T.C. ISTANBUL AYDIN UNIVERSITY
INSTITUTE OF SOCIAL SCIENCES

THE ROLE OF INTERMODAL TERMINALS IN LOGISTICS AND PROPOSAL FOR INTERMODAL TERMINAL IN ISTANBUL

MASTER THESIS

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With special thanks to my family,

FOREWORD

The growth of logistics sector is speeding up by consumption enhancement. Logistic companies are looking for a way to be efficient and affordable transportation. The critical issue regarding this subject is intermodal terminals. These terminals are effective enough to determine transportation corridors. The strategic advantages of Istanbul, its developing economy and existence of industrial area are good reasons to establish an intermodal terminal in Istanbul. The purpose of this thesis is to propose a cover for the need of intermodal terminal and determine the details, characteristics, situation and position of it.

JUNE 2015 Salih NUHOĞLU

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Abbreviations

ADB: African Development Bank

AH: African Highway

ALTID: Asian Land Transport Infrastructure Development

CEF: Common European Framework

COFC: Container on Flatcar

COSCO: China Ocean Shipping Company

DWT: Deadweight long tons

EC: European Commission

ECMT: European Conference of Ministers of Transport

EEA: European Economic Area

EFTA: European Free Trade Association

ERTMS: European Rail Traffic Management System

ESCAP: Economic and Social Commission for Asia and the Pacific

EU: European Union

EUR: Euro

GNP: Gross national product

IGA: Intergovernmental agreement

IGC: Intergovernmental Commission

IMM: Istanbul Metropolitan Municipality

ISO: Istanbul Chamber of Industry

ITU: Intermodal transport unit

IWW: Inland waterway

JIT: Just in time

KM: kilometers

LO-LO: Lift on Lift off

M: Meters

MEDA: Mediterranean and Trans European Network

MOU: Memorandum of understanding

NIS: New Independent States

OECD: Organization for Economic Co-operation and Development

PPP: Public–private partnership

R&D: Research and development

RO-LA: Rolling Road

RO-RO: Roll on Roll off

SQ: square

TAH: Trans African Highways

TAR: Trans African Railway

TCDD: Türkiye Cumhuriyeti Devlet Demiryolları

TEM: Trans European Motorways

TEN-T: Trans-European Transport Network

TER: Trans European Railway

TEU: Twenty-foot equivalent unit

TOFC: Trailer on flatcar

TRACECA: Transport Corridor Europe-Caucasus-Asia

UNCTAD: United Nations Conference on Trade and Development

UNDP: United Nations Development Program

UNECA: United Nations Economic Commission for Africa

UNECE OR ECE: United Nations Economic Commission for Europe

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ÖZET

Dünyanın artık küresel köy olarak anılmasında lojistik süreçlerin payı çok büyüktür. Lojistik tüketimle doğru orantılı şekilde artan bir yapıya sahiptir. Dünyada ticaret hacmi 16 trilyon dolara, lojistik hacim ise 6,4 trilyon dolara ulaşmıştır. Yani ticaret hacminin yaklaşık yüzde 40'ı lojistik faaliyetlerden oluşmaktadır.

Türkiye 600 milyar dolarlık mal hareketi içinde yer alan bir konuma sahiptir. Üç tarafı denizlerle çevrili, Asya Avrupa bağlantısı, Karadeniz ve Akdeniz de önemli rolü ile Türkiye lojistik faaliyetlerin odağı olabilecek durumdadır. 2023 hedeflerinde Türkiye lojistikte İstanbul'u merkez haline getirme hedefi belirlemiştir. Bu misyonu üstlenebilmesi için intermodal taşımacılık ağlarını ve intermodal terminalleri güçlendirmesi gerekmektedir.

Bu tezin ilk kısmında intermodal taşımacılığın doğuşuna sebep olan konteynır ve tipleri araştırılmıştır. Konteynırın bulusuyla iş gücündeki hafifleme modlar arası geçiş kolaylaştırmış bununla birlikte fazladan yükleme boşaltma işlemi olmadan taşımacılık modları arası bağlantılar artmıştır. Konteynırın taşımacılık üzerindeki olumlu etkisiyle birlikte modlar arası geçişi sağlamak üzere çeşitli operasyonlar da kullanılmıştır. Örneğin; Bimodal system Trailer-Train. Bu tür süreçlerde taşıma modlarının birbirine entegresi sağlanmıştır. Taşımacılık süreçlerinin azalmasına neden olan bu operasyonlarla birlikte maliyetler azalmıştır. Son kullanıcıya uzanan teslim suresi azalmış ticaret hacimleri genişlemiştir. Konteynır ve taşıma entegre modlarıyla birlikte dünyada intermodal ve taşımacılık radikal değişikliklere uğramıştır.

Tezin ikinci bölümünde intermodal taşımacılık ağları detaylı bir şekilde ele alınmıştır. Radikal değişiklikler sonucunda intermodal taşımacılık artmış ve bu süreçleri dünya kurduğu taşımacılık ağları üzerinden yönetmiştir. Trans-Avrupa taşımacılık ağı bu anlamda bilinen en yaygın ağlardandır. Her taşımacılık ağı kendi içinde koridorlara ayrılmış ve bu koridorlar üzerinde ana merkezler belirlenmiştir. Bu

sayede bu ağlar üzerinden ticaret genişlemiş rota üzerinde bulunan ülkeler bu yönden güçlü altyapıya sahip olmuşlardır.

Tezin üçüncü bölümünde intermodal terminaller ele alınmıştır. Bu bağlamda taşıma ağları üzerinde bulunan intermodal terminaller incelenmiştir. İntermodal terminallere en güzel örneklerden biri olan limanlar incelenmiş dünyada ve Türkiye'de intermodal terminaller ele alınmıştır. İstatistiki bilgilerle durum karşılaştırılmış altyapı eksiklikleri ortaya çıkarılmıştır.

Tezin dördüncü bölümünde Türkiye'de intermodal terminallerin durumu incelenmiştir. Mevcut devlet desteğine ve TCDD yatırımlarına rağmen intermodal terminallerin henüz kendi kapasitelerine çıkamadığı tespit edilmiştir. Türkiye'nin coğrafi konumu ve dünya mal hareket geçişinin ortasında olması nedeniyle intermodal terminal ve intermodal taşımacılık projelerinin daha ivmeli bir şekilde devam ettirilmesi gereği görülmüştür.

Tezin son bölümünde dünyada ve Türkiye'de lojistik ve ticaret verileri karşılaştırılmıştır. Türkiye'de kurulması gerekli olan intermodal terminal önerilmiş ve bunun İstanbul'a kurulması savunulmuştur. Bu bölümde intermodal terminalin nasıl olması gerektiği ve neden İstanbul'un kuzeyine kurulması gerektiği savunulmuştur.

3. Havalimanı olarak adlandırılan ve yaklaşık yıllık 150 milyon yolcu kapasitesiyle dünyanın en büyük projelerinden olan bu havalimanı Türkiye'nin hava taşıma anlamında rekabet gücünü ciddi anlamda artıracak ve ülkeyi ciddi anlamda bir hava kargo merkezi haline getirecektir. Diğer yandan yapımı devam eden Yavuz Sultan Selim köprüsü ve yolları üzerinden Asya-Avrupa bağlantısında bir otoyol daha açılacak olup İstanbul'un bu yönden gücünü arttıracaktır. Ayrıca bu köprü üzerinde yapılacak olan tren projesiyle Anadolu'dan Avrupa'ya ve tersi istikamette mal hareketi hızlanacak ve maliyetler düşecektir. Bir diğer yandan henüz projelendirme aşamasında olan Kanal İstanbul projesinin hemen yanında önerilen intermodal terminal deniz yolunda boğaz trafiğine takılmadan geçiş sağlayacaktır. Bu tezde İstanbul'a kurulaması önerilen intermodal terminal bahsedilen bütün bu avantajları içerisinde toplayacak olup konumu itibariyle ayriyeten bir liman projesidir.

Anahtar Sözcükler

1. Intermodal terminal
2. Koridor
3. Lojistik
4. Taşımacılık
5. İstanbul

THE ROLE OF INTERMODAL TERMINALS IN LOGİSTICS AND PROPOSAL FOR INTERMODAL TERMINAL IN ISTANBUL

ABSTRACT

The role of logistics process in calling the world as global village is a lot. Logistics as a growing structure is directly proportional to the consumption. World trade volume increased to 16 trillion dollar and logistics volume reached to 6.4 trillion dollar. So about 40 percent of the trade volume consists of logistic activities.

Turkey has a location within 600 billion worth of goods movement. Surrounded on three sides by the sea, connecting Asia and Europe and by its important role in Black Sea and the Mediterranean Sea, Turkey is in a situation to be a centre for logistics activities. In 2023 Turkey has set a target goal to make Istanbul a center of logistics. In order to undertake this mission Turkey must strengthen the intermodal transport network and intermodal terminals.

In this study, intermodal transport in the world and Turkey, these types of transport networks and intermodal terminals were investigated. However, an intermodal terminal is proposed to be made in Istanbul.

Key words

1. Intermodal terminal
2. Corridor
3. Logistics
4. Transportation
5. Istanbul

1. INTRODUCTION

Intermodal transportation is one of the new methods in international trade. Due to effective globalization, International trade grows rapidly. The survey includes the features of transportation corridors which are usually used by intermodal transportation all over the world and especially in Turkey. At the same time the intermodal terminals that are using ports have been investigated and compared by using statistical figures.

Logistic process has a huge role in calling the world as global village. Logistic has a direct relation with consumption. World trade volume increased to 16 trillion dollar and logistics volume reached to 6.4 trillion dollar. So about 40 percent of the trade volume consists of logistic activities.

In 2023 national income in Turkey would be 2 trillion dollars; national income per person would be 25 thousand dollars. The predicted goal for Turkey is to increase export rate to 500 milliard dollars and to be one of top 10 economy of the world.

Turkey has a location in which 600 billion worth of goods could be moved in it. Surrounded on three sides by the sea, connecting Asia and Europe and by its important role in Black Sea and the Mediterranean Sea, Turkey is in a situation to be a centre for logistic activities. According to government master plans for 2023, Istanbul is predicted to be logistic hub of the world. So Turkey should be able to empower intermodal transport network and intermodal terminals.

Total demand for container handling in Turkey is estimated to be 10.7 million TEU in 2015 and in 2030 will be 39.9 million TEU. 9 million TEU capacities seem to be sufficient until 2014. Turkey needs new container handling capacity. This capacity is possible by new project or expansions of existing port terminals.
Logistic performance index (LPI) is the critical issue about the effect of international trade from logistics. According to a research in 2014 Turkey is located in the 30^{th} row of LPI list. The LPI analyze is based on many issues which are; the activity of

customs, the necessity of infrastructure trade and transport, the decreased bureaucracy of shipment, the adequate capacity of logistics services—trucking, forwarding, and customs brokerage, following up shipment and delivery time(The World Bank; 2012).

In 2012 Turkey is the biggest exporter of goods with the amount of 153 billion dollar also Turkey is the 15th biggest importer with the amount of 237 billion in the world. In the meantime it is the 17th biggest service exporter with the amount of 42 billion also our country is the 27th biggest service importer with the amount of 19 billion dollar (World Trade Organization; 2012).

Factors that will affect the future of the World Trade which are; Trends in International Trade, Economic Factors Affecting International Trade; Openness to trade and wide socio-economic context and Prospects for the Multilateral Trade Cooperation(World Trade Organization; 2012).

The volume of the logistics industry reached 8 trillion dollar in the world, the industry is estimated to reach to 10-12 trillion dollars in 2015. Turkey has to get a share from this industry using strategic position.

According to research of JLL, with the effect of increasing foreign investment in the logistics industry is expected to grow 48 percent in 5 years. According to same research Turkey the fastest growing logistics was second after Russia.

One of the biggest problems of the logistics sector is Turkish logistics sector doesn't increase parallel with the volume of foreign trade developed at the same rate.

75% of the logistics activities in our country is currently engaged in manufacturing firms are covered by the resources in their internal structure. This action prevents the development of the logistics industry and sector cannot afford the desired level.

Despite Turkey is located on world trade way, it does not have the ability of giving logistical service to the other countries because of lack of infrastructure. That why this thesis offers an intermodal terminal which can easily reach intermodal transportation network. This terminal would be world's biggest intermodal terminal which includes four main logistical activities.

Turkey's logistic details were investigated and compared with World's. According to this research, generally in Turkey especially in Istanbul the need for an intermodal terminal is obvious and this terminal is highly offered to get started as a huge project. Finally the physical situation and location of the project is offered and the explanation of why this location is selected is given at the end.

2. INTERMODAL TRANSPORTATION

Intermodal transportation is a term to explain the connection of two or more transportation types which work together in order to freight a cargo from origin to the last user which is at the destination. This procedure initially started by containers (Novack, 2006; 211).

Intermodal freight transport is activity in which cargos deliver on one unit. This activity happens between two or more transportation types without handling the cargo itself (European Conference of Ministers of Transport (ECMT) and European Commission (EC), 2001; 17).

The critical factors for intermodal operators and companies is point-to-point bundling concept which should be affordable trustworthy. Point-to-point bundling is a procedure in which the cargo that is load at the origin on the train totally goes to destination point (Bontekoning, 2006, 1).

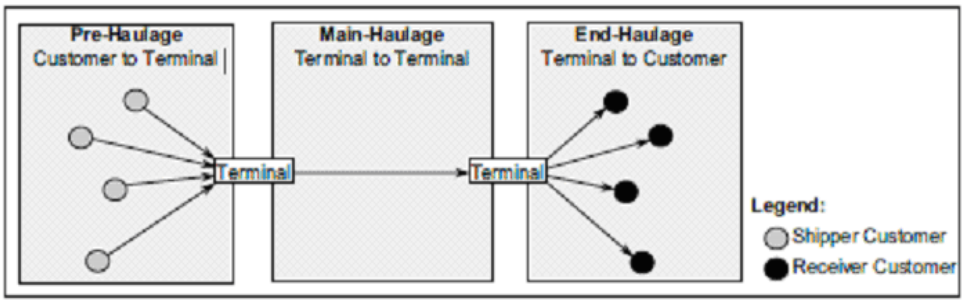
According to combined transport technology have prepared with the of The United Nations Economic Commission for Europe (UNECE or ECE), European Conference of Ministers of Transport (ECMT) and European Commission (EC) intermodal transportation is kind of transportation without classification, same loading unit (for example container) and two or more than transportation modes (UNECE, 2001).

According to European Union (EU) intermodalism is to provide a back field warranty of different shipping models in order to respond customer demands offering door-to-door service, this means that the transportation system will work adequately and profitably while encouraging between competitors (Bektaş, 2007; 2).

The transshipment yards are the designed terminals which specially used for changing the transportation modes by transferring the loading units without discharging the freight itself (Nossack, 2013; 2).

Intermodal transportation has three levels; first is pre-haulage, second is main-haulage and last one is end-haulage which refers to first step customer to terminal, second terminal to terminal and terminal to customer (refer to table1.1).
Table 1.1 refers to intermodal freight transportation.

Tab. 1.1: Intermodal Freight Transportation (Nossack, 2013; 2).



2.1 CONTAINER

Containers are produced of steel box-shaped in order to carry or transfer goods in a safe way which can be carried on truck, train and ship between international transportation units.

The improvement of the intermodalism is because of developing entrance of containers. Malcolm McLean is a successful truck line owner, he create the fact of using a trailer to freight by both highway and seaways in the mid-1950s. He is created the operation improved and at the end it became to be one of the largest seaways carriers (Coyle, 2010; 211).

The most important role in intermodal transportation development was the role of containers. Container is a kind of transportation unit that different kinds of goods could be load on it facilitates the transferring job between different transportation types and this procedure is a time and money saving. Also safe load and discharge is another advantages of this procedure.

In International Convention for Safe Containers (Geneva, 2 December 1972);

1. "Container" means an article of transport equipment:

(a) Of a stable texture and in respect of that suitable for repeated use,

(b) Designed to ease the transportation of goods by one or more types of shipping without loading over and over,

(c) Suitable use by supporting corners for secure,

(d) For main types it has an area which is closed by four sides.

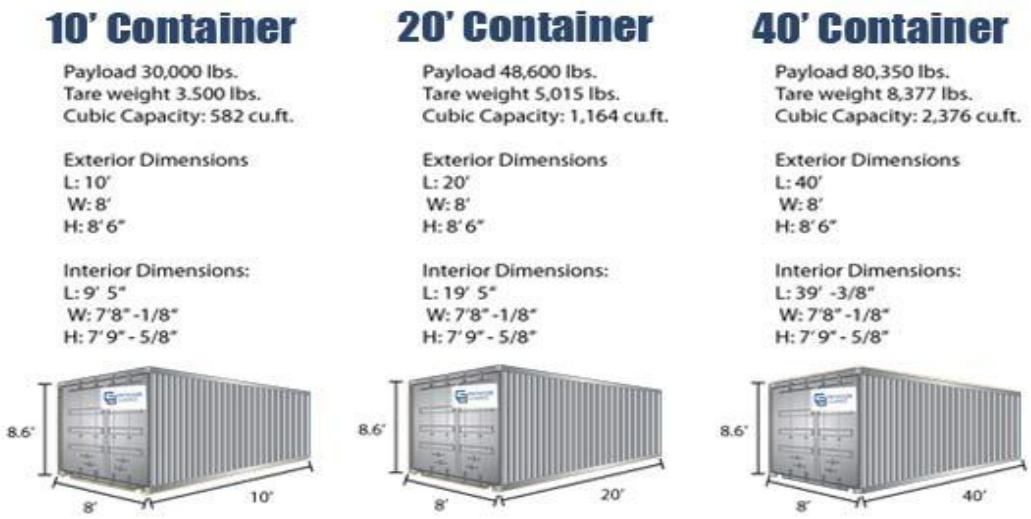
(i) At least 14 sq. m. (150 sq. ft.) or

(ii) At least 7 sq. m. (75 sq. ft.) if it is fitted with top corner fittings;

Container are used on wheel vehicle they do not include vehicles and packaging.

Table 1.2 refers to Container Alliance firm of rental container size and types.

Tab. 1.2: Container sizes (Container Alliance - The Storage & Shipping Container Network; http://www.containeralliance.com/california-container-rentals.php; 10.03.2014)



Container causes radical changes in world marine sector. For example in traditional discharge system discharging 40.000 tons needs 24.000 man/time but container ships needs 750 man/time for discharging the same amount. Previously ships waits for discharge 25 days, this period decreased just two days by the use of containers (Slack,2001:143 Transmitting:Muhteşem Kaynak-Hülya Zeybek, Logistics Centers in intermodal terminals Development, Distribution and State Parks in Turkey;2007;42).

2.1.1 Container Usage

Intermodal is a transportation mode which includes two or more different kinds of shipping methods. When goods from one to another type of transportation the risk of damaging and loss would happen, also more time would be waste. Main challenge is to minimize the transit time. The company has to manage handling cost in order to decrease transportation cost. That's why using container is essential.

In order to minimize waiting time the usage of same containers is prefered, this is one of the updated technology which is newly founded to standardize transportation. In addition companies prefer systematic transfer firstly; they use trailers in order to transfer cargos. This is going to be very safe and fast from a truck to the train. Suitable ways to ensure the security of goods are containers. The only difficulty is the weight of containers which are hard to be transported. The rail containers are lighter than sea containers these two forms usually come together with road transportation. After that to transfer the cargo between two modes the carriers are used two develop the activity. Even in some cases the whole truck is transported by train (Gourdin, 2001 Transmitting Prokopowicz; Outsourcing in Transportation; 2010; 9).

Figure 1.1, 1.2, 1.3 refers to world container fleet annual tonnage changes as 1998-2012, tonnage additions and idle container fleets 2008-2012.

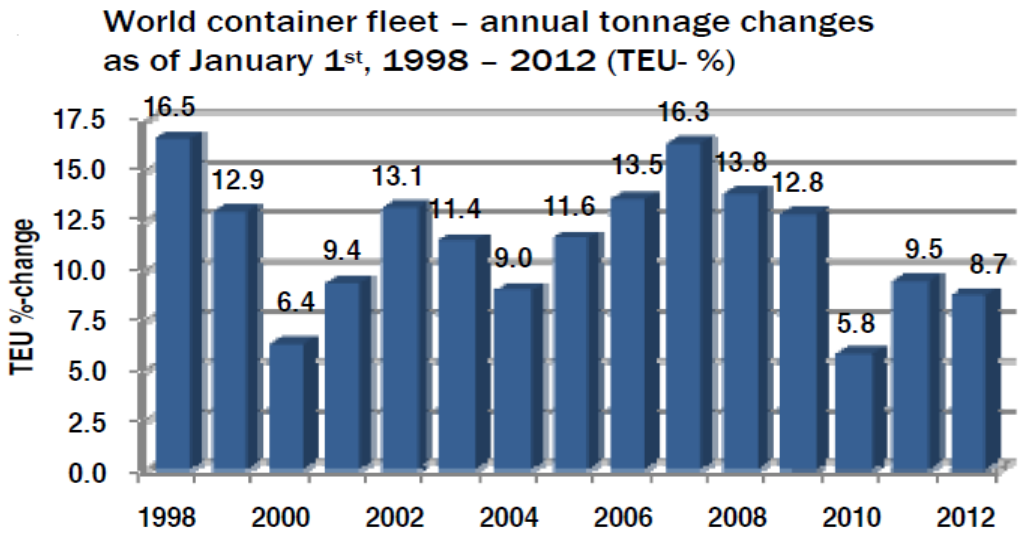


Fig.1.1 Container usage rates (ISL Shipping Statistics and Market Review; 2012)

The figure 1.1 is an explanation for world container fleet annual tonnage changes comparing to the previous year. For example in 2002 the increase rate was 13.1 comparing to 2001. Between 1998 and 2012 world container fleet increased to 500%. The pick of this figure is in 1998.

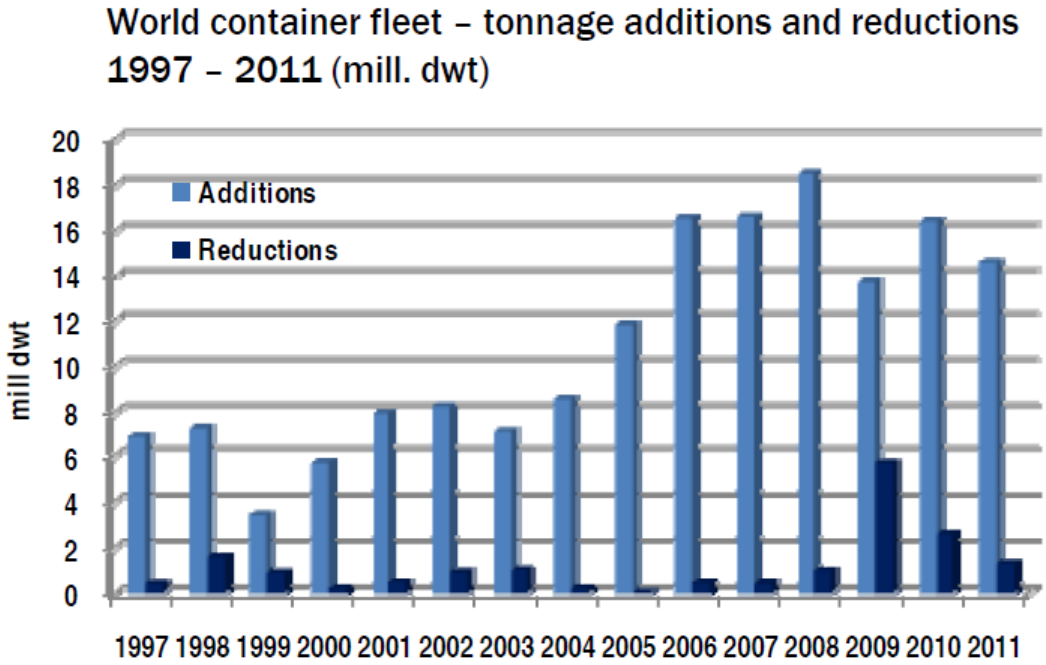


Fig. 1.2 Container usage (ISL Shipping Statistics and Market; 2012)

According to figure 1.2 the huge change happened two times. The first one was between 1999 and 2000 and the second one was happened 2004 and 2005. The highest amount was in 2008. The amount was more than 18 million mt. The highest reduction was in 2009.

Figure 1.3 we can see idle container fleet between 2008 and 2012. The reason that figure is between 2008 and 2012 is a big chance that happened in 2009. In 2009 global economic crisis directly affected shipping sector.

Figure 1.3 refers to idle container fleet rates.

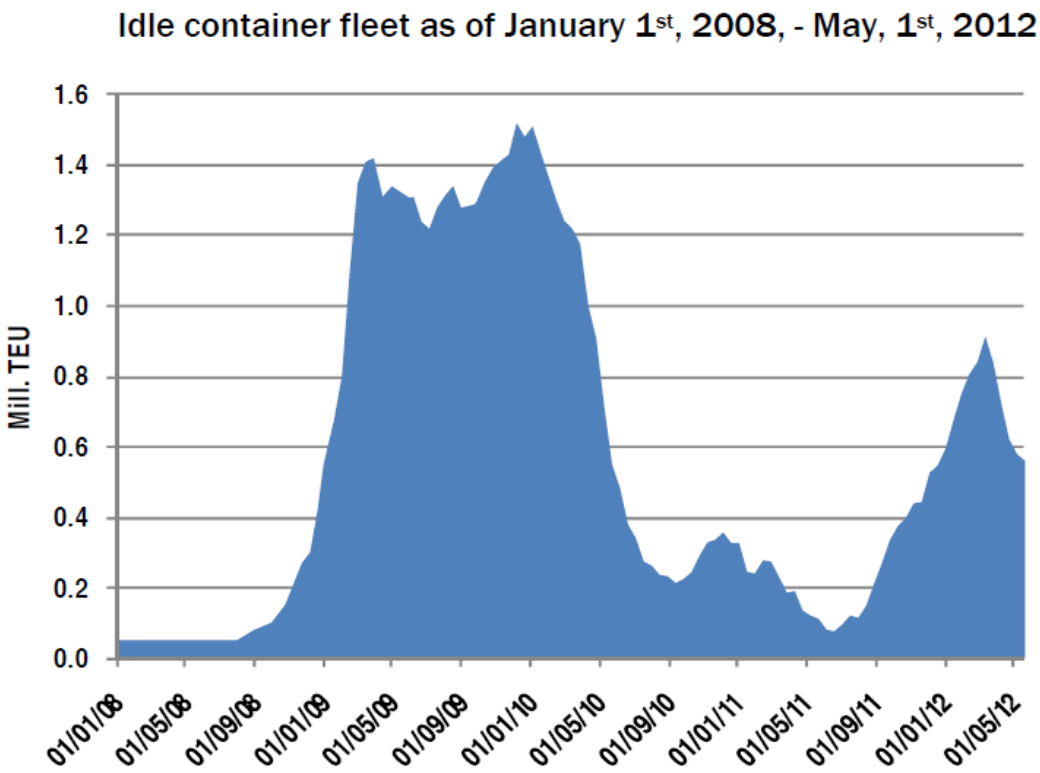


Fig. 1.3 Idle container fleet rates (ISL Shipping Statistics and Market Review; 2012)

Table 1.3 refers to container traffic volumes of top 20 countries in 2010. The highest numbers of container exist in China. The next one is United States with the amount of 38.5 million TEU which is less than half amount of China.

Table 1.3 refers to Container Traffic Volumes

Tab.1.3 Container Traffic Volumes (CHO and YANG, 2011;161).

Rank	Country	Amount	Rank	Country	Amount
1	China	88,548,470 TEU	11	Spain	9,170,109 TEU
2	United States	38,519,040 TEU	12	United Kingdom	8,598,891 TEU
3	Singapore	23,192,200 TEU	13	Belgium	7,889,994 TEU
4	Japan	16,777,410 TEU	14	Brazil	5,598,110 TEU
5	Korea	15,113,280 TEU	15	Indonesia	5,503,176 TEU
6	Germany	13,507,040 TEU	16	Thailand	5,115,213 TEU
7	Malaysia	12,027,050 TEU	17	India	4,938,226 TEU
8	Italy	9,855,451 TEU	18	Australia	4,830,254 TEU
9	UAE	9,845,930 TEU	19	Canada	4,163,424 TEU
10	Netherlands	9,520,844 TEU	20	France	3,839,739 TEU

Figure 1.4 refers to world container traffics yearly (million TEUs). The crisis in 2009 is obviously found in figure 1.4. The highest amount of world container traffic was 500 million TEU till 2009.

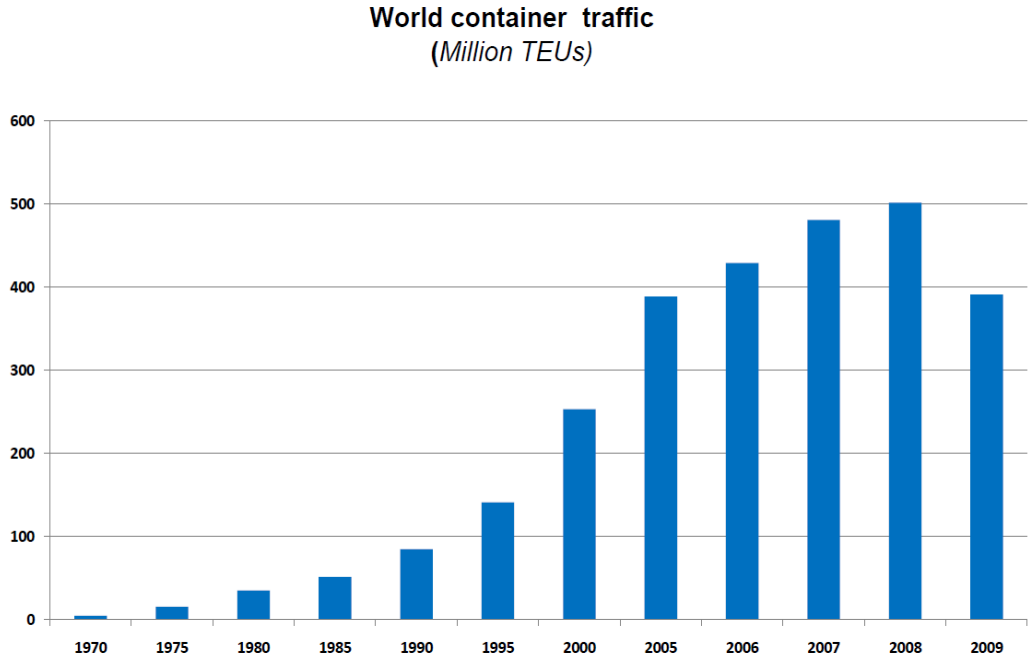


Fig.1.4 World container traffic (Source: International Transport Forum; 2010)

2.2 INTERMODAL TRANSPORT UNIT (ITU)

Intermodal transport unit (ITU) is a term that defines different types of units that load goods. The ITUs parts are containers, swap bodies, semi-trailers and roll-on frame.

The most common ITU types are shown schematically in the below figure.

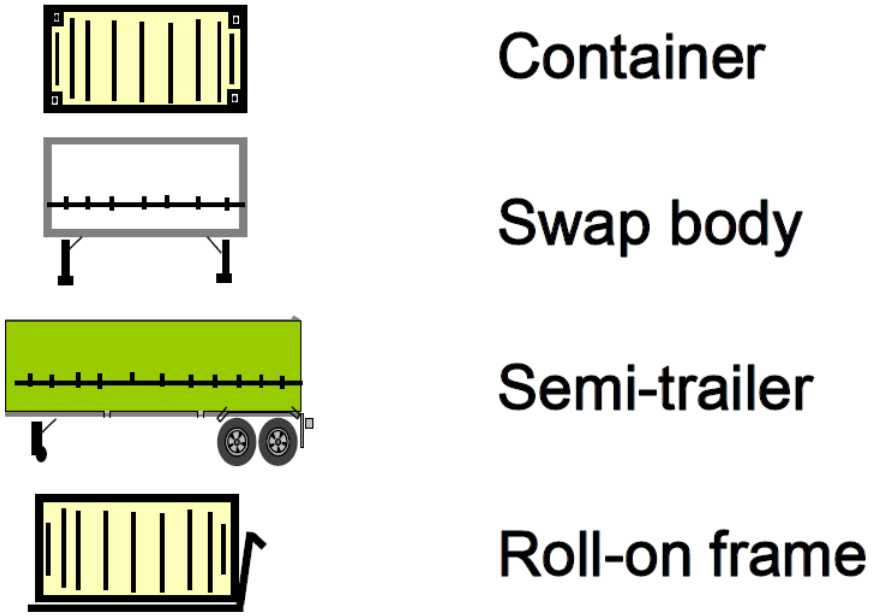


Fig.1.5 Intermodal Transport Unit Types

2.2.1 Container

Container is a transportation unit which transports goods easily without loading or discharging during transportation procedure.

The different between container and swap body is that each container can be top-lifted and stacked one on the other but this characteristic does not exists swap body. The size of main unit is 6.10 and 12.20 meters (20 and 40 feet) and they are normally used for rail forwarding and Lo-Lo shipping. In shipping sector for measuring capacity and movements TEU is used which is equal to twenty foot equivalent units (Woxenius, Kania and Podsiadly , 2006;3).

Some types of containers are dry freight containers, refrigerator containers, open top containers and flat-rack containers.

2.2.2 Swap Bodies

Swap bodies are used in European countries for an intermodal/multimodal transportation purpose. For national movements, As long as the sizes of trucks are different, the containers should be standards and fit for them.

The sizes of normal swap bodies are 7.15; 7.45 or 7.82 mt. Some companies have different size of containers also. Due to the inadequate legs they are not very harmonious with Ro-Ro shipping

2.2.3 Semi-Trailers

The size of semi-trailer is 13.6 meters. Road transportation companies commonly use semi-trailers. Also Ferry and Ro-Ro ports used them a lot.

2.2.4 Roll-on Frame

Usually Roll-on/roll-off containers are used for waste in order to receive, store and transport them. In roll-on frame activity the container is not covered that's why it's not safety regarding to its design.

2.3 UNACCOMPANIED TRANSPORT

The most common forms of transport are containers, swap bodies and semi-trailers. In the most countries unaccompanied transport has 80 percent of market share in which only the loading units are transported by rail. Transport of maritime containers which include inland rails has 90% market share in the most countries of the world.

In order to make unaccompanied transport some details are needed which are technical, organizational and infrastructure preparations. For unaccompanied transport in road haulage and freight forwarders mobile or gantry crane should be used. This activity is called vertical transshipment. The normal vehicles are cheaper than road vehicles with swap bodies and semi-trailers. A haulier duty is to get the container from the origin and transferred to the final destination. Many transportation companies improve their activities by managing their own offices and finding trustworthy partners (Focus on Combined Transport, 1995; 4).

Figure 1.6 shows an example of unaccompanied transport.

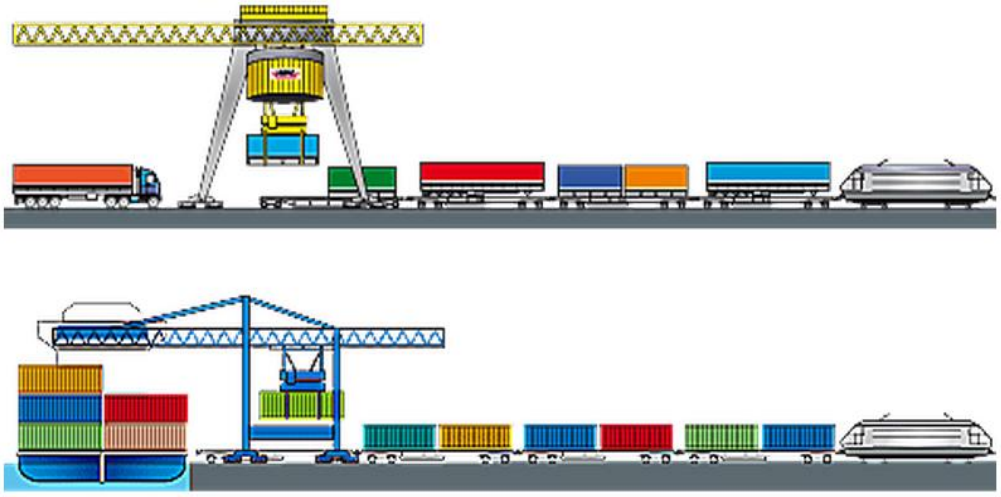


Fig. 1.6: Unaccompanied Transport
(http://www.hupac.ch/index.php?node=333&lng=2&rif=fc18cbf50c; 10.03.2014)

2.4 ROLLING ROAD (ROLA) - ACCOMPANIED COMBINED TRANSPORT

Ro-La transportation system is a process in which transport road vehicles (trucks) on trains including low-floor wagons. On transportation procedure the drivers stay in their couchettes.

The trucks are transferred in terminals thought mobile ramps. The vehicles should have specific requirements applicable to the category.

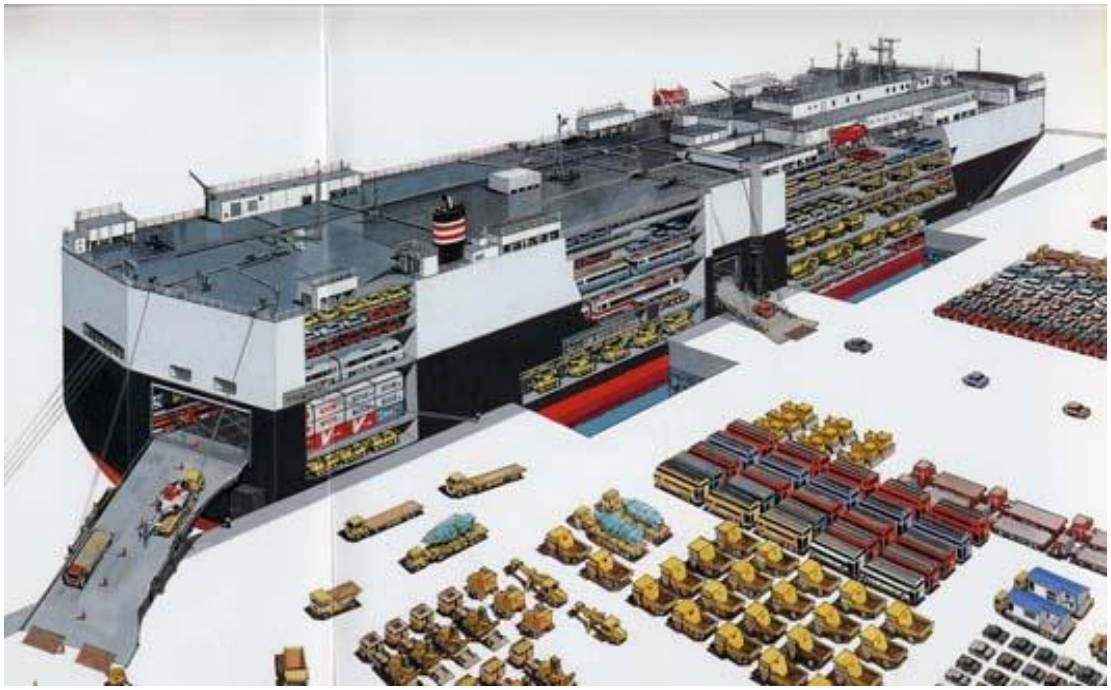
The advantages of RO-LA system is that it is too easy and quick to load and unload. It is quite convenient especially in situations that require rapid delivery and it is suitable for the distances between 200-400 km transportation. Figure 1.7 refers to rolling road system.

Fig. 1.7 Rolling Road (RO-LA)
(http://www.sbbcargo-international.com/en/rolling-highway-rola.html; 20.02.2014)

2.5 ROLL ON, ROLL OFF (RO-RO) SHIPPING

Ro-Ro is a shortening of "roll on, roll off". Ro-Ro procedure is about the transportation vehicles and machinery by huge ocean ships. Roll-on/roll-off (RORO or ro-ro) ships are produced for transporting wheeled cargo like automobiles, trucks, semi-trailer trucks, trailers, and railroad cars without using handling operation. This procedure is opposite of lift-on/lift-off (LOLO) vessels that is using for crane to handling (Sorgenfrei, 2013; 34).

In RO-RO vessels there are doors that can be open and close so they can be used as ramps for cargos in order to be load and discharge simply at ports. There are smaller ferries that also have built in ramps which move across rivers and other short distances but the term RO-RO usually could be used for larger oceangoing vessels. The ramps and doors may be stern-only, or bow and stern for quick loading. Picture 1.1 refers to type of RO-RO shipping system.



Picture 1.1: RO-RO Shipping (http://aaronpb.com/?page_id=33;10.03.2014)

2.6 PIGGYBACK TRANSPORTATION

Piggyback transportation is a kind of transportation in which has two types. one of them is trailers on flatcars (TOFC), the other one is containers in flatcars (COFC) . This transportation is on railways. Moreover in double-stack transportation two containers at the same time place loaded onto one flatcar (train). The usage of double-stack transportation is; increasing the operating efficiency and reducing the cost per container (Coyle, 2003; 212).

According to figure 1.8 piggyback transportation include two types. One of them is side by side on the train. The other type is double stack. In double stack one container located on the top of the other one.

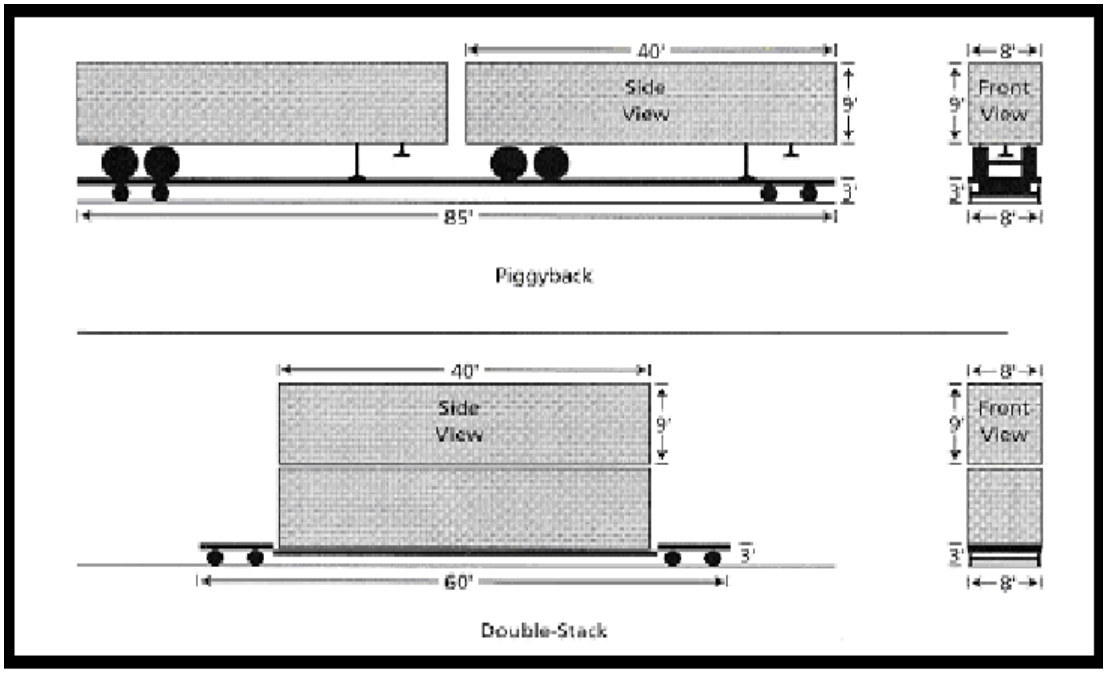


Fig. 1.8 Piggyback Transportation (Coyle, 2003; 212).

2.7 BI-MODAL TRANSPORTATION-ROADRAILER

Bimodal transport is a kind of transportation that cargo is being load on pallets or containers which are load on road-railway or ship. This procedure is not related to the cargo handling objects.

Bimodal transportation has advantages is transporting without needing any special handling process and built terminals in between railway and road (Strumberger, 1998; 89).

In the majority of minor railway stations there are paved parts of tracks as well as auxiliary tracks which provide the necessary space for handling manipulations from road to railway and vice versa.

Bimodal system is a procedure between trailer and train as shown in the figure blow.
Part I: Position the frame of the rear adapter on the bogie and position the front trailer.
Part II: Mount the first trailer on the rear adapter frame.

Part III: Lift the wheels for road usage. Lower the supports, push backwards, and pull out the tractor.

Part IV: Position the next undercarriage and trailer.

Part V: Mount the trailer on the bogie.

Part VI: Connect the trailers.

Part VII: Position the front adapter, join and connect the engine.

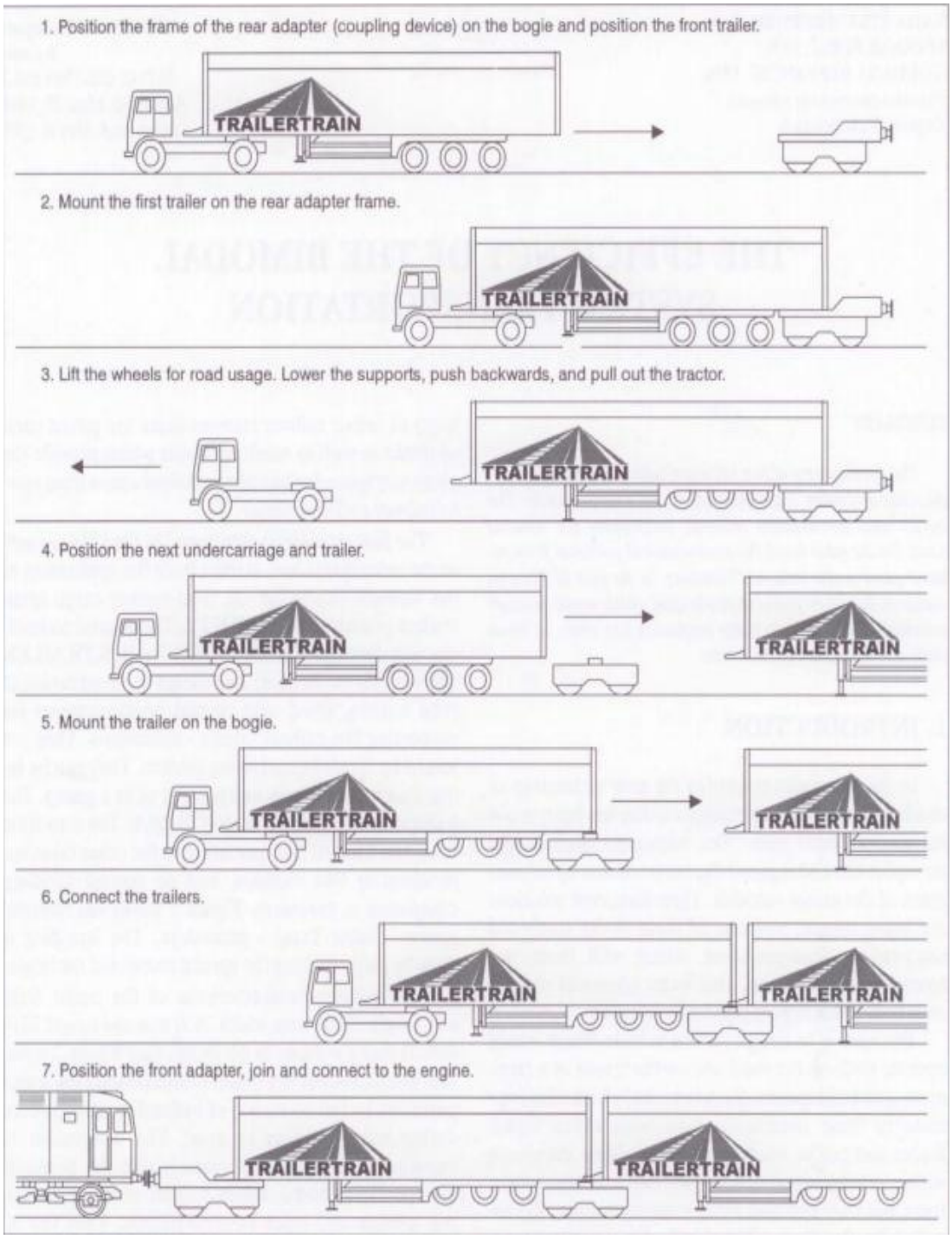


Fig. 1.9 - Bimodal system Trailer-Train (Strumberger, 1998; 89)

2.8 TRAIN FERRY TRANSPORTATION

A train ferry is a ship that has a rail on it is body for train. This shipping mode looks like RO-RO. The railway vehicle enters to ship and transfers to the other destination. Train ferry provides transportation without any handling operation.

Picture 1.2 is about train ferry organizations.

Picture 1.2 Train-Ferry Organizations
(http://www.ukrferry.com/eng/vessels/vessel-geroi-plevny; 10.03.2014)

2.9 LIFT-ON/LIFT-OFF (LO/LO)

Lo-Lo vessel (Lift on - Lift Off) is used for shipping extraordinary cargos. It has flexible cargo space and onboard cranes. In this mode of transportation handling equipment is used for loading and discharging. Lo-Lo transportation system gives services by its own cranes at port. In the other transportation systems cranes are at the port.

In roll on-roll off (Ro-Ro) transportation, the transporter vehicle enters to the ship that why there is no need to handling operation and less labor is used comparing to lift on-lift off (Lo-Lo) . But lift on-lift off (Lo-Lo) cannot handle the type of cargoes which are like bulks (Cambridge Systematic, 2004; 9).

Deep sea ports are not suitable for short time freight operations. The primary customers of deep sea ports are ocean-going vessels. All the equipments of deep sea ports are designed and set up for ocean-going vessels. Lift-on/lift-off (lo-lo) cargo handling systems are frequently used on ships or boats which transport containers in short distances sea operations. In Lo-Lo ship there are special equipment and specialized labor for loading and discharging (Kruse, 2010; 71). The needed time for loading and discharging of Lo-Lo ships is 12 hours. But the port gives 24 hours in case.

The ships have kinds of cargo handling equipment. The most popular systems are Lo-Lo and Ro-Ro. (Even the ships have been known Lo-Lo or Ro-Ro vessels). Every ship and cargo handling equipment has services for special goods. Also each of them has their own advantages and disadvantages regarding to their cost and service policy. If the technology matches to port infrastructure, market of goods and labor limitation would have huge effect on the operation economics.

Some lo-lo vessels is a type of vessel that is self-geared vessels. These vessels have deck-mounted handling cranes because of this the capacity decreases. Some times when there are not enough cranes in the ports, the vessel-mounted cranes are used instead (http://www.globalsecurity.org/military/systems/ship/lo-lo.htm;10.03.2014).

The picture 1.3 refers to Lo-Lo transportation organizations.

Pic.1.3 Lo-Lo Operations (Source: http://www.tgal.us/lift-on-lift-off-shipping;10.03.2014)

3. INTERMODAL TRANSPORTATİON NETWORK

3.1 TRANS-EUROPEAN TRANSPORT NETWORKS (TEN-T)

In 2013 the Trans-European transport network (TEN-T) new legal basis was accepted. It includes transport infrastructure policy in Europe. some researchers has been done regarding the combined multi-modal network in the past 20 years, accordingly combined multi-modal network shows the main innovation of the new TEN-T policy. Until 2030 this network should be improved. Trans-European transport network (TEN-T) connects main points through rail, road, inland waterway, maritime and air transport connections (European Commission, 2014; 5).

The most significant role about applying of the new TEN-T policy is main network corridors. TEN-T includes three main routes. These are border connectivity and reducing strait barriers, to shipping modes to each other and improving technical interoperability.

In order to actualize the goals for Europe, a strong basis project establishment and network improvement. All standards all set for networks, existing parts and planned parts suitable for EU legislation.

The existing standards are informing new railway policy, transport telematics and security. The new TEN-T policies are about improving "green" transport and innovative issues. This policy is about connection between TEN-T and urban mobility and high-quality services for freight and passengers.

These policies are;

- One of the most important issues is setting the connection between networks. Maritime ports and airports as Europe's gateways, inland ports and rail road terminals are going to connect and make an intermodal transportation chain to deliver goods from origin to destination.

- In new corridors they decided to respond to future needs of mobility, support efficiency of resources, lower carbon emissions for sustainable transport solutions (http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/transport policy/index_en.htm ;17.03.2014).

Trans-European network infrastructure development is closely related with executing and progress of EU transport policy.

3.1.1 Corridors

In order to facilitate the coordinated use of core network, core network corridors were explained. They connect together public and private resources and focus on EU support from the Connecting Europe Facility (CEF), especially to:

- remove bottlenecks,
- remove lack of cross-border connections and
- Improve modal integration and interoperability.

They also aim at:

- connecting rail transportation corridors,
- support environmental fuel
- other innovative shipping solutions,
- advancing telematics applications for efficient infrastructure use,
- integrating urban areas into the TEN-T,
- increasing safety.

There are 9 corridors includes different kind of projects that are eligible to get EU funding in the period of 2014 and 2020. These projects are according to Connecting Europe Facility (CEF) regulation they are as added value of TEN-T and factor that develop it.

Connecting Europe Facility helps to improve TEN-T network. Amount of 26 billion EUR budget it considered to perform this project. In order to reach competitor

Europe and sustainable European network all the stakeholders are cooperating (European Commission, 2014; 6).

In order to understand that corridors are effectively and efficiently developed each of them should be direct by a European Coordinator patronage by a consultative forum.

Below we can find the explanation of nine core network corridors:

The Scandinavian-Mediterranean Corridor; is a significant north-south route for economy of Europe. The Scandinavian-Mediterranean Corridor which is longest corridor of TEN-T core networks begins in Russia border and passes through Helsinki, Stockholm and Malmö to the continent of Europe. In this corridor Nuremberg is the center point between eastern and western side. The corridor includes some parts of Italian cities. These are Bologna, Rome, Naples, Geneva and also last station is Sicily in Italy. This corridor includes sea-way options, for example the connection between Sicily and Malta. The main goal of this project is Fehmarnbelt crossing and Brenner base tunnel that include access routes (http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/index_en.htm; 17.03.2014).

According to figure 2.1 Scandinavian-Mediterranean corridors, sub-corridors and connection are shown including the situation of connections and details. For example Hamina-Kotka–Helsinki sub corridor has port interconnections, rail upgrading and icebreaking capacities.

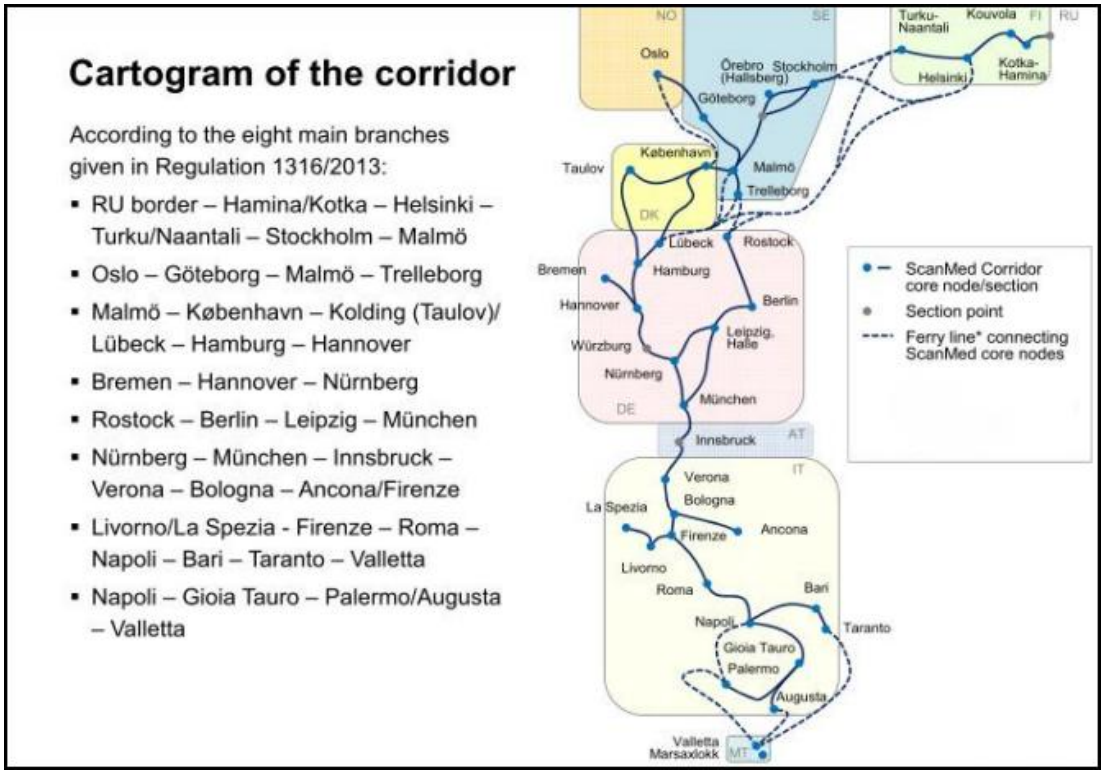


Fig. 2.1 Scandinavian - Mediterranean Corridor Map (Ramboll, 2014; 2)

The North Sea-Baltic Corridor; starts from Tallinn continue to Riga, Kaunas, Warszawa, Berlin, Hannover and ends Amsterdam. This supports an availability of Baltic Sea and North Sea. It connects Finland with Estonia by ferry and supports rail and road connection between Poland, Germany, the Netherlands and Belgium on the other. Mittelland-Kanal refers to inland waterways which connects Odra River and German, Dutch and Flemish ports. The main goal of this project is European standard railway connection of Tallinn, Riga, Kaunas and North-Eastern Poland.

Below there is a list of pre-identified project of Connecting Europe Facility (CEF). For example Tallinn-Riga-Kaunas-Warszawa rail connections. International Union of Railways (UIC) is working in order to improve interoperable line. The line starts to give service before 2020. This line is going to be an airports, ports and rail-road terminal connection.

NORTH SEA-BALTIC CORRIDOR

CEF: Pre-identified projects

Helsinki - Tallinn	Ports, MoS	port interconnections, (further) development of multimodal platforms and their interconnections, icebreaking capacity, MoS
Tallinn - Riga - Kaunas - Warszawa	Rail	(detailed) studies for new UIC gauge fully interoperable line; works for new line to start before 2020; upgrading and new line on PL territory; rail – airports/ports interconnections, rail-road terminals, MoS
Ventspils – Riga	Rail	Upgrading, port interconnections, MoS
Klaipeda – Kaunas	Rail	Upgrading, port interconnections, MoS
Kaunas – Vilnius	Rail	Upgrading, airports interconnections, rail-road terminals
Via Baltica Corridor	Road	works for cross-border sections (EE, LV, LT, PL)
BY border - Warszawa - Poznań - DE border	Rail	works on existing line, studies for high speed rail
PL Border - Berlin - Hannover - Amsterdam/Rotterdam	Rail	studies and upgrading of several sections (Amsterdam – Utrecht – Arnhem; Hannover – Berlin)
Wilhelmshaven - Bremerhaven - Bremen	Rail	Studies and works
Berlin - Magdeburg – Hannover, Mittellandkanal, West-German Canals, Rhine, Waal, Noordzeekanaal, IJssel, Twentekanaal	IWW	studies, works for better navigability and upgrading waterways and locks
Amsterdam locks & Amsterdam - Rijnkanaal	IWW	locks studies ongoing; port: interconnections (studies and works, including Beatrix lock upgrade)

Tab.2.1 North Sea-Baltic Corridor Pre-Identified Projects (European Commission, 2013)

The North Sea-Mediterranean Corridor; starts from Ireland and the north of United Kingdom to Netherlands and Luxembourg continue to the Mediterranean Sea in the south of France. This corridor has also inland waterways for interconnecting British island and Europe (http://ec.europa.eu/transport/themes/infrastructure/ten-tguidelines/corridors/index_en.htm; 17.03.2014).

In table 2.2 pre-identified project of Connecting Europe Facility (CEF) is shown.

Tab.2.2 North Sea-Mediterranean Corridor Pre-Identified Projects (European Commission, 2013).

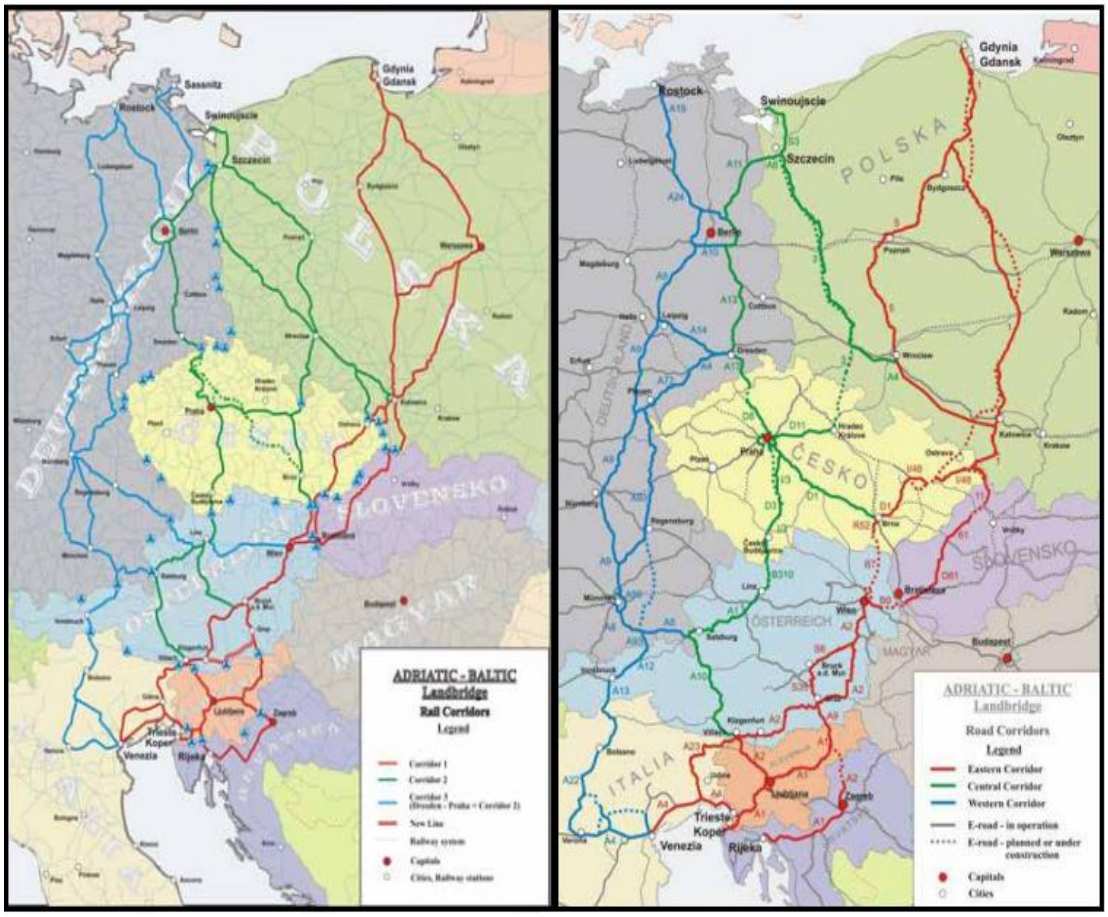
NORTH SEA-MEDITERRANEAN CORRIDOR

CEF: Pre-identified projects

Cork - Dublin - Belfast	Rail	Studies and works; Dublin Interconnector (DART);
Belfast	Port, multimodal connections	upgrading
Glasgow - Edinburgh	Rail	Upgrading
Manchester – Liverpool	Rail	Upgrading and electrification, including Northern Hub
Birmingham – Reading – Southampton	Rail	Upgrading of the freight line
Dublin, Cork, Southampton	Ports, Rail	Studies and works on port capacity, MoS and interconnections
Dunkerque	Port	Further development of multimodal platforms and interconnections
Calais - Paris	Rail	preliminary studies
Bruxelles/Brussel	Rail	studies and works (North-South connection for conventional and high-speed)
Felixstowe – Midlands	Rail, port, multimodal platforms	rail upgrading, interconnections port and multimodal platforms
Maas, inculding Maaswerken	IWW	Upgrading
Albertkanaal/ Canal Bocholt-Herentals	IWW	Upgrading
Rhine-Scheldt corridor: Volkeraklock and Kreekaklock, Krammerlock and Lock Hansweert	IWW	locks: studies ongoing
Terneuzen	Maritime	locks: studies ongoing; works
Terneuzen - Gent	IWW	studies, upgrading
Zeebrugge	Port	locks: studies, interconnections (studies and works)
Antwerp	Maritime, port, rail	locks: studies ongoing; port: interconnections (including second rail access to the port of Antwerp)
Rotterdam - Antwerp	Rail	upgrading rail freight line
Canal Seine Nord; Seine - Escaut	IWW	studies and works; upgrading including cross-border and multimodal connections
Dunkerque – Lille	IWW	studies ongoing
Antwerpen, Bruxelles/Brussels, Charleroi	IWW	upgrading
Waterways upgrade in Wallonia	IWW	studies, upgrading, intermodal connections
Brussel/Bruxelles - Luxembourg - Strasbourg	Rail	works ongoing
Antwerp – Namur - LUX border – FR border	Rail	upgrading of rail freight line
Strasbourg - Mulhouse - Basel	Rail	upgrading
Rail Connections Luxembourg - Dijon - Lyon (TGV Rhin - Rhône)	Rail	studies and works
Lyon	Rail	eastern bypass: studies and works
Canal Saône - Moselle/Rhin	IWW	preliminary studies ongoing
Rhône	IWW	upgrading
Port of Marseille-Fos	Port	interconnections and multimodal terminals
Lyon - Avignon - Port de Marseille - Fos	Rail	upgrading

Baltic-Adriatic corridor; the most critical north-south corridor of Europe is Baltic-Adriatic corridor. It stretches from Poland, continues to Czech Republic, Slovakia, Austria and Italy. The critical issue of this corridor is the connections from hinterland of Baltic and Adriatic (Austrian Ministry for Transport Innovation and Technology, 2009; 2).

Map 2.1 shows Baltic-Adriatic rail and road corridors map



Map 2.1 Baltic-Adriatic Corridors (European Commission; 2013)

The Orient/East-Med Corridor; The corridor that connects maritime interfaces of the North, Baltic, Black and Mediterranean Seas is The Orient/East-Med Corridor which supports the availability of ports and accordingly the Motorways of the Sea. This corridor has Elbe inland waterway that can support the multimodal connections between Northern Germany, the Czech Republic, the Pannonia region and Southeast Europe. It passes from the sea through Greece to Cyprus.

In this corridor main routes are;

Hamburg – Berlin

Rostock – Berlin – Dresden

Bremerhaven/Wilhelmshaven – Magdeburg – Dresden

Dresden – Ústí nad Labem – Melnik/Praha - Kolin

Kolin – Pardubice – Brno – Wien/Bratislava – Budapest – Arad – Timişoara – Craiova – Calafat – Vidin – Sofia

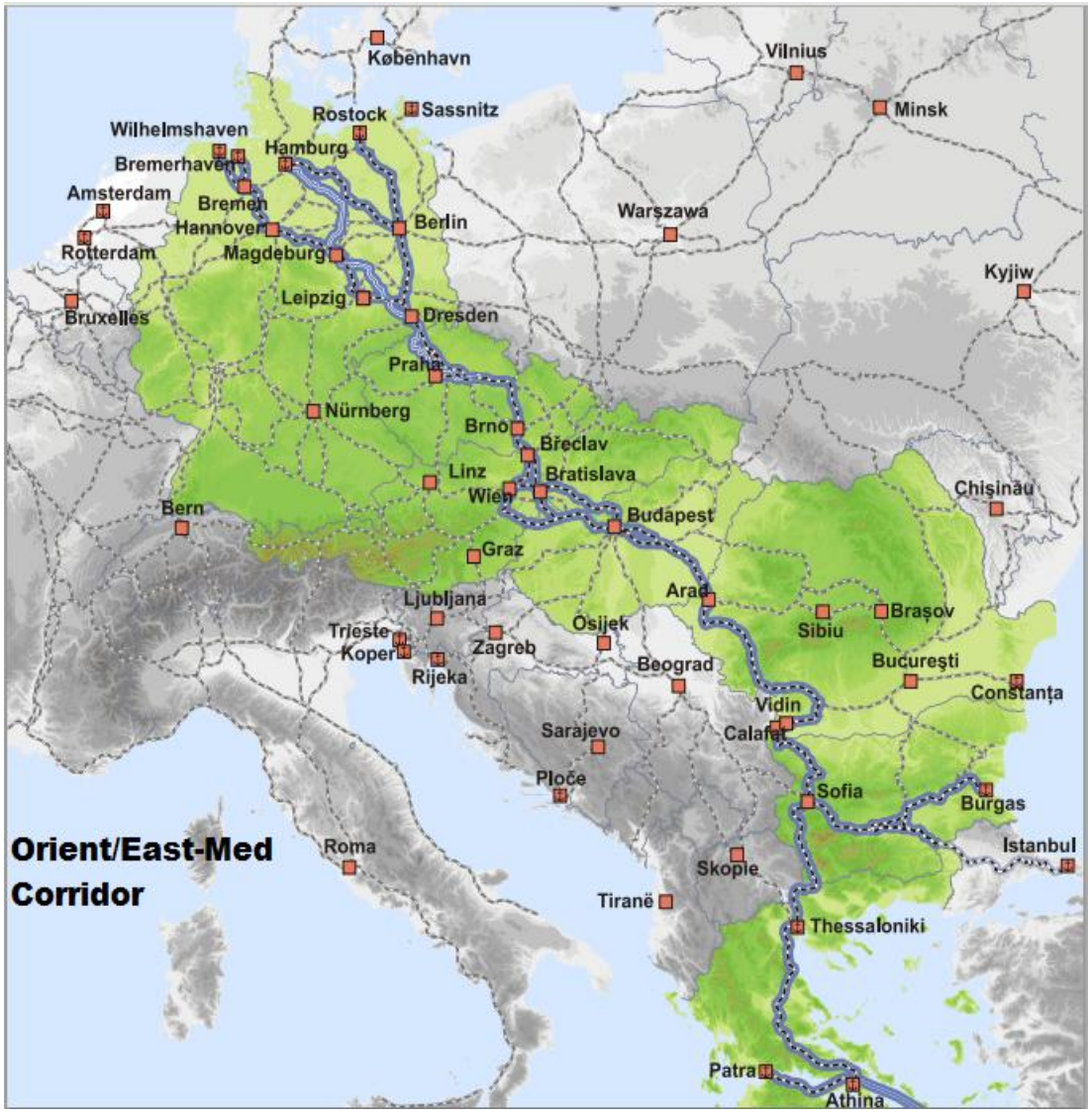
Sofia – Plovdiv – Burgas

Plovdiv – TR border

Sofia – Thessaloniki – Athina – Piraeus – Lemesos – Lefkosia

Athina – Patra/Igoumenitsa

This corridor has too many missing links. Exactly region of Hungary, Bulgaria, Romania and Greece have to improve about this topic. And also this corridor exists in land of high traffic flows. Especially border crossing will access easily and rail and inland waterway should be improved for connectivity(http://ec.europa.eu/transport/themes/infrastructure/ten-tguidelines/corridors/doc/orient_east_med.pdf ; 19.03.2014).



Map.2.2 Orient/East-Med Corridor (Neubaustrecke Dresden-Prag, 2011; 2)

The Rhine-Alpine Corridor; is the busiest transportation corridors in Europe. This corridor starts from North Sea in Amsterdam and ends in Mediterranean Sea in Genoa. The Rhine-Alpine Corridor has also inland waterway. The main projects are based on tunnels in Switzerland to receive corridors in Germany and Italy (http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/index_en.htm;17.03.2014).

The map 2.3 shows Rhine-Alpine Corridor and sub corridors. The corridor starts Amsterdam and ends in Genoa. In this corridor the distance between Rotterdam to Genoa is 1.400 km. And also the distance between Genoa to Zeebrugge is 1.500 km.

The total corridor lines are 3.900 km. Rhine- Alpine corridors have 6 sea ports, 10 inland ports and 100 main terminal facilities. Expected growth of rail freight on the corridor would be doubled till 2020.

Map 2.3 Rhine-Alpine Corridor Map (International Corridor Rhine-Alpine Conference 2014; 2)

The Atlantic Rail Corridor; is running between Atlantic coastal areas. The corridors pass from Portugal, Spain, France, Ireland, Belgium, the Netherlands, Germany, Denmark, Sweden and Norway.

To the East it connects with the Lyon, Ljubljana, Budapest axis up to the Ukrainian border (Kiev), and with the Berlin, Warsaw axis up to the Byelorussian border (Minsk) (Atlantic Rail Corridor Development, t.y; 1).

The whole cargo which goes through Atlantic corridor is addressed to more than 80 million inhabitants (That is 25% of the population of Euro zone). These cargos are distributed between Lisbon, Madrid, Paris, Brussels, The Hague, London, Dublin and Berlin in stack of more than one million inhabitants.

Table 2.3 shows connections between main terminals and connection types. For example from Bordeaux to Tours rail transportation is used. And also in some sub corridors the constructions update are continuing.

Tab.2.3 Atlantic Corridor Pre-Identified Projects (European Commission, 2013)

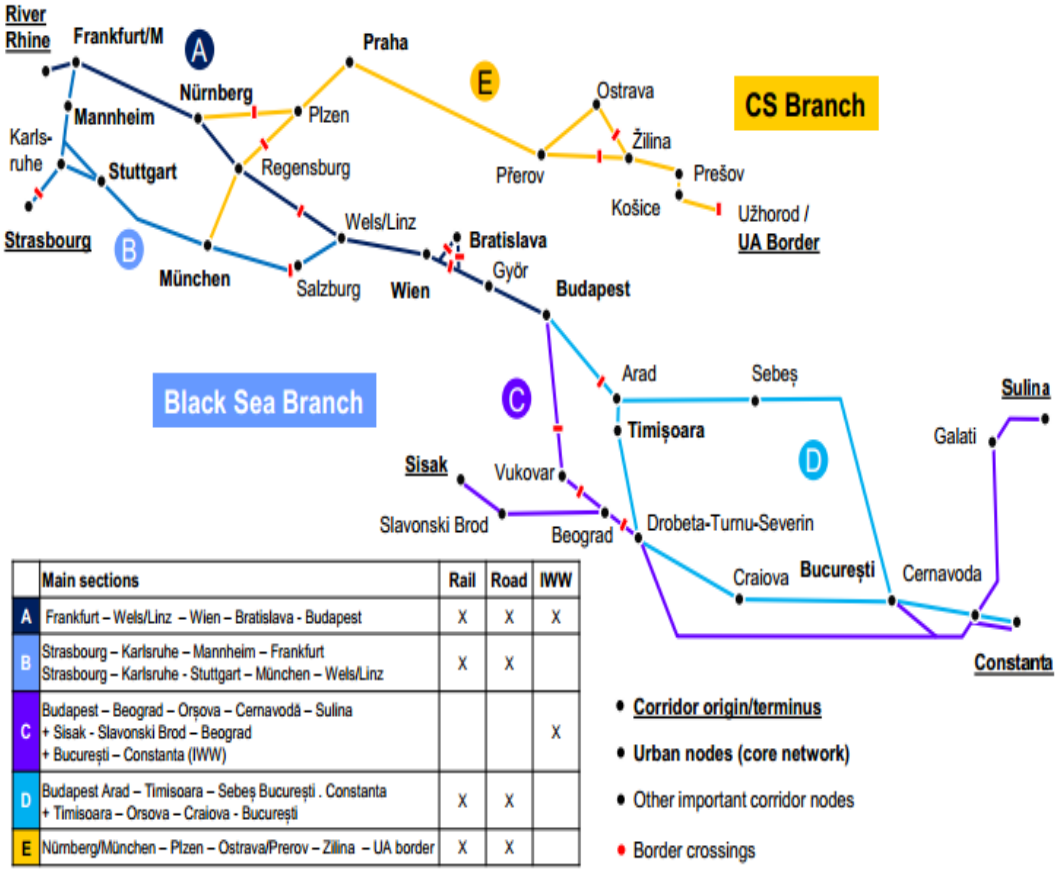
ATLANTIC CORRIDOR

CEF: Pre-identified projects

High Speed rail Sines/Lisboa - Madrid	Rail, ports	studies and works ongoing, upgrading of modal interconnection ports of Sines/Lisboa
High speed rail Porto - Lisboa	Rail	studies ongoing
Rail connection Aveiro – Salamanca – Medina del Campo	Rail	cross-border: works ongoing
Rail Connection Bergara - San Sebastián - Bayonne	Rail	completion expected in ES by 2016, in FR by 2020
Bayonne - Bordeaux	Rail	ongoing public consultation
Bordeaux - Tours	Rail	works ongoing
Paris	Rail	southern high-speed bypass
Baudrecourt - Mannheim	Rail	upgrading
Baudrecourt - Strasbourg	Rail	works ongoing, to be completed 2016
Le Havre - Paris	IWW	Upgrading
Le Havre - Paris	Rail	Studies, upgrading
Le Havre	Port, Rail	Studies and works on port capacity, MoS and interconnections

The Rhine-Danube Corridor; Such as understood from the name The Rhine-Danube Corridor is located in Rhine and Danube rivers. The corridor connects the central areas of Strasbourg and Frankfurt continues to Southern Germany to Vienna, Bratislava, Budapest and lastly the Black Sea.

Figure 2.2 shows Rhine-Danube corridor. As we can seen in figure the corridors starts from Frankfurt follows Danube River and finally ends in Constanta. This figure includes 5 main corridors. The sub corridor which starts from Frankfurt and ends in Budapest is a complex of rail, road and inland waterways. Also as it is shown in the figure 2.2 we can recognize how many different types of transportation exist in sub corridors.



	Main sections	Rail	Road	IWW
A	Frankfurt – Wels/Linz – Wien – Bratislava - Budapest	X	X	X
B	Strasbourg – Karlsruhe – Mannheim – Frankfurt Strasbourg – Karlsruhe - Stuttgart – München – Wels/Linz	X	X	
C	Budapest – Beograd – Orșova – Cernavodă – Sulina + Sisak - Slavonski Brod – Beograd + București – Constanta (IWW)			X
D	Budapest Arad – Timisoara – Sebeș București . Constanta + Timisoara – Orsova – Craiova - București	X	X	
E	Nürnberg/München – Plzen – Ostrava/Prerov – Zilina – UA border	X	X	

Fig.2.2 Rhine-Danube Corridor (IWW refers inland waterways) (Hacon, 2014; 65)

The Mediterranean Corridor; connects south-western Mediterranean areas, continues to Spain and France coastlines and fits in the Alps and reaches to Italy (European Coordinators, 2014; 36).

The Mediterranean Corridor include these cities; Algeciras – Bobadilla –Madrid – Zaragoza – Tarragona - Sevilla – Bobadilla – Murcia - Cartagena – Murcia – Valencia – Tarragona – Barcelona – Perpignan – Marseille/Lyon – Torino – Novara

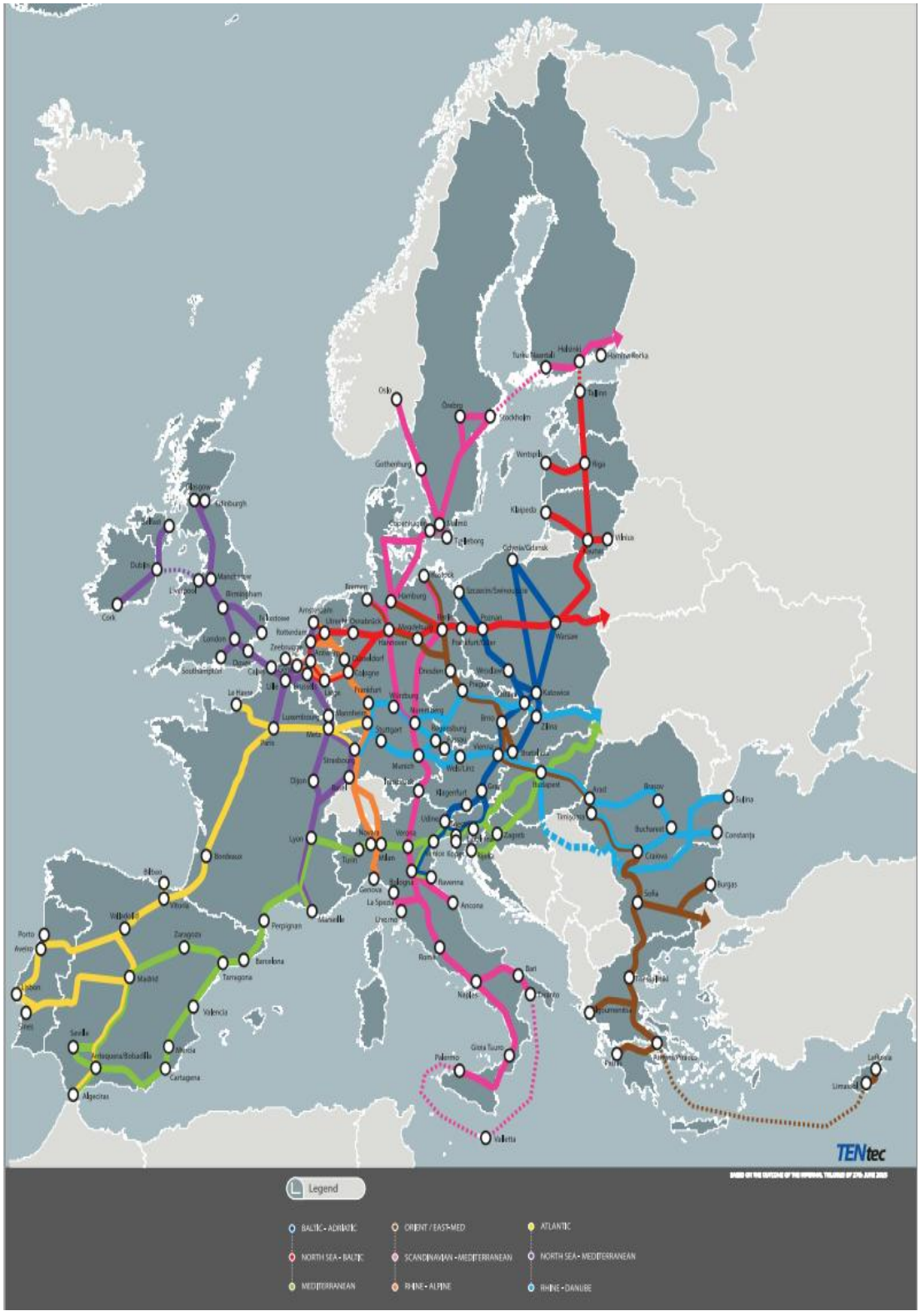
– Milano – Verona – Padova – Venezia – Ravenna/Trieste/Koper - Ljubljana – Budapest - Ljubljana/Rijeka – Zagreb – Budapest – UA border.

Table 2.4 shows connections between sub corridors and connection types. For example between Algeciras to Madrid the railway construction is continuing and it would be finish in 2020.

Tab.2.4 Mediterranean Corridor Pre-Identified Projects (European Commision; 2013)

MEDITERRANEAN CORRIDOR		
CEF: Pre-identified projects		
Algeciras - Madrid	Rail	studies ongoing, works to be launched before 2015, to be completed 2020
Sevilla - Antequera - Granada - Almeria - Cartagena - Murcia - Alicante - Valencia	Rail	studies and works
Madrid-Zaragoza-Barcelona	Rail	Upgrading of existing lines (gauge, sidings, platforms)
Valencia - Tarragona - Barcelona	Rail	construction between 2014 - 2020
Barcelona	Port	interconnections rail with port and airport
Barcelona - Perpignan	Rail	cross-border section, works ongoing, new line completed by 2015, upgrading existing line (gauge, sidings, platforms)
Perpignan - Montpellier	Rail	bypass Nîmes - Montpellier to be operational in 2017, Montpellier - Perpignan for 2020
Lyon	Rail	Relieving Lyon bottlenecks: studies and works
Lyon – Avignon – Marseille	Rail	upgrading
Lyon - Torino	Rail	cross-border section, works base tunnel ; studies and works access routes
Milano - Brescia	Rail	partially upgrading, partially new high-speed line
Brescia - Venezia - Trieste	Rail	works to start before 2014 on several sections in synergy with upgrading actions undertaken in overlapping stretches as in Baltic Adriatic Corridor
Milano – Cremona- Mantova – Porto Levante/Venezia – Ravenna/Trieste	IWW	Studies and works
Cremona, Mantova, Venezia, Ravenna, Trieste	Inland Ports	Port interconnections, (further) development of multimodal platforms
Trieste - Divača	Rail	studies and partial upgrading ongoing; cross-border section to be realised until after 2020
Koper - Divača - Ljubljana – Pragersko	Rail	studies and upgrading/partially new line
Rijeka – Zagreb – Budapest	Rail	Studies and works (including construction of new track and second track between Rijeka and HU border)
Rijeka	Port	Infrastructure upgrading and development, development of multimodal platforms and interconnections
Ljubljana – Zagreb	Rail	Studies and works
Ljubljana node	Rail	rail node Ljubljana, including multi-modal platform; rail airport interconnection
Pragersko - Zalalövő	Rail	cross-border section: studies, works to start before 2020
Lendava - Letenye	Road	cross-border upgrading
Boba- Székesfehérvár	Rail	upgrading
Budapest-Miskolc-UA border	Rail	upgrading
Vásárosnamény-UA border	Road	cross-border upgrading

This map 2.4 refers to TEN-T core network corridors.



Map 2.4 TEN-T CORE NETWORK (http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/doc/ten-t-corridor-map-2013.pdf; 17.03.2014)

3.2 PAN-EUROPEAN TRANSPORTATION NETWORK

Three Pan-European Transport conferences have been talked about Pan-European Transport Network and improved it. The first Pan-European Transport conference was held in Prague in 1991. The concept for transport infrastructure was agreed in this conference.

The second Pan-European Transport conference was held in 1994 in Crete. In this conference they discussed about infrastructure improvement for the countries of Western, Central and Eastern Europe. Also nine long distance transport corridors were mentioned.

Third Pan-European Transport conference was about tenth corridor and the Pan-European Transport Areas for maritime basins were added. This conference was held in Helsinki in June 1997.

The Helsinki Corridor is approximately 48.000 km. this corridor is a multi modal corridor. 25.000 km of it is railway and 23.000 km road network. For Central and Eastern European countries the long distance interconnection are airports, sea- and river ports and major terminals (European Commission Dg Energy & Transport, 2002; 6).

Pan-European Transport Infrastructure Investment Partnership supports the enterprise of all essential parts for future Pan-European Transport Network. This partnership is going to give this help to European countries and candidate countries (European Commission Dg Energy & Transport, 2002; 6).

In table 2.5 we can see the details about corridors that pass cities and railways and road length.

Overview over the Corridors:

Tab.2.5 Pan-European Corridors (Source: the details taken from European Commission)

	Length (in km)
Corridor I: Tallinn – Riga – Kaunas – Warszawa Branch: Riga – Kaliningrad – Gdansk	
Rail	1,655
Road	1,630
Corridor II: Berlin – Warszawa – Minsk – Moskva – Niznij Novgorod	
Rail	2,313
Road	2,200
Corridor III: Dresden – Wroclaw – Lviv – Kiev Branch: Berlin – Wroclaw	
Rail	1,650
Road	1,700
Corridor IV: Dresden – Praha – Bratislava/Wien – Budapest – Arad Branch: Nürnberg – Praha Branch: Arad – Bucuresti – Constanta Branch: Arad – Sofija – Istanbul Branch: Sofija – Thessaloniki	
Rail	4,340
Road	3,640
Corridor V: Venezia – Trieste/Koper – Ljubljana – Budapest – Uzgorod – Lviv Branch: Rijeka – Zagreb – Budapest Branch: Ploce – Sarajevo – Budapest Branch: Bratislava – Zilina – Uzgorod	
Rail	3,270
Road	2,850
Corridor VI: Gdansk – Grudziadz/Warszawa – Katowice – Zilina Branch: Grudziadz – Poznan Branch: Katowice – Ostrava – Breclav/Brno	
Rail	1,800
Road	1,880
Corridor VII: Danube	2,415
Corridor VIII: Durres – Tirana – Skopje – Sofija – Varna/Burgas	
Rail	1,270
Road	960
Corridor IX: Helsinki – St. Petersburg – Pskov/Moskva – Kiev – Ljubasevka – Chisinau – Bucuresti – Alexandroupolis Branch: Klaipeda/Kaliningrad – Vilnius – Minsk – Kiev Branch: Ljubasevka – Odessa	
Rail	6,500
Road	5,820
Corridor X: Salzburg – Ljubljana – Zagreb – Beograd – Nis – Skopje – Veles – Thessaloniki Branch: Graz – Maribor – Zagreb Branch: Budapest – Novi Sad – Beograd Branch: Nis – Sofija Branch: Veles – Florina	
Rail	2,528
Road	2,300

3.2.1 Corridor I

Corridor I is between North - South route. Multi-modal transportation is possible in this corridor. It begins from Helsinki (Finland) and connects Tallinn (Estonia), Riga (Latvia) and Kaunas (Lithuania) with Warszawa (Poland) and Gdansk (Poland).

Corridor I includes the following three components;

1. The road Corridor starts from Tallinn to the Latvian metropolis Riga. From Riga the Corridor passes Kaunas (Lithuania) and crosses the Lithuanian / Polish border at Kalvarija / Budzisko and ends in Warszawa.

2. The rail Corridor starts from Tallinn through Tartu and ends in Riga . It crosses the Latvian border at Meitene/Kalviai and continues to Siauliai and Kaunas (Lithuania). The railway crosses the Lithuanian/Polish Border at Mockava/Trakiszki keeps going on, then southwest to Warszawa.

3. The branch of Corridor I run in Riga (Latvia) and then thought Kaliningrad (Russia) to Gdansk (Poland). The road branch crosses the Lithuanian/Russian border at Panemune/Pagegiai running to Kaliningrad (Russia). After that the road passes the Russian/Polish border at Grzechotki and ends in Gdansk (Poland).

The railway of Corridor I cross the Lithuanian/Russian border at Pagegiai goes on to Kaliningrad and to the Russian border Mamonovo and terminates in Gdansk (European Commission Dg Energy & Transport, 2002; 34).

In this corridor concerned countries are Finland, Estonia, Latvia, Lithuania, Poland and Russia. This corridor includes all of transportation modes without pipeline. The length of railways is 1,655 km and roads are 1,630 km. 6 airports and 11 ports exist in this corridor.

3.2.2 Corridor II

Corridor II is a multi-modal East–West link connecting Berlin - Warszawa - Minsk - Moscow and Nizhny Novgorod. This corridor is a road railway combination going parallel with links cities. The distance from Berlin to Nizhny Novgorod is 2,313 km by rail and 2,260 km by road.

In Helsinki Conference it was decided to lengthening corridor II from Moscow in 1997. The access to the inland waterways in Russia is given by the extension along the Volga River to the Caspian Sea and via the Volga/Don Canal to the Sea of Azov and the Black Sea.

Road and rail route stretches Berlin, Warsaw, Minsk, Moscow and Nizhny. Polish segments are taken large investment of routes. Rehabilitation and upgrading of motorway in the Belarus and Russian segment are needed, together with technical modernization and administrative improvement of border crossings, which still suffer long delays (Emerson, 2009; 34).

3.2.3 Corridor III

The Ukrainian road segments (two lane highways) do not yet meet European standards and the delays at border crossing into Ukraine are substantial (4-5 hours). Some European Bank for reconstruction and development funding is being made available.

The table 2.6 shows technical features of corridor III. A corridor passes from Germany, Poland and Ukraine. In this corridors railways, roads, aviation and seaways exist. In table 2.6 corridors III includes 1.650 km railways, 1.700 km roads networks and also 4 airports and 9 ports exist.

Tab.2.6 Technical Features Of Corridor III (European Commission Dg Energy & Transport, 2002; 43).

Concerned countries	Germany, Poland, Ukraine
Transport modes	Railways, roads, aviation, navigation
approx. length of the Corridor Railways Roads Inland waterways Number of Airports Number of Sea- and Riverports	 1,650 km 1,700 km n.a. 4 9
Alignment: Railway Road	**Dresden – Wroclaw – Lviv - Kiev** Dresden – *Görlitz/Zgorzelec* – Legnica – Wroclaw – Opole – Katowice – Krakow – Tarnow – Rzeszow – *Medyka/Mostiska* – Lviv – Ternopol – Grecany – Vinnitsa – Kiev Dresden – Zgorzelec – Legnica – Wroclaw – Opole – Gliwice – Katowice – Krakow – Tarnow – Rzeszow – *Medyka/Sheghini* – Lviv – Rivne – Zhytomyr – Kiev **Branch from Berlin** Berlin – Cottbus - *Forst/Olszyna* – Legnica

3.2.4 Corridor IV

Corridor IV passes from Austria, Bulgaria, Czech Republic, Germany, Greece, Hungary, Romania, Slovakia, and Turkey. This corridor includes all transportation types without pipeline. The length of railways in this corridor is 4,340 km and roads are 3,640 km. there is no inland waterways in this corridor but there are 8 ports and 10 airports.

305 km rail connection of corridor IV starts from Turkish/Bulgarian border (Kapikule) to Edirne and ends in Istanbul (Sirkeci). 277 km are single-track however the total length is electrified. A new railway hub is going to be built in Halkalı. The train which used this corridor can reach Asian side by passing Marmaray project.

A multi-modal Northwest - Southeast shipping routes start from Dresden/Nurnberg (Germany), through Prague (Czech Republic), Wien (Austria)/Bratislava (Slovakia), Budapest (Hungary) to Romania.

3.2.5 Corridor V

Bosnia Herzegovina, Croatia, Italy, Hungary, Ukraine, Slovakia and Slovenia are a part of corridor V. The total length of railways is 3,270 km in corridor V. The longest railway is 585 km which is in Bratislava/ Slovakia. The longest road is 588 km in Hungarian/Slovenian. Also total length of road is 2,850 km in this corridor. There are 5 airport and 3 ports. All transportation selections exist in corridor V.

This corridor is connected to Venezia and Trieste ports in Italy. There is a place in Slovenia named Divaca which has a connection between Koper port and Corridor V. In Budapest the corridor divides two branches, both of them goes to the Adriatic Sea. one sub corridor continues to Rijeka in Croatia, the other sub corridor continues to Sarajevo (Bosnia-Herzegovina) (European Commission Dg Energy & Transport, 2002; 68).

Between Slovenia and Hungary there was a missing part on this corridor railway part (European Commission Dg Energy & Transport, 2002; 68).

3.2.6 Corridor VI

This corridor consists of railway lines with a length of 1800 km and roads with a length of 1,880 km. This corridor has a connection with corridor V. Corridor VI is a multi-modal corridor which starts from Brno/Czech Republic through Warszawa and ends in Gdańsk port. This corridor has benefit of connecting the Polish Baltic Sea ports of Gdańsk with Slovakia and the Czech Republic.

Map 2.5 Pan-European Corridor VI (source; map/google.com)

According to the Map 2.5 we can see two main routes in Poland. Corridor VI stars from Gdańsk port in Poland. Gdańsk port is the main port for Baltic Sea because of two main branches running from this port. One of them is going to Warszawa and ends in Martin in Slovakia. The other branch is going to Katowice through the border of Czestoshnowa which is in Czech Republic. Finally this branch reaches to Brno city.

Poland is the main city of Corridor VI. Corridor VI has a length of 1,559 km railways and 1,447 km of roads in Poland.

3.2.7 Corridor VII

The Danube Corridor is a connection that links East-West it is one of three European corridors. There are three different transportation modes in Austria, Bavaria and Hungary. Corridor infrastructure generally is bimodal (road and railway) but in Bavaria, Austria and Hungary it has tri-modal (road, railway and inland waterway). The East-West Danube Corridor, close to Vienna and Bratislava links to Baltic-Adriatic corridor. By this connection the Danube Corridor subscribes integration of Europe (Logistikum, 2010; 13).

In 1997, regarding to the conclusion of 3rd Pan-European Transport Conference of Helsinki this corridor denotes:

- The Danube inland waterway,
- The Black Sea-Danube Canal,
- The Danube branches Kilia and Sulina,
- The inland waterway links between the Black Sea and the Danube,
- The Danube – Sava canal,
- The Danube – Thissa canal, and
- The about port infrastructures place on these inland waterways (European Commission Dg Energy & Transport, 2002; 80).

3.2.8 Corridor VIII

Another multimodal corridor is Corridor VIII which is passing from East to West in south-eastern Europe. This corridor connects Pan-European Transport Area Adriatic-Ionian Sea with the Black Sea Pan-European Transport Area. The Corridor starts at the port of Durrës, runs via Tirana and Skopje, further to Sofia and to the Bulgarian ports Burgas and Varna at the Black Sea (European Commission Dg Energy & Transport, 2002; 87).

The Corridor goes through three countries, which are Albania, Bulgaria and Macedonia. Four transportation types exist in this corridor; railways, roads, air

transportation and seaways. The railway length is 1,270 km, road length is 960 km. Also 4 airports and 2 ports exist in Corridor VIII.

3.2.9 Corridor IX

As we know there are ten Pan-European multi-modal Transport Corridors, the longest is Corridor IX. Railway length of this corridor is 6,500 km and roadway length is 5,820 km. It starts from Helsinki, goes to St. Petersburg. There it divides to two parts; one of them goes to Moscow, the other one goes to Pskov. In Kiev both parts meet together. In Rozdilna the Corridor splits again.

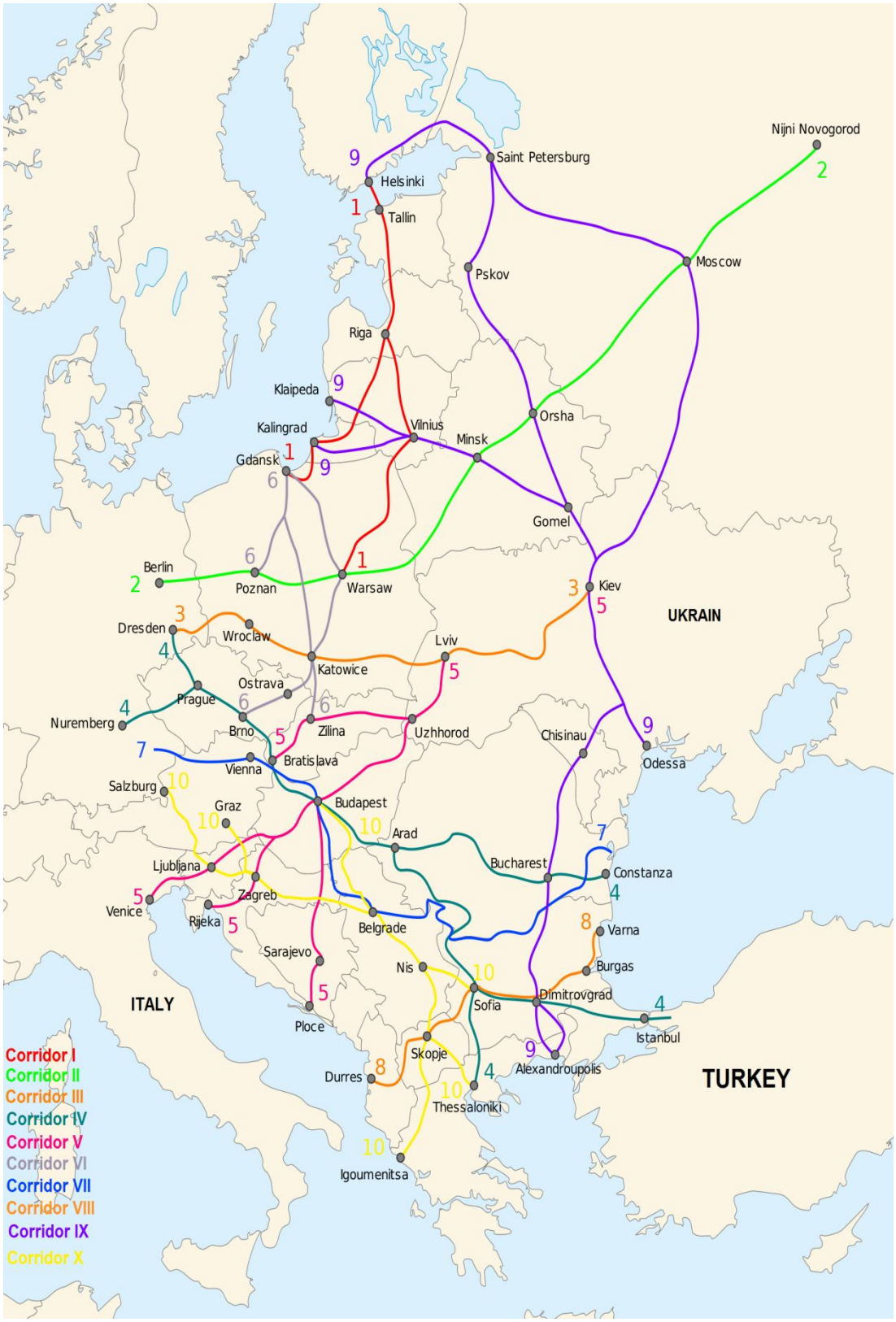
The connection between Helsinki, St. Petersburg, Pskov/Moscow, Kiev, Ljubasevka, Chisinau, Bucharest, Dimitrovgrad, Alexandroupolis is road and railway. The infrastructure development is already done but because of managerial problems at border crossing road and rail traffic is increasing (Checchi , 2009 ; 35).

3.2.10 Corridor X

This corridor was decided to perform in order to empower peace period of Former Federal Republic of Yugoslavia in 1997 at Helsinki. It passes through Pan-European Transport Motorway North–South and according to the traditional road its goes to South Eastern Europe and the Balkans (Cerovski, 2004; 5).
The main axis is connected to the following cities or areas via four branches:

• Graz (Austria) – Maribor (Slovenia) – Zagreb (Croatia);
• Budapest (Hungary) – Novi Sad (Yugoslavia) – Beograd (Yugoslavia);
• Nis (Yugoslavia) – Sofija (Bulgaria) and further along Corridor IV to Istanbul;
• Veles (Macedonia) – Bitola (Macedonia) – Florina (Greece) and further via Florina – Kozani (via Egnatia) to Igoumenitsa. (Status of the Pan-European Transport Corridors and Transport Areas; European Commission Dg Energy & Transport; 2002; 108)

Below there is a map of developed Pan-European corridors.



Map 2.6 Pan-European Corridors (UNECE, 2010)

3.3 THE MARCO POLO II PROGRAM

Marco Polo I project started in 2003 with the budget of 102 million euro and the project ended by 2006.

Three different main activities were supported in this program; Model Shift Actions, Catalyst Actions and Common Learning Actions.

The Marco Polo II project continued between 2007 and 2013. This project runs with the budget of 450 million euro. Comparing to Marco Polo I program, this project supports 5 different main action plans; Model Shift Actions, Catalyst Actions, Common Learning Actions, Motorways of the Sea and Traffic Avoidance Actions.

Marco Polo program was found in order to; prevent road traffic, improve environmental performance of freight transport system, improve transportation between different modes and contribute to sustainable transport system.

Between 2007 and 2013 a new program named Marco Polo II was designed in order to change transportation types to more environmentally friendly vehicle.

The following actions are eligible:

- Catalyst actions: there are some actions that speed up the activities. In the procedure of EU freight movement bazaar there are some barriers in this case some actions are considered. Using the existing infrastructure, their goal is to develop railway synergies and good effect to inland waterway and short sea shipping operations.
- Modal shift actions: the purpose of these actions is using short sea shipping, rail, inland waterways or a combination of modes of transport instead of roadway. The critical issue of this action is reducing road freight;
- Common learning actions: the goal of these actions is developing cooperation for working methods and process in freight shipping chain regarding to logistics needs;

- Motorways of the sea: this idea of motorway of sea was decided in 2001 for European transport policy. The purpose of these actions was to use short sea shipping and combination of shipping instead of roadway. The motorway of sea is used to remove the road traffic;
- Traffic avoidance actions: there are some way avoid heavy traffic like offering innovative actions using transportation process and other transportation types instead of roadway without effecting on production output (http://europa.eu/legislation_summaries/environment/tackling_climate_change/l24465_en.htm; 09.04.2014).

3.4 MEDITERRANEAN AND TRANS-EUROPEAN NETWORKS FOR TRANSPORT (MEDA TEN-T)

One of the critical facts that improve Euro Mediterranean transport network, Mediterranean Partners and Trans European transport network is MEDA TEN-T. In order to accomplish this action there should be a plan for future. In this procedure existing network should be a specified and link to Mediterranean countries (NESTEAR, 2006; 24).

Because of the fact that Mediterranean region is highly including possibility of sea motorway, in this project sea motorway should be preference developed. There would be interconnectivity between all transportation modes. Malta and Cyprus are in primary level for this corridor (NESTEAR, 2006; 25).

The selected corridors are;

West Mediterranean corridors

Paris – Bordeaux – Madrid - Rabat (concentrate on passenger transport)

Paris – Marseille – Algiers (Djhen – Djhen) – Transahara (freight / passenger)

Paris – Marseille /Genoa – Tunis / Sfax (freight / passenger)

Berlin – Munich – Verona – Napoli (Palermo) – Tunis (freight / passenger)

East Mediterranean corridors

Marseille / Italy – Malta - Limassol – Beirut / Tartous – Damascus – Bagdad

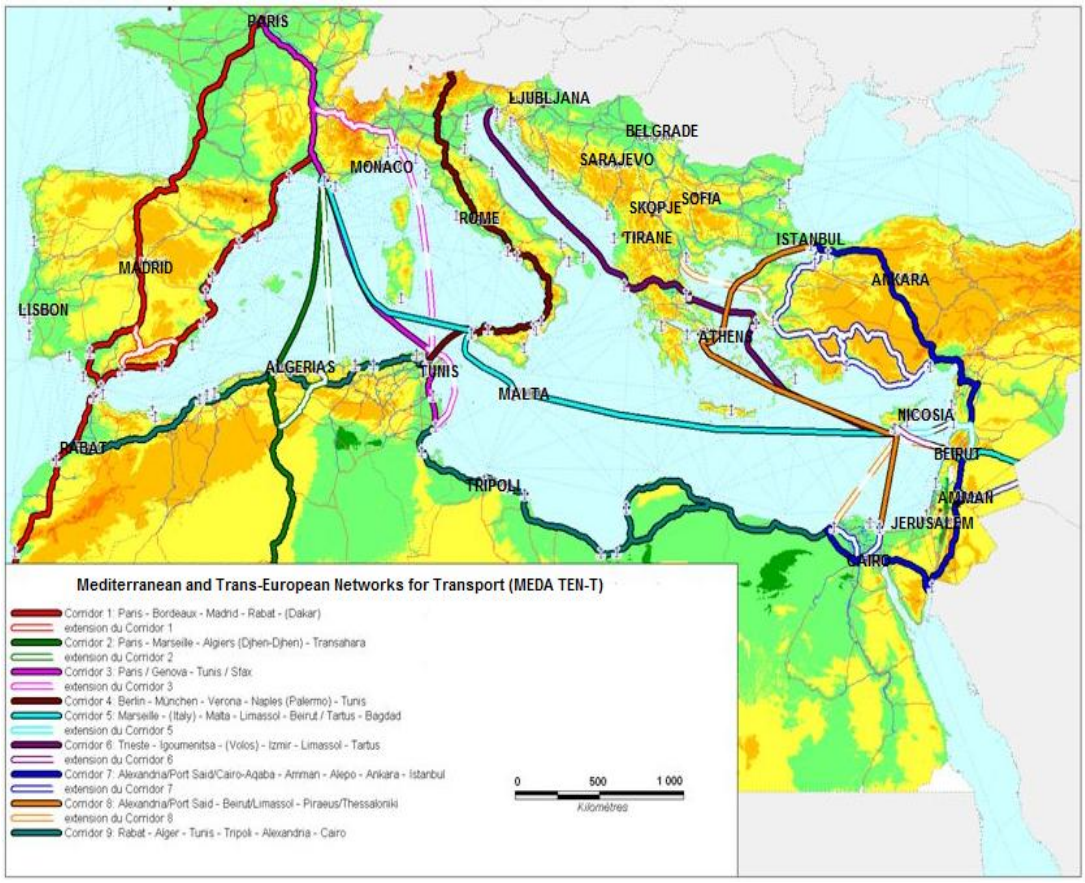
Trieste – Igoumenitsa – (Volos) – Limassol – Izmir – Tartous / Beirut

Alexandria / Port Said / Cairo – Aqaba – Amman (Bagdad /Gulf) Damaskus /Alepo or Beirut – Ankara / Izmir – Istanbul (with branches from Izmir to Antalya through Konya and Mersin

Alexandria / Port Said – Beirut / Limassol – Piraeus / Thessaloniki – Izmir – Istanbul West-East Mediterranean corridor

Rabat – Algers – Tunis – Tripoli – Alexandria – Cairo

Map 2.7 shows all Mediterranean corridors in different colors. According to this map we can see Turkey's important role in connecting other countries. The corridor which starts from Paris and ends in Dakar is a strategic route. That is the connection between Europe and Africa continent. As we can see the map Cyprus is the transit centre of these corridors. Turkey should take this role from Cyprus and transfer it to Mersin port.



Map 2.7 Mediterranean and Trans-European Network for Transport and corridors (Sıarov, 2004; 29).

3.5 TRANS-EUROPEAN MOTORWAYS (TEM)

In 1972 governments of Poland and Hungary demanded cooperation from UN for planning and building of motorway. Accordingly the idea of a Trans-European north-south Motorway started. The length of this motorway was 10,000 km. this motorway strengthen eastern borders of Turkey. Trans-European Motorway supporting 24.000 km. this motorway reached Italy in the West to Lithuania in the North. UNECE organized and accompanied for developing TEM project. There are 15 member states and three observers. The project office is situated in Warsaw, Poland (Bergman, 2009; 22).

A high speed road cooperation between Central, Eastern and South Eastern European countries named Trans-European Motorways (TEM) Project. There are 15 member countries: Armenia, Austria (associate member), Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Hungary, Italy, Lithuania, Poland, Romania, Slovakia, Slovenia and Turkey. Montenegro, Serbia, Sweden and Ukraine countries are observer membership in this project. Another country, Azerbaijan is pending for membership. United Nations Development Program (UNDP) was the first financial supporter and UNECE is the arranging agency.

The main objectives of the TEM project are;

- To facilitate road traffic in Europe
- To develop the standard and performance of transportation process
- to support the integration process of transport substructure
- To stability exists gaps and inequality between motorway routes in Western, Eastern, Central and South-Eastern Europe

In order to prove that the design and planning of the TEM road can support traffic by the use of low operation cost and also can provide suitable terms for users enough service, safety, speed and driver ease over medium and long distances.

3.6 TRANS-EUROPEAN RAILWAY (TER)

Trans European railway project is established by Central, Eastern and Southeastern European countries in 1992. The main subject of this project is;

- Coordinated improvement of rail and combined shipping routes
- unify connection of European transport
- developed international railways and multi-modal transportation services in the area
- decreased environment and safety problems during main transport routes

United Nations Development Program (UNDP) was the first financial assistance and UNECE is executing agency. There are 17 associate countries: Armenia, Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Georgia, Greece, Hungary, Italy, Lithuania, Poland, Romania, Russian Federation, Slovak Republic, Slovenia and Turkey. Moreover, a number of observer countries; Belarus, Latvia, Moldova, Montenegro, Serbia, Macedonia and Ukraine. Azerbaijani affiliation is pending in this project.

3.7 ASIAN HIGHWAY NETWORK

Asian Highway project has started to respond the demand of trustworthy and effective road transportation network and services in the Asian Pacific region. This highway is 140.000 km which is among 32 countries. All this organization is managed by UNESCAP. The Asian Highway Network was officialized by a contract between governments of the 20 countries. In 2006 the number of countries increased to 28 (ESCAP, 2006; 11).

As a matter of fact Asian Highway network project was decided in 1959. The purpose of this project was to improve the infrastructure of existing roadway and connect them to the network. The important jump was in 1960 but between 1970 and 1975 the project was slow down because of financial problems. In 1990 project

process was speed up because of reconstruction, changed world political situation and rapid economic growth in some Asian economics (United Nations Publications, 2009; 97).

Trans African Highway Network is a unit of the Asian Land Transport Infrastructure Development (ALTID) project being braced by United Nations Economic and Social Commission for Asia and the Pacific (ESCAP).

There are three different project in ALTID program; one of them African highway network, second one is Trans-Asian Railway and the third one is land transport projects. The main goal of ALTID program is supporting low cost transportation activities for national and international trade (http://www.roadtraffic-technology.com/projects/asian-highway-network/; 15.04.2014).

The Asian Highway routes are classified into four classes;

1. Primary class: a road which has four or more lanes with access-controlled
2. Class I: a road which has four or more lanes
3. Class II: road with two lanes,
4. Class III: road with less than two lanes (United Nations Publications, 2007; 99).

Tab. 2.7 Status of the Asian Highway in Member States in 2006 (United Nations Publications, 2007; 100)

Country	Primary	Class I	Class II	Class III	Below III	Other	Total
Afghanistan	0	10	2,314	77	1,846	0	4,247
Armenia	0	147	710	109	0	0	966
Azerbaijan	0	97	1,017	348	0	0	1,462
Bangladesh	0	20	1,718	0	30	0	1,768
Bhutan	0	6	0	0	161	0	167
Cambodia	0	0	453	879	3	0	1,335
China	14,859	2,255	5,788	3,237	42	0	26,181
Democratic People's Republic of Korea	0	492	0	15	220	735	1,462
Georgia	0	17	924	160	0	0	1,101
India	90	3,787	1,962	5,690	121	0	11,650
Indonesia	409	188	1,734	1,550	55	34	3,970
Iran (Islamic Republic of)	752	2,468	7,933	0	0	0	11,153
Japan	1,111	0	0	0	0	0	1,111
Kazakhstan	0	557	4,671	6,835	793	0	12,856
Kyrgyzstan	0	60	981	338	316	0	1,695
Lao People's Democratic Republic	0	0	0	2,032	285	0	2,317
Malaysia	795	67	733	0	0	0	1,595
Mongolia	0	16	432	595	3,243	0	4,286
Myanmar	0	147	0	1,585	1,271	0	3,003
Nepal	0	0	208	1,098	8	0	1,314
Pakistan	358	1,272	349	2,224	1,174	0	5,377
Philippines	0	134	928	1,917	388	150	3,517
Republic of Korea	466	255	186	0	0	0	907
Russian Federation	0	1,532	13,085	670	1,759	0	17,046
Singapore	11	8	0	0	0	0	19
Sri Lanka	0	49	337	151	113	0	650
Tajikistan	0	20	707	977	221	0	1,925
Thailand	182	2,926	1,187	813	2	0	5,110
Turkey	1,251	885	797	2,312	0	0	5,245
Turkmenistan	0	60	0	2,120	24	0	2,204
Uzbekistan	0	1,185	1,111	670	0	0	2,966
Viet Nam	0	338	2,018	85	190	0	2,631
Total	**20,284**	**18,998**	**52,283**	**36,487**	**12,265**	**919**	**141,236**
Percentage	**14**	**13**	**37**	**26**	**9**	**0.65**	**100**

In table 2.12 shows the road situation of member countries. According the this table Turkey has 1.251 km Primary line, 885 km Class I roads, 797 km Class II roads and 2.312 km Class III roads. The total length of Asian Highway network is 141.236 km and also the total length of Turkey roads is 5.245 km.

3.8 TRANS-ASIAN RAILWAY (TAR)

Back in 1960 The Trans-Asian Railway (TAR) project launched its activity by supporting a continuous 14.000 km rail link which is a connection between Singapore and Istanbul (Turkey) and planning to be a connection to Europe and

Africa. This connection provided: shorting long distances, improvement in trade, economic growth and sustainability transportation.

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) has done Trans Asian railway (TAR) project to in order to make integrated freight railway network across Europe and Asia.

Participating countries determined the links that create the Trans Asian Railway according to the regulation below:

a. Capital to capital links (for international transport)
b. Connections to main industrial and agricultural centers (links to important origin and destination points)
c. Connections to major sea and river ports (integration of land and sea transport networks)
d. Connections to major container terminals (integration of rail and road networks) (United Nations Publications, 2001;3).

The purpose of Trans African Railway is to respond to enhances of international trade between Eurasian nations the other countries, also in order to develop the economy of shoreless countries such as Laos, Afghanistan, Mongolia, and the Central Asian republics. These countries are landlocked that's way sea transportation does not exist in this counties. So this railway project should be empowered.

There are some problems in the railways which were built before. The biggest problem is that distance between rails of railways is different in each country. Most of European countries also Turkey, Iran, China, and the Korea gauge of railway is 1435 mm. However the standard in Russia and Finland is 1520 mm. Finland, Russia, and use a 1520 mm gauge; most of the railways in India, Pakistan, Bangladesh and Sri Lanka use a 1676 mm gauge, and most of Southeast Asia has meter-gauge.
Table 2.8 refers to Trans African railways routes.

Tab.2.8 TAR routes (UNESCAP; http://www.unescap.org/resources/trans-asian-railway-network-map;15.04.2014)

South-East Asia:	Cambodia, Indonesia, Malaysia, Myanmar, Singapore, Thailand, Viet Nam	12,600 km
North-East Asia:	China, Democratic People's Republic of Korea, Mongolia, Republic of Korea, Russian Federation	32,500 km
Central Asia and Caucasus:	Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan	13,200 km
South Asia + Islamic Republic of Iran and Turkey:	Bangladesh, India, Islamic Republic of Iran, Pakistan, Sri Lanka, Turkey	22,600 km
Total:		**80,900 km**

3.9 TRANSPORT CORRIDOR EUROPE – CAUCASUS – ASIA (TRACECA)

The Transport Corridor Europe-Caucasus-Asia project was started in 1998 signed by EU and 14 other countries. This project includes connection between EU countries and Southeast Europe, South Caucasus and Central Asia. TRACECA has Dostyk-Tashkent-Ashgabat-Turkmenbashi-Baku-Tbilisi-Poti parts. Also it has ferry lines to Odessa, Varna, Constanta and Istanbul. There are a lot of technical assistance projects and a couple of financial support from routes in TRACECA (Vinokurov, 2012;109).

Armenia, Azerbaijan, Bulgaria, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Romania, Tajikistan, Turkey, Ukraine, and Uzbekistan are partner of TRACECA. The last member is Islamic Republic of Iran which joined the TRACECA in 2009.

In order to realize this aim, a number of pillars have been established, including;

- Improve the financial relations, commercial and shipping in Europe, the Black Sea region and Asia.
- developing road, rail and seaway transportation for access to the world market
- provide roadway safety, cargo security
- regulation of shipping policy (German, 2012).

The TRACECA corridor starts in Eastern Europe (Bulgaria, Romania and Ukraine) and crosses Turkey. The corridor continues, using the transport infrastructure of the Southern Caucasus, and a land connection towards the region from Turkey. A second route crosses the Black Sea to the ports of Samsun, Turkey, and Poti and Batumi in Georgia. This route reaches the railway networks of Turkmenistan and Kazakhstan via Azerbaijan's Caspian Sea routes that lead to Turkmenbashi, Turkmenistan and Aktau, Kazakstan. Further on the corridor passes through Uzbekistan, Kyrgyzstan and Tajikistan and reaching the borders of China and Afghanistan (Asadov, 2012; 16).

3.10 NORTH–SOUTH TRANSPORT CORRIDOR

United States and European Union stress on critical role of countries of Caucasus and Central Asia in order to improve East-West corridor and shipping routes which connecting Central-South Asia and Europe. Also advance routes of North-South transport routes connecting bazaar in South Asia with Europe through Iran and Russia (Spector, 2002).

3.11 TRANS AFRICAN HIGHWAYS

In 2007 latest improving policy was done. The purpose of this policy was advancing the role of EU and African partnership on shipping, in order to follow two key issues. These issues are about future plan; high quality transport infrastructure, building, funding and sharing of knowledge. Also improving Infrastructure in Africa was started by EU and the African Union (Sklias, 2013; 221) .

The total length of this program is 59.100 km. Trans African Highways comprise of 9 main corridors. At first Trans African Highway was created in 1970s. The goal of this program is to build a connecting network of quality roads, these are;

a) to supply possible routes between the main city of the continent,
b) contribute to the political, economic and social integration,
c) provide resources for road transportation between significant point of production and consumption.

TAH network must strengthen in order to cover South Africa regarding to some rules. Requirement for improving TAH project:

• The minimum standards should be mentioned and total weight regulation. For example maximum weight that can be loaded on a trailer is 40 tons. But the allowed weight is 24 tons. Overload would damage the highway texture.
• This project normally cost a high amount but after the project is done transporters cost would be reduced. a plan should be made for missing links .
• The private sector should get the permission to help TAH network project in South Africa
• In order to strengthen TAH project to South Africa the procedures should be passed (Review of the Implementation Status of the Trans African Highways and the Missing Links; 2003).

After the time period one corridor has been opened. Djibouti – Libreville - Bata is the last corridor of Trans African Highways.

Tab. 2.9 Main Trans African Highways Length (Length information takes from website UNECE)

ROUTE NUMBER	ROUTE	LENGTH (KM)
TAH1	CAIRO-DAKAR	8.636
TAH2	ALGIERS-LAGOS	4.504
TAH3	TRIPOLI-WINDHOEK-CAPE TOWN	9.610
TAH4	CAIRO-GABORONE-CAPE TOWN	8.860
TAH5	DAKAR-N'DJAMENA	4.500
TAH6	N'DJEMANA-DJIBOUTI	4.220
TAH7	DAKAR-LAGOS	4.760
TAH8	LAGOS-MOMBASA	6.260
TAH9	BEIRA-LOBITO	3.520
TAH10	DJIBOUTI-LIBREVILLE-BATA	7.600

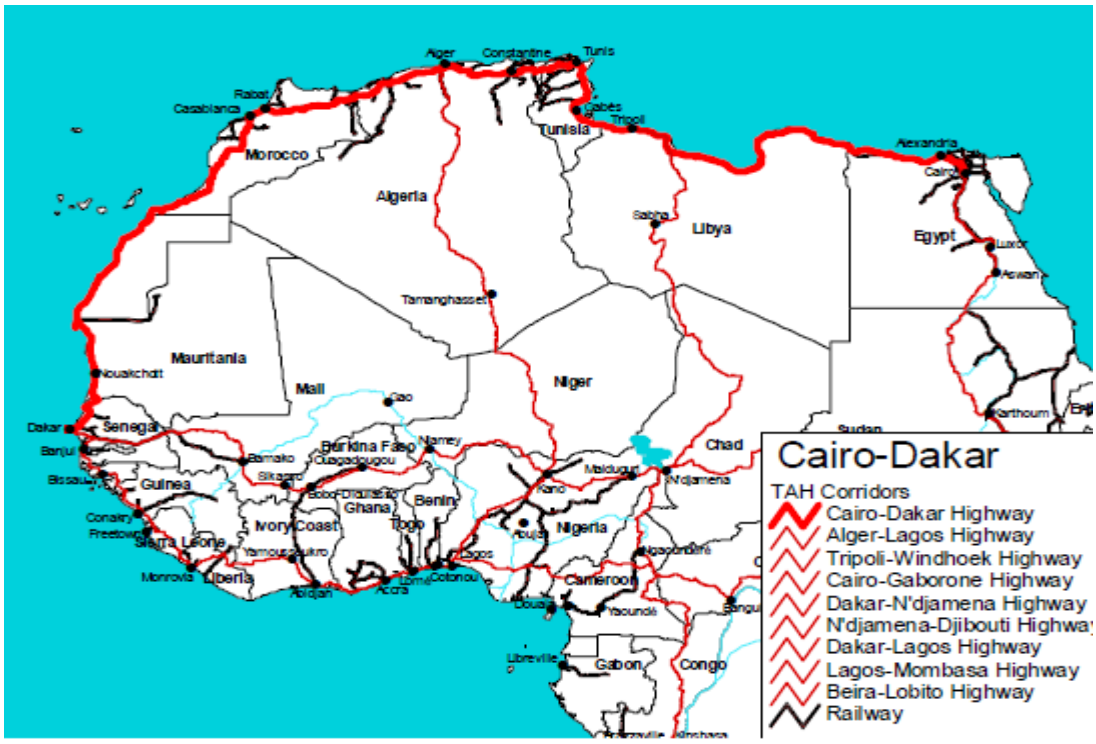
Table 2.9 shows main Trans African Highways lengths. The longest route is Cairo-Gaborone-Cape Town (TAH4) corridor. Also map 2.8 refers to Trans African Highways.

MAP 2.8 TRANS AFRICAN HIGHWAYS (UNECA, 2011; 5)

3.11.1 Cairo-Dakar

The Cairo-Dakar Trans African Highway has a total length of 8.640 km. This highway which starts from Cairo passes through Tripoli, Tunis and Algeria's and ends in Dakar. There are important ports in this highway; Dakar, Port Said, Tripoli, Tunis and Algeria's. These ports also locate in Mediterranean corridor. That why transportation density is high in this location. This is a coast corridor. The most important corridor is the Cairo-Dakar corridor in Trans African Highways.

Cairo-Dakar corridor (TAH1) has connection with TAH2, TAH3, TAH4, TAH5 and TAH7. In Casablanca and Cairo, there is an airport connection. Around Algeria, there is a high speed railway. The disadvantage of this corridor is that between Nouadhibou and Nouakchott is unpaved.

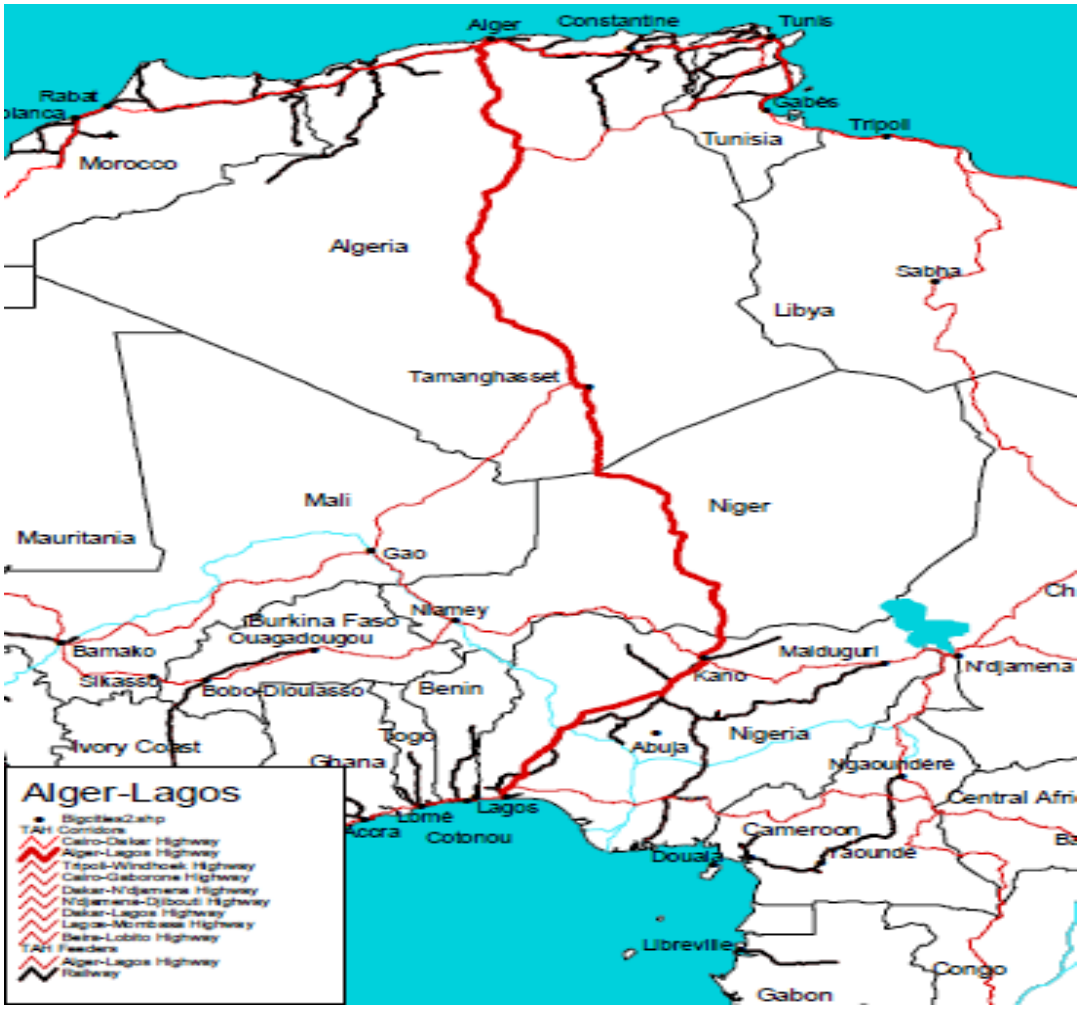


Map 2.9 Cairo-Dakar Corridors (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 24)

3.11.2 Algiers-Lagos

Algiers-Lagos corridor (also called the Trans Saharan Highway) length is more than 4500 km, 85% of this length is paved. The corridor which starts from Algiers and ends in Lagos passes three significant locations; Kano, Agadez and Tamanrasset. In this corridor there are two main ports; Algiers and Lagos. In TAH2 corridor two airports located. It connects to TAH5, TAH7 and TAH1.

The critical thought for establishing Trans Saharan Highway is connecting Algiers to Lagos with roadway. In last 30 years important developments have been done for this project. Although there was a problem in middle sections, road transportation is available (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 25).



Map 2.10 Algiers – Lagos Corridor (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 25)

3.11.3 Tripoli-Windhoek

It begins in Cape Town and ends in Tripoli. This corridor which located between two main ports (Cape Town and Tripoli) is the longest corridor with the length of 9.600 km. The important part of this corridor passes the desert. That why the unpaved parts are a lot. Average daily traffic in TAH3 is a few thousand vehicles. The only corridors that TAH3 is not connected are, TAH2 and TAH7.

This corridor has a big share of Trans African Highway network and also has much missing links. This corridor includes 3.700 kilometers missing links. This amount refers to 40% of total distance of Trans African Highways. On the other hand there is some alternative alignment in this corridor. These are passing in Chad, Cameroon, Central African Republic and Congo (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 26).

Map 2.11 Tripoli - Windhoek Corridor (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 27)

3.11.4 Cairo-Gaborone

TAH4 is the second longest corridor with the length of 8.860 km. It locates between Cairo and Gaborone. The construction for road extension to Cape Town is continuing. The road between Cairo and Gaborone was standard.

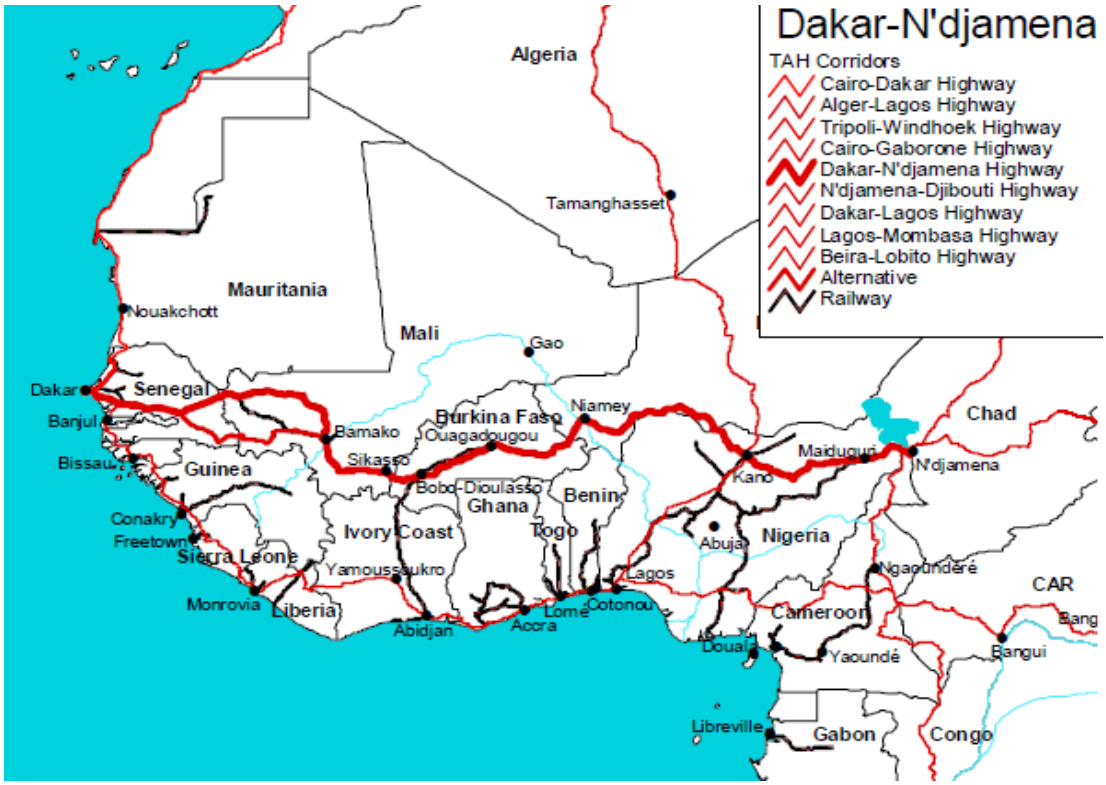
The traffic of this corridor is in Egypt, especially in Cairo. The daily high traffic is in all major capitals in TAH4.

The Cairo-Gaborone Highway ensures the significant shipping route for export and import passes the South African and Namibian ports. Moreover it supports local trade in South Africa and other North countries (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 28).

Map 2.12 Cairo Gaborone Corridors (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 28)

3.11.5 Dakar-N'djamena

The critical characteristics about Dakar - N'Djamena corridor are that it passes through Senegal, Mali, Burkina Faso, Niger, Nigeria, Cameroon and Chad, cities like Dakar (Senegal), Tambacounda, Saraya, Kidira, Kenieba (Mali), Kita, Bamako, Sandaré, Diéma, Kolokani, Bobo Dioulasso (Burkina Faso), Ouagadougou, Koupela, Kantchari, Niamey (Niger), Dogondoutchi, Birnin-Konni, Maradi, Jibiya (Nigeria), Katsina, Kano, Maiduguri, Fotokol, Maltam (Cameroon), Kousseri, N'djanema (Chad). Also languages like French and English are used. This corridor links Dakar - Lagos Highway in Dakar and in Kano connects to Algiers - Lagos (Trans Saharan) corridor. In addition the corridor links with Tripoli - Windhoek Highway in N'djamena (Chad). An amount of 43 million dollar was invested for this project which has taken from The Islamic Development Bank (http://en.reingex.com/Trans-Sahelian-Highway.shtml;25.11.2014).

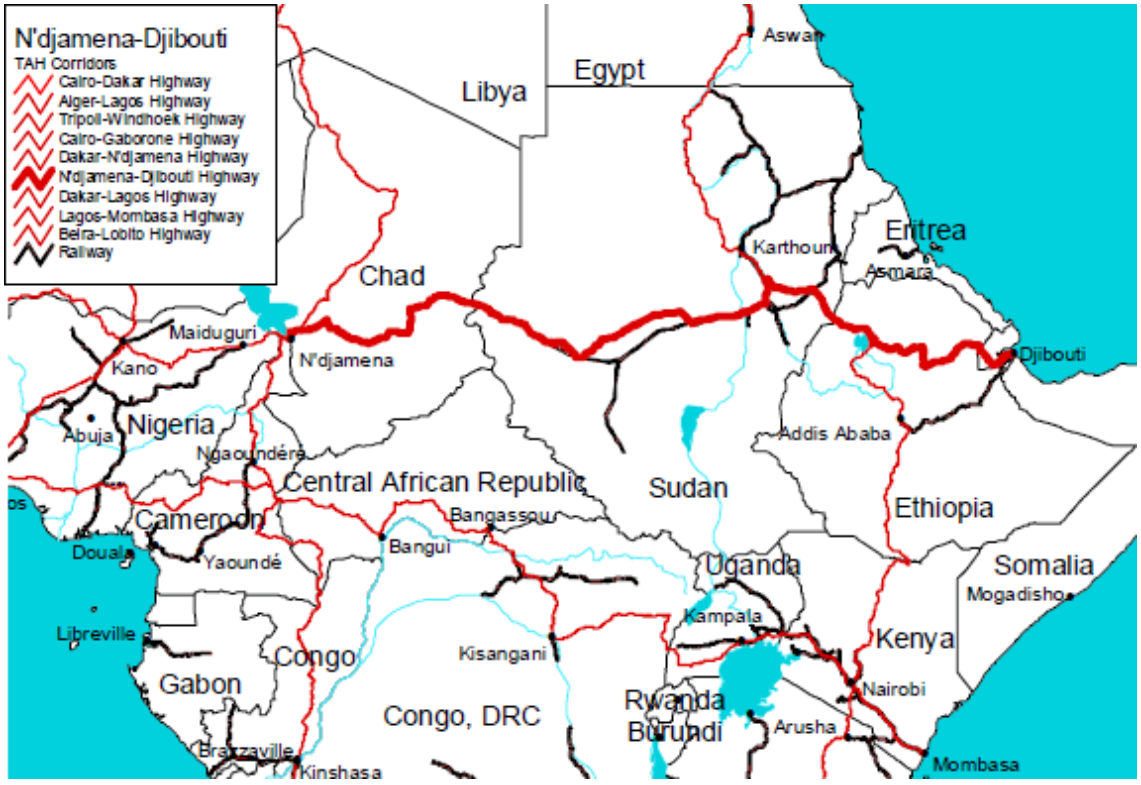


Map 2.13 Dakar N'djamena Corridors (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 30)

3.11.6 N'djamena-Djibouti

According to the map 2.10 TAH6 corridors passes Sudan in the centre desert or semi-desert areas in the west and mountains in the east. The corridor which crosses Africa in parallel located between ports of Sudan and Djibouti and it's unpaved in some parts. It's one of the two highways of Africa continent.

N'Djamena-Djibouti Trans African Highway comprises of 4.300 kilometers of highway that %40 of this amount was paved. Almost half of length of corridor is poor condition and have some missing links. Heavy trailers are mostly used this corridor and cause the traffic (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 31).

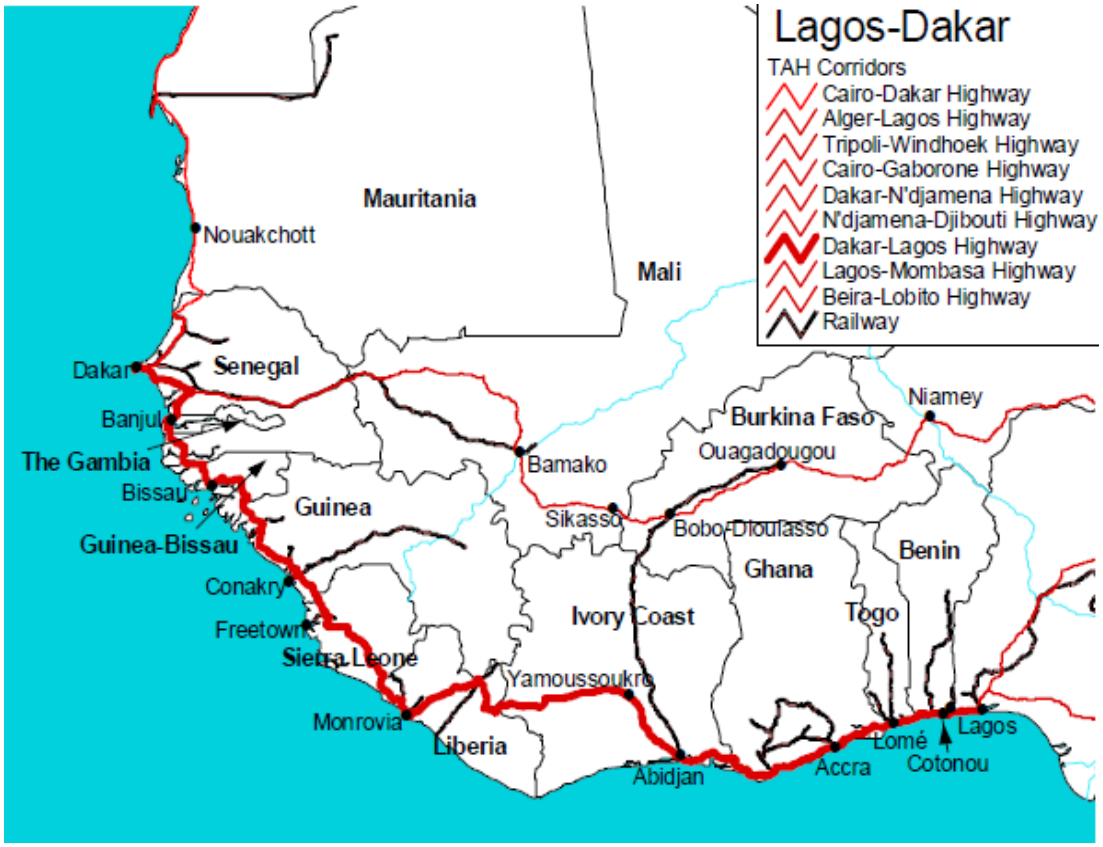


Map 2.14 N'djamena Djibouti Corridors (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 31)

3.11.7 Dakar-Lagos

The Lagos-Dakar Trans African Highway is between Dakar port and Lagos port. It is also named Trans Coastal West African Highway. This corridor connects Lagos-Dakar by passing through coastal road of Nigeria and Senegal.

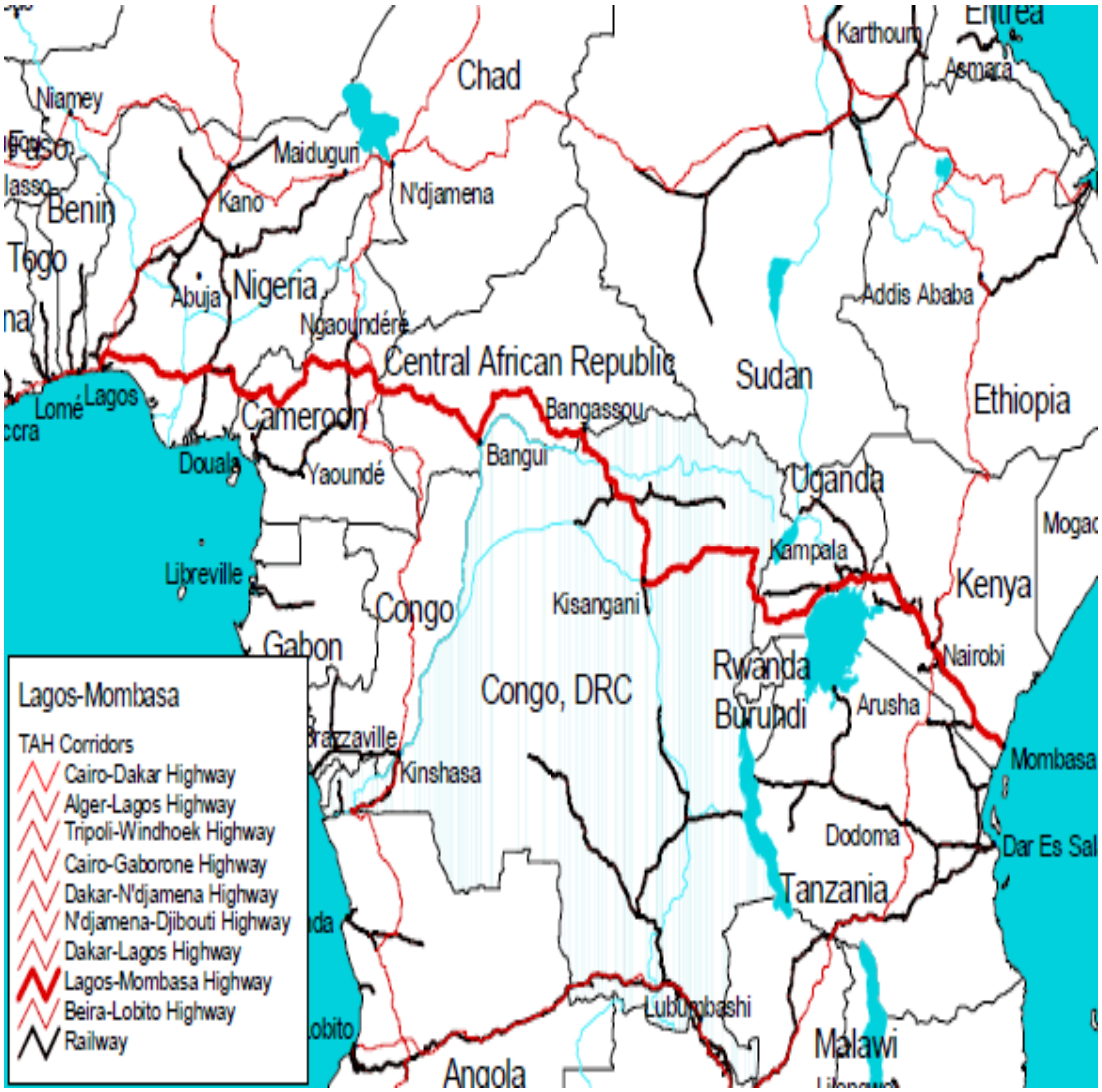
This highway is the only road connection between the capitals of the countries. This is the most important characteristic of this highway. In the meantime it is the starting point of the road which goes into the continents. This highway is totally 3.900 kilometers with different qualities of about 3.135 kilometers paved. 765 km of this corridor is 9 missing links they are distributed in 7 countries which are earth roads.



Map 2.15 Lagos - Dakar Corridor (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 32)

3.11.8 Lagos-Mombasa

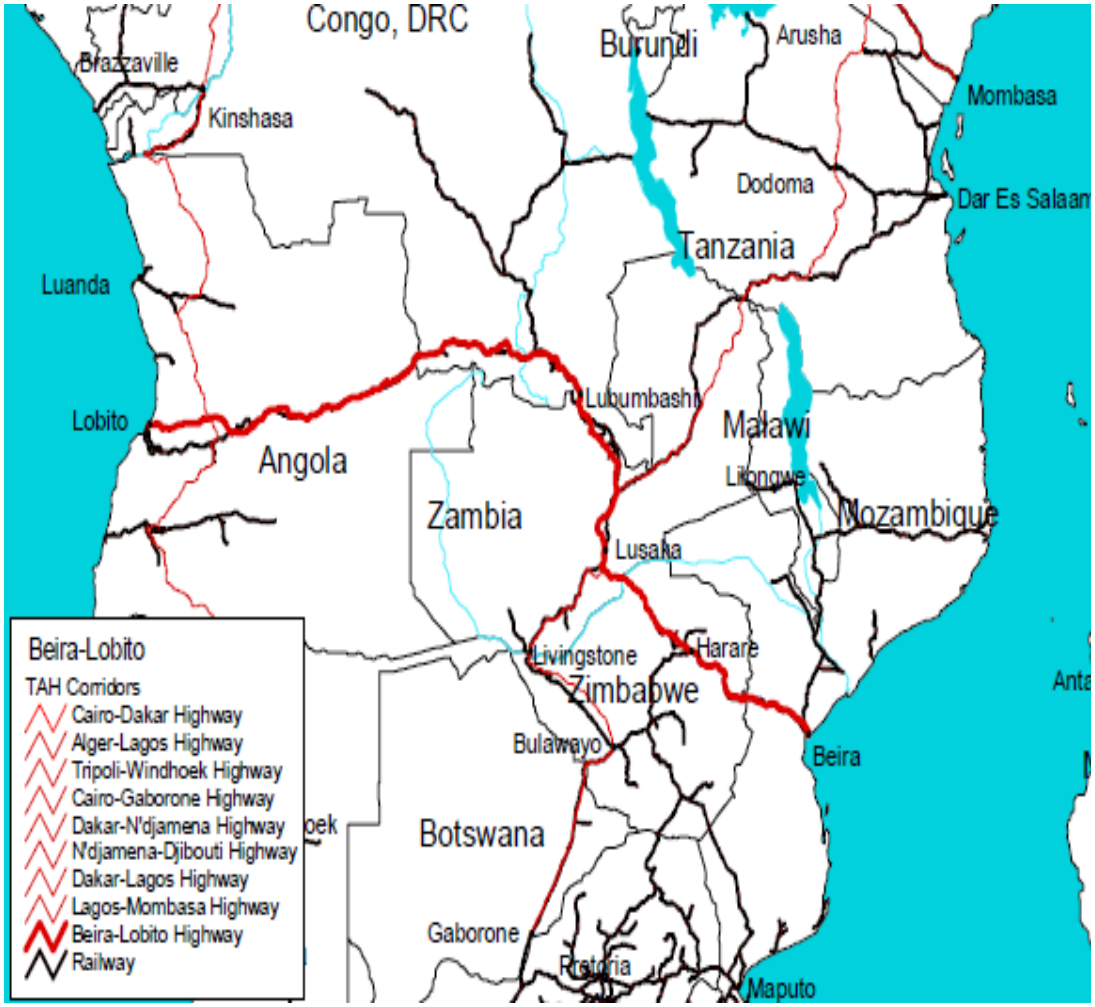
The Lagos-Mombasa Trans African Highway starts from Lagos passing through Cameroon and Burundi and ends in Mombasa. In this corridor includes two ports of start and last station. The main goals of this highway are connecting shoreless countries to East and the other one supporting to bind Congo and the Central African Republic with the Atlantic Coast (International Conference on the Great Lakes Region, 2006; 2).



Map 2.16 Lagos – Mombasa corridor (Review of the Implementation Status of the Trans African Highways and the Missing Links, 2003; 33)

3.11.9 Beira-Lobito

The Beira–Lobito Highway is called Trans-African Highway 9. This corridor is transcontinental road network which established by the United Nations Economic Commission for Africa (UNECA), the African Development Bank (ADB), and the African Union. TAH9 length is 3.523 km passing Angola, the most southerly part of the Democratic Republic of the Congo, Zambia, Zimbabwe, and central Mozambique. It has connection with TAH3 and TAH4. The part which is in Zambia area is unpaved. Also it is close to Cape Town but it is not that much crowded.



Map 2.17 Beira – Lobito corridor (Review of the Implementation Status of the Trans African Highways and the Missing Links; 2003; 34)

3.11.10 Djibouti-Libreville-Bata

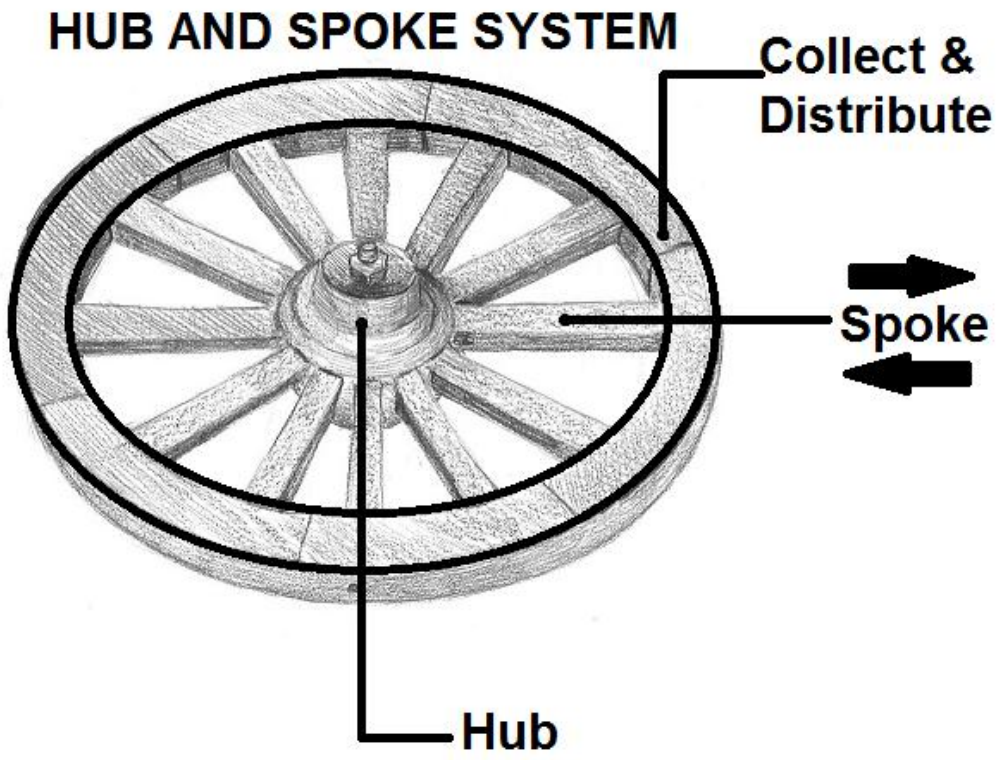
This highway is 7.600 km and passes through Djibouti (95km), Ethiopia (1,942km), Kenya (1,200km), Uganda (720km), Rwanda (240km), Burundi (150km), DRC (3,090km), Congo (7km), Gabon (815km) countries. The main point of TAH10 is Djibouti (Sea Port) and – Libreville (Sea Port/ Gabon).

3.12 INTERMODAL HUB AND SPOKE SYSTEM

In distribution model of hub and spoke, the cargo for a vast area places in hub, accordingly it directs to a distribution center by spoke. That distributor holds the cargo of smaller region. The critical characteristic of hub and spoke is that it's close to the customer and it can service to lots of customers in a short time (Altekar, 2005; 234).

There are different points of view that categorize Hub and Spoke such as: topology, number of hubs and spokes, their arrangement and the connectivity between them. The simplest hub and spoke is a procedure in which sending and receiving is through one depot. Multiple allocations are a hub and spoke method including a two or more depots. Multiple allocations method does not need connected depots to each hub. Also this connection models would stay without any change for a long period (Kemeny, 2011; 22).

The hub and spoke system came from the imagination of cartwheel which is shown in picture 2.1. In the external round part goods collect then they transfer to the hub by spoke part. In the hub the goods will be separate regarding to the address location.



Pic.2.1 Hub and Spoke Network

The hub and spoke network divided two main point-to-point branches regarding frequency of transport services, the destination network and economies of scale. As it is shown in the figure 2.3 example 1 a train goes to the destination ones a day in point-to-point network. Figure 2.3 examples 2 relates to one origin three destinations. it means that there can be three transportation from one origin to three different destinations (Bontekoning, 2006; 3).

If transporter vehicle is train running on spoke part (picture 2.1) when it goes from hub to collecting part if there is no cargo in the collecting part the action will be wasted. But in figure 2.3 example two the train goes three different points in order to collect cargo. If at first point there is no cargo it will go to the second or third point. So the activity during this procedure would be totally useful.

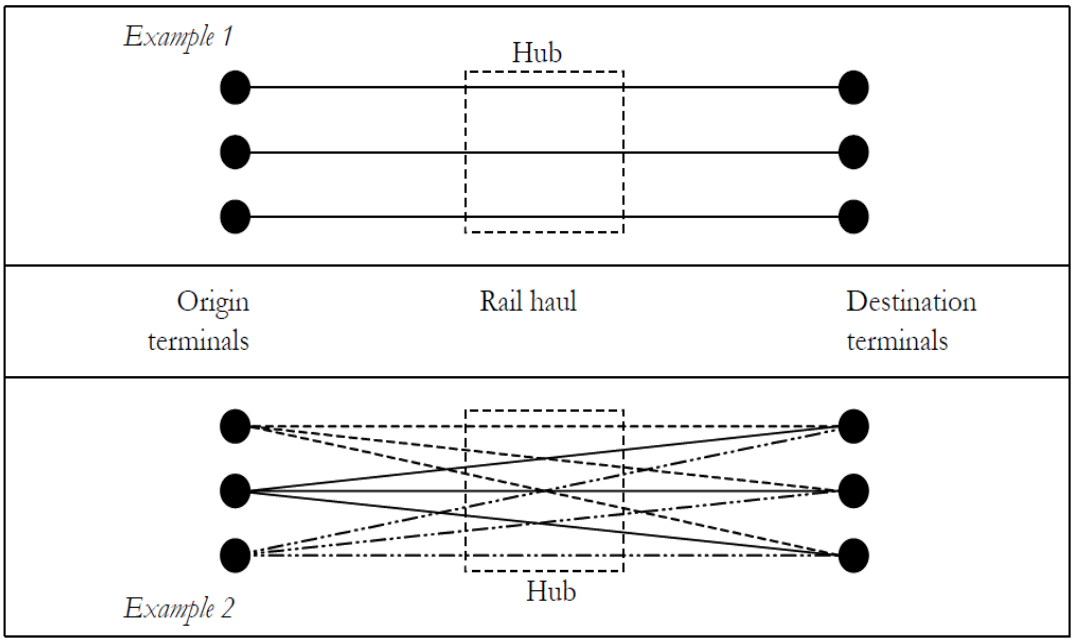


Fig.2.3 Two examples of point-to-point bundling networks connecting three origin terminals and three destination terminals being transformed to a hub-and-spoke network (Bontekoning, 2006; 2).

4. INTERMODAL TERMİNALS

Transportation sector is in a transformation level, this is to actualize the demand of global economy. The changes in production and distribution modify the base of transportation and freight system. The extending of average transportation distance and frequency of freight are increase amount of load flow. Minimizing the size of posts increased the importance of consolidation. This improvement help the growth of terminals leads to achieve a consolidated structure.

There are a wide variety of concepts and terms in literature about terminals. These are distribution center, logistics center, logistics parks, cargo village, dry port (land) and Distribution Park.

Intermodal terminals are the terminals that include two or more transportation types. These terminals which improve by containers are established in lots of different countries in the last 50 years. They also need variety of different equipments in order to connect transportation types together. The significant things of intermodal terminals are modes, modes connectivity and distribution of goods. The intermodal terminals should establish and develop infrastructure in order to present a good service. In intermodal terminals the critical things is to choose a suitable location.

Most important factor in global freight shipping chain is intermodal terminals. They support the connection not only between modes, but also between shippers and carriers. So the performance of those terminals should be carefully control and their performance was seen regarding to two main performance areas; customer service and operational efficiency.

Logistics centre is a complex in which all processes regarding to shipping, logistics, and cargo distribution, custom and warehousing come together. These activities are done by different operators. These centers are commercial centers. These operators activity is warehouses, distribution centers, storage areas, offices, truck services, etc.

In order to do these operations, they can rent or buy land from logistics center (Jowsey, 2015; 87).

Features of terminal must satisfy customer demands by sustainable transportation with low capital and cost. The main element that impacts terminal activities are;

- the train operating plan
- terminal operating strategies
- lifting equipment fleet
- management information systems

The evolution of terminal options and operating strategies for a new container transfer facility is done by the above details (Ferreira and Sigut, 1995; 3).

In order to support services of logistics center there should be public facilities establishment. Logistics center should support roads, rail, sea, inland waterways, air services for transferring cargo, handling operation and intermodal shipping (EUROPLATFORMS EEIG, 2004; 3).

For establishing a logistics centre Public-Private-Partnership is a critical point. There are some rules and regulation for this. At the end logistics centers rules and regulation should be according to European standards (EUROPLATFORMS EEIG, 2004; 3).

The important basement of intermodal transport is terminals and logistics centers. These terminals can supports connection between railway, road, seaway and inland water transport from one mode to the other without handling operations. Although it is one mode high cost and time consuming, but its supports uni-modal transportation. It is very efficient, secure, reliable, predictable and transparent manner (Economic and Social Council, 2011; 2).

Nowadays large and small terminals and logistics centers are available in many European countries. They supply the main operation of transferring services,

additionally all the warehousing, value added services. Below there are the differences between terminals and logistics centers

• Bi- or tri-modal operations (road, rail, inland waterways);
• Number and length of rail tracks and berths;
• Kind of equipment (gantry cranes, reach stackers);
• Transshipment operations and storage capacity;
• Additional value added services (repair facilities, freight forwarding, Customs services);
• Ownership (private/public, public-private partnership (PPP); rail infrastructure manager, railway undertaking);
• Management/operator (owner, rail infrastructure manager, railway undertaking, dedicated terminal operator) (Economic and Social Council, 2011; 2).

There is no limitation for choosing terminal or a logistics centre location. The place changes regarding to variable parameters like physical, logistical, environmental and legal context.

The following factor could be considered for choosing the location of terminal or logistics center.

• Availability of space and location (important for inland waterway access);
• Topography
• Industry requirements
• Size (depending on local/regional considerations, distances and type of terminal operator);
• Suitable access (road, rail, inland waterways);
• Environmental context.

4.1 THE MAIN REGIONS OF WORLD'S INTERMODAL TERMINALS

As we know the biggest intermodal terminals in the world are container ports. After container was found, ports were growing up rapidly and costs decreased. In 1950s London and New York ports each employed more than 50.000 longshoremen. Containerization had impact of lowering the need for labor for port operations. For example, the number of employee in the Port of New York and New Jersey declined from 35,000 in the 1960s to about 3,500 in the 1990s.That is because of cost level reduced day by day. The following graph shows the biggest container ports and also level of Turkey/Ambarlı ports.

Tab. 3.1 Top 10 World Container Ports (The Journal of Commerce annual top 50 World Container Ports; http://www.worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports; 21.11.2014)

Rank	Port, Country	Volume 2013 (Million TEUs)	Volume 2012 (Million TEUs)	Volume 2011 (Million TEUS)	Website
1	Shanghai, China	33.62	32.53	31.74	www.portshanghai.com.cn
2	SIngapore,Singapore	32.6	31.65	29.94	www.singaporepsa.com
3	Shenzhen, China	23.28	22.94	22.57	www.szport.net
4	Hong Kong, China	22.35	23.12	24.38	www.mardep.gov.hk
5	Busan, South Korea	17.69	17.04	16.18	www.busanpa.com
6	Ningbo-Zhoushan, China	17.33	16.83	14.72	www.zhoushan.cn/english
7	Qingdao, China	15.52	14.50	13.02	www.qdport.com
8	Guangzhou Harbor, China	15.31	14.74	14.42	www.gzport.com
9	Jebel Ali, Dubai, United Arab Emirates	13.64	13.30	13.00	www.dpworld.ae
10	Tianjin, China	13.01	12.30	11.59	www.ptacn.com
39	Ambarli, Turkey	3.38	3.10	2.69	ww.altasliman.com/en

4.1.1 Shanghai

The improvement of capacity in China ports, as a result of development of economy raises average of 200% in capacity. For example: in 1998 the capacity increased 21% and in 2001it was 34%. Shanghai's survey, with the population of 21 million, is 6.340 km^2 which is the biggest city of China and accordingly its port is the biggest comparing to the other cities. In 1995 the TEU capacity of this port was about 1.5 million TEU, regarding to growth of 35% comparing to the past. This growth in 2000 was 5.6 million TEU even it contained to increase, in 2006 it become to 21.7 million TEU. We can see all these movements also the transshipment and direct freight in the figure 3.1 (Yap, 2010; 483).

In the last three years as we can see table 3.1 Shanghai port was the leader port in the world. After 2011 the growth capacity was slow down. Because it was full and no chance was left to grow up for potential. In Shanghai port handled 33.62 million TEU.

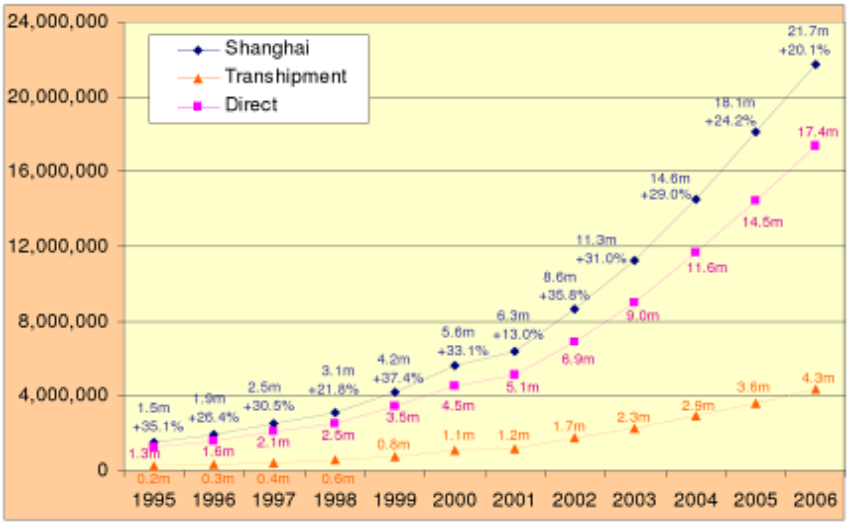


Figure 3.1 Container Throughput for Shanghai in TEUs (Informa Uk Ltd and Drewry Shipping Consultants Ltd; 2008).

Shanghai port owes it high capacity to China's high production line, strategic location and a strong basement. This port is not only a port but also an intermodal terminal. This intermodal terminal which has railway connection it supports

availability of other regions. China has invested huge money for railways infrastructure improvement in neighbor countries in order to increase connectivity.

Here is the summary of the port cargo capacity in tones for four years. In 2007 it was 560 million tones, in 2008 582 million tones, in 2009 590 million tones and finally 2013 with huge raise 776 million tons (http://www.ship-technology.com/projects/portofshnaghai/; 21.11.2014).

According to information of 2012 the total value of Chinese trade was $3.87trillion. US trade stayed on this amount $3.82trillion. The port established land of 3.94 square kilometers and it takes average 470 football pitches.

4.1.2 Singapore

In 1819 Singapore port was established by the British East Indıa Company in order to be trade center. It was built to serve the Malayan hinterland to be regional distribution centre for cargo operations. When Singapore started the independency, it concentrated on its position for the transshipment centre. Strategically in 1960 transshipment port was not exist in that region. Today this port has used these advantages to be the foremost transshipment hub in the world (Yim, 2010; 459).

Map 3.1: Singapore Map

There are thousands of ship a waiting in port which connect the Singapore ports to more than 600 different ports in more than hundred different countries distributed in six continents. A port like this has the following characteristic:

The Advantages

- Strong infrastructure
- Easy availability for international trade centers and industrial zones
- The existence of international transportation and logistic suppliers centers.
- Educated workforce
- Strong logic system and suitable tax base for companies
- Government supports and helps new entrepreneurs

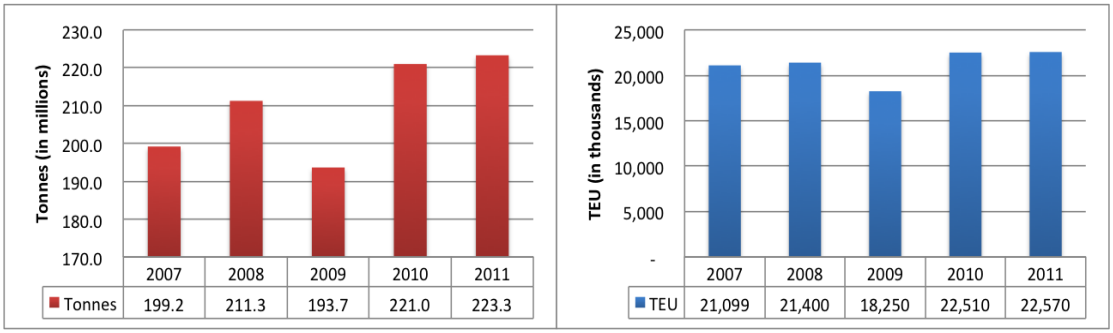
Disadvantages

- High operational cost
- Small geography and national market
- Partial industry

4.1.3 Shenzhen

The second much used container port in China is Shenzhen which is the fourth busiest in the world. The container support operations were started in 1985. This port was customizing after three years. The China merchants (Hong Kong) and COSCO companies invested on this port. Also the container handling operation was started in at Chiwan region in 1990. In 1994 Shenzhen port total container throughput handled only 102,100 TEUs. This amount was less than 1 percent of Hong Kong's performance (Yim, 2010; 469).

Table 3.2 Shenzhen Port handled information (http://www.port-investor.com/shenzhen/; 22.11.2014)



In 2011 22.6 million TEU and 223.3mn tonnes cargo was handled from Shenzhen port. After the growth of 12.1% between the years of 2007 and 2008, together with the growth in 2009 the demand decreased. In 2012 the amount of handling container was 22.94 million TEU and in 2013 it was 23.28 million TEU. The Shenzhen port didn't leap in recent years, but still it's a critical port. These facts are shown in table 3.2.

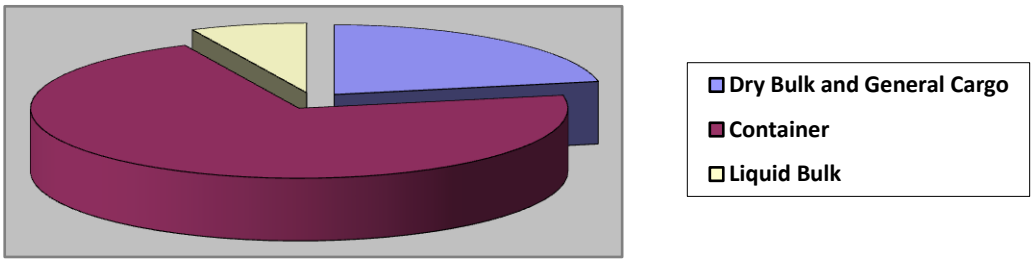


Figure 3.2 Shenzhen Port Handling Statistics

According to formal statistic in figure 3.2, 22% dry bulk and general cargo, 71% container and 7% liquid bulk related in total Shenzhen port capacity in 2010 (http://www.port-investor.com/shenzhen/; 22.11.2014).

Today Shenzhen and universities are doing wide attempt in order to to consolidate relationship. This attempt is to do a useful investigation and commercializing these results. Shenzhen is a perfect chance for the talented people who want to immigrate according to its industrial improvement and its innovative side. The reason of this growth is new and high-tech industries, government encouragement and financial support, setting of related rules and regulations, the establishment of the High and New Technology Investment Service Company.

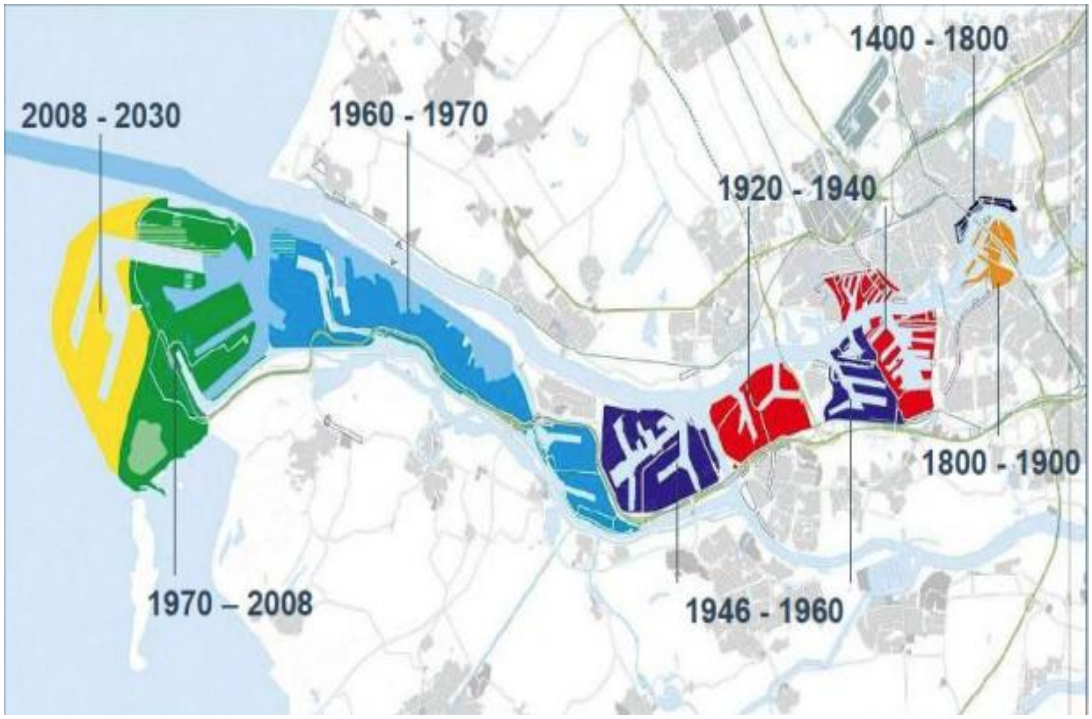
Shenzhen Free Zone Trade Center can provide tax incentives, entering commercial partnerships and freedom of marketing. Local governments can also provide incentives. Today logistics and service sectors are eligible to get the incentives like the production companies. The incentives which were given in global crisis period increase the power of competition in Shenzhen port.

4.1.4 Rotterdam

If there is a place that can show Netherlands became a main trading country that is Rotterdam. The port is located in largest river delta of Europe. The port is available for the ships which travel the sea or ocean. In addition just in one day shipping distance, cargos go to almost one hundred million people. The port of Rotterdam is the largest port in Europe. Rotterdam port as a market leader tries to increase its connection with Germany in strengthens its position. The port of Rotterdam is exactly international terminal. The port has railways and interestingly pipeline. The port has powerful location. On the other hand port has an inland shipping and too suitable to expansion position.

The Port area has been developed increasingly downstream from the earliest port location close to the centre of Rotterdam. The extension of the port is underway; the reclamation of the land began in 2008. The first container terminal is expected to be operating in 2013 or shortly afterwards.

The port area of Rotterdam started from inside and step by step moved to the areas which are close to the North Sea. The construction is still continuing as it is shown in the yellow area in map 3.2.



Map 3.2 Historical Development of the Port of Rotterdam (Schuylenburg, 2010).

Table 3.3 shows the total dry bulk throughput in 2013 was 295.986 mt. 89.187 mt of it was total dry bulk throughput and liquid bulk throughput was 206.799 mt. In 2012 the figures was total dry bulk throughput 292.316 mt. In 2013 the change was 1% comparing to 2012. Total number of TEU in 2013 was 11.621.249 TEU throughput. In 2012 this amount was 11.865.916 TEU throughput. So the change was 2% less.

The most important factor which is being focus in Rotterdam port is petrochemical and Cargo Ship Transportation process. The cargos transfer to the port by ship, barge, train and truck.

Table 3.3 Throughput port of Rotterdam (Port of Rotterdam Authority Abridged Annual Report 2013; 4)

Throughput Port of Rotterdam*

(Gross weight x 1,000 metric tonnes)

	2013	2012	Diffe-rence	% Diffe-rence
Iron and scrap	35,944	32,742	+3,202	+10%
Coal	30,675	25,282	+5,393	+21%
Agribulk	10,318	8,050	+2,268	+28%
Other dry bulk goods	12,250	12,029	+221	+2%
Total dry bulk	**89,187**	**78,103**	**+11,084**	**+14%**
Crude oil	91,054	98,324	-7,270	-7%
Mineral oil	81,608	81,814	-206	-0%
LNG	756	560	+196	+35%
Other liquid bulk	33,381	33,515	-134	-0%
Total liquid bulk	**206,799**	**214,213**	**-7,414**	**-3%**
TOTAL DRY	**295,986**	**292,316**	**+3,670**	**+1%**
Containers	**121,251**	**125,428**	**-4,177**	**-3%**
Roll on/roll off	18,512	17,919	+593	+3%
Other general goods	4,715	5,865	-1,150	-20%
Breakbulk	**23,227**	**23,784**	**-557**	**-2%**
TOTAL GENERAL	**144,478**	**149,211**	**-4,734**	**-3%**
TOTAL THROUGHPUT	**440,464**	**441,527**	**-1,064**	**-0%**
Total in number of containers	7,006,301	7,183,675	-177,374	-2%
Total in number of TEU	11,621,249	11,865,916	-244,667	-2%

According to the fact that port of Rotterdam gives different kind of services and it has a good geographic location and also firm infrastructure, various goods comes and goes through this port it plays the role of transit port.

The figure 3.3 shows port of Rotterdam container throughput 2004 to 2013. We can see Europe crisis directly effect to shipping sector in 2009.

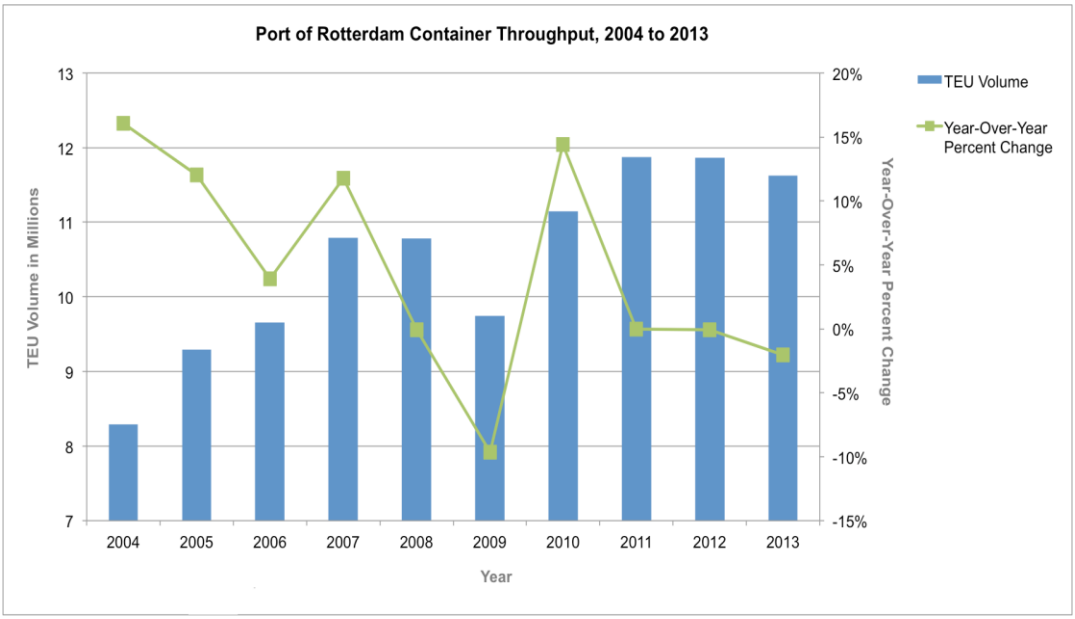


Figure 3.3 Port of Rotterdam Container Throughput 2004 to 2013 (Port of Rotterdam Authority, 2014)

The Port in Figures in 2013

• 29,448 seagoing vessels and 133,000 inland vessels came at the Rotterdam port yearly.

• 1,118 employees and 86,000 (National Ports Council, 2006). Dutch people work in the port (Port of Rotterdam Authority, 2013; 3).

• Rotterdam is the largest port in Europe. 440.5 million Tones cargo and 11.6 million TEU are handled by this port yearly (Source Figure 3.4).

• An industrial area length is 40 kilometers in Rotterdam port and working on port is continuing.

• Yearly the amount of 100 million mt transfers from this port. This is three times more than the whole amount which is used in Turkey in a year.

• 11.6 million TEU was handled in 2013 in Rotterdam port. This amount average is two times more than Turkey's ports capacity

• West part of Rotterdam port can give service to huge ships. Height of this part of port is 24 meters.

• One of the biggest dry bulk carrier ships meets this port ‘Berge Stahl’ which is 342 meters long (equals to 27 trailer length) and 63 meters wide. The ship loads iron ore between Brazil and Rotterdam.

• The popular fuel which is used in Dutch and German power stations is coal. This fuel imports by Rotterdam port (Rotterdam WORLD-CLASS PORT; 2009).

There is a railway in Rotterdam it directly goes to Germany and then by using Rhine River the cargo distributes in Belgium, Germany, France, Netherlands and all Europe.

The figure 3.4 shows incoming and outgoing cargo by commodity in Rotterdam 2009-2012. According the figure 3.4 total throughput between 2009 and 2010 critical raise happened but in the next two years it was limited.

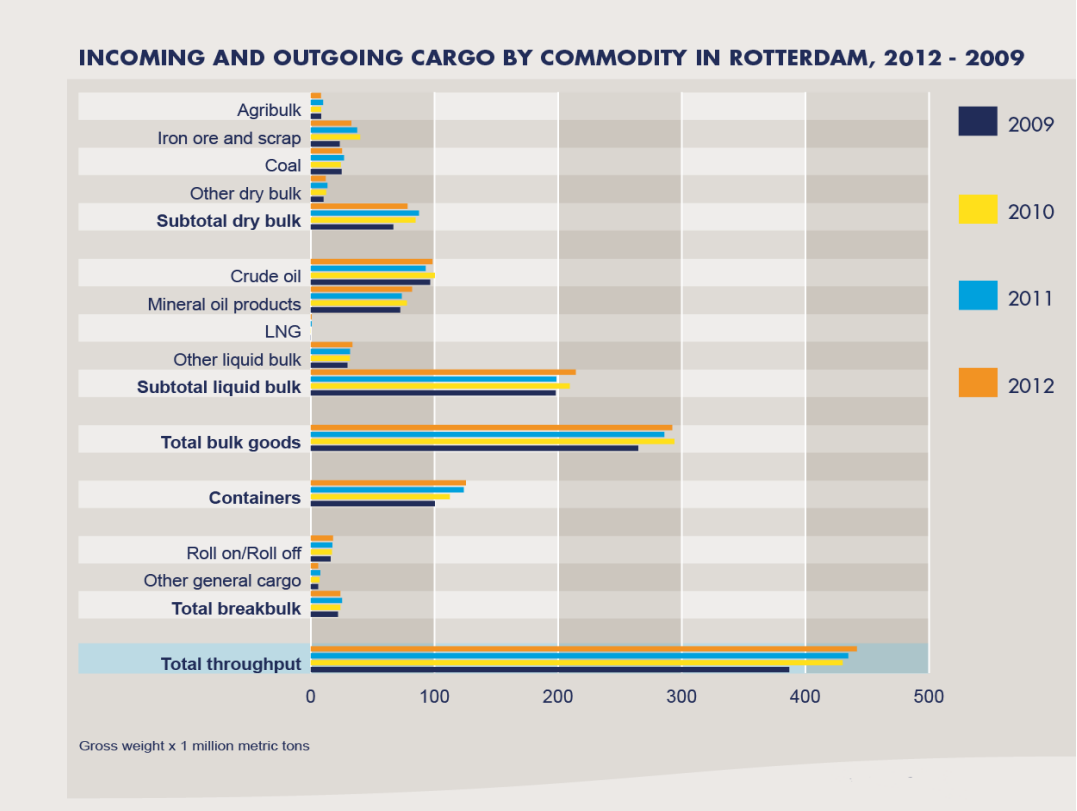
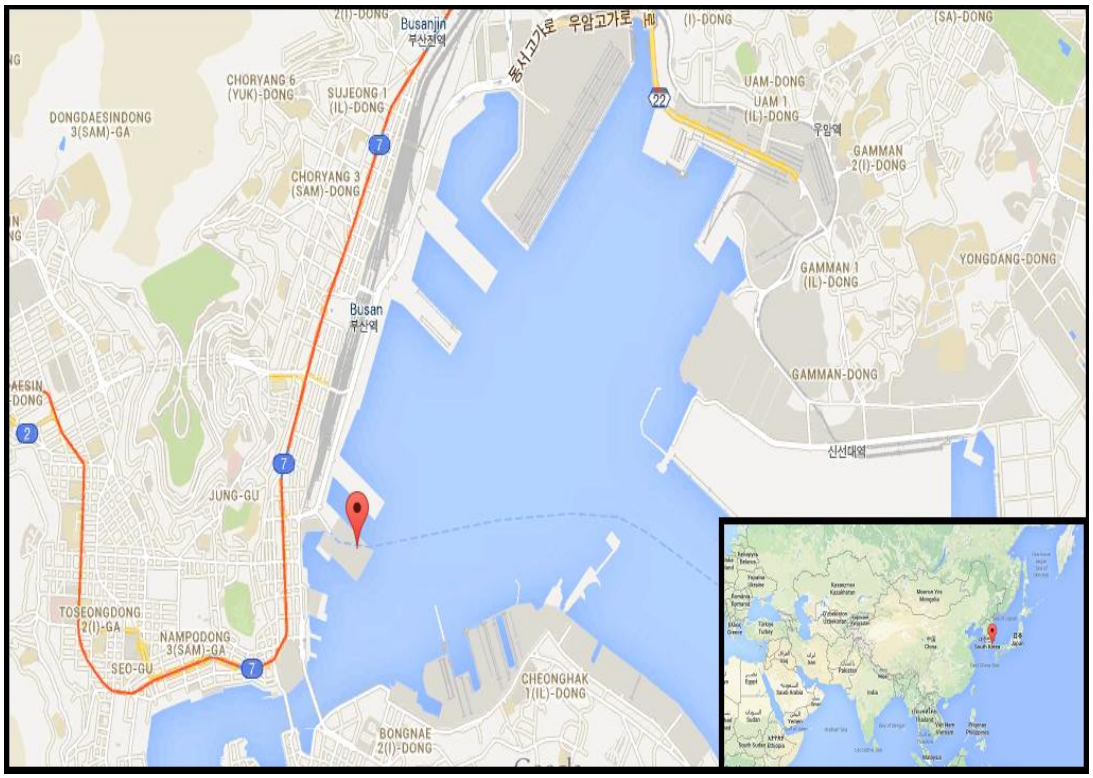


Figure 3.4 Incoming and Outgoing cargo in Rotterdam 2012-2009 (http://www.portofrotterdam.com/en/Port/port-statistics/Pages/throughput-statistics.aspx; 24.11.2014)

4.1.5 Busan

The largest port in South Korea is port of Busan which is in Korean chersonese. In 1876 this port was fully equipment in order to be logistics center which is links to Japan, China and Russia. In 1970 the port started to use containers and in 1976 there were 351.000 TEU active containers. The throughput of containers reached 1.5 million TEU after ten years and lately this port turned to be 8th largest container port. In 2000 the ports most successful movement came. By making a throughput 7.5 million TEUs the port located in the third place of the list (Yim, 2010; 473). After that accordingly it reached to the fifth position of Top 10 world container ports (Table 3.1).



Map 3.3 Port of Busan (https://www.google.com/maps;25.11.2014)

The figure 3.5 refers Busan ports local container throughput 2002 to 2013. The first remarkable thing is the drop 2009. The reason is global economic crisis effect on shipping sector. But Busan port saved the situation at the end of 2010. The throughput reached to 26,434 million TEU with transit container.

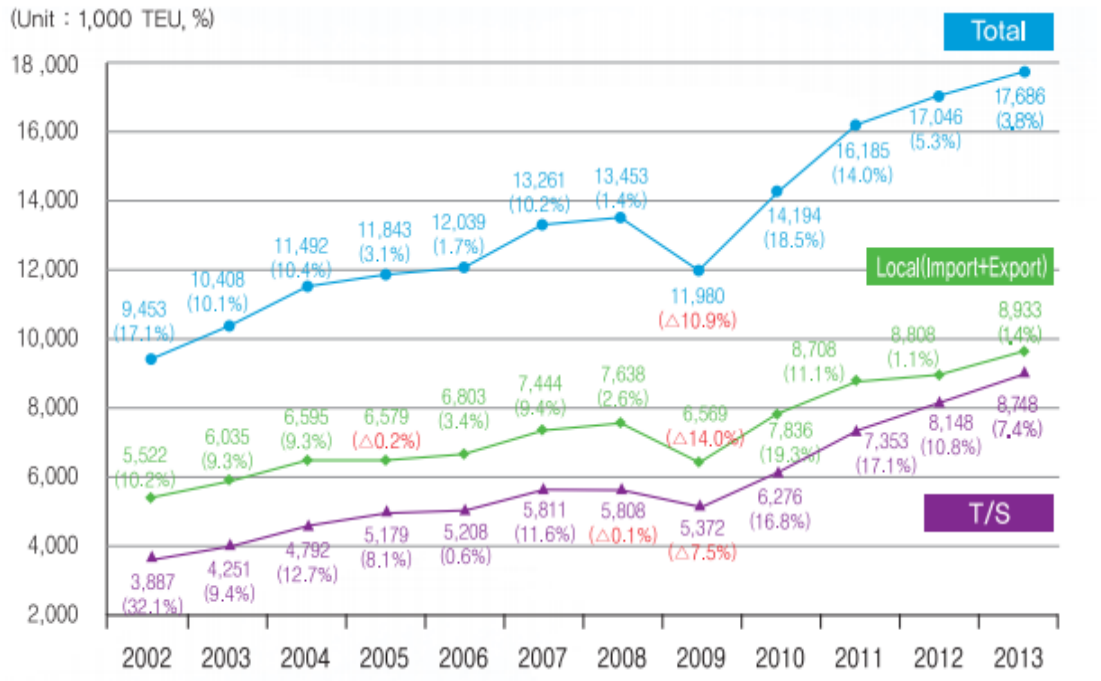


Figure 3.5 Busan ports local container throughput 2002 to 2013 (Port of Busan statistics 2013)

4.1.6 Ambarlı

Turkey's largest port, Ambarlı located in Istanbul. Annually 3.38 million TEU is handling at Ambarlı port which is world's 39th largest port. Ambarlı port is in European side of Istanbul city. The port feeds hinterland hosts a population of approximately 20 million. Turkey's biggest city and the industrial and commercial capital is Istanbul which is the pioneer of location and development of all types of investment.

Turkey has a population of 75 million world's 16th successful economy. Due to the fact that it locates in between Mediterranean, Aegean, Marmara Sea and Black Sea regions it has geopolitical position. So the crossroads of trade routes are available. The most important thing is that Turkey connects the Asian side of the world with European side. The only connectivity to the Black Sea (Bosphorus) crosses Istanbul.

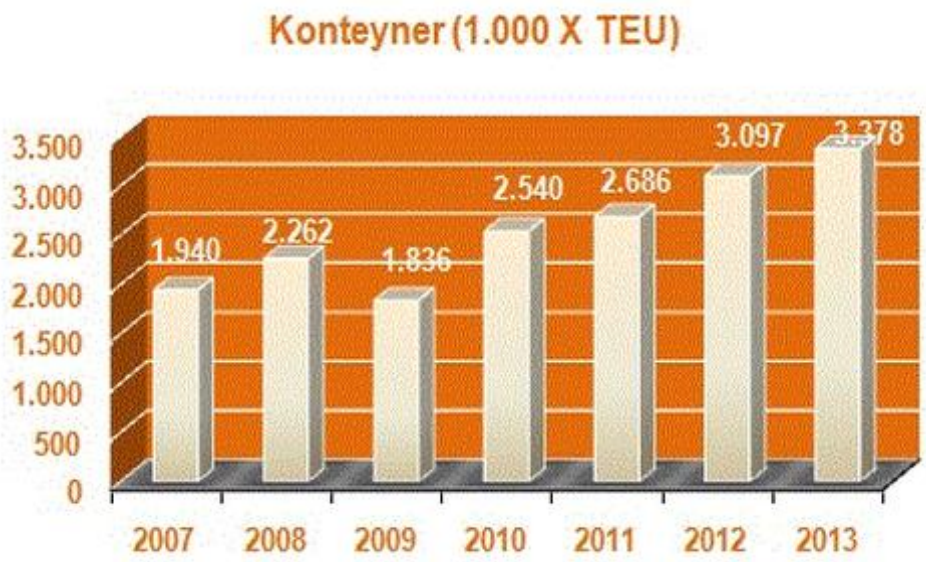


Figure 3.6 Ambarlı port container throughput 2007-2013 (http://www.altasliman.com/sirket_profili_istatistikler.php; 02.12.2014)

From 2007 to 2013 container throughput increased 1.5 times. After 2009 we can see a step by step adding amount the most is in 2013. In 2013 Ambarlı port handled 3.378 million TEU. According to figure 3.6 Ambarlı port could not achieve to the aimed goal.

5. INTERMODAL TERMINALS IN TURKEY

In recent years, Turkey's foreign trade highly increased. In 2004 foreign trade volume was while 161 billion dollars, in 2014 volume reach 330 billion dollars (http://www.tuik.gov.tr/PreTablo.do?alt_id=1046; 16.12.2014).

One of the critical factors affecting as competitiveness of Turkish exports is efficient transport and logistics system. Insufficient and poor quality of transport infrastructure increases delivery time, therefore, the transport costs. This problem leads to a reduction of competitive advantage of Turkish products in international markets. Therefore, the transport infrastructure and improving the management will contribute significant reduction of costs in international trade.

In Turkey, although there is a concept of intermodal terminals but practice is not yet widespread enough. In Integration process with European Union, even Turkey wants to be a regional power in global logistics, it is necessary to improve the intermodal transport system.

5.1 CONTAINER PORT IN TURKEY

Container handling port in the world in the second half of 1960 has begun to spread. However, container handling port in Turkey has begun to be seen in the second half of the 1980s. First private container terminal in 1987 (Gemport) opening into operation in Turkey, after the container is raised resulting in the share of private sector in port business every day.

Table 4.1 Throughput container in Turkish ports (http://www.turklim.org; 16.12.2014)

Cargo Handling in Turkey's Ports

Container (TEU)

	2004	%	2005	%	2006	%	2007	%	2008	%
Members of TURKLIM	1.956,105	63	2.175,274	66	2.568,631	67	3.389,876	72	3.964,373	72
Other	1.125,210	36	1.435,556	34	1.254,096	33	1.309,653	28	1.263,781	28
Total	3.081,315	100	3.610,830	100	3.822,727	100	4.699,529	100	5.228,154	100

	2009	%	2010	%	2011	%	2012	%	2013	%
Members of TURKLIM	3.485,468	77	4.932,869	77	5.679,049	86	6.336,425	87,64	7.101,613	89,18
Other	1.035,318	22	932,916	22	933,986	14	919,992	12,86	861,317	10,82
Total	4.520,786	100	5.865,785	100	6.613,035	100	7.256,417	100	7.962,930	100

Containerized trade volumes expanded in 2012 to reach 155 million TEUs without transfer in the world (Unctad, 2011).

Turkey, despite high container cargo traffic in the harbor bottom to progress rate has lagged behind the world-class structure. This is because as does not have sufficient physical conditions of the ports in the region of the load transfer, failure to obtain enough share (the main port deficiency), occurring in the world technological improvements such as could not keep up and lack of qualified staff mentioned disadvantages.

Table 4.2 Top 10 Ports Throughput Container in Turkey (Maritime Trade Statistics, 2013; 33).

	2013				2012		
	Ports	Total Handling	Rate of total handling	Difference of previous year	Ports	Total Handling	Rate of Total Handling
1	AMBARLI MARPORT TERMİNALLERİ	1.685.504	21,34	8,49	AMBARLI MARPORT TERMİNALLERİ	1.553.670	21,60
2	MERSİN ULUSLARARASI LİMANI	1.364.378	17,27	9,32	MERSİN ULUSLARARASI LİMANI	1.248.106	17,35
3	AMBARLI KUMPORT TERMİNALİ	1.276.313	16,16	19,19	AMBARLI KUMPORT TERMİNALİ	1.070.814	14,89
4	İZMİR TCDD ALSANCAK LİMANI	683.430	8,65	-1,77	İZMİR TCDD ALSANCAK LİMANI	695.726	9,67
5	KOCAELİ EVYAP LİMANI	454.551	5,75	16,05	AMBARLI MARDAŞ TERMİNALİ	399.106	5,55
6	AMBARLI MARDAŞ TERMİNALİ	353.523	4,48	-11,42	KOCAELİ EVYAP LİMANI	391.688	5,45
7	GEMLİK GEMPORT LİMANI	331.604	4,20	-10,63	GEMLİK GEMPORT LİMANI	371.062	5,16
8	KOCAELİ YILPORT TERMİNALİ	305.059	3,86	32,56	ALİAĞA AKDENİZ KİMYA NEMPORT LİMANI	273.867	3,81
9	ALİAĞA AKDENİZ KİMYA NEMPORT LİMANI	253.826	3,21	-7,32	KOCAELİ YILPORT TERMİNALİ	230.133	3,20
10	ANTALYA ORTADOĞU LİMANI	216.215	2,74	20,62	GEMLİK BORUSAN LİMANI	184.649	2,57
	Total	**6.924.404**	**87,65**	**7,88**		**6.418.820**	**89,24**
	Other Ports	975.530	12,35	26,11		773.577	10,76
	Total Handling	**7.899.933**	**100,00**	**9,84**		**7.192.396**	**100,00**

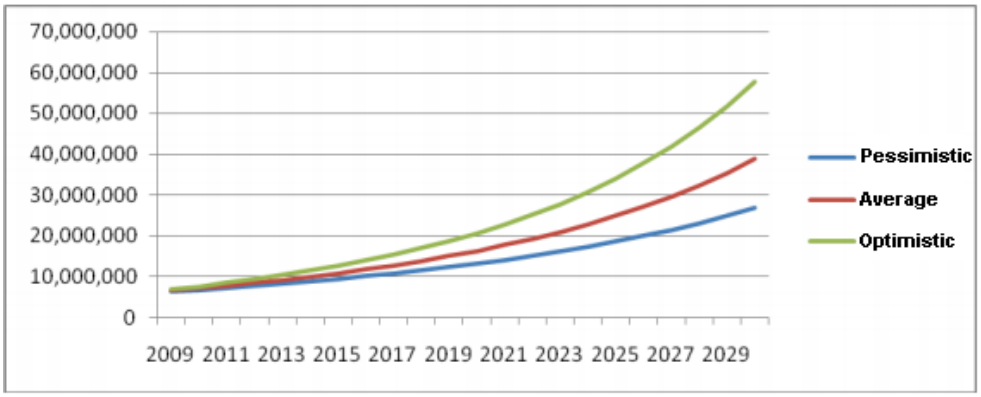
According to table 3.1 and table 4.2 the world's first 20 container ports are very high comparing to the port capacity in Turkey. Lack of main ports which serves transferring goods through huge ships causes this case.

Table 4.3 refers to belongs to the container handling port of Turkey 2015-2023 year total load forecasting (TEU)

Table 4.3 Belongs to the container handling port of Turkey 2015-2023 Year Total Load Forecasting (TEU) (Turkey's national committee 2008; 556).

Year	Pessimistic	Average	Optimistic
2015	6.527.001	8.652.043	11.126.631
2016	6.866.932	9.323.029	12.238.100
2017	7.217.115	10.027.564	13.427.315
2018	7.577.861	10.767.326	14.699.715
2019	7.949.490	11.544.076	16.061.121
2020	8.332.330	12.359.663	17.517.759
2021	8.726.722	13.216.030	19.076.294
2022	9.133.015	14.115.215	20.743.854
2023	9.551.571	15.059.360	22.528.066

The graph 4.1 seen belongs to the container handling port of Turkey 2009-2030 Year Total Load Forecasting (TEU).



Graph 4.1 Turkey 2009-2030 Year Total Load Forecasting (TEU)
(Transportation Coastal Structures Master Plan Study – 2. Interim Report, 2008; 22)

Total demand for container handling the average of all ports in Turkey estimate to 10.7 million TEU in 2015, and in 2030 will be 39.9 million TEU. 9 million TEU capacities seem to be sufficient until 2014. Turkey needs to the new container

handling capacity. This capacity is possible with new projects or expansions of existing port terminals.

5.2 LOGISTICS VILLAGES IN TURKEY

Logistics villages are which national and international transportation, distribution, storage, handling, consolidation, separation, customs clearance, export, import and transit operations, infrastructure services, insurance and banking, containing many integrated logistics activities such as counseling and production.

Logistic (Load) villages began to be created by TCDD in 2006, than establishment by the private sector. In this context, the establishment of some of the 19 villages targeted by TCDD largely completed, some of the construction process, some are still in the design or planning stage.

Completed logistic villages by TCDD in Turkey

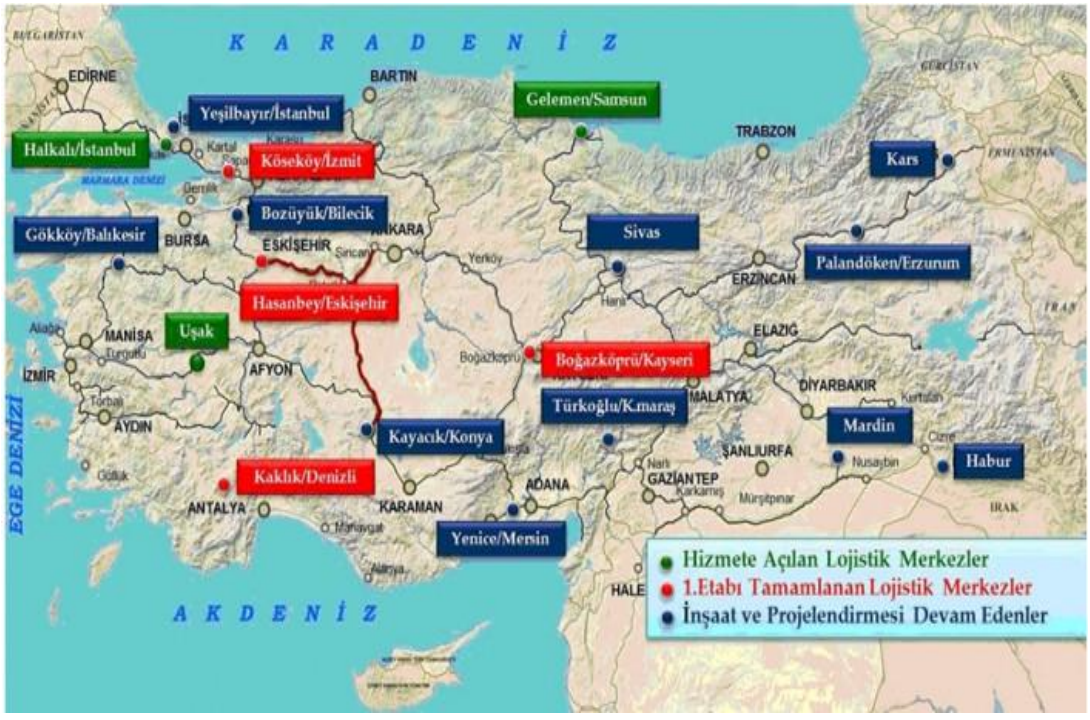
- İstanbul (Halkalı)
- İzmit (Köseköy)
- Samsun (Gelemen)
- Eskişehir (Hasanbey)
- Uşak
- Denizli (Kaklık)

Construction process logistic villages by TCDD in Turkey

- Balıkesir (Gökköy)
- Bilecik (Bozüyük)
- Mersin (Yenice)
- Erzurum (Palandöken)
- Mardin

Planning process logistic villages by TCDD in Turkey

- İstanbul (Yeşilbayır)
- Kars,
- Habur
- Bitlis (Tatvan)
- Sivas
- Kahramanmaraş (Türkoğlu)
- Konya (Kayacık)
- Kayseri(Boğazköprü)



Picture 4.1 Logistics village in Turkey (www.tcdd.gov.tr; 22.12.2014)

The main objective of logistic villages establishment to reducing vehicle usage in transportation, manpower organization, warehouse utilization, personnel costs and by optimizing the logistics chain, providing an increase in the total volume of transport operators to achieve the highest level of quality.

As well as TCDD, Istanbul Metropolitan Municipality (IBB) plans to build logistics village Hadimkoy and Tuzla. With the completion of this project many warehouse and truck depot located in Istanbul will be moved to this center. According to research from Istanbul Metropolitan Municipality average 7700 depot and 424 warehouses exist in Istanbul. On the other hand two logistics park project carried out jointly by the public and the private sector. These are Tekirdağ/Çorlu and Manisa logistics village.

5.2.1 Halkalı Logistics Village

Halkalı logistics village is the located from near lake of Kücükçekmece and middle of Istanbul city. This village is biggest logistics village from current load potential and total area in Turkey. Halkalı logistics village has 1.060.000 m2 total area and 944.00 tones pear years' current load potential. This village still closed to railways traffics due to renovation.

Therewithal Halkalı logistics village has the most important exporting customs in Turkey. But this customs will be moved to another area after several years. Halkalı logistics village is in the middle of city anymore. Due to this problem it affects to traffic. Nevertheless, strong customs, warehouses, many parks for truck, due to the closest terminal to the industrial centers of Turkey was the last stop of all European container trains for many years. Halkalı line moved about 800 thousand tons of cargo in 2012. The most important developments for Halkalı logistics village, the existing warehouse was strengthening to be earthquake resistant in recent years.

5.2.2 İzmit (Köseköy) Logistics Village

Izmit 765.000 m2 Logistics Park was established over and nearest Kocaeli. This village is planned to serving all of Marmara region and organizing to transportation of foreign trade. After finished the all parts of village the amount of freight transport will be 1.5 million tons / year. Logistics village mainly automobiles, automotive spare parts, wood, petroleum products, gypsum, container, clinker, iron, cellulose,

enamel raw materials, water, will contribute to the transport of products such as boric acid and steel.

5.2.3 Samsun (Gelemen) Logistics Village

Samsun (Gelemen) is the first logistics village in Turkey. The first leg of this village started to serving in 2007. This village a particularly important transit point for transport to Russia and Kazakhstan. Samsun Logistics Park was established to 330.000 m2, nowadays this area grown up 350.000 m2.The target of railway transportation for this village planning to 500 thousand tons to 1.1 million tons.

Logistics village, mainly iron, scrap, coils, copper, clinker, container, cement, coal, timber, wheat, food, transportation and distribution of products such as fertilizers and will be carried out.

Samsun, Turkey and the Black Sea is one of the most important port city. Also connects the inner part of the Black Sea coast is located just two rail lines, one of which is the last station in Samsun. The last trade agreement of between Turkey and Russia will be increase significance of this village.

5.2.4 Eskişehir (Hasanbey) Logistics Village

Eskişehir logistics village is the located from site of Hasanbey due to connectivity infrastructure and mainly from organized industrial zones. This village is planned to be built on about 630.000 m2. Eskişehir logistics village was opened in 2014 by TCDD. The average transportation volume is 566.000 tons/year. Mainly tiles, feldspar, iron, ceramics, construction materials, home appliances, container, magnetite, food, water and coal transportation will be provided in this village.

Eskişehir is the central city of the railways and highway transportation of Turkey and city has a large industrial capacity. At the same time Eskişehir is nearest to capital

city Ankara of Turkey. Due to these reasons establish here logistics village the right preference.

Nowadays logistics village railways extended with industrial zones. In this way organized industrial zones freight will be connected with easily to village.

5.2.5 Uşak Logistics Village

The logistics village established 140.000 m2 area. TCDD build this village closed Uşak train Station. Before the planning Uşak train station transportation volume was 113.000 tones for year. After the village opened aim is 246.000 tones for year. Logistics village will be provided ceramic containers, blankets, yarn, marble, plastic raw materials, machinery and equipment, food transportation.

5.2.6 Denizli (Kaklık) Logistics Village

A total of 120.000 m2 logistics center, built on an area of 150 thousand tons annually made from the rail transport is planned to increase to 500 thousand tons. Logistics village of marble, coal, clinker, container and textile products will be shipped.

5.2.7 Balıkesir (Gökköy) Logistics Village

Gökköy 200 thousand m2 will be built on the land. Land expropriation work with the protocols signed between the Balıkesir with TCDD has been completed. In addition, the building project was completed with the distribution plan. Gökköy Logistics Village project is designed to be integrated with Tekirdağ-Bandırma Train-Ferry and the railway project Bakü-Kars-Tiflis. Thereby uploaded products from this region can be easily transported to the Central Asian countries to Europe. The amount of cargo transported by the entry into service of 390,000 tons / year to 1,000,000 tons / year will be generated. Logistics village, cars, container, wood, marble, food, china clay, fibers and synthetic materials, coal, military material and various products such as iron ore will be transported.

5.2.8 Bilecik (Bozüyük) Logistics Village

Bozüyük Bilecik the county, with a strong central position in the industry and transport is set to become an important logistics center. Due to the railroad connection with the Gemlik port has the ability to take benefit from each of the three modes of transportation. Village which will provide 1.9 million tons of capacity to the logistics sector will be established on an area of up to 132 thousand m2. Logistics village will be carrying container, ceramics, insulation materials, iron and steel products, construction materials and military cargo.

5.2.9 Mersin (Yenice) Logistics Village

Which will be built on about 640 thousand m2 Yenice Logistics Village project process has been completed. Yenice logistics village is located from 13 km to Mersin port and 2.2 km to railways. When start operating the amount of cargo transportation 896 000 tonnes / year.

Logistics village will be transport containers, tools, machinery, spare parts, agricultural equipment, iron, steel, pipe, food, cotton, ceramics, chemicals, cement, and shipping military material.

5.2.10 Erzurum (Palandöken) Logistics Village

Palandöken logistics village is located Aziziye and established 327 thousand m2 of land. After Palandöken Logistics Village will finish with approximately the freight amount will be 437,000 tons / year. Logistics village will be serving cars, coal, iron, flour, bricks, tiles, container, ceramics, food, water, beverages, fertilizers, feed and military supplies.

5.2.11 Mardin Logistics Village

Mardin logistics village will building 316.000 m2 area. Not only Mardin and surrounding businesses, but also established for import and export shipments, especially Syria and Iraq. The logistics village will be serving to transport container, ceramics, insulation materials, iron and steel products, military materials and construction materials. Mardin logistics village average transportation volume will be 1.5 million tones.

5.2.12 İstanbul (Yeşilbayır) Logistics Village

Yeşilbayır logistics village will be biggest village in the Turkey. Region has the opportunity to grow up to 10 million square meters. 1 million square meters of logistics field will be built. 6 million tons of capacity will be provided for sector.

Yeşilbayır will be serving to transport container, exported goods, imported goods, textiles, processed leather, small appliances, sand, auto spare parts, trucks, cleaning agents, food, paper, MDF and pipe transportation.

5.2.13 Kars Logistics Village

Logistics village will appeal to Kars and surroundings, the Turkic republics (of the former Soviet Union) and Iran. The village will be establish 13 km east of Kars and at the intersection of railway Kars-Tbilisi , Kars-Iğdır railway projects. The village will be transported coal, military goods, fertilizer fodder, container, flour and fuel. Kars logistics village will be integrated with Kars-Tbilisi-Baku the project. The transportation volume will be 412.000 tones and 316.000 square meters of logistics space will be built.

5.2.14 Habur Logistics Village

The place selection is continuing.

5.2.15 Bitlis (Tatvan) Logistics Village

The location is not selected yet.

5.2.16 Sivas Logistics Village

Sivas logistics village will be established 500.000 square meters area. TCDD is planning to add 1 million tones capacity for logistics sector. From this village will be carrying ceramic, coal, iron ore, wrought iron, construction materials, fertilizers, military and administrative material.

5.2.17 Kahramanmaraş (Türkoğlu) Logistics Village

Türkoğlu logistics village will be planning to establish highway of Nurdağı-Kahramanmaraş. The village will be 3 km away to industrial zones. This logistics village shipping capacity is average 2 million tones. Türkoğlu logistics village will have 800.000 m2 areas.

5.2.18 Konya Logistics Village

Konya logistics village will began to build in Kayacik locality. Coal, cement, marble, food, flour, feed, hay, fertilizer, sugar, agricultural machinery, agricultural products, container, transport military goods to be transport. This logistics village will has 1 million square meters and 1.7 million tones transportation volume.

5.2.19 Kayseri (Boğazköprü) Logistics Village

Approximately 1,511 thousand m2 logistics park planned to be built on land Kayseri logistics village first phase of construction was completed. Kayseri logistics village will has freight amount 1.782.000 tones / year. Iron, pipes, fodder, container, sheet

metal, ceramics, coal, cotton, zinc, furniture, cables, tires and military equipment will be shipping of this village.

6. LOGISTICS SECTOR ANALYSIS AND RECOMMENDED STRATEGY ABOUT INTERMODAL TERMINALS. (TURKEY IN GENERAL AND ISTANBUL IN PARTICULAR)

6.1 COMPARING WORLD'S LOGISTICS INFORMATION WITH TURKEY'S

General data about the logistics sector in the world economy are as follows;

- World economic market trade volume is 16 trillion dollars and logistics volume is average 6.4 trillion dollars. It means logistics trade volume is 40% part of world economic market trade volume.

- Our country today as 50-60 billion dollars (about one percent of the global logistics volume) has a logistics capacity. Used in this capacity is the average annual 6-8 billion dollars. In other words, the capacity is used of only 13%.

- Logistics capacity in developed countries, 10-12% of GDP per part. 2-5% in developing countries, and in Turkey this ratio of 2-3%.

- The developed countries spend 2% GNP for logistics activities. In developing countries is between 0.2% and 0.5%. This ratio is around 0.3% in Turkey.

- The developed countries logistics investment share is between 15-40% in total annual investment. This rate in developing countries remains between 2-5%. Turkey is the annual rate of 3%.

- The annual growth rate in the logistics industry, 5-12% in developed countries while in developing countries this percentage raises to respectively 15-25% levels. The average growth rate is 15-20% in Turkey.

- Two thirds of world logistics consists of transport and supply chain activities for the retail sector. In this context, the top 10 logistics companies in the global market situation with 27% of the total market. In our country, the share of the top 10 players received from all sectors ranged from 2% to 3%.

- Depending on the development level of the company about 25% to 80%, logistics activities are carried out using the rate of 65-85% by outsourcing Logistics Service Providers Companies. In Turkey, 6-8% of commercial companies fulfill their logistics outsourcing using 10-30%.

- In addition, enterprises have advantage from average 2.8 to 3.2 days using outsourcing in the supply chain.

- When the use of outsourcing logistics activities aside other will provide added value to businesses, providing profit between 60% and 45% in financial terms.

- When looking at the issue in terms of expenses, most important part of business in expenses constitute logistical costs. 15% 25 percent of the cost of logistics costs in the formation of the product is located. The product's selling price constitutes 4-20% of logistics costs (MÜSİAD, 2013; 39).

Today, Turkey is 600 billion dollar worth of goods movement in the transition point between East and West; highways, railways, 3 sides of the surrounding seas, in the heart of the Eurasian trade with airports and distribution centers; Europe, the Balkans, the Black Sea, the Caucasus, Central Asia, goods between North Africa and the Middle East is a hub location of the stream. With this strategic position which has the potential to be the most important and valuable logistics base of this region.

The volume of the logistics industry reached 8 trillion dollar in the world, the industry is estimated to reach to 10-12 trillion dollars in 2015. Turkey has to get a share from this industry using strategic position.

According to research of JLL, with the effect of increasing foreign investment in the logistics industry is expected to grow 48 percent in 5 years. According to same research Turkey the fastest growing logistics was second after Russia.

One of the biggest problems of the logistics sector is Turkish logistics sector doesn't increase parallel with the volume of foreign trade developed at the same rate.

75% of the logistics activities in our country is currently engaged in manufacturing firms are covered by the resources in their internal structure. This action prevents the development of the logistics industry and sector cannot afford the desired level.

SWOT Analysis on the Logistics Industry in Turkey

Strengths

- The demand of qualified human resources increases in the company.
- Companies which have strong capital structure.
- The geo-strategic importance of Turkey, the center is on the path to Europe emerging from the Middle East and the Turkic republics.
- The presence of multinational logistics company in the country offers to benefit from their technical knowledge and experience with local companies.
- Turkey has one of Europe's largest truck fleet and improved road transport sector.
- Labor costs are lower.
- The growth rate of the economy (above the EU average).
- Companies have rich alternatives for transportation subjects.
- Possible locating a logistics base and harbors.
- Capability to build supply chain.
- Experience in crisis management.

Weaknesses

- Price-based competitions are forcing the companies offering high quality service and negatively affect profit margins, especially in the truck transportation.
- The informal activities in the sector lead to unfair competition.
- There is needed modernization of railway and maritime infrastructure requirements.
- Qualified personnel are insufficient.
- Choice of rail transport is relatively low.
- The lack of intermodal terminals and logistics centers.
- Lack of use of technology in firms.
- Lack of use of information technologies.
- Environmental friendly transportation systems are extremely low.
- Land transportation over use
- Obstacles of external funding
- Lack of infrastructure investment by firms in ports

Opportunities

- International trade is increasing.
- The possible EU membership of Turkey will further increase the volume of trade.
- Topography suitable for the construction of a new port.
- The size of the sector is significantly smaller compared to EU countries and the market is still unsaturated.
- The EU has set itself as one of the most important of the 10 major transport corridor Europe-Caucasus-Asia corridor with (TRECECA) directly pass through Turkey.
- Show the rapid development of logistics technology.
- Universities have started several departments of logistics educations.
- High speed development in logistics technologies.

- Geographic location allows different modes of transportation.

Threats

- Truck transportation quota, visa restrictions and customs document liabilities is high.
- A threat as major competitors Greece for maritime transport and Bulgaria for the road transport.
- There is a large amount of investment required for the logistics infrastructure. There is a risk that investment cannot be realized on time.
- Cycles oil prices.
- The global economic crisis.
- Rising purchasing costs by increasing the dollar.
- Inelastic structure of rail transportation.

6.2 COMPETITIVE POWER OF LOGISTICS INDUSTRY IN TURKEY

Despite of European crisis, Arab spring and political tensions in Syria, Turkey was capturing the growth figures in the logistics sector. Logistics sector is in the most important sector in turkey with 55 thousand truck fleet and 80 billion lira trade volume.

Approximately 95 percent of passenger transport and about 90 percent of goods transport was done via the road in Turkey. Improvement of existing roads and newly constructed roads, gives impetus to the highway logistics.

In recent years, because of the fact that Turkey's airline companies grow in a global scale, very significant improvements happened that increase the power of cargo logistics. Moreover, until 2023 23.5 billion budget allocated to development of railways projects it will stop the deficiencies of Turkish railway sector.

In 2023 the target of 500 billion dollar export, comes one of the most important logistic sectors in order to achieve this goal. To reach this target, transportation infrastructure and logistics services should be ready for quality and capacity. In addition to Turkey's logistic potential it has also the potential of Black Sea and Central Asia region because it is located in the center of it. But it is not enough to compete for supremacy of the location. Particularly logistics sector is expected to complete the competition and sector development will focus on the following objectives:

- Choosing the right customers and to determining customer needs
- Increase the level of customer service
- Improve the existing product range
- Consider profit target as pre-plan
- Customer satisfaction
- Strategic control (Cash flow and operations execution)
- Providing special transportation services according to customer product
- Interactive and automation supported storage
- Reducing shipping costs, delivery times and labor cost
- Reducing inventory costs by keeping the minimum stock
- Make new fixed investments
- Building new intermodal terminals and logistic villages

In recent years on global competitions, companies have to speed up the production and delivery. Nowadays production costs are obviously close to each other, from the competition point of view logistics services and strategies are important. However, in order to obtain a competitive advantage in the logistics sector the priority has been given to six titles.

- Creating logistics strategy and corporate structuring
- Improve the logistics infrastructure in cities
- Ensure the effectiveness of customs procedures
- The completion of major transport infrastructure investment

- Increasing the competitiveness of firms operating in the sector (R & D, innovation, mergers)
- Integrated domestic logistics project with international structure (Ministry of Development, 2014;3-6).

6.3 SUGGESTIONS TO IMPROVE TURKEY'S FUTURE LOGISTICS STATUS

Logistics sector makes a significant breakthrough in Turkey's stable growth in 2013, a growth rate of 15-20. The size of the logistics sector, which employed 500 thousand people with sub-sectors around 80 billion dollars. In 2015 is expected to increase to about three times that volume.

Turkey is located close to Europe, the Middle East and North Africa's market; it has the opportunity to access 1.5 billion consumers easily. Turkey is one of the most important member of Black Sea Economic Cooperation Organization and plays a key role in the Central Asia connected Pan-European transport corridors.

Turkey's ambitious vision for 2023 will celebrate 100 years establishment of the republic, just needs projected high goals for the transport and logistics sector. These targets are located in the following;

- 19 large-scale new logistics center
- 36,500 km of divided highway, 7,500 km of highways
- An undersea tube crossing the Bosphorus in 2019
- Finishing third bridge and integrated roads in Istanbul
- Çanakkale Strait bridge
- 10,000 km of high-speed train railway, 4,000 km of additional rail
- Making 8,000 km line electrical and signaling
- The renewal 500 km of railway in a year
- The opening of Railways for private sectors

- Renewal of the terminal and station for high-speed railways
- Supporting the rail project that will connect the Middle East, Caucasus and North Africa
- 400 million passenger capacity with new airports
- 3 new airport to Istanbul
- 750 aircraft fleet
- Connecting the railways of the main port
- Making transfer ports in Aegean, Mediterranean, Black Sea and Marmara.
- Having at least one of the world's top 10 ports In 2019
- Handling capacity of 32 million TEU container transport
- Handling 500 million tons of solid, 350 million tons of liquid cargo
- 10 million metric tons ship building capacity
- Making 100 marinas with the capacity of 50.000 yacht
- Making new modern customs
- Increasing the use of railways and maritime in local transport
- Intermodal transport should be encouraged
- Encouraging the value added project
- Developing and Supporting Combined Transportation
- Developing and Supporting Ro-La Lines
- Revitalization of the historic Silk Road
- Making new port-hub in Istanbul

Turkey should improve logistics and physical infrastructure to provide a competitive advantage for intermodal transport corridors. Asian-European intermodal transport corridor is already the busiest economic activity corridor. Marmara region located in the middle of this corridor and also have a large exit point in foreign trade transport, because it is the most important industrial center. In addition, the Bosphorus Rail Tube Crossing project will accelerate the corridor.

Intermodal facility and investments are the medium and long term investments that require significant funding. Government must be organized and encouraged these investments.

After privatization the important export port of Izmir Port will increase efficiency and the growth of economy of the region. For example, to become an important base for trade with Asia Mersin Port, Izmir will be concentrated on the more trade and logistics activities will be realized from within European and Mediterranean countries.

Speed of Turkey's transport system needs to be improved in terms of cost and quality.

Ro-Ro transportation should used in Mediterranean and Black Sea for domestic trade. In additionally RO-RO corridor should be established for trucks without entering Istanbul traffic from east to Europe.

Factors which negatively affected the competitiveness of the company for the realization of Turkey's 2023 target should be avoided. During the transport of goods should be minimized delay and unnecessary costs in import and export operations. Under these conditions, the company also needs to develop new business strategies and processes. Logistics sector is also important to provide good quality services at an affordable price to the Turkish industrialists which have an international standard.

Logistics centers are the heart of the commercial and economic development. These centers play an important role in the increase the growth of foreign trade and foreign capital. In particular, two of the most interested points of the foreign investors; rapid movement of goods and that are the simplicity of the legislation in this area.

The beginning of the necessary characteristics of a logistics center in a place that can be created be strong transport infrastructure and connectivity, the manufacturing sector show intense activity and accordingly the trade and intense traffic load.

Istanbul is of the most important logistics centers potential for Turkey. In particular, playing a role in the distribution of goods from Europe and other regions, it has

motorways, railways and ports. There are many ports and piers around outside Istanbul Haydarpasa. These are running by private sector. The fast road transportation of highway between Istanbul and Ankara are provided. Industrial and commercial activities in the free zone are also significantly affecting the traffic load.

Despite the fact that there is still enormous potential, Istanbul doesn't have major port of suitable to be a hub.

Although the realization of 90% of Turkey's foreign trade by sea, there isn't a value-added port in the country.

Creative value-added activities in Singapore harbor in 1990 have generated revenue of approximately 63 million dollar. This constituted 12% of total revenue of harbor in 1990 (Japan International Cooperation Agency, 1996).

1950-2002 years between road lengths increased 80%, rail length increased by only 11% (Mevlana Development Agency 2023 vision report; 9). Despite the investment rate in recent years is not balanced at all. One of the most important tools in the development of intermodal terminals is railways. On the other hand supplier or transporter reduced the cost using the railways easily. Turkey must be developing of the railways for to be regional power. The goal is to increase the share of railway freight rate to 15% and the share of passenger transport to more than 10%.

Another vision to achieve the objectives is making port worldwide. The current ports of Turkey are not sufficient to achieving this goal. Turkey should launch a new port project. This harbor must be established in Istanbul.

Turkey have been started to build third airport in Istanbul. This project is expected to be the highest capacity airport in the world. This project is going to make Istanbul as a hub for air cargo. Lack of capacity problems will be solved.

New port should be made near in the third airport. Thus the integration of air, sea, must be provided. Region should become a logistics base completely. This region will become very strong by the help of Yavuz Sultan Selim bridge road extension.

Finally, only governments would not perform these projects. However, private companies also need to contribute to these targets. A general incentive packages for the private sector to support these projects should be removed. The new stimulus package should focus on marine and rail. Seaways are called God's highways. Incentives should be increased in this direction because our country geography surrounding seas. Priority should be given to promote investment in the railway because it is the least cost mode of transportation.

6.4 A PROPOSAL FOR INTERMODAL TERMINAL IN ISTANBUL

Istanbul is the most important city for Turkish economy. Istanbul has a major industrial zone and production area. Moreover Istanbul's location is like a bridge connected with Asia and Europe. Two significant things for logistics are production and position. Istanbul has both of them. Istanbul have absolute advantage for the city to become an important international logistics hub. For this reason, promoting this city as a logistics center of international importance has been high on the agenda of the Turkish government.

The concentration of foreign logistics firms in Istanbul, high rates of profitability for logistics activities and rapid market growth have also been recognized by the Turkish central government. The Ninth Development Plan (2007-2013) prepared by the State Planning Organization (SPO) has framed policies to promote important ports to be developed as logistics centers to encourage transportation of freight through railways as opposed to motorways and to create an integrated and safer network of various transportation modes. Parallel to central government efforts, a number of proposed infrastructure investments in ports, airports, cargo villages and railways modernization projects have also been supported by the Istanbul Metropolitan

Municipality (IMM) to promote Istanbul as a principal logistics center for the wider region beyond Turkey (Özdemir, 2010, 155).

Turkey, 2014 was the 30th of 160 countries in the World Logistics League. In the same survey in 2010, Turkey was as 39. The geographical location of Turkey in general and Istanbul in particular become important day by day.

90 percent of world trade is made by maritime and in our country it is 88 percent. There are 174 ports and piers in Turkey and the whole length is 8 thousand 333 kilometers. During the next 5 to 10 years, is expected to be the fastest growing segment of the cargo container in cargo traffic. So ports will continue to gain importance that is, we can say new intermodal terminal should be a harbor.

Capacity of Turkey's ports by regions in 2009 is below;

Tab. 5.1 Capacity of Turkey's ports by regions in 2009 (Information has been received from the Ministry of Transport)

	Marmara Region	**Ege Region**	**Akdeniz Region**	**Karadeniz Region**
Container (TEU)	5.240.000	1.400.000	1.900.000	505.000
General and Bulk Cargo (TONNES)	118.000.000	43.000.000	55.000.000	54.000.000
Liquid Cargo (TONNES)	50.000.000	36.000.000	55.000.000	2.900.000
Ro-Ro Trade	1.050.000			
Ro-Ro	250.000	50.000	130.000	450.000
Car	2.290.000	200.000		
Passenger	900.000	1.300.000	200.000	30.000

Estimated local container handled in the Marmara region is below;

Tab. 5.2 Estimated local container handled in the Marmara region (Information has been received from the Ministry of Transport)

TEU	Pessimistic	Average	Optimistic
2020	3.902.781	5.026.694	6.644.277
2025	4.911.182	6.844.193	9.912.672
2030	6.092.560	9.149.845	14.478.223

Estimated total container handled (with transit) in the Marmara region is below;

Tab 5.3 Estimated total container handled (with transit) in the Marmara region (Information has been received from the Ministry of Transport)

TEU	**Pessimistic**	**Average**	**Optimistic**
2020	4.803.767	6.228.009	7.545.263
2025	6.563.661	9.047.498	12.391.390
2030	9.236.480	13.341.739	19.194.104

According to information this region is most powerful in Turkey logistics sector. When we look at the investments and future load forecasting worldwide intermodal terminal is needed for this region.

There are too many characteristics related to the intermodal terminals. There are;

- geographical / locational factors
- economic indicators
- easily access manufacturing and services
- hinterland area
- infrastructural requirements
- Availability
- Two or more than transportation modes

All these have a direct influence the performance of intermodal terminals.

The locational advantage of intermodal terminal should also be guaranteed by accessibility to various transportation modes. This is most important feature in the success of intermodal terminals. We can describes a intermodal terminals as a hub, with road, rail and port connections in which transportation logistics and distribution activities are performed nationally and internationally.

As a result, intermodal terminals are expected to be built closer to main railway, motorway and near the sea, inside these centers assorted facilities like customs, warehouses, portal services should be available. Logistics infrastructure, accessibility via various transport modes, two or more than transportation modes include intermodal transportation facilities, economic indicators, and locational advantages can all contribute directly and indirectly to performance of intermodal terminals.

Table 5.4 shows pickup truck movement of Istanbul in 2009. Table was organized according to the direction of truck movements.

Tab. 5.4 Pickup truck movement of Istanbul in 2009 (Istanbul Metropolitan Municipality, 2011; 244)

	Asia	Europe	Asia Southern	Asia Outside	Europe Southern	Europe Outside	Total
Asia	10,650	7,806	18	6,532	282	473	25,761
Europe	7,447	21,708	26	5,668	2,052	3,539	40,440
Asia Southern	18	26	0	65	0	2	112
Asia Outside	6,532	5,668	65	481	0	989	13,736
Europe Southern	74	2,285	0	0	68	4	2,431
Europe Outside	473	3,539	2	989	4	132	5,139
Total	25,195	41,031	112	13,736	2,406	5,139	**87,618**

Table 5.5 shows truck movement of Istanbul in 2009.

Tab. 5.5 Truck movement of Istanbul in 2009 (Istanbul Metropolitan Municipality, 2011; 245)

	Asia	Europe	Asia Southern	Asia Outside	Europe Southern	Europe Outside	Total
Asia	4,715	3,956	11	2,813	163	243	11,901
Europe	3,508	6,739	15	2,442	1,177	1,750	15,632
Asia Southern	11	15	0	39	0	1	66
Asia Outside	2,813	2,442	39	97	0	509	5,900
Europe Southern	41	1,167	0	0	34	2	1,244
Europe Outside	243	1,750	1	509	2	46	2,552
Total	11,331	16,069	66	5,900	1,376	2,552	**37,294**

According to these movements Istanbul is clear that the transition point. There is also a side effect of the high pass rate. This side effect is traffic. Traffic is the biggest problem of Istanbul city. One of the big issue of transportation process is delivery time. Even some production companies change their system to JIT. The just-in-time (JIT) production model is an approach where materials, parts and other goods are ordered only in quantities required to meet immediate production needs. Just-in-time production method is reduced to stock cost for companies. Istanbul rental is $ 5 per square foot of storage in this production model is quite usable. Not only just in time production method but also all transportation process delivery time is vital. But table 5.4 and table 5.5 show us heavy truck movement and Istanbul's traffic are directly impact to the delivery time. This problem can be solved by making the transfer station set up a great hub it. We can see in the next table of 2023 truck movement in Istanbul.

Table 5.6 shows estimated pickup truck movement of Istanbul in 2023.

Tab. 5.6 Estimated pickup truck movement of Istanbul in 2023 (Istanbul Metropolitan Municipality, 2011; 247)

	Asia	Europe	Asia Southern	Asia Outside	Europe Southern	Europe Outside	Total
Asia	20,160	14,776	35	12,365	533	896	48,764
Europe	14,097	41,093	49	10,729	3,885	6,699	76,552
Asia Southern	35	49	0	124	0	5	213
Asia Outside	12,365	10,729	124	911	1	1871	26,002
Europe Southern	140	4,326	0	1	129	8	4,604
Europe Outside	896	6,699	5	1871	8	250	9,728
Total	47,693	77,672	213	26,002	4,556	9,728	**165,863**

Figure 5.1 shows estimated pickup truck movement of Istanbul in terms of geography in 2023

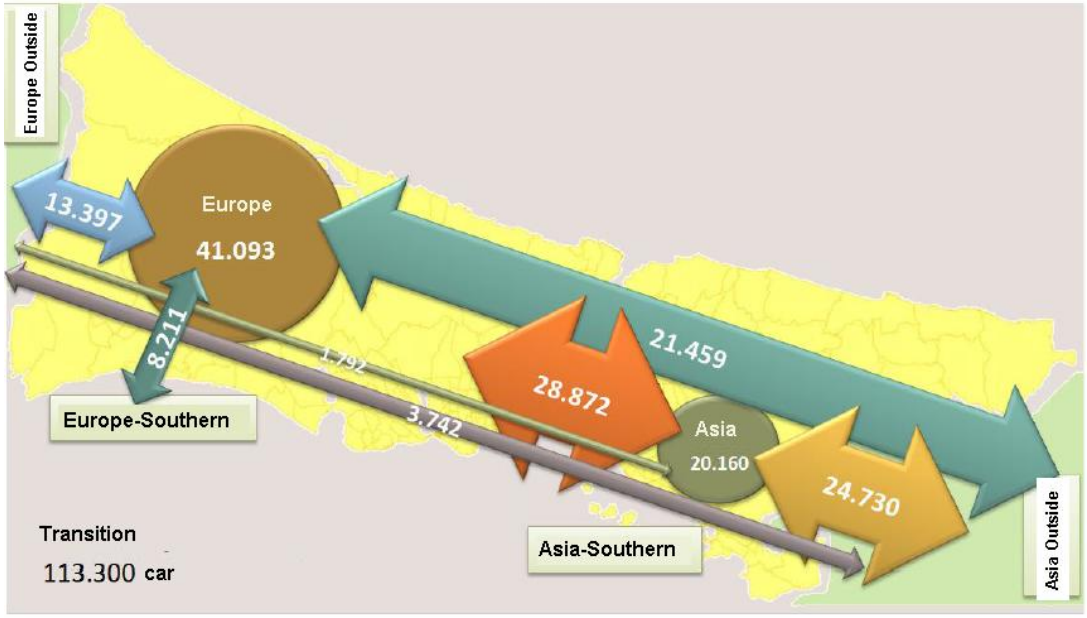


Fig. 5.1 Estimated pickup truck movement of Istanbul in terms of geography in 2023 (Istanbul Metropolitan Municipality, 2011; 247).

These movements are covering Asian and European inside, Asia and Southern European, Asian and European external pickup movements in the direction of 2023. In 2023 a total of 165.863 pickup movements are being observed. The numbers of pickups which transit from Bosporus are 56,650. According to length one pickup

equals to two cars. This means that 113,000 cars are transition. 180,000 vehicles pass the Bosphorus Bridge per day. So just pickup movements through Bosphorus, will fill all the capacity of bridge.

Table 5.7 shows estimated truck movement of Istanbul in 2023. For example all truck movements inside the Asian parts would be average 8.925. These movements happen without using bridges. In the table the movement from Asia to Europe would be 6.641. Total movements from Europe to Asia are 7.489.

Tab. 5.7 Estimated trailers movements of Istanbul in 2023 (Istanbul Metropolitan Municipality, 2011; 248)

	Asia	Europe	Asia Southern	Asia Outside	Europe Southern	Europe Outside	Total
Asia	8,925	7,489	21	5,324	308	460	22,527
Europe	6,641	12,758	29	4,624	2,227	3,312	29,590
Asia Southern	21	29	0	73	0	3	125
Asia Outside	5,324	4,624	73	183	0	963	11,167
Europe Southern	77	2,209	0	0	65	4	2,355
Europe Outside	460	3,312	3	963	4	87	4,829
Total	21,448	30,420	125	11,167	2,604	4,829	**70,593**

Figure 5.2 shows estimated truck movement of Istanbul in terms of geography in 2023.

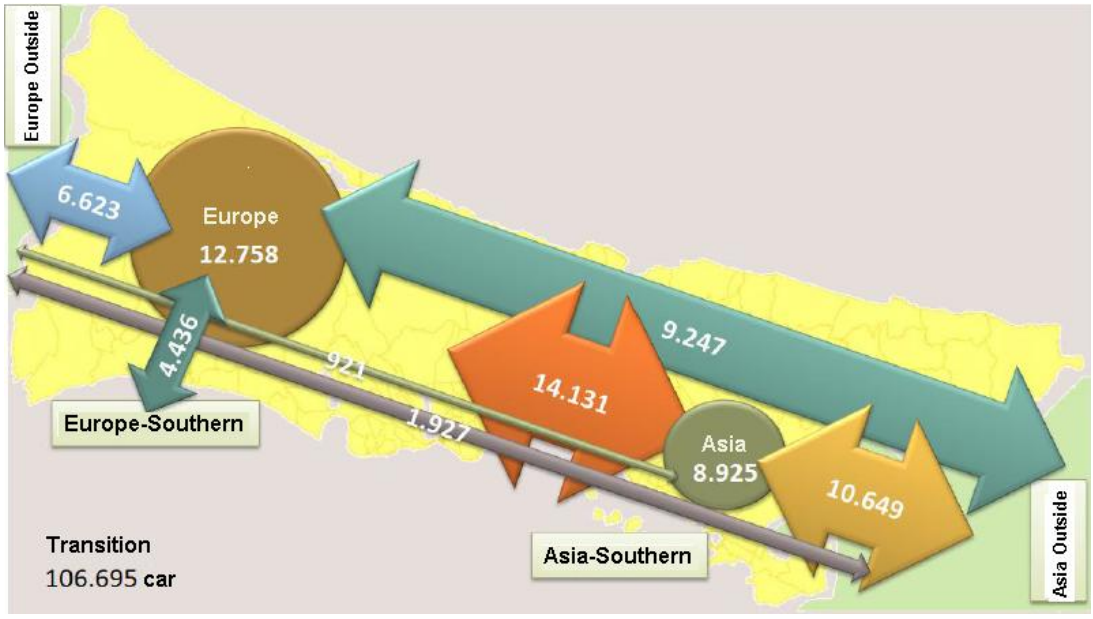


Figure 5.2 Estimated trailers movement of Istanbul in terms of geography in 2023 (Istanbul Metropolitan Municipality, 2011; 248).

Total 70.593 trailers movement is observed in 2023. In the European side 12 758; 8,925 in the Asian side; 14.130 truck movement in transition sides except for external action is carried. . According to length one trailer equals to four cars.

This means that average 107.000 cars are transition. As a result all movements must be made via intermodal terminal to avoid traffic and delivery on time.

The other element contributing to the performance of intermodal terminal is the level of economic activity. This can be analyzed under several heading. These include the presence of industrial regions in the Marmara region, service sector activities in Istanbul and inward investment. In addition, accessibility through various transport modes and specific locational advantages are considered to be important factors.

Istanbul is also a city of an industry. 42 of 100 biggest industrial establishments of Turkey are in Istanbul. And 250 of 500 biggest establishments are also in Istanbul. Istanbul Chamber of INDUSTRY (ISO) is Turkey's largest non-profit organizations. According to researcher the first five most developed provinces in Turkey are, in order Istanbul, Ankara, Izmir, Bursa and Kocaeli. Istanbul, Bursa and Kocaeli exist in Marmara region. The established terminal is required to carry this density region.

The service sector activates movement of goods that trigger each other. Transportation needs service sector to continue the process and on the other way service sector like advanced banking and producer services have to working with transportation firms for survive. Istanbul is also financial capital of Turkey. Legal, advertising and banking services as well as the retail sector are more highly concentrated here than any other Turkish city. With the existence of these services good affect the level of logistical activity.

According to data from the Ministry of Economy last year the number of foreign owned companies as of October 2014, an increase of 13.8 percent compared to the same period reached 41.000. The numbers of foreign partner companies which locate

in Istanbul are 25.000. Foreign investment will continue to grow with the Istanbul economy. In this context there should be an intermodal terminal in the region to manage the freight flows.

Another thing that made Istanbul the logistic center is that the third airport. Third airport is under construction. Third airport is being built in north of Istanbul Arnavutköy region. The third airport will be biggest in the world from the point of capacity view. This airport capacity will be 150 million annual. This airport will make Istanbul a hub of air cargo. The availability of this region would be possible by Yavuz Sultan Selim Bridge and highways. Also the railway which is going to built on this bridge will support the availability of the airport.

The terminal which is goes to made in this region will ease all the transportation activities. Even if the terminal establishes in the coastal region it will include 4 main transport activities inside. So the availability and infrastructure of the terminal would be very powerful.

Istanbul has benefited from its unique geographical location for millennia. The locational advantages of Turkey in general and Istanbul in particular have always been considered as an important strength by the Turkish central government. In this condition, in periodic program railways and maritime transportation have been promoted and capacities of ports will be increased and adapted to become logistics centers which offer combined transportation opportunities.

Istanbul also part of TRACECA transportation project. TRACECA strategy has been identified for short, medium and long term basis formed on 2015. They are;

- To modernize developed transport at an institutional level,
- The integration of infrastructure networks,
- Continuously forming a multi-modal transport chains,
- The creation of a fair aviation market in the region,
- Safe, secure and sustainable transport,

- Development of national funding programs,
- Promoting public-private cooperation

Apart from the above, TRACECA have been launched to slogan of 2015 "Turkey should be logistic center".

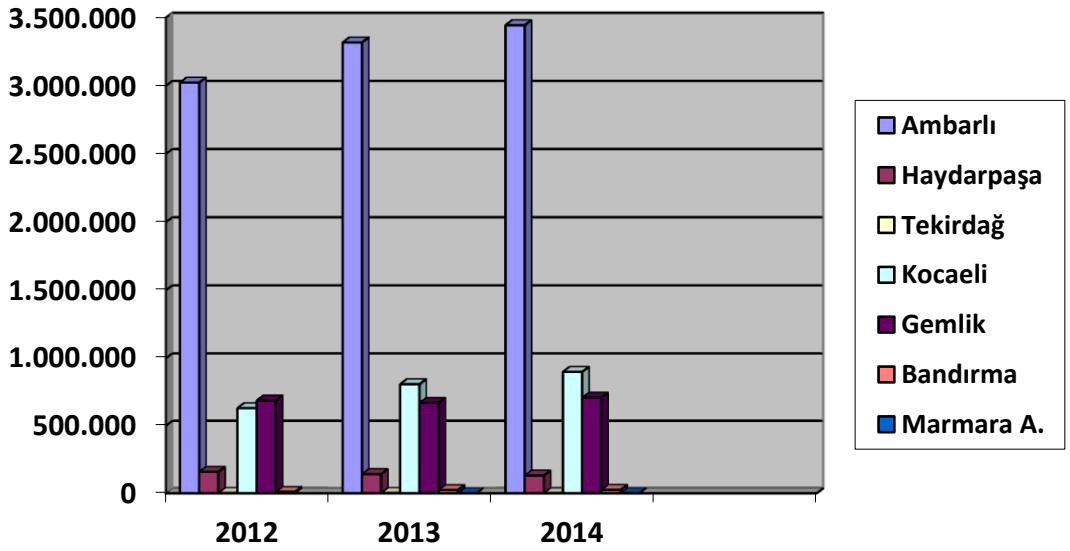
Turkish ports in the Marmara region are vital in strengthening the location of Istanbul, as they can be connected to transportation corridors within Pan-European and Trans-European transport networks. All of these opportunities are not fully using. Turkish logistics companies in maritime transportation suffer from excessive bureaucracy, high charges, lack of storage space and insufficient handling machinery. Also sector suffer from lack of railway connections and multi-modal transportation. Furthermore Turkish ports in the Black Sea region are underutilized in the network of TRACECA. As a result freight is mostly delivered to Georgia though Ukrainian and Romanian ports, rather than using Turkish ports. It seems Turkey needs a port for Black-Sea in Istanbul.

According to the fact that Istanbul played critical role of being a hub for Turkey's international transportation corridors, The Organization for Economic Co-operation and Development (OECD) mentions this subjects. Also Istanbul supports air and overland routes to different countries. This is the significant role of industrial area that locates in between Black Sea and Mediterranean Sea.

From optimistic point of view, estimated local container handled in the Marmara region average is 15 million TEU in 2030. This number increases the average of 20 million TEU with transit goods. Today ports which locate in Marmara region can handle the capacity of average 7 million TEU. Moreover these forecasts are not based on added investment or value added. Even this case, Turkish port should increase capacity double. But it may not sound possible. Because for example Haydarpaşa port in Istanbul which run by TCDD can upgrade 600.000 TEU to 1.200.000 TEU. There is no expanded area for Haydarpaşa port. Even if the capacity reaches these numbers, the density will increase and the waiting period will extend.

So it means that, there is a need for a huge port in this region. This port should be built in Istanbul and must include intermodal transportation options.

Graph 5.1 shows ports of Marmara region container throughput;



Graph 5.1 Ports of Marmara region container throughput (TEU)
(Information has been received from the Ministry of Transport)

Average 6 million container throughputs in all ports of Marmara region. The most Ambarlı port is used in this region. Even if Ambarlı port expands at the maximum rate it cannot handle the capacity of future density. That's why Marmara region should a new huge port capacity.

Excessive bureaucracy and complicated customs regulations, lack of investment, lack of planning and coordination are mentioned for all modes of transport. According to target of 2023, Turkish government should arrange rules and regulations. Especially government should encourage the companies about intermodal transportation. Government should offer priority in customs for the companies which use intermodal transportation. On the other hand there are fifteen different public bodies responsible for making decisions in port management, which makes it difficult to take concerted

action. The new intermodal terminal will be ensured to be managed from a single center to achieve main goal.

Also regarding railways transportation logistics firms suffer from lack of investment, limited stock, management problems, an outmoded and inadequate network. For example Ankara-Adana express train voyages. Train departures from Ankara at 20.05, arrives Adana 07.25. It takes more than 11 hours. Same direction takes 6.30 hours by truck, 1 hour by plane.

The development and modernization of TCDD has been slow, allowing it to retain its monopolistic role and lack of market competitiveness. Nowadays Turkish government opens the private sector railways. After transition process, railways will have important role in transportation. Actually not only focus on improving the railways but also actuate the intermodal terminals. Huge intermodal terminals or logistics centers triggering the railways transportation volume if it is connected.

6.5 ECONOMIC DIMENSION OF INTERMODAL TERMINALS

The Freight distribution has been expanding due to the growth of global trade and transportation. This is more noticeable in modes and terminals where the containerized freight movements take place with the impact on landscape. The vast and expensive technical and engineering developments achieved the freight distribution due to the need. This expense is only justifiable for the current scale high trade volume.

The last decade has seen the emergence of mega containerships handling more than 10,000 TEUs and the world's 50 largest container ports having jointly handled more than 326 million TEUs in 2007 alone (Brunn, Engineering Earth: The Impacts of Megaengineering Projects; 2011;865).

The range in handled TEUs by these ports is from above 2 million TEUs in the smallest port to 28 million in Singapore, the largest port facility in the world. However, there exist limitations because of the ownership structure.

“A too large single facility would represent an undue risk of capital investment as they can take a long time to amortize and reach profitable traffic levels."

The current model would result in a great competitive pressure on different operators owning a port in a same or close terminal.

In many ways constrains in economies of scale has been less on maritime shipping. Mega containership can be re-positioned with the aid of commercials as they are mobile transport platforms. The truth is that the limitations are visible on the landslide as their accommodation requires substantial transshipment and inland distribution capabilities. This brings up the question that if economies of scale has any more potential to handle larger batch of freight?

The cost of this offered project is almost 10 billion dollar. Not only government but also private sector invests this amount of money for untried project in Turkey.
Therefore the government financial power and private sector experience and administrative power should be unified. Besides government should consider this policy in order to support this project. Otherwise project infrastructure will catch new technology in order to compete with other intermodal terminals.

If the system works properly we can offer good price for new customer, this situation would be possible with professional and technical staff. So for the first years we should transfer from biggest hub station. In addition we should consider about increasing the connection between this project and other hubs.

6.6 LOCATION OF PROPOSED INTERMODAL TERMINAL ESTABLISHMENT IN ISTANBUL

The intermodal terminal should be established in the north of Istanbul, which the need for it was proved according to the above details. Because this region is newly improved and there is a wide space for constructions. The main factor of intermodal terminal is container that's why the terminal should be built at the black sea coast and be in a port shape. Meanwhile it should be close and connected to new third airport. Third airport will be the most high capacity airport in Europe and Turkey will be a hub for air cargo. This terminal should also establish over the highway of Yavuz Sultan Selim Bridge. These highways would be Istanbul's cargo transportation ways which all trucks pass. On the other hand the railway which passes Yavuz Sultan Selim Bridge and extends to Anatolia should reach this terminal. So the intermodal terminal would be connected to railway. Actually this railway will end in the third airport. The intermodal terminal should have large warehouses and storage. So the intermodal terminal would include the connection of seaway-airway, railway-seaway and railway-highway. At the first step it should support the cargo potential for the target of 2023 and then for 2050 and 2100. It should be neighbor of Canal Istanbul project.

A proposed map of intermodal terminal location;

Map 5.1 Chosen Area

Map 5.2 Chosen Area

This intermodal terminal would be built between Durugöl Lake and Black Sea coast. Whole location is going to be 20.000.000 square meters. This area starts from Karaburun and it will end Karacaköy. A terminal which has a huge port like this can support average 30 million TEU and 600 million cargos. This capacity is 5 times more than Istanbul ports capacity.

Intermodal terminal features;

- Customs area
- Truck parking lot
- Weighbridge
- Accommodation and social facilities
- Management department
- Fuel stations
- Recycling area
- Terminal area
- Storage and packaging area
- Bulk storage
- Cargo exchange area
- Loading and discharging area
- Huge warehouses
- Airport connection
- Wide road for truck traffic
- Train-Ferry station
- Ro-Ro area
- Unaccompanied transport area
- Lift on-Lift off area
- Transit area
- Ro-La area
- Highway connection
- Railway connection

- Storage for private connection
- Canal Istanbul project connection
- Cold storage

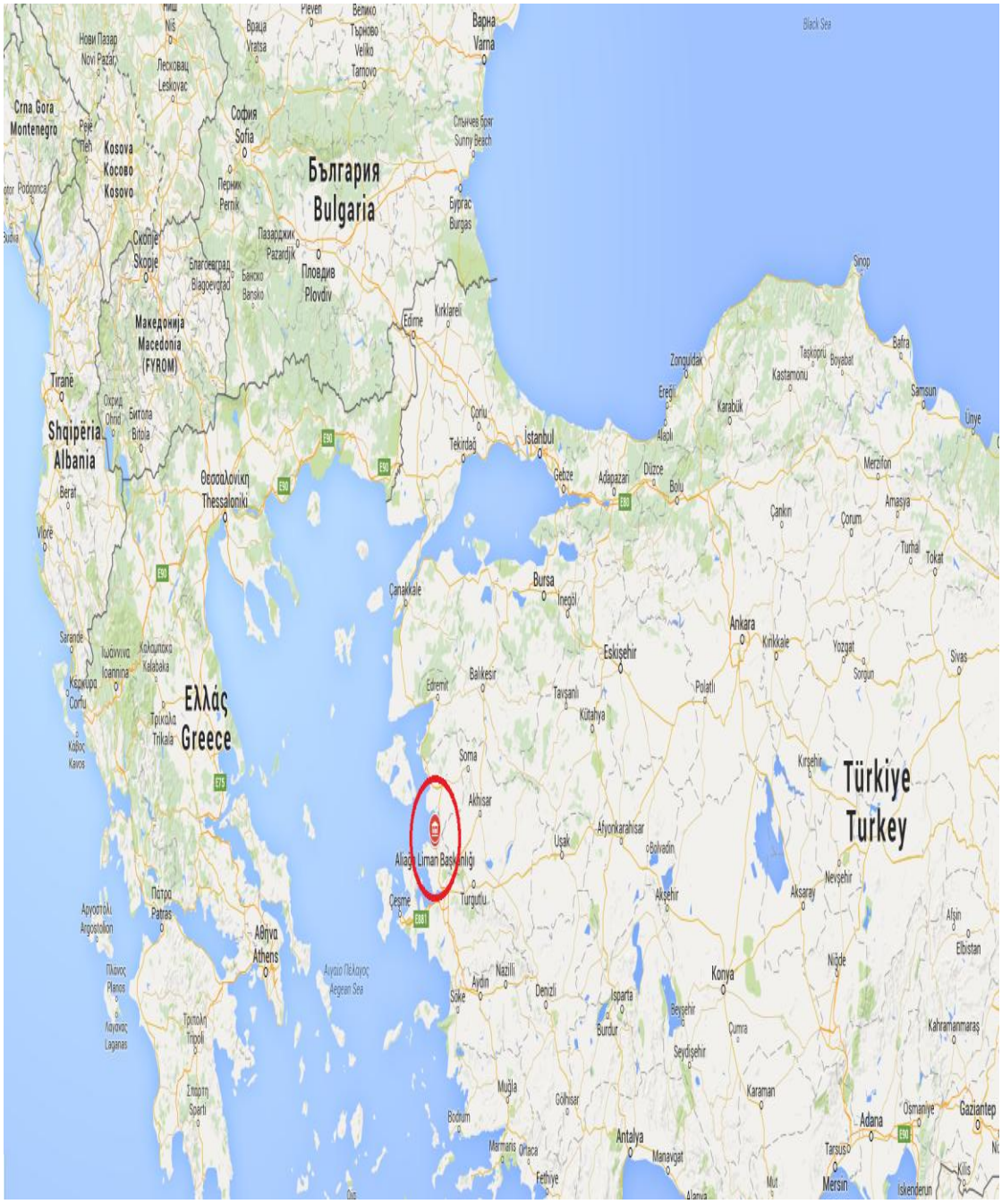
Map 5.3 Future image of Istanbul map

In this terminal there would be special areas for private companies. When this terminal establishes it would be a hub for all cargos which enter Istanbul. This terminal also play important role in distributing air cargo from third airport. It will distribute 30 million TEU cargos through connection of highways and railways. The terminal will play a strategic role by its strong infrastructure and high technology. Ship can easily pass Canal Istanbul and reach this terminal and at the same time the availability of Mediterranean Sea would be possible. This terminal would be a candidate for leadership in Black Sea, Europe and Middle East area. It will add more value to Istanbul's role in logistics center of world.

Other possibilities for intermodal terminal in Turkey;

Port of Aliağa (İzmir): In the port of Aliaga, there are 36 piers belong to 12 industrial companies. The total length of the piers is approximately 8.849 meters long. A world-class service has been provided with the modern technical equipment in those

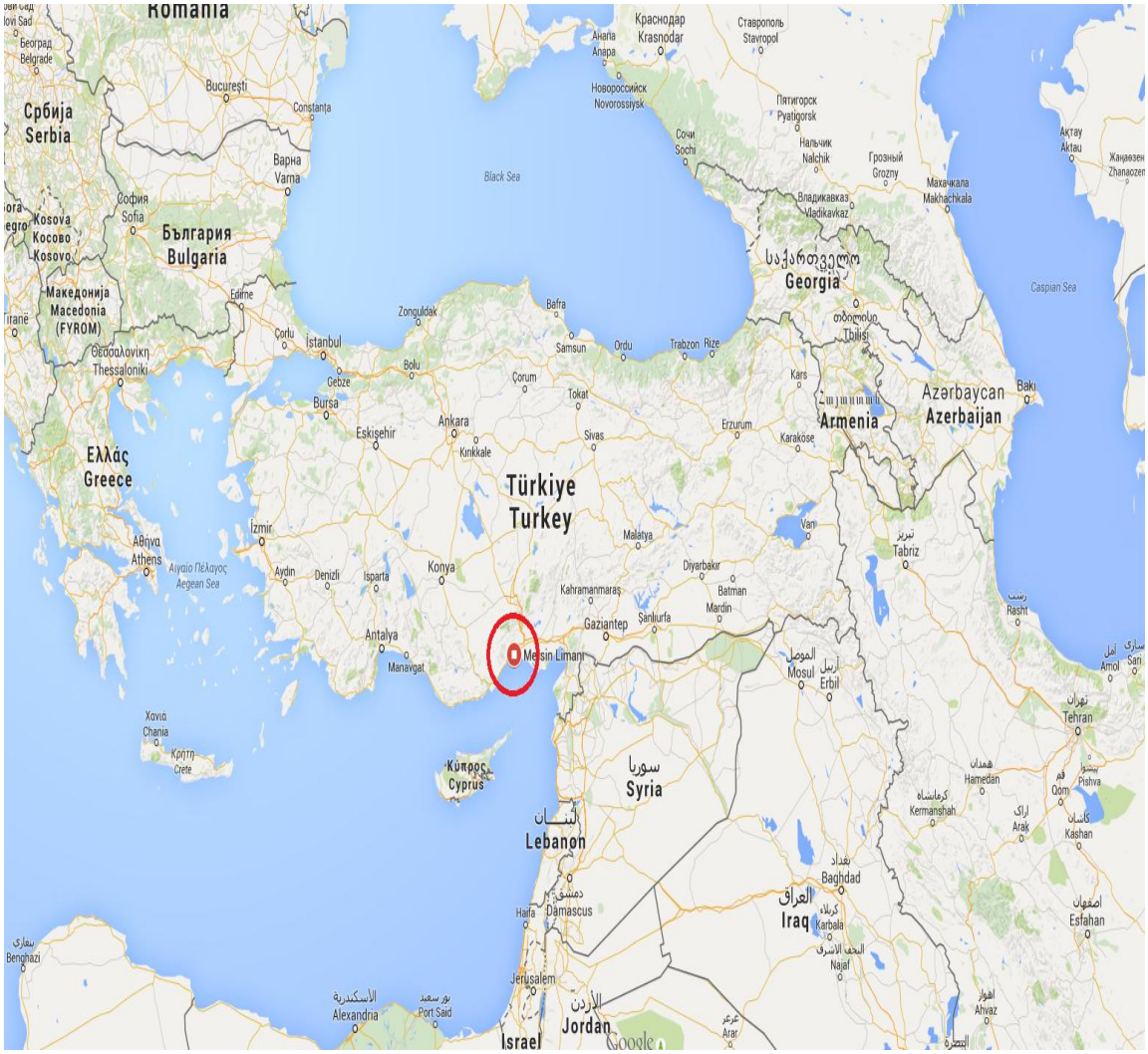
piers. The annual shipping capacity of Aliaga Port is 9.999 ships per year. Among the Port premises, the piers of Tüpraş, Habaş and Petkim have stood out in terms of the total weight of goods loaded and discharged. The Ship Breaking Recycling Yard-being the only ship recycling premise of our countrylocated in Port area, has a distinct importance (Eroğlu and Bozyiğit, 2013).



Picture: 6.1 İzmir Aliağa Port (picture taken from google map)

Port of Mersin: Mersin International Port (MIP) is connected via railways and highways with Turkey's industrialized cities such as Ankara, Gaziantep, Kayseri, Kahramanmaraş and Konya, and with bordering countries such as Syria, Iraq and Iran. It is one of the main container ports in the Mediterranean Region with its transit and hinterland connections with the Middle East and the Black Sea.

Mersin International Port (MIP) meets a significant portion of Turkey's import and export volumes with its vast hinterland, accessible transportation opportunities and qualified human resources (Mersin port, 2007).



Picture: 6.2 Port of Mersin (picture taken from google map)

7. CONCLUSION

In the recent 20 years logistics sector has reached to a great improvement in globalized world. Because of cheap labor and national resources the production centers moved to the other countries. The manufacturers aimed to reduce costs by moving. This fact increased the demand for logistics. The most important factor in developing logistics is increasing the production.

When the importance of logistics increased the competition started and logistics system has been activated. Logistic systems have been used in order to reduce the cost and delivery time. After the adaptation of containers a new era has started for the logistics system. Today it is thought to be 17 million containers worldwide. This much of using containers increased the requirement for intermodal terminals.

Turkey is one of the most strategic important countries of the world. Turkey's land has been on the trade routes since many years ago. If Turkey improves logistics infrastructure regarding the developed economy and young population, it may play more active role in the world. The capital of Turkey’s economy is Istanbul which increased its worldwide importance by government supports and interest of foreign capital.

Many transportation corridors already determined the world. These corridors were selected according to the flow of goods and locations. In order to be a part of these routes the investment of infrastructure should be ready. Nowadays the combine transportation is preferred because of high speed transportation procedure and on-time delivery. The most important thing for a logistic company is a short transportation period with affordable cost. That’s why they have to use intermodal terminals.

Intermodal terminals effect on the economy directly. The TEU capacity of just one port in China is 5 times more than Turkey's. On the other hand Rotterdam has become famous just by its harbor. Also for example, in Louisiana ports there are

73.000 people working and the added value is 11 billion dollars. Because Istanbul is like a bridge between Asia and Europe the need for intermodal terminal is essential.

The other factor that enhances Istanbul's value is government investments. Third airport is one of the most important investments of Turkey’s government. Another one is Yavuz Sultan Selim Bridge. Istanbul Metropolitan Municipality (IMM) is looking for a way not to let trucks enter the traffic. The only solution is constructing new intermodal terminals.

This intermodal terminal will support Istanbul's required cargo for the next ten years. Together with these terminal Istanbul will continue to be a nominee of logistics center in the world.

Mersin and İzmir ports don’t reach to their own potential because their infrastructures are low.

This is a survey on intermodal transportation improvement, factors and types. Also the network, corridors and routes which used in intermodal transportation are investigated. World intermodal terminals and Turkey's are researched in details. Lack of intermodal terminal in Turkey has been proved and an intermodal terminal establishment in Istanbul has been proposed.

REFERENCES

"International Corridor Rhine-Alpine Conference 2014", 2014.

ALTEKAR, Rahul, 2005, Supply Chain Management: Concepts And Cases, New Delhi, Prentice Hall of India Private Limited.

ATLANTIC RAIL CORRIDOR DEVELOPMENT; "Manifesto of the Atlantic Rail Corridor for Freight", t.y.

AUSTRIAN MINISTRY FOR TRANSPORT INNOVATION AND TECHNOLOGY, 2009, "The Baltic-Adriatic Corridor".

BEKTAŞ, Tolga, 2007, A Brief Overview of Intermodal Transportation.

BERGMAN, Lars, 2009, "Future European Road Network".

BONTEKONING, 2006, Hub exchange operation in intermodal hub-and-spoke networks, IOS Press, Netherlands.

BONTEKONING,Yvonne Margaretha, 2006, Hub exchange operations in intermodal hub-and-spoke networks.

BRUNN, D. Stanley, 2011, Engineering Earth: The Impacts of Megaengineering Projects, New York, Spinger Science+Business Media.

CAMBRIDGE SYSTEMATIC, 2004, "Cross Border Shortsea Shipping Study".

CEROVSKI, Valentın, 2004, "Pan-European Transport Corridors Passing Through The Territory Of Bulgaria".

CHO, Hyuk-soo and YANG, Kun-woo, 2011, "Identifying Country Environments to Increase Container Traffic Volumes", The Asian Journal of Shipping and Logistics, Vol. 27, p.161.

CONTAINER ALLIANCE, "The Storage & Shipping Container Network", http://www.containeralliance.com/california-container-rentals.php; 10.03.2014.

DENİZ TİCARET İSTATİSTİKLERİ, 2013, 33, www.ubak.gov.tr.

ECONOMIC AND SOCIAL COUNCIL, 2011, "Role of terminals and logistics centers for intermodal transport", p.2.

EMERSON, Michael and CHECCHI, 2009, Arianna, Synergies Versus Spheres of Influence in the Pan-European Space, Brussels, Centre for European Policy Studies.

EMERSON, Michael, 2009, Synergies Versus Spheres of Influence in the Pan-European Space, Brussels, Centre For European Policy Studies.

EROĞLU, İlker and BOZYİĞİT, Recep, 2013, “The Port of Aliağa" MARMARA COĞRAFYA DERGİSİ, Vol: 28, p. 81-116.

ESCAP, 2006, “Integrated International Transport and Logistics System for North-East Asia", United Nations Publication, Bangkok.

EUROPEAN COMMISION, 2013, "The Core Network Corridors", p.5.

EUROPEAN COMMISSION, 2002, "Status of the Pan-European Transport Corridors and Transport Areas", p.68.

EUROPEAN COMMISSION, 2014, "The Core Network Corridors Progress Report", United Nations Publication, Belgium.

EUROPEAN COMMISSION, 2014, "The Core Network Corridors Progress Report", United Nations Publication, Belgium.

EUROPEAN COORDINATORS, 2014, "The Core Network Corridors Progress Report", United Nations Publication, Belgium.

EUROPLATFORMS EEIG, "Logistics Centres Directions For Use", 2004, p.3.
FERREIRA, Luis and SIGUT, Julius, "Modelling Intermodal Freight Terminal Operations", 1995, p.3.

Focus on Combined Transport, 1995, "International Union of Rail-Road Transport Companies", p.4.

GERMAN, Tracey, Regional Cooperation in the South Caucasus ; 2012
GOURDIN, 2001 Transmitting PROKOPOWICZ; Outsourcing in Transportation, Wien, Universitat Wien, 2010.

HACON, 2014, "Study on TEN-T Core Network Corridor Rhine–Danube", Draft Final Report, p.65.

Informa Uk Ltd and Drewry Shipping Consultants Ltd; 2008.

INTERNATIONAL CONFERENCE ON THE GREAT LAKES REGION, 2006, "Trans-African Highway: Mombasa – Lagos", p.2.

ISL, "Shipping Statistics and Market Review", 2012, Bremen, Germany, p.1-11.

İSTANBUL BÜYÜKŞEHIR BELEDIYESI, "İstanbul Metropoliten Alani Kentsel Ulaşim Ana Plani", 2011, p.244.

JAPAN INTERNATIONAL COOPERATION AGENCY, "The OECD/DAC's New Development Strategy", 1996.

JOWSEY, Ernie, 2015, "Real Estate Concepts: A Handbook", New York, GreenGate Publishing Service, p.87.

KALKINMA BAKANLIGI, 2014, "Onuncu Kalkınma Planı , TAŞIMACILIKTAN LOJİSTİĞE DÖNÜŞÜM PROGRAMI EYLEM PLANI", p.3-6.

KEMENY, Zsolt , 2011, Multiple-Participant Hub-And-Spoke Logistics Networks: Challenges, Solutions And Limits.

KRUSE, C. James, 2010, North American Marine Highways, USA, Transportation Research Board.

MEVLANA KALKINMA AJANSI, "2023 vizyon raporu", t.y, p. 9-10.

MÜSIAD, 2013, "Lojistik Sektör Raporu 2013" p.39.

NESTEAR, 2006, "MEDA TEN-T – Final Report", p.24-25.

NOSSACK, 2013, "Operational Planning Problems in Intermodal Freight Transportation", p.2-3.

NOVACK, A.Robert, John Joseph COYLE, Edward J. BARDI, 2005, Transportation, USA, South-Western College Pub. Six edition, p. 11-101.

ÖZDEMIR, Dilek, 2010, "Cities; Strategic choice for Istanbul: A domestic or international orientation for logistics", p.155.

PORT OF BUSAN, "Statistics", 2013.

PORT OF ROTTERDAM AUTHORITY, 2013, "Abridged Annual Report 2013", p.4-7.

RAMBOLL, 2014, "Mediterranean–Scandinavian Corridor Ten-T Info", p.2-3.

Rotterdam World-Class Port; 2009.

SCHUYLENBURG ,M. Van, 2010, "Rotterdam Workshop".

SIAROV, Vesselin, "Pertinence et potential de l'intermodalite dans la region de la Mediterranee et de la Mer Noire", 2004; s.29-30.

SKLIAS, Pantelis and Tzifakis, Nikolaos, Greece's Horizons: Reflecting on the Country's Assets and Capabilities, Greece, Springer Science & Business Media, 2013.

SLACK, 2001,143 Transmitting: Muhteşem KAYNAK-Hülya ZEYBEK, İntermodal Terminallerin Gelişiminde Lojistik Merkezler,Dağıtım Parkları ve Türkiye'deki Durum, 2007, s.42-43.

SORGENFREI, Jürgen, 2013, "Port Business", p.34.

SPECTOR, A. Regine, 2002, "The North-South Transport Corridor", p.2.

STAATSMINISTERIUM FÜR WIRTSCHAFT ARBEIT UND VERKEHR, "Neubaustrecke Dresden-Prag", 2011, p.2-4.

STARKL, Hannelore and ROTTER, Friedrich, 2010, "Strengthening the Danube Waterway in Austria as Part of Corridor VII for the Chemical Industry" p.13.

ŠTRUMBERGER, Nada, PERIĆ, Teodor, ŠTEFANČIĆ, Gordana, 1998, The Efficiency of the Bimodal System Transportation, Zagreb, Fakultet prornetnih znanosti.

THE AFRICAN DEVELOPMENT BANK, 2003, "Review of the implementation status of the trans African highways and the missing links", p.3-15.

TÜRKIYE MILLI KOMITESI ; 2008, Türkiyenin kıyı ve deniz alanları ; kıyı alanları yönetimi, p.556-557.

ULAŞTIRMA BAKANLIĞI DEMIRYOLLAR LIMANLAR VE HAVA MEYDANLARI INŞAATI GENEL MÜDÜRLÜĞÜ, 2008, Ulaştırma Kıyı Yapıları Master Plan Çalışması – 2. Ara Rapor.

UNECA, 2011, "Eca Transport Corridors", p.5-6.

VINOKUROV, Evgeny and LIBMAN, Alexander, 2012, Eurasian Integration: Challenges of Transcontinental Regionalism, New York, Palgrave Macmillan.

WOXENIUS, KANIA and PODSIADLY, 2006, Possibilities to Transfer Goods from Road to Rail to and From the Ports of Karlskrona and Gdynia, Göteborg, Sweden.

YIM,Yap Wei, 2010, Container Shipping Services and Their Impact on Container Port Competitiveness,

Internet Resources

RO-RO (Roll-on/roll-off) Vessel, viewed 10.03.2014, <http://aaronpb.com/?page_id=33>.

Infrastructure - TEN-T - Connecting Europe, viewed 17.03.2014, <http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/transport policy/index_en.htm>.

Infrastructure - TEN-T - Connecting Europe and Corridors, viewed 17.03.2014, <http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/index_en.htm>.

The Core Network Corridors, viewed 19.03.2014, <http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/doc/orient_east_med.pdf>.

TRANS-EUROPEAN TRANSPORT NETWORK viewed 17.03.2014, <http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/doc/ten-t-corridor-map-2013.pdf>.

Trans-Sahelian Highway (Dakar - N'Djamena), viewed 25.11.2014, <http://en.reingex.com/Trans-Sahelian-Highway.shtml>.

The Marco Polo II program, viewed 09.04.2014, <http://europa.eu/legislation_summaries/environment/tackling_climate_change/l24465_en.htm>.

Ambarlı Port statistics viewed 02.12.2014, <http://www.altasliman.com/sirket_profili_istatistikler.php>.

Lift-on/Lift-off (LO/LO) Ships, viewed 10.03.2014, <http://www.globalsecurity.org/military/systems/ship/lo-lo.htm>.

Unaccompanied combined transport, viewed 10.03.2014, <http://www.hupac.ch/index.php?node=333&lng=2&rif=fc18cbf50c>.

Shenzhen Port Market, viewed 22.11.2014, <http://www.port-investor.com/shenzhen/>.

Port of Rotterdam viewed 24.11.2014, <http://www.portofrotterdam.com/en/Port/port-statistics/Pages/throughput-statistics.aspx>.

Asian Highway Network, Great Asian Highway viewed 15.04.2014, <http://www.roadtraffic-technology.com/projects/asian-highway-network/>.

Rolling highway (Rola) viewed 20.02.2014, <http://www.sbbcargo-international.com/en/rolling-highway-rola.html>.

Port of Shanghai, China viewed 21.11.2014, <http://www.ship-technology.com/projects/portofshnaghai/>.

Lift on / Lift off Shipping viewed 10.03.2014, <http://www.tgal.us/lift-on-lift-off-shipping>.

Dış Ticaret İstatistikleri viewed 16.12.2014,

<http://www.tuik.gov.tr/PreTablo.do?alt_id=1046>.

TÜRKLİM viewed 16.12.2014,
<http://www.turklim.org>.

Train-Ferry Organizations viewed 10.03.2014,
<http://www.ukrferry.com/eng/vessels/vessel-geroi-plevny>.

map/google.com.

The Journal of Commerce annual top 50 World Container Ports;
http://www.worldshipping.org/about-the-industry/global-trade/top-50-world-container-ports; 21.11.2014.

UNESCAP; http://www.unescap.org/resources/trans-asian-railway-network-map;15.04.2014.
UNITED NATIONS PUBLICATIONS, "Review of Developments in Transport in Asia and the Pacific 2007 (Data and Trends)", 2009, s.97-98.

www.tcdd.gov.tr; 22.12.2014.

Port of Mersin, 2007, Viewed 30 March 2015,
<http://en.mersinport.com.tr/corporate/detail/About-us/182/428/0>.