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The carriage of automobiles in containers : an alternative method to address the excess capacity in the liner trade

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THE CARRIAGE OF AUTOMOBILES IN CONTAINERS - An alternative method to address the excess capacity in the liner trade.

By

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DECLARATION

I certify that the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has been previously conferred on me.

The contents of this dissertation reflect my own personal views and are not necessarily endorsed by the University

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21st September 2014

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Abstract

This dissertation is a study of the containerized transport of automobiles in an attempt to use the full potentials and advantages of a full-liner service and network while trying to use up excess capacity in the container trade. This type of transport makes use of a racking system that will ensure a safe and secure means of stowing the automobiles inside the container and prevent it from sustaining damages in all stages of the sea and land transport.

Interviews were conducted with industry experts who represented the major players in this study such as NYK Line, Maersk Line, Copenhagen Malmo Port, City of Malmo, Toyota Logistics Services Sweden AB, NYK Auto Logistics, NYK Fil-Japan Shipping Corporation and Trans-Rak International. All have openly shared their personal and professional opinions about adapting to such a grand objective.

Actual data about car carrier cargo operations was utilized in this study that will represent the factors to be compared with the containerize cargo operations. Data regarding sustained damage to automobiles was difficult to obtain being the most sensitive factor in this study because it is this factor which is the main reason why the car manufacturers are reluctant to even consider adapting this new method. Cost of freight was also a challenge that had to be faced. Similarly, while there are pressing issues from legislations about the reduction of the effects of greenhouse gas emissions, the implementation and the effects thereof, in affecting the global movement, transport and manufacture of automobiles, still remains to be seen.

The concluding chapters examine the results of the major comparison of both transport methods and citing the growth potential of this proposed method by making use of a containerization process that has already proven its worth in shipping and transport.

KEYWORDS: Containerization, Automobiles, Transportation

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LIST OF ABBREVIATIONS

BIMCO	- Baltic and International Maritime Council
BRIC	- Brazil, R, India, and China
CBU	- Completely Built-Up Unit
CKD	- Completely Knocked-down Unit
CMP	- Copenhagen Malmo Port
ECA	- Emission Control Area
FEU	- Forty-foot Equivalent Unit
GDP	- Gross Domestic Product
ICS	- International Chamber of Shipping
INCO	- International Commercial (Terms)
JAMA	- Japan Automobile Manufacturers Association
NOX	- (NO_x) Nitric Oxide or Nitric Dioxide
SECA	- Sulphur Emission Control Area
SKD	- Semi-Knocked-down Units
SOX	- (So_x) Sulphur Oxides
PCC/PCTC	- Pure Car Carrier/Pure Car and Truck Carrier
PDI	- Pre-Delivery Inspection
PPO	- Post-Production Option
RO/RO	- Roll-on/Roll0ff
OEM	- Original Equipment Manufacturer
SUV	- Sport Utility Vehicle
TEU	- Twenty-foot Equivalent Unit
USEC	- United States East Coast
USWC	- United States West Coast
UNCTAD	- United Nations Conference on Trade and Development
WSC	- World Shipping Council

Chapter 1 Introduction

1.1 Objective and significance of the study

The global economic crisis of 2008 resulted in the threat of total collapse of large financial institutions, the bailout of banks by national governments and downturns in stock markets around the world. This crisis played a significant role in the failure of key businesses, declines in consumer wealth leading to decline in demand for commonly sought-after commodities such as electronics, textiles etc.. Demand for iron ore and other minerals also declined resulting to piling-up of these minerals in South American and African mines when China no longer needed as much natural resources to produce goods (Schulz: 2008).

While shipping benefits from globalization more than almost any other sector, it was also not spared to the effects of the global economic crisis. When freight rates have plummeted, numerous ships sailed half-empty or even worse, never sailed at all and were pulled out of service to be laid-up for months at a time.

Incidentally, banks became extremely nervous and hardly issued loans. This created an atmosphere of mistrust and nervousness in trading where banks refused to issue letters of credit -- payment guarantees issued to shippers and exporters for cargoes usually worth millions of dollars -- was so critical to international trade.

Before 2008, shipping was a booming industry, full of energy, transporting more and more goods around the world at a staggering pace. The global economic crisis brought this activity to a staggering halt. UNCTAD (2013), explains that even if the market has slightly improved, the shipping sector continues to experience suppressed freight rates in various segments due to surplus capacity in the world-wide fleet generated by the severe downturn created by the same economic crisis. It was even compounded by a steady delivery of newbuildings into an oversupplied market coupled with a weak economy, which kept freight rates under heavier pressure.

Similarly, with a slightly improved market, BIMCO believes that 2013 will be a turning point in the macroeconomic scene where a global GDP was projected to become stronger in that year.

This research therefore attempts to study what prospects and challenges container shipping present, the implications thereto and to explore the potentials of the transport of automobiles in containers to address the current downtrend in shipping as it tries to recover from a very depressed market caused by overcapacity and low freight and charter hire rates. The transport of automobiles in containers is not a new concept. It has already been a common practice to transport second hand cars or luxury/race cars in containers. This study, however, will attempt to use automobiles, as an alternative to mitigate the effects of the overcapacity problem in the container fleet by allocating the excess capacity to the transport of automobiles while taking advantage of the economy of scale which containerization is able to provide.

This concept may be two-pronged, because not only does it try to address the overcapacity problem, it can also be a viable option in applying a door-to-door approach in the transport of automobiles, from the manufacturer to the dealer and/or end user. In this option of transporting automobiles in containers, there is a foreseen provision of creating alternative hub ports in the handling of automobiles. These are ports which do not have storage capacities similar to that of which car terminals have for PCCs and RO/ROs. This will allow more flexibility in the transportation of the automobiles to land-locked destinations where the network of rail transport is limited or not available at all.

1.2 Scope of the study

As for the scope of this study, the following aspects have been taken into consideration:

a. Profiling the main features of the car carrier and container trades with particular focus on the transport of Completely-Built-Up (hereinafter referred to as CBU) automobiles in containers so that it can, as an alternative, use up excess capacity without affecting the transport of automobiles by conventional PCCs and RO/ROs.

b. How these features will affect the automotive transport supply chain; initially, the Asia-Europe sector of the automobile transport trade will be covered in this study.

c. If these findings can be explored to further open up new hub ports for automobile transport considering the vast reach of the highly developed containerized trade and therefore, extend the reach of the car carrier

This study is not intended to compete with or displace the existing PCC or RO/RO fleet or even promote any market product for containerization or car carrier transport, but rather aims to find means to balance-off the global seaborne container trade with the global seaborne automobile trade by exploiting whether excess container fleet capacity could be allocated to be utilized for the transport of automobiles which are normally transported in PCCs or RO/ROs. Considering that the findings of this study are meant to be as an alternative only while the container fleet freight rates still have not picked-up, hence it is meant as a temporary measure only. However, nothing is going to stop the containerized trade should this method be the preferred choice of transport of automobiles by manufacturers or shippers.

1.3 Structure of the study

The research focuses on finding alternative means of optimizing the surplus capacity created by the oversupply of newbuildings to an already oversupplied market just before the onset of the global recession in 2008 and on the basis of these findings, this study will draw up conclusions, strategies and make necessary recommendations in an attempt to direct the liner trades towards a more workable way of utilizing the said excess capacity. The research is divided into five chapters. Chapter 2 will present an industry analysis by showing an overview of the worldwide seaborne trade after experiencing the effects of the global recession of 2008 and 2011 to the world-wide container fleet as well as to the car carrier trade (RO/RO). It will also include what the current issues are regarding the transport of automobiles. This industry analysis will then be followed by introducing the problem this research intends to tackle.

Chapters 3 and 4 constitute the core research area of this study. Beginning with a brief definition of port rotation, Chapter 3 presents how the study will start addressing the problem by providing a comparative study of the various aspects common to both modes of transporting automobiles such as loading and discharging rates, damage to automobiles, methods of stowing and securing automobiles in containers and storage area capacity.

Chapter 4 provides a comparative analysis in order to be able to decide on the viability of introducing the proposed method of transport of automobiles in containers, advantages and disadvantages, possible strategies to be recommended, as well as critical issues of concerns to both the container and car carrier trades.

In conducting the research, information available in the WMU library such as journals, research materials, the worldwide web as well as from the websites and homepages of shipping companies and automobile manufacturers have been sourced not to mention inputs shared by industry experts obtained during the lectures, seminars, field studies and interviews. The experience gained during the past couple of years by interacting with professional seafarers, shipping executives, educators and industry experts in the capacity of a Master Mariner, Dean of Shipboard Training and Continuing Education in the newest maritime academy in the Philippines, coupled with the excellent academic exposure at the World Maritime University have paved the way to appreciating the industry perspective from a maritime economics perspective.

1.4 Limitations of the study

The transport of automobiles covers a wide range of operations depending on whether the automobiles are transported on board RO/ROs or PCCs. For the purpose of simplification, this study has limited its scope to liner shipping, particularly in container shipping. Some operators treat the Pure Car Carrier operations under liner trade, however for this study, it will be treated as a special trade under the dry cargo. The limitations considered are hereby listed as the following:

a. 40-ft high cube containers and FCL terms
b. Nagoya and Mizushima as loading ports in Japan because some car manufacturers have production plants situated in these ports.
c. Southampton and Zeebrugge as hub ports for discharging automobiles in Europe
d. PCC loading rate of automobiles in Mizushima and Nagoya in Japan and discharging rate in Zeebrugge, Belgium or Malmo, Sweden
e. Container loading rate in Singapore and discharging rate in Rotterdam, The Netherlands.

It will also be mentioned in the succeeding chapters that one major point of comparison to be established is the damage to automobiles during the shipment phase from the manufacturing plant to the end user, the buyer. It will be explained that data regarding customer complaints (from the shippers, consignees, buyer or insurance) emanating from damage to automobiles will be difficult to obtain since it is a sensitive issue where each party within the various stages of transport may not be aware of the presence of any damage(s) to the automobiles only until after the receipt of the automobile in the next stage of the transport process. Similarly, seldom will the damage be discovered right away and will perhaps go unnoticed for a long time. The longer the gap in the time of discovery of the damage, the slimmer will be the chance that the damage will be admitted while the automobile is under their custody. It will therefore be difficult to establish who caused the damage as users/drivers of the automobile will be reluctant to admit fault for fear of negatively affecting their

individual or group performance. This can, of course, be avoided if for example, the area of movement of the automobiles in the plant or yard, is completely monitored by a high-definition CCTV camera or perhaps an effective quality system is in place where emphasis is placed on system improvement rather than fault-finding.
Some data about damage to automobiles and containers will also be coming from information gathered from interviews with industry experts and management level merchant marine officer colleagues who are considered subject matter experts in their own right regarding the PCC and container trade owing to their vast experience. This will restrict the information about damage to automobiles/containers to the seaborne leg of the transit only and will still not provide necessary data about the land-based-derived damages to automobiles.

Similarly, most car manufacturers and/or shipping lines will not openly divulge trade practices in their shipment patterns and costing. Consequently, these shipping patterns and costing will be treated as generic and/or similar regardless of manufacturer or shipping line.

Chapter 2 Literature review and statement of the problem

2.1 Industry Analysis

The World Shipping Council defines liner shipping as the service of transporting goods by means of high-capacity, ocean-going ships that transit regular routes on fixed schedules. This service is usually in the form of containerships and roll-on/roll-off (RO/RO) ships and is responsible for carrying about 60% of the goods by value moved all over the world each year by sea (WSC, 2014). Liner shipping is by far the most efficient mode of transport in the carriage of goods. A large containership could carry over 200,000 container loads of cargo in a year. While individual ships vary in size and carrying capacity, the average size of a containership is in the range of about 8,000 TEUs (Twenty-foot equivalent units) of finished goods and products in one voyage. The same is true for Pure Car Carriers (PCCs) where some ships can carry about 7,600 automobiles in a single journey. To carry these huge amounts of cargo, would require hundreds of freight aircraft, miles and miles of rail cars, and fleets of trucks to carry the goods that can fit in one trans-ocean size liner vessel. Almost all commodities now can be shipped by means of containers, e.g. electronics, textiles, minerals, dangerous cargo in liquid and gaseous form, fruits, vegetables, meat, and other perishables. Before the arrival of containerization, these commodities used to be loaded in bales, bags, pallets and/or specialized ships.

This study intends to explore the advantage of shipping containers in the transport of commodities by stuffing them with automobiles. For the purpose of this study, the term stuffing and vanning will be used which refers to the process in which cargo is loaded into an empty container which is then sealed and transported to the ocean carrier for loading onboard a ship. On the other hand, unstuffing, devanning and stripping will be used for unloading the cargo from the container.

While the transport of automobiles in containers has already been going on ever since containers were utilized in shipping, this concept has only been limited to the secondary market for automobiles and high end luxury/vintage cars. This study envisions to tap into the container market by loading the automobiles into shipping containers instead of the conventional PCCs or RO/ROs.

It is however, not the intention of this research to displace the PCC fleet but instead, to utilize the current excess capacity in the worldwide container fleet, which was brought about when the maritime sector experienced volatile freight rates in almost all segments created by the severe downturn in trade in the wake of the global economic crisis of 2008. After the global economic crisis, shipping found it difficult to recover and even to this date, the maritime sector is still experiencing these effects with extremely low freight rates and excessive unused fleet capacity.

This study will be advantageous to shipping lines/operators who have both container and PCC operations in their scope of activities, at the same time, also being a logistics service provider.

It is common that manufacturers will transport automobiles on quay-to-quay (port-to-port) terms. It will also be ideal to some shippers, that these automobiles are transported using shipping containers end-to-end (door-to-door), because of the advantages it offers.

2.1.1 Overview of the World Seaborne Trade

Presently, there are about 50,000 merchant ships responsible for transporting 90% of the world trade by volume (ICS, 2013). While it is difficult to quantify in monetary terms the volume of seaborne trade as it is described either in tonnes or in ton miles, the United Nations Conference on Trade and Development (UNCTAD), estimates that about US$380 Billion in freight rates have been contributed by merchant ships. This comprises about 5% of the global trade (ICS, 2013).

The trend of the world seaborne trade indicates a continuous expansion which means it will continue to bring more benefits to the consumer due to competitive freight rates in the market. The International Chamber of Shipping projects a modest but continuous rise in World Seaborne Trade, World GDP and World Population until the year 2030. This rise can be attributed to the growing efficiency of shipping as a mode of transport and increased economic liberalization (ICS).

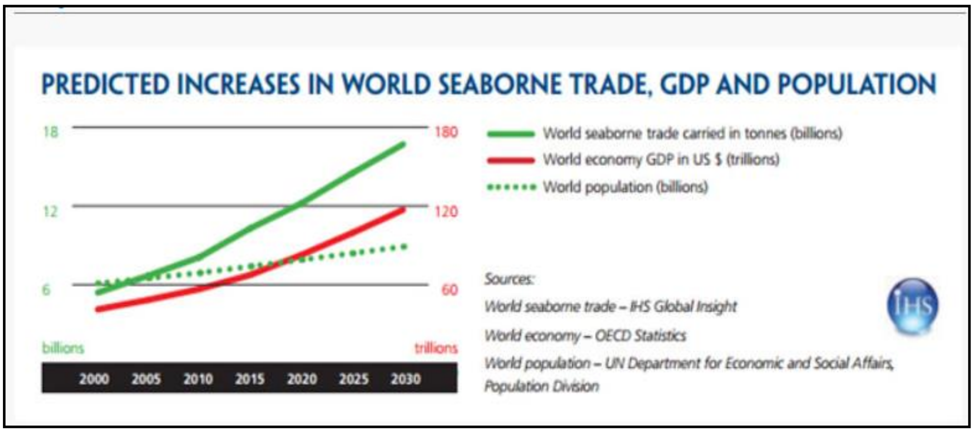


Figure 1 Predicted increases in World Seaborne Trade, GDP, and Population; Source: UNCTAD

The global seaborne trade basically performed better than the world economy. This was driven by an increase in China's domestic demand as well as increased intra-Asian trade. About 9.2 billion tons of cargo were handled in the various ports all over the world with the tanker (crude, petroleum and gas) trade accounting for about a third of the total and dry cargo accounting for the remaining cargo share.

While there is significant growth in the international seaborne trade, UNCTAD reports in 2012 however, that shipping remains vulnerable to downside risks being faced by the global economy (UNCTAD, 2013). This is mainly affected by the following elements and operating landscape in global shipping:

a. Continued negative effect of the 2008 crisis on trade, finance and global demand
b. Structural shifts in global production patterns

c. Changes in comparative advantages and mineral resource subsidies or funding e.g. oil and gas
d. Shift of economic influence away from traditional centers of growth
e. Demographics, with ageing populations in advanced economies and fast-growing populations in developing regions with relative implications for global production and change in consumption patterns
f. Entry of container megaships and other transport-related technological advances
g. Natural calamities and climate change as effected by global warming
h. Energy costs and environmental sustainability

UNCTAD (2013) reports that while these elements are already affecting world seaborne trade, other challenges and opportunities lie ahead, to name a few:

a. Deeper regional integration and South-South cooperation
b. Growing diversification of sources of supply enabled by technology and efficient transportation
c. Emergence of new trading partners and access to new markets facilitated by growing trade and cooperation agreements
d. Expansion of new sea routes, such as the Panama Canal and the Arctic routes
e. Increased presence of other developing economies like Southeast Asia and Africa as they raise the value chain in sectors, such as labor-intensive China
f. A noticeable increase in the global demand induced by a growing world population and a rise in the middle class consuming category, indicating a change in spending patterns and affecting the demand for commodities directly
g. Emergence of developing-country banks, e.g. BRICS (Brazil, the Russian federation, India, China and South Africa) Banks – These banks have the potential to provide funding for investment needs in the transportation infrastructure.

2.1.2 Overcapacity in the world-wide container fleet

It cannot be denied how containerization has paved the way for globalization and fragmentation of global production. It has by far been the fastest-growing market segment accounting for over 16% of global seaborne trade by volume in 2012 and more than half by value in 2007. Almost any commodity can now be containerized. Empirical evidence has shown that containerization has been the driver of the 20th century economic globalization, where of the 22 industrialized countries examined in the research, containerization accounted for a 320% rise in bilateral trade in the first five (5) years of adoption and 790% over a span of 20 years after adoption. In their findings, not only did containerization stimulate trade in containerizable products (like auto parts and accessories), but it also had complementary effects on non-containerizables (such as automobiles) (Berhofen et al., 2013). In line with the Berhofen et al, 2013 research, this study intends to make use of containerization as the mode of shipment of automobiles by taking advantage of its growth potential.

The deployment of container ships worldwide has also caught the attention of UNCTAD where in the past ten years, two important trends have been observed, particularly in the liner trades. First, ships have become bigger and secondly, the number of companies in the markets have decreased. The latter one has an important implication in the level of competition most especially for smaller trading nations.

UNCTAD has also reported in its 2013 report that the maritime sector continued to feel the effects of low and volatile freight rates in its various segments, primarily due to the surplus capacity in the global fleet generated by the collapse of the market during the 2008 economic and financial crisis. This and the steady delivery of newbuildings into an already oversupplied market, coupled with a weak market has kept freight rates under heavy pressure.

The low freight rates observed in 2012 has reduced the carriers' earnings close to, and more often so, below operating costs, particularly when bunker prices have remained extremely high and volatile. This has led carriers to apply different strategies to address the situation. Strategies in 2011 continued to persist in 2012, e.g. ships being scrapped, ships in layup, postponing if not cancelling newbuilding deliveries, slow steaming, etc.

2.1.3 Overview of the Car Carrier Trade (PCC and RO/RO)

The pure car carrier trade was perhaps one of the segments of the maritime sector that was hardly hit during the global economic downturn in 2008. The conventional transport of automobiles by PCCs and RO/ROs has somehow risen from the previous economic slump and has weathered the crisis with less damage than most other sectors. According to the Drewry Report, CAR CARRIERS 2012, the small orderbook of PCCs during the onset of the crisis allowed this sector to be better positioned than most other sectors which suffered from large newbuilding orderbooks to weather a double-dip recession (Drewry, 2014).

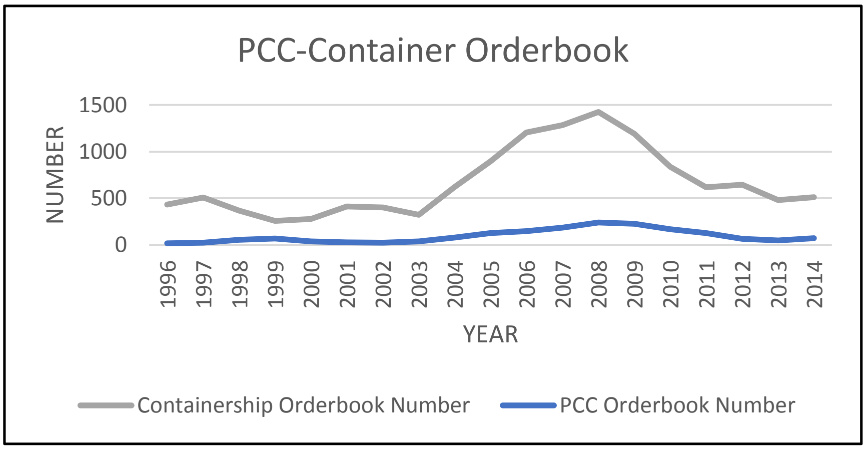


Figure 2 Comparison of PCC-Container Orderbook. Source: Clarkson's Shipping Intelligence Network

The recent recession hurt the car carrier trade badly causing the capacity to be significantly underutilized. Ship operators are less likely to charter tonnage for long periods but instead will place emphasis on full employment of owned tonnage. Since there are minimal newbuilds joining the trade, the increased demand will most likely be easier to face. Even if there is excess in new capacity, it will not diminish the capacity of the operator if faced by another downturn in the economy.

The same Drewry report also highlights an increase of 3-4% in global trade in motor vehicles over the next 15 years. It however, becomes complicated as there has been a noticeable shift in production pattern bases from Europe to Asia. This shift towards regionalized production will suppress the deep sea trade to a certain extent, but will benefit the seaborne trade in containerized vehicle parts.

While there is a looming threat in the deep sea trade, due to Japan's projected strong growth within 2012-2015 coupled with South Korea's projected 4.5% growth in seaborne trade in the next ten years it can be foreseen that this threat may just not materialize.

Likewise, even with a production base shifting towards the east, what used to be a ballast leg in the car carrier trade may now be an optimization in the voyage cost in the return leg because there is paid freight even in the ballast leg because of a seen continued demand for European luxury car brands.

The Drewry report also looks into ports and terminals and the impact they can have on a country's desire and suitability as a manufacturing hub. With India aiming to be the world's third largest auto maker next to Japan and South Korea, it is investing highly in infrastructure including ports and terminals. Government investment earmarked for ports is about US$60 billion by 2020, with individual carriers setting up locally to handle the export business for car manufacturers.

2.1.4 Production and Export of Automobiles

According to the Japan Automobile Manufacturers Association, Japan's automobile production was recorded to be at 894,742 units in July 2014 compared with 910,246 units recorded for the same time of the previous year. This is a decrease of 15,504 units or 1.7% and production decrease on the same month of the previous year after eleven months of upturn. The decline in the production is in the small and mini type vehicles with a 10.8% and 00.4% being reported respectively while an increase of 0.2% was seen in the standard sized vehicles was seen. Similarly, in the same JAMA report, the Japanese car manufacturers have exported a total of 414,273 units. This is 375 units or 0.1%, export increase compared to the same period in the previous year after eight (8) months of downturn (JAMA, 2014).

In the mid-1980’s, Japanese automobile manufacturers made extensive investments in the European Union under the premise of building automobiles where the significant demand exists. Since then, the Japanese automobile manufacturers have established 14 production plants as well as 16 research and development centers. The plants’ yearly production totaled 1.38 million vehicles or more than two-thirds of all Japanese-brand vehicles sold in the EU in 2013 of which 243,415 units were sold

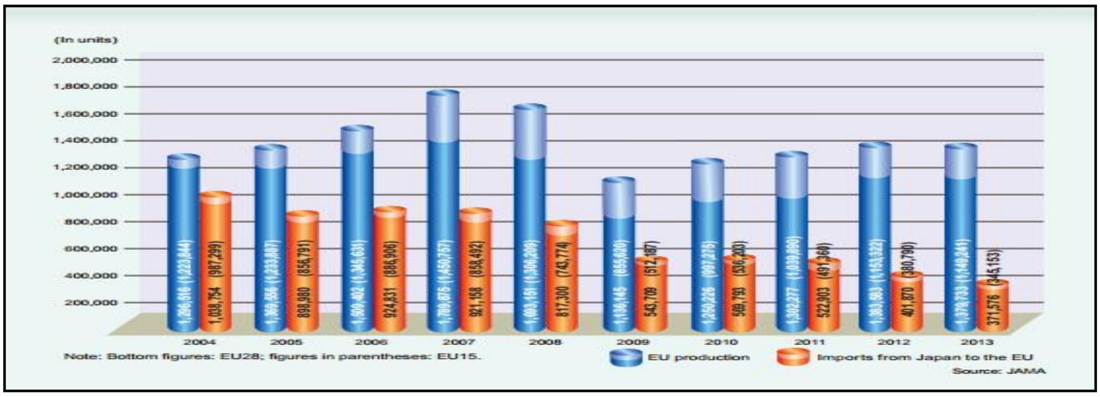


Figure 3: Japanese Automakers' EU Production versus Imports. Source: Japan Automobile Manufacturers Association

globally. The data in Figure 3 also shows that since 2004, imports from Japan to the EU have significantly declined (JAMA, 2014).

The research and development centers, on the other hand, were intended to conduct design activities that will meet the specific needs of the European market with the production operations in Europe.

2.1.5 Contemporary issues related to the transport of automobiles

High on the agenda regarding contemporary issues about the transport of automobiles is the impact of current legislations about the environment. Will this study be able to justify the need to find alternative means of transporting automobiles when there are legislations about environment-friendly activities and reducing the number of transportation running on fossil-fuel? Sweden, like most other member countries of the European Union, have committed to transforming Europe into a highly energy-efficient, low carbon economy. They have set targets for reducing the greenhouse gas emissions progressively up to 2050. In the Kyoto Protocol, the 15 countries that were EU members before 2004 (also known as 'EU-15') committed to reducing their collective emissions to at least 8% below the 1990 base year levels by 2012. The 2012 figures established by the European Environment Agency, EU-15 emissions averaged 15.1% below base year (1990) level. This means that the EU-15 over-achieved its first Kyoto target by a very wide margin. This time, the EU has made a unilateral commitment to reduce overall greenhouse gas emissions from its 28 member states by 20% compared to the 1990 levels. The EU also declared that the targeted level can also be increased to a further 30% if other major economies agree to undertake their fair share of global emissions reduction effort. These are bold targets by the EU but they have already shown that the targets can be achieved (EC, 2014).

In one of the special lectures delivered at WMU, the city government of Malmo has also been requested to provide a special lecture regarding the effects of EU legislations on the city of Malmo's infrastructure planning. In their presentation, the city government of Malmo said they have an intensified campaign for its constituents to cut down on the use of private vehicles with a target that just 30% of its population would use their personal vehicles. All the remaining 70% are expected to take public transport or bicycles to and from work. Please note that a majority of Malmo's city buses (even provincial buses) run on biogas as fuel. Only a small percentage of the bus fleet of Skanetrafiken are running on fossil fuel and the total replacement of these old buses is already included in the modernization plan of its bus fleet. Similarly, Malmo's future infrastructure programs include increasing the bicycle lanes and beautifying pedestrian lanes as well as providing safety features along these lanes.

The shipping industry is having its own share of problems regarding the implementation of controlled emissions from ships. The actions that have to be taken by ships navigating in SECAs and ECAs require stiff and costly measures. These include the use of expensive, low-sulfur fuel grades or retrofitting of propulsion and auxiliary machineries to control sulfur emission levels. It was stressed however, in one of the Integrated Shipping Studies (ISS) lectures, where the IMO Secretary General was quoted regarding the importance of the cooperation of society in the emission-reduction efforts worldwide. "The burden and cost of complying with new environmental regulations should also be shared by the society and not just pushing it on to the shipping industry alone" (Donner, 2014). This being said, the shore-based participation in implementing EU legislations on NOx, SOx and CO2 emissions is expected to be intensified, including the use of automobiles which run on fossil fuel. Norway for example, has already included in its legislation the use of electric cars. However, these electric cars are very expensive. Hence, Norway is giving owners of electric cars incentives, such as exemptions from payment of parking fees and tax incentives. It is expected that because of this initiative by Norway, other countries in Scandinavia and the rest of the member nations of EU will follow suit. Car manufacturers have already gone deep into their research stages and some have already launched prototypes of hybrid and/or electric cars for testing.

The impact of these legislations as well as green initiatives of the individual member states within the EU, will not diminish the need for automobile transport in all of Europe, but will later on, affect the automobile supply and demand and eventually affect the global trading patterns of the automotive transport trade in Europe.

2.2 Problem Identification

It was mentioned earlier that the shipment of automobiles in containers has already been a practice since the start of containerization, however, its applicability is limited to the second hand automobile market or the luxury car/ high-end automobile market. Davies and Kahn (2010), concluded in their study that developed nations have a demand for high-quality transportation equipment and durable goods. These transportation equipment and durable goods depreciate in quality over time. The developing and underdeveloped nations, have a similar desire, however, due to operating cost difference and income, the less developed countries tend to desire for lower and affordable quality. From a societal perspective, the study determines that there are economic gains in trade from the shipment of used durable goods from rich and developed nations to poorer developing countries. This pattern has already established a niche in the transport of second hand automobiles and the practical mode of shipment is through shipping containers. While this study has covered the effects of legislation in the North American trade (USA and Mexico) only, considering that the EU over-achieved its target in the reduction of greenhouse gas emissions, as stated by the European Commission in the Climate Action report, there will even be a greater chance that there will also be a greater demand in the transport of second hand automobiles in containers.

The luxury/high-end cars have a similar need for their transport in shipping containers. Considering the high value of the commodity, shipping containers will protect the automobiles from potential theft and pilferage, because it conceals the commodity from view of would-be thieves and pilferers. Since this shipment of luxury automobiles comes in very small or limited numbers, it would just be practical for the owners or consignee(s) of the automobiles to have them shipped in containers so that the automobiles will be available at the soonest possible time rather than wait for the arrival of a PCC or RO/RO ship which have lower frequency of calls. Similarly, having it shipped in containers minimizes the risk of getting further damage if it will be exposed to the weather elements if these type of automobiles are left parked in car yards at the berth while waiting for the arrival of the PCC or RO/RO that will do the ocean transit and take them to its intended port of destination.

In an interview conducted with representatives of Trans-Rak, an industry leader in the manufacture of removable racking systems for shipping automobiles in containers, they have reported that TESLA®, the electric car manufacturer, only transports their automobiles using containers and a removable racking system. With a limited production of 30,000 to 35,000 units every year, the unit cost per automobile of US$ 57,400 (Tesla, 2014) for the TESLA Model S is enough to justify the shipment in containers. Likewise, its special batteries do not make prolonged parking in car yards exposed to the weather (which most cars intended for loading in PCCs and RO/ROs undergo), an ideal choice of storage. Although the volume of shipment is still not high, this move of TESLA is an indication that there is a growing trend in the shipment of brand new, small to medium sized automobiles in containers by car manufacturers.

2.2.1 Damage to automobiles inside the containers

The concept of transporting automobiles inside shipping containers can be an appealing option to shippers or car manufacturers, especially if the stacking advantage of a containerized operation can be maximized and the risk of exposure to damage can be minimized, if not eliminated. Perhaps the most difficult part to convince car manufacturers and shippers alike, on whether to opt for a containerized shipment of automobiles as CBU instead of the conventional shipment by PCCs or RO/ROs is the frequent exposure of the automobiles to damage. The risk of exposing the automobile to damage increases as the number of movements and handling also increases. That risk of and exposure to damage to the automobile may occur at the following points or stages of the shipment:

a. the moment the automobile is rolled-out of the manufacturing plant;
b. transported to the car yard at the port of loading

c. loaded to and discharged from the PCC or RO/RO
d. landed at the port of discharge
e. transported to the car manufacturer's receivers
f. transported to the dealerships

Types of damage can range from scratching damage from close contact of car handlers to denting damage or paint chip damage from loose gravel and stones striking the transported automobile during the land transport stage. Therefore all ways and means must be ensured that in all stages of the transport, these damages are reduced to a minimum, if not eliminated, before the car reaches the end user, the buyer. For example, during the sea transport stage, the crew on board who are working in the vicinity of the cargo operations are required to wear special safety shoes, coveralls that are non-static, without zippers or metal attachments or accessories and have reflectorized strips etc. This has been confirmed by the Quality Specialist at the Toyota Logistics Services in Malmo, Sweden where he has reported that there is a very low occurrence of damages to automobiles coming from Japan. About 0.1% to 0,2% per incoming vessel is common. This due to the strict standards the shipboard personnel have to adhere to when the PCC is under a charter with a major car manufacturer.

However, to consider transporting automobiles in containers, one must also factor-in the possible additional damage that can be sustained by the automobile inside the container. While the shipping container is supposed to protect its contents from being damaged by sudden bumps, jolts and exposure to weather, it cannot be avoided at times when the container will encounter some damage due to the stresses endured by the container itself or by the ship carrying the container during the sea voyage or land transport or due to poor handling.

<u>Racking</u> is the deformation of the container end or side frame resulting from static and dynamic forces parallel to the deck. When transverse dynamic forces from ship

motions are expected to exceed the standard ISO container racking limit – nominally 150kN – some form of horizontal restraint must be applied. In higher stacks, the lowest containers are subject to the greatest racking forces and therefore the lashing system must be designed to take this into account.

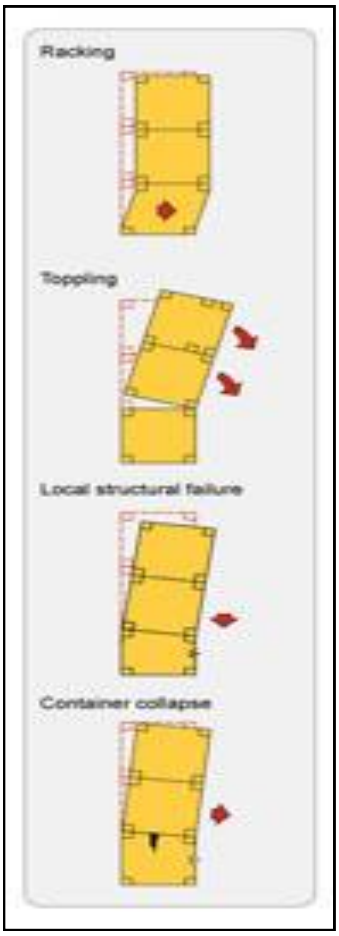


Figure 4 Typical damage on containers. Source: MacGregor

Toppling is the tendency of a container to pivot on its bottom edge and eventually to overturn when subjected to extreme rolling motions of the ship. This tendency can be restricted by the use of twistlocks and vertical lashings.

Local structural failure is the separation of structural components of a container. The most common type involves the separation of the corner casting and end of side rails. Lashing load limits on a corner casting should be adhered to in order to prevent this type of failure.

Container collapse results from exceeded allowable loads on the container corner posts or vertical corner structural members. Risk of this form of failure can be minimized by limiting the weight of the upper containers in a stack and by avoiding lashing over-tensioning.

These stresses can be minimized or eliminated by observance of good stowing and securing (lashing) procedures. However, damage to the container can still occur not only during the land transit and sea voyage, but during the handling of the containers in the container terminal or during the loading and discharging operations on board the ship.

The profitability of the shipping operations and the port productivity can be determined by the length of time the cargo operations need to take place. It is safe to say that ships should stay in port for as short a time as possible. In order to shorten the cargo operations in port, the speed of the loading and/or discharging operations will also have to be increased. This is what makes containerization as appealing as a mode of unitizing cargo to most shippers and shipping lines alike. Containerization has the potential to utilize speed during handling. It is so specialized that it has its own container handling equipment, and dedicated storage space. While this speed is considered as an advantage, it is also this same speed in handling the container that makes would-be-shippers of automobiles very reluctant to consider automobiles being shipped in containers.

TOP PORTS: GLOBALLY

PORT	COUNTRY	BERTH PRODUCTIVITY*
Qingdao	China	96
Ningbo	China	88
Dalian	China	86
Shanghai	China	86
Tianjin	China	86
Yokohama	Japan	85
Jebel Ali	United Arab Emirates	81
Busan	South Korea	80
Nhava Sheva (Jawaharlal Nehru)	India	79
Yantian	China	78
Taipei	Taiwan	77
Xiamen	China	76
Long Beach	U.S.	74
Khor al Fakkan	United Arab Emirates	74
Elizabeth	U.S.	74
Nansha	China	73
Kaohsiung	Taiwan	72
Salalah	Oman	72
Mawan	China	71
Southampton	U.K.	71

Source: JOC Port Productivity Research

Figure 5 Top 10 Container Terminal Productivity (2013). Source: JOC

Note: The productivity metrics contained in these rankings are the average berth productivity for all validated and standardized vessel calls in the database for each port or terminal during the calendar year 2012

The JOC July 2013 Port Productivity publication featured an article "Key Findings on Terminal Productivity Performance Across Ports, Countries And Regions". In this article it ranked the berth productivity[1] of the Top 100 container terminals all over the world where the port of Quingdao, China ranked first on the list with productivity recorded at 96 moves per hour. With cargo operations moving so fast, it won't be long before fatigue (to the gantry crane operators) will set in and will eventually end up damaging a container and most likely its contents. Even if the containers do not incur damages, with the speed these containers are being

[1] Berth Productivity is defined as the number of total container moves (on-load, off-load and re-positioning) divided by the number of hours during which the vessel is at berth (time between berth arrival or "lines down" and berth departure or "lines up") without adjustments for equipment and labor downtime

handled, it can't be avoided that the crane operator can bang the container as it is brought into the cell guides of the cargo holds or even on to the trailer truck. These sudden jerks and banging can cause damage to the automobiles inside the container, most especially if the automobiles inside the container are not properly lashed and secured.

2.2.2 Unused space inside the container

No matter how appealing the option of loading automobiles in containers may appear to be, it cannot be denied that even if it is possible to stuff a 40-foot, high-cube container with four (4) automobiles, there will still be a lot of wasted space inside the container, which in principle should be minimized to take advantage of the potentials of a containerization process.

In an interview with Mr. Lars Kastrup, head of Maersk Line's automotive sector, he said that in the containerized trade, Maersk is always targeting big volumes and one good thing about the transport of automobiles is that the demand is very steady. Hence, achieving big-volume shipments is not difficult. He also stated that there has been an observed trend in the shift of manufacturing plants to other places for reasons primarily linked to cost. An automobile may be branded as something originating in North America or Europe but its parts are all manufactured in a plant in Seoul, South Korea and assembled in a plant in Russia. Maersk's automotive sector head says that volume of shipment is the basis of the auto manufacturer in deciding which mode of shipment will be chosen based on the type of manufacturing process the automobile will undergo. In practice, automobiles can either be shipped as CKD (Completely-Knocked-Down units), SKD (Semi-Knocked-Down units) or CBU (Completely-Built-Up units). A CKD vehicle means a vehicle is assembled locally using all the major parts, components and technology imported from the country of its origin. These parts and components (roughly about 8,000 parts) are packed in a boxed pallet and are then loaded into a container. GM (General Motors), for example, is based in Detroit, Michigan but the spare parts, engine, and components are all produced in South Korea. All these parts are then stuffed into containers and shipped to an assembly plant in Russia, Latin America or Africa. It will therefore be ideal for the mass production of small and medium sized automobiles, that manufacturers will build factories at or near a country where there is a big demand, and assemble the automobiles there.

Similarly, SKDs are vehicles that have partially assembled units and are then stuffed into containers and shipped to assembly plants in a country near or at the intended point of sale.

Therefore, the decision to ship by CKD and SKD will depend on how effective and how good is the assembly plant at the receiving end. If the automobile manufacturer has a sophisticated and well-established assembly plant at the receiving end, then a CKD shipment will be the more logical choice. As a shipping line, CKD will be the most cost-effective means of optimizing all available space of a container, no matter what the size of the container is, if the assembly plant has such a configuration.

This trend of containerized shipment of CKDs (at least for Maersk Line) will continue for as long as volume of required automobiles will justify establishing an assembly plant other than that of the original location or country of the manufacturer.

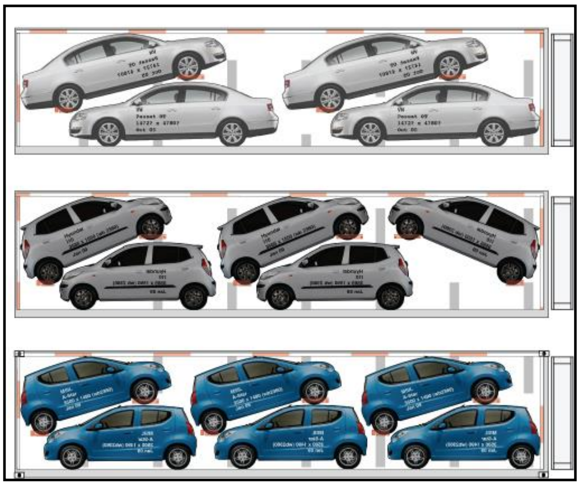


Figure 6: Section view of a 40-foot, high cube container loaded with automobiles using a removal rack system. Source: Trans-Rak International

The CBUs on the other hand are vehicles that are completely built and assembled, usually in an exporting country and imported by another country as one whole piece and can be driven immediately upon arrival at the intended point of destination. These automobiles are conventionally shipped in PCCs and RO/ROs. If automobiles are transported as CBUs in 40-foot, high-cube containers, then not all the space of the container will be utilized. The illustration in figure 5 shows how the container space can be maximized by using a removable racking system. The Daimler group for example, will normally opt to transport 400 Mercedes Benz SLS in CBUs to Argentina in a year. Since the volume is not sufficient to fill up a PCC, they are then shipped in containers.

The information derived from the interview with Mr. Lars Kastrup, is something that will be explored in this study. He stated that the parts needed in a CKD shipment in a container will be able to fit three (3) automobiles in a 40-foot container. A CBU shipment on the other hand, utilizing a removable racking system, can stuff a 40-foot container with four (4) automobiles. The difference, therefore, between a CBU or CKD option will be the taxes imposed at the importing country and the quality of the automobile at the exporting side as the quality of the vehicle will very much depend on the quality control of the plant. The wider scope and range of services, such as more container ports, multi-modal modes and door-to-door service as well as the stacking advantage of containerization will be the basis for pursuing this study.

2.2.3 The difference in loading and discharging rates between automobiles and containers

Another key consideration in this approach will be the lead time for the arrival of an automobile. In logistics, lead time can be described as the delay (aka latency) between the initiation of an order and the completion of its fulfillment. Since lead time is considered as a delay in logistics, it is therefore preferred that lead time should be minimized. Therefore, the lead times for both approaches will need to be compared based on the following:

Process	CBUs in Containers	PCC
1. Transport time from the assembly plant (export) to the importer	Time to stuff the container with automobiles	Transport time of the automobiles from the plant to the port car yard
	Time to transport the	Storage time in the

	container from the plant to the container yard	load port car yard, waiting for PCC
	Sea voyage Time	Sea voyage Time
	Storage time at the discharge port container terminal and customs clearance	Storage time at the discharge port car yard and customs clearance
	Time to transport the container to the manufacturer's hub	Travel to the manufacturers hub
	PDI/PPO (Last mile activity)	PDI/PPO (Last mile activity)
	Transport time to the Dealer	Transport time to the Dealer

Which method will come out with the shortest lead time from the moment an order is placed at a dealership until the needed automobiles have indeed arrived, will be a prime indicator of efficiency in the operation.

2.2.4 The impact of the shipment of automobiles in containers on the PCC trade

The context of this study runs along the lines of product research and innovation. The objective of this study is to come up with a good product mix for shipping lines which may have all three product services i.e. container fleet, PCC fleet and its own logistics arm. In a way, it can be viewed as a disruptive innovation process, because the innovation can address the overcapacity by allowing the automobiles to be considered as a regular cargo to use up capacity but at the same time, may disrupt the existing supply of automobiles by the PCC or RO/RO fleets. Emphasis is put on the term disrupt to put a semblance of being temporary and just affecting a steady PCC market. Granting that the shipment of automobiles in containers proves to be efficient (perhaps, after a cost-benefit analysis) and does lead to a weakening of the current PCC model, this study will still be very important from a strategic point of view, because it will allow the shipping lines enough time to prepare alternative actions or an exit strategy properly. The study intends to let the shipping lines use containers as an alternative in a very depressed market in case this trend does continue by making use of a product mix that has already been proven to be an effective mode of shipment.

Chapter 3 Methodology and data gathering

This study will compare the operations in loading and discharging the automobiles in containers with that of the conventional loading of the same automobiles onboard a PCC. The process flow in both methods will also be studied and the possible effect(s) it will cause to their respective supply chains.

To realize the viability of this study, data will have to be obtained to determine if:

a. the time it will take to stuff a container with automobiles should at least match the time it will take to prepare the automobile from the manufacturer's plant, loading and discharging of containers with conventional cargo. While the loading and discharging rate is the same for any container in a particular port, the time it will take to stuff/unstuff the container will vary from one commodity to another and depending on whether the container will be loaded as FCL or LCL
b. the cost of the shipment of containers with automobiles will be able to match that of the cost of automobiles when loaded on board pure car carriers
c. this alternative method will expose the automobiles to more damages than the conventional method.

Perhaps the most important factor to be considered in the viability of this study is the last item because data regarding damage to the automobiles during their shipment either by PCC or in containers will be the most difficult to acquire owing to the sensitivity of the issue and its impact to the business. While there has been significant number of reported damages to automobiles loaded in the containers, transporting automobiles in PCCs has its equal share of reported damages as well.

3.1 Data Collection

Various data have to be gathered and analyzed in order to arrive at a conclusion that would best describe whether the transport of automobiles in containers will indeed, be a viable alternative to address an excess capacity in the containerization trade. Basically, operational aspects of both the container and car carrier trade will be compared in this study.

3.1.1 Automobile production data

Japan's production and export data will also be presented as a reference for the intended focus of the Asia-Europe trade to determine if there is enough trade to justify the introduction of this alternative means of transporting automobiles in containers.

Passenger cars: 757,523 units, down 18,481 units or 2.4%

Standard cars (over 2000 cc)	436,358 units, up 995 units or 0.2%
Small cars	160,751 units, down 19,469 units or 10.8%
Mini car (under 660 cc)	160,414 units, down 7 units or 0.004%

Figure 7: July 2014 Production figures by type of vehicle. Source JAMA

3.1.2 Automobile Export Data for July 2014

Number of Automobiles Exported

Automobile exports in July 2014 were recorded as 414,273 units. Compared with the 413,898 units total recorded for the same month of the previous year, this is an increase of 375 units or 0.1%, and an export increase on the same month of the previous year after eight months of downturn.

July 2014 Automobile Export Figures by Type of Vehicle

Passenger cars	355,272 units (including 16,252 units for KD) down 8,000 units or 2.2%
Trucks	43,315 units (including 18,844 units for KD) up 4,935 units or 12.9%
Buses	15,686 units (including 2,764 units for KD) up 3,440 units or 28.1%

Figure 8: July 2014 Automobile export figures. Note: KD "knock-downs", refers to both CKDs and SKD Source: JAMA

July 2014 Automobile Export Figures by Export Destination

Export Destination Region	Units	Compared w/ prev. year (%)
Asia	53,082	110.5
Middle-East	55,589	113.1
Europe	74,090	143.3
(EU)	46,135	161.4
North America	149,558	86.2
(U.S.A).	139,352	86.2
Latin America	28,296	82.8
Africa	17,271	95.5
Oceania	35,944	92.8
Others	443	112.4
Total	**414,273**	**100.1**

Figure 9: July 2014 Automobile Export figures by destination. Note: EU and USA are sub-categories of Europe and North America respectively hence, corresponding values of 46,135 and 139,352 units are already included in the EU and USA values respectively. Source: JAMA

July 2014 Automobile Export Figures by Manufacturer

Automobile	Units	Compared w/ prev. year (%)
Toyota	176,013	105.0
Nissan	43,417	72.7
Mazda	66,017	107.6
Mitsubishi	34,721	109.6
Isuzu	15,581	113.4
Daihatsu	714	97.4
Honda	2,754	25.9
Subaru	47,793	115.0
UD Trucks	795	117.3
Hino	8,171	104.8
Suzuki	12,952	95.5
Mitsubishi Fuso	5,345	111.2
Total	**414,273**	**100.1**

Figure 10: July 2014 Automobile Export figures by Manufacturer. Source: JAMA

3.2 The containerized and PCC trade routes

The port rotation of NYK Line of Japan will be used as an example because this shipping line is one of the companies that have all three segments of shipping mentioned in this study (container, PCC and logistics center) as the intended subject in this study. Please note that, unlike the container trade, the PCC trade is more of a tramp service rather than a liner service considering that both PCC and container trade routes have nearly similar patterns, this study will consider Nagoya, Japan as the loading port in Asia while Zeebrugge, Belgium as the discharging port in Europe.

The main difference of course is that the PCC trades do not have fix routes like the container trade. While there are fixed car carrier and ro/ro terminals worldwide, the PCC trades do not call all these car carrier and/or ro/ro terminals regularly like the container ships do in a fixed liner service. The port rotation for PCCs may vary from voyage to voyage.

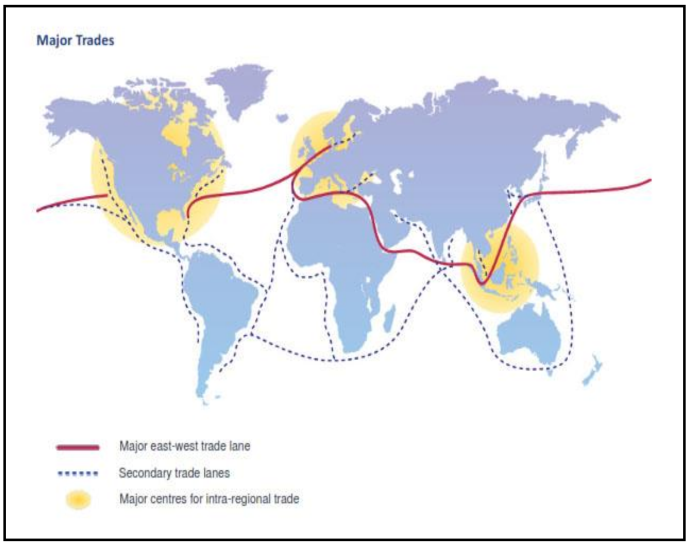


Figure 11 Major shipping trade routes

Port rotation refers to the common order or sequencing of the geographical positions of the ports of loading and discharging. The port rotation utilized in both concepts will play an important role in this study, because it will determine the turnaround time for the vessel and delivery times of the automobiles. In this study, the port rotation between a typical PCC and a Full Container ship in the Asia-Europe trade will be compared. The frequency of calls by these PCCs and ro/ros will depend on the bookings made by the car manufacturers. Hence, both trades cannot be treated the same way.

3.2.1 The automotive transport supply chain

Another item that should be factored-in in this proposed method will be the modification in the process flow of the automobile transport supply chain. The shipper of the cargo can consider applying the method at the loading port where the manufacturer may also have his own manufacturing plant located.

The conventional automotive transport supply flow will normally start from the production phase until it is received at the customer's hub. The following figure illustrates a typical flow in the transport of automobiles. Here, auto manufacturers will set up production plants in strategic locations, which will allow for ease in shipment, usually in the vicinity of sea ports when the intended mode of transport will be by sea.

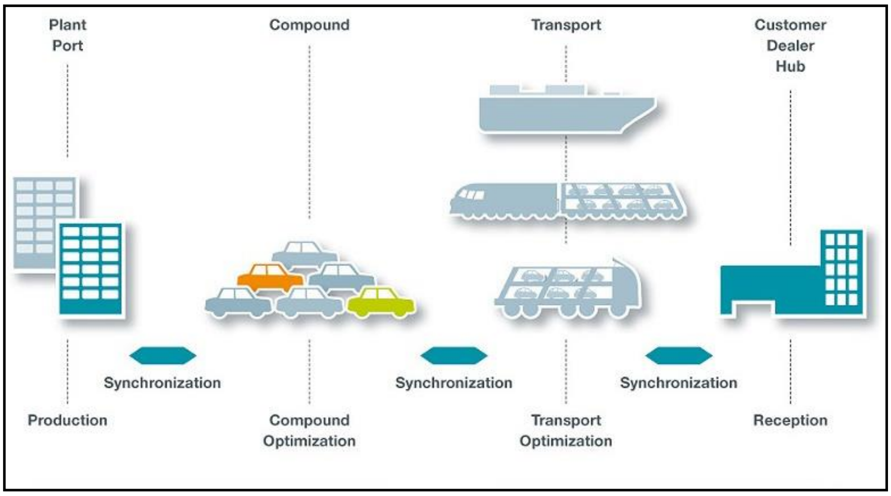


Figure 12: Typical automobile transport flow.

The finished automobiles are stored at the manufacturer's compound prior to transporting them to the car carrier terminal at the sea port. Synchronization in the illustration refers to the supply chain adapting to changing market conditions. Synchronizing the supply chain intends to balance the risk of having excess inventory (or the lack thereof) and not missing market opportunities (Wachs, 2014). This can be done through appropriate processes, governance, organization and effective IT systems. In the illustration, synchronization is carried out to ensure that there will always be enough stock of automobiles produced, enough stock at the point of loading, ensuring that the shipper is able to optimize the use of transportation by having the required number of automobiles to be transported by sea, rail or road available so that it can reach the intended dealer's hub at the right time for distribution or sale.

3.2.2 PCC Port Rotation

A typical port rotation of a PCC on the Asia-Europe trade will depend on the number of automobiles booked and which manufacturer has booked the transportation. Each Manufacturer will have varying loading ports depending on the proximity of the manufacturing plant to the car yard/berth. The table below lists the different loading ports in Japan indicating the location of the manufacturing plant.

PCC Port Rotation (Loading)	**Manufacturer**
Toyohashi	Toyota, Suzuki,
Nagoya	Toyota, Mitsubishi
Kawasaki	Subaru, Trucks
Yokohama	Subaru, Isuzu, Truck
Mizushima	Mitsubishi
Hiroshima	Mazda
Nakanoseki	Mazda

Figure 13: Port Rotation (Loading). Source: NYK Line

Similarly, the manufacturers also have their own respective discharging ports, also based on the proximity of the discharging port either to the assembly plant (for CKDs and SKDs) or from the manufacturer's dealer hub (for CBUs). Typical discharging ports are listed below.

PCC Port Rotation (Discharging)	**Make**
Alexandria	(D) Toyota (Pick-up truck)
Tartous	(D) Toyota
Mersin	(D) Toyota (Pick-up truck)
PIREAUS	(D) Toyota
Gioia Tauro	(D/L) Bunkering
Barcelona	(D/L) Mazda, Suzuki
ZEEBRUGGE	(D) All Makes
Rotterdam	(D) Mitsubishi, Mazda
Emden	(D/L) Volkswagen, Porsche (for USWC)
BREMERHAVEN	(L) Mercedez Benz, BMW, H&H
Southampton	(D/L)
Malmo	(D/L)

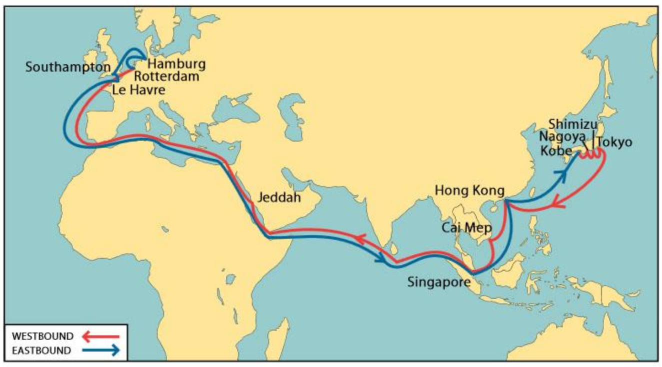
Figure 14: Port rotation (discharging). Source: NYK Line

Since the discharging port rotation is not fixed, the port names in the list appearing in bold fonts are the most common discharging ports where PCCs will be calling 85% to 90% of the time. While these are the ports of call in the car carrier trade, since the car carrier trade is not a fixed liner service, some car carriers may call to these ports on the current voyage but may have to pass them by on future voyages if, the volume of automobiles is not enough to justify a port call. If the need of the manufacturer is very high to transport a small volume of automobiles, the shipping line will most likely accept the booking of the manufacturer even if there will be no call for that particular carrier in the intended port. Instead, the shipping line will carry the small volume of vehicles to the nearest discharging port possible and will arrange for a short-sea service to transport the small-volume vehicles to the intended discharging port instead. All incurred costs in this arrangement will of course, still be borne by the shipping line because it is still the shipping line’s responsibility to shoulder all costs from the port of loading to its final destination. These are special arrangements already established between the shipping line and the shipper/manufacturer. Due to long established relationships and since there are only a few automobile manufacturers playing in the international arena, allocation of future shipments by the manufacturers can be so arranged to be higher, as a commercial settlement.

For discharging of automobiles, the typical port rotation would be Zeebrugge, Rotterdam, Emden, and Bremerhaven, where Emden and Bremerhaven are also load ports intended to facilitate the optimization of the voyage cost of the ballast voyage back to Japan. The ballast voyage will always be the biggest cost for this specialized trade, because it is usually non-revenue carrying and therefore, cost must be brought down to the minimum as possible. While the vessel is in Emden and/or Bremerhaven to discharge automobiles loaded in Japan, it will also do a partial loading of additional automobiles for Southampton, for the USEC and USWC (via the Panama Canal). The ballast voyage of 4,987 nautical miles from Los Angeles to Nagoya then commences after discharging the last unit for the USWC. Another option would be that after the discharging operations on the US East Coast, it will also load in the US East Coast automobiles (mostly SUVs and pick-up trucks) for Jeddah, Kingdom of Saudi Arabia via the Suez Canal. From Jeddah, the vessel starts its ballast voyage back to Japan with a distance of 7,185 nautical miles.

3.2.3 Container Port Rotation

Container shipping has a more predictable time frame which is the main advantage of a liner trade. This gives traders a better means of planning their commodities to be delivered and/or received as well as maintain sufficient inventories. The Asia-Europe trade (Loop 1) of NYK Line will be presented in this study where most shipping lines maintain a similar fixed weekly service in this particular Asia-Europe trade with an average turnaround of about 77 days. NYK Line's website provides information regarding the sample port rotation.



ASIA - EUROPE TRADE : LOOP 1 (Turnaround: 77 Days)
Source: NYK Line

Port Rotation

Origin	ETA/ETD
Kobe	SAT/SUN
Nagoya	SUN/MON
Shimizu	TUE/TUE
Tokyo	WED/FRI
Hong Kong	MON/TUE
Cai Mep	FRI/SAT
Singapore	SUN/MON
Jeddah	THU/THU
Rotterdam	MON/TUE
Hamburg	WED/THU
Southampton	SAT/SUN
Le Havre	SUN/TUE
Singapore	WED/THU
Hong Kong	MON/MON
Kobe	SAT/SUN

Figure 15: Port rotation of NYK Line's Asia-Europe trade Loop 1. Source: NYK Line website

For this study, a loaded voyage with NYK Line as the carrier will be used. Sailing instructions from the shipping line to the pure car carrier MV Rigel Leader was issued for Voyage No. 15. This particular voyage took the vessel to load in Nagoya about 4000 units and to discharge them in Zeebrugge, Belgium and Malmo, Sweden. Appendix 1 shows a copy of the Sailing Instructions. Unfortunately, this sample is unable to exactly match a discharging port under the container trade port rotation. Hence, the nearest port to be used as reference to Zeebrugge will be Rotterdam.

Load Port – Discharge Port	Distance (Nautical Miles)	@15 Kts (Days)	@18 kts (Days)
Nagoya to Suez	7,798	21d 15h 52m	18d 01h 13m
Suez to Port Said (SC Transit only)	89	00d 12h 00m	00d 12h 00m
Port Said to Zeebrugge	3,625	10d 01h 40m	08d 09h 23m
Zeebrugge to Malmo	635	01d 18h 20m	01d 11h 16m
Zeebrugge to Rotterdam	75		
Rotterdam to Malmo	601		
Malmo to Southampton (Next Voyage)	796	02d 05h 04m	01d 20h 13m

Figure 16: Distance-Steaming Time Table from Nagoya to Malmo. Source: Netpas

When comparing the two port rotations, we will assume that both the PCC and containerized mode will be using the same speed requirement of 18.0 knots as indicated in the Sailing Instructions for Voyage No. 15 of MV Rigel Leader, in order to level the playing field. While it will take about 29 days to sail from Nagoya to Malmo, this does not, of course, include the port stay in Zeebrugge for cargo operations. On the other hand, it will take about 35 days to sail from Nagoya to Rotterdam in the container trade, which will be the closest port to the port of Zeebrugge, Belgium in the PCC trade.

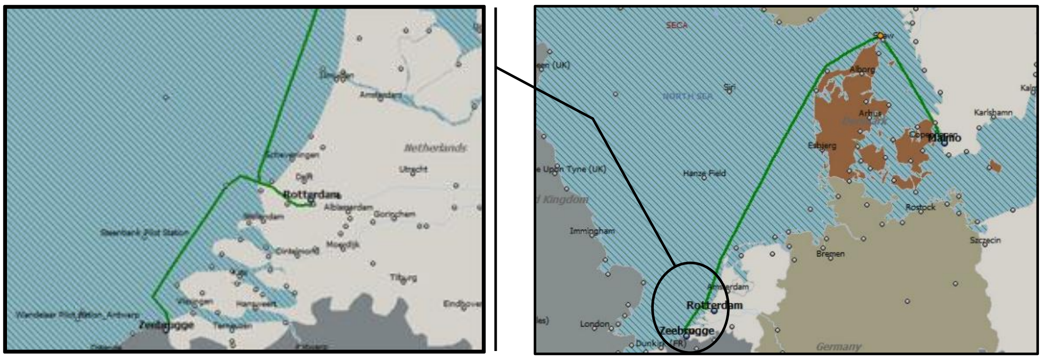


Figure 17: Maps showing the discrepancy in the distances between the Nagoya-Zeebrugge and Nagoya-Rotterdam port rotations

From the Distance-Steaming Time Table in Figure 24, it can be noted that the distance from Zeebrugge to Malmo is 635 nautical miles, Zeebrugge to Rotterdam 75 nautical miles and Rotterdam to Malmo at 601 nautical miles. This gives a discrepancy of 41 nautical miles and we can attribute this discrepancy to the river distance inland towards the port of Rotterdam.

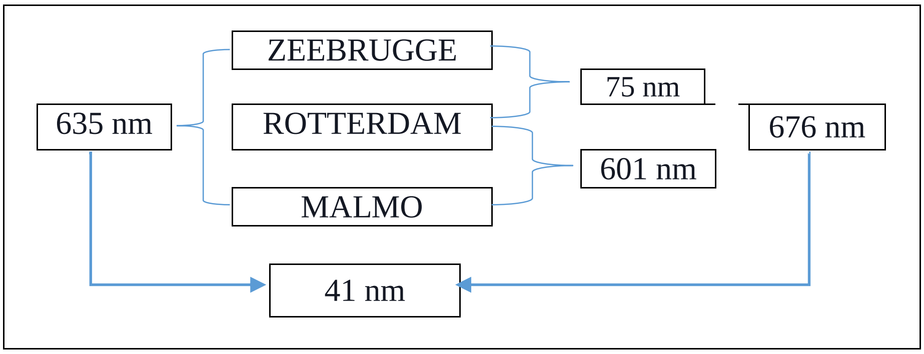


Figure 18 Diagram showing the discrepancy in ZBB-MMO and ROT-MMO distances

River distance = (676 nm – 635 nm)

River distance = 41 nm

Since the 41-nautical mile river distance is present in both legs, this distance needs to be divided equally to get the difference between the Nagoya-Zeebrugge leg and the Nagoya-Rotterdam leg. The Nagoya-Zeebrugge PCC port rotation is shorter by 21 nautical miles than the Nagoya-Rotterdam container port rotation

Asia – Europe Port Rotation Comparison	
PCC Trade Source: NYK Line	Containerized/Liner Trade (Loop 1) Source: NYK Line
Toyohashi	Kobe
NAGOYA	NAGOYA
Kawasaki	Shimizu
Yokohama	Tokyo
Mizushima	Hong Kong
Hiroshima	Cai Mep
Nakanoseki	Singapore
Singapore	Jeddah
Suez Canal Transit	Suez Canal Transit
Alexandria	Rotterdam
Tartous	Hamburg

Mersin	Southampton
PIREAUS	Le Havre
Gioia Tauro	Suez Canal Transit
Barcelona	Singapore
ZEEBRUGGE	Hong Kong
MALMO	Kobe
Emden	
Bremerhaven	
Southampton	
Rotterdam	

Figure 19: Comparison of PCC and containerized port rotation

3.2.4 Loading rate of automobiles in car carrier operations

As in any shipping operation, the time spent in port is as much as possible, brought down to the minimum. The longer the vessel stays in port the more the operations will be costly either to the shipper or to the carrier, depending on the terms of the shipment. The car carrier trade is no exception to this requirement. As a matter of fact, this car carrier trade has reached its maximum potential in efficiency of loading and discharging automobiles without having to incur damage to any automobile while the ideal speed of loading and discharging of automobiles is also achieved.

A typical PCC operation will thus be presented for analysis and comparison. The illustration in the succeeding page presents a detailed timing sequence of a loading operation in Kawasaki, Japan by a major shipping line. It shows the turnaround type of one complete cycle plus the time to lash or secure the automobiles loaded to the intended stowage position by one gang of stevedores. Please note that a gang of stevedores in Japanese car carrier operations is usually composed of the following:

a. Drivers (8)
b. Final stow driver (2)
c. Signalmen (2)
d. Lashers (8)
e. Parking guide (2)
f. Traffic guide (2)

The typical number of personnel composing one gang will vary from one port to another. Even so, the number of men comprising a gang in Japanese stevedoring will have a steady and consistent performance and work output on a per driver basis. In a typical PCC loading in Kawasaki, for example, the performance standard is almost the same, as measured during the actual loading operations.

LOADING RATE (via Stern Ramp)	= 213 Units/hour
Time/duration	= 6 hours 30 minutes
Units Loaded	= 1,383 units
Units loaded per driver	= 8.87 units per driver
Note: 3 gangs (8-9 drivers)	

LOADING RATE (via Center ramp)	= 100 Units/hour
Hours	= 3 hours 52 minutes
Units Loaded	= 387 units
Units loaded per driver	= 12.5 units per driver
Note: 1 gang (8 drivers)	

The port of Nagoya, Japan has three berths allocated for car carrier operations. Two of these berths are public, which allows for 24 hours, round-the-clock cargo operations. The private berth (Tokai) allows for cargo operations only from 0800H-1700H. This is significant information as this affects the duration of cargo operations and eventually the total stay of the vessel in port.

The average loading rate of automobiles in Japan is almost the same in all ports with roughly about 60-70 units per gang per hour, where one (1) gang is composed of four to five drivers. The duration of stay in port therefore depends on the number of gangs utilized in the cargo operations. For a ship to be loaded with 4,000 units will take about 1.5 to 2.0 days where it will be common that in the first day of operations, five (5) gangs will be utilized and at the point of reaching the intended loading capacity, the number of gangs will then be reduced to just two (2) to reduce the risk of damaging the automobiles caused by congestion and queuing on board the PCC.

3.2.5 Discharging rate of automobiles in car carrier operations

For discharging operations, the scenario is quite different where most ports in Europe, if the berth is free and visibility is not hampered by fog, rain, snow or strong winds, then continuous discharging operations is carried out. The average discharging rate in Zeebruge is about 200 – 250 units per hour per gang where one gang is composed of 8 drivers. For this particular voyage, it took MV Rigel Leader about 10 working hours to discharge the 1992 units in the port of Zeebrugge.

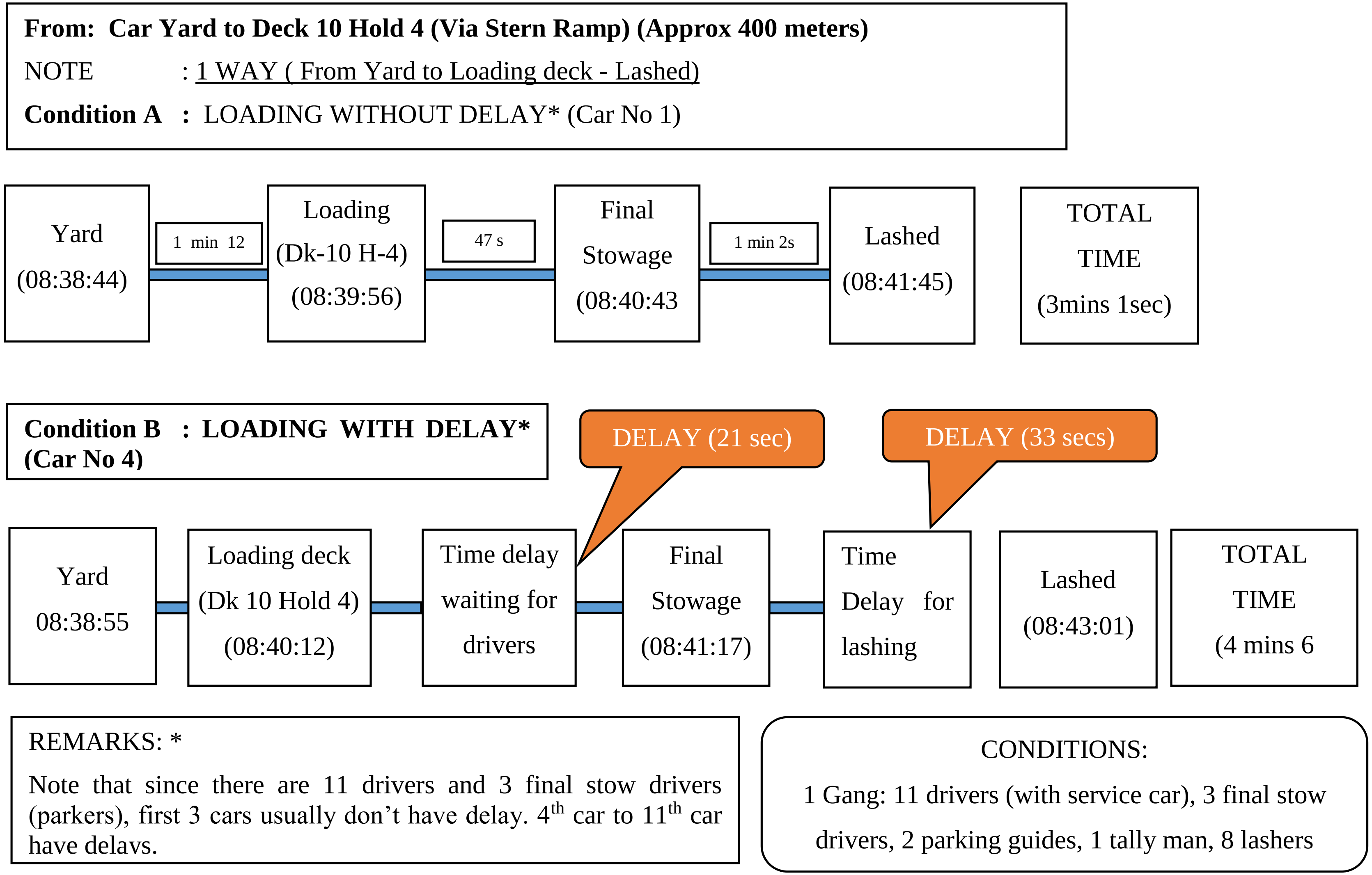


Figure 20: Comparison of PCC loading time in the port of Kawasaki, Japan

3.3 Advantage of containerizing commodities

The use of shipping containers has been a worldwide accepted mode of transporting commodities. These shipping containers come in standard sizes allowing them to be stacked one on top of the other, stowed inside cells of cargo holds, or loaded into trailer trucks, trains and airplanes. The seamless movement of commodities in shipping containers from one port to another and capable of using a wide array of transportation, makes this mode a prime consideration by shippers and shipping lines alike.

The World Shipping Council (WSC, 2014) reports on its website that Drewry has recorded in 2012, a global container fleet of 32.9 million TEU. Dry containers (standard and special) comprise the majority of about 93% of the total. The remaining 7% is split between insulated reefer and tank containers where reefers make up approximately 6.25% of the global fleet while tank containers occupy the remaining 0.75%[x]. With these ratios, the WSC estimates that the size of the dry container fleet in 2012 was approximately 29.3 million TEU. Reefer containers comprised 2.1 million TEU of the global fleet and about a quarter of a million TEU was allocated to tank containers. Drewry Maritime Research projects a 1.6 million TEU growth in 2013 making the global container fleet to about 34.5 million TEU.

What makes containerization a common choice for shipment is its standardized concept and uniformity in processes. Almost anything can be shipped in containers to almost any place in the world. The whole containerization process can be broken down into 10 steps:

STEP	PROCESS
1	The need to supply a particular commodity by a seller has reached a level that needs replenishment of current stock. The supplier of the said commodity will make arrangements with a freight forwarder to arrange transport from the manufacturing plant for the shipment of the required commodity.
2	A trucking company will arrive at the manufacturing plant and loads

	the required number of the ordered commodity onto a 40-foot, high cube container. Once completely loaded, the container is then bolted shut and fitted with a high-security seal. This container will no longer be opened again until it arrives at a distribution warehouse in the country of destination (unless customs officials decide to open and inspect it).
3	The freight forwarder determines the port of origin of the shipment and contracts a container shipping line who then must submit documentation about the shipment to government authorities in the exporting and importing countries. These are "manifest data" which contain accurate information about the contents, exporter, importer and the carrier.
4	The cargo is loaded onto a container ship and is then carried to its designated port of discharge.
5	Prior to arrival at the port of discharge, the captain of the ship then reports to the government of the destination country information about the ship, the crew and its cargo
6	The government of the destination country then issues a clearance to enter the port and dock at a container berth to unload the container containing the commodities to be discharged.
7	Numerous dockworkers e.g. crane operators, lashers, clerks, and cargo equipment operators arrive and start working to discharge the containers
8	The container passes through a careful evaluation by the Customs officials of the port
9	Once the container is cleared by customs, it is loaded onto a truck trailer and will be transported to the intended distribution center
10	The truck reaches the distribution center, the container is then opened and its contents are separated and prepared for shipment according to the orders by individual stores. After which, the commodity is received by the seller's store.

Table 21: Ten-step containerization process (Source: World Shipping Council, 2014)

3.3.1 Usage of port storage space

Car terminals are known to use up very large areas, especially if the terminal is designed to allow the pure car carriers that can accommodate 6,500 to 7,000 automobiles. This is where the advantage of shipping containers comes in. Containers have the advantage of being stacked vertically, thereby being able to stow more commodities in the same land area used up by the car yard by utilizing the height as well.

In the sample shipment of 4,422 automobiles by the pure car carrier MV Rigel Leader, 1,992 were earmarked for Zeebrugge and 2,430 were for Malmo. Out of these 2,430 automobiles discharged in Malmo, 1,798 were going to be transshipped to Russia. Those 1,798 units would have required a minimum land area of about 11,496 m^2 as storage area. The total land area needed as car storage area for the 1,798 discharged automobiles would be calculated as follows:

1,798 automobiles x (4.125 m x 1.550 m) = 11,496 square meters

For the purpose of this study, the RT43[2] would be used as the standard measurement of an automobile. The total storage area if the 1,798 discharged automobiles were containerized, will be calculated as follows:

Required containers = 1,798 automobiles ÷ 4 (no. cars per 40ft HC container)
= 449.5 or 450 containers

The minimum storage area occupied by 1,798 automobiles in 450 containers is hereby computed as follows:

Total storage area = (6 x 2.44 m) x (12 x 12.19 m)
Total storage area = (14.64 meters) x (146.28 meters)
Total storage area = 2,141.54 square meters
Total storage area = 2,142 m^2

The basis of this configuration is a maximum stacking height of 5 high-cube containers and 6 rows x 12 longitudinal stowing to allow for safe operation of container handling equipment such as gantry cranes and reach stackers.

[2] An RT43 is a unit used to measure the capacity (volume) of PCCs and PCTCs referring to the dimensions of a 1966 Toyota Corona with dimensions of: (L)4.12m x (W)1.55m x (H)1.40m)

Therefore, these 1798 automobiles would have occupied 2,677 m^2 only in a container terminal instead of 11,496 m^2 occupied by the same number of automobiles in the car yard of CMP, or 77% less storage area needed. This minimum area, of course, refers to the area of the parked vehicles only and does not include the space to safely operate and park the vehicles as well as access roads. In PCC operations, there is a required 30-cm bumper-to-bumper distance and a 10-cm side-to-side distance to maximize the available loading space of the PCC. The car yard stowage has a similar maintained distance of about 30 centimeters side-to-side and 50 centimeters bumper-to-bumper.

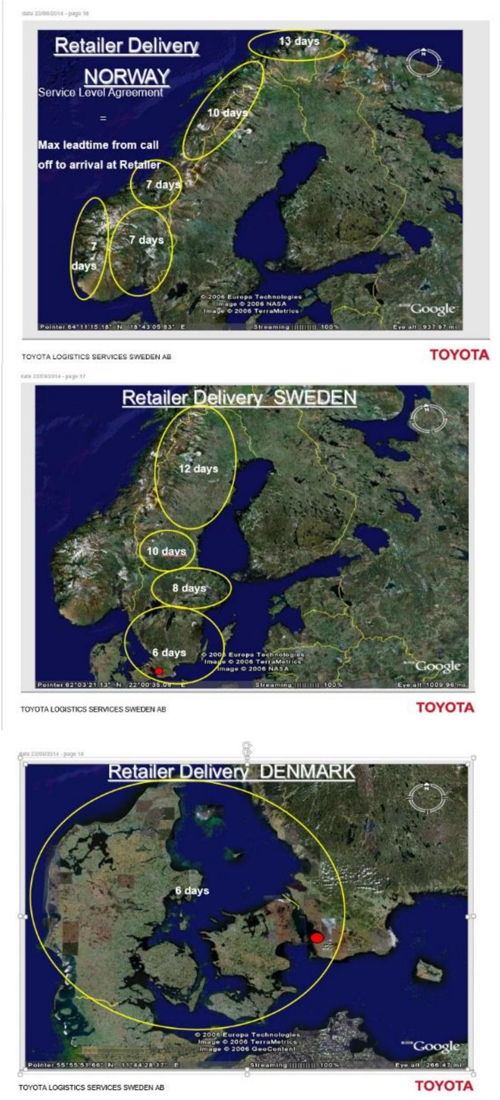


Figure 22 The scope of Toyota's transport of automobiles in Scandinavia from the hub center in Malmo, Sweden. Photo courtesy of Toyota Logistics Services, Sweden.

3.3.2 Transshipment Cargo

Another thing to examine is the condition of the automobiles being transshipped. It can be noticed in the Exact Plan report prepared for the pure car carrier MV Rigel Leader after completion of loading in Nagoya, that the two discharging ports are not the final destination of the automobiles. Containerization will provide a safer means of transshipment of the automobiles as opposed to the conventional method of trailer truck transport which exposes the automobiles to a lot of damage risks. The more the transshipments are made for these automobiles, the more the damage risks also increase. During the Integrated Studies Seminar in WMU, Mr. Olsson of the Toyota Logistics Services of Sweden made a presentation about their automobile hub at the Copenhagen Malmo Port, where they reported that the imported automobiles from Japan for the Scandinavian market, required a lot of transshipment and that the automobile transport for the Scandinavian market were all done by trailer trucks and rail. These again, poses a lot of risks for the automobiles to sustain damages during the transshipment and/or land travel. He later on concurred, in a separate interview that containerizing these automobiles will be ideal in this kind of scenario.

Cargo Status : **Exact Plan Mode**					
		TOTAL ZEEBRUGGE		**TOTAL MALMO**	
DISCHARGE PORT	**FINAL DESTINATION**	**QTY**	**WEIGHT**	**QTY**	**WEIGHT**
LEIXOES	AFRICA	2	4	0	0
ZEEBRUGGE		0	0	0	0
ZEEBRUGGE	AFRICA	49	98	0	0
ZEEBRUGGE	ICELAND	20	43	0	0
ZEEBRUGGE	IRELAND	64	103	0	0
ZEEBRUGGE	SWITZERLAND	65	99	0	0
ZEEBRUGGE	AUSTRIA	65	101	0	0
ZEEBRUGGE	BELGIUM	209	287	0	0
ZEEBRUGGE	CZECH	25	39	0	0
ZEEBRUGGE	FRANCE	390	572	0	0
ZEEBRUGGE	GERMANY	238	351	0	0
ZEEBRUGGE	HUNGARY	31	31	0	0
ZEEBRUGGE	POLAND	757	757	0	0
ZEEBRUGGE	NETHERLANDS	77	110	0	0
MALMO	MALMO	0	0	632	1167
MALMO	RUSSIA	0	0	1798	3491
TOTAL		**1992**	**2591**	**2430**	**4658**

Figure 23: Cargo status report indicating final destination of automobiles after unloading the vehicles at the intended discharging ports. Source: NYK Line

The figure shows that out of the 2,430 vehicles discharged in Malmo, 1,798 units will be shipped further to Russia as transshipment cargo via a short-sea service. This transshipment process exposes the 1,798 automobiles to a lot of risk of damages. If the automobiles were loaded into containers, then these automobiles were protected from damage and exposure to the weather elements. It also enjoys the benefit of a wider container port network and faster service and then perhaps, the number of transshipments can be minimized.

3.3.3 Stowing and securing means for automobiles in containers

The key to this mode of transporting automobiles in containers will depend in a removable racking system that will allow for the speed and ease in stuffing the container with automobiles, safe handling and securing of the automobiles inside the container as well as being able to maximize the full use of the container's internal space. Hence, an investment in this racking system will have to be made, either by the car manufacturer/shipper or the carrier.

Figure 24 Using a removable racking system to load cars in a container. Source: Trans-Rak International

The racking system is intended to safely elevate an automobile inside the container so that another automobile can be driven-in underneath the elevated automobile. With this racking system, four (4) medium to standard sized sedans can be fitted inside. The racking system makes use of a pod, where after being assembled according to the specifications of the automobile to be loaded, enables the front and rear wheels of the automobile to be parked on where it is then secured on and finally elevated to the desired height. It will therefore need two (2) pods to lift two automobiles and fit a total of four (4) automobiles inside a 40-foot, high cube container.

Calculating the time needed to load the containers with automobiles using a removable racking system

Required time to load 300 Toyota Altis inside the container using 3 gangs

= 75 minutes[3] x 75 containers

= (5,625 minutes) ÷ 60 minutes

= (93.75 hours) ÷ 3 gangs

= 31.25 hours per gang

= 01D 07H 15 mins

Required time to load 400 RAV 4s inside the container using 3 gangs

= 75 minutes[3] x 50 containers

= (3,750 minutes) ÷ 60 minutes

= (62.50 hours) ÷ 3 gangs

= 20.8 hours per gang

= 00D 20H 50 mins

Note: A gang is composed of two (2) men. All three gangs can be supervised by one foreman. Source: Trans-Rak®

The price of a pod, inclusive of the lashing and securing system is pegged at US$ 1,200. Considering the depreciation as well as wear and tear of the unit, the manufacturer of the racking system expects the unit to be used for about 7 to 8 years. Therefore, with an average of 77 days as turnaround time for the Asia-Europe trade, the pod can be used at least 4.7 times in a year and about 33 times during its expected

[3] 75 minutes is the average time needed to assemble the pods inside the container and complete loading the four automobiles until the container doors are shut and sealed. Source: Trans-Rak® International

depreciable life. Therefore, with the investment of US$ 1,200, it can be determined that it will cost about US$ 36.36 per usage of the equipment.

Repositioning the containers and pods

It is common knowledge that the volume of trade between Europe and Asia is not the same as far as exports are concerned. There will always be more trade coming from the Far East going to Europe as compared to Europe going to the Far East. In the container trade alone, the Far East was recorded at using 91.68 M TEUs in exporting various commodities as opposed to Europe's 29.31 M TEUs in the same year. The obvious problem particularly for the carrier seems to be the repositioning of the containers back to the Far East with as much freight as possible. More often than not, a big percentage of the containers will go back to the Far East as empty containers. The same will hold through if the export of Japanese automobiles will be using containers with a removable racking system. However, if this system becomes an acceptable practice, then it can also be foreseen that the European car manufacturers will consider using this option to export their automobiles to the Far East. If so, then the used containers as well as the removable racking system can also being used of the export of automobiles to the Far East by the European car manufacturers.

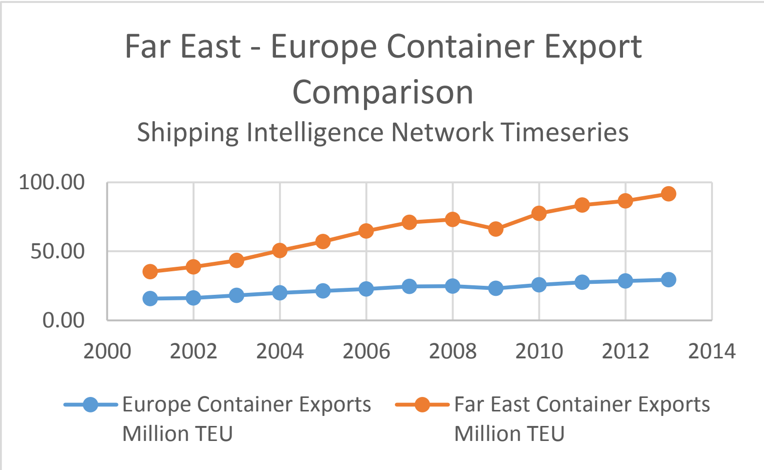


Figure 25 Comparison of Far East and European container exports. Source: Clarkson

As for the repositioning of the pods, it must be also ensured that the pods return to the point of shipment at the least possible time. This requires a suitable amount to at least allow a weekly shipment of automobiles in containers. These pods or removable racking system are so designed that they can be re-packed and repositioned back to Nagoya in containers. If properly re-packed, a 40-foot high cube container can fit about 60 pods. As an example, since the shipment in Voyage 15, of MV Rigel Leader of 1798 automobiles for Russia, will require 450 40-foot, high cube containers, this also means that it will need 899 pods if it is decided to load them on containers.

Number of pods = No. of containers x 2 pods per 40-foof High cube container
= (1798 ÷ 2) x 2
= (449.5[4] 40-ft high cube containers) x 2
= 899 pods

Since one 40-ft high cube container can fit 60 of these pods, then all these 899 pods can fit in roughly 15 40-ft high cube containers. Therefore, the 15 40-ft, high cube containers with the 899 pods can be securely shipped back to Nagoya. This will be advantageous on the part of the carrier because this means that 15 containers go back to the Far East with freight. It may be an added cost on the part of the shipper, but the shipper is assured that the pods are intact and secure when they go back to Japan for re-use. This cost, however, can be offset by including the cost for using the pods in the freight.

3.4 FREIGHT

The freight will be the next item to be examined in this comparison. Freight is defined as the amount of money paid to a shipowner or shipping line for the carriage of cargo (Brodie, 2014). This may include the cost of loading and/or discharging the cargo or may simply cover the ocean carriage and whether the type of contract the shipper has entered into particularly whether it is entered as liner shipment or charter shipment. The actual quotation for the ocean freight for the shipment of the 4000

[4] Depending on the size of the automobile, the arrangement can also be configured in such a way that these 1798 automobiles can be fitted in 449 40-ft high cube containers and one (1) twenty foot container.

automobiles from Nagoya is difficult to obtain. As mentioned previously, shipping lines will provide different prices to different shippers depending on the size volume of the volume being shipped. Each customer (or shipper) treated differently).

3.4.1 PCC Ocean Freight

Although difficult to obtain, a generic rate for the ocean freight was obtained from a shipping line for the purpose of this study. A generic rate means that it is not the rate that the shipping line would offer to its customers as shippers.

For this particular case, the ocean freight for a PCC shipment is pegged at US$ 70.00 per cubic meter of cargo and terms are Freight Prepaid[5]. Looking back at the Sailing Instructions of MV Rigel Leader, it indicated that it will be loading in Nagoya 1992 units for Zeebrugge, Belgium and 2,430 units for Malmo, Sweden. Since only a generic rate was provided, for purposes of this study, this rate will be used for the farthest point of the voyage which is Malmo, Sweden. The ocean freight for 2,430 units discharged in Malmo is calculated as follows:

Rate	= US$ 70 per cubic meter
Volume of shipment	= 2,430 units x ((L)4.12m x (W)1.55m x (H)1.40m)
	= 2,430 units x 8.9404 m^3
Volume of shipment	= 21,725 m^3
Ocean Freight	= Volume of shipment x rate
Ocean Freight	= (21,725 m^3) x US$ 70 per cubic meter
Ocean Freight	= US$ 1,520,762.04

3.4.2 Container Ocean Freight

Determining the cost for shipment of a container (otherwise known as the freight) is calculated differently and not by the volume occupied by the cargo. The freight is determined by the size of the container, whether it is a 20-footer or 40-footer, and if

[5] Freight prepaid is freight payable before the contract of carriage has been performed. Note that, this rate is generic and is not the same rate given to the regular shipper/customers of NYK Line.

it is also a high-cube container. In a way, it is the space occupied (slot) by the container that is being considered in the computation. Therefore, no matter how expensive the value of the cargo is or how heavy or light the cargo is, the cost of freight will still be based on the size of the container.

Consider the shipment of a 40-ft High Cube Container from Nagoya to Hamburg), Freight Pre-paid on CIF[6] terms. The cost of transport is the total of the Ocean Freight and Local Charges. Ocean freight is the freight payable on the sea or ocean leg of a voyage which is composed bunkers, currency, arbitrary cost, carrier cost and other charges. The Local Charges, on the other hand, are the combined Terminal Handling Costs (THC) and the Documentation Costs both at the port of loading and at the port of discharge.

An ALL-IN rate, which is commonly used in the liner trade, can also be considered in this example. This refers to the freight rate which is inclusive of all surcharges and extras (Brodie, 2014: 158).For example, the breakdown of the cost of a shipment of a 40-foot high-cube container, in an ALL-IN (subject to Local Cost) terms from Nagoya to Hamburg:

Freight (For June 2014)		Local Charges		
Bunker	US$ 1,228*	THC$_{Origin}$	¥48,000	
Currency	US$ 30	Docs$_{Origin}$	¥ 2,000	
Arbitrary	-	THC$_{destination}$	€ 140	
Carrier	US$ 305	Docs$_{destination}$	€ 40	
		Entry Summary**		
		Advance Manifest**		
	US$ 1,563	EURO (€) 180	JPN (¥) 50,000	TOTAL
Conversion	US$ 1,563	US$ 245	US$ 490	US$2,298

**Bunker charge varies on a monthly basis depending on the price of bunkers in the market*
***Although prices are being quoted on a per container basis, the Entry Summary and Advance Manifest charges are quoted on a per Bill of Lading (B/L) basis. This means that if in the B/L covers five containers, then only one Entry Summary charge and one Advance Manifest charge will be given for all the five containers.*

Conversion rates are of 03 June 2014 levels
1 Euro = US$1.3614 and 1 JPN ¥ = US$ 0.0098

Figure 26 Sample calculation of ocean freight from Nagoya to Hamburg for a 40-foot, high cube container

[6] CIF or Cost, Insurance and Freight, refers to a pre-defined INCO term where the seller must pay for the cost of freight to bring the goods to the port of destination, including insurance for the goods.

This means that the ocean freight for a 40-foot, high cube container, with four (4) automobiles inside, will cost US$ 2,298 to be transported from Nagoya to Hamburg or roughly US$ 575 per automobile.

Opportunities for growth

Fitting three automobiles into a container used to be the common practice with the use of wooden supports and scaffolds. Modern engineering as well as lightweight and good quality-alloys, makes it possible to have a more secure and safer means of vanning a container with four to six automobiles. There is no need to discuss further the advantages of a multi-modal containerization system. What must be made clear to the car manufacturers is that the potential of making their products reach farther than the normal PCC or RO/RO terminals and tap new markets can even be greater by considering a containerized method of transporting automobiles. It is high time that this potential should be maximized. With an effective containerization system coupled with the use of a well-engineered removable racking system, the transport of automobiles in containers will reach new heights. It is with hope that this study will pave the way for a more intensive research on the feasibility of this method of transport of automobiles.

Chapter 4.0 Analytical findings and implications

Strict legislations are and will be implemented regarding emission of gasses for both ships and automobiles alike. While the EU is trying to contribute their own share in the society to reduce the greenhouse levels to as much as 20% to 30% by the year 2020, these legislations can serve as deterrent to use automobiles that run on fossil fuel so that it can reduce the emission of greenhouse gases. It does not however, stop people from owning automobiles that run on fossil-fuel. People can still own cars but can have the option to use them less often because of local and national incentives to resort to environment-friendly means to move around within their locality. Similarly, automobiles can still be registered even if it has aged already as long as they are roadworthy and the engine passes the emission testing prior to registration of the vehicle (automobile). There are also incentives for automobile owners to get paid for disposing automobiles in authorized scrapping yards.

Therefore, these legislations in the reduction of emission of greenhouse gases will have minimum effect in the importation of automobiles from Asia or the manufacture of automobiles in Europe. This condition can be used as a basis to continuously pursue adapting this method of transporting automobiles in containers since the need for automobiles to transport people and goods will always be there.

To proceed with this system would mean convincing the car manufacturers/shippers to consider this mode as an additional option for transporting automobiles. The success of this method lies mainly in an already-reliable global containerization system coupled with the use of a compatible removable racking system that will ensure:

- Speed and ease in stuffing the container with automobiles
- Safety of the automobiles inside the container
- Maximize the use of the internal container space

The use of this compatible racking system will also mean an additional investment on the part of the manufacturers/shippers and/or the carriers. A lot of designs about these racking systems have already appeared in the market and it is a matter of marketing these designs to the car manufacturers/shippers or carriers to convince these players to start investing in a system that is ready for entry into a competitive market of transporting automobiles. From the point of view of Lars Kastrup, of Maersk Line, with an already depressed liner market, it would be difficult for him to allocate additional budget to consider investing in the shipment of CBUs in containers using a removable racking system. Instead, he sees the car manufacturer/shipper and the designer/owner of the removable racking system to tie-up and initiate the venture into this system.

Another prime consideration in using a removable racking system would be their repositioning after use at the discharging port. The pods used can be re-packed and arranged so that at least 60 pods can be fitted in a 40-foot container. This will entail initial outlay to build up sufficient inventory of pods to be used on board the ships running on the regular Asia-Europe containerized trade. Considering the cost of a pod, it is essential that all the pods used continuously monitored and are eventually returned to the point of origin after use. Just like the birth pains that container lines had to undergo in building up inventory of containers at the start of containerization, the same will be true when choosing this method of transporting automobiles in containers.

There has been significant signs where manufacturers have started doing regular shipments of automobiles in containers. TESLA produces about 20,000 to 25,000 automobiles annually. While these volumes still, are not big enough, there is a growing indication from car manufacturers to transport these CBUs in containers using a racking system. Eventually, when it shall have been realized that not only is this method practical but also cost-efficient, others will follow suit.

Comparative Analysis

	PCC	Containers
Ocean Freight	US$ 626 per automobile	For US$ 575 per automobile from Nagoya to Hamburg
Storage Area needed	About 10,148 m^2 of land area is needed if 1,000 RT43 units will be parked.	Only 2,142 m^2 for a 6-row x 12 longitudinal stow x 5 stacks
Storage Time	10 days free storage time for automobiles (CMP)	Usually about 7 to 10 days free storage time for containers at the loading and discharging port container yards

On a port-to-port comparative analysis, the ocean freight alone cannot be the basis in determining whether the shipment of automobiles in containers is better or on PCCs. In the example given in the shipment of 1000 automobiles from Nagoya to Hamburg, under CIF terms, still, the shipper has to carry the cost of Export customs declaration, carriage to port of export, unloading of truck in port of export, loading on vessel in port of export, and cost of insurance.

The US$ 626 per automobile cost for the PCC ocean freight is derived from the calculation in the previous chapter where the generic freight rate given per cubic meter (m^3) is US$ 70. Using the RT43 as reference with dimensions of (L) 4.12m x (W) 1.55m x (H) 1.40m will have a volume of 8.9404 m^3. This gives us about US$ 625.83 or US$ 626.

It has to be noted though, that for this particular shipment of 1,000 automobiles, two (2) models are being shipped. Each model will have different volumes and will therefore, have to be factored in for a more detailed cost of ocean freight instead of just using the RT43 model as reference. Likewise, the generic rate given was based on the distance from Nagoya to Malmo. These rate will therefore vary depending on the special rates given to the shipping line's regular clients and the shorter distance between Nagoya and Hamburg.

Similarly, the calculated ocean freight of US$ 575 per vehicle from Nagoya to Hamburg was derived from the calculated ocean freight per container of US$ 2,298.

Another advantage of the shipment by container will of course be, the storage area that will be used, if all the 1,000 automobiles will be parked at the loading and discharging ports. In the PCC operations, these 1,000 automobiles will require 10,148 m^2 of storage area.

Required Storage area = 1,000 automobiles x 10.148 m^2 per automobile
= 10,148 m^2

It must be noted that unlike in the PCC stowage, where a minimum 30-cm bumper-to-bumper and 10-cm side-to-side distance is strictly maintained to optimize the usage of stowage space on board, a minimum distance of at least 30 centimeters on all sides must be maintained at the car yard. Therefore, instead of using the length of 4.12 meters and width of 1.55 meters, of an RT43 unit as reference for the storage area at the car terminal, an additional 30 centimeters must be added on all sides and ends of the car. This makes the required storage space at the car terminal of about 10.148 m^2 per automobile.

For the storage space requirements of the containers if all the 1,000 automobiles will be loaded onto containers, it will require only a minimal storage area of 2142 m^2 at the container yard area. This is computed as follows:

Dimensions of a 40-ft, high cube container: (L)12.19m, (W)2.44m, (L)2.90m

Total storage area = (6 x 2.44 m) x (15 x 12.19 m)

Total storage area = (14.64 meters) (182.85 meters)

Total storage area = 2,141.54 square meters

Total storage area = 2,142 m^2

This storage of 1, 000 automobiles is arranged in a pile of 4 stacks with 72 containers in each stack and that the 5^{th} stack has a loose stow of 34 containers. The basis of this configuration is a maximum stacking height of 5 high-cube containers and 6 rows x 12 longitudinal stowing to allow for safe operation of container handling equipment such as gantry cranes and reach stackers.

This implies that a containerized option of transporting automobiles has the potential of being transported to small ports or to ports that do not have car terminal berths or yards. It can even be transported to land-locked ports.

Chapter 5 Conclusions and recommendations

The transport of automobiles in containers as CBUs may not be an ideal choice for car manufacturers and shippers at the moment. It is not only a matter of convincing these car manufacturer how safe it is to use containers in loading automobiles by invest in a new system that still has to be proven but also how cost-efficient this method would be for them.

5.1 Conclusion

This study intends to tap into containerization of automobiles because of the over-tonnage in the liner trade which has continued to keep the freight rates in the Trans-Pacific and Asia-Europe trades in their all-time lows (Lloyds, 2014). There has been little indication that the current container freight rate is improving. It has been observed that market freight rates on the transpacific and Asia-Europe trade lanes continue to decline (Lloyd"s, 2014). With this continued decline, it may be possible that by considering to add new commodities to be used in containers such as automobiles, the over-capacity can be tipped to the other side of the scale and help start increasing the demand for liner trade slots. Shipping lines will have to improve marketing strategies to convince car manufacturers to consider another fast mode of transporting automobiles.

It may still be difficult to convince car manufacturers to consider transporting big volumes of automobiles using shipping containers. The analysis showed that the shipment of one container with four automobiles loaded is more cost-effective than just transporting it on a PCC but the results are not as astonishing as expected to even convince would-be investors. A more in-depth study therefore is needed where accurate costing and reports from insurance companies about damage cargo claims are also factored-in.

The steaming time from Nagoya to Zeebrugge for the PCC MV Rigel Leader is almost just the same as the steaming time of a container vessel from Nagoya to Rotterdam. Opting to containerize the transport of automobiles will allow a more extended reach in much smaller feeder ports, reaching further beyond the limits of major port car terminals and instead, moving the transport to reach more inland through a transshipment system using smaller feeder ports and/or rail-truck system.

5.2 Recommendations

Further in-depth study should be carried out to determine the effect of this concept to the available supply of containers. In the Container Leasing and Container Equipment Insight, it was reported that in 2013, there was a 7.3% expansion in the leased container fleet (in TEU) in the preceding year. It has outpaced the 2% growth recorded by the fleet owned by the transport operators (Drewry, 2014). This growth in leased containers may help sustain the demand for additional containers should this mode of shipping automobiles be considered by car manufacturers as another viable option.

With the limited resources gathered, the door-to-door concept may not be an attainable option at this point. While it is recommended for the manufacturer to construct an outdoor loading dock to facilitate the vanning of containers with automobiles outside the manufacturing plant, it will be difficult for the distribution plant to empty the containers without a loading dock constructed as well or if it does not have in its inventory, container-handling equipment. More information must be gathered to determine if there is a need for the car manufacturer to invest in container-handling equipment and gear or construct an outdoor loading/unloading dock at the receiver’s end. This would mean factoring-in additional operations and maintenance cost if the door-to-door concept will be pursued.

Listed on the table below is a sample process flow in transporting automobiles in containers.

The Process flow for the containerized automobiles		
	Process	Remarks
1	The process starts when an order is placed for 600 units of Toyota Altis for Russia and 400 units of RAV 4 for Hamburg.	
2	Considering the availability of the desired automobiles, and the next available PCC will not arrive Nagoya in the next two weeks, it was decided to ship an initial 50% of automobiles in containers as FCLs and the remaining 50% by PCC	
3	The same shipping line as the PCC was assigned by the car manufacturer to be used for the containerized transport	
4	Arrangements were made by the shipping line to send 75 containers for the 300 units of the Altis models The manufacturer has a loading dock that can accommodate 12 container trucks at a time and supplies the pods for the racking system. *(Please refer to* ***Appendix 2*** *for site plan of car manufacturing plant using an outdoor loading dock)*	Man hours to stow and secure 4 automobiles in a 40-foot, high cube container using a removable racking system is 75 minutes* The training of gangs to mount and disassemble the removable racking system will take about 1.5 days
5	Similarly, the next 50 containers were arranged to load the 200 RAV 4s. All 125 containers were transported to the Nagoya Container Terminal after three (3) days upon completion of vanning.	Note: It will be ideal to do the PDI for all the 500 automobiles at the manufacturer's plant before it is loaded onto the container however, change in atmospheric conditions during the ocean transit can change the condition of the external finish of the loaded automobiles inside the container. This might just end up in doing the PDI process all over again at the receiving end of the transport hence, it would be more

<table>
<tr><td></td><td></td><td>ideal to do the PDI during the last-mile delivery stage.</td></tr>
<tr><td>6</td><td>The 125 containers are then loaded on board the container vessel that will transport all the containers to the discharging port in Hamburg, Germany</td><td></td></tr>
<tr><td>7</td><td>Using the shipping line’s Key Transit Table, it will take 37 days to sail from Nagoya to Hamburg via the Suez Canal</td><td>
<table>
<tr><th colspan="13">Key Transit Table</th></tr>
<tr><th>*W/B</th><th>JED</th><th>RTM</th><th>HAM</th><th>SOU</th><th>LEH</th><th>*E/B</th><th>SIN</th><th>HKG</th><th>UKB</th><th>NGO</th><th>SMZ</th><th>TYO</th></tr>
<tr><td>UKB</td><td>25</td><td>36</td><td>38</td><td>41</td><td>42</td><td>RTM</td><td>29</td><td>34</td><td>39</td><td>40</td><td>42</td><td>43</td></tr>
<tr><td>NGO</td><td>24</td><td>35</td><td>37</td><td>40</td><td>41</td><td>HAM</td><td>27</td><td>32</td><td>37</td><td>38</td><td>40</td><td>41</td></tr>
<tr><td>SMZ</td><td>23</td><td>34</td><td>36</td><td>39</td><td>40</td><td>SOU</td><td>24</td><td>29</td><td>34</td><td>35</td><td>37</td><td>38</td></tr>
<tr><td>TYO</td><td>20</td><td>31</td><td>33</td><td>36</td><td>37</td><td>LEH</td><td>22</td><td>27</td><td>32</td><td>33</td><td>35</td><td>36</td></tr>
<tr><td>HKG</td><td>16</td><td>27</td><td>29</td><td>32</td><td>33</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CMP</td><td>12</td><td>23</td><td>25</td><td>28</td><td>29</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>SIN</td><td>10</td><td>21</td><td>23</td><td>26</td><td>27</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>JED</td><td>-</td><td>11</td><td>13</td><td>16</td><td>17</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
Figure 4Key Transit Table. Source: NYK Line</td></tr>
<tr><td>8</td><td>The container vessel arrives Hamburg, Germany after 37 days and discharges the 125 containers.

The containers will undergo random screening and clear Customs for the 50 import containers for Hamburg while the 75 transit containers for Russia will be stowed at the container yard while waiting for the feeder vessel that will transport them to Russia (explanation for Russia ends here).</td><td>Under CIF terms, the consignee settles remaining fees and charges e.g. Unloading in port of import, Loading on truck in port of import, Carriage to place of destination, Import Customs’ clearance and Import taxes</td></tr>
<tr><td>9</td><td>The 50 containers are then transported to the manufacturer’s distribution center for Pre-delivery Inspection prior to delivery to the car dealership.</td><td>Note: It should be noted that if the containers are to be devanned at the distributor’s yard, it should either have container-handling equipment or a portable mobile ramp in place of the outdoor loading dock mentioned in process no. 4 to avoid traffic congestion caused by 50 trucks entering the distributor’s yard at the same time.</td></tr>
<tr><td>10</td><td>The 50 containers are then devanned</td><td>While the containers are being devanned, the pods used (100</td></tr>
</table>

		pods) for stowing the cars inside the containers are re-packed for the return journey to Nagoya. The 60 pods will fit inside one 40-ft HC container. The remaining 40 pods will be loaded in another container.
11	The 50 containers are then returned to an agreed depot for repositioning. The 48 containers can be repositioned within Hamburg for loading back to Asia while the two remaining containers will be transported to the container yard for loading on board the next container vessel going back to Nagoya.	

In the end, it will require not just the investment of the car manufacturer into this new method that will be needed but also the rest of the stakeholders and players who are involved in this activity of transporting automobiles. This was the same dilemma that Malcolm Maclean faced when he first introduced the concept of unitizing cargo. If he could just see how far his concept has already gone. As long as there is a need for people to move from one place to another in land or to transport goods over land, there will always be a demand for automobiles. The way population, and GDP are growing, it can be visualized that the demand for automobiles will also increase.

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APPENDIX 1: Specimen Sailing Instruction

From: NYK CAREUROPE
Sent: Friday, XXXXXX 2014 01:52
To: Rigel Leader
Subject: Fw: SAILING INSTRUCTION - M/V RIGEL LEADER V.15 (EUR)

FM NYK CAREUROPE
TO MASTER OF M/V RIGEL LEADER
CC XXXXXX

RE: SAILING INSTRUCTION - M/V RIGEL LEADER V.15
(LINE CODE: xxx VSL CODE: xxx PRESTO CODE: xxxx)

WE ARE PLEASED TO INFORM YOU THAT YR NEXT TRADE HAS BEEN
FIXED AS FOLLOWING SCHEDULE.

AAA) PROFORMA SCHEDULE
======================

PORT(WHARF)	ETA-ETD	REMARKS
-[V.14]---		
SAN DIEGO	DEC 26-26	DISCH
-[V.15]---		
NAGOYA(MEIKO)	JAN 13-14	LOAD ON 13TH AND 14TH 4422 UT
SINGAPORE	21-21	BUNKER
SUEZ CANAL	FEB 02-02	TRANSIT ON 02ND
ZEEBRUGGE	12-12	BUNKER/DISCH 1992 UT
MALMO	14-15	DISCH 2430 UT
BREMERHAVEN	17-17	FOR NEXT VOY.

- YOUR PRESENT VOY NO. WILL BE SWITCHED FM V.14 TO V.15
  UPON ARRIVAL AT "NAGOYA(MEIKO)".

//SPEED INTENTION//

ABOVE SCHEDULE IS CALCULATED WITH FOLLOWING SPEED BASIS.

FROM JAPAN TO SINGAPORE : 18 KT BASIS

FROM SINGAPORE TO SUEZ : ADJUSTING ETA SUEZ 0100LT 02ND FEB
(FROM LONGITUDE-60E TO LATITUDE-15N : 18.0 KT AT LEAST)

FROM ZEEBRUGGE TO MALMO : ADJUSTING AT EACH PORTS (18 KT BASIS)

FROM MALMO TO BREMERHAVEN : ECO SPEED BASIS

IF YOU HAVE ANY OBJECTION TO THE SCHEDULE ADVISED BY THE OPERATOR, OR SPEED INTENTION GIVEN IN EACH AREA, KINDLY INFORM THE OPERATOR IN TIMELY MANNER.

- SHOULD YOU HAVE ANY INCIDENT/TROUBLE/MAINTENANCE/REPAIR WHICH COULD AFFECT ABOVE SAILING SCHEDULE, PLS REPORT TO US.

AAA-1) CONFIRMATION OF THE SCHEDULE

WE WOULD LIKE YOU TO CONFIRM IF YOU ARE ABLE TO MANAGE WORK AND REST TIEM FOR YOUR CREWS WITH ABOVE SCHEDULE.
IF THERE IS ANY DIFFICULTY IN PLANNING OUT THE SCHEDULE, PLEASE ADVISE US IN ADVANCE SPECIFYING WHICH PART AND HOW THE SCHEDULE NEEDS TO BE RECONSIDERED.
AFTER OBTAINING YOUR PROPOSAL WE WOULD LIKE TO DISCUSS AND REARRANGE SCHEDULE AT OUR SIDE.

AAA-2) T/S INFORMATION

<T/S AT ZEEBRUGGE>
LEIXOES

BBB) BUNKERING
===============
AT JAPAN:
NIL

AT SINGAPORE:(MIN REACHABLE TO ZEEBRUGGE)
HFO - 770 MT
LSFO - 150 MT
*PLEASE ADVISE IF ANY CHANGE.

AT ZEEBRUGGE
LET'S DISCUSS LATER

BBB-1) IN CASE OF SHORTAGE OF BUNKER

IF THE BUNKER QUANTITY AT RECEIPT DOES NOT MATCH THE QUANTITY SOUNDED BY THE VSL, YOU ARE REQUESTED TO REPORT THE SHORTAGE

TO "LOCAL AGENT","FUEL TEAM", AND "OPERATOR IN TOKYO" IMMEDIATELY.
IN ADDITION, PLS TAKE FOLLOWING ACTIONS.

A. PLS AT FIRST NEGOTIATE THE BARGE TO TOP UP ADDITIONAL BUNKER TO MEET THE ORDERED AMOUNT.
HOWEVER, FURTHER NEGOTIATION UNNECESSARY WHEN CONSIDERED POSSIBLE DELAY TO THE VESSEL'S SCHEDULE.
WE WOULD LIKE TO AVOID ANY DELAYS IN THE VSL'S SAILING TIME.

B. IF YOU DETERMINE THAT YOU WILL BE UNABLE TO SETTLE THE TROUBLE,
PLS SIGN BUNKER DELIVERY NOTICE WITH THE REMARK.
(PLS NOTE, DO NOT SIGN WITHOUT THE REMARK.)

C. ADDING TO ABOVE, PLS MAKE A PROTEST LETTER WITH UTMOST SPECIFICATION OF THE SITUATION IN DETAIL.
ON THIS LETTER, PLS INCLUDE THE SIGNATURES OF THE REPRESENTATIVE OF THE BARGE AND VSL'S C/E.
IF THE BARGE REPRESENTATIVE REFUSE TO SIGN THIS PROTEST LETTER, PLS MAKE THE REMARK OF THIS STATUS AS WELL,
SUCH AS, "REFUSED TO SIGN"

BBB-2) SULFUR REGULATION IN GLOBAL CAP

1. BUNKER DELIVERY NOTE SHOULD BE KEPT ONBOARD.

2. BUNKER REQUISITION FM VESSEL SHOULD BE REQUESTED TO SPECIFY AS MAX 3.50% SULFUR CONTENT.

3. IF THE SULFUR CONTENT STATED ON THE BDN IS OVER 3.50% M/M, BUNKERING SHOULD NOT BE STARTED.
IN SUCH A CASE, THE VESSEL REPRESENTATIVE IS REQUESTED TO IMMEDIATELY INFORM THE OPERATOR PIC
AND THE SHIP MANAGER ABOUT THIS FACT AND ASK FOR THEIR INSTRUCTIONS.
SOF AND PROTEST LETTER SHOULD BE WRITTEN AND KEPT ONBOARD ALONG WITH ABOVE ACTION.
IF YOU DO NOT HAVE A BLANK PROTEST LETTER FORM, PLS KINDLY ADVISE US.

BBB-3) DNV BUNKER SAMPLING KIT

PLS ADVISE US WHEN DNV BUNKER SAMPLING KIT NECESSARY.

NOTE: NO NEED TO ANALYZE BUNKER SAMPLES SUPPLIED AT
JAPAN*, KOREA, AUSTRALIA AND NZ UNLESS OTHERWISE INSTRUCTED.

*AS WITH JAPAN, BELOW PORTS ARE EXCEPTIONAL THUS WHEN BUNKERING

AT BELOW PORTS, PLS DO CONDUCT BUNKER SAMPLING.
<EXCEPTIONAL PORTS>
KASHIMA, HITACHINAKA, ONAHAMA, HARAMACHI,
SOUMA, SENDAI, ISHINOMAKI, MIYAKO AND HACHINOE

CCC) NOON REPORT/VMF
======================

CCC-1) NOON REPORT

PLS SEND THE QRS NOON REPORT TO THE FOLLOWING ADDRESSES:

TO:
* nyk-report@sea.wni.com

CC:
* CAREUROPE@jp.nykline.com
* CARFLEET@jp.nykline.com
* THE NEXT PORT AGENT
* THE OPERATOR PIC

CCC-2) ETA NOTICE TO NYK LINE EUROPE RORO LONDON

AFTER SUEZ, NYK EU LONDON TAKES COASTAL OPERATION.
PLS SEND ALL POSITION REPORT TO 'caropmlon@ne.nykline.com' ADDRESS AFTER SAILING FROM LAST PORT IN JAPAN/FAR EAST.
AT THE SAME TIME PLS SEND SEPARATE MESSAGE ADVISING ETA SUEZ AND PERFORMANCE SPEED IN EUROPEAN WATERS.

OPERATOR IN CHARGE:
=====================
MR XXXXXX XXXXX
TEL (WORK): +44 XX XXXX XXXX
FAX (WORK): +44 XX XXXX XXXX
TEL (MOBILE): +44 XXXX XXXXXX
EMAIL: XXXX.XXXXXX@ne.nykline.com

OPERATOR IN CHARGE:
=====================
MR XXXXX XXXXXXXX
MR XXXXXX XXXXX
TEL (WORK): +44 XX XXXX XXXX
FAX (WORK): +44 XX XXXX XXXX
TEL (MOBILE): +44 XXXX XXXXXX
EMAIL: XXXX.XXXXXX@ne.nykline.com

OPERATOR IN CHARGE:
=====================
MR XXXXXX XXXXX
TEL (WORK): +44 XX XXXX XXXX
FAX (WORK): +44 XX XXXX XXXX
TEL (MOBILE): +44 XXXX XXXXXX
EMAIL: XXXX.XXXXXX@ne.nykline.com

MANAGER - INBOUND:
============================
MR XXXXXX XXXXX
TEL (WORK): +44 XX XXXX XXXX
FAX (WORK): +44 XX XXXX XXXX
TEL (MOBILE): +44 XXXX XXXXXX
EMAIL: XXXX.XXXXXX@ne.nykline.com

MARINE STOWAGE PLANNER:
===========================
MR XXXXXX XXXXX
TEL (WORK): +44 XX XXXX XXXX
FAX (WORK): +44 XX XXXX XXXX
TEL (MOBILE): +44 XXXX XXXXXX
EMAIL: XXXX.XXXXXX@ne.nykline.com

MANAGER - MARINE & QUALITY:
=============================
MR XXXXXX XXXXX
TEL (WORK): +44 XX XXXX XXXX
FAX (WORK): +44 XX XXXX XXXX
TEL (MOBILE): +44 XXXX XXXXXX
EMAIL: XXXX.XXXXXX@ne.nykline.com

CCC-3) VMF

WHEN YOU SEND US VMF DATA, PLS INCLUDE FOLLOWING ITEMS ON REMARKS.

[POB]
- ARR PILOT EMBARKED:
- DISEMBARKED:
- DEP PILOT EMBARKED:
- DISEMBARKED:
[TUG]
- ARR TUG USED:
- DEP TUG USED:
[CARGO]
- CARGO DISCHARGED:
- CARGO SHIFTED ON BOARD:

- CARGO LOADED:
- CARGO DAMAGED:
- CARGO NON-STARTED:

DDD) VSL PARTICULAR

=====================

VESSEL	: MV RIGEL LEADER
OWNER	: xxx XXXXXXXX XXXXX X S.A.
SHIP'S MANAGEMENT COMPANY	: NYK SHIPMANAGEMENT
BUILT	: 2012.03
FLAG	: PANAMA
CALL SIGN	: XXXXX
G/T	: (INTL)59,694/(JPN)38,001
N/T	: 19,122
D/W	: 18,884 M/T
LOA	: 199.97 M
B(MD)	: 32.26 M
D(MD)	: 34.48 M (ACC DK)
DRAFT(SUMMER)	: 10.017 M
INMARSAT - (TEL)	: XXXXXXXX
Back-up INMARSAT	: xxxxxxxxx
INMARSAT - (FAX)	: xxxxxxxxx
INMARSAT C	: 437303510
E-MAIL	: rigelleader@xxxxxxx.xxx
BOW TO BRIDGE FRONT	: 21.6 M
BOW TO SIDE PORT	: 98.4 M
BOW TO STERN PORT(S)	: 194.6 M
KEEL TO TOP OF MAST	: 48.7M (NORMAL) / 45.72M (Folded)
MIDSHIP CAR LADDER	: 17.00 x 4.50M x 1SET (Loadable 15T)
STERN CAR LADDER	: 32.00 x 8.00M x 1SET (Loadable 80 TON)
MAIN ENGINE	: 8UEC60LSII-ECO
B.THR	: 1350 KW
CLASS	: NK
OFFICIAL NO.	: 43708-12
LLOYD'S NO.(IMO NO.)	: 9604940
MMSI NO.	: 373035000
P&I	: UK P&I
SUEZ NET TONNAGE	: 60224.48

PLS CHECK THE ABOVE CONTENTS AND IF ANY CHANGE, PLS LET US KNOW.

EEE) ATTENTION

=================

FFF) //SPECIAL ATTENTION// ADDITIONAL REMARKS FROM CAREUROPE
==

- DELETED -

GGG) EXTRA WORK FEE
=====================

WE WILL ARRANGE EXTRA WORK FEE IN CASE BELOW EXTRA WORKS
HAD BEEN CARRIED OUT BY CREW.
THEREFORE, PLEASE PREPARE "WORKING REPORT"(SEE EXAMPLE)
UPON COMPLETION BUT NO LATER THAN 1 MONTH.

// EXAMPLE - WORKING REPORT //

WE HAVE CARRIED OUT FOLLOWING EXTRA WORK ON "DD/MM/YYYY"
(DATE/MONTH/YEAR) AT VOY.XX (VOYAGE NUMBER).

- REMOVAL OF CAR LASHING MATERIALS
- SWEEPING OF CAR DECKS
- RIGGING OF CAR RAMPS/LIFTABLE DECKS
- INSTALLATION & REMOVAL OF FUNNEL MESH FILTER AT NAGOYA(MEIKO)
  (*) WE CONSIDER BOTH INSTALLATION & REMOVAL OF FUNNEL MESH FILTER
  ON ALL THE FUNNELS TO BE A SET WORK.
- TAKING PREVENTION OF SHORT/OVERLANDING

HHH) PERSON IN CHARGE
======================

/// IMPORTANT ///

==
MARINE ACCIDENT - CONTACT NUMBERS ON EMERGENCY
==

IN AN EMERGENCY, i.e. OIL SPILL, COLLISION, STRANDING, BURNING, DEAD SHIP,
INJURY ACCIDENT AND OTHER TROUBLES WHICH WERE CONSIDERED AS AN EMERGENCY BY
MASTER,
YOU ARE KINDLY REQUESTED TO CALL PIC OF MARINE/TECHNICAL REGARDLESS OF
ANY TIME DIFFERENCE.
IN CASE ABOVE PERSON IS NOT AVAILABLE, PLS CONTACT TO PIC OF OPERATION OR
MARKETING.

1) MARINE/TECHNICAL AND STOWAGE

MR XXXXXX XXXXX
TEL (WORK): +44 XX XXXX XXXX
FAX (WORK): +44 XX XXXX XXXX
TEL (MOBILE): +44 XXXX XXXXXX
EMAIL: XXXX.XXXXXX@ne.nykline.com

2) OPERATION / PERSON IN CHARGE
MR XXXXXX XXXXX
TEL (WORK): +44 XX XXXX XXXX
FAX (WORK): +44 XX XXXX XXXX
TEL (MOBILE): +44 XXXX XXXXXX
EMAIL: XXXX.XXXXXX@ne.nykline.com

3) MARKETING

MR XXXXXX XXXXX
TEL (WORK): +44 XX XXXX XXXX
FAX (WORK): +44 XX XXXX XXXX
TEL (MOBILE): +44 XXXX XXXXXX
EMAIL: XXXX.XXXXXX@ne.nykline.com

A CONFIRMATION REPORT BY E-MAIL OR FAX SHOULD FOLLOW, BUT
DO NOT USE E-MAIL OR FAX AS THE PRIMARY MEANS OF REPORTING.

AS FOR OTHER THAN ABOVE MARINE ACCIDENTS, PLEASE CONTACT
PIC OF OPERATIONS FIRST.

PLS CONFIRM THE SAFE RECEIPT OF THIS MESSAGE.

WE TAKE THIS OPPORTUNITY TO WISH YOU, YR OFFICER AND CREW A SAFE AND
PLEASANT VOYAGE.
REGARDS/CAREUROPE

APPENDIX 2: Site Plan of car manufacturing plant with an outdoor loading dock near the parking area of the manufactured cars