

THE IMPACT OF APPLYING ROLLING HIGHWAY ON STATE COMPANY FOR LAND TRANSPORT IN IRAQ

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Abstract

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<p>Abstract</p> <p>The aim of this thesis was to study the possibility of implementing rolling highway system in Iraq and to highlight its impact and contribution in the development of transport industry in the country, also it may contribute to the development of economy in Iraq by reaching the Mediterranean sea, which will allow the country to export oil and import goods in huge amounts without obstacles.</p> <p>The problem is that the capacity of transport industry in Iraq doesn't match the capacity required. Furthermore, the accidents, air and noise pollution and consumption in general that are caused by transport industry have a huge impact on the economy and environment.</p> <p>In this study it is concentrated mainly on goods import as there are only two major companies (State Company for Land Transport and General Company for Iraqi Railways) that are responsible for land transportation. Additionally, these two companies don't work together in order to cover the needs of the country.</p> <p>The thesis concentrates on combined transportation option, which is seen more effective for the transport industry, which can cause less environmental pollution, accidents and lower costs.</p> <p>Implementing such an idea in the transport industry of Iraq can cause an economic boom and specifically benefit the Ministry of Transportation and their beneficiaries, which will also benefit the consumer.</p> <p>The thesis highlights the challenges of analyzing the structure of the land transport, the possibilities of using rolling highway system in Iraq, and the impact of using such system on the overall transport.</p>			
<p>Keywords Rolling highway, combined transportation, environmental protection, transport industry, land transport.</p>			

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ABBREVIATIONS

State Company for Land Transport (SCLT): 7
General Company for Iraqi Railways (IRR): 7
General Corporation for Ports of Iraq (GCPI): 7
Ministry Of transportation (MOT): 7
Ministry of Oil (MOO): 8
Ministry of Agriculture (MOA): 8
Ministry of Trade (MOT) 8
The Iraqi Ministry of Interior (MOI): 10
Ministry of Finance (MOF): 10
Ministry of health (MOH): 11
Ministry of housing and contraction (MOCH): 13
World Health organisation (WHO): 28
Ministry of planning (MOP): 30
National Investment Commission (NIC): 31
General statistical organization (GSO): 39

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1 INTRODUCTION

Iraq is one of the West Asian countries that have a coast line on the Arab Gulf. It borders Turkey to the north, Iran to the east, Kuwait to the southeast, Saudi Arabia to the south, Jordan to the southwest, and Syria to the west. The Arab Gulf is the only maritime access port from Iraq to the world and the costal length is about 58 km.

The transportation system in Iraq was affected in the 80's by the political instability and insecurity situation which caused many challenges like high transportation costs, lack of punctuality in the delays and the delivery of goods.

The aim of this master's thesis was to study the impact of applying rolling highway system in state company for land transport in Iraq which could modernize the multi-transportation system in the country and link the Iraqi oil fields with Arab Gulf, Turkey, Syria and Lebanon which overlook to the Mediterranean Sea as well as easing the oil transportation from Iran, Syria and Lebanon.

Rolling highway is a multi-transportation system, if used it could dominate most of the imports and exports to and from Iraq as well as the transit transportation through Iraq. It might contribute significantly to reducing the cost of transportation of imported goods to Iraq, which would then benefit the local consumers, sustain roads infrastructure, wildlife and the environment by reducing exhaust emissions. It could ease the delivery of imported goods from border crossings to all area in Iraq as the country has sufficient networks of highways and railways. The main beneficiaries would be Iraq's Ministry of Agriculture (MOA), Ministry of Trade (MOT), Ministry of Industry and then the rest of the ministries as well as traders and importers of goods, retailers and different stores.

The rolling highway system can be evaluated if it's an effective alternative for oil transportation instead of the pipelines as they are facing many challenges like the lines are dowdy and need regular maintenance which is difficult, costly and takes time which delays the oil transportation for months. As Iraq is undergoing a bad security situation this system will reduce the risk of oil transportation through pipelines, which are in danger of being exploded by terrorist attacks. This will benefit the Iraqi Ministry of Oil (MOO) and all foreign companies which are contracted to extract and export oil from Iraq. The project will be sponsored by the Iraqi (MOT) represented by (SCLT's) statistics and (IRR) as active partners of the project which will have the financial benefits and help to mobilize all the workforce within the transportation sector.

In this master's thesis truck traffic and trucks entering Iraq are studied. Also their impact is analyzed and the results are compared with the proposed rolling highway system. The data is based on the transportation of different goods through the border crossing depending on the statistics from (SCLT) for the period from 2009 until 2014 and the researchers own working experiences, where he worked as an employee for the Iraqi MOT for a long period of time as an employee of the transport sector in Iraq.

1.1 State Company for land transport (SCLT)

SCLT is a semi-public owned firm, founded in 1970 and managed by the MOT. It functions as a basic transporter of goods by truck and is the first national carrier in Iraq. Its 529 trucks transported nearly 449 445 tons' of material. In 2013 there were about 3500 trucks which are not owned by the company but operate in a partnership with SLTC. Those transported around 3,615,802 tons of goods in the same year, 2013. SCLT has around 3683 employees distributed among offices in all border crossing ports to monitor the imported and exported goods and issues all necessary documentations.

1.2 General Corporation for railways

General Company for Iraqi Railways (IRR) is a subsidiary of the Iraqi (MOT), which transports people and goods within Iraq and between the neighbouring countries. It's a public company of Iraqi government ran by the Iraqi (MOT) which transports people and goods within Iraq and abroad. It operates mainly between the production and distribution points. This service was initially started in 1914, until the General Company for Iraqi Railways (IRR) was established in 1953. In 2013 the company's railway total length was 2370 km of which about 81.1% were main lines and 18.9% were branch lines. The company transported 1703 thousand tons of goods, in 2013 the number of IRR's total employees was estimated around 7996.

2 LAND TRANSPORTATION CHALLENGES IN IRAQ

2.1 Iraq's Export and Import status

Iraq entered the global trade market in mid-1800 as one of the grain exporting countries. In early 1930 the crude oil became as a major export for the country which reached 49.3% of the national income in 1953, by 1980 the crude oil was 83% of the total exports while 17% was other products such as fertilizers, building materials, fresh and dried fruit. (Jones, p. 4)

Iraq imports various goods: different goods from different markets such as Europe, Asia, America and Africa. As Iraq was engaged in very long wars from 1980 until around Mid-2003, the country needed different goods for economic reconstruction of industry and service sector were destroyed during the war. Most of these imported goods had supported the industries and contributed to the reestablishment of the destroyed infrastructure and thereafter supported the county's exports. Figure 1 illustrates the continuous rise of the imported and exported goods.

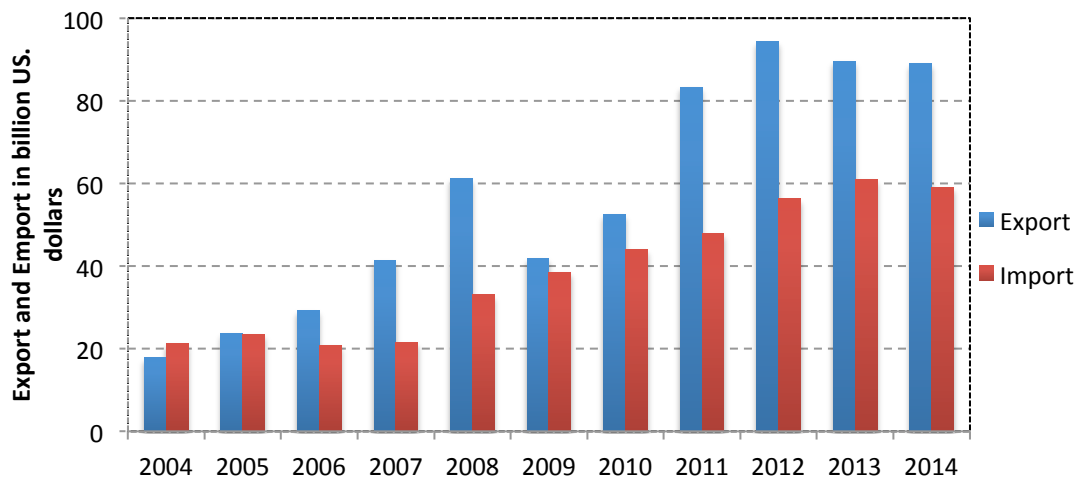


FIGURE 1. Iraq export and import of goods from 2004 to 2014 (in billion U.S. dollars). (Statista, 2015)

Iraq has different border crossing points and customs offices for import and export, these are both land border crossing points with neighbouring countries and sea ports linking the country with the Arab Gulf. These custom points are run by several Iraqi ministries including the Iraqi Ministry of Interior (MOI), Ministry of Finance (MOF), (MOT) and Ministry of health (MOH). The country has different imported goods which

helped to be ranked as number 62 of the largest importers in the world. The imports have increased dramatically from 2004 to 2014; the imported goods include many various items such as machineries 27 %, metals 15 %, transportation 9.6 %. Iraq's main imports were from Turkey 30 %, China 18 %, South Korea 5 %, Italy 4.3 %, Germany 4.2 % and 38.5% of the goods were from Middle East Arabic countries and from other European countries. (The Observatory of Economic Complexity, 2015)

Iraq's borders were shown in Figure 2 of a total length of 3631 km divided between Iraq and neighbouring countries including the eastern border with Iran with a length of 1458 km, the southern border with Saudi Arabia and Kuwait of 1056 km, the western border with Syrian Arab republic and the Kingdom of Jordan of 786 km and finally then northern border with Turkey of a 331 km length. The land borders are encircling Iraq 98.4%, which is considered the life artery of the Iraqi economy with the other world's continents. The remaining 1.6% is the water crossing border connecting the country to the Arab Gulf through different Iraqi ports. Figure 2 describes the border crossing points of Iraq with neighbouring countries and 14 water ports. (National Investment Commission, p. 6)

Iraq is well known as top oil producer, 98% of its exports are crude oil and petroleum related products. The focus here is on the challenges of the imports from the land border crossing points. If solutions are found, then it's easy to solve the exports challenges as they are mostly identical and of oil related products.

Figure 2 shows the number of trucks entering Iraq which represents the volume of imports through the land border crossing points of an annual rate of over 1.2 million trucks carrying various imported goods.

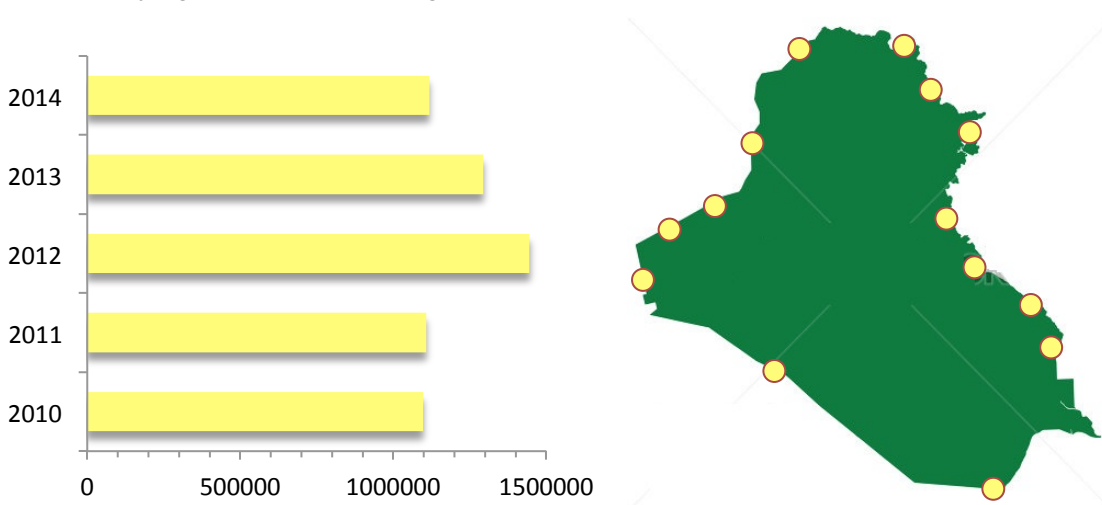


FIGURE 2. Trucks are entering Iraq from the border. (Statistics Department offices, 2015)

These huge numbers of trucks carrying imports entering the country were causing a lot of challenges to Iraq transportation system. This needs rapid solutions including construction, reconstruction, development and a lot of investments.

2.2 The impact of road transportation using truck for imports to Iraq

2.2.1 The impact on internal roads

Iraq is a large country with an area of around 437,072 km², its population according to 2007 estimated 27,449,638 million. (Fattah and Caso, p. 272)

This large area and an increasing number of population has been depending on roads and played a key role in the movement of both people and goods. These road networks were developed during the period from 1970 to 1980 to reach a total length of 40.6901 km, which has divided into five main categories such as

- i. Expressways are divided into 6 tracks services, which absorb 20% of the total traffic volume in Iraq. The total length is 1061 km and they are strategic roads linking the Iraqi ports in southern Iraq and continue their path through more than 7 provinces including the capital Baghdad, and up to the borders of Jordan and the State of Syria in western Iraq.
- ii. Primary roads, which are divided into four tracks and link the capital with the other 18 provinces.
- iii. Secondary roads which connect the cities with the provinces.
- iv. Village roads, which link Iraqi villages with the secondary roads.
- v. Military / border roads which are used by the Iraqi military forces considered as logistical hub for the country mainly used during the Iran-Iraq war from 1980 until 1988. (Feghoul, p. 4)

By 1980, 85% of the country's roads were paved, while 15% unpaved roads included secondary and village roads. But after 1980 the use of roads has become common for military logistical support as well as the transport of goods and passengers. This has affected the roads and started to deteriorate and some of them have become unfit. The first Gulf War started in 1990 followed by the subsequent economic sanctions on Iraq, which led to the exit of foreign companies from the country. This led to the deterioration of the Iraqi economy, with the sole economy resource for the country the UN oil against food program only, which led to the use of roads of all kinds to manage oil and food imports. The consequences were the destruction of infrastruc-

ture without rebuilding or maintenance and occurrence of damage to roads and lack of suitability for long distances as shown in Table 1. (Feghoul, p. 4)

TABLE 1. Roads, Length, and Condition. (Feghoul, p. 4)

Classification	Length (km)	Condition of Roads (%)		
		Good	Fair	Poor
Expressway	1,061	60	40	10
Primary Roads	10,917	30	65	5
Secondary Roads	14,193	20	70	10
Village Roads	3,704	10	30	60
Military/Border Roads	10,815	na	na	Na
Total:	40,690			

*na = not available

The main reason which led to the occurrence of severely damage in the Iraqi road network and especially the main roads that connect Iraq with neighbouring countries is the movement of goods by truck, because the loads were exceeding the assigned standard load which is 16.3 tons per axle which limited the life cycle of roads and played a big role in roads damaging specially the highways.

Iraq also has two rivers running from north to south starting from Turkey and Syria, making it an integral part of a lot of bridges to interconnect Iraq's road networks. There are 148 major bridges and 1008 secondary bridges all a cross the country, but they all are in poor condition as a result of being main targets for attacks both during the first and second Gulf War, although most of them were restored but still were not fit for trucks with heavy loads. (Feghoul, p. 4)

After 2003 the economic sanctions were lifted and this led to the opening of all land border crossing points, where goods and cars were imported into Iraq in massive quantities, and Oil was exported by tankers using the sea oil export gates and also over land export, still roads remained in their unfit conditions. This increased the destruction of the infrastructure, besides the lack of applicable traffic law and roads safety regulations. After 2003 the Road and Bridges Directorate which is a subsidiary of the ministry of housing and contraction (MOCH), which is responsible for constructing houses, buildings and road beside their maintenance works. The construction of roads and bridges was delayed, as priority was given to re-build all the laboratories, which were destroyed during wars, as well as the preparation of the necessary equipment for construction and operation. The costs were estimated to be around US \$ 17 million over the period from 2004 up to end of 2007. In addition, MOCH had de-

veloped the design of roads, detection of damage a roads and bridges and also plans that keep construction with the latest know-how technology through multinational foreign companies with an estimated cost of 2 \$ million divided over 2004 till 2007. (Feghoul, p. 6)

The need for infrastructure of the road network maintenance and restoration had taken a lot of money, from 2004 to 2007 nearly 5,600 km of road were covered with a layer of asphalt ranging between 4-5 cm, divided into 1100 km in 2004, 1300 km in 2005, 1500 km in 2006 and 1700 km in 2007, while the estimated costs for maintenance (Routine and Periodic) was estimated to \$ 358.31 million. The estimates and details about the maintenance of the network of Iraqi roads are given in Table 2.3 and 4. (Feghoul, p. 6)

TABLE 2. Roads - Routine Maintenance. (Feghoul, p. 6)

Routine Maintenance									
	Total Length	2004		2005		2006		2007	
		US\$/km/year	US\$ Mil- lion	US\$/km/year	US\$ Mil- lion	US\$/km/year	US\$ Mil- lion	US\$/km/year	US\$ Mil- lion
Expressway	1,061	420	0.446	510	0.541	550	0.584	600	0.637
Primary Roads	10,917	280	3.057	340	3.712	360	3.930	400	4.367
Secondary Roads	14,193	140	1.987	170	2.413	180	2.555	200	2.839
Village Roads	3,704	70	0.259	80	0.296	90	0.333	100	0.370
Total	29,88	192	5.75	233	6.96	248	7.40	275	8.21

TABLE 3. Roads – Periodic Maintenance. (Feghoul, p. 7)

Periodic Maintenance (4 to 5 cm overlay)				
	Total Length	(4 to 5 cm overlay) US \$/km	Total 2004 - 2007	
			Km	US\$ Million
Expressway	1,061	147,000	222	32.599
Primary Roads	10,917	91,000	2,079	189.162
Secondary Roads	14,193	36,000	2,640	95.026
Village Roads	3,704	20,000	660	13.198
Total	29,875		5,600	329.986

TABLE 4. Road Maintenance - Routine and Periodic Maintenance. (Feghoul, p. 7)

Total Assets (Roads) Maintenance	70.241	83.430	96.008	108.632
Average annual maintenance budget per km	2,351 US\$/km	2,793 US\$/km	3,214 US\$/km	3,636 US\$/km

Because of the war the country was for 20 years' without establishing new roads or regular maintenance processes only for urgent matters, and also without long future planning to cope with the increased transport in the country. In addition to the roads maintenance cost, there are other costs such as traffic jams among conjunctions of highway, which cost about \$ million 36 plus the road safety program with a cost of about 70 \$ million. (Feghoul, p. 8)

This leads to the conclusion that transportation using trucks without the presence of traffic rules, activated laws and regulations caused a continuous deterioration of the condition road network and maintenance became incompetent.

Trucks with overloads are the main cause for the deterioration, there are no laws pertaining to overloading which do not only apply to the total load of the vehicle but also include such concepts as weight per axle and load distribution. Beside the lack of maintenance, the existence of damage due to non-compliance with the rules and regulations as per the traffic law. For example pouring water from reservoirs on roads and oil poured from badly serviced vehicles, or from oil as well as accidents and fires. All of these cause lots of potholes and those rarely get repaired, and if repaired these potholes are continually washed open again by the water volumes (CSIR, Roads and Transport Technology, p. 9-12)

2.2.2 Road traffic accidents

Accidents occur without prior planning mainly by vehicles involving one or more than one vehicle, animals or objects using roads, this usually, and in most instances cause minor or serious damage which may lead to death or permanent disability. They can be different kind of accidents such as a collision, with solid object or pedestrian. There are three main factors involved, (driver, road and the car and its surrounding circumstances). To analyse the accidents, whether there is a human error caused by the driver, or technical faults in the roads, or mechanical error in vehicles, there are direct and indirect causes to the accident.

Direct causes contribute directly to incidents such as these factors:

1. The driver is not able to estimate the real traffic position.
2. There is no enough background about the road.
3. Driver lacks skill and expertise.
4. Poor health condition of the driver.
5. Excessive speed.

Indirect causes contributing to the occurrence of accidents such as:

1. The case of bad road.
2. The case of bad weather.
3. Infantry.
4. Lack of traffic awareness.
5. Not obeying the traffic regulations.

Effects of traffic accidents:

Traffic accidents which cause human losses and materials have three effects such as:

1. Social effects: It is an effect caused when a family, and community lose an individual, the effect of such loss is when he/or she is a productive and effective one.
2. Medical effect, which is an important element in measuring the magnitude of the problem when there is physical injury, which is serious and costly.
3. Economic effects which cause financial involvement to both individuals and harm the public resources.

Looking to the accidents caused by trucks in Iraq to see what is the proportion of the total traffic accidents, it's found that the truck accidents were 6.9% in all the roads inside Iraq, and 67.6% were caused by drivers' fault while only 7% because of the roads.

2.2.3 Environmental effects resulting from the traffic in Iraq

2.2.3.1 Air pollution from transportation fuels

Transportation is a main cause of air pollution (El Raey, p. 17) in which the atmospheric exposure to chemicals, physical or biological compounds causes damage that harms humans and other living creatures, or causes damages to the natural environment. There are major pollutants such as volcanoes, plants, car exhaust etc., and minor pollutants which have no direct effect. Pollution starts when natural concentrations of such substances as (SO_x, NO_x, CO, HCs, etc) are increased, as these materials are usually found in low amounts in the atmosphere but when increasing cause harm to humans and the environment. (Admassu and Wubeshet, p. 5)

Today air pollution is a major issue that concerns people, scientists and governments which has direct effect especially in urban areas and it is known that road transportation plays an important role in the pollution which causes problems on public health. (Hitchcock et al. p. ix)

The size of the pollution within the Arab region, where mostly there is no great care about global pollution standards, reasons, are found and pollution is caused by multiple sources, but mostly by transportation (CO and HC).

TABLE 5. Arab countries and MNA region estimated pollution loads (1000 ton) in main sectors. (El Raey, p. 11)

	SO₂	NO_x	TSP	CO	HC
Power	1600(39%)	1000(34%)	200(17%)	150 (>1 %)	50 (>1 %)
Industry*	750 (18%)	400 (13%)	120(10%)	50 (>1 %)	30 (>1 %)
Refineries	1100(27%)	80 (>5 %)	50(>5 %)	10 (>1 %)	300 (10%)
Cement/Steel	150(>5 %)	300 (10%)	600(50%)		
Total Industry	2000(49%)	780 (26%)	770(65%)	60 (>1 %)	330 (10%)
Road Transport	200 (5%)	1100(37%)	120(10%)	16000(<90%)	3000(<80%)
Residential	300 (7%)	100(>5 %)	100 (8%)	20 (>1 %)	10(<1%)

(*) Other than refineries, cement / steel and metal smelters.

Figure 3 shows the output of pollution due to transportation in Iraq and the increasing concentration of CO₂ in the air from 1971 until 2011 which represents an increase amounted to 34.22 in 2011 and less than the value of 2.44 in 1971. This is due to the increased of population that caused increase in transportation that depends mainly on road traffic.

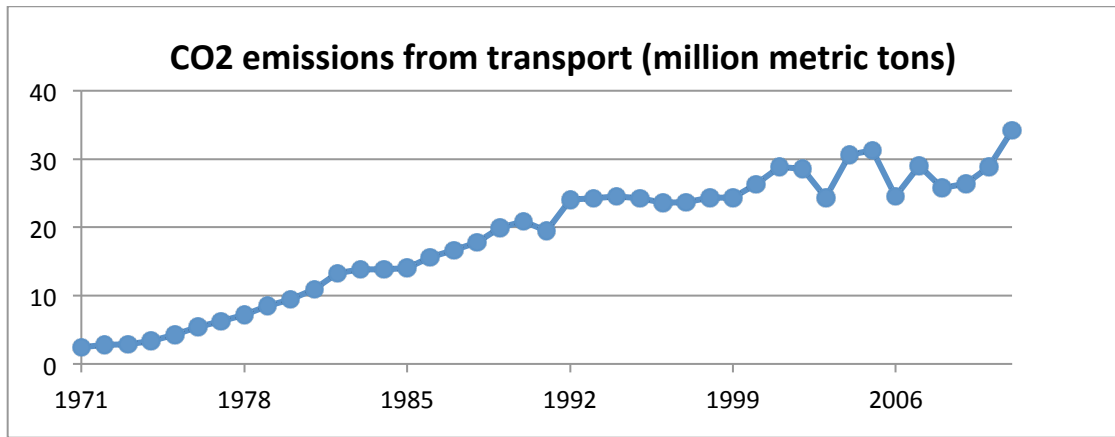


FIGURE 3. Iraq carbon dioxide (CO₂) emissions from transportation. (World Data Atlas, 2015)

2.2.3.2 The transport noise pollution

Health side effects caused by noise are causing serious damages to humans.

Noise can be in different places that cause difficulties in hearing, but accumulation of the noise especially in the developed countries can be a serious problem. And the greater the level of noise it will turn into a major public health problem while the long-term exposure to noise levels because of traffic above 65 decibels can dramatically affect the elderly. (El Raey, p. 17)

Noise levels were measured in different locations of the capital of Iraq (Baghdad) and other provinces in units (DB), which include areas (residential, service, commercial, industrial, health and educational institutions). Figure 4 illustrates a recent measurements of the noise level according to the national rate proposals as reported by Ministry of Health in Iraq. As we can observe, the capital city Baghdad and the second biggest city in Iraq (Basrah) are mostly polluted by noise because of the fact that they are the core of Land and Maritime Transport due to their high population density. (Ministry of Health in Iraq, 2013)

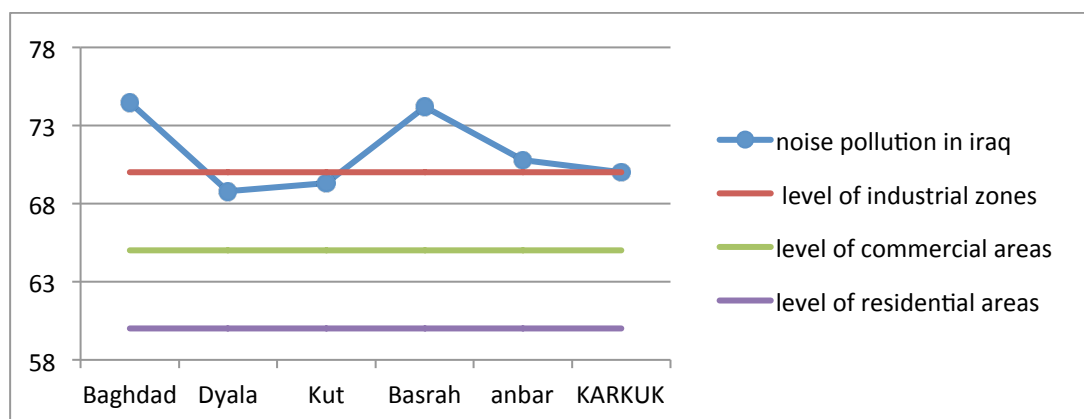


FIGURE 4. Noise levels in Iraq 2013. (Iraqi Health Ministry statistics)

2.2.4 Economic losses and costs

The trucks entering Iraq consume a lot of fuels to deliver the goods to the merchants and importers of diesel fuel consumption rates up to almost 1 litre per km.

Most of the goods entering from Turkey are distributed to the provinces with distances ranging from 100 km to 1100 km when trucks are heading south and vice versa for the distribution of goods, while trucks distance rate when moving from west to east and vice versa are between 100 to 850 km. These distances lead to a lot of fuel consumption. These trucks coming to Iraq are loaded with exported goods, but return empty which added cost to consumers. Most of these trucks come from different countries, different companies such as Turkey, Lebanon, United Arab Emirates, Kuwait, etc. Drivers of trucks are expanding their fuel tanks to increase the volumes of fuel filled in tanks. They buy government-subsidized fuel from Iraq at a very low price compared to what they pay elsewhere, such fuel which is meant for national consumption and domestic use as to support local transportation. Foreign drivers sell the fuel in Turkey because of the difference in prices; it is sold at a tripled price to what they have bought it for. Such smuggling operations harm the Iraqi economy. Diesel fuel price in Iraq is around half a US Dollar, per litre in Turkey around \$3 cents per litre. Most of Iraqi overland transport companies are running on losses, because of lack of control over internal transport, as well as external transport, as most merchants and traders are using bad reputed companies to reduce transportation costs because they agree to increase the load of goods, exceeding the permitted axel weight. The lack of dry ports in Iraq and exchange of goods points caused the road transport currently to have negative effect in Iraqi economy, which led to that 99% of imported goods are using foreign companies.

2.3 Scenarios for the land transportation by trucks in 2030

Going back to the recent history of Iraq, it's found that there was always political and economic instability. The country had four wars in three decades from 1980 to 2003, which affected the country energy, education, transport and health infrastructure.

After 2003 the economic and political situation were changed, the country system has also changed from a dictatorship into a democracy resulted into a positive transformation where, the collapsed infrastructure was move for advancement and growth to help the development of the country oil production, energy, human resources and scientific research (Parker and Moore) It is possible to move in four scenarios for the country political and economic position to reach its expected land transportation goal for 2030.

	Low economic growth	High economic growth
Stable politically	Scenario A	Scenario C
Unstable politically	Scenario B	Scenario D

It is possible to move in four scenarios for the country is political and economic position to reach its expected land transportation goal for 2030

Scenario A

The political stability in Iraq leads to the beginning of growth and investment, down to 2030, but Iraq must proceed to pay all its debts and war reparation losses while facing the global decline in oil prices. This led to a large deficit in the Iraqi budget and let the country stop a lot of investment including transport of all types relying on foreign transport companies, which is very costly.

Scenario B

The lack of political stability was because of different religious movements in the northern and western of Iraq, as well as Syria to the west of Iraq. This problem led to cutting of the strategic oil pipeline from Iraq to the Mediterranean Sea for export, as well as stopping Iraqi industries and dependence on oil exports to rebuild Iraq budgets. Cutting roads and stopped oil piped makes transportation in Iraq weak and fragmented which cause Iraq not to be linked to other countries of the world and participate within the international market and satisfy economy growth by 2030.

Scenario C

Access to political stability in the country will remain very demanding and important for the developments in the region and the country has access to global markets. However, the roads transport investment, which help in receiving most of the imports within the region it needs and advanced system which can extremely valuable because of Iraq crossing border to Europe through Turkey and the Mediterranean to several countries through an advanced system of joint transport and the promotion of all the Iraqi transport sectors in 2030.

Scenario D

Economic growth within unstable political situation in Iraq let the country not to be able to move forward. It is likely there will not be a change between 2003, 2015 and 2030, although there is a huge sale of oil to cover the high budget, plus the high financial liquidity but the lack of political stability prevents the target to be reached.

The four scenarios share a number of similar elements, including forecast estimates of increased population density to Iraq for 2030 which to reach 48.09 million, which will increase the imports to 73980 USD million. Thus imports are very important to be developed by 2030 to face many challenges to ease the opening of new markets, existence of a common market and accommodate the passage of goods through Iraqi territory to different countries of the world.

3 ROLLING HIGHWAY TECHNOLOGIES

3.1 Interrelationships between transportation and logistics

The logistics services cannot be achieved in an integrated manner without a good transportation system and good logistics activities to offer efficiency in goods and people movement. This will reduce operating costs, enhance the quality of services and improve and develop transport systems and supply chain can be achieved by increasing competition between public and private sector. (Tseng et al. p. 1660)

The transport industry is considered to be one of the most developed fields in recent history which had a substantial contribution in economic growth. It has eased the movement of people and goods. The transport infrastructure and quality of services are determining the development and civilization of any country. The most advanced countries today are those having the best logistics projects and the human resources to run it to enable the reduction of their cost and maintain sustainability. (Tseng et al. p. 1661) Security is considered of high concern for logistics companies when choosing the kind of transport routes which need planning for exit sides, loading and storage centres to reduce the impact of threats. (Ruske and von der Gracht p. 7)

Figure 5 shows the importance of transport in relation to the other services. The high cost proportion in relation to other activities needs some consideration and justifies the development of transportation system. This will play a big role in customer satisfaction, cost reduction of goods, enhancing quality and safety etc.

Here we know the importance of transport in the logistics operations that should go to transportation to find appropriate solutions, reach the advanced transfer operations, meet market needs and satisfy the consumer. (Establish Davis, 2013 p. 11)

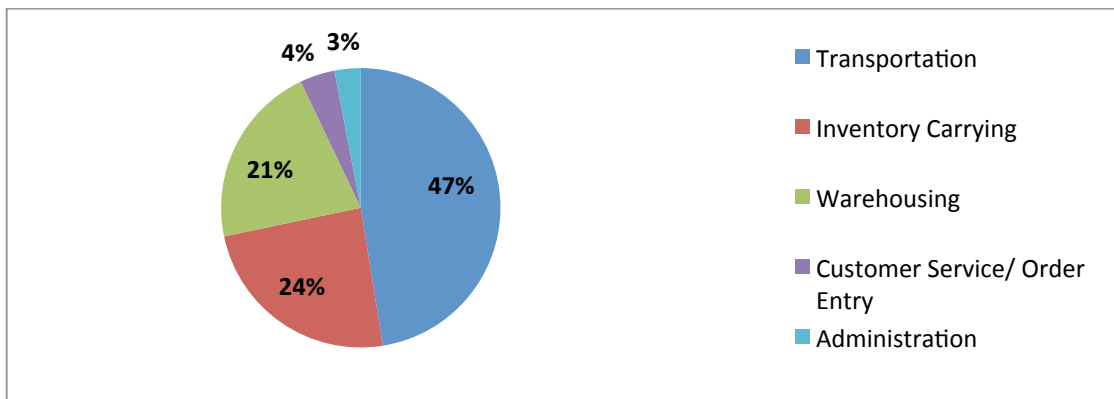


FIGURE 5. Cost as a Percent of Sales. (Establish Davis, 2013 p. 11)

3.1.1 Integration of transportation in multimodal transport chains

Shipping is considered the most common denominator in international trade of goods flows creating integrated loops transport of goods from their sources (origins of commodities) to the final objectives (destinations of commodities) in a multi-model transport system. There are two types of integration within the road transportation system. Combining transport in an intermodal freight system this will include the transfer of goods in semi-trailers, standardized containers, swap bodies or truck and the transport of goods using multiple transport modes such as railways, ships, trucks and bad handling of goods will create risks and losses which delay the transfer and increase the cost especially when dealing with multimodal goods transportation either such as dangerous or flammable goods. (United Nations, 2001)

The Piggy- back system is known as the loading system on the train's wagons and it has five forms as follows:

- Rolling Highways, full transportation of trucks in a train as shown in Figure 1 where they are driving through the road to the driver of the wagon train without the use of cranes. The benefit of this system is the use of the truck from the beginning of the journey until its end and the truck is loaded with goods without resorting to the loading and unloading to and from the train. To apply this system railway carriages should have special surface specifications of flat low altitudes so as not to exceed the height of the truck. The wagons have small diameter of rails to ease the loading of trucks and fit the roads length and width in case of bridges, tunnels and other situations along the line. Truck drivers are also hosted in a private vehicle to get some rest until they reach the desired point. (Sbb cargo international, 2015)
- Standardized containers, here only the container with goods is loaded using special tools to lift it to the train leaving the head of the truck or the vehicle as in Figure 6. After the arrival of the train to the desired point the container is again put on another truck to complete the transfer process till the last point where cranes are used to offload the goods to the customers. The system is used widely in the European countries as well as in Iraq especially when transferring goods from ships into the rest of the country. To apply this system, we need to have available of equipment and cranes in the process of lifting cargos and loading them on train's flat cars / flat wagons, considering the different sizes and measurements of containers.
- Swap bodies/Interchangeable unit, is a bear body truck without chassis which is downloaded directly from the truck to the trolley through back sliding and

spinning the body to settle in a parallel longitude to the trolley ribs and when loading the goods the same process is used but in adverse way.

- Trailer On Flatcar (TOFC) or (semi-trailers), it is the process of loading trailers above the trolley. In this case trucks are separated from the trailer and the trailer only is loaded on the train till reaching the last station where tractors are used for distributing goods to their last destinations.
- Block train, also called Unit train or a trainload service, is a train in which all cars (wagons) carry the same commodity, such as cars, fuel tanks and hazardous materials, and those are shipped from the same origin to the same destination, without being split up or stored in route. This saves time and money, as well as the hassle, delays and confusion associated with assembling and disassembling trains at rail yards near the origin and destination. It also enables railways to compete more effectively with road and internal waterway transport systems. However, unit trains are economical only for high-volume customers. Since unit trains often carry only one commodity, cars are of the same type, and sometimes the cars are all identical apart from possible variations in livery.

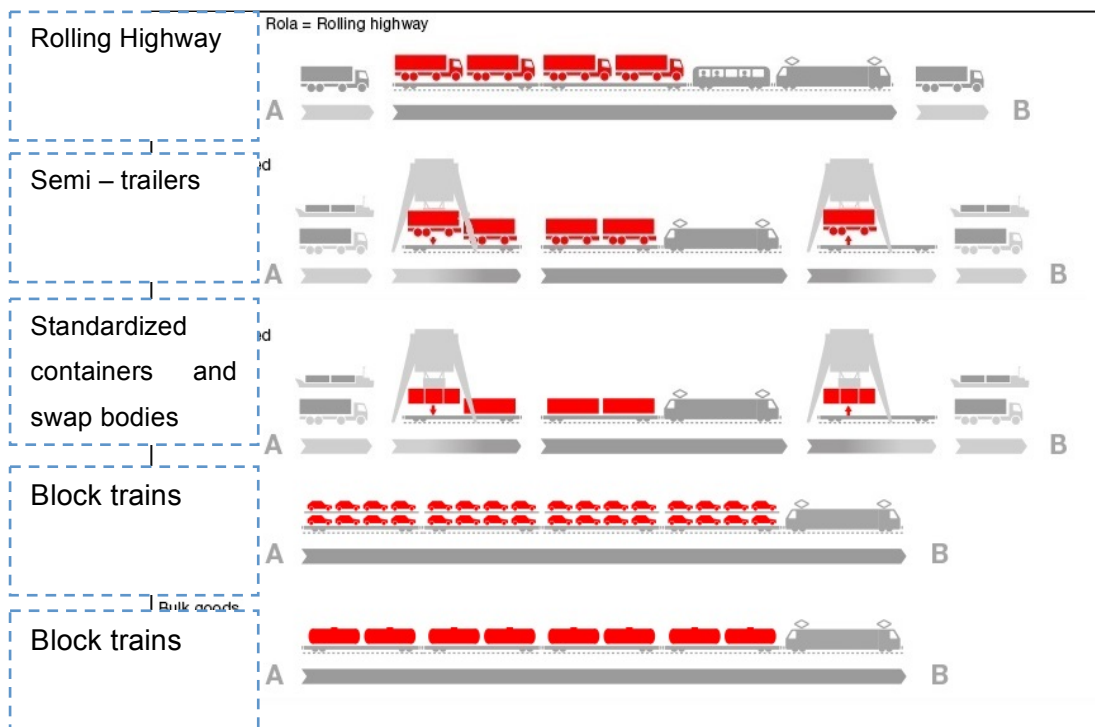


FIGURE 6. Freight transport (Sbb cargo international, 2015)

3.2 Applications of Rolling Highway in the EU and Indian subcontinent

The Rolling Highway is a kind of modern transport in the world and it makes sense to say so because the idea relies on rail and trucks, and there is no doubt that the transport history of these two transportation mediums together is older than the Rolling Highway system.

The Rolling Highway system has not been applied in the developing countries, but a few tracks and railway transportation have been used in the Middle East. These tracks and railways are not in advance level that can be used as a connection between the countries. In contrast, the Rolling Highway in Europe has been developed to facilitate the movement across the mountain and harsh roads conditions.

Examples of applied Rolling highway in Europe are RAlpin AG, which based in Switzerland, Olten that runs and administrates the Rolling Highway through the Swiss Alps. Each year it transports about 100,000 trucks and contributes to the creation of an intelligent mix of roads and railways and reduces carbon emissions, protects the sensitive areas of the Alps, provides solutions for the transit freight traffic and supports the Swiss economy and transport system. RAlpin AG owns two lines Switzerland from the city of Lugano to Basel and *vice versa*. The distance between them is 260 km and the trip for 5 hours having 5 trains each week one-way, while the second line of Freiburg, Germany to Novara, Italy and *vice versa* of 414 km distance between them. The duration of the trip is 10 hours having 60 trains every week one-way. The Shareholders of RAlpin are SpA, BLS AG, Hupac SA, SBB Cargo AG and Trenitalia. (Ralpin, 2015)

The goals of Rolling Highway are reduction of costs, better environment, safety and security to bypass the Alpine heights in which Switzerland allows the utmost load on the wild roads not to exceed 28 tons. In other countries 40 tons are allowed, which encourages the use of Rolling Highway. (Seidelmann, p. 45)

Statistics of goods crossing the Alps, through Switzerland was about 16 m ton in 2011 regardless of a decrease in growth of 4% in 2012. An unprecedented growth of 7% was achieved that the transfer of approximately 16.3 m ton. As well as transport across Austria achieved 8.85 m ton in 2011 and 8,5 m ton in 2012 and in general the multi-transport in the European Union achieved a growth of 1% in 2011 to 1.5% and this represents a high level in this sector. (European Commission, 2015 p. 109-110)

Other examples are added to the successes in the European Union. They are HUPAC SA founded in 1967 with a large capital and more than 100 shareholders

72% to transport and logistics companies and 28% of the railway companies, and has more than 414 employees in 2012. They achieved more than 11.5 m ton, 3.6 million euros of profit and more than 100 movement every day in to Basel, Busto Arsizio, Oleggio, Piacenza Singen, Köln, Duisburg, Rotterdam, Antwerpen, Taulov, Warsaw, Moscow crossing the Alps through Switzerland, Austria and France, including other works from Spain to Eastern Europe. (Valenti, 2013)

Rolling Highway application in India was set up in the Konkan region, which lies on the west coast of India and the neighboring hills to the east and the Arabian Sea to the west. The aim of this project is to connect the gap between Mumbai and Coastal Karnataka and Kerala. The gap between this area has a complex terrain and difficult transport system, as well as a lot of rivers and streams that cause problems in traffic, but using Rolling Highway in these areas has eased movement of goods through the loading of trucks loaded with goods on the train, which saved time and reduced the cost. (Garg, p.17); (Chandra and Jain, p. 11)

The applications of this type of transport have a lot of goals and benefits, including easing the transportation in high altitudes such as the Alps Mountains, which claimed high consumption of fuel and high transport prices that cause the increase in the final prices of goods. Another good application is the Indian experience applied to use Rolling Highway to solve the problem of transportation during the raining seasons and difficult weather conditions in those mentioned areas.

The main idea of using Rolling Highway either in Canada or the European Union was to reduce transport cost by reducing fuel consumption, eliminate dependence in costly transportation systems and reduce traffic accidents as well as traffic congestion and maintain the infrastructure of roads and preservation of the environment.

Diesel engines are predominant as power units for railway industry which can be fitted into three different types as follows

First there are shunting locomotives, which are used to shunt railway wagons usually equipped with engines sizes of 200 to 200 kW. The second are Railway cars, which are mainly used for countries is internal logistics for short distance goods transportations and their sized are between 150 to 1000 kW. The third type is the line haul locomotive. As the name suggests they are used for long distances both for goods and passengers with engine sizes between 400 to 4000 kW. Today there are two types of fuels used for train engines which are gas oil and diesel fuel (Norris et al. p. 4)

3.3 Benefits of Rolling Highway in solving transport problem

3.3.1 Reducing transport cost

Rolling Highway led to reduction of the transportation cost through complete reduction of fuel consumption for trucks, which depends on many factors such as driver, the cargo size, weather condition, vehicle model. For example what found is that, truck Volvo Model 1980 consumes 44 liters / 100 km despite the company's attempt to reduce fuel consumption been able to reduce consumption by 38% at a rate of 27.5 liters / 100 km. The main cause of fuel consumption are the stops on the roads because of congestion or traffic lights and intersections cause increased fuel consumption by 35%, the low air pressure tires of 20% causing increased fuel consumption by 2%. (Volvo tracks, 2014)

The Rolling Highway reduced the fuel consumption by 50% which is considered the best solution to reduce the oil consumption of the engine, extinction of motors, reducing maintenance of the truck, tire consumption and reducing the prices of transportation.

Concluded are the costs associated with Cost component described in Table 6 in case of urban roads which found that the supreme value of the trucks is 4.4 € ct / tkm and train 0.8 € ct / tkm but in the case of the road interurban for trucks it is 1.2 € ct / tkm and Train 0.5 € ct / tkm. (Essen and Maibach, 2007)

TABLE 6. Three different type of costs. (Maibach et al. 2008 p. 14)

Cost component	Social costs	External part
Costs of scarce infrastructure (congestion and scarcity)	Time losses and decreased reliability Opportunity costs of scarce slots	Costs of additional demand above a certain traffic volume imposed to other users
Accident costs	Material damages Health costs Production losses Suffer and grief	Costs which are not considered in own risk anticipation and not covered by insurance
Environmental costs	Environmental All remaining costs damages: air pollution, noise climate change others	All remaining

3.3.2 Rolling Highway for reduction of air pollution

The most cost of air pollution is caused by transportation in which vehicles are emitting carbon monoxide, ozone, nitrogen dioxide and sulphur dioxide etc. A research conducted in recent decades indicated that. There is continuity in air pollution process as a result of increased transport volume in the world, which increased the risk of damage to human health.

The environmental programs of action in the European Union, which aimed to reduce the pollution level that has effects on human health causing by the transportation. The pollution also resulted from the internal combustion of motors, as well as other components such as tires, brakes, fuel leaks and roads etc. materials handler (Krzyzanowski et al. p. 1). In particular, trucking is part of the road transport and causes major pollution in Iraq by 28%. Especially country uses diesel fuel for trucks which emits SO₂, which respiratory penetrates rapidly as well that 90% of emissions (CO) in the Arab countries as a result of transportation. (El Raey, p. 17)

The increase in emissions is associated with the growth of road transport by truck movement. This is one of the reasons why Europe tended to support the use of rail and combined transport system. Also a lot of governments and organizations such as the World Health organisation (WHO) are promoting appropriate solutions to reduce the pollution caused by transport, especially the road transport. What is found is that fuel consumption causes all emissions. In order to, reduce them we must change the mode of transportation and one of the best options is the direction to the railway because it is emissions below 4 to 5 times of the road traffic. (Maibach et al. 1997 p. 3) Rolling Highway solves most of the emissions problem in the world for example, the emissions from freight transport study by Heavy goods vehicle in Switzerland is 316 g / Tkm, Wagonload traffic is 72g / Tkm, Rolling Highway is 25.28 g / Tkm and unaccompanied combined It includes (semi-trailers, standardized containers and swap bodies) is 18.96 g / Tkm. (Maibach et al. 1997 p. 4)

3.3.3 Joint transport links of Iraq to neighbouring countries and Europe

The application of Rolling Highway in intermodal transport, which is a combination of overland, and railways is a new idea in Iraq or even in the region. The applications of this type of multi-transport will resolve many problems including the building of the Iraqi economy and meeting the obligations to export Iraqi oil to other countries and also to contribute to the infrastructure of Iraq which was destroyed because of the 30 years' of wars that are considered to be one of the main challenges.

Rolling Highway is a solution to connect the ports of Iraq in order to strengthen the Iraqi import and export of Iraq, enhance trade and help in the establishment of the common market within the area and globally.

As in Figure 7 there are four important countries, which share borders with Iraq and have extended links of rail lines, which will contribute to the application of Rolling Highway. The figure shows that the red lines inside Iraq and the red dashed lines outside Iraq. Both exist railway lines but the black lines are new lines under construction. The first access links Baghdad to Jordan and down to the Gulf of Aqaba and its length extends to the Iraqi border (510 km) and controls the most important western part of Iraq outlets and that the proportion of entry of trucks from there to Iraq, 21% of the total percentage of trucks that enter Iraq. This vital line can be replaced and used for transport of goods by road to rail transport multiple users.

The eastern access to Iraq includes two new lines connecting the northern Iranian city of Kermanshah down to the Iranian capital Tehran and this line controls the import of goods from Iran and transits from Iraq to Syria, while the second line links southern Iraq city of Basrah to Shalamchah-Khorromshahr in Iran with a length of 60 km is used usually for transport between Iraq and Iran.

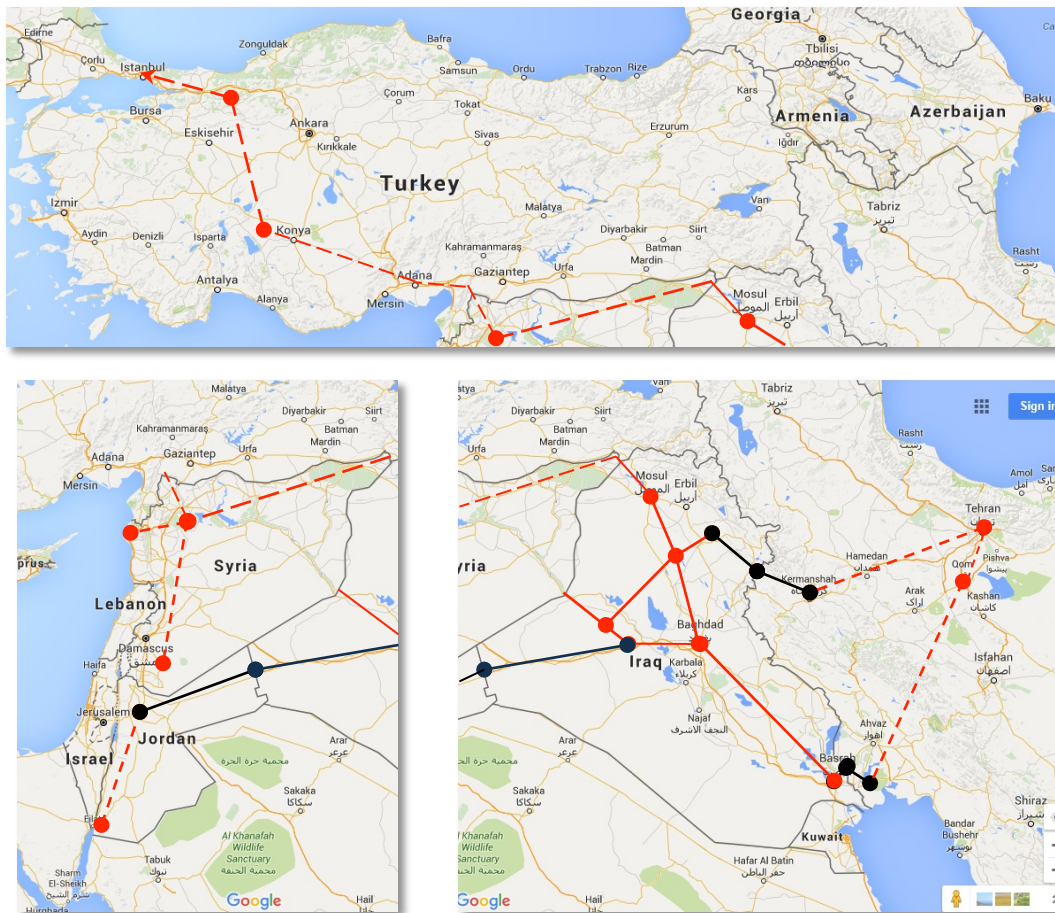


FIGURE 6. Train network in Iraq and linking it with neighboring countries.

The main rail line for Iraq in southern part of the country which links the northern part until binds line with the Syrian lines to get to the Mediterranean Sea as well as lines linked with the Turkish network to Europe, as shown in Figure 7.

Rolling Highway gives the ideal solution for connecting neighbouring countries to Iraq to boost the country oil exports. This could be an alternative and backup line in the case of increasing oil production capacity in Iraq. This will also help in Iran transport to be closer to the Mediterranean Sea, which helps Iran to transport Iranian goods and products to Iraq.

The current transportation system, which is not using multi-transport, imported systems for goods flow using trucks, causes significant losses to the Iraqi transport ministry. In the case of multi-transport application there will be choices and also increase the completion, which help the quality of transports. More trucks will find that the Rolling Highway is the most appropriate choice for companies, which generate profits for the Iraqi General Company for Land Transport and the Iraqi rail.

3.4 Roads and rail transport until 2020

When analysing roads and railways in Iraq for five years to 2020, it was found that all the strategies associated with programs to build infrastructure are often delayed in the process of implementation due to the unstable financial budgets of government. The (MOT) and the (MOCH) are responsible for strategic planning in particular for land transport, and also is support general transportation programmes and decisions for international conventions.

3.4.1 Strategies for the future development of the transport sector

- The development and expansion of railway lines, was to improve the specifications in terms of speed and axle loads through the study of the current situation in the light of the economic and financial feasibility studies. The proposed projects aim to develop and implement some priorities within specific programs to achieve economic and financial policies.
- Railway network processing systems and advanced traffics signals, implementation of the best projects that contribute increasing the speed of the trains and the achievement of safety requirements in accordance with international standards.
- Linkage between production and consumption, export and import and linking the Iraqi centres with the neighbouring countries and beyond.
- Securing the areas of cargo and passenger transport.

- Development of promotion, marketing, adherence to punctuality methods for the largest amount of movement to attract (cargo and passenger) and make this objective in the construction and development of railways transport activity and process which is a part of the common transport system.
- Achieving Arab railway network integration of good specifications and standards.
- Increasing the effectiveness of investment in creation of global rail companies.

In Iraq there is a continuity of the transfer of goods from ships by truck or train. The Figure 8 below shows the Iraqi Ministry of Planning (MOP) statistics concerning goods transported by rail.

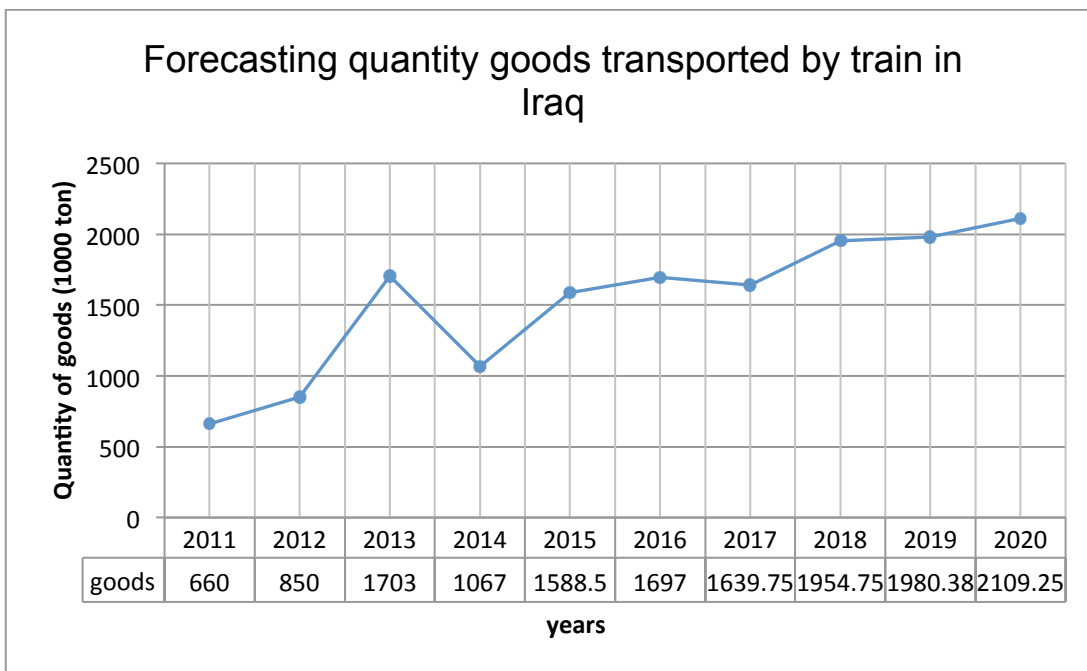


FIGURE 7. Forecasting goods transported by train inside Iraq.

The amount of goods transported was on the basis of actual figures on goods transported from 2011 to 2014 and prediction of the amount of goods transported by train from 2015 to 2020. It is possible that there will be an increase when applying the Rolling Highway.

The most important projects that contribute to the Rolling Highway according to the Iraqi National Investment Commission (NIC) statistics are in Table 7. In which it evident through that Iraq is interested in heading to transport by rail and joint development of the transport as well as the strengthening of certain goods to be transported via Iraq to another country as a transit process.

TABLE 7. Railway projects in Iraq (National Investment Commission, 2004)

Products goods Speed Km/h	Axial load	Type of line	Length Km	Project name	Transportation capacity (million)		Execution period (Years)	Estimated cost (million dollar)
					Products goods			
The circular the city of Baghdad	284	mix	25	140		46	2430	5
Basrah- faw south of Iraq	100	double	25	100		70	1710	3
Iraq(Basrah)-Iran	35	double	25	80		10	635	3
Middle of Iraq	288	double	25	140		2	3150	3
North of Iraq – Turkey	160	double	25	140		55	2607	3
Middle of Iraq (Baghdad) to south of Iraq (Basrah)	910	double	25	140		35	1373	7
Baghdad – East of Iraq – Iran	700	mix	25	140		20	8650	7
North of Iraq	120	double	25	140		6	3350	5,5
West of Iraq	133	double	25	140		36	1900	3
Iraq - Jordan	400	double	25	140		12	4050	5
Iraq - Kuwait	52	double	25	140		20	650	3

There are a large financial allocations estimated at 30,505 million dollars for the completion of such a giant and large project which includes renovation and development which is shown in Figure 9. The allocations of 2015 are higher, but they will start to decline until 2020, because of two important reasons. The first is the decline in the price of a barrel of oil rates and Iraqis budget depends on the subject, and the second reason is that, when the basic infrastructure is done the needs for upgrades are not so much which also will depend on future profits for such an important sector.

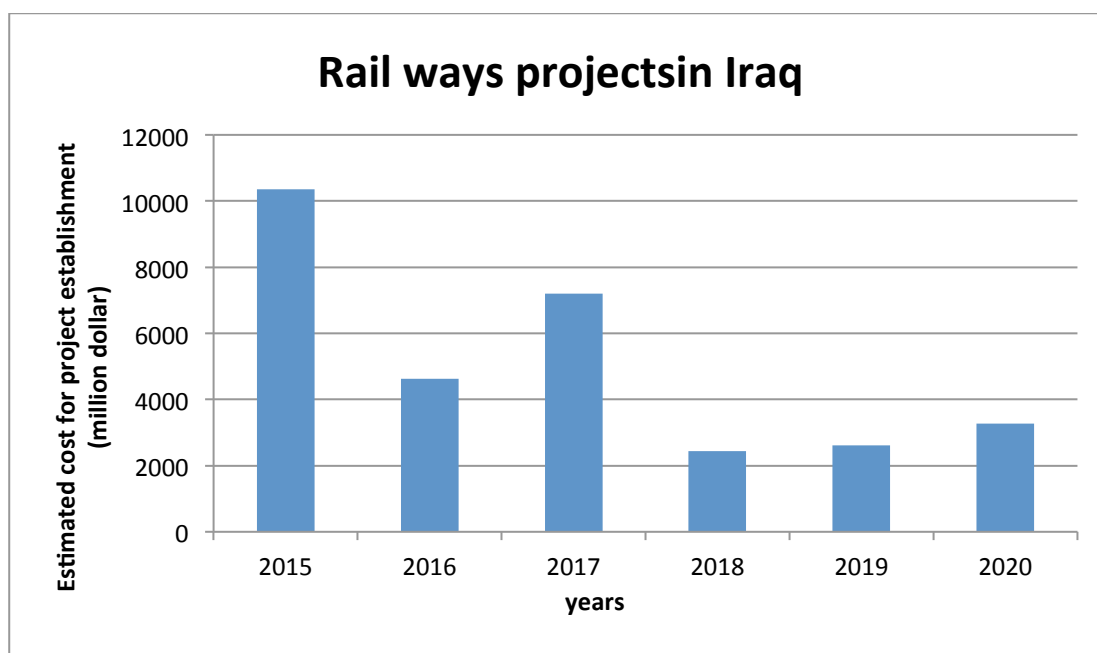


FIGURE 8. Financial allocations for the completion of rail projects linking Iraq Pique international rail.

3.4.2 Secondly - Trucking

Most of the imports coming into Iraq are by trucks but most of them are not of Iraqi origins while the (SCLT) depending on them for transport within Iraq, which caused great losses due to association with the international transport rules. The process could be handled by local truck owners and large or small companies. This might be governmental or non-governmental. Thus the (SCLT) aims to modernize the trucks fleet of its own. This modernization shall be updated to match the traffic and transport with the neighbouring countries, where such standards of transport adopted trucked to the infrastructure of roads and bridges, have undergone development and the renewal process called (Transport Corridors Project in Iraq) with a loan from the World Bank by US \$380 million and the project started from 2014 until 2020 and divided into years, the loan stages shown in Table 8

TABLE 8. Expected disbursements (in USD Million)

Fiscal Year	2014	2015	2016	2017	2018	2019	2020
Annual	20.00	50.00	80.00	80.00	80.00	45.00	0.00

The development objective of this project is to improve the link between the roads in the road transport sector and improve the safety conditions of traffic on a selected number of roads located on highway 1 connecting transport corridor between North-South in Iraq.

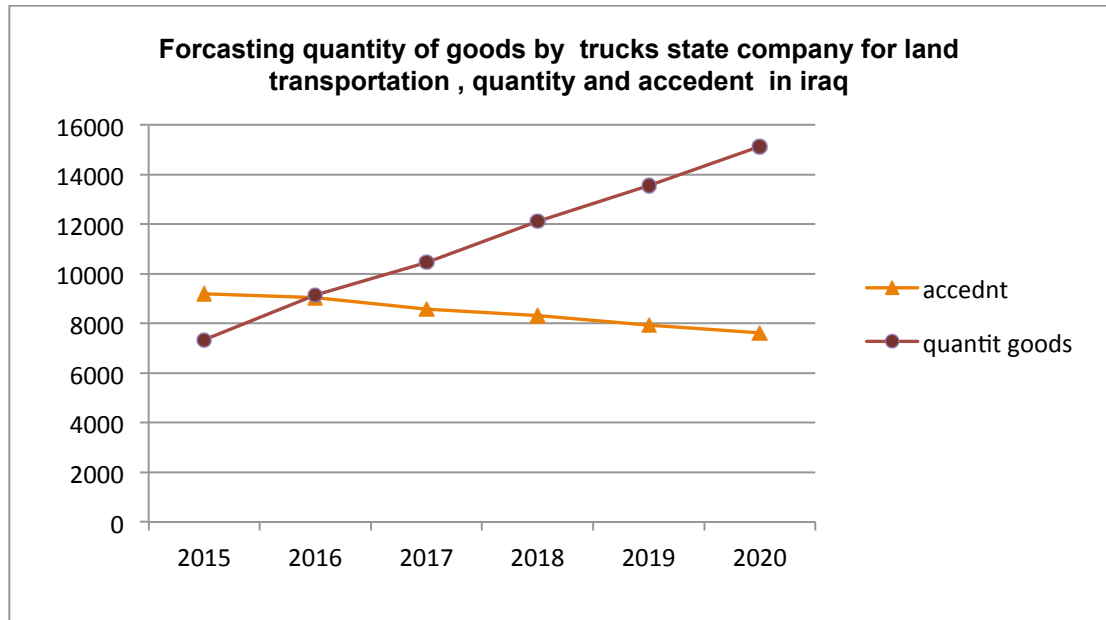


FIGURE 10. Prediction for the transport of goods by the state company for land transportation

Figure 10 is a prediction for the transport of goods by the (SCLT), and contracting using trucking companies. It shows that goods transported are growing, when applying the Rolling Highway. The increase of goods transport by truck will continue but the non-Iraqi trucks entering Iraq will be controlled by using Rolling Highway which will add profit to Iraq (MOT), support the national economy of Iraq and increase the market share in the region. In addition, Figure 10 also contains a predictable road accident in Iraq, which shows a high proportion despite real rates are higher than these figures because of statistical weakness of the study.

4 COMPARISON BETWEEN TRAINS AND TRUCKS

A Rolling highway which is also known as Rolling Motorway in Germany Rollande Landtrasse is combined transportation system that transports trucks by train.

Combined transportation consists of unaccompanied and accompanied. Unaccompanied combined transportation consists of goods transportation by three methods which are swap bodies, standardized containers and semi-trailers. The efficiency of transportation in these methods depends on the facilities of the terminal, such as speed, technology, and man power.

Accompanied combined transportation consists of the truck transportation by train including the driver. Having a cabin for the drivers is a mandatory in this type of transportation. At this point we have to compare and discuss the transportation of goods by road and rolling highway in order to conclude the suitable option.

The rolling highway companies are considered as an alternative option to transportation by road because they save costs, time due to traffic and accidents, fuel, highway taxes and vehicle operation hours.

The rolling highway will operate according to its fixed timetable during day and night which means it will not be affected by traffic jams and weather condition. Also the drivers will travel with their vehicles while they are resting during travel time when there is a long driving journey.

According to road transportation laws and restrictions the driver should take a rest after a certain driving time. Also, there is little other complexity during weekend's transportation such as road services are closed. Therefore, rolling highway is a better suitable option that will overcome these restrictions and make it possible for goods to be transported 24/7 without such restrictions. Furthermore, it will increase trucks lifetime.

One of the most important advantages of rolling highway transportation is environmental. Advantage aspect it was an important study conducted in 2003 by IFEU at Heidelberg University with the development of the Transportation Emission Model (Tremod). This model is used among others, by the German Federal Environment Agency and the Ministry for the Environment, Nature Conservation and Nuclear Safety. Updated by the IFEU in 2005. (Danielis et al.)

The rail transportation will save up to 53 grams of greenhouse gas/ton-km compared with road transport. Rail transportation gives us major advantages over other transportation means due to the fact that railways are the less polluting transportation method. This also applies to the other relevant pollutants such as nitrogen oxides and hydrocarbons as well as primary energy consumption. According to Ökombi (2008), the Rolling highway has 80% less CO₂ emissions for each train-pair and it lowers particulate matter by 80%, SO₂ by 59%, NO₂ by 96%, and CO by 83%.

We can see the comparison in Figure 11 that compares the emitted pollutant by trucks and railways. The emitted pollutant by trucks is much higher compared to railways. This means that the exhaust emissions of trains are for ton-mile is less. However, the train emits a certain amount of pollution, but it is mainly far away from populated area.

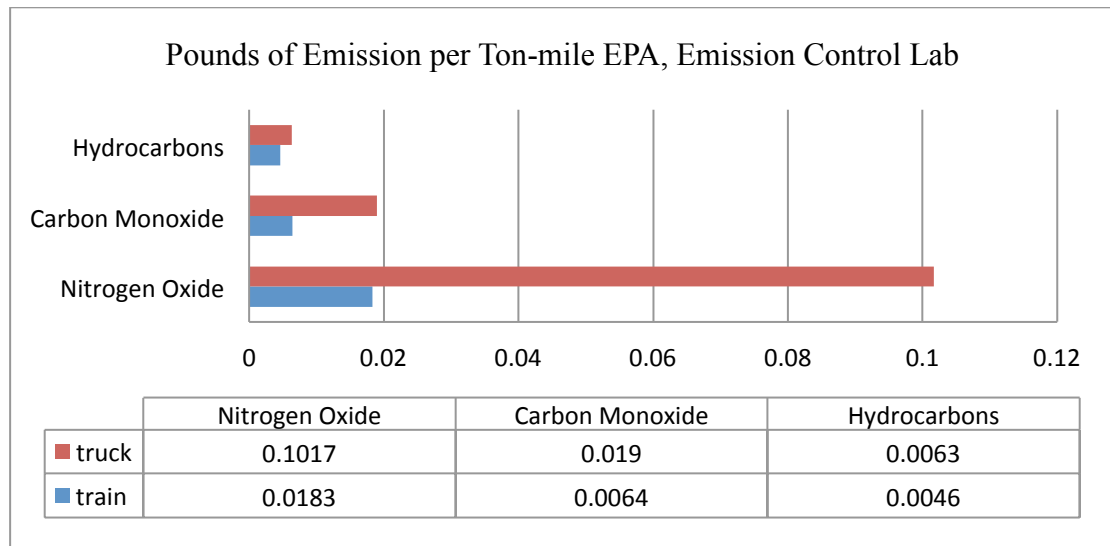


FIGURE 9. Pounds of Emission per Ton-mile (Haulk, p.24).

In order to measure energy efficiency that is used in transportation a maximum weight should be easily moved by a minimum energy and discrete time. The energy that is required to move certain weight including goods for a certain distance was expressed as BTU, which means one ton / one mile. The water transportation requires 433/ton-mile while rail transportation required 696 BTU /ton-mile. This means that water transportation is more efficient compared to rail transportation. However, water transportation is not a suitable option for Iraq, due to the fact that Iraq's rivers don't go to all Iraq's borders that Iraq has with neighbouring countries. Furthermore, the water level is not suitable for such transportation. This leads us to the comparison between rail transportation 696 BTU/ton-mile and Truck transportation higher than

696 BTU/ton-mile. As we can see the rail transportation is more efficient. Supporting this conclusion is the statistical data that shows each mode of transportation and how much it can carry one ton of cargo for every gallon of fuel burned (truck 155 miles, train 413 miles and barge 576 miles).

As shown in Figure 12 the rail car can carry bulk material up to 58 times of what a truck can carry. Also, a barge can carry 15 times of bulk material compared to rail car.

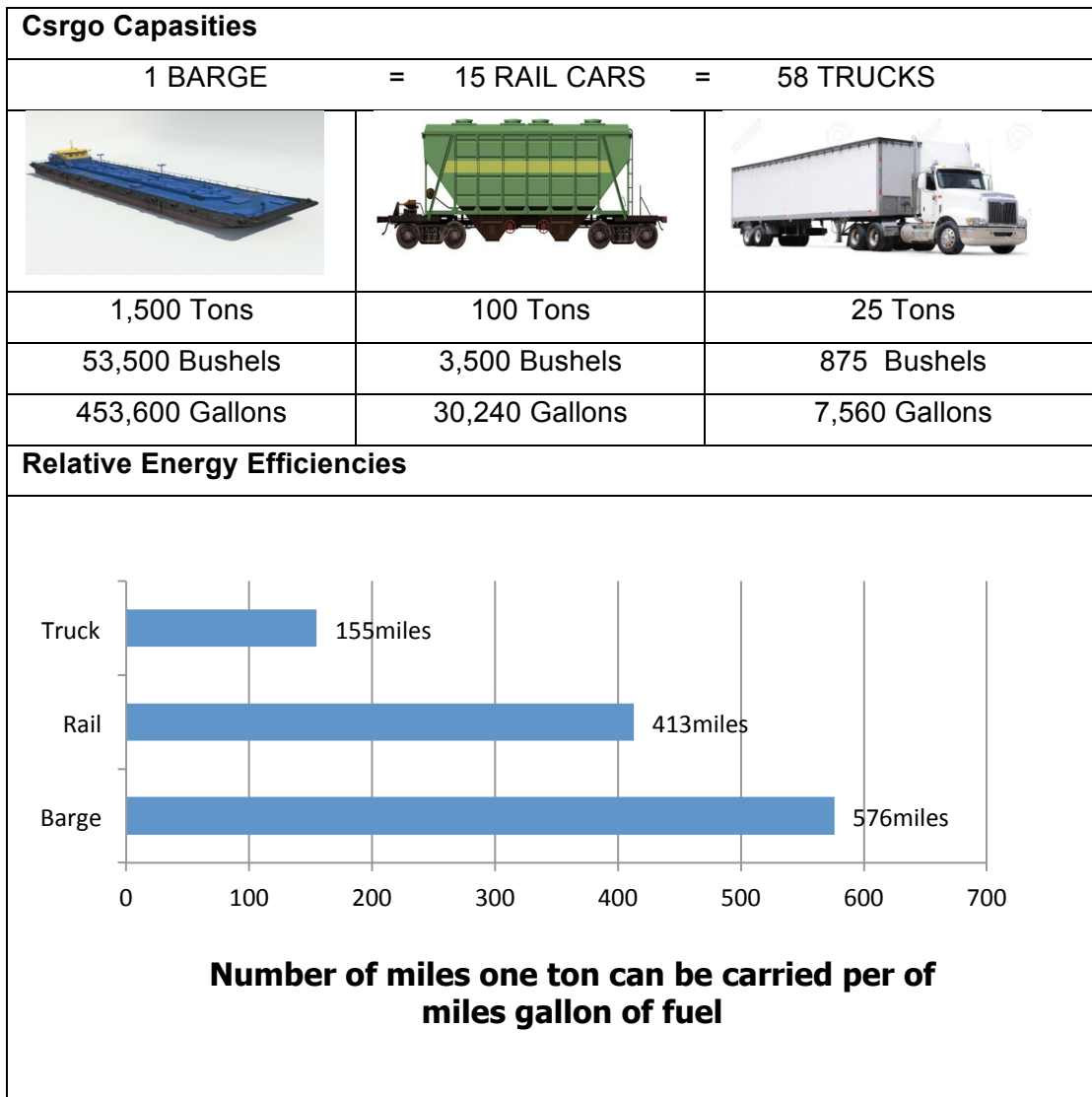


FIGURE 10. Alternate transportation mode comparison and moving freight efficiently throughout america (U.S. Army Corps of Engineers, 2000); (Wilkins)

One of the disadvantages of transporting a whole truck by train is the weight that is caused by the head of truck, which is roughly about 12.5 ton. According to Swiss transport estimations trains can transport at the same time 15 whole trucks. However,

transporting semi-trailers, standardized containers or swap bodies will raise the maximum possible transported weight up to 3 times.

Also, the maximum height of the train including its shipment should be taken into consideration. Therefore, Intermediate car "Rolling Highway" should be as low as possible to avoid collision into bridges. The area which the train goes through doesn't have many bridges, but the height of the cargo should be taken into consideration if there will be any plans in the future to develop the area.

When comparing two types of transportation (railway and road transportation) we must know the integration between each other in order to apply combined transportation. Afterwards, we can apply rolling highway in Iraq. Applying rolling highway doesn't eliminate road transportation. However, it does improve and develop the transportation system in Iraq.

We would like to compare between railway and road transportation in order to find the best solution considering environmental, issues maintenance, capacity, costs and time wise see Table 9.

TABLE 9. Pros and cons for rolling highway

Rolling highway	Pros	Cons
Environment	Less air and noise pollution	Good way of goods transportation using but not most of the best
Maintenance	Continuing on a regular basis	Needs good planning
Safety and security	Less train accidents rates trucks accident	One incident on the train may equivalent to dozens of accidents in the trucks in material and human losses
Speed	The train has a speed compete in the speed of trucks delivering goods	The train does not delivery goods from door to door
Capacity	The train transports full containers semi-trailer trucks	Truck head has a weighed burden on the cargo size because uses a largest area
Costs	It reduces the cost of goods transporting and roads maintenance	Distances to deliver goods by train must at least 200 km from economic to have efficiency
Congestions and time factor	Does not cause a lot of traffic congestion during goods delivery which reduces the cost	Causing many rail intersections within cities

5 CONCLUSIONS

The multi-transport that contains Rolling Highway includes accompanied or unaccompanied transport of goods by train through swap bodies, standardized containers or semi-trailers.

Rolling Highway is an alternative to road transportation that has proved success in European countries and especially the way passing the Alps Mountains. The system also succeeded in other areas like India to overcome harsh climate challenges such as permeate long running rivers, which caused difficulties in road constructions and maintenance especially those roads which can be suitable for trucks transportation. The system also has many other examples around the world.

The application of this type of multi-transport system in Iraq is very important especially now as the country has a good railway infrastructure for transportation of a long good history administered by the (IRR).

Rolling Highway in a long range scenarios is a new idea in Iraq, neighbouring countries, and in the region all together, as that will contribute to the ease of connecting all inner cities of Iraq, as well as linking it with the neighbouring countries, especially with Turkey, Syria and Lebanon which bridge the gap between the country and other part of the world especially Europe through these countries.

This service will be an important and effective on the long run. Also, it will increase and support the national economy of and create Iraq new common markets and approach the international markets at the level of its oil export and import.

This study is based on Statistics that were gathered from the State company for land transportation that belongs to the (MOT). General statistical organization (GSO), (MOP) Portal (NIC) and other interested companies to transport goods using trucks or train and multi-transport. To understand their level of knowledge about what is the Rolling highway, and uncover the factors that determine decision-making and considering the importance and significance of the lack of Rolling Highway in Iraq.

There is a number of interesting quantitative and qualitative factors found in the results.

As expected, the cost factor plays an important role but not the only. Also, the time factor that affects the time it takes for the goods to be delivered is an important factor for both the exporter and importer. So, the Rolling Highway has a big role in achieving lower transport costs associated with fuel consumption and lower insurance rate on goods because of the lack of incidents. In addition, the rolling highway offers the opportunity for the goods to be delivered around the clock compared to trucks drivers don't like working during holidays. While Rolling Highway includes the reduction of road accidents by using train transportation as well as long-distance truck drivers ensure comfort in a private vehicles in order to be able to drive the truck to deliver goods to the door and thus be within driving hours' restriction.

It is predictable that the need for rolling highways in Iraq is essential and demanded, due to quite a few reasons, such as; the high fuel costs, road taxation, goods damages due to long transit time in such hot weather during summer months, where temperature could sometimes reach to or near to 50 Celsius. The long distances between major cities and the borders gateways are considerably long ones, for example, the distance between Baghdad, the capital, and the southern seaport city of Basra is around 500 KMs. Similarly, between Baghdad and the Iraqi/Turkish border gateway in the north and Iraq/Jordan and Syria borders in the west, are again around 500 KMs. Thus, with such long distances for goods to transport, the implementation of rolling high ways will be viable and feasible too.

The Rolling Highway needs financial support and in-depth study, especially in the field of railways, which has already been planned for in the National investment commission. The NIC is the responsible authority for giant projects such as the railway. However, the idea of multi-transport is well-known, but needs media promotion and government support.

Although this thesis highlighted the Rolling Highway and discussed European success in this area, this topic needs to be studied in future as well as other studies in the Middle East area in which development process and planning is more difficult compared to developed countries. Finally, we can say that the Rolling Highway is beneficial from an economic and environmental point of view that will support Iraq's economy on the long run.

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