YANGON UNIVERSITY OF ECONOMICS
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A STUDY ON THE SOCIAL EFFECT OF CONTAINER TRUCKS CONGESTION ON THE PUBLIC IN YANGON PORT AREA

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EMPA - 45 (16th BATCH)

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A STUDY ON THE SOCIAL EFFECT OF CONTAINER TRUCKS CONGESTION ON THE PUBLIC IN YANGON PORT AREA

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Public Administration (MPA)

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ABSTRACT

The congestions are the outcome of many factors depending on the level of technological development and economy of the country concerned, which in a way influence the rest of other factors that can cause on the social effect of all human being. This study aim is to identify the social effect of traffic congestion due to container trucks in Yangon Port Area. The research method is descriptive method based on secondary data. Concerning the impact of traffic caused by container truck, there were be made questionnaires and these gave to public, truck owners, transportation department, traffic polices and port facilities. The findings showed that the container truck traffic congestion can be effect on the social activity of daily life of citizen. In the study, there is increase additional money on commuters in fuel consumption costs. This is the huge loss for the economy of the individual and the country at large given the fact that the fuel is imported and its price is still very high and there also have extra cost for daily concerning road congestion. Moreover, every person living or who come to Downtown area of Yangon either employed or unemployed and whether in formal or informal sector do waste time due to traffic congestion so that container traffic congestion can meet to social effect. And also, the container traffic congestion can cause the challenge on economic increasing, and be effect on country development.

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LIST OF ABBREVIATIONS

BCA	Benefit Cost Analysis
CT	Container Transport
DWT	Deadweight Tonnage
ECA	Emission Control Area
FLT	Front Lift Truck
FMCSA	Federal Motor Carrier Safety Administration
GDP	Gross Domestic Product
GRP	Gross Regional Product
HGV	Heavy Goods Vehicle
ICD	Inland Container Depot
IMO	International Maritime Organization
ISO	International Organization for Standardization
ISPS	International Ship and Port Facility Security
IWT	Inland Water Transport
JICA	Japan International Cooperation Agency
km/h	Kilometer Per Hour
LOA	Length Overall
m	Meter
MCTA	Myanmar Container Truck Association
MGV	Medium Goods Vehicle
MITT	Myanmar International Terminals Thilawa
OD	Origin and Destination
Port EDI	Port Electronic Data Interchange
RFID	Radio-frequency identification
RMG	Rail Mounted Gantry
RTG	Rubber Tire Gantry
SC	Straddle Carrier
TRT	Turnaround Time
WIM	Weight in Motion
YCDC	Yangon City Development Committee

CHAPTER I
INTRODUCTION

"Connecting Ships, Ports and People" illuminates how critical it is to cooperate and integrate the functions of port facilities and shipping activities in order to create employment opportunities, prosperity and sustainability in maritime trade. Promoting the maritime transport, shipping and port sectors can play a vital role in helping to achieve the objectives of the Sustainable Development.

1.1 Rational of the Study

As ships need ports to load and discharge cargoes, the ports also need ships for the efficient support of commercial trade for the wider public, the people who depend on shipping for most of everything they need and want. Accordingly the information, every day the containers trucks that to transport exchange the goods between industries to port. The original schedule allowed for container trucks from Kyimyindine Kannar Road to pass through the inner city to Insein between 8pm to 6am. Some exceptions were made to allow trucks to operate from 1 p.m to 2 p.m and for trucks traveling from Insein to Kyimyindine to operate from 11 a.m to 12 p.m. Traffic jams can cause by container trucks in that time and parking alongside on the Kanner Road to wait for the operation time. Although, container trucks only on one road most of the time, and they don't race or break the law like some bus drivers do, there is a challenge for traffic jams. There are approximately 15,000 container trucks operating in the Yangon Region with 5,000 registered in the Container Trucks Association (MCTA, 2018).

Several port operations that are located in the Yangon port area deal with the congestion of trucks during busy hours for cargo operations. In general, at these ports trucks arrive at random moments during the day in order to deliver or pick up goods although specify the limited time to transfer. Since these ports just have a limited capacity, truck drivers often experience high waiting times during peak hours. In addition to these long, annoying, waiting times, the amount of available space, or the

number of available parking places plays an important role. Regularly, the number of available parking places is a bottleneck, which results in truck traffic on the access routes towards the ports.

The congestion of trucks is not only disturbing for the truck drivers themselves, but it is also annoying for other road users and damaging to the environment. For instance, when all of the available parking places are occupied, arriving trucks need to wait (in the near neighborhood) until a parking place becomes available. However, in some areas no alternative parking places are present, by which the truck drivers are either forced to wait on the access road, or to drive around in the neighborhood until a parking place becomes available. It is not only disturbing for the truck drivers themselves to be unnecessarily on the road, but it is also annoying for the other road users. The presence of trucks in crowded areas can lead to risky situations, or even can lead to accidents. Moreover, trucks need in general more time to speed up and slow down than other road users, which limits the flow of traffic around traffic lights and roundabouts. From the research goal the research questions can be formulated.

The research question should be formulated such, that answering it is fulfilling the research goal.

From the research objective the main research question can be formulated: 'How can container track traffic for the Yangon ports be affected to urban transportation and how should the container transportation system change in the future?'

1.2 Objectives of the Study

The main objective of the study is to analyze the social effect of traffic congestion due to container trucks on the public in Yangon Port Area.

1.3 Method of the Study

The method used in this study was descriptive method based on primary and secondary data. Concerning the impact of traffic caused by container truck. A survey was conducted with questionnaires to public, truck owners, transportation department, traffic police and port facilities. There has collected data through distribution of questionnaire to the respondents in selected related organization with transportation sectors and distribution governmental departments. Before the survey, there were

prepared to make questionnaires to classify the group upon the situation of social effect by congestion of container truck, and give the question randomly to the five groups as a target each by each.

1.4 The Scope and Limitation of the Study

The coverage of this study is focused on social effect such as daily life, economic, waste of time and operations research techniques by Container Transportation sector in Yangon Region. Study area was only in Yangon Port Area.

This study does not cover in environmental issue and does not include the traffic jams by public transportation and empty trucks, but will only be the economic impact and operational impact of container trucks in transportation sector.

1.5 Organization of this Study

This study is organized into five chapters. Chapter 1 is an introductory one that presents rational of the study, method of the study, scope and limited of the study and organization of the study. Chapter 2 is the literature review of the container truck traffic effects and related studies. Chapter 3 describes the current container truck transportation of Yangon region in Myanmar. Chapter 4 consists of the analysis of findings. Chapter 5 presents the part of conclusion that concludes with findings and recommendations.

CHAPTER II
LITERATURE REVIEW

2.1 Introduction

As indicated the proposed development is located in the Yangon Port area, with a very low car ownership, and in an area where residents are extensively dependent on the public transport system (e.g., bus, taxi and train etc.) for daily commuting.

Any meaningful activity should be able to generate or expand knowledge capacity (Rwegoshora, 2006). It may do so by identifying certain knowledge gaps which exist and hence open up a new set of fruitful inquiry. In order to avoid a duplication of research efforts, a researcher ought to survey comprehensively the literature pertinent to the problem. This could be used to identify the missing links. A theoretical framework is the conceptual model of how theories make logical sense of the relationship between the several variables that have been identified as important to the problem (Sekaran, 2003). It can be viewed as both a foundation and a pillar of a research project. A research without a conceptual framework cannot be focused since the researcher does not know what data to collect (Adam and Kamuzora , 2008). Therefore, theories aid a researcher in understanding the problem and guiding the study.

2.2 Definition of Traffic Congestion

Congestion is essentially a relative phenomenon that is linked to the difference between the road way system performances that users expect and how the system performs. Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing. The most common example is the physical use of roads by vehicles (Dawrie, 2008). When traffic demands exceeds or is greater enough that the interaction between vehicles slows the speed of traffic stream, it results in some congestion. As demand approaches the capacity of a road (or the intersections along

the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, it is colloquially known as a traffic jam or traffic snarly–up. In other words, congestion can be seen as a situation in which demand for forward space exceeds supply.

Container traffic congestion must be understood in the wider context of city dynamics and agglomeration benefits. Traffic congestion in the port area is often the outcome of successful port economic development, employment; housing and cultural policies that make people want to live and work relatively close to each other and attract firms to benefit from the gains in productivity derived. There are many indications that even though they may not be thrilled by the prospect, road users are prepared to live with crowded roads so long as they derive other benefits from living and working in the cities (Kathrin, 2017).

Time may be one of the most important factors to determine whether a transport system is efficient or otherwise. If the ratio between time taken by private car and time taken by public transport is less than one, the private transport would be more efficient.

2.3 Impact of Container Truck Congestion

Typically, economic impact studies report how an economy changes when an external source of funds moves into a regional economy (e.g., a new manufacturing plant locates in a town, or a highway is constructed or improved). The literature on the mechanisms by which the construction of, or investment in, highways produces economic shocks to the regional economy is extensive and largely identifies the short term impacts generated by the construction activity itself (Birkinshaw, 2000)as opposed to the longer term employment and output changes, which are often demonstrated to be minimal at best and generally not uniform in effect (Peterson and Jessup, 2008). Adding context to potential for economic development following an investment in new highway infrastructure, Chandra and Thompson (2000) find certain industries grow following investment, while others have more ambiguous outcomes and each witness spatial allocation implications.

Contrary to the consideration of investing in new infrastructure as a component of economic development, congestion is somewhat unique in that “new” money is not being injected into the economy. Instead, congestion causes freight-dependent businesses to operate less efficiently. In other words, they operate on a

different, less efficient production function. Traffic congestion often acts as a mitigating factor of the achievable benefits of agglomeration in urban areas, particularly in relation to firms who are heavily dependent on container truck transportation (Tongzon, 2009).

Allen (1994) highlight that given the trucking industry's rather competitive structure, it may be assumed that much of any cost reduction resulting from an infrastructure improvement will be passed onto the shippers. These effects are subsequently felt throughout the regional economy. The function served by freight transportation in the economy and the suggested transmission of any cost reductions to shippers, who are the direct consumers of freight services, motivates a need for a regional economic framework. Freight movement enables trade networks between industries and their market locations. Improvement to the routes reduces travel cost and thus production costs of goods, as well as reducing uncertainties and risk that come with unreliable delivery. These combine to increase industrial productivity (Tongzon, 2009). Increases to the efficiency of a freight network then produce positive effects felt via job creation and economic activity.

While it is often speculated or assumed, that investments in transportation infrastructure contribute to economic growth and increased productivity, the actual measurement of such a response resulting from a specific investment in a component of the system is often difficult to establish (Tongzon, 2009), and its full implementation is thus often underdeveloped or overlooked entirely. Improvements via investments in transportation infrastructure that seek to minimize the barriers to travel have an effect of shrinking space and time (Birkinshaw, 2000). Subsequently, carrying an analysis forward only at the level of a benefit cost analysis (BCA), may prove insufficient by not establishing the expanded 'network' effects felt by freight dependent and other service based sectors that rely on the services obtained on the transportation network. Peters (2008) suggest that the individual parts of a transportation system may not capture its true economic value, and as such, the best measure may be one of the overall network quality. Additionally, Munnell (1990) found that a state's investment in public capital has a significant impact on the state's private employment growth. Thus, in an approach identifying and accounting for economic impacts beyond the direct benefits, analysts may more fully capture the produced externalities of the infrastructure investments not captured by the BCA. It is in this type of approach that transportation benefits (or costs) are transferred to

economic impacts via labor, market, business and trade development, as well as increases in Gross Domestic Product (GDP) or Gross Regional Product (GRP), and other organizational changes and logistics reorganization (Tongzon, 2009).

2.3.1 Theory of Social Development

Social development can be summarily described as the process of organizing human energies and activities at higher levels to achieve greater results (Hardin, 1968). Social development theory attempts to explain qualitative changes in the structure and framework of society, which help the society to better realize its aims and objectives. A society's progress is determined by its ability to grow and change. The organizations and structures that drive its workings directly affect its ability to function. A theory of social development examines the strengths and resources available within a society and how they are used to promote social development.

A theory of social development identifies the factors that influence the growth of a society and how those factors affect change. Growth occurs according to a process of change that brings out the inherent strengths and abilities of a society. These changes affect how a society functions and how it is structured. Social development can take place on political, social, economic or technological levels. However, a society's economic progress is a significant indicator of social development. Organizational change within a society is a key factor influencing its social development. An increased awareness of how a society's available resources can be better utilized provides the direction needed for effective organizational change to take place. Social development theory points to how this greater awareness allows societies to harness and direct their strengths and resources towards more productive ends. The result is a more efficient and directed output that benefits the society as a whole or works to improve the social conditions within specific segments of the population (Goodchild, 2008).

Physical changes within the social development of a society are borne out of the accepted models of productivity and organization that sustain its current existence. Revised agricultural methods, newly formed public assistance programs and the use of alternative energy sources are examples of physical changes. Existing conditions may be unable to meet the needs of the people in terms of providing for their survival. Conditions may escalate to the point where the structures within the society begin to break down. Medicare, the social security retirement system and the stock market are

examples of structures within a society. As a result, existing patterns of organization become ineffective and further aggravate developing problems. These conditions set the stage for change to occur.

Social development theory links a society's level of social interaction to its ability to change and grow. The level of interaction points to the interconnections that exist between the different functional areas within its structure. An example of this would be how closely a manufacturer and a retailer work together to ensure the success of a product. Social development occurs when organizational structures begin to work together to achieve a common goal by redefining their objectives and the methods used to carry them out.

2.3.2 The Causes of Traffic Road Congestion

Public transport in Yangon city is generally poor and unsafe; lacking professionalism, efficiency, quality and safety for the passengers. The main factors leading to these situations include: rapid expansion of the city which has far outpaced the capacity to provide basic infrastructure (such as good roads) and services, poor state of majority of the buses, untrained bus drivers and conductors driven by the pursuit of daily revenue targets payable to the bus owners, non-adherence to traffic rules and regulations; and lack of an organized public transport system (Nkurunziza, 2012).

Public transport service in Yangon is dominated by buses called YBS which are about 12,000, with capacities ranging from 50 to 65 passengers. The service offered is poor due to overloading and overcrowded buses particularly during peak hours; reckless driving, route shortening, harassment of women and school children. The following are the underlined causes of road traffic congestion in Yangon region.

2.3.3 Traffic Influencing Events

Congestion of container trucks at the port area is an unforeseen phenomenon worldwide. It happens because of the abundant of trucks operating in the terminal at that time (Dekker, 2012), unanticipated Turnaround time (TRT) of the truck by terminal operators, low utilization of assets vehicles (container trucks) where there are empty slots contained in the container truck chassis and the underutilized truck journey (Islam, 2017), Port capacity has not increased enough to adjust the volume

growth. Thus, it leads to congestion around the port. Many countries have limited tools and data to know the number of container trucks (Giuliano, 1990).

External events have major effect on traffic flow. These include traffic incidents such as crashes and vehicles breakdown; work zones, bad weather such as heavy rainfall; special events like passing of government officials; and poorly timed traffic signals. When these events occur, their main impact is to steal physical capacity from the road way. Such events cause travelers to rethink their trips. The level of congestion on a roadway is determined by the interaction of physical capacity with the events that are taking place at a given time.

2.3.4 Loading and Unloading Times

One of the main components of truck scheduling is the distribution of the loading and unloading times of trucks. In many (appointment) scheduling models the service times are assumed to be exponentially distributed. As far as we know, just a small number of studies have been done in which the distribution of the loading and unloading times of trucks is investigated. Kiesling and Walton (1995) showed in an empirical study about wharf crane operations in shipping ports that the service times within these wharfs are not necessarily exponentially distributed. Based on test results of multiple data sets, they conclude that very tight or very broad distributions are generally appropriate. These results are also obtained by Franz and Stolletz (2012), who showed in an empirical study that the service time distribution of trucks at an air cargo terminal is right-skewed (Institute, 2005).

More recently, The Tioga Group (2013) analyzed the truck turn times at Vancouver's container terminals. In this empirical study, they showed that the truck turn time - which is defined as the sum of the waiting time and dwell time – differs per terminal. From their data they obtained an average truck turn time of 56 minutes, averaged over three different terminals. Besides, they illustrated that the distribution of the time that is needed to import goods does have a quite different shape than the distribution of the time that is needed to export goods. This suggests to take different types of customers with different service time distributions into account in the model (Canada, 2009). However, their graphical illustrations clearly show that the service time distribution is right-skewed. Additionally, it was found that the number of trucks that were present in the terminal are subjected to a day pattern, i.e., during the day several peak hours were present.

In addition to the empirical studies that show differences in the loading and unloading times of trucks, models have been developed that estimate the loading or unloading time of a truck. For example, Fatthi (2013) present a decision model for estimating the unloading time of incoming trucks in cross docking terminals on the basis of three factors: the number of purchase orders carried by supplier, the variation of items listed in the purchase order and the quantity of boxes that were carried by the truck (Goodchild, 2008). This model can be used at one of the last states, when this kind of information is known. At earlier moments during the order and delivery process, this information is often not known and thus more general methods for estimating the unloading time are required.

2.3.5 Container Ship

Traffic follows its own dynamic quite different from that of road transportation, since it is more associated to international flows, gateway ports and containership companies operating at the international level. The main hubs provide feeder services to many ports that are also fed by road. When port container handling is efficient, Shipping usually can offer competitive transport costs from the origin or to the final destination, in particular for longer distances and where the road system is deficient (in terms of network or congestion) (Chen, Govindan, and Yang, 2013). This competitiveness can explain why the evolution of the container shortsea sector shows increases of 110% in 2012 (compared to 2002), parallel to total international container trade increase.

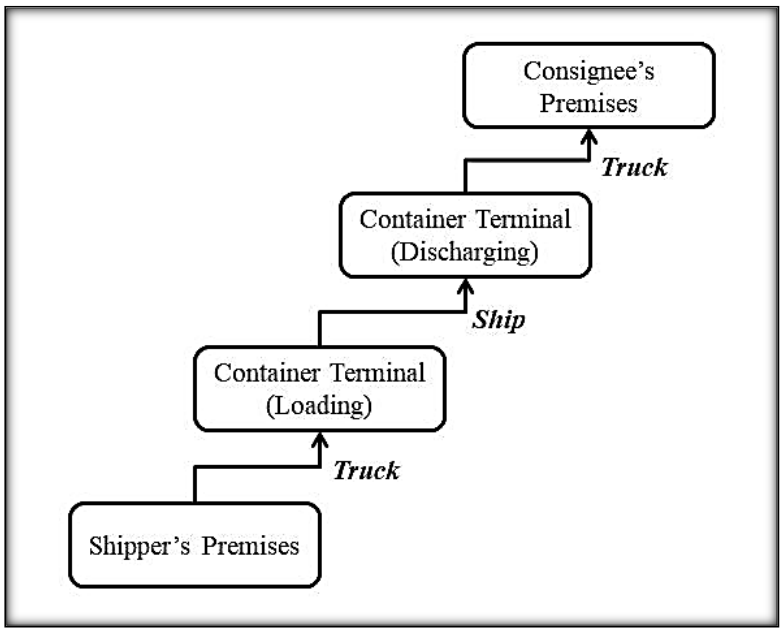
In such context, as containership size is growing, carriers have to come together in alliances to fill these vessels, thus a change in the nature of demand is expected. Demand for bigger ports and higher capacity terminals due to consolidated volumes and greater peak volumes (and less frequency of vessels) is to be expected (Guan and Liu, 2009). This involves the need for an extended feeder services connecting transshipment hubs with smaller spoke ports. Thus, container shipping services in the Myanmar range are expected to increase in a short/medium term because of this incoming scenario.

2.3.6 Container Transport System

The container transportation is completed by many individuals. The truck operators, the railway companies, terminal operators, the ship companies for the

inland river and the international ocean companies load the containers through the chain to make sure that the containers can be delivered efficiently and rightly. And now it is widely accepted that the container port development plan needs to be coordinated with the inland container transport system. The inland container transport system has significant effect on the port development (Schepler, 2017).

Figure (2.1) Concept of Nodes and Links in Container Transport



Source: Survey 2019

2.3.7 Quay Side Operation — Berth Planning and Capacity

Efficient utilization of resources efficiently is the goal of management in many container ports, in order to reduce costs. Resources to provide service to ships include human resources, berths, container yards, ship-shore cranes, and various container handling equipment. Since ships are the primary customer for ports, berths are considered the most important resource among them. Inadequate berth, crane, storage, handling, and labor all mean delay, causing high value of waiting time for ship owner and cargo interests. Delay (time) is a critical variable in structuring operational relationships in port operation and elapse time had financial consequences for all stakeholders in port business (Robinson, 1976). In quay side operation, there are three elements: one is berth allocation and the others are vessel loading and discharging. In general, the entire quay area of a container terminal is divided into several berths. The allocation of incoming vessels to the proper quay location is based on the berth. A

good berth scheduling (allocation) is essential to improve customer satisfaction as well as to increase cargo throughput, resulting in higher revenues of ports (Kim and Moon, 2003). Also, construction of berthing facilities requires large amount of capital that high return on asset is desirable for either public or private investment in ports. Vessel loading and discharging issues deal with how efficient the crane operation can be carried out after vessel berthing. The third issue is berth planning and capacity. The literature review will be concentrated on how to address the berth planning and capacity issues for forwarding transportation.

When a ship arrives at a port, a berth is needed to accommodate cargo loading and discharging operation, then to carry the cargo for further transportation. If a berth is vacant, the ship can go in and undertake loading and discharging operations right away. If there is no berth available, the ship has to wait until a berth is available. A ship sitting idle does not generate revenue, instead there are operating costs incurred such as crew wage, insurance, fuel, port charges, etc. Therefore, it constitutes a waiting line and waiting cost problems.

2.3.8 Yard Operation

Yard operation plays a vital role in the overall terminal operations; it serves as a buffer to support both the quay side operation and container receipt and delivery operation. It provides the critical interface function between water transport and land/ intermodal transport. The yard operation involves the following (Yahalom, 2001):

(a) Space allocation for import, export, empty containers, and chassis
(b) Segregation of containers according to their size, weight, port of discharge, ownership, vessel/voyage, special cargo such as reefer or hazardous, etc.
(c) Sorting out containers
(d) Stacking and unstacking of containers
(e) Delivering and receiving of containers
(f) Traffic control

The objectives of the yard operation are two-fold: minimizing truck turnaround time and providing adequate support for vessel operation (high productivity). On the other hand, it needs to minimize operating costs to maintain profitability. There are different types of yard handling systems that have different operating characteristics. The selection of yard handling system is primarily subject to dynamics of traffic volume, land space availability, cost of land, labor cost, and

equipment cost. These factors are interdependent of each other. Mainly there are five types of yard handling systems: chassis system, front lift truck/reach stacker system (FLT), straddle carrier system (SC), rubber tire gantry system (RTG), and rail mounted gantry system (RMG). A number of studies have been done to address various yard operation issues using operations research techniques and computer simulation.

To improve day-to-day yard operation at a Hong Kong container terminal, Lai and Lam (1994) develop a computer simulation model formulated on a queuing system. The model is programmed in Pascal using observed operational data such as truck inter arrival time distributions of import and export containers, service time distributions for container handling, and tractor travel time distribution. Performance measures include productivity of container handling (containers handled per hour), yard equipment and truck waiting time, and handling equipment utilization (Lai and Lam, 1994).

2.4 Road Transportation

Use road to deliver the container is normally faster and convenient before the shipment for the goods seller and buyer. With the road operation, the container can be transported for the door-to-door service. The meaning of door-to-door service means the goods can be directly delivered from the exporter to the importer through different kinds of transport methods such as shipping, land carriage or air transportation. The plan is flexible due to the driver can choose the best route or change the route immediately with their former experiences and the information which is provided by the government. Since the highways are developing quickly in all over the world, the road transportation cost less time than before. But due to the limitation of volume for the flatcar, the amount of containers can be transported is limited. And sometimes, the transport time is influenced by the bad weather.

2.4.1 Operational Differences

Unique origin-destination patterns exhibited by containers owing to each container originating or terminating at a rail intermodal terminal change the routing patterns of goods in metropolitan areas. Container trucks operate almost exclusively as urban drayage movements, which are different than other tractor semi-trailer general freight operations that function as medium- or long-haul movements.

Container trucks make multiple intra-city trips per day between shippers and terminals and are especially susceptible to urban congestion. Drayage movements contribute to high proportions of trucks entering or exiting terminals without a container and increase volumes of bobtail traffic to the urban road network.

Tightly defined rail intermodal terminal schedules in response to just-in-time delivery demands dictate when containers must be picked-up and delivered. These schedules, along with the location of intermodal terminals, can directly impact the temporal characteristics of container trucks and influence the efficiency and cost of drayage operations. These operational differences affect how container truck traffic is modeled and can potentially alter truck traffic characteristics in the event of an intermodal terminal relocation.

2.4.2 Physical Differences

Container trucks are physically different than other truck types in terms of length, tare weight, structural integrity, and chassis connection to truck tractors. International containers have lengths conforming to International Organization for Standardization (ISO) standards of 20 and 40 feet (and sometimes 45 and 48 feet), which are unlike traditional trailer and domestic container lengths typically of 53 feet. Despite shorter lengths, international container tare weights are typically higher than traditional trailers and domestic containers since a stronger construction is necessary for stacking on ships and sustaining severe environmental conditions during ocean voyages (Roads, 2002). Containers are primarily carried by truck tractors using a special purpose tridem axle chassis which interchanges between truck tractors, extends to carry different lengths of containers, and increases the maximum allowable payload of the unit. This is important for pavement design engineers because container trucks increase the proportion of tridem axle configurations and can influence pavement design inputs.

2.4.3 Effects of Policy Measures over Container Transport

Several series of papers study the effect of transport policies and regulations on the competitiveness of container transport (CT). For instance, the qualitative studies from Baird (2007) and Styhre (2009) discuss the unequal treatment of maritime transport when compared with its competitors in terms of infrastructure financing. The road is seen as the most funded transportation mean. In the same line

of thought, Douet and Cappuccilli (2011) are extremely critic with the ambiguity of the European policies and the lack of a common policy with an equivalent treatment of all means of transportation and countries (Davies, 2009).

The current policies favoring CT are also analyzed in a series of papers by Baindur and Viegas (2012a, 2011, 2012b). They not also described and quantified the effect of the current policies and identified technical and regulatory barriers to the competitiveness of the CT but also whenever specific measures or projects were successful. As a result, they built a microsimulation model that not only assigns the demand to the network, but also studies the cross-relationship between demand, offer and transport regulation. Juste and Ghiara, (2015) also used a simplified method to assess the effects of transport policies, generically speaking, whereas Tsamboulas,(2010) from studying line deployments, assert how harmonization of ports, standardization and achieved port productivity are intrinsic to their continuity (Regan and Golob, 2017).

Additionally, and beyond the set-up papers by Blonk (1994a, 1994b) or the critical contribution by Douet and Cappuccilli (2011), there are several other contributions specifically aimed at discussing the European policies and the necessary future steps needed, with a special focus on Motorways of the Sea (Regan and Golob, 2017).

Besides these, some research focuses on the effects of specific policies - already implemented or in discussion- that could have an effect on the competitiveness of CT. For instance, regarding the implementation of a possible European Ecobonus (subsiding the transporter that opts for using a RoPax service, the effects from the deployment of the ECA (Emission Control Area) enforced by the Annex VI of the 1997 MARPOL protocol either in the North Sea or in the Mediterranean (Wang, Corbett and Firestone, 2007).

2.4.4 Ports and the Effect on the National Economy

Ports play a number of roles within the logistic and supply chain; they are not anymore restricted to their traditional role of a transshipment point for freight. Ports establish a critical link in the supply chain and the ports level of efficiency and performance, which in turn influences the country's competitiveness. Shancez (2003) have demonstrated that port efficiency is a significant determinant of a country's competitiveness. Furthermore, they state that port efficiency can be influenced by

public policies (Murty, 2005). This demonstrating is the importance of governmental and port coordination in order to improve a country's competitiveness as a whole.

Moreover, with the constant increase in vessel size, some ports become unable to handle them. This leading was to a traffic concentration at only a few ports. Mid-sized ports are taking over a feeder role of larger ports as hub and spoke networks. Prosperity of smaller ports tends to become dependent on the route strategies of the shipping lines. Major shipping lines favour ports which have; a good geographical location in relation to other ports of call in order to achieve the best vessel transit and steaming time; near to marketplaces; have the adequate infrastructure and service; and are flexible when ships are not on schedule. Other studies support the notion that value added activities of a port, (such as transportation and transfer, loading/unloading, processing/distribution, packaging etc.) have a multiplier effect on regional and national economies. However, often ports consider that by offering value added services, the port can charge higher prices since the port perceives that it is offering services which add value to its customers that other ports do not. This does not necessary mean the port is uncompetitive as long as the port offers services which are perceived by users as a value added service for their business (e.g. customized services).

Bottasso (2014) have analysed the impact of port activities on local development. Results indicate that ports have an effect on local Gross Domestic Product(GDP) (direct effect). A large share of this effect is outside the port region (indirect effect). A 10 percent increase in the level of port throughput will increase GDP in a specific region by 0.01-0.03 percent, whist the same the increase (10 percent) in the level of throughput will lead to an increase in GDP in regions ranging the port of 0.06-0.2 percent. This meaning is an indirect spill over effect of 0.05-0.18 percent. The existence of positive effects of port activities on regional GDP, demonstrates the impact of ports on the national economy and also the importance of further developing the port's hinterland.

An efficient port rises the productivity of prime factors of production (labour and capital) and the profitability of the producing units enables higher levels of output, income and hence, employment. This makes the importance of a port on the national economy evident. Ferrari (2013) studied the impact of port activities on local employment by analysing more than 500 regions in West Europe and found that regional employment is positively correlated with port throughput. A study conducted

by Botasso (2013) demonstrates similar results. In a region with a million workers, an increase of 1 million tons of port net throughput would determine an immediate increase of about 400 to 600 jobs (depending on model specification). Significant share of break bulk and Ro-Ro traffic tend to have a greater impact on employment with respect to container traffic. Whilst, port activities seem to have a lower impact on service activities, this could be due to the fact that not all port related services are necessarily located in port regions. Whilst, the high impact of port activities on industrial employment can be explained due to bulk traffic; which is one of the main components of the overall throughput in western Europe (Aronietis, Road Pricing Impact On Port Competitiveness: A Port Of Antwerp Case Study, 2010).

To study port operation and the relationships among different factors in the port operation system, queuing theory has been widely used to identify operational bottleneck and optimization solutions. Hansen, (1972), Wanhill (1974), Robinson (1976), Edmond and Maggs, (1978), Noritake and Kimura (1983), Noritake (1985), Schonfeld and Sharafeldien (1985), Sheikh, (1987), Ramini (1996), Gambardella. (1998), Thomo, (1998), Bruzzone, (1998, 1999), Shabayek, and Yeung (2001), Chu and Huang (2002), and Yamada, (2003) have applied queuing theory and computer simulation to study berth planning problems and capacity issues with the objectives of optimal use of resources. Their researches represent a more practical approach to address the port operation and planning issues (Aronietis, Road Pricing Impact On Port Competitiveness: A Port Of Antwerp Case Study, 2010).

To measure the port system performance, a systematic approach is essential. Robinson (1976) argues that the traditional approach failed to develop quantitative and predictive models capable of revealing the basic dimensions of spatial structure and functions of a port. Robinson proposes a framework to rectify such shortcomings. The first step was to conceptualize the port as an operational system. Such conceptualization made it possible to develop a modeling framework that functional linkage between subsystems can be quantified, spatial structure defined, and capacity and efficiency determined (Robinson, 1976). As a result, progressively, the port system can be modeled at varying levels of complexity and a hierarchy of models is formulated to deal with more complex relationships progressively --- starting from arrival and service time to queuing, simulation, and optimization models. Three basic dimensions are identified: elapse time (time for ship stay in port), inter-berth shipping

linkages, and system capacity and efficiency; each of them is amenable to statistical analysis. They form the foundation for modeling the port as an operational system.

Robinson's application of queuing theory Robinson's application of queuing theory with three parameters of ship arrival, ship servicing time, and queuing times are particularly appropriate in modeling the time capacity relationship in port. Two types of statistical distributions: Poission and Erlang distributions are used in constructing his queuing models: Poisson distribution to model and Erlang distribution to model service time (k = 2, or 3). Lastly, Robinson suggests that since queuing models are restricted by assumptions and system behaviors may not conform to such assumptions, simulation is necessary. Simulation can be used in problem solving, optimization, and long term planning.

Other studies have also demonstrated a positive impact of transport infrastructures on regional development. Extensive and efficient infrastructure are essential in ensuring the effective functioning of the economy, it is also important in determining the location of economic activity and the kind of activities that can develop within a country. Well-developed infrastructure reduces the distance between regions, integrating national markets and connecting it at lower costs to international markets. An increase in transport infrastructure, like a ports hinterland connection, might cause an enlargement of important markets for local producers and increase in competitive pressure. More competition induces local producers to be innovative and/or cutting costs with the purpose to maintain or gain a competitive position. This continues in an ongoing loop, where positive effects on local economic growth and its associated employment increases, further leading to a reduction in transport costs which is associated to the new transport infrastructure (Aronietis, 2010).

Ports also tend to attract logistic companies which can lead to logistic clusters, which in itself also leads to economic growth. Logistic clusters1 are local networks of firms that provide a variety of logistic services (e.g. transportation carriers, warehouses, third-party logistics). They are strategically located to enable efficient transportation. These clusters attract further companies. Logistics is an essential element of their services or a large share of their overall costs. Behaviour of the individual firms also plays an important role in the competitiveness of a port. The success of a port cluster is depended on the governance structure of the cluster. In the last years, logistic clusters have had regional and national governmental support and funding in order to promote national/region economic growth.

Logistic clusters start with a seed investment, which after a while leads to a self-reinforcing positive loop. More companies lead to the arrival of new suppliers seeking to be close to their customers. At the same time, employees develop more skills to meet the needs of the industry. This leading to further growths and the cluster expands. As the cluster expands, it becomes more important for the regional economy, and governments tend to introduce more favourable regulations and public funding for research and/or training. Also, as the trade of goods in and out of the cluster grows; transportation costs decreases and the level of service improves. This is due to the fact that higher freight flow enables transportation carriers to operate larger conveyances, hence, reducing operating costs. Also, as freight flows increase, the frequency of services by carrier's increases. As service improves, more distribution and logistics operators are attracted to the cluster, this in turn leads to more freight movement and more carriers; a positive feedback loop. Another major benefit of logistic clusters is the creation of jobs. An example is the Port of Rotterdam with an average of 34,000 oceangoing ships ad even more inland vessels arrive annually. The logistic-industrial cluster around the port employs directly 94 thousand people and offers indirect employment 84 thousand. Van den Bosch and others (2011) presented a detailed report on the relation between competitive advantage of a country and the impact of port infrastructure by providing an in-depth case study on the Port of Rotterdam. The port's direct and indirect value added equals to around 22 billion euros; this being more or less 3,7% of the Netherlands GDP in 2008 (Vonderembse, 2017). An improvement of international competitiveness of companies throughout the Netherlands would mean a higher value added of 1%. Resulting in more or less 6 billion euros of value added throughout the Netherlands. This being the indirect value added of the Port of Rotterdam. Moreover, researchers concluded that the competition in the Port of Rotterdam leads to the stimulation of innovation and productivity, both of which are important in order for firms to be successful in the long run. However, innovations requires network relations; cooperative relations between firms, knowledge institutes and governments. This cooperation can be improved by initiating strategic cooperation with logistic hub in the hinterland, with North Sea ports or other ports, creating even more strategic value for the Netherlands. This demonstrates the importance a port can have, not only on the regional economic growth but also the national importance a port can have. Moreover, it demonstrates

the effect a port can have which is competitive and functions efficiently as an engine of growth of the nation.

In sum, ports have a positive impact on a country's national economy. Ports can lead to an increase in the country's GDP, whilst also leading to the creation of direct employment at the port but also indirect employment in the port's surroundings by constantly attracting new companies to the region. This possibly leading to clusters.

2.5 Truck Accident Analysis

Truck driving is one of the most dangerous professions in the world today. It was considered one of the ten deadliest professions in the world in a survey carried out a few years ago. To get an idea of how dangerous it is, consider the fact that some of the other professions on the list included mining, logging and deep sea fishing.

Truck driving isn't just dangerous for the driver. Truck and big rig accidents account for the second highest number of road accident fatalities around the world because they're usually loaded with heavy cargo. Even a slight mistake or misjudgment by the driver can cause the large vehicle being driven to go out of control, and ram into other vehicles or buildings, causing a loss of both property and life.

Over 70% of the resources moved across the Nations are transported through trucks and large vehicles. These include raw materials, fuel, processed food, produce and finished products. These account for $1671 billion worth of goods every year. More than 185 million trucks operate in the world and about 79.4 million people are employed in jobs related to trucking according to the American Trucking Associations, making it the largest trucking industry in the world (SHA, 2018).

2.5.1 Truck Accidents on the Rise

Statistics provided by the World Health Organization show that truck & motor vehicle accidents are on the rise. Road crashes are expected to become the fifth leading cause of death around the world by 2030 (Truck Accident Statistics, pp. New York: Accident Authority Network, 2018).

While there are many causes of 18-wheeler accidents, researchers believe that there are several reasons why truck accidents are more common than any other type of road accident.

(a) **Driver Critical Error**: The top reasons reported for truck driver error are: traveling too fast for the conditions, unfamiliarity with highway, over-the-counter drug use, inadequate surveillance, fatigue, stress or pressure from carrier, illegal maneuver, inattention and distractions.

(b) **Vehicle Critical Error**: The most common reported truck malfunction that caused an accident was brake failure, followed by tire problems and blowouts.

(c) **Environmental**: Accidents involving the environment are typically attributed to highway conditions, traffic and weather.

2.5.2 Truck Driving Regulations, Load Regulations and Speed Limits

For majority of truck accident cases, the truck drivers and carriers are held liable for injuries or trucking accident deaths. Truck drivers are required to abide by certain rules and regulations to protect the safety of other motorists on the road. In most of country, Truck driver regulations include the following;

(a) Truck drivers can only drive up to a maximum of 14 hours each day and may not drive consecutively for more than 14 hours.

(b) Truck drivers are required to take rest breaks if less than 8 hours have passed since end of driver's last haul.

(c) A driver is not allowed to drive more than 60/70 hours consecutively in 7/8 consecutive days.

Each state has its own specific road speed limits for truck drivers. Speed limits normally range between 35 mph in urban areas to 85 mph in rural areas and interstate highways. For most jurisdictions, the speed limit for trucks is much lower than the speed limits for smaller passenger vehicles.

There are also regulations concerning the cargo that can be loaded on trucks. Trucks carrying fuel and highly inflammable or toxic chemicals must display a warning sign visibly for other vehicles.

Cargo must be loaded evenly throughout the truck. If a truck has more load than capacity or an unbalanced load, it can affect the driver's ability to stop quickly in response to roadway hazards.

The trucking industry is one of the most heavily studied & scrutinized industries in the country because mistakes and breaking the laws & regulations cause people to be killed or catastrophically injured. The attorneys listed within this website

have based their careers on helping the families of truck & big rig accidents get the compensation and medical solutions they need to move on with life.

2.5.3 Specific Causes of Large Truck Crashes

The Federal Motor Carrier Safety Administration (FMCSA) publishes regular reports on accident statistics that include a section on large truck accidents. The report suggests that most crashes have more than one contributing factor. Some of the common causes of large truck crashes include; Truck engine failure, Suspension, braking or other truck failures, Following the vehicle ahead too close, Over compensating the steering wheel while trying to avoid obstacles, Driver fatigue or falling asleep at the wheel, Physical impairment of the driver and or Fog and environmental factors (Truck Accident Statistics, pp. New York, Accident Authorty Network,2018).

The same study conducted by the FMCSA revealed that major factors for large truck accidents included the following:

(a) The most common cause of truck crashes was brake failure which accounted for 27% of the accidents.
(b) In 19% of cases, truck drivers were unfamiliar with the route.
(c) A significant number of drivers, 10% in this case, felt under pressure while driving.
(d) 7% of the driver found to have been very tired.
(e) Drivers who were found driving aggressively was 5%.
(f) The number of drivers that experienced tire failure was 3%.
(g) Roughly 1% drivers were ill or under the influence of illegal substances.

2.6 Review on Previous Study

Chiguma (2007), Analysis of side friction impacts on urban road links; Case study Dar-Es-Salaam region in Brunei, was based on statistical methods, chiefly regression analysis. In the macroscopic approach, traffic and friction data from all sites were adjusted through a process called ‘normalization’, which enabled the data from the different sites to be merged, and consequently to obtain speed-flow curves for each road type. The individual friction factors through regression analysis were weighted and combined into one unit of measure of friction called ‘FRIC’. The effect of ‘FRIC’ on speed-flow curves was analyzed (Chiguma, 2007). This paper showed

that the friction variable, through in the form suitable to their own particular circumstances and this paper results should be applied to formulate management programs seeking to limit levels of side friction on high mobility urban arterial streets in order to improve traffic safety and operation efficiency.

Elisonguo (2013), the social-economic impact of road traffic congestion in Dar-Es-Salaam region in Brunei, observed the current public transport system in DSM has difficulties in coping with the demographic and spatial growth of the city and in meeting the basic needs of its inhabitants. Access to affordable and quality public transport services is critical for the urban population, as a lack thereof leads to economic, social, and physical isolation, especially in low-income communities, located in the city outskirts, with inadequate access to public transport and other basic urban facilities (Elisonguo, 2013). In this study, researcher concluded that there needs contribute to transit objectives or transit system performance, including reducing travel times, improving reliability, providing identity and a quality image, improving safety and security increasing capacity and enhancing accessibility.

CHAPTER III
CONTAINER TRUCK TRANSPORT IN YANGON

3.1 Road Freight Transport in Myanmar

There were 138,000 trucks registered in Myanmar as of June 2014, of which 53,000 were heavy-duty trucks. In 2011, the government relaxed requirements and taxes to import heavy vehicles. The trucking fleet doubled in size between 1990 and 2011 and doubled again in just 2 years between 2012 and 2014 (ADB, 2016).

There were 7,112 registered trucking companies in 2011 in Myanmar. As of 2010, it was reported that the largest private operator had 17 trucks, and that none provided nationwide services. However, by 2013, surveys carried out in areas other than Yangon identified five operators with 50 trucks or more, including one with 200 trucks. New medium-scale transport enterprises have likely been created, but we do not have enough data to characterize in detail the market landscape.

The largest operator likely remains to be the Road Transport, under the Ministry of Rail Transportation. Its fleet comprises 1,100 trucks, mainly of medium size (6.5–10.0 tons capacity), and 285 large buses (40-seaters). It has 3,000 staff. This makes it a large company in a country where road operators are small. Its fleet, however, only accounts for 2% of the nation's heavy-duty truck fleet. Its truck fleet is not expanding (1,385 trucks in 1990), and most trucks are old.

The vehicle fleet has been growing at a fast pace since 2012. Until 2011, the vehicle fleet remained small. There were 174,379 vehicles in the Yangon Region in 1995, and only 267,594 in 2012, a 2.7% annual growth rate. In 2012, the government lifted several restrictions regarding the import and licensing of vehicles. During 2012–2015, the vehicle fleet in the Yangon Region has grown 37%. By April 2015, the number of vehicles in the Yangon Region reached 691,021. The number of trucks nearly doubled in 3 years (ADB, 2016).

Some roads are narrow compared to the volume of the traffic in the road. This problem affects Yangon roads including roads extending to the periphery. An example is Kannar road in Yangon, which is narrow and has no parking bays; a

situation which forces the vehicles to stop anywhere on the road for passengers to board and offload (Kanyama, 2007). This practice causes more traffic congestion and more chances for accidents.

The Yangon Port operation is an integral part of the terminal system; its performance has a direct impact on Yangon Port area freight efficiency as well as financial performance of the terminal operator. But there is a lack of data of gate processing and truck flow; detailed and systematic analysis of the gate operation and its behavioral pattern is seriously lacking. Part of the reasons is due to the lack of data; another is due to the complexity of the truck flow behavior. First of all, freight planners would like to know that given the current trade pattern, how many truck trips will be generated for infrastructure planning purpose. For a port operator, for a given number of vessel import or export container, the number of transactions they generate represent resources requirements for yard equipment and gate processing. For truckers, the number of import or export containers and the transaction volume represents business opportunities.

Lastly, Yangon port area congestion level is one of a serious concern for all parties. To address the road congestion issue, it is essential to understand the overall characteristics of the gate operation beside Kannar Road and truck traffic behavior. A comprehensive data set was obtained from both terminal operators and field observation.

The comprehensive data set was obtained; it includes almost 20 days of terminal operational activities such as vessel loading and discharging volume, daily gate transaction volume, types of gate transactions, daily inbound and outbound truck volume, parking for operation time and volume, parking area and hourly break-down of gate transactions. This chapter provides the analysis on container truck congestion in the Yangon Port Area as per survey and data collection; it has six categories. Category one provides an overall description of vessel loading and discharging activities, and its patterns. Category two explains the various truck activities and port terminal gate transactions that take place on a day to day basis, resulted from vessel cargo activities. Category three analyzes the patterns of inbound truck activities. Category four analyzed the impact of traffic in Kannar road. Category five integrates the vessel, truck, and gate transaction activities, and identifies the relationship among them. Category six is a challenge that highlights the major traffic control and road distribution.

Table (3.1) Vehicle Fleet in Yangon

Year / Category	FY 2000	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Heavy machine	-	-	-	-	-	-	-	71	-	-	377	435
Trawlergi	132	2,867	2,756	2,515	2,243	1,280	1,036	658	1,189	1,548	2,132	2,570
Three wheeler	-	-	-	-	-	52	48	145	244	618	1,415	2,316
Motor cycles	21,442	3,466	3,310	3,162	3,013	42,416	46,539	50,660	56,094	113,651	161,236	204,680
Other	4,835	7,746	7,694	8,052	9,151	9,900	10,401	11,463	11,897	14,791	21,820	27,819
Bus	9,041	9,997	9,882	10,415	10,674	10,780	10,592	11,388	11,384	11,434	13,493	16,012
Truck (heavy duty)	8,112	8,843	9,102	9,244	9,703	9,624	10,252	11,263	10,914	13,234	17,820	17,079
Truck (light duty)	13,845	12,464	13,630	13,717	13,943	14,012	14,561	15,813	16,411	17,206	57,997	101,670
Cars	101,396	117,129	122,159	126,433	134,088	142,869	149,415	159,025	159,461	195,969	279,630	318,875

Source: Road Transport Administration

3.2 Vessel Traffic

The primary driver for truck pickup and delivery activities is import and export containers. This directly translates into vessel loading and discharging volume. When an export cargo booking is made, trucks are dispatched to the Inland Container Depot (ICD) which located in Yangon Port Area to pick up empty containers; after cargo is stuffed into containers trucks deliver those export loaded container back to the port before the intended vessel arrives. For import containers, trucks are dispatched to the port to pick-up import containers and deliver to the importers' warehouses. After cargo is taken out of the container(s), truckers take those empty containers back to the ICD. Therefore, the volume of vessel loading and discharging containers provides a good indicator for the volume of Yangon Port area traffic.

Eighteen container shipping lines with 51 vessels are providing container-handling services at the container ports in Yangon. Yangon has seven container ports – Asia World Port Terminal, Htee Tan Port Terminal, Myanmar Industrial Port Terminal, Thilawa Multipurpose International Terminals, Myanmar International Terminal Thilawa, Ahlone International Port Terminal and The Myanmar Terminal – with berths for 69 vessels. A total of 51 vessels are currently operating. A port EDI (electronic data interchange) system will be introduced at Myanmar's ports on 2018, allowing the tracking of arrivals and departures and exchange of other information. The Myanmar Port Authority has also issued a new order this month regarding the fees importers are required to pay shipping line representatives to carry out port clearance. The order stated that the consignee can submit a bill of loading (receipt for the cargo), and that box operators must not collect detention charges above the actual rate.

Most of the container shipping lines nowadays use the weekly service, meaning the frequency of port calls is once a week for import and export cargo. Based on the information provided by the terminal personnel and author's own working experience at the terminal, almost all of the clients deploy their ships on weekly services; only one shipping line uses the 10 day service: one ship for every 10 days, a less frequent service. All the services cover major trade routes such as Yangon-Asian Region, Yangon-West Asia, and Yangon-South Asia.

Table (3.2) Container Handling Statement for Two Weeks

Date	Import (TEU)	Export (TEU)	Total (TEU)
6-May-19	1290	1550	2840
7-May-19	1400	1800	3200
8-May-19	1098	2201	3299
9-May-19	989	1800	2789
10-May-19	1409	1100	2509
11-May-19	1980	1566	3546
12-May-19	1909	2250	4159
13-May-19	1100	1090	2190
14-May-19	976	2198	3174
15-May-19	932	1329	2261
16-May-19	1098	2210	3308
17-May-19	780	590	1370
18-May-19	2100	980	3080
19-May-19	2207	2401	4608

Source: Port Electronic Data Interchange

The vessel load and discharge figures are compiled; there were 110 vessel calls with 37,725 containers in 2018. The container handling statement of import and export for two weeks is showed in Figure 4.1. It shows a wide variation of cargo volume for different vessel calls. This reflects the fact that there are different shipping companies calling the terminal with various services deployed in different routes. In general, vessel sizes and the frequency of calls closely correspond to the trade volume in a particular route.

In order to analyze the impacts of vessel cargo volume on container truck traffic volume in Yangon Port area, it is necessary to show behavior of the vessel cargo volumes over time. Daily vessel cargo volume is obtained by aggregating all vessel loading and discharging figures during the week. Since the first vessel that called the terminal was in 2018, the weekly vessel loading and discharging figures are aggregated from Monday to next Sunday. Figure 3.3 shows the monthly vessel cargo volumes; it illustrates several patterns. First, the daily volume increased as time went by from the beginning to the end of survey. This corresponds to the general trend of

increasing trade volume combined with seasonal factors in the Port of Yangon that cargo volume always decrease during the weekend holidays.

Table (3.3) Vessel Monthly Cargo Volumes (1.1.2018 to 31.12.2018)

Month	Monthly Cargo Volumes
January	90840
February	120000
March	132099
April	52789
May	80509
June	193546
July	210159
August	108190
September	203174
October	211261
November	193308
December	91370

Source: Port Electronic Data Interchange

3.2.1 Truck Traffic and Gate Transactions

Because of vessel loading and discharging activities, the terminal gate processes inbound and outboard container movements. As mentioned earlier, there are different types of truck traffic passing through the gate complex. Since the gate is the point where equipment and cargo liabilities are exchanged, the gate complex processes and keeps track of what is coming in and what is going out. Any equipment both containers and chassis passing through the gate complex is of the interest of the port management, shipping lines, truckers, and shippers as well as government agencies. For example, a shipper may want to know when its export container is received by the terminal in order to meet the vessel schedule; or the shipper wants to know when the import container leaves the terminal in order to have the warehouse ready to receive the cargo for distribution. Shipping lines also want to know how many of the export containers have been received at the terminal against the total export bookings for a particular vessel. The terminal itself also wants to keep track of

the number of containers and equipment in and out of the terminal for business purposed. When a piece of cargo equipment, either a container or a chassis, or both, passes through the terminal gate, it is considered a transaction. Therefore, the terminal gate transactions are important records. In general, there is inbound and outbound traffic at the Yangon Port Area. The inbound traffic includes returning empty containers (EMIN), export loaded containers (LDIN), returning chassis (CHIN), and bobtail (BTIN). The outbound traffic includes empty containers for export bookings (EMOT), import container deliveries (LDOT), outgoing chassis for equipment reposition purpose (CHOT), and bobtail (BTOT). BTIN and BTOT traffic are not considered a transaction since it does not involve any equipment passing through the gate, only the truck-tractors that owned by drivers or trucking companies. A trucker can come into the terminal to pick up or deliver a container or chassis only; this is called a single move. On the other hand, a trucker can also bring in a container or chassis to the terminal and pick up a container or chassis on his way out. This is called a double move. Apparently, double moves are more productive for both the trucker and the terminal operator.

In general, terminals in the Yangon port area are operate for container pickups and deliveries during regular weekdays between 12:00 a.m to 2:00 p.m and 7:00 p.m. to 6:00 a.m., to avoid high costs of overtime and warehouse work schedules during evenings and weekends. Also, they do not operate between 6:00 a.m. to 12:00 a.m. and 2:00 p.m. to 7:00 p.m. Therefore, there are 365 working days for the terminal in Yangon port area. But for vessel loading and discharging, the terminals work 13 hours a day. They provide a very detailed picture about the terminal gate activities (DMA, 2016).

Table (3.4) Daily Inbound and Outbound Truck Traffic Pattern

Days	BTIN	CHIN	LDIN	EMIN
6.5.2019	20	1220	1300	1400
7.5.2019	90	1020	1200	1200
8.5.2019	22	1400	1500	800
9.5.2019	30	900	1700	770
10.5.2019	15	1500	1800	1300
11.5.2019	30	1040	1300	1200
12.5.2019	26	1100	1200	1001
13.5.2019	27	800	1900	1320
14.5.2019	28	1230	1550	1660
15.5.2019	29	1410	1520	1220
16.5.2019	30	1022	1600	1450
17.5.2019	31	1070	1300	1620
18.5.2019	27	770	1900	1700
19.5.2019	32	980	1800	1200

Source: Port Electronic Data Interchange

These findings show that peak container truck traffic volumes occur during non-peak hours of other traffic, including articulated trucks. Furthermore, container truck volumes are highest between Monday and Friday whereas articulated truck traffic volumes are highest during weekdays. Therefore, while traffic operation improvements specific to peak-hour traffic and weekday conditions may address critical issues for articulated trucks, these improvements may not translate into benefits for most container trucks. The only temporal similarity between container truck and articulated truck volumes is their proportionality between day and night; about 70 percent of daily truck traffic occurs during night time hours (defined as 07:00 p.m. to 09:00 p.m.).

3.2.2 Yangon Port Information

The Port of Yangon is the premier port of Myanmar and handles about 90 % of the country's exports and imports. The Port of Yangon is situated at Latitude 16^0 47' N and Longitude 96^0 15' E on the Yangon River and about 32 km inland from the Elephant Point on the Gulf of Martaban. All vessels calling to the Yangon Port,

pilotage is compulsory if they are over 200 GRT. Navigation from the Pilot Station, which is further 32 km seaward from Elephant Point, to the Yangon harbour is generally on a flood tides and has to be timed to cross both Inner Bar and Outer Bar near high tide to ensure sufficient depths.

There are two restricted bars along the approached channel:

(1) Inner Bar (near Yangon Port at Monkey Point)

(2) Outer Bar (at the mouth of the River)

The average tidal range is about 19.3 feet (5.85 m) at spring tide and 8.4 feet (2.55 m) at neap tide. The velocity of the current at Yangon River is 4 to 6 knots at spring. Flood stream continues for about 1 hour 15 minutes after high water and Ebb current for about 30 minutes after low water. Waves within the Yangon River do not hinder marine operations and even at the mouth of the river wave conditions are seldom rough with less than two metres wave-height (MPA, 2019).

The Yangon Port is accessible to vessels of 167 m LOA, 9m Draft, 15000 DWT and Thilawa Port is accessible up to vessels of 200 m LOA, 9m Draft, 20000 DWT. Day shift is from 08:00 hours to 16:00 hours. Night shift is from 20:00 hours to 04:00 hours. Overtime works is available on request for periods between shift hours. Myanma Port Authority (MPA), has been implementing Port Security measures in its ports since July 1, 2004 to comply with the International Ship and Port Facility Security Code (ISPS Code) adopted by IMO in 2002 (DMA, 2016).

3.3 Terminal Operation System of Yangon Port

Most of Terminals which is located in Yangon under the supervision of Myanma Port Authority and in Terminal operation system, it is designed to manage automatically for its operation system such as cargo handling for incoming and outgoing vessels, yard planning and vessel planning for the cargoes carried by the system, generating of necessary passes which are needed for port operation by using computerized system. The system is designed to manage the following basic information as mentioned below:

(a) Information of export and import cargo

(b) Dynamic and static information of Main ship

(c) Container information(Static and dynamic attribute information of cargo）

(d) Billing information

Moreover it is designed in order to conduct information management intended to support the following works relevant to containers;

(a) Yard Planning
(b) Yard Operation
(c) Gate Operation
(d) Vessel Planning
(e) Also the system is designed in order to support the following works relevant to General Cargo.
(f) Cargo registration
(g) Location management
(h) Status management
(i) Carry-out management
(j) Container Truck driver control management

3.3.1 Container Truck Network

Defining a container truck network prior to data collection is difficult. While understanding areas of the city that generate containers and the magnitude of container volumes helps develop a skeleton network between origins and destinations, identifying container routes is challenging without traffic data. Defining these routes relies on transportation engineering judgement and industry intelligence. As data is collected, the definition of the container truck network changes and matures.

Another challenge with defining a container truck network is establishing criteria that define these routes. For example, any segment that carries a container can be classified as a container network segment and it is expected, or at least it is reasonable to expect, that every segment of the truck network will accommodate a container at least once. Therefore, different criteria must be established to differentiate roads that are critical for container truck movements and those that are incidental. For this research, a truck route segment is defined as part of the container truck network if it carries a minimum number of container trucks per day as determined by performing a statistical analysis. One thing to be difficult, there is a railway that works to carry container two times per day which has been built to be passing on Kannar rode as parallel.

There were many difficulties to be particularly acute in urban areas that are generally characterized by dense road networks with multiple access points, insufficient truck data sources, lack of transportation system analysis tools, congested traffic conditions, truck trip chaining travel patterns, multimodal interfaces, and competing needs from other transportation system users such as buses, pedestrians, and railway. Due to these characteristics, most places in port area have little understanding about urban goods movements and even less understanding about urban container truck movements. Since the Kanner road network provides the first or last leg of an intermodal freight movement (which is critical for container freight transportation) this lack of understanding is detrimental to the local area and percolates through the entire global system.

3.3.2 Container Truck Characteristics

It reveals that the Yangon have the highest volume of trucks entering and leaving the city during the 6-hour count survey period with 8,500 truck movements. This is not surprising as majority of freight traffic generators, such as factories, warehouses and industrial parks, are located in the southern periphery of Yangon. Additionally, products coming from the eastern and North provinces are usually transported via the southern arteries, such as the Kyimyindine Kannar Road, Insein Road and Bandula Road. Products from the northern regions are generally transported via Insein and from the eastern regions are generally transported via Kanner through Bandula. Truck flows to and from port area via the northern account for some 3,500 truck movements and via eastern account for some 3,500 truck movements.

There would two types of surveys need, as follows: truck volume counts and truck driver roadside interviews, including origin and destination (OD) data. The surveys would conduct for 13 hours from 12 AM to 2 PM and from 7 PM to 6 AM. A 24-hour survey count is ideally preferred but visual limitations and safety and health concerns of surveyors precluded a more thorough collection of data.

Truck traffic volume was counted by vehicle type and direction. The roadside interview survey was conducted on the same day as the truck traffic volume survey. This is important as the expansion factors will be computed from the ratio of truck traffic volumes and the number of samples taken during the driver interview survey. The expansion factors will differ according to vehicle type, direction, and time period.

Information on the truck's origin and destination, truck type, loading capacity, commodity type, and loading factor were obtained through direct driver interviews and visual inspection. Driver interviews should be as many as possible to obtain a more realistic data set. The OD data will be used in the traffic assignment process.

3.3.3 Financial Costs and Profitability

There can compare freight rates on Yangon–Mandalay corridor with predictions of financial operating costs. Financial costs are calculated on the same basis as economic costs, but also include taxes, tolls, and a higher interest rate. Large trucks only cover 70% of their costs, while medium trucks cover almost 95% of their costs. Operational costs (tolls, fuel, crew, and maintenance costs) are about covered by rates, but no profit seems to be generated to finance vehicle ownership costs and overheads (e.g., staff, taxes, brokers). On other corridors, rates are higher but so are unit costs, which compounds with the larger share of small trucks. On a typical road in a flat area, it can find a financial cost of 6.3 cents per ton-km, against surveyed rates of 4.5–5.7 cents. This implies again that rates would cover only about 80% of a truck operator's long-term costs. Only in mountainous areas do rates more closely compare with the financial costs to operators (ADB, 2016).

When determining costs, it can consider a nominal financial interest rate of 25% and a real economic interest rate of 12%. This financial rate is higher than the official maximum rate authorized for private banks in Myanmar (13% in 2015). It is representative of the true costs of financing for small businesses having limited access to credit from personal loans (inflation in 2015 in Myanmar was 6%) (ADB, 2016). These findings, beyond the possible margin of error, clearly highlight the ongoing phase of transition in the Myanmar's trucking industry. It is likely characterized by intense competition, low profits or losses, and frequent bankruptcies of small operators, together with a transition from medium 2-axle trucks (which are mainly used in feeder areas) to multiple axle-trucks (which are dominant on trunk and international corridors). In the long run, we would expect freight rates to reach levels closer to costs.

Table (3.5) Truck Economic Costs ($ per vehicle-kilometer)

Particular	Yangon-Mandalay Corridor			Other Areas		
	Medium Truck	Large Truck	Truck with Trailer	Medium Truck	Large Truck	Truck with Trailer
Average Load (ton)	9.8	17.3	29.7	7.0	15.2	27.7
Fuel	0.180	0.332	0.505	0.203	0.376	0.572
Lubricants	0.005	0.009	0.010	0.005	0.010	0.011
Tire	0.007	0.015	0.028	0.007	0.017	0.032
Maintenance parts	0.020	0.049	0.072	0.028	0.070	0.100
Maintenance labor	0.021	0.027	0.026	0.026	0.032	0.031
Crew Time	0.095	0.095	0.095	0.109	0.109	0.109
Depreciation	0.017	0.041	0.080	0.023	0.055	0.109
Interest	0.017	0.041	0.062	0.019	0.045	0.068
Overhead	0.025	0.055	0.110	0.027	0.060	0.121
Total	**0.388**	**0.662**	**0.989**	**0.448**	**0.773**	**1.153**

Source: ADB estimates based on model developed for the study

Container trucks differ from other truck types in seven critical ways: operational, physical, competitive, legal, safety, ownership of containers, and traffic measurement and estimation characteristics (Gorge, 2009). These differences must be considered in analyzing and modeling container truck volume and developing container-specific metrics such as container truck volumes on a road network (Gorge, 2009). These differences are important because they allow for certain assumptions that are not applicable for general truck traffic. For example, the origins and destinations are assumed to be fixed at rail intermodal terminals and temporal characteristics of container trucks are assumed to follow those exhibited at terminal entrances.

3.4 Need for Container Truck Volume Estimates

Due to the economic importance of containers, the rapid increase of container freight in recent decades, the presence of containers in urban areas, insufficient tools to quantitatively analyze urban container trucking, and the lack of technology to measure and estimate container truck traffic, there is a need to develop a methodology

to acquire container truck traffic data for the purpose of modeling container truck volume. Few sources of container truck data are available in Yangon from The Myanmar Container Truck Association (MCTA).

These databases are either aggregated at national or provincial levels or provide inadequate geographic detail for modeling urban container trucking.

Some of the reasons why container truck volume estimates are important are they:

(a) help transportation engineers and planners understand urban container truck traffic characteristics;
(b) assist with scenario-based analyses;
(c) serve as a baseline for developing forecasting models;
(d) can be used as inputs for transportation system performance measures; and
(e) feed pavement designs.

Without sufficient tools to objectively assess container freight in urban environments, transportation engineers and planners struggle to strategically provide adequate infrastructure to maintain and enhance the competitiveness of the transportation system to improve efficiency, safety, productivity, and economic growth. Given that Yangon Region is supporting inland ports, major railroads are considering the development of large value-added intermodal hubs outside metropolitan areas, and the importance of the last mile for intermodal freight transport, it is critical for transportation engineers and planners to understand container truck flows in urban areas to design and operate transportation infrastructure to facilitate these movements.

The literature reveals that the influence of container trucks on the transportation system is complex and significant and that research specific to this unique freight transportation environment is undeveloped and warrants special attention. The literature also calls for increased operational research using strong quantitative approaches to obtain understanding of the dynamic relationship between terminal schedules and drayage movements. Currently, “there is no methodology aimed specifically at the analysis and planning of freight movements within the city”. This paper addresses the need to develop a methodology to estimate container truck traffic volume that recognizes the unique characteristics of container trucks and overcomes the traffic measurement and estimation technology limitations.

3.4.1 Modeling Truck Waiting Time Functions

In the terminal gate situation, truckers are viewed as customers and the terminal gate booths are treated as servers. They are integral parts of the queuing system. First, due to the unpredictability of decisions regarding when truckers will be dispatched to the terminal of Yangon port for pickup and delivery, highway congestion, and weather delays, the arrival process can be viewed as a random process or stochastic process. Second, the system has unlimited capacity as the waiting area can be stretched from the gate holding pan to access roads. One of the concerns is whether the trucker waiting line is spilled over to major highway accesses. As a result, regular highway traffic or traffic on arterial roads will be affected. In the vicinity of the Port of Yangon, all marine terminals are located in Port areas where sufficient road capacities are provided. In addition, little private and passenger vehicle traffic is present in these areas. Therefore, whether the truck waiting lines interfere with regular highway traffic is not an issue in this study. Third, there is no priority for customers. Fourth, each gate booth can be treated as an independent and parallel server. In order to select an appropriate queuing model for the terminal gate system, the characteristics of the queuing theory must be determined.

Since there are no prioritized truckers in general, no limit on the number of truckers coming to the terminal to pick up or drop off containers, and the size of the trucker population is quite large, the impact of last three characteristics of the queuing system can be ignored. In general, the number of gate lanes opened is more than one under normal operating conditions; therefore, the system is a multi-server one.

3.5 Description of Current Situation

The increase in vessel sizes and the relating strain imposed on the landside operation of container terminals due to peaks in truck arrivals for delivering or picking up a container lead to a rising interest in improvement strategies in both industry and research. Based on the high fluctuation in truck traffic load the capacity at the terminal gates and in the yard are mainly either too high or too low, leading to high labor costs for the terminal or to long waiting times for the trucks and as a consequence to congestion at the gates. This phenomenon also affects public streets and the performance of other companies in the port, e.g. freight stations, empty container depots or customs. As the truck engines are running most of the time while queuing or waiting in a traffic jam, the situation leads to higher emissions in the port

area. The port drayage sector is highly impacted by these developments due to its focus on transport in the port area and the dependency on the container terminals as main sources and drains of drayage transports.

Furthermore, the drayage truck drivers, which are mainly owner operators and get paid per successful trip, are dependent on a certain amount of trips per day to pay their expenses. Extensive waiting times lead to a low number of trips per day for the drivers and therefore to financial challenges.

CHAPTER IV
SURVEY ANALYSIS

4.1 Survey Profile

Yangon Port is an area along the kanner road, Yangon, Myanmar. This area has five primary schools, two middle schools, six high schools and a university. The township is home to three public and three private hospitals, including East Yangon General Hospital, one of the major hospitals in Yangon. One of the country's two Burmese language dailies Kyemon, is based out of here. In October 2012, Pearl Land Company won a rental bid from the Myanma Port Authority to redevelop the Botahtaung jetty into a recreation area with hotels. The proportion of the urban population of Yangon Port Area is almost double that of Tharkata, which has the second highest proportion of urban population at 36 percent, about 2,500,000. The large population size, the high population density and the high proportion of urban population in Yangon Port Area may be attributed to come people from other township to Yangon Port Area, in search of employment, schooling and other economic and social opportunities. These attributes of the population of Yangon Port Area (and other 40 kilometer 40 areas) require urgent attention in terms of policies and development programmes that address issues such as unemployment, housing, sanitation, overcrowding, violence and crime, pollution, public transportation and public health issues, among others.

The population density of Yangon Region in March 2014 was 716 persons per square 40 kilometer. This is about nine times higher than the Union level population density of 76 persons per square 40 kilometer. Mandalay and Ayeyawady are the closest to Yangon Region in terms of population density, with 200 and 177 persons per square 40 kilometer, respectively. The population density of Yangon Region has increased from 310 persons per square 40 kilometer in 1973 to 387 persons per square 40 kilometer in 1983, and to 716 persons per square 40 kilometer in 2014. The Census results show that for every 100 persons in Yangon Region, 30 persons live in rural areas while 70 persons live in areas that are classified as urban by GAD. The

proportion of the urban population in Yangon Region is much higher than the Union level where 30 percent of the total populations live in urban areas.

4.2 Survey Design

A total number of 200 survey questionnaires were distributed to local people within May 2019, reflection of response was 200 answering so that it was 100 %, can assume that it was strongest. In the survey, there was indicated to social impact by container traffic in Yangon port area, there was included 5 categories, and open answering for participants' opinion. Questionnaires to Drivers, Port Facility Security Officers, Public, Truck Owners and Administrators from Government site like traffic police. By comparing the questionnaire survey result with the different survey result from level to be identified for social impact of local people.

In this survey, 5 types of social impact for local people were conducted. These 5 types of survey items are categorized into salary, cost of daily life, impacts of container traffic, barrier of travel flow and country economy impacts.

A total number of 200 people were interviewed in First Week May 2019 and Second Week May 2019 for the survey. Total number of participants was 200 excluding invalid participants' data. Total population of ages 20 years and above in 2019 in the survey area was assumed to be 200 by the Survey Team, sampling rate was 100%.

4.3 Survey Results

After interpreting the survey data, it is found that the demographics data of the container trucks congestion in Yangon Region, influencing factors on fuel consumption of truck drivers, increasing operating costs for truck drivers and owners, wastage of time .Based on these factors, recommendations and suggestions could be made in order to reduce container trucks congestion.

4.3.1 Demographic Characteristics of the Respondents

There was been interviewed to 200 people including students, Workers, drivers, owners and government officers in First Week of May 2019 and Second Week of May 2019 for the survey. According the survey questionnaires' result, this part identified to analysis on social impact by container traffic.

Table (4.1) Demographic Characteristics of Survey Questionnaires

Particular	Number	%
Gender		
Male	142	71 %
Female	58	29 %
	200	**100 %**
Age		
16-20	12	6 %
21-25	10	5 %
26-30	48	24 %
31-35	50	25%
36-40	11	5%
41-45	40	20 %
46-50	8	4 %
51-55	10	5%
56-60	4	2 %
60-above	7	4 %
	200	**100 %**
Education Level		
Basic Education	70	35 %
Not Graduate (Higher Education)	59	29 %
Graduate	71	36 %
	200	**100 %**
Occupation		
Driver	70	35 %
Port Facility Security Officer (PFSO)	8	4 %
Public	95	48 %
Truck Owners	15	7 %
Government Sector	12	6 %
	200	**100 %**
Travel Route		
West to Port Area	-	
East to Port Area	110	55 %
South to Port Area	40	20 %
North to Port Area	50	25 %
	200	**100 %**

Source: Survey Data (2019)

From the table, it reveals that 71 respondents occupy the largest number in the Education level of Graduate level (36%), followed by 70 respondents in the Education level of Basic Education level (35%), and the last 59 respondents in the Education level of Not Graduate (Higher Education) level (29%). Table also shows that 50 respondents occupy the largest number in the age group of 31-35 years old (25%), followed by 48 respondents in the age group of 26-30 years old (24%). In the survey, there is separated as the field of activities, table shows that driver is 70 respondents as 35 %, PFSO is 8 respondents as 4 %, public is 95 respondents as 48 % that included with students 20%, business owner 18%, labors 44% and households 22 %, truck owner is 15 respondents as 7 % and the government sector is 12 respondents as 6 %. Most of the respondents (110) as 55 %, their destination to work around Yangon Port Area come from East of Yangon, 50 respondents of all as 25 % come from North of Yangon and 40 respondents of all as 20 % come from South of Yangon. In this study, out of the selected sample respondents, that represents the whole populations; (142 respondents or 71%) were males whereas (58 respondents or 29%) were females as shown in Table 4.1.

According to the data analysis and found out that most of respondents can discuss about the social impacts of local people by container traffic that facing problem, barriers, and way of their future. Most of response in survey, these can help to conclude and analyze for this study.

4.3.2 Fuel Consumption of Truck Drivers

There was made survey to truck drivers accordingly with normal fuel consumption and fuel consumption by traffic congestion. 81% of the respondents from truck drivers acknowledged the high rate of fuel consumption especially petrol and diesel by container trucks due to queuing. The stopping and starting in traffic jams burns fuel at a high rate than smooth rate of travel on the open highway. This increase in fuel consumption costs commuters additional money for fuel. This is a huge loss for the economy of the individual and the country at large given the fact that the fuel is imported and its price is still very high.

Table (4.2) Fuel Consumption of Respondents

Attribute	Category	No. of Respondents	Percentage (%)
Extra cost for daily concerning road congestion	More Fuel consumption	57	81 %
	No more cost	13	18 %
Total		**70**	**100%**

Source: Survey Data (2019)

Accordingly the open source for fuel consumption, the survey showed that each vehicle losses 4-7 liters of fuel per day due to long stay in the congestion. Assuming that each bus and truck loses 7 liter of fuel per day, a total of approximately 35,000 liters of fuel is lost in a day. For the current price of Kyat (Kyat) 995 per liter, a total loss in Kyat is 34,825,000 per day and 1271.112 billion per year. This is just a loss from public transport leave aside other means of transportation. This huge amount of money which is lost annually could have substantial impacts on social and economic development of the bus owners, drivers, conductors and their dependents.

4.3.3 Increasing Operating Costs for Truck Drivers and Owners

There was made survey to truck drivers and truck owners how beat the operation cost than normal situation by traffic congestion.

Table (4.3) Operation Costs of Respondents

Attribute	Category	No. of Respondents	Percentage (%)
Extra cost for daily concerning road congestion	Extra operation cost	69	81 %
	Extra more cost	16	19 %
Total		**85**	**100%**

Source: Survey Data (2019)

The industrial condition and standards question from questionnaire was answered “yes” or “no” to clarify if the respondent has to cost more operation cost because when traffic congestion, the truck and the other related vessels in this area were remaining to wait in operation, then overall main question is target to the all that is facing the some barriers to move. The result for this question described a percentage of 81% and 19% respectively. Most of the truck owners are trying to pass this problem; in that case the future truck owners should need to prepare how to solve this challenge to invest.

4.3.4 Wastage of Time and social impact

There needs to analyze the waste of time by traffic congestion how much to be impact on daily life.

Table (4.4) Time Wastage of Respondents and Social Impact

Attribute	Category	No. of Respondents	Percentage (%)
Impact on daily-life	More Time Wastage and Social Impact	200	100 %
	No more wastage and Social Impact	-	- %
Total		**200**	**100%**

Source: Survey Data (2019)

As the survey result, all respondents agreed that the daily time wastage can be more in daily life. Upon open questionnaires, data from the field showed that every person living or who come to Downtown area of Yangon either employed or unemployed and whether in formal or informal sector do waste time due to traffic congestion. It was revealed that majority of residents in Yangon lose 2-5 hours daily. These precious hours are lost during the congestion. The survey from people showed that about 70% of the respondents wake up at 4: 00 or 5:00 so as to be able to arrive at work on time. In some days, they reach on time while in others arrive very late. Sometimes a person arrives at the work premises earlier than expected for instance at 6:30 or 7:00 a.m. Such a person is supposed to wait until the office is opened probably at 8:30 am as it is for most organizations. The waiting time here is 30 minutes to 1 hour. This time is simply wasted and not paid while there is a saying that “Time is

Money". During the evening, it is the same story. A person leaves at work at 4:30 and arrives home at 8:30 or 9:00 p.m.

Worldwide, it is known and emphasized that there should be a need for parents in proving essential services to the children in order to enable them to survive. This has been established by the international conventions and even being agreed by member states – Yangon being one among them. Traditions, various disciplines in social sciences ,customs as well various religious denominations emphasize and acknowledge the significant effect of the parents and the guardians to nurture for the children in intellectual and spiritual formation. The survey indicated that it is very inevitable for a parent or guardian who leaves at home at 5:00 or 6:00 in the morning and returning back at 8:00-9:00 p.m to perform well this duty of molding the children and the family at large. There is no enough time for this important task. Currently, children in Yangon city are faced with a number of challenges such as school dropout, use of drugs, and engagement in heterosexual and homosexual behaviors especially by some young boys. It is not that the parents have no time to stay with their children, but to a large extent, there are precious hours that are lost daily on the way due to congestion that could be used for that purpose and produce substantial results for the betterment of the children themselves, family and the nation at large.

4.3.5 Cargo Flow of Port Facility

Cargo flow rate is important of economic index which will be pointed the national interest of their development. So, there was made to clarify the cargo flow of port facility by questioning to port facility security officers.

Table (4.5) Timely Cargo Flow of PFSO Respondents

Attribute	Category	No. of Respondents	Percentage (%)
Timely cargo flow	Traffic congestion can be barrier on timely cargo flow	7	86 %
	No impact	1	14 %
Total		**8**	**100%**

Source: Survey Data (2019)

According to the data analysis on table and found out that 7 (86%) of respondents agree that traffic congestion can be barrier on timely cargo flow, so this impact can cause the challenge on economic increasing, and 1 (14%) of the respondents disagree to improve.

4.3.6 Impacts of Container Truck in Yangon Port Area

The first thing many people think of when it comes to congested road ways is the delay. Traffic congestion delays people to their places of work and the consequence of this is that many working hours are lost on the way, which is a great challenge to the employers. Delays due to traffic road congestion results in late arrival for employment, meetings, and education, resultant loss of business, disciplinary measures or personal losses and performing below standards.

When one dials a police officer, an ambulance or a fire truck to request help over emergency vehicles, the help may be offered too late because of road traffic congestion which will stall them to reach the scene on time. Moreover, blocked road traffic may interfere with passage of emergency vehicles travelling to their destinations where they are urgently needed.

Accidents occur during road traffic congestion as drivers maneuver their vehicles unlawfully in order to reach their destination as early as possible. This results into loss of lives and destruction of properties. Moreover, the accidents are accompanied by blocking other road users' passage thereby causing gridlock. If accidents did not cause fatalities or serious injuries and if the traffic police are not present in the incidence, the two drivers involved in the accident compromise and reach the consensus on the amount to compensate the innocent driver.

There is a good number of policy and rules concerning transportation in Yangon, that to large extent, have not yet been well implemented and some are beyond the implementation time frame. Hence, there is a need to review them so that they suit the current situation in Yangon port area and other area in the Yangon city that are fast growing.

Table (4.6) Social Effect on People

Questions	Strongly agree (%)	Agree (%)	Neither agree nor disagree (%)	Disagree (%)	Strongly Disagree (%)	Mean
Traffic congestion can impact on your daily-life	9	59	18	9	5	3.6
Traffic congestion can be barrier on timely cargo flow	9	59	18	9	5	3.7
Traffic congestion can effect on economic condition	30	57	12	0	1	4
Traffic congestion can be cost operation budget	28	26	10	24	12	3.3
Traffic congestion can be more accident	10	16	25	32	17	2.7
Traffic congestion can be effect on country development	51	22	9	11	7	3.7

Source: Survey Data (2019)

In Table 4.7, 59 % of the respondents agreed that container traffic can impact on their daily-life, 57 % agreed that on traffic congestion can effect on economic condition, and according to promote trade flow of cargo, traffic congestion can be barrier on timely cargo flow, there have 59 % agree. And there is also pointed out that traffic congestion can be effect on country development by agreeing of 51 %.

CHAPTER V
CONCLUSION

5.1 Findings

In recent years, particularly since the early 2010s, rising transport demand and road traffic have led to increasing congestion, delays, accidents and environmental problems, particularly in Yangon city. This explosive increase has been the result of greater access to cars (as the purchasing power of the middle-income classes has risen), easier access to credit, falling retail prices, a larger supply of used cars, population growth, a decline in household size and an unstructured approach to urban transport policy.

As the survey and literature of this studying, the study has brought about some fascinating findings about the impacts that container truck traffic congestion has upon the Yangon society, economy, and the individual. These findings should be taken into consideration by the Yangon Government, policymakers, truck service companies, the working population, as well as the general public. The empirical findings have demonstrated that people believe that container truck traffic congestion negatively impacts upon the social concern of Yangon Port Area.

The study found that there is significant relationship between the social-economic activities in Yangon and container truck traffic congestion. The affectivity and efficiency of the social economic activities are affected or hindered by container truck traffic jams in terms of delays, accidents, road rage, and decrease in income; few working hours for work and study; tiredness, boredom, fatigue, illness but few to mention. Thus, the variable; road traffic congestion is an independent factor while social economic aspects remained to be dependent factor. A slight change in traffic jam automatically affects the social economic aspects of the residents in Yangon port area.

5.2 Recommendations

The city of Yangon approximately loses 80 lives annually on road traffic accidents by container truck in Yangon Port Area. In that area, Yangon Traffic Police account to 39% of all injuries, primarily in male aged 16-44 years. Due to high motorization and urbanization, the country's economy is also growing at high rate, poor traffic control management, poor road networks that connect to deliver area are in sorry state. Therefore government and other bodies should work hand in hand to make sure that they curb the cause of container truck traffic congestion by fully planning, contracting and managing of public infrastructures and developing transits control travel demand by concentrating and encouraging public transport, non-motorized like walking and other travel demand management measures car sharing, carpooling.

The purpose of this study is to identify the causes of traffic jam due to container trucks in Yangon port area. Far from having reached its apex, assessing the repercussions of traffic congestion still needs more research and practice. There is strong empirical evidence in this research demonstrating that people do believe that traffic congestion negatively affects different aspects of a society, economy and an individual. This is where the Government's as well as other policy-makers' role become vital. Eminently, the empirical findings can be a useful and pragmatic tool for policy-makers, bus companies, and even the general public of Yangon to reorient their strategies and habits, and opt for an approach that is in the best interest of the various stakeholders. The research has some potential limitations, such as a larger sample size could have been chosen. Results might be biased due to unforeseen circumstances. Furthermore, the lack of qualitative analysis could have resulted in various aspects not being considered. Also, the study focused mainly on the individual, the economy and the society as whole, thus ignoring the views of other parties concerned, such as the Regional Transport Authority, the Regional Road Development Authority, the Yangon Traffic Police as well as the Government.

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APPENDICES

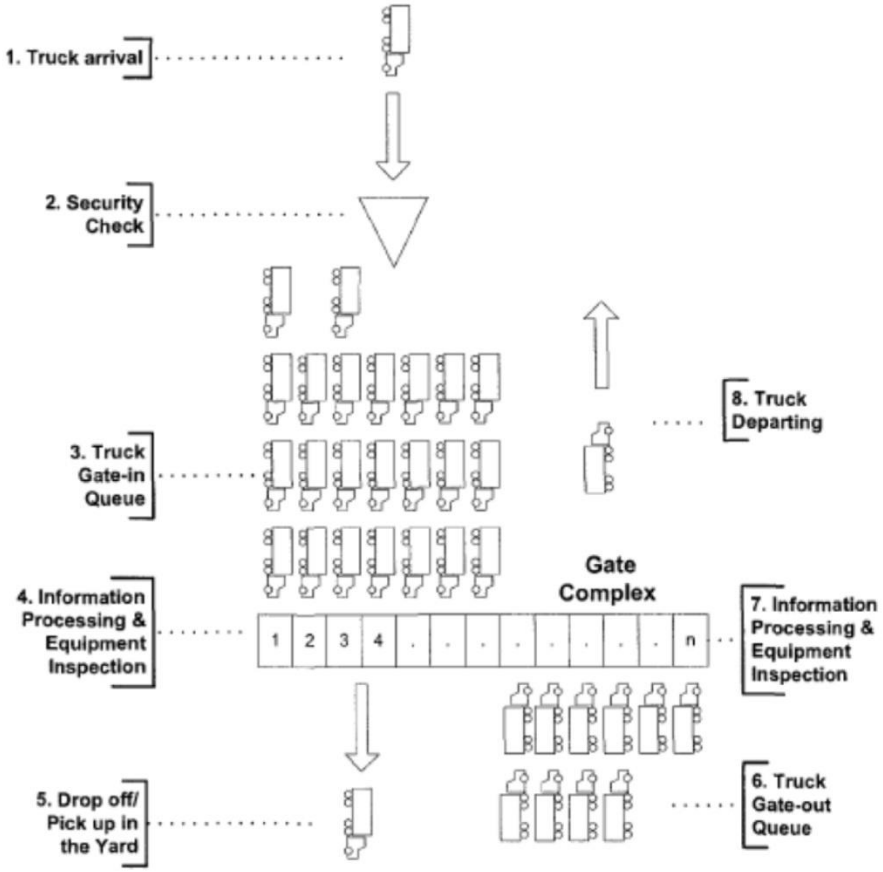
APPENDIX (I)

Port of Yangon

Source: Myanmar Port Authority

APPENDIX (II)

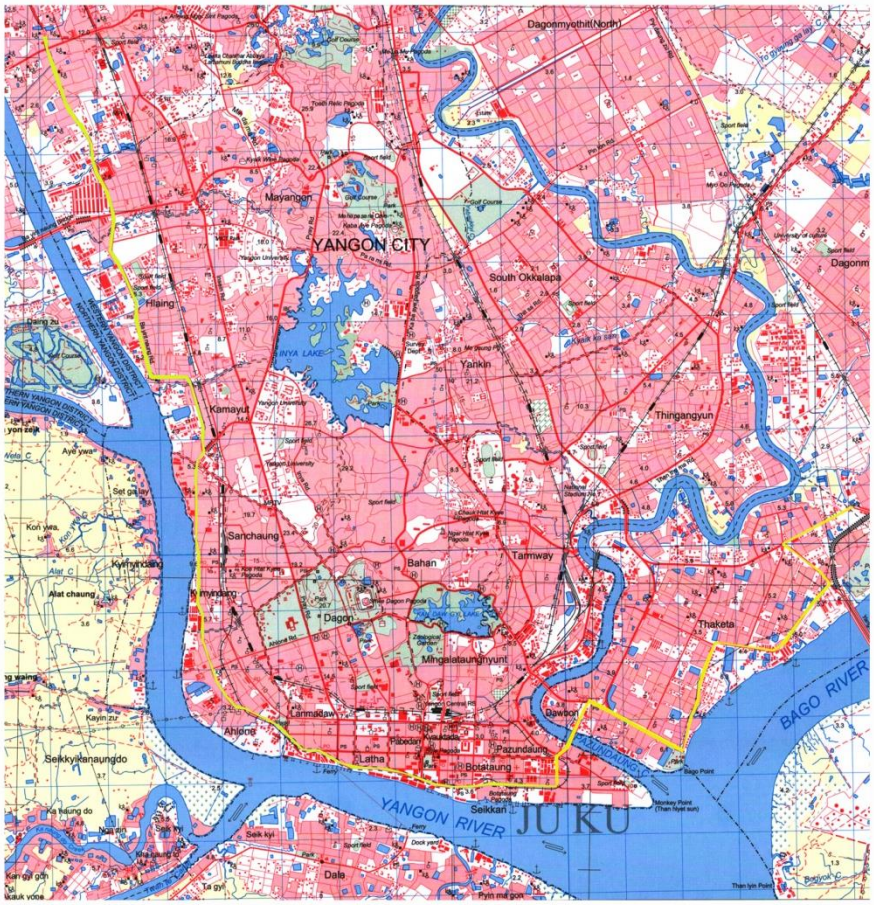
Terminal Gate System and Process of Yangon Port



Source: Survey 2019

APPENDIX (III)

Container Truck Road Map



Source: Survey 2019

APPENDIX (IV)

Status of Container Congestion in Kanner Road

Source: Survey 2019

APPENDIX (V)

SURVEY QUESTIONNAIRE TO DRIVER

1. Background Information
   a. Choose the most suitable alternative by drawing a circle.
      Gender: Male □ Female □
   b. Age: _____
   c. Education: _____
   d. Position: _____
   e. Work experience: _____
   f. Company: _____

2. General Operation Information
   a. What is your License Class?

   b. How old are you?

   c. What is your driving truck type?

   d. How long did you drive?

   e. Where do you live in Yangon?
      South North West East
   f. What is your driving pathway?

   g. What is your salary type?
      Timely Daily Monthly Contract
   h. Do you really know the discipline of road and transport safety?
      Yes No
   i. How long is the approximate time of driving for each route?

   j. Are you driving for Company or Private Owner?

   k. How much your extra cost for daily concerning road congestion?

   l. What are the impacts of Truck traffic on your job?

3. Above mentioned answers:
   i. Traffic congestion can impact on your daily-life.
      5 = strongly agree □
      4 = partially agree □
      3 = neither agree nor disagree □
      2 = partially disagree □
      1 = strongly disagree. □

ii. Traffic congestion can be barrier on timely cargo flow.

5 = strongly agree □
4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

iii. Traffic congestion can effect on economic condition.

5 = strongly agree □
4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

iv. Traffic congestion can be cost operation budget.

5 = strongly agree □
4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

v. Traffic congestion can be more accident.

5 = strongly agree □
4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

4. General Comments:

_____
_____
_____
_____
_____

APPENDIX (VI)

SURVEY QUESTIONNAIRE TO PORT FACILITY SECURITY OFFICER

1. Background Information
   g. Choose the most suitable alternative by drawing a circle.
      Gender: Male □ Female □
   h. Age: _____
   i. Education: _____
   j. Position: _____
   k. Work experience: _____
   l. Company: _____

2. General Operation Information
   a. How many trucks enter in Port every day?

   b. How do you manage trucks within Port?

   c. What kinds of challenges are you facing with the container trucks?

   d. How long is the operation time of loading and unloading of the container trucks? (approximate)

   e. How do you control the traffic congestion of container trucks?

   f. Which authority do you cooperate concerning with truck traffic in port Gate?

3. Above mentioned answers, how do you think following impacts:
   vi. Traffic congestion can be barrier on timely cargo flow.
      5 = strongly agree □
      4 = partially agree □
      3 = neither agree nor disagree □
      2 = partially disagree □
      1 = strongly disagree. □
   vii. Traffic congestion can effect on economic condition.
      5 = strongly agree □
      4 = partially agree □
      3 = neither agree nor disagree □
      2 = partially disagree □
      1 = strongly disagree. □

   viii. Traffic congestion can be cost operation budget.
      5 = strongly agree □

4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

4. General Comments:

_____
_____
_____
_____
_____

APPENDIX (VII)

SURVEY QUESTIONNAIRE TO PUBLIC

1. Background Information
   m. Choose the most suitable alternative by drawing a circle.
      Gender: Male □ Female □
   n. Age: _____
   o. Education: _____
   p. Position: _____
   q. Work experience: _____
   r. Company: _____

2. General Society Information
   a. How old are you?

   b. What is your occupation?
   c. Student □ Private □ Government □ Owner □

   d. What is your transportation type?
      Bus □ Own vehicle □

   e. Where do you live in Yangon?
      South North West East

   f. Where is your work?
      South North West East

   g. What are the impacts of Truck traffic on your daily life?

3. Above mentioned answers, how do you think following impacts:
   ix. Traffic congestion can impact on your daily-life.
      5 = strongly agree □
      4 = partially agree □
      3 = neither agree nor disagree □
      2 = partially disagree □
      1 = strongly disagree. □

   x. Traffic congestion can be more accident.
      5 = strongly agree □
      4 = partially agree □
      3 = neither agree nor disagree □

2 = partially disagree □
1 = strongly disagree. □

xi. Traffic congestion can effect on economic condition.

5 = strongly agree □
4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

xii. Traffic congestion can be effect on country development.

5 = strongly agree □
4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

4. General Comments:

_____
_____
_____
_____
_____
_____

APPENDIX (VIII)

SURVEY QUESTIONNAIRE TO OWNER

1. Background Information
   s. Choose the most suitable alternative by drawing a circle.
      Gender: Male □ Female □
   t. Age: _____
   u. Education: _____
   v. Position: _____
   w. Work experience: _____
   x. Company: _____

2. General Operation Information
   a. How many Trucks and types of truck do you have?

   b. Estimate monthly income from your transportation?

   c. How about your recommendation on recently container truck transportation policy?

   d. What is your opinion how different between container truck transportation and Local truck transportation?

   e. What are the impacts on your profit by truck traffic?

   f. What is your experience in truck transportation business?

   g. What is your service pathway?

   h. How to conduct the safety training for Driver?
      Monthly Yearly

3. Above mentioned answers, how do you think following impacts:
   xiii. Traffic congestion can impact on your daily-life.
      5 = strongly agree □
      4 = partially agree □
      3 = neither agree nor disagree □
      2 = partially disagree □
      1 = strongly disagree. □

xiv. Traffic congestion can be barrier on your economic income.

5 = strongly agree □
4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

xv. Traffic congestion can effect on your investment more in your industry.

5 = strongly agree □
4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

xvi. Traffic congestion can be cost operation budget.

5 = strongly agree □
4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

xvii. Traffic congestion can be more accident.

5 = strongly agree □
4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

4. General Comments:

_____
_____
_____
_____
_____

APPENDIX (IX)

SURVEY QUESTIONNAIRE TO TRAFFIC POLICE

1. Background Information
   y. Choose the most suitable alternative by drawing a circle.
      Gender: Male □ Female □
   z. Age: _____
   aa. Education: _____
   bb. Position: _____
   cc. Work experience: _____
   dd. Company: _____

2. General Operation Information
   a. Which places do you facing container truck traffic every day?

   b. How many officers manage for truck traffic?

   c. How do you control for truck traffic?

   d. What is your challenge(s) for controlling truck traffic?

   e. Do you have any future plan for truck controlling?

3. Above mentioned answers, how do you think following impacts:
   xviii. Traffic congestion can impact on your daily-life.
      5 = strongly agree □
      4 = partially agree □
      3 = neither agree nor disagree □
      2 = partially disagree □
      1 = strongly disagree. □
   xix. Traffic congestion can be barrier on your daily duty.
      5 = strongly agree □
      4 = partially agree □
      3 = neither agree nor disagree □
      2 = partially disagree □
      1 = strongly disagree. □

   xx. Traffic congestion can make overtime for you.
      5 = strongly agree □
      4 = partially agree □
      3 = neither agree nor disagree □
      2 = partially disagree □
      1 = strongly disagree. □

xxi. Traffic congestion can be more accident.

5 = strongly agree □
4 = partially agree □
3 = neither agree nor disagree □
2 = partially disagree □
1 = strongly disagree. □

4. General Comments:

_____
_____
_____
_____
_____
_____