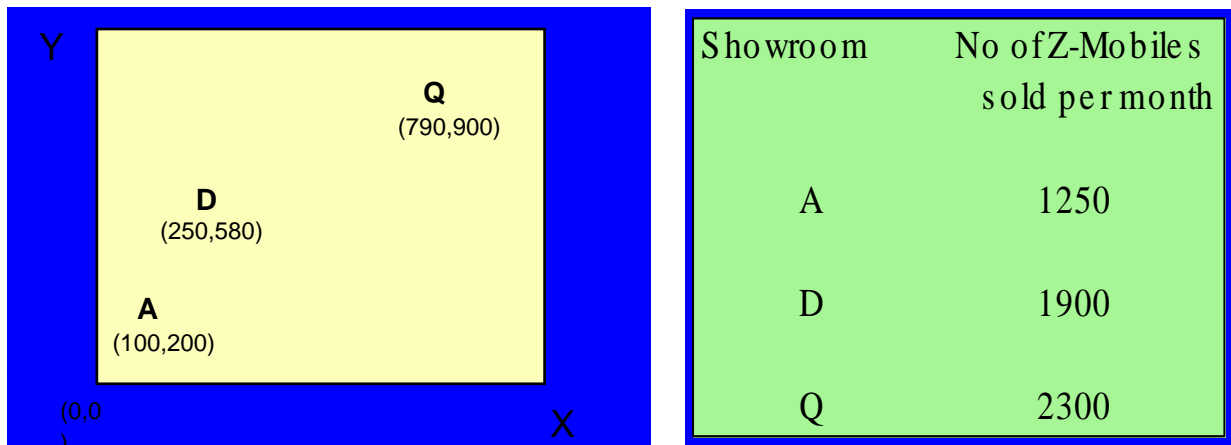
$C_y$  = y coordinate of centre of gravity

$d_{ix}$  = X coordinate of the ith location

$d_{iy}$  = Y coordinate of the  $i$ th location

$V_i$  = volume of goods moved to or from  $i$ th location

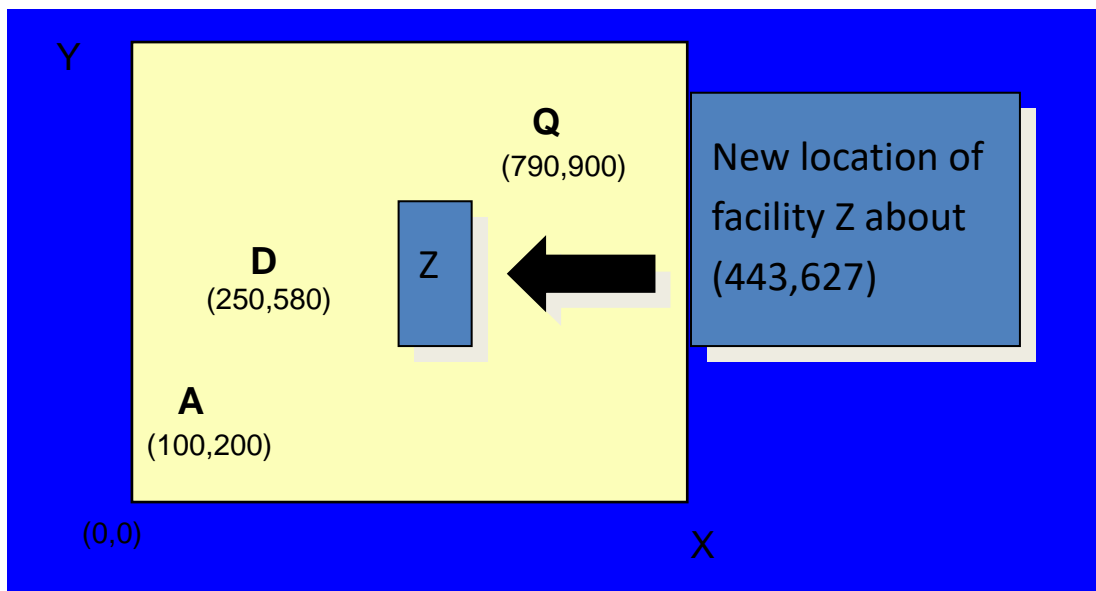
Example: Several Z-Mobile showrooms are located according to the following grid which represents coordinate locations for each showroom



#### 4.1.1 Determining the Coordinates of the New Facility

$$C_x = \frac{100(1250) + 250(1900) + 790(2300)}{1250 + 1900 + 2300} = \frac{2,417,000}{5,450} = 443.49$$

$$C_y = \frac{200(1250) + 580(1900) + 900(2300)}{1250 + 1900 + 2300} = \frac{3,422,000}{5,450} = 627.89$$



The suggestions and ideas for the innovative model will be discussed with some experts in the field such as heads of Sri Lanka Customs, Sri Lanka Ports Authority, Sri Lanka Railways and few people from respective terminals.

The length of the railway terminal will be determined by how many numbers of containers are supposed to be transported simultaneously and the frequency of travels will be calculated based on the demand which means the average number of containers released per a given time. The particular demand is expected to be a constant for a certain period of time, hence the relative probability theory will be applied to calculate the frequency of container releases.

#### 4.2 Relative Probability

If some event A occurs f times out of N possible opportunities, the probability of A can be defined as f divided by N.

$$P(A) = f/N$$

#### 4.3 Railway Cargo Transport Modes



Single Stack Method



Double Stack Method One

One of the methods mentioned above of freight transportation of railway cargo will be used to transport the containers. The speed of the train will be calculated based on the international norms for cargo trains and the distance between the port and the examination yards. The simple method of  $Speed = Distance / Time$  will be used for those calculations.

The new railway terminal will be consisted with a new scanning unit and also some gantry movements. The terminal handling times are already calculated in the previous studies hence there is no requirement in calculating them again and the time consumed in the scanning unit will be taken from the existing data from the ASYCUDA system. There is no specific study or data for gantry handling times to be found hence the time consumed in that process will be estimated purely based on the ground experience of the researcher.

The ground transport network will be introduced for the rest of the containers which do not undergo the examination in the yards. The alternative locations for the railway terminal except the location to be found from the calculations will be presented in the recommendations.

DATA ANALYSIS & INTERPRETATION

5.1 Customs Declaration Process

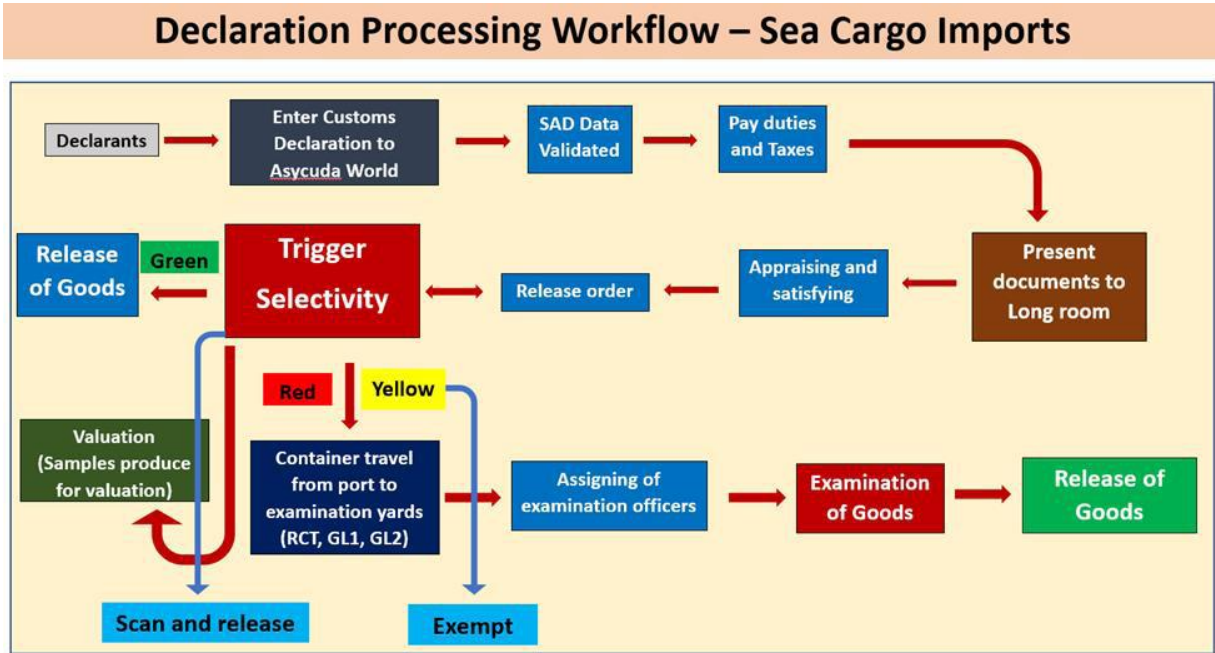


Figure 5: Import Cargo Clearing Process of FCL

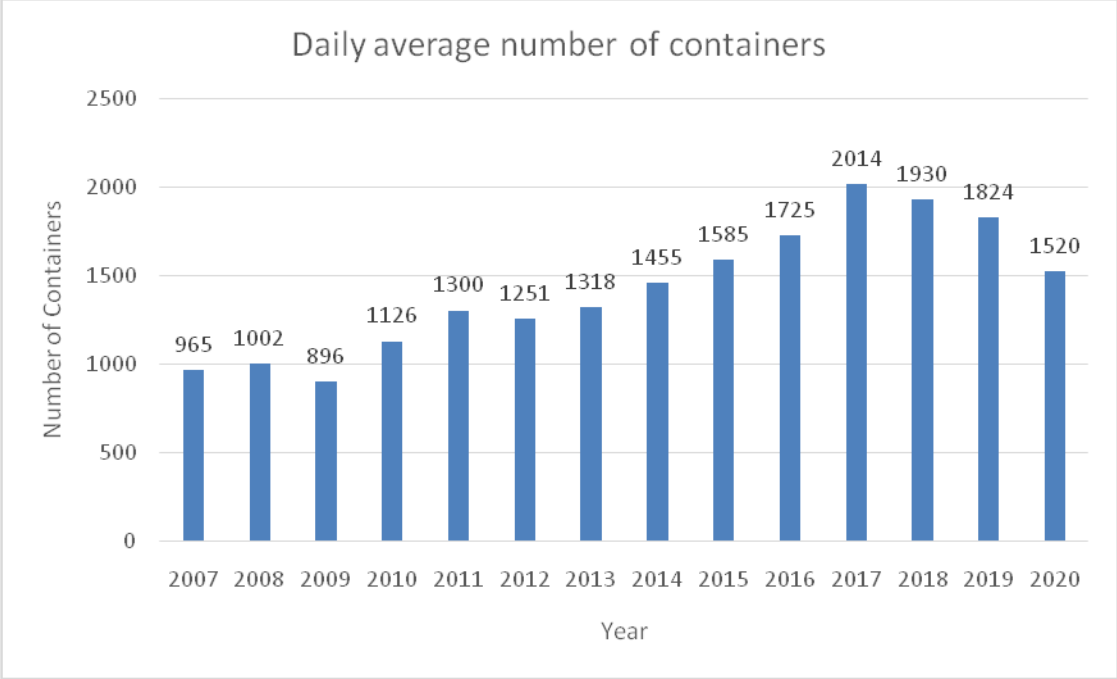
Customs clearance process is started with entering Customs Declaration to ASYCUDA World system and then paying applicable duties and levies. The release order is given after the appraisals of goods. The selectivity is triggered based on the risk analysis, past track records and the nature of goods. Selectivity means, whether the goods undergo which examination criteria or exempted.

5.2 Average number of containers released by Sri Lanka Customs each year on daily basis

Table 2: Average No. of Container on Daily Basis

Year	Average No. of Containers	Year	Average No. of Containers
2007	965	2014	1455
2008	1002	2015	1585
2009	896	2016	1725
2010	1126	2017	2014
2011	1300	2018	1930
2012	1251	2019	1824
2013	1318	2020	1520

According to table 2, number of containers get released per day has been increased over the years and went pass over 2000 units in 2017. However, there is a decreasing pattern afterwards it was just above 1500 units in 2020 which is quite similar to the figures shown in years 2014/15.



Graph 2: Average No. of Container on Daily Basis each year

It is clearly shown in Graph 2 that number of containers released before 2010 is lower than 1000 units or just above 1000 and it was slightly increased towards the 1500 mark by the year 2015. And it went more than 1500 units afterwards marking its peak in 2017 as more than 2000 units per day. However, the increasing pattern got slightly deviated after 2017 but still showing more than 1800 units in the following couple of years, though it has been just over 1500 mark in year 2020 due to unexpected scenarios.

### 5.3 Total number of containers examined by Sri Lanka Customs during last four years

Table 3: Number of Containers examined by SL Customs

Description	2017	%	2018	%	2019	%	2020	%
Exempted from examination	54,714	8.39	59,684	9.54	52,826	8.94	105,281	21.38
Scanned and exempted	-	-	-	-	-	-	2,009	0.41
<b>Examined at yards</b>	<b>359,777</b>	<b>55.15</b>	<b>323,668</b>	<b>51.76</b>	<b>297,462</b>	<b>50.32</b>	<b>213,798</b>	<b>43.42</b>
GRAYLINE 1	36,259	5.56	37,127	5.94	36,427	6.16	28,478	5.78
GRAYLINE 2	49,986	7.66	41,341	6.61	35,720	6.04	30,025	6.10
RCT	270,432	41.45	238,538	38.15	221,299	37.44	152,358	30.94
HRC	3,100	0.48	6,662	1.07	4,016	0.68	2,937	0.60
BOI released	68,967	10.57	70,108	11.21	70,323	11.90	62,390	12.67
Out-panel	148,235	22.72	151,053	24.16	152,549	25.81	97,484	19.80
UPB	18,805	2.88	17,041	2.73	15,244	2.58	10,339	2.10
Transshipment Katunayake	1,907	0.29	3,773	0.60	2,713	0.46	1,046	0.21
Other	5	0.00	8	0.00	4	0.00	80	0.02
<b>Total</b>	<b>652,410</b>	<b>100.00</b>	<b>625,335</b>	<b>100.00</b>	<b>591,121</b>	<b>100.00</b>	<b>492,427</b>	<b>100.00</b>

According to the table 3, more than 50% of containers are examined every day. It has been reduced to 43% in 2020 due to the various reasons and such as importation bans, high freight chargers, lack of cargo vessels and containers and prevailing covid-19 situation around the globe.

### 5.4 Number of containers examined at different yards on daily basis

Table 4: Number of Containers examined daily at different yards

Description	2017	%	2018	%	2019	%	2020	%
Average Daily Containers	2,014		1,930		1,824		1,520	
Daily examined at yards	1,110	55.15	999	51.76	918	50.32	660	43.42
Daily examinations								
GRAYLINE 1	112	10.08	115	11.47	112	12.25	88	13.32
GRAYLINE 2	154	13.89	128	12.77	110	12.01	93	14.04
RCT	835	75.17	736	73.70	683	74.40	470	71.26
HRC	10	0.86	21	2.06	12	1.35	9	1.37

75% of the examinations are carried out at RCT with respect to the table 4. Only around 10-15% of examinations are taken place in the rest of the yards. As it mentioned above, year 2020 is

shown some outlier figures, hence it is not considered in the future calculations as only 2017-2019 data will be considered. By that,

#### 5.4.1 Average figures during the years 2017/19

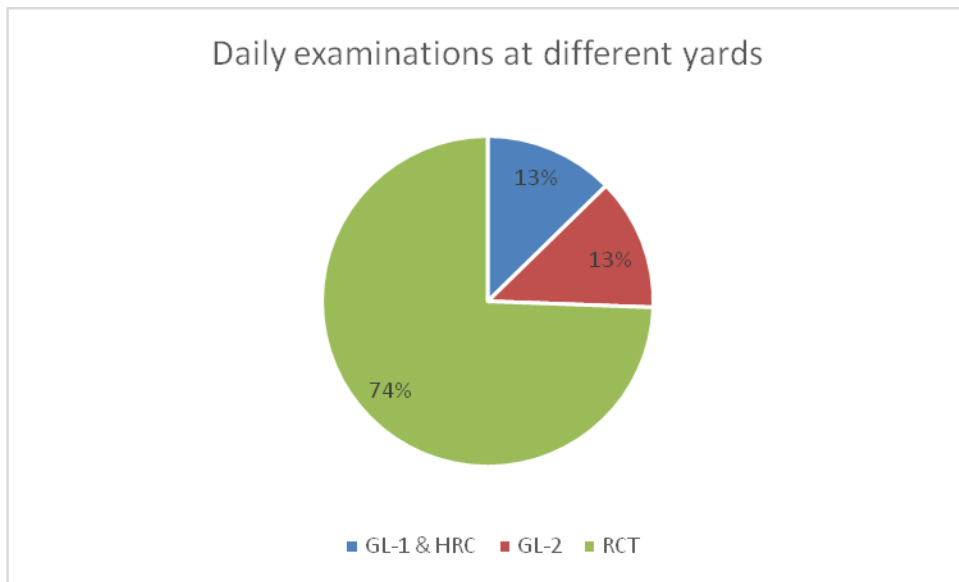
Daily average containers =  $(2014+1930+1824)/3 = 1923$

Daily examine average =  $(55.15+51.76+50.32)/3 = 52.41\%$

GL-1 & HRC = 12.69% (both yards are located in the same place)

GL-2 = 12.89%

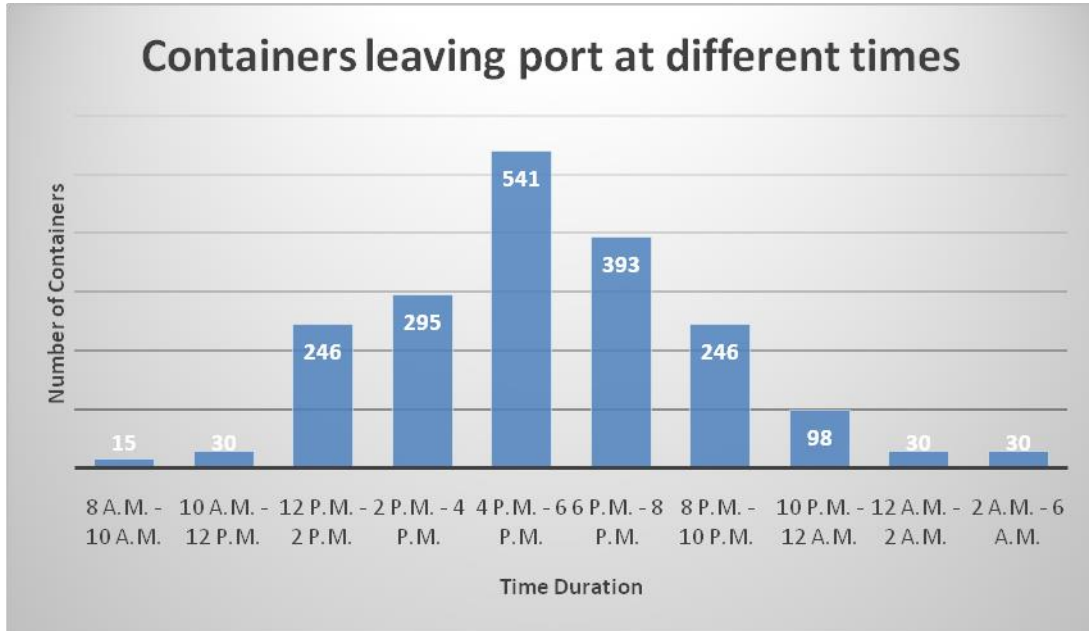
RCT = 74.42%



Graph 3: Percentage of examinations taken place at different yards daily

Graph 3 clearly shows that almost 75% of the daily examinations are carried out at RCT and it is 74%. The rest of the amount is similarly divided into another two yards.

### 5.5 Container leaving the port at different time slots of a given day



Graph 4: Number of Container leaving the port at different times

The distribution of container departs from port is normally distributed as per the graph 4. It is rapidly increasing after 12p.m. and comes to the peak during 4-6p.m. which is considered as most peak hours during the day at public roads. Then it is slowly going down until 12a.m. 76% of the containers are leaving the port during the peak hours on public roads.

Table 5: No. of containers reached different yards at different times

Time Duration	No. of Containers	For examinations 52.4%	GL-1 12.7%	GL-2 12.9%	RCT 74.4%
8 a.m. - 10 a.m.	15	8	1	1	6
10 a.m. - 12 p.m.	30	15	2	2	12
12 p.m. - 2 p.m.	246	129	16	17	96
2 p.m. - 4 p.m.	295	155	20	20	115
4 p.m. - 6 p.m.	541	283	36	37	211
6 p.m. - 8 p.m.	393	206	26	27	153
8 p.m. - 10 p.m.	246	129	16	17	96
10 p.m. - 12 a.m.	98	52	7	7	38
12 a.m. - 2 a.m.	30	15	2	2	12
2 a.m. - 6 a.m.	30	15	2	2	12
<b>Total</b>	<b>1923</b>	<b>1008</b>	<b>128</b>	<b>130</b>	<b>750</b>

According to the table 5, most of the containers, 76% of to be examined containers (773 out of 1008) to be reached by respective yards are during the most peak hours in the day. That means 12.00-8.00p.m. is considered as the most peak hours at the public roads where most of the congestions are occurred during this period due to the school times and office hours.

## 5.6 Graphical representation of port terminals and examination yards



Figure 6: Graphical representation of the map from port premises to examination yards

The routes from the port premises to all three yards are located across the extreme high congestion, public roads in order to figure 6. The container movement is also marked its peak when the public roads are getting congested due to the after schools and office hours.

Even though, the containers which are supposed to be examined are reached by the yards at regular intervals continuously, all the containers could not be examined simultaneously due to the less capacity of the yards.

## 5.7 Existing capacities of the examination yards

Table 6: Capacity of RCT Yard

<b>Dimension(Ft.)</b>	<b>Bay 01</b>	<b>Bay 02</b>	<b>Bay 03</b>	<b>Bay 04</b>	<b>Bay 05</b>	<b>RTF</b>	<b>RTF UPB</b>
<b>Length</b>	177	130	227	229	265		
<b>Width</b>	5.8	5.8	5	15.4	27		
<b>Capacity/ containers</b>	17	12		25	28	6	2

RCT yard is only capable of handling 90 containers at once, according to the figures shown in the table 6. Bay 03 of the yard is not being used at the moment due to some technical issues. According to the table 5 figures, RCT gets 750 containers everyday, but it could only examine 90 containers at once.

Table 7: Capacity of GL-2

<b>Dimension(Ft.)</b>	<b>Bay 01</b>	<b>Bay 02</b>	<b>Bay 03</b>	<b>De mounting space</b>
<b>Length</b>	420	180	405	
<b>Width</b>	23	16	11	
<b>Capacity/containers</b>	35	15	25	5

According to the table 7, GL-2 yard could handle 80 containers simultaneously during any given time on the day. Demounting space is available for 5 containers means 5 containers can be examined without lorries keeping only the container grounded.

Table 8: Capacity of GL-1

<b>Dimension(Ft.)</b>	<b>Bay 01</b>	<b>Bay 02</b>	<b>Bay 03</b>	<b>De mounting hut</b>
<b>Length</b>	308	300	173	110
<b>Width</b>	14	19.6	20	35
<b>Capacity/ containers</b>	24	28	15	6

With respect to the table 8, 73 containers could be examined at once in the GL-1 yard. Demounting space is available for 6 containers.

Though the capacities of the yards are mentioned above, it is necessary to identify the time taken for each type of examinations. Mainly, there are two types of examinations are carried out by the Customs and the channels of examinations are selected based on these two types.

## 5.8 Channel Selection for different yards in a given day (2<sup>nd</sup>February, 2021)

Table 9: Channel selection for different yards

Yard	Channel	No. of Containers	%
RCT	Red	77	28
	Yellow	195	72
GL-1	Red	83	100
	Yellow	0	
GL-2	Red	101	100
	Yellow	0	

As it is shown in table 9, there are two channels called Red and Yellow. Red means 100% fully detailed examination and Yellow is just a panel examination or may be called it as random examination. Both GL-1 and GL-2 are dedicated for detailed examinations while RCT is allocated for most of the panel examinations. Because of this reason, almost all the FMCGs are directed to RCT and only a few percentages of detailed examinations are carried out at RCT.

## 5.9 Time taken for different type of examinations in three different yards

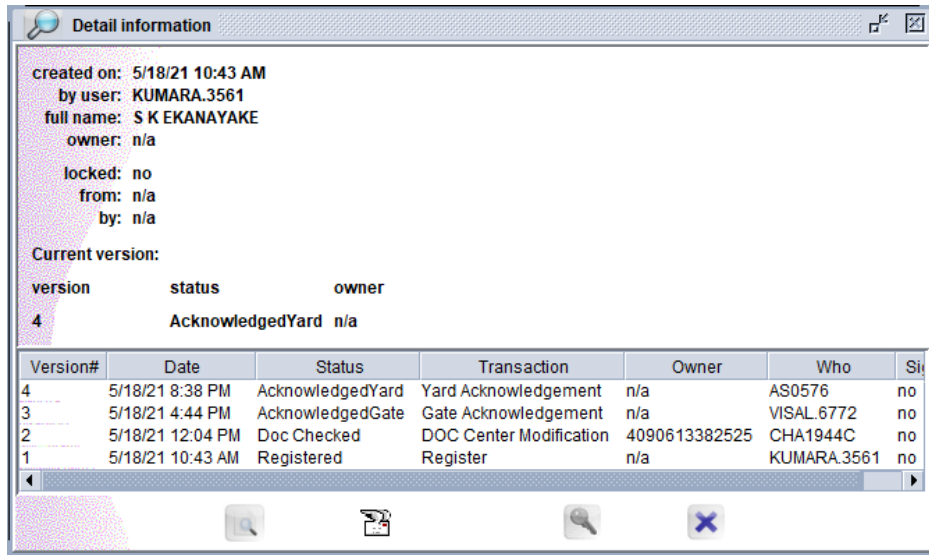
Table 10: Average turnaround times by examination yards

Channel Yard	Amber/Panel	Detailed/ Red
RCT	1 hr 20 min	6 hr 30 min
GL-1	1 hr 56 min	6 hr 52 min
GL-2	2 hr 26 min	6 hr 00 min
HRC		7 hr 19 min

It takes 1 hour and 20 minutes to complete a panel examination at the RCT yard with respect to the table 10. Therefore, the containers have to wait in the roads for their turn to be arrived until the current examinations are finished even though the containers are continuously arriving to their desired yards. This makes a long queue of containers on the roads and going back to the port premises inside itself.

## 5.10 The real time actual data of the analysis

In order to verify the accuracy of the above details, let us go through the original captures taken from the ASYCUDA system. It is randomly taken a capture from the system in a normal day.



created on: 5/18/21 10:43 AM  
by user: KUMARA.3561  
full name: S K EKANAYAKE  
owner: n/a  
locked: no  
from: n/a  
by: n/a


Current version:

version	status	owner
4	AcknowledgedYard	n/a

Version#	Date	Status	Transaction	Owner	Who	Site
4	5/18/21 8:38 PM	AcknowledgedYard	Yard Acknowledgement	n/a	AS0576	no
3	5/18/21 4:44 PM	AcknowledgedGate	Gate Acknowledgement	n/a	VISAL.6772	no
2	5/18/21 12:04 PM	Doc Checked	DOC Center Modification	4090613382525	CHA1944C	no
1	5/18/21 10:43 AM	Registered	Register	n/a	KUMARA.3561	no

Figure 9: Time laps between each process shown in the system

This CusDec is registered in the system at 10.43a.m and the release order was given in 12.04 p.m. by the Doc Centre. The time difference is only 01 hour and 21 minutes. After that, it was taken 04 hours and 45 minutes to reach the NCT gate which is the exit gate of the port. That is mentioned here as the Gate Acknowledgement at 4.44p.m. It took 04 hours to exit port premises. Then, it takes almost another 04 hours to reach the yard as it is clearly shown here as 8.38p.m.



Stop Container

Registration Number P 114271 18/05/2021

**CUSDEC Information**

Customs Office CBHQ1 Colombo Head Quaters Importer 1031750892525  
 CUSDEC Reference 2021 73789 SAMEERA CERAMIC  
 CUSDEC Date 17/05/2021 Declarant 4090613382525  
 M & K FREIGHT SERVICE

**DOC CENTER**

Container No. WHSU5093609 Vessel Name SM NEYYAR  
 Cargo Handler SLPA Destination GRAYLINE1  
 Truck No. 290-0151 Trailer No. 67-3233  
 I acknowledge receipt of Customs Container Pass Issued By:  
 Wharf Clerk / Importer's Representative Assistant Superintendent of Customs - Doc Center / CHA  
 CHA No. CHA1944C S.Ragupathy(693160154V)

**NCT Gate**

Seals No. F418006 Seals Affixed / Container Released By:  
 Expected Arrival Time to Yard 18/05/2021 16:56 Assistant Superintendent of Customs - NCT Gate  
 V Mudalige

Figure 10: Container Pass document of the above consignment

Even though it has taken 04 hours to reach the yard from port exit, it has shown only 14 minutes (Gate Acknowledgement is at 4.44p.m. according to figure 09) of expected time to reach the yard (16.56p.m) in the system according to the figure 10. That means if there wasn't any congestion in the road, it would have only taken 14 minutes to reach the yard.

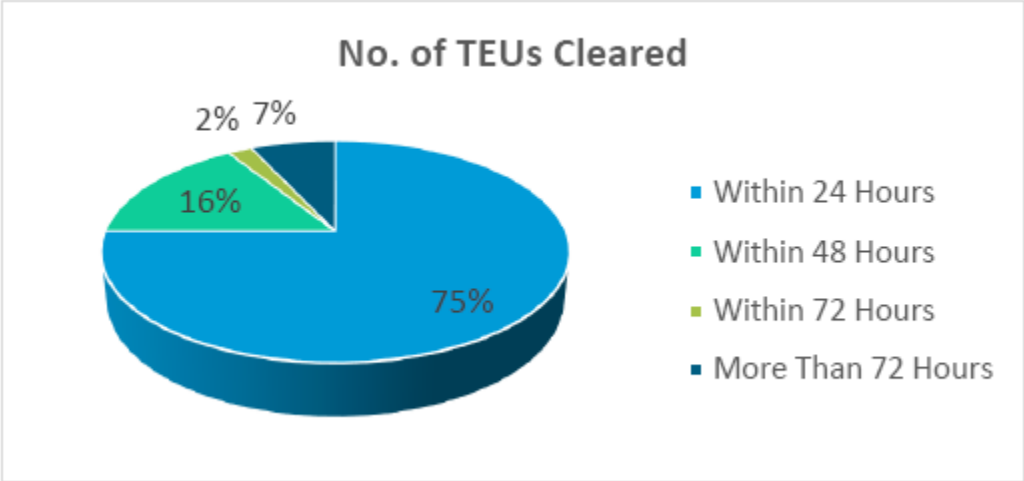
Current version:

version	status	owner
9	Totally exited	4090613382525

Version#	Date	Status	Transaction	Owner	Who	Signe
9	5/20/21 8:03 PM	Totally exited	Totally exit	4090613382525	DD281	no
8	5/20/21 6:01 PM	Paid	Payment	4090613382525	LK_CLEAR_008	no
7	5/20/21 5:26 PM	Assessed	Post-Entry	4090613382525	SAMEERA.5406	no
6	5/18/21 10:43 AM	Paid	Release Order (selectivity)	4090613382525	KUMARA.3561	no
5	5/18/21 10:43 AM	Paid	Post-Entry	4090613382525	KUMARA.3561	no
4	5/18/21 10:42 AM	Paid	Post-Entry	4090613382525	KUMARA.3561	no
3	5/18/21 10:01 AM	Paid	Post-Entry	4090613382525	AS0166	no
2	5/17/21 6:07 PM	Paid	Payment	4090613382525	LK_CLEAR_009	no
1	5/17/21 4:36 PM	Assessed	Validate and assess	4090613382525	CHA1944C	no

Figure 11: Total time laps shown in the system

Even though the CusDec is validated into the system on 17<sup>th</sup> May, the inside processes had started only on 18<sup>th</sup> May. However, the consignment has been released within 72 hours, which is somewhat exceptional into normal figures as most of the containers are released within the 24 hours as shown in the graph 5.



Graph 5: No. of TEUs released within a certain time period

### THE EXPERT IDEA

#### 6.1 The factors identified for delaying the customs clearance process

As it clearly identifies the causes for delaying the customs clearance process by the analyzing the current data, few major factors can be stated as follows,

1. Lack of capacity of the existing examination yards
2. Locations of the examination yards
3. The distance between the examination yards and the port
4. The route between the examination yards and the port is laid through the public roads
5. Those public roads are highly congested at any given time of the day especially at peak hours
6. Container movement also shows its highest figures at the peak hours of the day
7. All the containers, including non-examinations ones also have to go on the same line
8. Containers are continuously reaching yards, so they have to wait outside at the roads until the current examinations are over.
9. Those long queues make public roads more congested and also the port premises inside.
10. The lorry drivers have to be in idle for hours as they couldn't find a proper sanitary facilitation on the way or meals.
11. The fuel wastage of the lorries and the environmental impact due to the long hours of engine workings.
12. Wastage of valuable man hours of both public and stakeholders of the process due to the time wasted for roads.
13. Finally, the entire customs clearing time gets increased

There are a few factors in the mentioned above which cannot be addressed with instant solutions due to several reasons.

Examination yards were built in early 90's to cater the demand in later 90's and early 2000's demands hence the capacities couldn't match with current demands. Unfortunately, those yards are located in highly populated urban areas in Colombo suburbs, which utilize the maximum area they could accommodate as the size of the yards cannot be increased further. The distance between those yards and the port premises is a constant all the time because there is no alternative route or minimum distance road as it is currently used the route with minimum distance. The route is laid through the highly congested public roads where the public congestions in the roads cannot be controlled over the years in Sri Lanka. And also, the container movement has also become increasing with peak hours of the day as Sri Lanka Customs could not retain from releasing container during such hours because we are not the only stakeholder of this process as there are many other stakeholders involving in the process such as banks, accredited organizations. Space for new examination yards within a certain range from the port could not be found since there is no free land available with acres in Colombo Suburbs. There is a proposal for a new examination yard to be built in Kerawalapitiya and it has been dragging over last two decades and still being in the discussion & the feasible study levels. Therefore, as Sri Lanka Customs, we cannot address above mentioned scenarios because they are without our control.

And there are few factors among the mentioned above which can be changed by Sri Lanka Customs.

## **6.2 Different modes of cargo transportation**

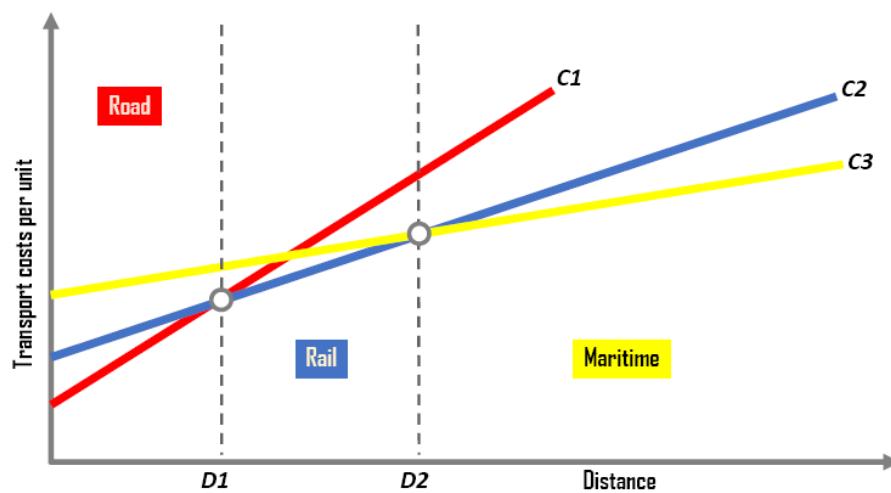
If the public roads are congested, we should be looking for alternative modes of transports. In Sri Lanka, it can be seen the container are transported only by lorries but when it comes to international contexts, containers are transported using the waterways and railways. Specially in Europe countries, it is common to see such transport methods and also it has become popular in India too.

## 6.2.1 Waterways Transportation



Figure 12: Inland Waterway transportation of containers

We don't have such huge inland waterways to be found in Sri Lanka for container transportation. But, we do have a good network of railways around the country. The railway is the most environmentally friendly and low-cost method of transportation for middle level of distances in the world.



Graph 6: Distance, Mode of Choice & Cost of the transportation

## 6.2.2 Railway Transportation

Railways are widely being used for container transportation in countries like USA, China, several European countries and also countries in Asia like Russia, Siberia, Ukraine, India and so on.



Figure 13: Railway transportation of containers

Railways are not only used for taking containers from one station to another station, but also they are used to carry the containers from the port premises inside itself. Therefore, huge number of lorries are not required to come inside terminals to carry those containers from port to outside. But, only one rail movement could cater more than 40 lorries demand at once.



Figure 13: Railway facilities inside the terminals

### **6.3 Why railway is a better method for container transportation in Colombo seaport?**

The same method can be applied at the Colombo port in order to take the container to the examination yards. Why railways can be used to perform the above task in Colombo port?

- There is already a railway line built coming inside to the Colombo port in order to carry the engines, boxes whenever there is a new arrival. Unfortunately, that is only used for such instances whereas new arrivals coming to the port and it is vacant rest of all the time.
- The all three yards are located just alongside with the railway line.
- The particular railway line is only crossed any of the public roads just once on its way all three terminals.
- Other than that, the railway line is going under the roads and above the roads.

By this way, 50% of the container movement in the roads could be reduced, whereas 1000 odd containers out of 2000 containers which is undergoing examinations daily can be transported through railways to the examination yards without any turbulences.

## Chapter 07

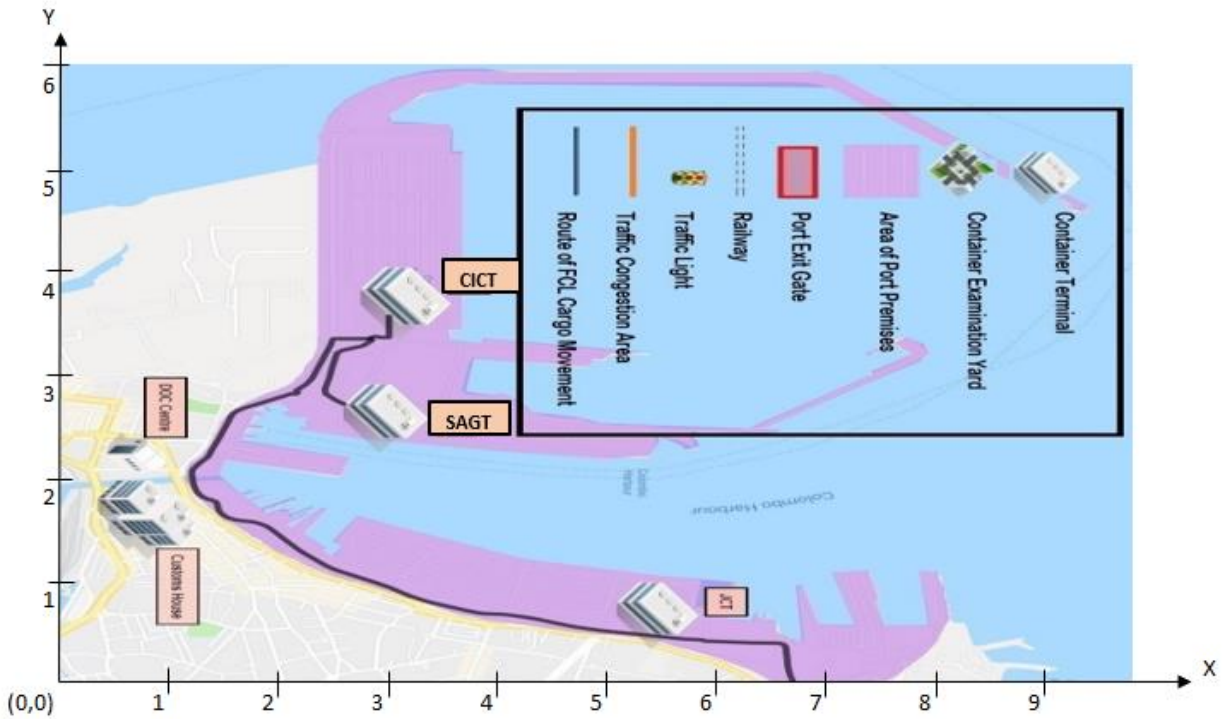
### RESEARCH DESIGN

#### 7.1 Identification of location for the Railway Terminal

Though it is really simple to say to put the containers on rail and transfer, it would not be a simple job as it seems. It is necessary to identify how these containers are to be picked at the port. Colombo port is consisted with three terminals and containers are released from every terminal in regular intervals at proportionate figure, according to the number of TEUs that each terminal handles. Basically, 50% of the TEUs are handled by CICT and respectively 30% and 20% are handled by SAGT and JCT. Therefore, a major portion of the containers is released from CICT and rest of the containers by other two terminals. And also, there will be another two major terminals in recent years called ECT (East Container Terminal) and WCT (West Container Terminal) as well. Because of this reason, there should be a centre to collect all the containers released from all the terminals at one place in the port that can be called as a Central Railway Terminal (CRT).

This CRT cannot be established in a random place selected in the port since the number of TEUs released from each terminal is different from terminal to terminal. Therefore, the location should be more towards the CICT since 50% of the TEUs are released by the particular terminal. The following methodology can be used in order to find the appropriate location for CRT.

Central Gravity Method is widely being used to find the appropriate location for a warehouse, factory etc. in the Facility Planning and Plant locations based on the demands. The same method can be applied here in order to find a suitable location for CRT whereas the number of TEUs handle by each terminal can be considered as the demand of each terminal. The co-ordinates of the terminals can be obtained by a simple scale graphing as follows.



Graph 7: Port premises with a simple scale graphing

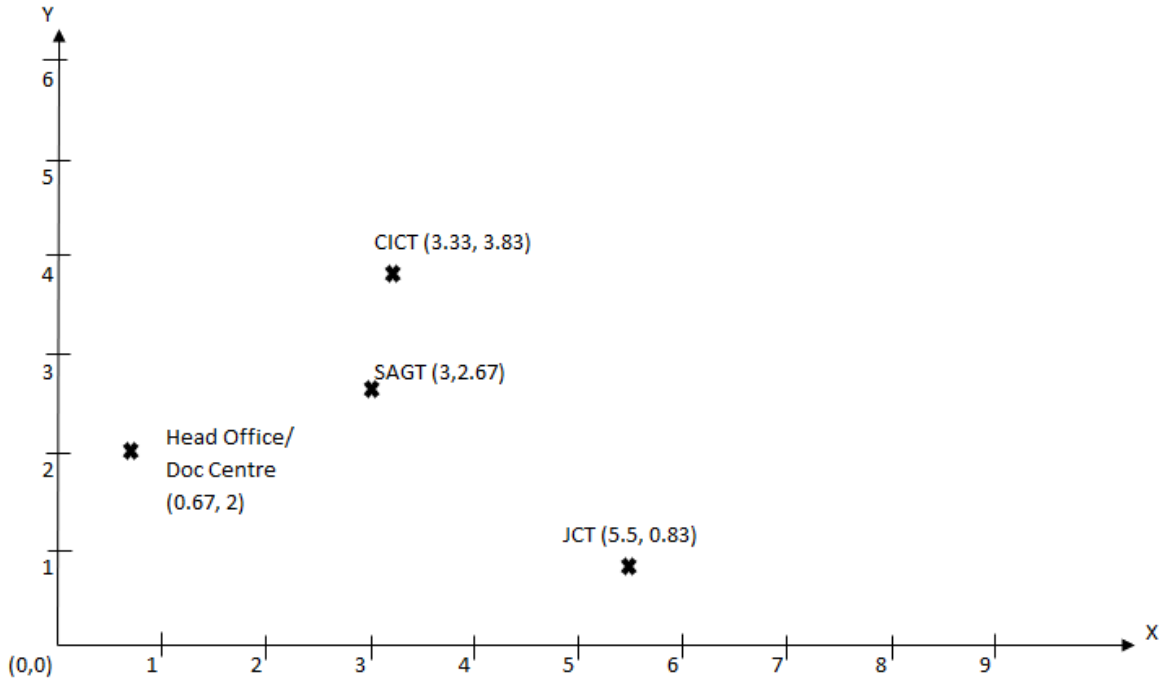
According to the graph 7, the simple co-ordinates of three terminals and the Customs Head office along with the Doc centre are as follows,

Head office/ Doc Centre = (0.67,2)

CICT = (3.33,3.83)

SAGT = (3,2.67)

JCT = (5.5,0.83)



Graph 8: Simple scale graph of the port premises with co-ordinates

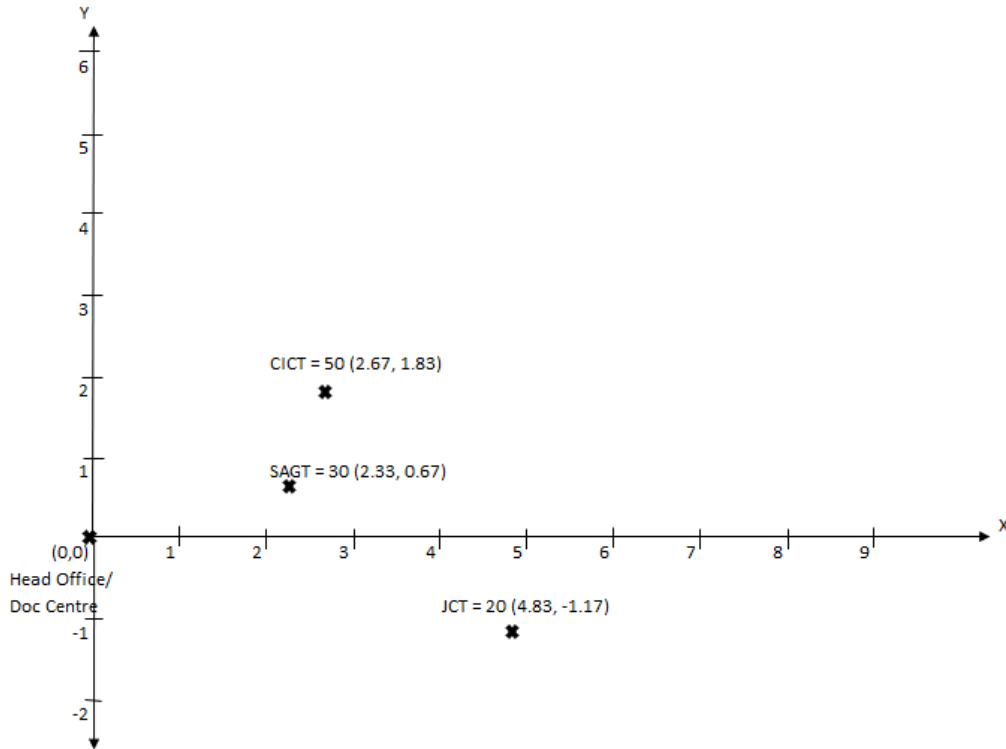
The head office and the doc centre has been considered as one location since both of them are for administrative purposes and took the middle co-ordinate of both buildings. There should be a (0,0) coordinates with zero demand in order to calculate using Central Gravity Method. Therefore, the coordinates have to be changed until one main facility becomes (0,0) with zero demand. It is an obvious fact that head office and the doc centre have no demand at all since they are only the administration buildings. Thus, the coordinates of the head office and the doc centre can be shifted to (0,0) point. The revised simple scale graph and new co-ordinates can be shown as follows,

$$\text{Head office/ Doc Centre} = (0,0)$$

$$\text{CICT} = (2.67, 1.83)$$

$$\text{SAGT} = (2.33, 0.67)$$

$$\text{JCT} = (4.83, -1.17)$$



Graph 9: Revised scale graph with new co-ordinates

The demands of respective terminals are also added in the graph 9 for the ease of calculations.

The co-ordinates of the CRT can be derived as follows,

$$C_x = \frac{50(2.67) + 30(2.33) + 20(4.83)}{50 + 30 + 20} = 2.99 \text{ which means almost } 3$$

$$C_y = \frac{50(1.83) + 30(0.67) + 20(-1.17)}{50 + 30 + 20} = 0.88$$

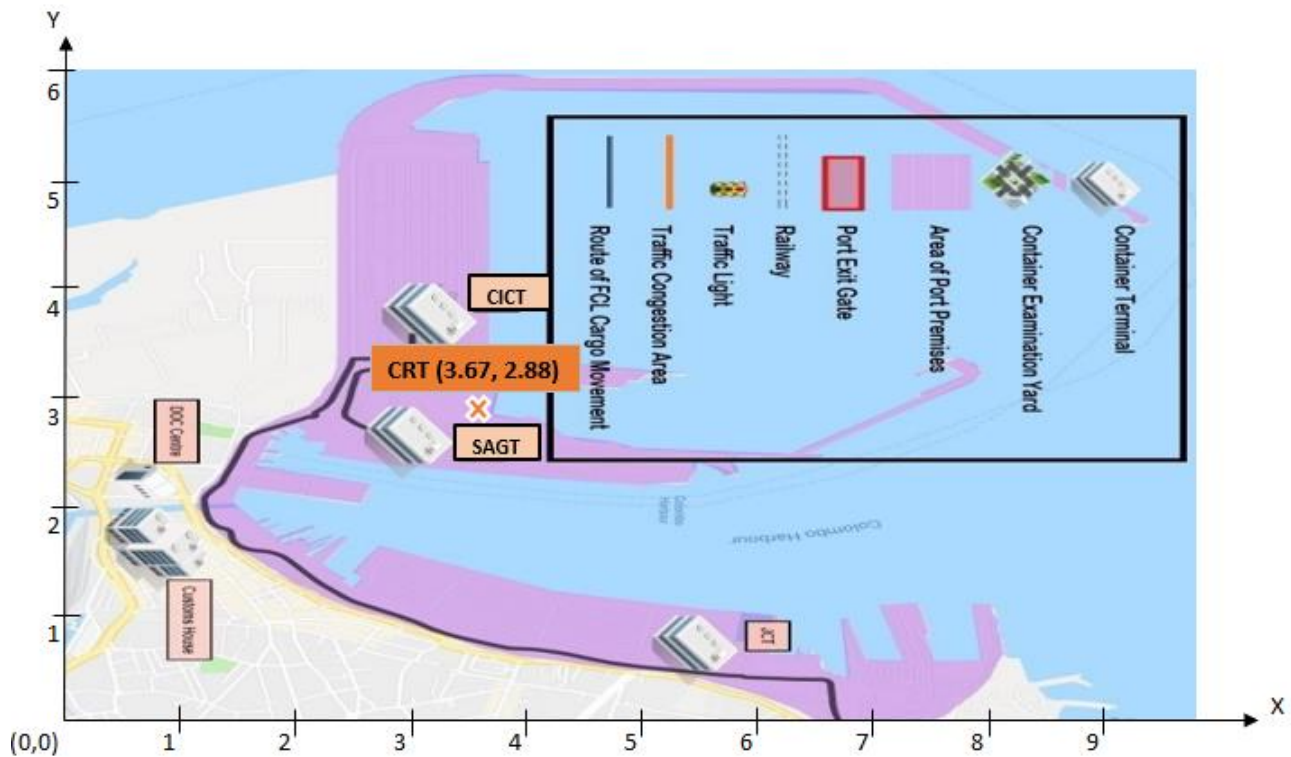
Therefore,

$(C_x, C_y) = (3, 0.88)$

But, this is not the actual location of the CRT since the original coordinates were shifted. Therefore, the original co-ordinates of the CRT can be shown as follows,

New co-ordinates =  $(3.67, 2.88)$

If these co-ordinates match with the original map which is graph 7, then the actual location of the CRT can be found.



Graph 10: Location of the CRT

As per the graph 10, the virtual location of the CRT is located somewhere in between CICT & more towards SAGT. There is no doubt about that coordinates as 80% of the TEUs of Colombo port is handled by these two terminals. Thus, either some lands from one of these terminals or part of each terminal should be acquired and convert some part of its area into a railway terminal.

Though it has been identified a perfect location for the CRT, it is also necessary to identify how many movements of tarins should be carried out in which time periods and how many trains

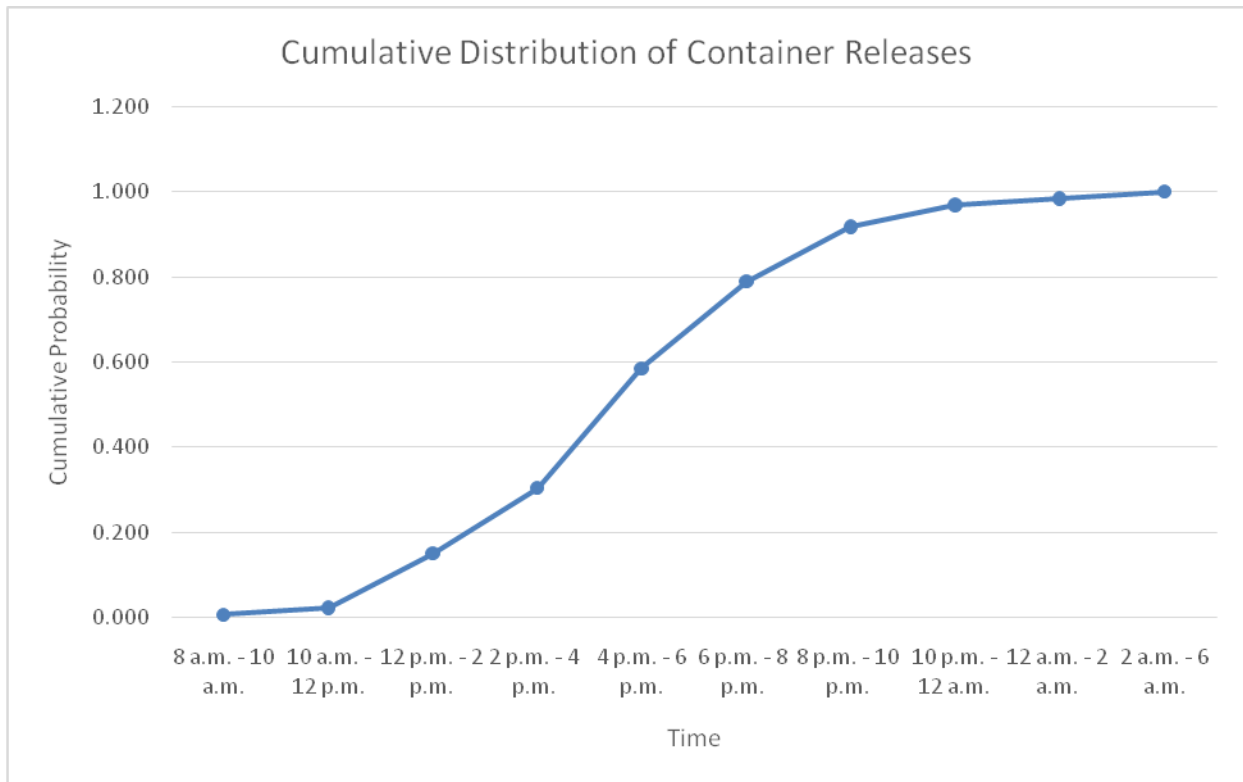
required in a given day. In order to do that, it should be determined how many containers are transported to each examination yard within a certain period of time from Colombo port. And also the channel selection should be considered since different types of examinations consume different times.

## 7.2 Probability of releasing containers in different time slots in a given day

According to table 11, only 23 containers are released for examinations before 12.00 p.m. of the day. Altogether it is only 45 containers are released from the port. Therefore, there is no requirement of the additional transport method to carry out containers since there is no huge rush in the morning sessions. But after 12.00 p.m. it can clearly be seen, there is a rapid increment of releasing containers as it is 129 for examinations and 246 altogether. That is the time where container traffic keeps starting to increase inside the port. The schools' traffic on public roads usually starts after 1.00 p.m. to 1.30 p.m. hence 1.00 p.m. should be the cut off time for all the containers which undergo examinations that should not be allowed to leave the port premises through lorries. That is where railway transport comes forward. According to the relative probabilities, 90% of the containers are released in between 12.00 p.m. to 10.00 p.m. That should be the time period where railway lines should be used for container transportation.

Table 11: Probability of releasing containers

<b>Time Duration</b>	<b>No. of Containers</b>	<b>For examinations 52.4%</b>	<b>Relative Probabilities</b>	<b>Cumulative Probability</b>
<b>8 a.m. - 10 a.m.</b>	15	8	0.008	0.008
<b>10 a.m. - 12 p.m.</b>	30	15	0.015	0.023
<b>12 p.m. - 2 p.m.</b>	246	129	0.128	0.151
<b>2 p.m. - 4 p.m.</b>	295	155	0.153	0.304
<b>4 p.m. - 6 p.m.</b>	541	283	0.281	0.586
<b>6 p.m. - 8 p.m.</b>	393	206	0.205	0.790
<b>8 p.m. - 10 p.m.</b>	246	129	0.128	0.918
<b>10 p.m. - 12 a.m.</b>	98	52	0.051	0.969
<b>12 a.m. - 2 a.m.</b>	30	15	0.015	0.985
<b>2 a.m. - 6 a.m.</b>	30	15	0.015	1.000
<b>Total</b>	<b>1923</b>	<b>1008</b>	<b>1</b>	



Graph 11: Cumulative Probability Distribution of Container Releases in a given Day

According to the graph 11, containers, leaving the port is less than 20% before 12 noon and it is 80% exactly at the halfway stage. Which means most of the containers, leaving the port during the period of 12 noon to 8.00 p.m. on the day.

### 7.3 Channel wise selection of containers in different time slots in a given day

Table 12: Channel selection in different times at different yards

Time Duration	No. of Containers	For examinations 52.4%	GL-1 12.7%	GL-2 12.9%	RCT 74.4%	
			100% Red	100% Red	28% Red	72% Yellow
8 a.m. - 10 a.m.	15	8	1	1	2	4
10 a.m. - 12 p.m.	30	15	2	2	3	8
12 p.m. - 2 p.m.	246	129	16	17	27	69
2 p.m. - 4 p.m.	295	155	20	20	32	83
4 p.m. - 6 p.m.	541	283	36	37	59	152
6 p.m. - 8 p.m.	393	206	26	27	43	110
8 p.m. - 10 p.m.	246	129	16	17	27	69
10 p.m. - 12 a.m.	98	52	7	7	11	28
12 a.m. - 2 a.m.	30	15	2	2	3	8
2 a.m. - 6 a.m.	30	15	2	2	3	8
<b>Total</b>	<b>1923</b>	<b>1008</b>	<b>128</b>	<b>130</b>	<b>210</b>	<b>540</b>

Only 23 containers are left for examinations before 12 noon. Altogether 45 containers which means no rush. But it is significantly increased during the 12.00 – 2.00 p.m. as 246 containers, leaving the port and 129 are to be examined out of those 246. Based on the assumption made, the probability of releasing a container in a certain time period is a constant as in other word a uniform probability over the time, it can be predicted same number of containers are released in between 12 noon to 1.00 p.m. as 1.00 p.m. to 2.00 p.m. Therefore, approximately 65 containers are leaving the port during 12 noon to 1.00 p.m. for examinations. In this model, these 65 containers are also allowed to leave the port using road transportation since the cutoff time is scheduled at 1.00 p.m.

### 7.4 Assumptions made in the calculations

There is almost 7km distance from CRT to RCT & GL-1. Cargo train could travel with a minimum speed of 15-20 kmph. Since, Speed = Distance/ Time then the average time taken from CRT to RCT & GL-1 can be estimated at 21-28 minutes.

The assumption was made on the minimum speed that train could travel. If it is calculated for different speeds, the following table can be derived.

#### 7.4.1 Estimated travelling speeds of a cargo train

Table 13: Time taken to travel for the train in different speeds

No	Speed/ kmph	Time/ minutes
1	15	28
2	20	21
3	25	16.8
4	30	14
5	35	12
6	40	10.5
7	45	9.3
8	50	8.4
9	55	7.6
10	60	7

The initial model is developed for average train speed of 30kmph which means it is only taken less than 15 minutes to reach yards from CRT. 65 containers have to be transported within the very first hour of operation. Four (04) trains can be railed with 15 minutes break and one train should be accommodated with at least 16 containers. According to the calculation, it is required trains with minimum 20 container holders if the trains are single stack ones. If it is double stacked, then it is only required trains with 10 container holders. For the moment, the model is developed with only one stack method due to following reasons.

#### 7.4.2 The factor behind not using double-stack method

- 1) The railway is through several bridges on its way to the yards and they are not built in sufficient height for double stack operations at the moment.
- 2) The scanning of each container separately would be somewhat difficult if the double stack method is implemented.

## 7.5 Estimated capacities of cargo trains & its movements

### 7.5.1 Capacity of a single cargo train

Table 14: Considering duration for rail transport

Time Duration	For examinations
12 p.m. - 2 p.m.	129
2 p.m. - 4 p.m.	155
4 p.m. - 6 p.m.	283
6 p.m. - 8 p.m.	206
8 p.m. - 10 p.m.	129
<b>Total</b>	<b>902</b>

period is constant.

According to the table 14, only 12 noon to 10.00 p.m. duration will be considered for rail transportation. From that also, 12 noon to 1.00 p.m. is exempted and will only be considered whatever releases after 1.00 p.m. Table 15 clearly shows what is remaining after 12 noon to 1.00 p.m. with respect to the relative probability as the probability of releasing containers within a certain

### 7.5.2 The number of train movements should be carried out between port & the examination yards in a single day

Table 15: Train movements and capacities

Time Duration	For examinations	Train Movements	Single Train Capacity
1.00 - 2.00 p.m.	65	4	16
2 p.m. - 4 p.m.	155	8	19
4 p.m. - 6 p.m.	283	8	35
6 p.m. - 8 p.m.	206	8	26
8 p.m. - 10 p.m.	129	8	16
<b>Total</b>	<b>838</b>	<b>36</b>	

Time taken for one side journey is estimated as 14 minutes, 04 journeys can be taken place per hour. One train should only depart once the other has reached the yard. Thus, it is shown 36 train journeys for a given day.

The minimum capacity of the train should be twenty, 40' containers which are calculated minimum for 800 feet long trains. It would be 900 feet along with its engines. Therefore, the CRT should be built with minimum distance of 300m long railway tracks. Twice of that distance can be acquired from the location identified for the CRT. Because SAGT could accommodate three 200m long vessels simultaneously. If it is divided the number of containers by the train movements, then the figure is more than 23 (838/36) which means one train should atleast carry 23 containers. And also the single train capacity in between 4.00 – 6.00 p.m is too higher than 20 and the average figure. The length of the train cannot be increased further because it is difficult

to build such a long length railway station in the examination yard though it is possible at the CRT. Eventhough it has doubled the speed of the train, it still takes 7 minutes to reach and we could only operate 6 trains per hour with 10 minutes break which is also not sufficient to cater the demand during the period. Because it requires atleast 14 train movements within 4.00 – 6.00 p.m. and 10 train movements within 6.00 – 8.00 p.m. with 20 container capacities.

### 7.5.3 Why GL-2 should not be considered for railway transportation?

The only way to overcome this situation is to reduce some numbers of containers. It is an obvious fact that GL-2 is located only 1km away from the port exit while other two are 3km away. The only reason why the time taken is so long to reach GL-2 because those containers are stuck in the middle of the port traffic with other destination containers. Since it is only 130 containers per day are reached by GL-2, a separate freeway(this will be discussed later) of the road can be allocated for GL-2 containers hence we could eliminate few numbers of containers on the railway. On the other hand, if we continue to put GL-2 containers on the railway, then there should be an intermediate station towards GL-2 on the way to RCT & GL-1. This is completely ruined timelines between CRT & RCT/GL-1. And also 90% of the containers is directed for RCT & GL-1, the main focus should be on that 90% which consumes most of the time. Table 16 clearly shows that only 880 containers are eligible for railway transportation.

Table 16: Total number of containers for examinations exempt GL-2

<b>Time Duration</b>	<b>No. of Containers</b>	<b>For examinations 52.4%</b>	<b>GL-1 12.7%</b>	<b>GL-2 12.9%</b>	<b>RCT 74.4%</b>	<b>Reduced GL-2</b>
8 a.m. - 10 a.m.	15	8	1	1	6	7
10 a.m. - 12 p.m.	30	15	2	2	12	13
12 p.m. - 2 p.m.	246	129	16	17	96	112
2 p.m. - 4 p.m.	295	155	20	20	115	135
4 p.m. - 6 p.m.	541	283	36	37	211	247
6 p.m. - 8 p.m.	393	206	26	27	153	180
8 p.m. - 10 p.m.	246	129	16	17	96	112
10 p.m. - 12 a.m.	98	52	7	7	38	45
12 a.m. - 2 a.m.	30	15	2	2	12	13
2 a.m. - 6 a.m.	30	15	2	2	12	13
<b>Total</b>	<b>1923</b>	<b>1008</b>	<b>128</b>	<b>130</b>	<b>750</b>	<b>880</b>

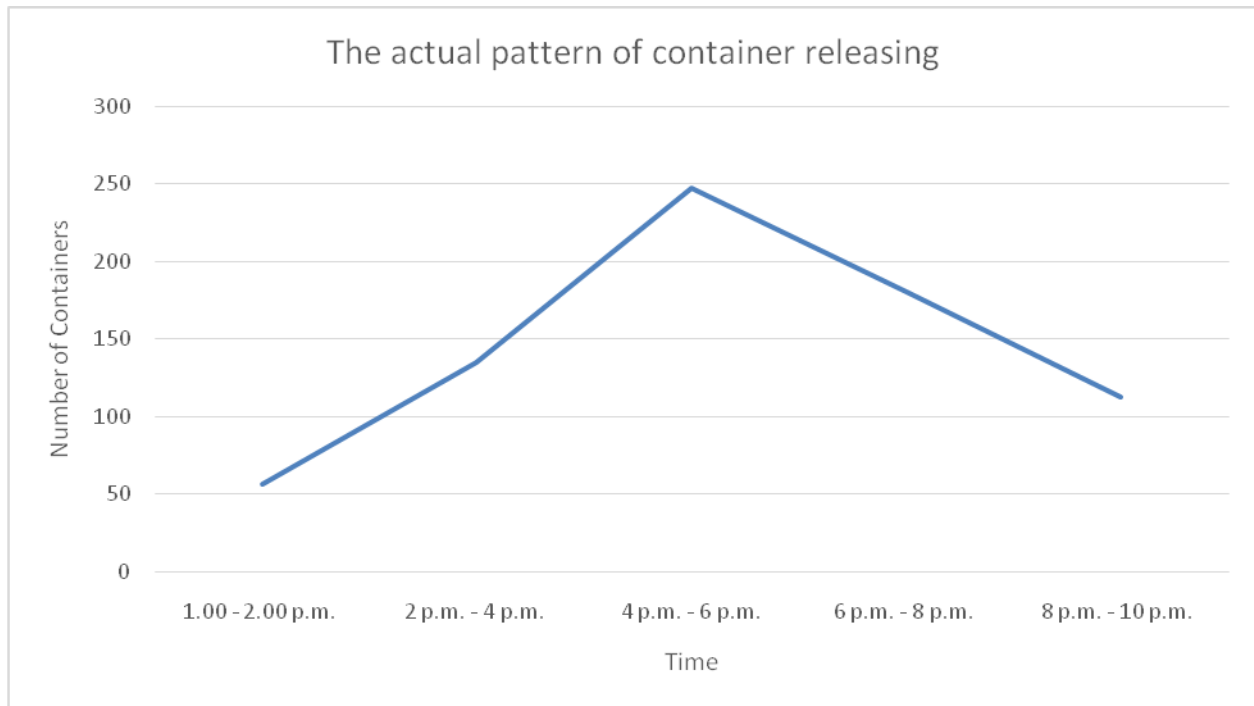
### 7.5.4 New capacities of cargo with same number of train movements

Table 17: Train movements with new capacities

Time Duration	For examinations	Train Movements	Single Train Capacity
1.00 - 2.00 p.m.	56	4	14
2 p.m. - 4 p.m.	135	8	17
4 p.m. - 6 p.m.	247	8	31
6 p.m. - 8 p.m.	180	8	22
8 p.m. - 10 p.m.	112	8	14
<b>Total</b>	<b>731</b>	<b>36</b>	

By this way, the single train movement average comes to 20 containers which means all the 731 containers can be transported by 36 train movements within 12 hours period if we allocated 3 train movements per hour. Every 20 minutes, a train departs and reach the destination within 15

Or 04 train movements per hour, which means train departs at every 15 minutes and reach the destination with 10.5 minutes. By this way, the entire operation can be wound up within 09 hours.



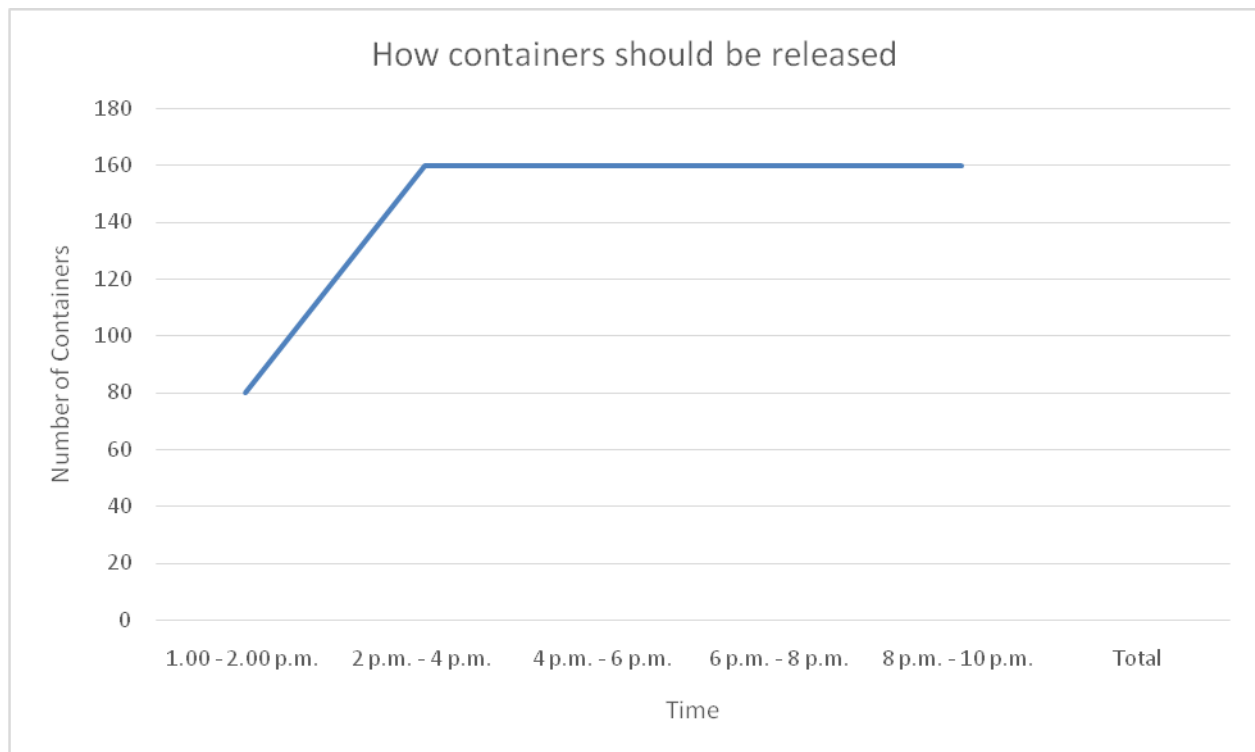
Graph 12: The actual pattern of container releasing of a given day

The realistic way of container releases is somewhat normally skewed for a given day but the proposed model cannot be implemented with the above shown method of container releasing pattern.

Table 18: How exactly the single train capacity should be

Time Duration	For examinations	Train Movements	Single Train Capacity
1.00 - 2.00 p.m.	80	4	20
2 p.m. - 4 p.m.	160	8	20
4 p.m. - 6 p.m.	160	8	20
6 p.m. - 8 p.m.	160	8	20
8 p.m. - 10 p.m.	160	8	20
<b>Total</b>	<b>720</b>	<b>36</b>	

According to the table 18, the exact number for a single train should be 20 containers hence the containers should be released in accordance with a constant rate in regular intervals.



Graph 13: How containers should be released according to the model

The probability of releasing containers for a given time period should be a constant in order to implement the above mentioned model or otherwise it is not possible. That process has to be addressed through a proper method of process development of protocols which has to be followed in the initial steps of the customs clearance process.

## **7.6 Requirements of the CRT**

- 1) It is required atleast 06 trains minimum or maximum of 08 with 20 loading capacity.
- 2) The minimum length of the CRT should be 300m.
- 3) CRT should be consisted with 06 railway tracks with additional two
- 4) 18 gantry cranes
- 5) 04 container lift trucks
- 6) The existing railway line is a single way line and that has to be doubled
- 7) Prime movers of each terminal
- 8) New scanning unit at the gate of CRT
- 9) Trained staff for railway cargo handling
- 10) Complete authorized body for CRT administration as a private, state collaboration entity called Central Railway Terminal.

### 7.6.1 The expected design of the CRT

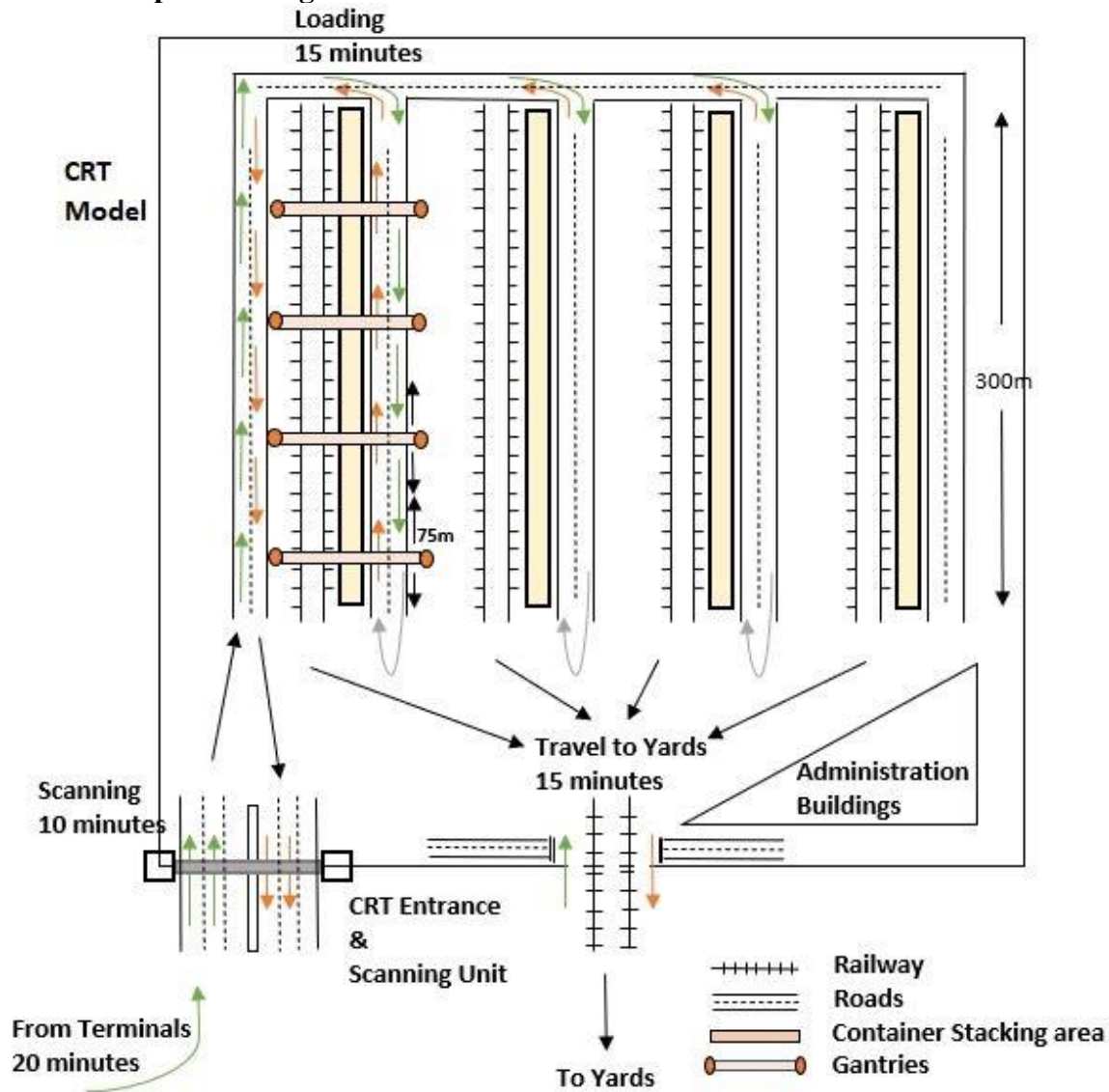


Figure 14: Central Railway Terminal (CRT) Model

According to the figure 8 at problem identification, all the three terminals take an average of 30 minutes to release a container from their respective terminals which includes the lorry coming inside time and also the document processing times at respective terminals in-gates. If it is assumed those two tasks would maximumly take 10 minutes, then it would only take **20 minutes** to transport a container from a terminal to port inside location using their own prime movers after releasing a container by the doc center. Therefore, time taken to carry a container from a terminal to the CRT can be estimated as 20 minutes.

Usually, it only takes 4 minutes to scan a 40-foot container at the current scanning unit established inside the port. Therefore, the maximum time taken to scan a container at the entrance of the CRT can be estimated as **10 minutes** including the document processing time.

There are four (04) gantry cranes are occupied for a double train line. Only one train is loaded at once and one gantry crane only has to load 5 containers to a single train since one train includes 20 containers. Usually, it is only taken 30-60 seconds to load a container using a gantry crane. If it is assumed the time taken to load a container as two (02) minutes, still one gantry crane could be able to load 05 containers by 10 minutes and the maximum time can be considered as 2 minutes and 30 seconds because trains are only departed in every 15 minutes. If it is taken maximum of 2 minutes and 30 seconds to load a single container, then it would only take 12 minutes and 30 seconds to load 05 containers. Since all 04 gantry cranes are simultaneously worked, all 20 containers can be loaded to a single train within 12 minutes and 30 seconds. Therefore, the train can depart by exactly in the **15 minutes** or before that.

It is already calculated the time taken between two destinations based on different train speeds. If the train travels on 30 kmph, then it can be reached the terminal within **15 minutes** and 40 kmph, it is somewhere around 10-11 minutes.

### **7.7 The railway design and the yards design**

The proposed model cannot be implemented with the existing single railway track,

A cargo train only takes 15 minutes to reach the yard from the port. The two yards RCT & GL-1 are consisted with two double line railway tracks with 04 gantry cranes each just like the CRT. So, it will only take another 15 minutes to unload the entire train at yards. Meantime, the second train could reach the respective yard. But the first train could not be able to return to CRT because the 3<sup>rd</sup> cargo train has already started its journey from the CRT. Because of this reason, the one train movement has to be held at every half & hour for the return of the previous cargo train to the CRT. By this way, the expected outcome cannot be achieved during the calculated time period. Therefore, two railway tracks are required in order to perform the above task in the most efficient way and also it will be a solution for following matters as well.

- 1) The second railway track can be used as an alternative in case of any emergency situation like break downs, trail root outs.
- 2) Two cargo trains can be sent simultaneously during the peak hours.
- 3) Two tracks can be used separately as one for inbound and another one for outbound without any turbulences.

### **7.8 The inside road network design of the port**

915 containers are not directed to any of the yard out of 1923 daily average resealing containers. Those 915 containers are allocated in following sections.

173 as exempted or Green channel

222 as BOI

462 as out panel

58 as UPB & Other

None of this container is examined at yards or either never examined.

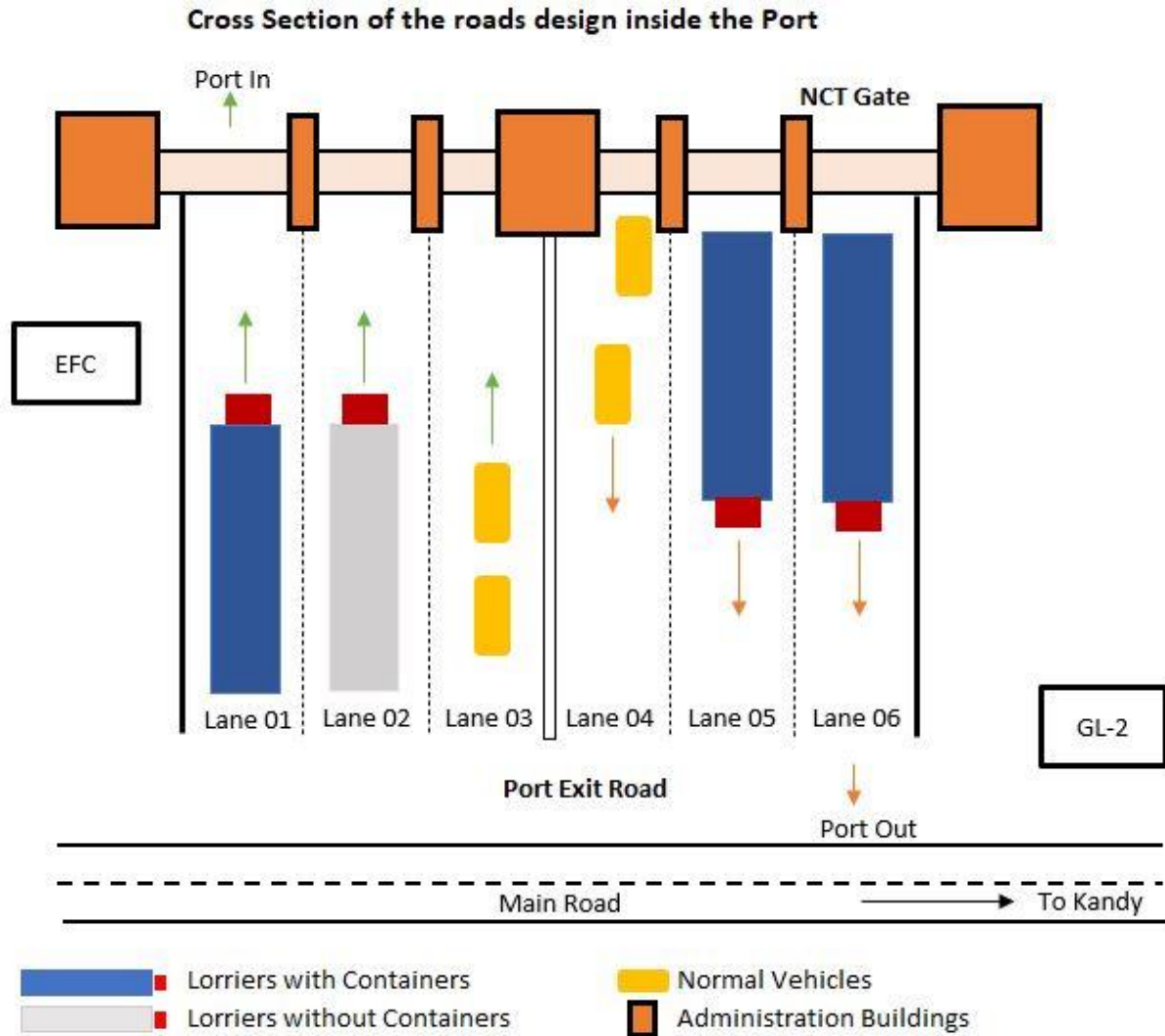


Figure 15: Road transport model inside the port

These containers are not supposed to be used railway transport, including remaining 130 containers which are going to GL-2. The port exit road is only consisted with 02 lines each for one side at the moment and that is not sufficient for container moment because one line entirely allocated for normal and administrative vehicles. Therefore, the port exit road has to be developed with six lanes along with the roads inside the port. GL-2 is located alongside with the main road just after the port exit hence lane 06 in figure should be dedicated for containers which are directed for GL-2. And green channel and BOI are also considered as facilitations given by Sri Lanka Customs to its customers. Therefore, what is selected as green channel and BOI also

should be gone through lane 06 of the port exit road along with GL-2 containers. Whatever is remaining especially the out-panel ones should only be gone through lane 05. By this way, facilitation for green channel & BOI is implemented as they do not have to be in long queues and also for GL-2 containers. The Export Facilitation Centre (EFC) is located just before the NCT gate alongside with the port exit road. Therefore, a dedicated lane should be allocated for export containers as it is shown as lane 01 in the road transport model. The empty lorries which are going inside port to carry containers out should be allocated with another lane where that should not be colliding with export containers. That is shown in the figure 15 as lane 02. Lanes 03 & 04 are completely dedicated for administrative & normal vehicles which do not collide with any of the container transportation. By this road design, the remaining traffic inside the port can be minimized upto a considerable level.

## **7.9 The comparison between the existing one and the new method of transportation**

### **7.9.1 The equation for the current method of transportation**

The variables of the existing method of transportation are as follows,

Time taken for empty lorry to come inside the port terminal	- $T_{TC}$
Processing time at the terminals	- $T_{TP}$
Time taken to travel from a port terminal to the NCT gate	- $T_{TTN}$
Processing time at NCT gate	- $T_{TN}$
Time taken to travel from the NCT gate to an examination yard	- $T_{TY}$

Total time taken for transportation in the existing process -  $TT_{EP}$

Hence the equation of the existing process of transportation,

$$TT_{EP} = T_{TC} + T_{TP} + T_{TTN} + T_{TN} + T_{TY}$$

Thus, the average time taken at each process according to the 2018 Time Release Study are as follows,

$T_{TC} = 01 \text{ hour \& } 17 \text{ minutes}$

$T_{TP} = 33 \text{ minutes}$

$T_{TTN} = 01 \text{ hour \& } 10 \text{ minutes}$

$T_{TN} = 20 \text{ minutes}$

$T_{TY} = 01 \text{ hour \& } 43 \text{ minutes}$

Therefore,

$$TT_{EP} = T_{TC} + T_{TP} + T_{TTN} + T_{TN} + T_{TY}$$

$= 01 \text{ hour \& } 17 \text{ minutes} + 33 \text{ minutes} + 01 \text{ hour \& } 10 \text{ minutes} + 20 \text{ minutes} + 01 \text{ hour \& } 43 \text{ minutes}$

$= 05 \text{ hours \& } 03 \text{ minutes}$

If the time taken for transportation has to be reduced, then the following variables of the equation should be reduced or eradicated.

$$TT_{EP} = T_{TC} + T_{TP} + T_{TTN} + T_{TN} + T_{TY} \quad \downarrow$$

$$TT_{EP} = \cancel{T_{TC}} + T_{TP} + \cancel{T_{TTN}} + T_{TN} + \cancel{T_{TY}}$$

The new model has eradicated the crossed variables in the equation and the new time laps are given by the new equation with new variables.

### 7.9.2 The equation for the new method of transportation

The variables of the new method of transportation are as follows,

Time taken to transport a container to the CRT from a terminal-  $T_{TR}$

Time taken for scanning and document processing at CRT entrance-  $T_{SD}$

Time taken for loading 20 containers into a train-  $T_{TL}$

Time taken to travel to RCT & GL-1 from CRT-  $T_{TCY}$

Total time taken for transportation in the new process –  $TT_{NP}$

Hence the equation of the NEW process of transportation,

$$TT_{NP} = T_{TR} + T_{SD} + T_{TL} + T_{TCY}$$

### 7.9.3 Estimated times of each process of the model and the total processing time

According to calculations made on the sub chapters 7.5.4 & 7.6.1, time laps of the new model are as follows,

To transport a container to the CRT from a terminal,  $T_{TR} = 20$  minutes

Scanning and document processing at CRT entrance,  $T_{SD} = 10$  minutes

Loading 20 containers into a train,  $T_{TL} = 12$  minutes & 30 seconds (2 minutes and 30 seconds x 5\*)

Loading a container to the train stack from a prime mover = 2 minutes and 30 seconds  
\*4 gantry cranes

Travelling to RCT & GL-1 from CRT,  $T_{TCY} = 15$  minutes

Therefore,

$$\begin{aligned} \text{Total estimated time to complete the task, } TT_{NP} &= T_{TR} + T_{SD} + T_{TL} + T_{TCY} \\ &= 20 \text{ minutes} + 10 \text{ minutes} + 12 \text{ minutes \& 30} \\ &\text{seconds} + 15 \text{ minutes} \\ &= 57 \text{ minutes and 30 seconds} \end{aligned}$$

Since the trains depart only at 15 minute intervals, the **exact total time estimated for the entire process is one (01) hour.**

### 7.10 The outcome of the research

According to the 2018-time release study, the time taken to release an FCL is 16 hours and 29 minutes. By that, almost 5 hours were taken for the transportation of containers from port to examination yards. So, this Rail-Road Hybrid Model can be reduced the container traffic inside the port and also upto the examinations yards by 80% of existing timelines where it was calculated as almost 5 hours and now it has been reduced to 01 hour, which means the **total customs clearance time can be reduced by four (04) hours.**

Thus, **Sri Lanka Customs could be able to release an FCL examined cargo within 12 hours and 30 minutes**, which is closer to **25%-time reduction of the entire customs clearance process**.

## CONCLUSIONS

- Time taken to release an FCL in 2018 is 16 hours and 29 minutes and it was a significant improvement with respect to 2014 figures as it was more than 28 hours.
- The average daily number of containers released by Sri Lanka Customs is somewhere close to 2000 and it is exactly 1923 containers during 2017/19 per day.
- It has taken almost five (05) hours to transport a container from port to an examination yard, though documentation is finished within 01 hour and 15 minutes.
- 52% of the containers are undergoing examination at three different examination yards and it is 1000 containers as a daily average.
- 750 containers are directed to RCT, and the remaining is directed similarly to GL-1 & GL-2.
- GL-1 & GL-2 are dedicated for detailed examinations and RCT is dedicated for most of the panel examinations.
- RCT & GL-1 get 90% of the examination containers and are located 7km away from the Colombo port while GL-2 is located just 4km away and the closest to the port.
- The capacity of all three yards is 243 containers at the moment while the demand for examinations are more than 1000 containers per day.
- Most of the containers are released in highly peak hours of the day at 2.00 -6.00 p.m where containers are collided with school traffic and the office traffic.
- A Panel examination takes around 01 hour and 30 minutes while it takes more than 06 hours for a detailed examination.
- Railway track can be used to transport FCL to the examination yards since there is already a built railway track which is going towards all three yards.
- The existing railway line has to be doubled or otherwise the model could not be implemented accordingly.
- The Central Railway Terminal can be established in between CICT & SAGT based on the current demands.
- The CRT should be at-least with 300m length with 8 railway tracks which could accommodate twenty, 40-foot containers.

- Double stack method of railway transportation cannot be used since the inbuilt infrastructures already made through the railway line.
- The containers should be released with a constant probability during the time of railway transportation.
- It only takes less than 15 minutes to transport a container from port to an existing examination yard through railway line.
- The entire time taken to transport a container after releasing it from doc center to an examination yard through railway line is exactly 01 hour.
- The current time taken to transport a container from port to an examination yard can be minimized by 04 hours using the railway track.
- The entire Customs Clearance time can be reduced by 25% by implementing the Rail-Road hybrid model of transportation for FCL cargo in Colombo Sea port.
- Sri Lanka Railways could earn some extra revenue by operating cargo trains and also it will generate lots of employments through Central Railway Terminal (Private) Limited which makes more revenue for the state.
- Lorry drivers will not have to worry about wasting several hours on the roads as man hours of the nation could be saved and facing difficulties in sanitary facilities, meals.
- Fuel consumption of the lorries will be reduced hence the burnt hot air with global warming influence emissions to the environment will also be reduced.
- The huge congestions of the public roads may be minimized of the particular area so the public could travel smoothly without any congestion.
- The facilitation of Green channel, BOI could be realistic and finally one of the main objectives of Sri Lanka Customs as well as the research, the “Facilitation of Legitimate Trade” could be accomplished.

## RECOMMENDATIONS

- The cost of the transportation through railway for shorter distances is anyway higher than the road transportation as there is a cost for any reduction of parameters of the above method. The existing chargers of terminal handling and yard handling remain same while only the additional cost will be acquired for the usage of the railway. But the time reduction of the process which means the “time value” can be considered as a neutralized factor for the additional cost that has to be borne.
- The existing capacity of examinations should atleast be doubled within next five years. Even though, there is an ongoing project of establishing a new Customs Inspection plant at Kerawalapitiya, the capacity that is expected to accomplish there, is absolutely not sufficient enough to cater the upcoming future demand. It is only planned to examine 150 containers simultaneously at Kerawalapitiya by removing all the three yards. The existing capacity of 243 spaces available in three different yards should be increased atleast upto 500 containers with these new expansions.
- The suitable land inside the port, especially the Blumendell Waste Dumping area should be acquired and converted into an examination yard would be ideal solution to overcome the current difficulties.
- The separate gate for Green Channel & BOI atleast for green channel ones apart from the NCT gate would be an ideal concept of enhancing the facilitations.
- Usage of RFIDs (Radio Frequency Identification) for container tracking of BOI, out - panel & Katunayake transshipment containers where it will reduce the human interventions of under supervision.
- The proposed double railway line can be built as tram facility where even lorries could travel on the railway line.
- The CRT should be brought forward in collaboration with several stakeholders like China Merchant, Jhon Keels, Adhani Group, Sri Lanka Ports Authority, Sri Lanka Railways, especially with World Customs Organization and Asia Development Bank for investing purposes since this is an incredible investment.

- The CRT should be established as a partnering business with above stakeholders which is mutually benefitted for all the parties and the 51% of the ownership should be with the Sri Lankan Government.
- The location of the CRT can be shifted to either ECT or WCT since they are being developed at the moment and the demand to be catered by those terminals will be somewhat similar to what CICT is currently handling in next few years. Therefore, the demands of respective terminals will automatically influence to change the location of the CRT. The most proffered or may be the ideal location for CRT would be the ECT, which is anyway closer to CICT & SAGT.
- The exemptions of examinations should be increased atleast upto 25% (now it is less than 10%) with new risk analysis methods of the Risk Management Unit and also by using advanced scanning tools.
- The railway transportation of cargo should not be limited only for examination yards, but also be carried out for different destinations around the country such as Galle, Kandy, Kurunegala.
- Feasible study has to be carried out in order to implement the theoretical ideas of the research before going active.

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Subject, Multimodal Freight Transport & Logistics (2<sup>nd</sup> Semester)

Subject, Transport Logistics & Management (3<sup>rd</sup> Semester)

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