INTERNATIONAL FUTURES PROGRAMME

TRANSCONTINENTAL INFRASTRUCTURE NEEDS TO 2030/2050

TURKEY/BOSPHORUS GATEWAY CASE STUDY

ISTANBUL WORKSHOP

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FINAL REPORT

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OVERVIEW

Introduction

The OECD's Transcontinental Infrastructure Needs to 2030/2050 Project is bringing together experts from the public and private sector to take stock of the long-term opportunities and challenges facing macro gateway and corridor infrastructure (ports, airports, rail corridors, oil and gas pipelines etc.).

The intention is to propose a set of policy options to enhance the contribution of these infrastructures to economic and social development at home and abroad in the years to come.

This Istanbul Workshop focussed on three strategic infrastructure projects in Turkey (Marmaray, Mersin Container Port and Nabucco Gas pipeline) proposed for consideration by the Turkish authorities.

While the workshop focussed exclusively on the projects put forward, after looking more broadly, it is clear that Turkey is becoming a new hub in the region and has much to offer to other Central Asian, Middle Eastern and South European economies.

Organisation and participation

The Workshop was organised by the State Planning Organisation in the Prime Minister's Department and chaired by Mr. Ekrem Karademir, State Planning Organisation (SPO).

There were 12 Turkish participants who came from the Turkish State Planning Organisation, Ministry of Energy and Natural Resources, Ministry of Transport, DLH and Avrasya Consult (Marmaray project) and, on the second day Altinok Ltd. (Mersin Container Port project) – see list in the attached Annex A.

The OECD's International Futures Programme was represented by John White. (Barrie Stevens was unable to attend owing to the disruption to international air services caused by the Icelandic volcano ash.)

The venue was provided by the Ministry of Transportation's General Directorate of Railways, Harbours and Airport Construction (DLH), the body managing the Marmaray construction project.

Case Study Programme – Status Report and Workshop Objectives – (OECD/IFP staff)

The Workshop noted the OECD's status report on its Transcontinental Infrastructure to 2030/2050 project, the Case Study programme approved by the Project's Steering Group and the Workshops being undertaken as part of the Project.

Workshop objectives identified included exploring the major opportunities and challenges associated with the three nominated strategic infrastructure projects.

Marmaray rail crossing

Presentation by OECD/IFP on Global outlook and regional developments – context

The OECD's presentation highlighted the global economic, trade and transport outlook in the short to medium term – and the longer term. Discussion focussed on the key aspects of importance to the project.

Consideration was given subsequently to current global and regional maritime container traffic and possible trade route developments that could bear on the Case Study area. The OECD advised Turkish input would be welcome on the outlook for the Bosphorus and nearby regions.

Presentations on Marmaray Project – objectives and current position

Nusret ILBAY's presentation on the Marmaray project outlined the objectives, scope and progress. There are three current contracts for the work: the Bosphorus Crossing (BC1); the Commuter Rail (CR1); and the Rolling Stock (CR2). The overall cost is expected to be well over US$3 billion. The expected project duration is 2004-2013, with delays in completion dates due primarily to archaeological works in the vicinity of the Bosphorus.

Serdinç YILMAZ's presentation highlighted planned connections between the Marmaray Rail project and the High Speed Network, connections to the Freight Network & the current position reached on the overall project.

Presentation in Marmaray Project Integration with Urban Transportation

Gülbün SALOR's presentation outlined the Integration with Urban Transportation, addressing the expected improvements in freight and passenger services, capacity and usage as well as in accessibility and the impacts expected on managing traffic congestion. Discussions explored the interactions between the project and its wider settings and additional issues that may need to be taken into account.

Infrastructure funding and financing

The current project focus is on completion of the challenging construction work. The hosts outlined funding and financing arrangements for the construction phases of the Marmaray line, which appeared quite robust. Once the construction work is more advanced, further work will be needed by the authorities on expected fares and revenues after the Marmaray rail line is in operation – and the relationship between expected revenues and expected operating costs.

Infrastructure contributions to "***Green Growth***"

The OECD highlighted the work being done across developed countries, following OECD Ministers' support for "Green Growth" approaches and their resolutions on the development of Green Growth strategies. Clearly, the Marmaray project will be expected to make a very large contribution to reductions in CO_2 emissions in the longer term, as a result of improved infrastructure operation and use over the project life. Further insights on these and any other aspects which might need some further advice could be pursued after the meeting.

Marmaray project site visit

There was a site visit to the Marmaray Rail Tunnel Project, which included a tour of the Üsküdar station, the tunnel between the station and the underwater crossing and an inspection of part of the underwater tube crossing under the Bosphorus Straits

Vessel traffic management system

There was also a visit to the Coastal Safety Directorate's Traffic Control Centre for the Bosphorus, where an advanced Vessel Traffic Management System (VTMS) system was being used to direct shipping traffic through the Bosphorus Straits. Automatic Identification Systems provide basic shipping route details and vectors and warn of impending collisions. Data from other sources provide the additional detail needed on cargoes etc.

Coastal safety educational centre

There was also visit to the Coastal Safety Educational Centre hosted by the Director.

Turkey's transport policy and maritime infrastructure needs

***Ekrem KARADEMIR*'s** presentation outlined Turkey's Transport Policy. His following presentation outlined Maritime Infrastructure Needs and reinforced that, for large infrastructure project financing, priority is being given to Public-Private Partnership models.

Transport infrastructure needs assessment for Turkey (TINA) study, 2007

Ekrem KARADEMIR's presentation on the TINA Study outlined its forecasts for transport in Turkey. These anticipated robust growth over the period to 2020. One of the priority projects identified in the TINA Study was the Mersin Container Port, the second of the strategic infrastructure projects put forward by the Turkish authorities. The hosts advised that the TINA forecasts are being reviewed but the new forecasts are not currently available.

Mersin container port

Arda ALTINOK presented plans for the development of the Mersin Container Port as a major gateway port in the eastern Mediterranean. The specific objective of the project is to facilitate the construction of a new container port in Mersin, adjoining the existing Port of Mersin, in order to consolidate the existing Port of Mersin as a gateway for import-export traffic and a transshipment hub in the region. The TINA (Transportation Infrastructure Needs Assessment – 2007) report includes the new development of the port of Mersin amongst the top priorities and a recent feasibility study conducted after the TINA study defined a capacity of 4 million TEUs by 2020 and 11.4 million TEUs by 2035.

Sources of traffic for the new Mersin Container Port are expected to be principally: Local Hinterland (vicinity of port); Turkish Hinterland (north, north-east and eastern regions); Land Transit (to landlocked countries); Land Bridge Mersin-Filyos (i.e. from Mediterranean to Black Sea via Ankara); Trans-shipment (not a major objective for the gateway port). The port would be developed in phases, in line with market demand. In terms of hinterland and land transit traffic, the new container port will build on established demand and services to the existing port of Mersin.

Nabucco project

Vahit ÇALIŞIR's presentation highlighted the Nabucco Gas Pipeline project, the third strategic infrastructure project put forward for consideration. Demand for gas in Europe is expected to increase considerably in the upcoming two decades. Sufficient gas reserves are available in the regions around Europe to meet this expected future increase in demand. The biggest challenge, however, is how the gas can best be transported to consumers. At present sizeable enough capacity does not exist for transporting the gas volumes required to European gas markets. Additionally the only region with rich gas reserves, and which is not yet connected with the European markets via pipeline, is the Caspian Region, Middle East and Egypt.

The Nabucco project will develop a new gas pipeline connecting the Caspian region, Middle East and Egypt via Turkey, Bulgaria, Romania, and Hungary with Austria and further on with the Central and Western European gas markets. The proponents believe this is the answer to the challenge outlined above and consequently will open up a new supply route for Europe. The pipeline length is approximately 3,300 km, starting at the Georgian/Turkish and/or Iranian/Turkish border respectively, leading to Baumgarten in Austria. A reasonable amount of the gas volumes reaching Baumgarten will have to be further transported through Austria to the Central and Western European Countries. According to market studies the pipeline has been designed to transport a maximum amount of 31 billion cubic metres of gas per year. The pipeline is expected to be fully operational by 2017.

Opportunities and challenges

The Workshop gave further consideration to each of the three major strategic infrastructure projects outlined. Discussions focussed on some of the key opportunities and challenges. The findings are set out in the following sections of the Workshop Report:

- Chapter 1: Marmaray Project
- Chapter 2: Mersin Container Port
- Chapter 3: Nabucco Gas Pipeline project

Final remarks

The Workshop covered a lot of ground, dealing with the three major strategic projects put forward by Turkish hosts that clearly are very important regionally and internationally, as well as to Turkey itself.

As an important and growing hub in the middle of the European and Asian economies, the three strategic projects show that Turkey's development will establish new patterns of trade and lead to important changes in trade routes in the region in the medium term.

The Opportunities and Challenges outlined in the following sections of this Report will be given further consideration by the OECD project, in conjunction with the findings of the other Case Studies and Workshops. The intention will be to draw out best practices and lessons learnt that will be valuable to infrastructure providers, managers and users around the world.

In many studies, the route from Central Asian (Black Sea) to African economies via Turkey is being rather overlooked as is the potential for growth in both eastern European and northern African economies. Discussions at this Workshop also focussed more on strategic infrastructure.

Nevertheless, as the region grows, Turkey will have many potential opportunities for improving trade in services as well as physical goods with other countries in the region – and opportunities to contribute to the growing north-south trade flowing through the Bosphorus.

The OECD wishes to express its gratitude to Turkey's SPO for the organisation and the other authorities for the hosting of the Workshop, which were both quite exceptional.

CHAPTER 1
MARMARAY PROJECT

Project description, purpose and objectives

Project description

The Marmaray project will provide an upgrading of the commuter rail system in İstanbul with its central element being a rail tunnel under the Bosphorus that connects existing rail lines on the European and Asian sides. The Project includes the upgrading of approximately 76 kilometres of commuter rail, connecting Halkalı at one end on the European side with Gebze at the other end on the Asian side with an uninterrupted, modern and high-capacity commuter rail system. Infrastructure investment costs are outlined in Annex 1.A1. The full project description sent by the Workshop hosts is at Annex 1.A2.

The outline of the project, its purpose and objectives are based on advice provided by the Workshop hosts.

Project justification (why it is needed)

One of the important urban problems of Istanbul is the difficulty of transportation resulting from the rapid and uncontrolled population growth, a rapid increase in motorisation and related traffic jams.

The Bosphorus Strait, which divides the city into two continents, exacerbates the transportation difficulties. Crossing the Bosphorus between the European side (where the main axes of the city and work areas are located) and the Asian side (where the largest residential areas are located) causes great time losses for Istanbul's inhabitants. The waste of time and fuel and the associated air and noise pollution, together with the traffic accidents associated with the increasing motorization levels, are having a serious negative effect on the health of both the city inhabitants and the city itself.

Furthermore, the two bridges opened in 1973 and 1988 to resolve transport problems between the two sides of Istanbul have created a transport system dependent on highways and private transport. The mass transportation solutions required to help resolve Istanbul's transport problems have not been developed sufficiently up to now.

Project district and other side benefits:

The Marmaray Rail Project will provide an upgrading of the commuter rail system in Istanbul. The Project will have three tracks either side of the tunnel. While two of the tracks will serve as a high capacity commuter rail system, the third track will be used by intercity passenger and freight trains between the Asian and European continents. The tunnel will provide an uninterrupted railway connection for Asia and Europe. The Project will also be significant for Turkey's connections to the Trans European Network.

Project objectives

Major project objectives include:

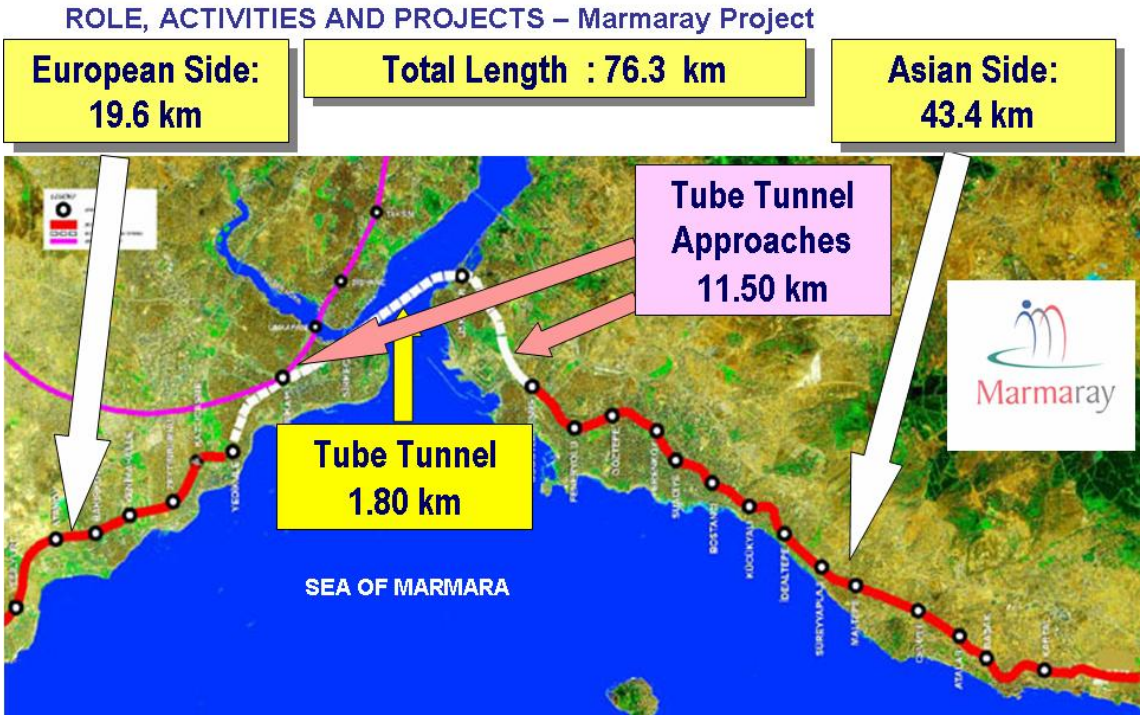
- to provide a long-term solution to the current urban transportation problems of Istanbul;
- to relieve existing operating problems on the mainline railway services;
- to provide direct connection of railway system between the continents Asia and Europe
- to increase capacity, reliability, accessibility, punctuality and safety on the commuter rail services;
- to reduce travel time and increase comfort for a large number of commuter train passengers;
- to reduce air pollution resulting from the exhaust gases and thereby improve the air quality of Istanbul;
- to reduce adverse effects on historical buildings and heritage sites by offering a potential for reducing the number of cars in the old centre of Istanbul.

More detailed project description

The Marmaray rail tunnel and railway upgrading is such a major infrastructure project that it will influence not only the daily traffic patterns in Istanbul; it will also influence the development of the city and the region.

A project graphic is provided below. The red line on the map shows the parts of the railway that are above ground. The white line shows the new railway system sections that will be constructed in tube tunnels under the İstanbul Strait as well as the bored tunnels constructed between the Tube Tunnels and two adjacent stations on either side.

Figure 1.1



Source: Ministry of Transport, Turkey.

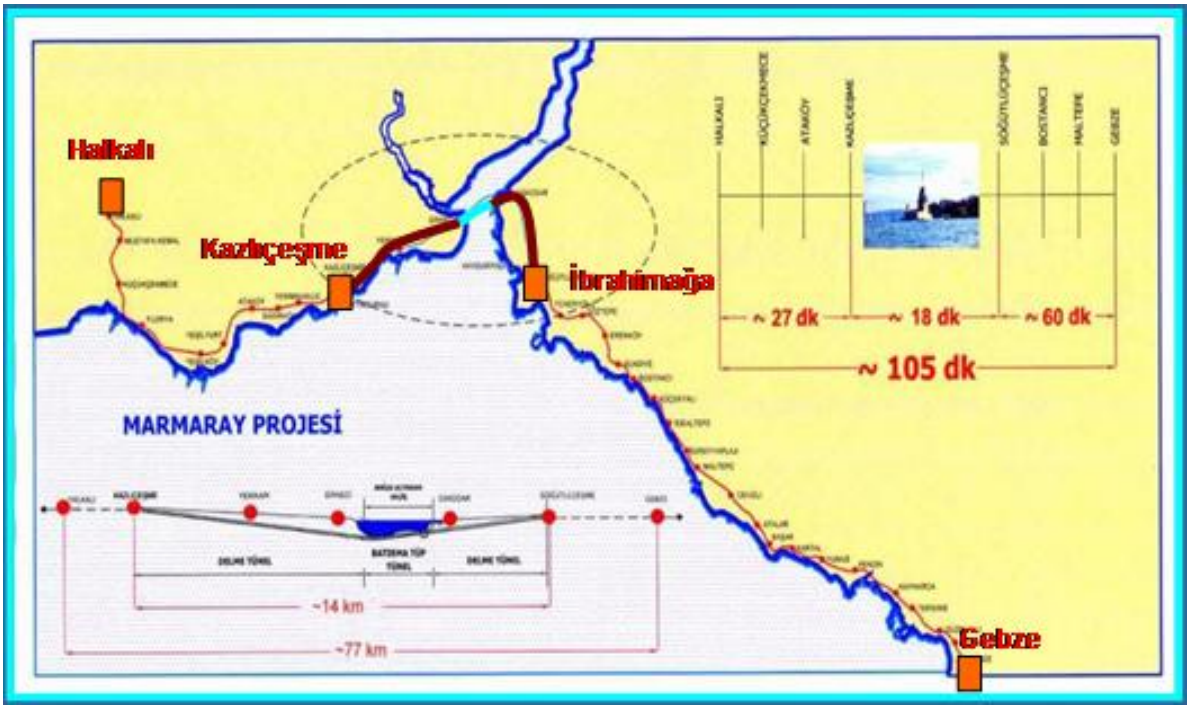
The section shown in white also joins the two separate rail system networks that currently exist and operate independently on the European and Asian sides of the Bosphorus. The entire Marmaray railway line, including upgraded and new sections, will be approximately 76 km long.

The main structures and systems of the Marmaray project include: the immersed tube tunnel, bored tunnels, cut-and-cover tunnels, grade structures, 3 new underground stations, 37 surface stations (renovation and upgrading), operations control centre, yards, workshops, maintenance facilities, upgrading of existing tracks, including a new third track on ground, completely new electrical and mechanical systems and the procurement of modern railway vehicles.

The capacity of the new commuter rail system for moving people across the İstanbul Strait will be 10 to 12 times higher than the capacity of one of the existing bridges.

The line goes underground after Kazlıçeşme station on the European side, continues through the new Yenikapı and Sirkeci underground stations, passes under the Bosphorus/İstanbul Strait, connects to the new Üsküdar underground station and emerges at Söğütlüçesme. This central section of the project including that tunnel under the Bosphorus is shown in more detail in the following map.

Figure 1.2. Marmaray project – Underground and underwater sections



Source: Marmaray project: Objectives and Current Position presentation April 2010.

At an operational level, the Marmaray Project is expected to:

- Create a long-term solution to transportation problems of Istanbul
- Have a capacity of 75 000 passengers per hour per direction
- Reduce impacts of car traffic in the old City
- Reduce congestion on the existing bridges
- Connect the Railway from Europe to Asia and vice versa
- Be an environmentally healthy Project
- Decrease pollution in Istanbul, decrease CO_2 release
- Decrease travel time for more than 1 million people every day.

Transport context for the project

Turkey's current economic situation and outlook

Turkey weathered the recent recession better than most of its developed and developing country neighbours. Turkey's GDP grew 0.7% in 2008 and fell –4.7% in 2009. The economy has recovered strongly with 5.2% growth expected in 2010 – and it is projected to increase by 3.4% in 2011.

Turkey's forward projections are in the range of 5.5% growth per annum, consistent with levels being projected for other countries at similar stages of development.

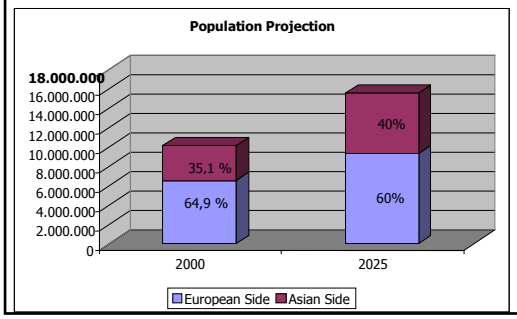
Over the same period, Turkey's GDP per capita reached US$10 000 in 2008 before falling to close to US$8 500 in 2009. It is expected to increase to around US$9 000 again by 2011. At these levels, experience in other countries suggests transport demand can be expected to increase quite quickly – and this is borne out by recent experience in Turkey (e.g. with vehicle ownership).

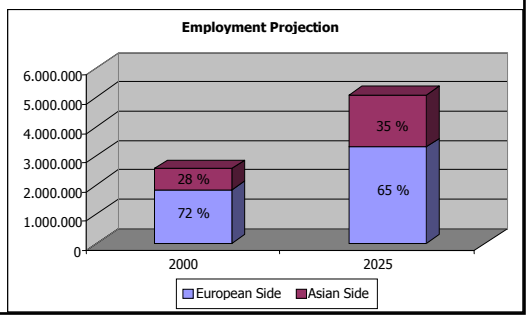
Istanbul land use and transportation characteristics

Istanbul's overall urban and transportation characteristics in 2000 and projections to 2025 are set out in the following graphic.

Figure 1.3.

	2000	2025
Population	10.160.916	15.585.464
Employment	2.571.814	5.100.000
No. of Students	1.606.378	2.849.802
Car Ownership	113 cars per 1000 inhabitats	550 cars per 1000 inhabitats
Daily (Motorized) Trip Generation Rate	1.00	1.28
Total Daily Motorized Trips	10.095.000	19.871.467





Source: Marmaray project: Integration with Urban Transportation presentation April 2010.

Employment is expected to double on the European side and more than triple on the Asian side by 2025. Car ownership is expected to increase dramatically from 1.15 million vehicles in 2000 to 8.5 million vehicles over this period while the total daily number of motorised trips is projected to double to 19.9 million.

Turkey is already growing strongly and the changes ahead are expected to be transformational. Given its prominence in Turkey, Istanbul will be at the forefront of the changes in prospect.

Transport Policy Context

Passenger transport. Turkey is improving passenger transportation with faster rail services. High Speed Rail projects are starting on a core network consisting of the İstanbul-Ankara-Sivas; Ankara-Afyonkarahisar-İzmir; and Ankara-Konya corridors, with Ankara being the central city. The intention is that every city with a population of greater than 1 million will be connected to Ankara and İstanbul with a high capacity railway system under five hours.

Turkey's *Freight Transport Strategy* for implementation over a number of years in future includes:

- Restructuring of Turkish State Railways (TCDD) according to EU regulations
- Opening the railway freight market to local and international train operators
- Privatisation of TCDD Ports and establishment of logistics centres near main ports or main railway junctions
- Rehabilitation or new construction of rail and road connections to main ports.

Transport Sector investment shares have increased from 18% in 2000 to 28% of Turkey's *Total Investment* in 2010. Rail transport is being given priority – with its share increasing from 6% of transport investments in 2000 to 48% in 2010. Reflecting its importance, the Marmaray project is being allocated some 80% of total rail investment of DLH in 2010.

The Workshop explored the interactions between the project and its wider settings, including the changes in population and employment outlined in the above graphic.

At present, the logistics sector in Turkey is rather small, estimated at around 4% of GDP. In line with Turkey's Freight Transport Strategy, the logistics sector is expected to grow (consistent with levels in the best performing developed and developing countries) to around 11% of the expanded economy; by 2025 logistics services could amount to around US$70 billion. Road freight represents a large portion of the current logistics sector activity. One of the major opportunities and challenges facing the country is to increase rail freight's contributions to the logistics services required, as the country grows.

In a similar way, Turkey as a whole and Istanbul in particular are very dependent on roads for passenger transport services (including road-based public transport) than many more developed countries and their large cities – even though car ownership is currently very low (around 217 cars per 1000 inhabitants of Istanbul in 2009).

Turkey's earlier transport strategies favoured road-based transport solutions; rail transport received relatively little attention. In combination with Turkey's geographic size and dispersed population, many ports and centres of activity and favourable climatic conditions, road transport now dominates freight transport carriage.

However, Turkey's transport strategies have been revised. Current transport policy now recognises the importance of a strong rail freight capability, the importance of rail mass transit for passengers in major urban centres and the need for rail's better environmental and CO_2 reduction capabilities.

A presentation on the Integration with Urban Transportation addressed the improvements in freight and passenger services, capacity and usage – as well as in accessibility and managing traffic congestion. The expected outlook is as follows:

Improving accessibility, managing traffic congestions and urban connections

The anticipated increases in overall transit and private car volumes across the Bosphorus by 2025 are set out in the table below.

The proponents' expectations are that Marmaray will carry half the total strait crossing passengers in 2025 and there will be almost no increase in private car volumes crossing the Bosphorus by 2025.

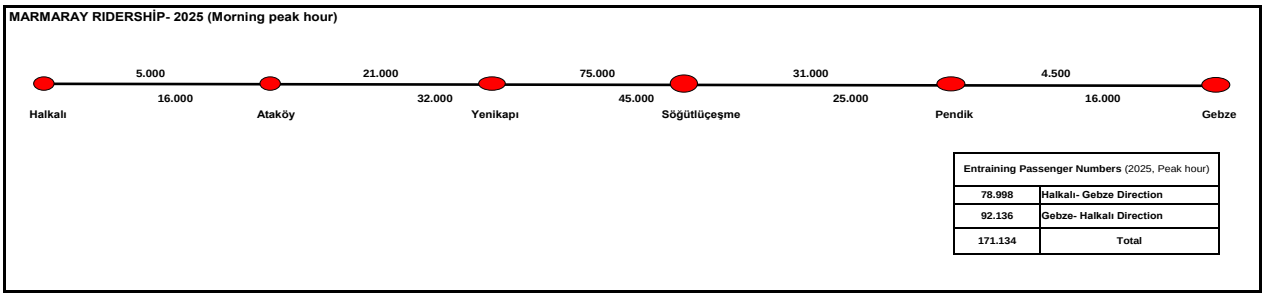
Table 1.1. Daily Passenger Trips across the Bosphorus – Actual 2004 and projected 2025

		2004				2025	
		Vehicles		Passengers		Passengers	%
Private Car		250.000	0,76	**500.000**	**0,47**	**516.000**	**0,23**
Transit	Marmaray	-	-	-	-	1.181.790	
	Total	80.000	0,24	**570.000**	**0,53**	**1.684.000**	**0,77**
TOTAL		330.000		1.070.000		2.200.000	

Source: Marmaray project – Integration with Urban Transportation presentation April 2010.

Expected morning peak hour rail passenger volumes along the Marmaray line are as set out below:

Figure 1.4. Improving passenger services, capacity and usage 2025



Source: Marmaray project: Integration with Urban Transportation presentation April 2010.

Discussions focussed on the issues identified in the project documents and additional issues that may need to be taken into account.

After completion, the usage of rail transportation in Istanbul is predicted to rise from 3.6% to 27.7%, which would see Istanbul's percentage rate of rail transportation usage as the third highest in the world, behind Tokyo (60%) and New York City (31%).

In February 2010, Railway Gazette International reported that the tunnel's administrators were hiring consultants to study the options for promoting the tunnel for carrying freight traffic.

Rolling stock

Hyundai Rotem announced in November 2008, that it had signed a €580m contract to supply the rolling stock for the Marmaray cross-Bosporus tunnel project in Istanbul. The Korean firm saw off competition from shortlisted bidders Alstom, CAF and a consortium of Bombardier, Siemens and Nurol for the 440-vehicle contract which was placed by the Ministry of Transport's General Directorate of Railways, Harbours & Airports.

The 22 m long stainless steel cars will be formed into 10 and five-car EMUs. Some production will be carried out locally by Eurotem, Hyundai Rotem's joint venture with Turkish rolling stock manufacturer TÜVASAŞ. The cars will arrive in three batches, the first 160 cars by 2011, the last by June 2014.

The outcomes are reflected in the next section which presents the findings on the ***opportunities and challenges*** facing the gateway.

Opportunities and challenges

Improving rail freight and passenger services, capacity and usage

The Marmaray project is expected to greatly improve freight and passenger services, capacity and usage in the Istanbul greater metropolitan areas, given the improved rail services along the Marmaray corridor that will be available once the project is completed.

Rail Freight Traffic

■ Opportunities

The Marmaray rail tunnel will provide rail freight connections between existing rail networks on European and Asian sides of the Bosphorus. This will allow uninterrupted rail services across the Bosphorus to European and Asian continents and direct rail freight connections beyond, in both directions. The project will improve rail connections to Europe via the extended TEN-T network. There will also be improved rail freight services across Turkey and to and through to the eastern parts of Turkey and with landlocked countries to the east. Better connections will be available to some of Turkey's important Mediterranean and Black Sea ports as well.

Rail services through the Marmaray tunnel will alternate between passenger and freight rail services. The tunnel will be open to freight trains when it is closed to commuter services (e.g. during the night).

With huge quantities of urban freight to be delivered daily to Istanbul and distributed within the metropolitan area, there will need to be good rail freight access to rail freight logistics centres on the outskirts of the metropolitan area – and very good urban distribution systems as well. There are plans for such centres to be developed at a number of points in Istanbul in conjunction with the Marmaray project.

■ Challenges

While there will be improved rail services, there is no guarantee that the Marmaray project by itself will produce the improvements in "door to door" freight times and reliability needed to achieve all the desired results for freight transport.

It will be important to focus on the improvements required in intermodal facilities (as outlined in the ITF's report on Intermodal Transport), rail freight efficiency and rail freight services from origin to destination that are competitive in terms of frequency, reliability and cost. This will require focussed and sustained efforts over many years.

Overall, the Marmaray project is expected to make a significant contribution to the improved rail freight operations that are required in Istanbul, within Turkey and between Turkey and neighbouring countries.

Rail Passengers

■ Opportunities

The Marmaray project will contribute to improved accessibility and reduced travel times for the hundreds of thousands of passengers that will use its services each day, particularly for travel to central areas. The capacity of the rail line itself is expected to be to around 75 000 passengers per hour per direction in peak periods. Further improvements and benefits to passengers can be expected to come from the broader contributions the cross straits rail services will make to the urban, regional and international transport networks with which they will connect.

The geographical layout of Istanbul is quite unique, with its concentration and growth of central business employment on the European side and its rapid and sustained population growth with some commercial and industrial development on the Asian side.

One important consequence of the geographical layout and expected patterns of employment and residential locations is the increasing travel across the Bosphorus. Such travel was estimated in 2004 at 1.07 million person crossings per day – with 500 000 by private car and 570 000 by transit. Most of this transit traffic is road-based, utilising the two bridges located around 5 and 10 kilometres north of the central Golden Horn/Corne d'Or axis. They encouraged more dispersed residential and commercial development in northern areas whose accessibility improved dramatically when the bridges were built. Many of these crossing trips involve travel to and from final destinations in the central areas at the southern end of the Bosphorus on the European side.

At present, car and passenger ferries (many are combined car / passenger ferries) currently provide the most direct services across the Bosphorus to the central areas. Ferry services from Harem to Sirkeci run between points closest to the Marmaray line route. At present, the Harem ferry runs as frequently as every 10 minutes in peak hours and takes about 15 minutes to cross the Bosphorus. Each ferry transports around 600 passengers and 80 cars per trip on average. On an hourly basis, the Harem ferry carries around 2 500 people per hour to the European side. Several other ferries operate in to Sirkeci from other ferry terminals along the Asian side. In 2000, in total, all ferry services carried around 19% of total crossing traffic – and around 35% of total public transportation.

■ Challenges

By 2025, the number of passenger crossings per day is expected to more than double to 2.2 million. The official forecast is for 1.68 million to be by transit (with 1.18 million by Marmaray rail) and 516 000 by private car. The private car proportion would be 23% and the transit proportion increased to 77% – with Marmaray accounting for close to 50% of the total daily Bosphorus passenger crossings. In operational terms, a rail service with a capacity of 75 000 passengers per hour per direction would have sufficient daily capacity to handle the 1.18 million passengers forecast by 2025. However, a normal morning peak to daily demand pattern would mean the rail service running close to capacity for extended periods of up to 3 hours each day.[1]

[1] Morning peak takes 15% of daily total (*ad hoc*) traffic – around 177 000 passengers, who can be handled in up to 3 hours with full capacity.

The expectations reflected in the project documents include that there will be no increases in private car passengers across the Bosphorus and reduced congestion in Istanbul seemed very optimistic. The levels of car ownership are expected to increase five times in Turkey from 2000 to 2025.

In most major metropolitan areas, increases in transit shares of the magnitude projected would not be possible, even with quite draconian actions to restrict the usage of private vehicles and to restrict vehicle parking. In Istanbul, the geographical layout of the city and the likely capacity restriction on direct road travel to the central areas together suggest they may be possible. However, achieving such outcomes would most likely require related actions to promote the use of the Marmaray rail services and complementary action taken to discourage higher increases in private vehicle use and other road based transport. As an example, it could be important to have active traffic management on bridge crossings, access routes to central areas and on major arterials – as well as tight controls on parking – to promote rail travel without a serious increase in the duration and geographic spread of congestion. .

From a public transport viewpoint, the new metro lines to be completed and operational and there would need to be sufficient capacity on planned tram and bus services to handle the rail passengers transferring between the Marmaray line and these modes. The interchanges between rail, metro, tram and buses that are being built will be high quality and high capacity. Further improvements could possibly be needed in the vicinity of key hubs (for example Sirkeci) which do not provide direct connections between the high capacity Marmaray rail and metro lines.

Improving accessibility, managing traffic congestion and urban connections

The central areas of Istanbul are very old and historic and have a high population accommodated at relatively high density. The streets are often not well designed for vehicles. Vehicle ownership has been increasing relatively quickly from a very low base. Although the rate of vehicle ownership is still low – 217 vehicles per 1000 population of Istanbul – compared with over 600 per 1000 inhabitants in many developed countries – the traffic levels are already high and the main routes are already heavily congested in peak periods.[2] Clearly, there is no real prospect of meeting future transport requirements on a metropolitan scale without the adequate public transport which the Marmaray will help provide.

■ Opportunities

The Marmaray project is expected by its proponents to contribute to improved accessibility, to managing urban traffic congestion and to improved urban connections. The project description anticipates ambitious benefits, including that:

> "travelling times shall be decreased; the burden of the traffic load on the existing Bosphorus Bridges shall be alleviated; a permanent solution shall be provided to resolve the traffic problem of Istanbul; and a significant amount of energy shall be saved through the decrease in the number of the motor vehicles in traffic; and the level of air pollution, noise and visual pollution will be decreased; and thus, the city of Istanbul shall turn into a habitable and liveable city".

There is no doubt that the Marmaray project will make a major contribution to improved accessibility in Istanbul. If assessed in terms of access to employment within a reasonable journey to

[2] There were 2.8 million vehicles in Istanbul at the end of 2009, which has an approximate population of 13 million.

work travel time, the reduced rail access times expected – in combination with increasing employment levels in the central areas – will lead to very significant increases in accessibility for the increasing numbers of people expected to travel to the central areas on a daily basis.

The extent of improvement in urban connections will depend in part on the quality of the public transport network performance achieved across the metropolitan area, after the Marmaray project is completed. As noted above, public transport interchanges between rail, metro, trams and buses will be centrally important and will need to be high quality and high capacity, as currently planned.

■ Challenges

The presentation on "improving accessibility" was followed by a discussion on traffic congestion in large metropolitan areas. Reference was made to the experiences in many countries and the ways in which traffic congestion can be managed, on a network basis.

Recent research (see Managing Urban Traffic Congestion, OECD Paris 2007) has highlighted that, with *laissez-faire* approaches to road use, all large metropolitan areas can expect to experience traffic congestion levels close to the limits that residents are prepared to tolerate. Irrespective of the actual levels of public transport usage, with the increasing motorisation rates forecast, there are likely to be so many people who would use their cars if levels of traffic congestion decreased that, realistically, prevailing levels of traffic congestion are likely to be maintained.

For this reason, expectations that the Marmaray project could by itself or even with other planned public transport improvements provide a permanent solution to the traffic problem of Istanbul would seem very optimistic. Rather than alleviating traffic congestion, high quality mass transit can be expected to ensure reasonable travel times for those who choose or have incentives to use public transport services. When they do, other new users can then be expected to begin using the road system, ensuring on-going traffic congestion close to the levels that residents and business can tolerate, on a daily basis.

Of course, this does not mean the Marmaray project may not be successful in its own right. It will contribute to improved accessibility and reduced travel times for the hundreds of thousands of passengers using its services each day, particularly to central areas. However, it would seem important to explore the complementary actions that will be required to ensure the increasing levels of car ownership do not translate to large unwanted increases in motor vehicle use across, especially across the Bosphorus and in to central areas and activity centres. If they do, it is likely they would translate into highly unreliable travel times on the roads over a wider geographic area and for a longer duration or even effective "gridlock" at times. As well as active traffic management on bridge crossings, access routes to central areas and on major arterials, tight controls on parking could also be important to avoid a serious increase in congestion. Controls on parking in central areas are likely to be important – as well as the ability to resist increasing pressure to replace existing buildings with parking structures, in central areas and activity centres.

If managed well, the overall outcome may be more like in Paris, for example, where some 75% of motorised trips within the "peripherique" (the major circular route that replaced the "old walls") are now made by public transport (metro, regional express rail and buses (often in their own lanes). Despite this, the level of traffic congestion on the roads to this area is relatively high and trip time reliability for vehicle travel and travel speeds to and within the central area are relatively low.

Useful Reference Document: *Managing Urban Traffic Congestion* report, Joint Transport Research Centre, OECD/ITF Paris 2007.

Infrastructure investment

Transport investments shares of total investment increased from 18% in 2000 to 28% in 2010. Rail transport is being given priority – with its share increasing from 6% to 48% over the same period. Reflecting its importance, the Marmaray project is being allocated some 80% of total rail investment of DLH in 2010.

The funding and financing arrangements and business models being proposed are of central interest to the OECD project – as are any funding or financing difficulties being expected.

Marmaray rail funding and financing

The Project Cost (including internal and external money) is well over 3 billion US$. Development assistance funding is being provided by the Japan International Co-operation Agency (JICA), European Investment Bank (EIB) and Council of the European Development Bank. As at 2009, the Japan Bank for International Co-operation had lent 111 billion yen, the European Investment Bank had lent 1.05 billion euros and Council of the European Development Bank had lent 217 million euros.

Incomes and expenses after the investment, as assessed by the SAPROF (Special Assistance for Project Formation) Study – in both economic and financial terms – are summarised in the table below.

Based on the analysis, the SAPROF study concluded that the project is economically feasible, though financially less viable.

Table 1.2. Result of Impact Analysis in SAPROF

Assumed Discount Rate of 8%

	Economic	**Financial**
IRR (Internal Rate of Return)	13.4%	7.1%
NPV ($000) (Net Present Value)	1 732 535	-240 235
B/C	1.65	0.91

Source: Project description – see Annex 1.A2.

The evaluation results of strategic projects such as this one are generally very sensitive to the discount rates used for discounting future benefits and costs to the present, allowing their comparison with current project investment costs.

In this respect, the Stern Review's Report on "The Economics of Climate Change" 2006, pioneered use of discount rates of less than 1% for assessments of the impacts of the long term (50 to 100 year) climate-related changes that could be expected. Such low discount rates were not universally accepted but did increase the focus on the rates that should be used.

A discount rate of 8% is at the high end of the rates that have typically been used in different countries for analysis of government funded projects. Use of a lower rate could be appropriate for

strategic projects with a long life and would most likely show more positive economic and financial evaluation results.

The expected completion date for the Marmaray project is October 2013 and the project life is assumed to be 35 years after the completion of overall construction. Given the project's increasing benefits in the long term (including contributions to CO_2 reductions), it could be useful to present evaluation outcomes with a range of discount rates (i.e. using a low discount rate as well as the 8% rate used above).

Marmaray rail operations – Incomes and Expenditures

Opportunities

Tariff, access charge and other charging systems for this project will play an essential role in governing the financial sustainability of high-quality infrastructure management and train operations required.

The public transport system is currently well placed with fare systems based on a multimodal magnetic fare collection system called AKBIL. There are also tokens used in ferries and compliance levels are high.

Challenges

Discussions on fare levels and operating costs suggested decisions have not yet been taken on fares and services levels to be applied from the outset of the Marmaray rail's operations. As a result, firm advice is not yet available on expected revenues and costs. However, it seems likely the service revenues are not likely to exceed operating costs and may in fact be considerably less.

Given the importance of high quality and high frequency rail services from the outset, there could be value in looking for reliable sources of funding consistent with the level of Marmaray services that will be needed to offer an acceptable alternative to the use of private cars. Passenger fares and freight charges would be primary sources. Consideration is to be given to other possible infrastructure manager revenues from on-rail and off-rail business such as advertisement business, real estate business and other potential business in property area such as logistic industry, other mode transportation services, retail commercial and hotel business, property, etc.

Other possible sources could include a share of revenues from passengers and truck toll charges paid when crossing the bridges (e.g. peak period revenues); charges for road access to the critical economic and historic areas (e.g. charges for use of major/arterial roads leading to the main activity centres on the European side); and revenues arising from parking and other charges intended to restrict private car use in central area and historic locations. Taxes and levies on parking are used in some other cities and could help control private vehicle use in critical economic and historic areas.

In summary, the Project is expected to yield positive net benefits within an acceptable time frame, even if some losses annually take place in the initial stage. Better service and financial outcomes might be achieved by dedicating a portion of the revenues raised from private vehicle use of road bridge crossings to Marmaray Rail operations – as well as from road access to and parking in central activity centres.

Infrastructure contributions to "Green Growth"

Opportunities

The Marmaray project is expected to make a significant contribution to other current policy priorities, including low carbon economies, lower CO_2 emissions and "Green Growth".

One of the major contributions will be to a lowering of CO_2 emissions while facilitating the growth and development of the Bosphorus Gateway Area. Attracting 300 million cross-Straits passengers to travel by rail and providing an alternative to road-based freight transport over the long distances involved in Turkey's internal markets can be expected to increase the savings to 400 000 tonnes of greenhouse gases (mainly CO_2) per annum and 25 000 tonnes of air pollution gases (NMHC, CO, NOX etc.) per annum by 2025. These contributions are likely to increase over the very long time frames that the Marmaray rail services are likely to operate.

Challenges

Of course, the same contributions to CO_2 reductions and "Green Growth" will not be achieved if motorisation levels are higher and the share of private car use is greater than forecast. There could well reinforce the need for active traffic management on bridge crossings, access routes to central areas and on major arterials – as well as tight controls on parking – to avoid a serious increase in car use and congestion.

Other Challenges

Risk of Earthquakes

The project is built in an earthquake zone very close to a fault. Parts of the Marmaray tunnel will eventually run just 20 km north of the active North Anatolian fault line. However, the tunnel is expected to be strong enough to resist earthquakes measuring up to 7.5 on the Richter scale.

Since AD 342, the area has seen large earthquakes that each claimed more than 10 000 lives. Scientific calculations estimate a 77 per cent probability that the area will suffer an earthquake of strength 7.0 or more at some time in the next 30 years. The waterlogged, silty soil on which the tunnel is being constructed has been known to liquefy during an earthquake; to solve this problem, engineers are injecting industrial grout down to 24 metres (79 ft) below the seabed to keep it stable. The tunnel is made to flex and bend similar to the way tall buildings are constructed to react if an earthquake hits. Floodgates at the joints of the tunnel are able to close and isolate water in the event of the walls' failure[2].

Archeological discoveries and associated delays

The project is currently four years behind its original schedule, largely due to the discovery of a Byzantine-era archaeological find on the proposed site of the European tunnel terminal in 2005. The excavations produced evidence of the city's largest harbour, the 4th-century Port of Theodosius. There, archaeologists uncovered traces of the city wall of Constantine the Great, and the remains of several ships, including what appears to be the only ancient or early medieval galley ever discovered, preventing the project from proceeding at full speed. In addition, the excavation has uncovered the oldest evidence of settlement in Istanbul, with artifacts, including amphorae, pottery fragments, shells, pieces of bone, horse skulls, and nine human skulls found in a bag, dating back to 6000 BC.

4. Final remarks

This Project is one of the major transportation infrastructure projects in the world at present. The Marmaray rail tunnel and railway upgrading is such a major infrastructure project that it will influence not only the daily traffic patterns in Istanbul; it will also influence the development of the city and the region.

The Marmaray rail tunnel will provide rail freight connections between existing rail networks on European and Asian sides of the Bosphorus. This will allow through rail services across the Bosphorus to European and Asian continents and will allow much more direct rail freight connections beyond, in both directions. The project will allow improved rail connections to Europe via the extended TEN-T network. There will also be improved rail freight services across Turkey and to and through to the eastern parts of Turkey and with landlocked countries to the east. Better connections will be available to some of Turkey's important Mediterranean and Black Sea ports as well.

In terms of passenger travel, the central areas of Istanbul are very old and historic and have a high population accommodated at relatively high density. The streets are often not well designed for vehicles. Vehicle ownership has been increasing relatively quickly from a very low base. Although the rate of vehicle ownership is still very low – 217 vehicles per 1000 population of Istanbul. (compared with over 600 per 1000 inhabitants in many developed countries) – the traffic levels are already high and the main routes are already heavily congested in peak periods.

Clearly, there is no prospect of meeting future transport requirements on a metropolitan scale without adequate public transport. The Marmaray project should be very successful in its own right. It will contribute to improved accessibility and reduced travel times for the hundreds of thousands of passengers using its services each day, particularly to central areas. The extent of improvement in urban connections will depend in part on the quality of the network performance achieved across the metropolitan area, after the Marmaray project is completed. As noted above, public transport interchanges between rail, metro, trams and buses will be centrally important and will need to be high quality and high capacity.

However, it would seem important to explore the complementary actions that will be required to ensure the increasing levels of car ownership do not translate to large unwanted increases in motor vehicle use across the Bosphorus and in to central areas and activity centres – which likely would translate into highly unreliable travel times on the roads or effective "gridlock". There could be a need for active traffic management on bridge crossings, access routes to central areas and on major arterials – as well as tight controls on parking – to avoid a serious increase in the geographic spread and duration of congestion.

ANNEX 1.A1
INFRASTRUCTURE INVESTMENT COSTS

Overall Costs for the separate Marmaray contracts are set out below:

SUB-SECTION NAME	US$
ENG (Engineering and Consulting Services)	75 690 000
BC1 (Railway Tube Crossing, Tunnels and Stations)	1 626 524 000
CR1 (Commuter Rail Upgrade Civil, Mechanical, Electrical)	1 240 266 000
CR2 (Commuter Rail: Rolling Stock)	837 498 000
GRAND TOTAL	3 779 978 000

Bosphorus Crossing Contract: Current Position

BC1 Taisei-Gama-Nurol JV (Railway Tube Crossing, Tunnels and Stations)	
Date of Award	19 July 2004
Commencement Date	27 August 2004
Original Due Date for Completion	28 April 2009
Forecast Date of Completion	24 October 2012
Increased Tender Sum	JPY 153 496 046 658
Cumulative Total Payment to Date	JPY 59 053 538 197
2010 Expenditure Forecast	JPY 26 882 352 000
Monetary completion ratio	39%

Commuter Rail Contract: Current Position

CR1 – AMD JV (Commuter Rail Upgrade Civil, Mechanical, Electrical)	
Date of Award	15 May 2007
Commencement Date	21 June 2007
Original Due Date for Completion	7 June 2011
Forecast Date of Completion	6 July 2012
Tender Sum	€ 866 482 910
Cumulative Total Payment to Date	€ 217 517 639
2010 Expenditure Forecast	€ 152 399 000
Monetary completion ratio	25%

CR2 – Eurotem (Commuter Rail: Rolling Stock)	
Date of Award	13 December 2008
Commencement Date	25 December 2008
Due Date for Completion	29 May 2014
Forecast Date of Completion	29 May 2014
Tender Sum w/o maintenance	€ 520 436 909
Cumulative Total Payment to Date	€ 31 890 000
2010 Expenditure Forecast	€ 23 317 000
Monetary completion ratio	%6

ANNEX 1.A2
MARMARAY PROJECT
PROJECT INFORMATION FORM PROVIDED BY HOSTS

1. Project description

- ***Name:***

  Gebze-Haydarpaşa, Sirkeci-Halkalı Commuter Rails Upgrading and Railway Bosphorus Tube Crossing Construction (MARMARAY)

- ***Location:***

  Istanbul and İzmit / TURKEY

- ***Sector:***

  Transport

- ***Project Type:***

  Urban Transport/Railway Infrastructure

- ***Project Executing Agency/Institution:***

  Ministry of Transportation / Railways, Harbours and Airports Construction General Directorate

- ***Responsible Person for the Project (name, position, telephone, e-mail):***

  Mr. Ahmet ARSLAN, General Director of Railways, Harbours and Airports Construction General Directorate

  Phone: +90 312 203 15 01

  e-mail: ahmetarslan@ubak.gov.tr

- ***Institution that Proposed the Project Idea (name, address, telephone, fax):***

  Ministry of Transportation/Railways, Harbours and Airports Construction General Directorate

  Address: Ulaştırma Bakanlığı Sitesi D-Blok 06510 Emek / Ankara

2. Project's justification, purpose and objectives

- ***Project's Justification (why it is needed):***

One of the most important problems of Istanbul is the difficulty of transportation resulting from the rapid and uncontrolled population growth and the traffic jams.

Another difficulty of transportation is coming from Bosphorus Strait, which is dividing the city into two continents. Crossing the Bosphorus between the European side, where the main axes of the city and work areas are located, and the Asian side, where foremost residential centers are located, is causing great loss of time in the everyday lives of its inhabitants, and waste of time, of fuel, accidents that occur, air and noise pollution are having a serious negative effect on the health of both the city inhabitants and the city itself.

Furthermore, the bridges built to resolve transport problems between the two sides of Istanbul have created a transport system dependent on highways and private transport. No alternative has been offered up to now and the arising intense traffic has caused a reduction in the efficiency of mass transport systems like buses. Also, mass transportation solutions required to solve Istanbul's transport problems have not been developed sufficiently up to now.

- ***Project district and other side benefits:***

The Marmaray Project provides an upgrading of the commuter rail system in Istanbul. The Project will have three tracks. While two of the tracks will serve as high capacity commuter rail system, the third track will be used by intercity passenger and freight trains between the continents Asia and Europe. The tunnel will provide uninterrupted railway connection for Asia and Europe. The Project has also significance for Turkey's connection to the Trans European Network.

This Project is one of the major transportation infrastructure projects in the world at present. When introducing major infrastructure projects such as the Marmaray Project, it is important to realise that it will influence not only the daily traffic pattern of Istanbul, but it will also influence the development of the city and the region.

- ***Project's General Purpose:***

The Marmaray Project provides an upgrading of the commuter rail system in Istanbul, connecting Halkalı on the European side with Gebze on the Asian side with an uninterrupted, modern, high capacity commuter rail system.

- ***Project's Objectives:***

  - ✓ provide a long-term solution to the current urban transportation problems of Istanbul;
  - ✓ relieve existing operating problems on the mainline railway services;
  - ✓ provide direct connection of railway system between the continents Asia and Europe
  - ✓ increase capacity, reliability, accessibility, punctuality and safety on the commuter rail services;

- ✓ reduce travel time and increase comfort for a large number of commuter train passengers;

- ✓ reduce air pollution resulting from the exhaust gases and thereby improve the air quality of Istanbul; and

- ✓ reduce adverse effects on historical buildings and heritage sites by offering a potential for reducing the number of cars in the old center of Istanbul.

3. Strategic documents on which the project stands

- ***The Plan, Programme, Administration's Strategic Plan, Performance Programme, Project and Researches that the Project is Endured/Related to:***

The Marmaray Project is not the first project conceived for an underwater crossing of the Istanbul Strait. The idea was first produced in the Ottoman Empire in 1860 during the reign of Sultan Abdulmecid. A preliminary design was prepared for a submerged tube through the sea that rests on columns. Similar ideas were produced during the following years and in 1902, during the reign of Sultan II Abdulhamit, a design similar to the first one was produced for a tube tunnel that crosses the Istanbul Strait. It was referred to as *Sea Tunnel.* In this design a platform on 16 columns rested on the seabed and a large sized water pipe was placed on the platform. However, the means of the time did not permit the construction of this project.

The idea of connecting two sides of Istanbul with an underwater crossing always remained on the agenda and finally in 1985 the first feasibility study for the tube tunnel project was carried out. The study was revised in 1997.

Marmaray Project had been based on some studies in its preparation period. The reference studies are;

- ✓ Pre-feasibility study

- ✓ Bosphorus Tube Tunnel Crossing Feasibility Study and Preliminary Design

- ✓ Preparation of Commuter Rails' Detailed Designs

During the development process of Marmaray Project:

- ✓ Marmara Region Transportation Study

- ✓ Istanbul Urban Transport Study

- ✓ Istanbul Metro Feasibility Study and Engineering Preliminary Designs

- ✓ Bosphorus Railway Tube Crossing Feasibility Study and Engineering Preliminary Designs had been taken into consideration.

Besides 168 volume of studies had been prepared for Marmaray Project on traffic, construction, mechanics, electric electronics, geology, hydrography, marine ecology,

seismic, environment, city planning, transportation planning, mass transport management, transportation economy, archeology and architecture issues.

- ***The Method Applied for the Improvement of the Project Idea (demand analysis, problem analysis, possibility research-opportunity analysis etc.):***

The Istanbul Metropolitan Municipality (IBB) has faced a large increase of car ownership in recent years in conjunction with current population increase (2.7%) and economic growth in association with large vehicle increase rate as 9.2% in contrast with Metropolitan Tokyo ratio (0.2%). On the other hand, the road network of urban and village roads in IBB has been provided insufficiently, causing traffic problems in contrast to highways that are developed like other metropolitan cities (Tokyo) by development density.

Public transportation development in recent years has been boosted in the railway sector in IBB although development density (0.02 km/km^2) is still low in comparison with other metropolitan cities (Tokyo), while bus network has served urban commuters as major transport means of citizen of Istanbul.

One of the distinctive transportation issues in Istanbul is the gap between large Bosphorus crossing traffic demand and supply-side shortage by current two bridges, although ferries of Bosphorus Strait serve commuters to be trying to fill the gap. The share of traffic for crossing Bosphorus by ferry of IDO A.Ş. and private sea bus services in 2000 was 19% of total crossing traffic.

Looking into the share among public transportation including school bus and company buses for crossing, the volume of ferries is a considerable 35% share out of total public transportation. In those contexts, the Bosphorus tunnel project is expected to be one of the panaceas to contribute to establishment of effective public transit network coping with transport issues of Istanbul.

A conventional four-step transport model was used to produce traffic forecast for the Marmaray Project. The model covers the Istanbul metropolitan area with a zoning system of 244 internal zones plus 6 external zones. The model was calibrated in two steps, in 1996-97 as part of the Istanbul Transport Master Plan (IUAP) and later using survey data collected in 2002 and 2003. The model is an aggregated classical four-step transport model, which includes trips generation, trips distribution, modal split and traffic assignment. The model is a mix of commercial software and specialized routines in-house developed by the Technical University of Istanbul.

The future public transport traffic in the Marmaray Project Traffic Report (2004) was estimated by revising the transportation model used for the Istanbul Transport Master Plan (IUAP) in 1998. The Marmaray Project Traffic Report focused on transport forecast without financial evaluation. The tables below summarise the review of the traffic estimates.

Table 1.A2.1. Annual Traffic Estimations on the Marmaray Project

Unit: 000s

	Transportation Study 1997	SAPROF 1999	Traffic Report 2004	SAPI 2007
2009	623 310	471 757	344 822	n.a.
2010	638 725	484 357	n.a.	373 999
2015	715 800	547 357	479 369	n.a.
2023	783 962	600 350	n.a.	564 018
2025	799 720	612 417	539 475	n.a.
2030	840 513	643 656	n.a.	673 652

Table 1.A2.2. Daily Traffic Estimations on the Marmaray Project

	Single Fare			BC Double Fare		
	Local	BC	Total	Local	BC	Total
2010	765 468	403 284	1 168 752	765 468	271 719	1 037 187
2023	1 150 892	611 668	1 762 560	1 150 892	435 964	1 586 857
2030	1 366 634	738 533	2 105 167	1 366 634	525 392	1 892026

4. Detailed information about the project

- ***Expected Results/Outputs:***

  - ✓ The share of the Rail Systems in the urban transportation shall be increased.
  - ✓ Most importantly, Europe and Asia will be connected together through railways and a high-capacity public transportation system shall be provided between the Asian and European sides.
  - ✓ The project shall have contributions in the protection of the historical and cultural environment.
  - ✓ The project shall not cause any change or modification in any section of the Bosphorus Strait.
  - ✓ Upon commissioning of MARMARAY project, the headway of 2-10 minutes shall be provided between the stations of Gebze-Halkalı and thus, a transportation capacity of 75 000 passengers per hour per direction shall be provided on both sides.
  - ✓ The travelling times shall be decreased.
  - ✓ The burden of the traffic load on the existing Bosphorus Bridges shall be alleviated.
  - ✓ A permanent solution shall be provided to resolve the traffic problem of Istanbul and the number of the traffic accidents shall be minimised; through the decrease in the number of the automobiles and buses, the road vehicle traffic shall be relieved and the private automobile drivers shall have the opportunity of a rapid transportation alternative.

- ✓ Significant amount of energy shall be saved through the decrease in the number of the motor vehicles in traffic; and the level of air pollution, noise and visual pollution will be decreased; and thus, the city of Istanbul shall turn into a habitable and liveable city.

- ✓ Easy, comfortable and rapid transportation opportunity for access to business and cultural centres shall be offered to the passengers and thus, various points of the city shall get closer and the economical life of the city shall be livened up.

- ***Project's Components:***

"Istanbul Strait Rail Tube Crossing and Commuter Railway Upgrading (MARMARAY) Project" comprises three phases as follows:

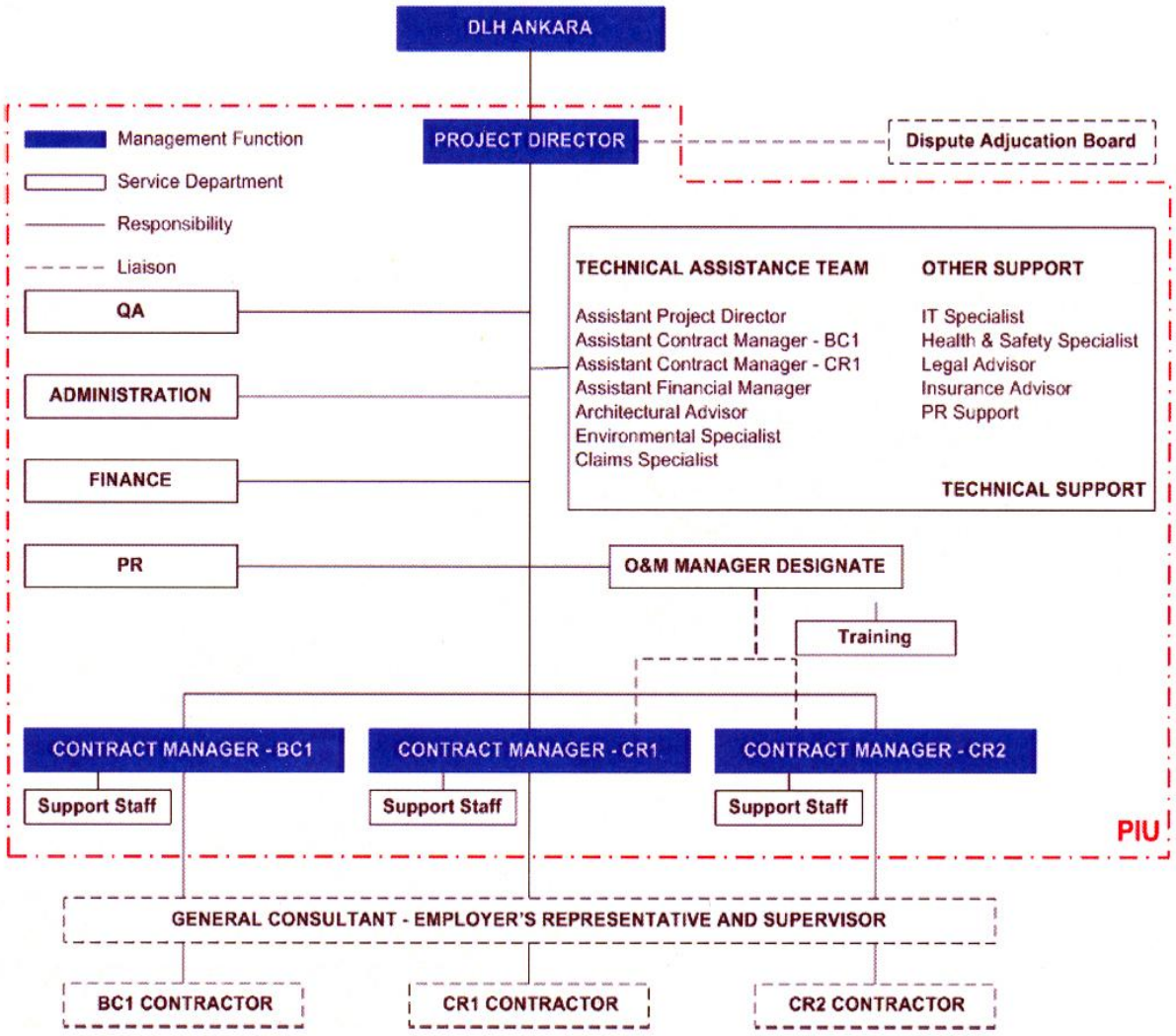
- ✓ constructing an immersed tube tunnel under the İstanbul Strait with approaching tunnels, three underground and one surface stations (Contract BC1);

- ✓ upgrading the existing commuter rail system including a new third track on ground and completely new electrical and mechanical system (Contract CR1); and

- ✓ procurement of the rolling stock (Contract CR2).

- ***Input Needed (manpower, organisation, technical assistance etc.):***

Scheme illustrating the Project Implementation Unit and general administration of the project:



- ***Project Cost (as internal and external money):***

3 billion USD

- ***Incomes and Expenses after the Investment:***

Results of economic and financial analysis performed by the SAPROF (Special Assistance for Project Formation) Study are summarised in the table below. Based on the analysis, the study concluded that the project is economically feasible, though financially less viable.

Table 1.A2.3. Result of Impact Analysis in SAPROF

Assumed Discount Rate of 8%

	Economic	Financial
IRR (Internal Rate of Return)	13.4%	7.1%
NPV($000)(Net Present Value)	1 732 535	-240 235
B/C	1.65	0.91

- ***Financial Sources Predicted (EU grant, institution budget, general budget etc.):***

  Japan International Co-operation Agency (JICA), European Investment Bank (EIB), Council of European Development Bank

- ***Project Implementation Plan (commencement and completion date etc):***

  Commencement Date: 27 August, 2004 Completion Date: 29 October, 2013

- ***Assumptions the Project is Enduring and the Risks it can Come Across:***

  The project life is assumed to be 35 years after the completion of overall construction. The Project is expected to yield a positive net profit within an acceptable time frame, even if some losses annually take place in the initial stage.

- ***Project Feasibility and Sustainability:***

  Although management and operation of the project has a mission to dedicate its infrastructure and services to public benefit and economic activities locally, nationally and internationally, high-skill services and intensive efforts to operate and manage this special infrastructure will be required in sustainable manner. These conditions will be achieved inevitably by certain level of financial foundation and appropriate income to sustain those services. Tariff, access charge and other charging system for this project will play an essential role in governing financial sustainability of high-quality infrastructure management and train operation.

Short term

- ✓ Establishment of appropriate tariff structure, access charge and other necessary dues or levies for infrastructure manager and train operators in consideration with all related public transportation system through necessary discussion and assessment among related stakeholders.

- ✓ Arrangement of financial supports for infrastructure management in case of necessity by subsidies from the state government through necessary discussion and assessment among related stakeholders.

- ✓ Legislative process (legal assessment, collective agreement, approvals, promulgation, etc.) for norms and regulation for all necessary arrangement for tariff and charges and dues of infrastructure management and train operation.

- ✓ Technical assistance programme by international funding for asset management and potential business development through introduction of Japanese experiences and

know-how for off-rail business expansion to be involved in asset management plan contributing to appropriate financial foundation and benefit (e.g. Japan ODA scheme such as JBIC and JICA).

Medium-long term

- ✓ Encourage operation and management services for users in order to increase financial revenue and minimise cost efficiently (bus terminal and other modes of transportation for transfer at stations).

- ✓ Encourage other revenues by on-rail and off-rail business for infrastructure manager such as advertisement business, real estate business and other potential business in property area such as logistic industry, other mode transportation services, retail commercial and hotel business within property, etc.

CHAPTER 2
MERSIN CONTAINER PORT PROJECT

Project description, purpose and objectives

Project Description

The project includes planning and development of the new Mersin Container Port as a new gateway facility. The new container port will be located adjacent to the existing Port of Mersin, which is an established multi-purpose port situated near the eastern end of Turkey's Mediterranean coast.

Purpose

The project's purpose is to fulfill the requirement for a port in the Eastern Mediterranean with a hub port function. Mersin Container Port has been conceived as a Gateway port serving Ankara and eastern Turkey as well as the countries beyond to the east.

Objectives

The specific objective of the project is to facilitate the construction of a new container port in Mersin, in order to consolidate the location as a gateway for import-export traffic and a trans-shipment hub in the region.

The full description of the Mersin Container Port project, as provided by the hosts, is at Annex 2.A1**.**

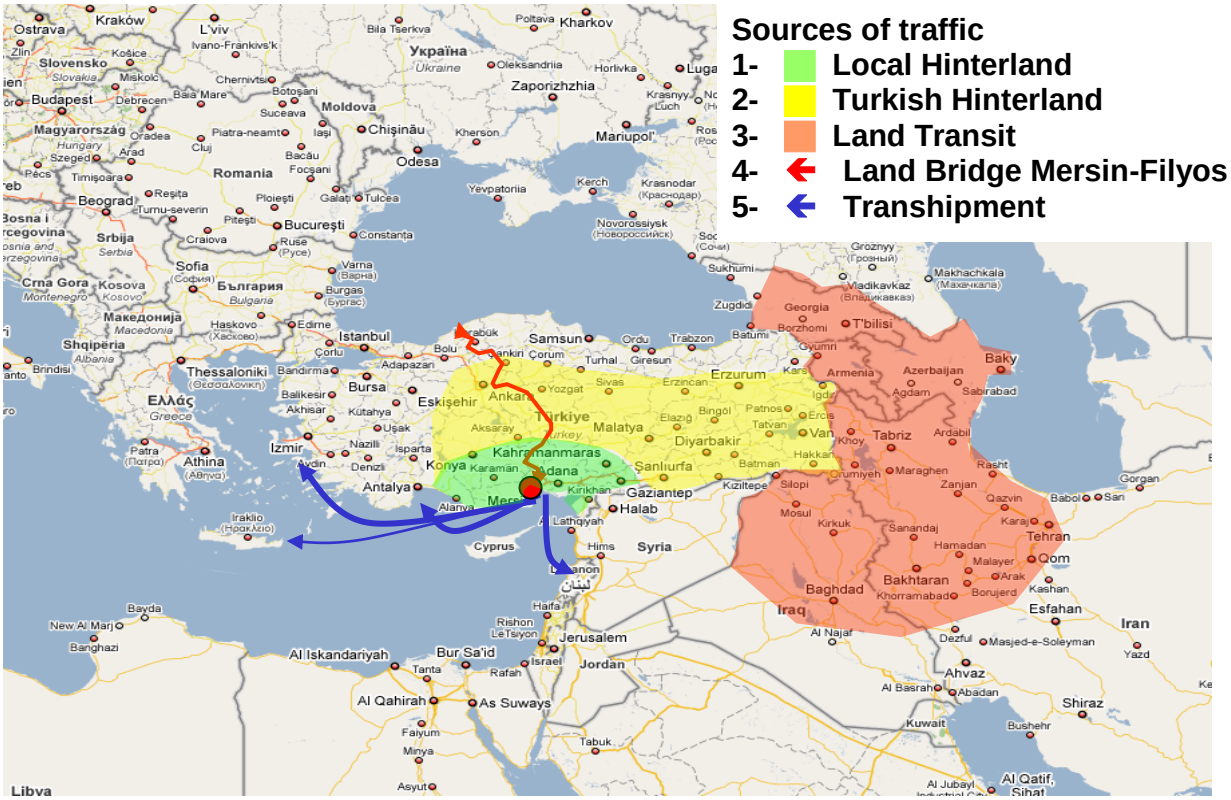
Mersin container port

Plans for the Mersin Container Port Development

Arda ALTINOK (GM, Altinok Consult) presented plans for the Mersin Container Port.

Mersin Container Port has been conceived as a gateway port serving Ankara and eastern Turkey as well as the countries beyond. It is located at the eastern end of Turkey's Mediterranean coast – see map below.

Figure 2.1



Source: Workshop presentation: ***Arda ALTINOK*** (GM, Altinok Consult).

The idea of a new container port in Mersin dates back to 1990s. The Transportation Infrastructure Needs Assessment for Turkey (TINA) Study (2007) anticipated the development of the port of Mersin as one of the top priorities. In the TINA Study, overall throughput at the port was expected to increase from 17 million tons per annum (at the Port of Mersin) in 2004 to 60 million tons at the combined Port of Mersin/Mersin Container Port in 2020. In the recent feasibility study, conducted after the TINA study, the capacity provided was anticipated to increase in five stages[3] as follows:

Stage 1:	1.9	million TEU	(2014)
Stage 2:	3.4	million TEU	(2018)
Stage 3:	5.7	million TEU	(2024)
Stage 4:	8.2	million TEU	(2029)
Stage 5:	11.4	million TEU	(2033)

Investment value expected for Stage 1 is 405 m EUR.

The existing Port of Mersin, which has been privatised by transfer of operational rights in 2007, is a general cargo port currently handling a relatively low volume of containers. The authorities consider the existing Port should benefit considerably from the container port co-development.

[3] Preliminary findings, subject to change.

Traffic projections

Expected sources of traffic for the new Mersin Container Port are principally:

1. Local Hinterland (in the immediate vicinity of port)
2. Turkish Hinterland (the north, north-east and eastern regions)
3. Land Transit (to landlocked countries to the east)
4. Land Bridge Mersin-Filyos (Note: Filyos is a planned new port on the Black Sea north of Ankara). The Land Bridge would run from the Mediterranean to the Black Sea, via Ankara.
5. Transhipment (not a major objective for the port)

3. Container Traffic: Local and Turkish Hinterland; Land Transit; and Land Bridge

Traffic Projections

The annual traffic projections provided for container traffic movements (TEUs) between the Mersin Container Port and the Port's *Local and Turkish Hinterland* in future years are as follows:

Table 2.1

TURKISH HINTERLAND			
SCENARIO	PESSIMISTIC	NEUTRAL	OPTIMISTIC
Year	TEU	TEU	TEU
2015	1.234.665	1.291.160	1.339.989
2020	1.856.513	2.041.893	2.207.561
2025	2.727.826	3.156.143	3.555.299
2030	3.916.147	4.767.666	5.470.269
2035	5.492.599	7.037.757	8.074.900

The traffic projections for container traffic transit movements along the routes between the Mersin Container Port and the *landlocked countries* to the east of Turkey are as follows:

Table 2.2

LAND TRANSIT			
SCENARIO	PESSIMISTIC	NEUTRAL	OPTIMISTIC
Year	TEU	TEU	TEU
2015	208.563	235.872	266.189
2020	384.264	474.423	583.606
2025	564.609	764.062	1.028.513
2030	755.575	1.122.658	1.656.431
2035	919.272	1.502.370	2.433.840

The traffic projections for container traffic transit movements along the *Land Bridge (Mersin to Black Sea via Ankara)* are as follows:

Table 2.3. Land Bridge – Mersin Container Port to Black Sea ports via Ankara

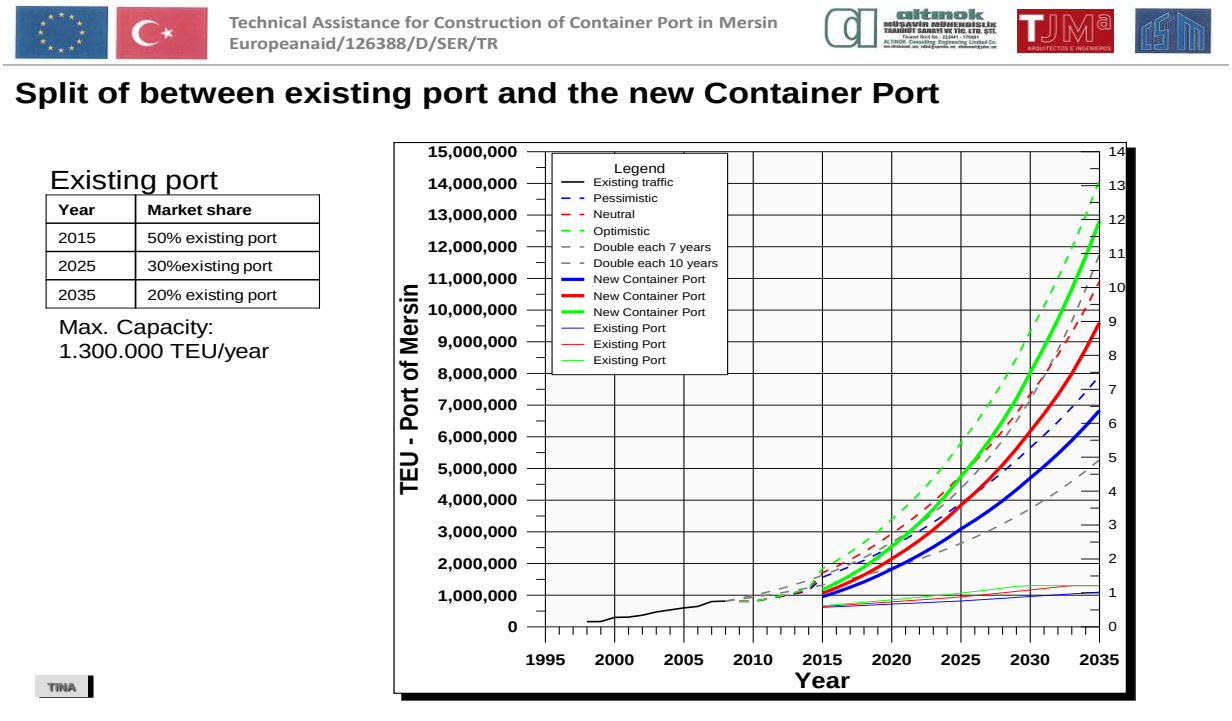
SCENARIO	PESSIMISTIC		NEUTRAL		OPTIMISTIC	
Year	Tons	TEU	Tons	TEU	Tons	TEU
2015	0	0	0	0	0	0
2020	341.318	34.132	341.318	34.132	682.635	68.264
2025	1.188.775	118.878	1.188.775	118.878	1.664.285	166.429
2030	1.524.256	152.426	1.524.256	152.426	3.048.512	304.852
2035	1.859.737	185.974	1.859.737	185.974	3.719.473	371.948

Source: Workshop presentation: ***Arda ALTINOK*** (GM, Altinok Consult).

Trans-shipment traffic is not seen as a primary objective of the port. Projections for transshipment traffic are as follows – 2015: between 15% and 25% of total TEU traffic volumes; 2025: between 20% and 30% of total TEU traffic volumes; 2035: between 25% and 35% of total TEU traffic volumes

The split of projected container volumes between the existing and new container port is set out below:

Figure 2.2



Source: Workshop presentation: ***Arda ALTINOK*** (GM, Altinok Consult).

Turkey's forecasts have a degree of support from international transport professionals. For instance, Ocean Shipping Consultants (OSC) has forecast 20 million TEU demand for Turkey for 2025. This anticipated level in 2025 appears broadly consistent with Turkey's forecast of 35-40 million TEU for 2035.

Port development – and capacity

The presentation outlined alternative port locations and layouts, as well as road and rail connections. For the preferred port layout, five possible development phases were identified. At the outset, the Government would build a temporary breakwater beyond the existing breakwater and build a quay wall and convert the existing breakwater for use as a new terminal wharf. Terminals and quays will be built by BOT model by phases. BOT tenders will include all quay infrastructures, superstructure and the equipment.

Plans for the subsequent phases are still under consideration but might include:

- *Phase 1-3.* A call for a BOT tender for development of the first three phases of port development and the terminals to be built on each wharf/quay location.

- *Phase 4.* A separate tender for the fourth quay/terminal location, as demand required.

- *Phase 5.* A possible additional phase which would also be tendered separately. The Phase 5 facilities would need to be built outside the new breakwater built at the outset by the government to enclose Phases 1 to 4.

Hinterland connections

The Gateway planning recognises the importance to the new container port's operations and competitive position of efficient inland transport connections.

The Mersin Container Port study assessed the capacity and adequacy of current land transport connections from the existing Port of Mersin. It also assessed the improvements in land transport connections required between the proposed new container port and the different port hinterlands outlined above: i.e. Local Hinterland (vicinity of port); Turkish Hinterland (north, north-east and eastern regions); Land Transit (to landlocked countries to the east); Land Bridge (Mersin-Filyos via Ankara).

Much of the basic land transport infrastructure required is already in place – e.g. road and rail connections from the existing Port of Mersin to Ankara as well as to the hinterland to the east. The Study identified roads and sections that needed to be improved to Motorway and Highway standards in future. Railway assessments indicated that certain sections (e.g. Yenice-Ulukışla line and Kayseri-Irmak line) need to be improved as their capacities would be exceeded.

Significant improvements would be required to create an efficient land bridge from Mersin via Ankara to Filyos, for this routing to be able to provide an attractive alternative to maritime transit via the Bosphorus.

Port Design Parameters

The new container port's design focusses on design parameters that seem well adapted to the challenges ahead. The port would have a water draft depth of 16.5 metres and the container terminal

equipment would be designed to handle vessels up to "Malacamax" size. Overall, the port is being designed to handle vessels up to 18 000 TEUs, much larger than any vessels currently in operation on the major routes.

Handling technologies and combinations had been mapped to identify the best/most efficient options (e.g. Rubber Tyred Gantries for stacking container boxes; automated systems for moving containers) with the objective of achieving low handling costs and globally competitive terminal productivity targets.

Ownership Funding and Development

The intention is to call a tender for a Build-Operate-Transfer (BOT) concession for the new container port. As noted above, the government would build the container port breakwater and the first terminal quay and then call tenders for phases 1, 2 and 3 as a group. The tender is likely to be for a BOT concession with a 49 year lease, with ownership expected to revert to the government at the end of the lease. The subsequent phase (phase 4) could also be tendered out. Phase 5 is indicative only – there is no physical limit to the possible expansion modules and surfaces built further into the Mediterranean.

Funding (grants etc.) and financing requirements have been assessed for the different options. A financial feasibility study has been prepared on the basis of the Government undertaking the necessary preparatory work (temporary breakwater beyond the existing breakwater, quay wall, convert the existing breakwater for use as a new terminal quay) – and the successful BOT tenderer taking responsibility for the port developments required in Phases 1 to 3. The overall investments required together with expected rates of return were also assessed.

The responsible authorities concluded the Mersin Container Port project is both strategically important and financially feasible.

Timing

Until recently, there have been significant global increases in trade, demand, container volumes and container rates. Over the last two years, international trade around the world has been affected by the global financial crisis. Maritime container traffic was hardest hit in 2009 – with big falls of up to 35% in some locations. Falling container traffic has meant lower port demand and reduced container throughput volumes. The shipping lines have also been seriously affected by the falls in container rates.

The Mersin Container Port timings have needed to be revised somewhat, with completion of the first phases under the BOT tender now expected to be completed in 2018 – instead of 2015.

4. Opportunities and challenges

Clearly, the Mersin Container Port offers a number of important opportunities as well as posing some significant challenges.

Improving trade opportunities and the quality of export and import services

The Mersin Container Port project and related inland transport improvements are expected to create greatly improved trade opportunities between the central and eastern parts of Turkey and its overseas trading partners.

International trade and container traffic

■ Opportunities

Population is increasing in Ankara, along the Mediterranean coast and along an easterly axis from the Port of Mersin. New export and import opportunities can be expected as a result of more efficient port services and a greater frequency of shipping services between eastern Turkey and many overseas destinations, as the Mersin Container Port grows.

Over recent decades, container traffic has been the fastest growing category of maritime trade globally. Trade growth has consistently been two times GDP growth and before the recession container traffic growth was up to 2.5 times GDP growth. While there is doubt that growth rates globally will see a return to the high levels achieved before the financial crisis, above average rates of economic growth are expected in many developing countries, including Turkey. At the same time, Asian GDP, trade and container traffic is expected to grow very strongly. Increasing trade opportunities and maritime cargo demand between Asia and the rest of the world will lead, inter-alia, to increasing container shipping movements though the Suez Canal. Therefore, greater opportunities can be expected for direct services and port calls at the Mersin Container Port – as well as for more frequent services via transhipment port locations.

■ Challenges

Increasingly, for international trade, the costs of inland transport within a country or region are higher than the costs of the international maritime services carrying freight to and from the gateway port. Clearly, the potential trade opportunities created by the development of the Mersin Container Port will not be secured by port improvements alone. Experience in many parts of the world confirms that the quality, efficiency and reliability of inland transport connections between the port and its hinterlands are as important as the efficiency of the port itself. In some cases, the land transport services will be even more important.

Experience elsewhere confirms that container supply chains are quite "footloose", with supply chain managers prepared to change routes and use different ports to facilitate more reliable services at acceptable costs. In this context, it is no longer sufficient to focus solely on the planned improvements in port operations and its inland transport services. While these improvements will be important in their own right, what will be even more important is whether the supply chain services using these routings will be competitive with the best supply chain services available between the different origin and destination locations – i.e. using alternative ports and / or alternative inland transport routes.

In the case of the Mersin Container Port, there seems to be a fairly extensive hinterland within which the Mersin Container Port will be well placed to provide the most efficient services. But this will need to be kept continuously under review.

The project plans note that the Mersin Container Port is planned as a Gateway rather than as a transhipment port. Despite this, traffic projections anticipate significant levels of transhipment traffic e.g. between 20% and 30% of total TEU traffic volumes by 2035. Of course, there are transhipment competitors for the Mersin Container Port, including Port Said in Egypt, which is even closer to the main shipping trade routes and already expanding its facilities to capture a large share. There are also transhipments ports such as Giao Tauro in Italy, which are well placed to capture trans-shipment traffic from the largest vessels that can then be delivered by direct services to other Mediterranean ports.

A further challenge related to trade demands is that Europe has been Turkey's major trading partner for years – and projections for container traffic handling in Europe generally over an extended recovery period are rather subdued. Germany has been Turkey's major trading partner within Europe – and the Mersin Container Port is not all that well placed to benefit from future German trade with Turkey in future.

Clearly, for the Mersin Container Port to be highly successful, port operations and inland transport services will need to be high standard and regionally competitive.

Governance

Turkey is giving thought to the regulatory framework and governance structure needed for Public Private Participation (PPP) projects, which will allow the country to maximise the benefits from private sector involvement in ports and related services. The Mersin Container Port will present some important opportunities and challenges that will need to be considered carefully.

■ Opportunities

The Mersin Container Port provides an important opportunity to contribute many aspects of Turkey's Transportation Policy Objectives, including: establishment of an efficient transport system; improved safety and security; integration with Europe and neighbouring economies; and environmental and financial sustainability.

Important decisions have been taken in principle on the government's roles in relation to the port's development and the nature and scale of private sector participation. The new PPP law that Turkey is developing aims to facilitate private investment and may provide an opportunity to clarify the governance arrangements required, strengthen the regulatory framework where needed.

In conjunction with the BOT development proposal, the changes could allow the government's role to be transformed, in this case, from ports manager, operator and financier to one of regulator overseeing the development and operation of a major strategic gateway port.

■ Challenges

Port operators perform functions that are not only commercial. They generally have important roles in relation to port safety, the safety of vessel operations and essential security functions. Transferring such responsibilities in full to a private sector operator can create conflicts of interest and reduce the effectiveness of safety and security regulatory activities. Many countries retain safety and security regulatory functions as government oversight responsibilities and advise other countries (including developing countries) to do the same. The governance arrangements being developed need to give this adequate consideration. Experience elsewhere suggests it will be important for the government to ensure it has effective oversight controls in relation to safety and security at the container port.

Although ports operate in a competitive environment, they may also be effectively monopolies in their geographic area including their natural hinterlands. They may therefore have the ability to wield some degree of market and monopoly power in respect of certain services and activities (e.g. access and pricing). A commercial port operator is likely to give more weight to revenues and profit and less to maritime sector operational requirements than a government business enterprise or corporation would do – and will certainly give them more weight than a government authority would do. Experience elsewhere suggests that it is wise to ensure there are reserve government powers in relation

to access, pricing and service quality, which allow monitoring and further action if required in respect of anti-competitive behaviour.

Experience elsewhere suggests it will also be important for the government to ensure it has effective oversight controls either in PPP legislation or in contracts in relation to other important matters such as *ownership of strategic assets*, *financial reports*, *transparency*, *environmental performance*, *safety reporting* etc. It will also need to ensure the appropriate regulatory or contract provisions in relation to provision of information (including performance-related information and financial aspects the operator would otherwise consider commercial-in-confidence) – as well as the responsibilities and performance expected in respect of *consultation* with stakeholders and the local community.

Turkey has already chosen a BOT tender with a lease period of 49 years as its preferred method for the development of the new Container Port. The Case Study therefore didn't explore the alternatives that would otherwise have been available. However, in case circumstances change, it is worth mentioning that a number of more developed countries favour retaining a government port authority for their strategic gateways ports and using a "port landlord model".

Demand and other project Risks

- Challenges

Since the financial crisis, there has been an increased risk aversion amongst investors internationally. Experience in many countries has shown that investors are increasingly reluctant to invest in "greenfields" projects with high demand risks – and financial institutions are very risk averse on such investments.

Project risks for the Mersin Container Port development are likely to be regarded as somewhat less than they would be for a truly "greenfields" project. The existing Port of Mersin has been operating for many years, it is already attracting considerable general traffic and some container traffic and the locations of current demand are known. The transport infrastructure and logistics services required for the current levels of demand are already in place. Given some ability to match development of the different phases of the new Container Port to demand, the risk profile could be seen as more manageable.

However, investors may still perceive that the Mersin Container Port is a relatively high risk project. Importantly, banks and other sources of finance may consider the risks too great, reducing or even eliminating the sources of longer term finance at reasonable rates.

To reduce risk levels and increase the prospects of tenders at worthwhile levels, some other countries are coupling a "greenfields" project they wish to put to tender with an existing "brownfields" project. (Since the crisis, Mexico for example has changed its approach to its PPP roads projects in this way.) Coupling new projects with existing ones in this way provides a steady source of revenue during the new project construction and the ability to spread the demand and other risks across a more substantial and diverse financial base.

The new Mersin Container Port development is being coupled to a brownfields development (i.e. the existing Port of Mersin) in a locational sense and, operationally, this reduces some of the risks. Of course, the demand and financial risks associated with the Mersin Container Port project development would also be reduced, if the new Container Port was to be owned, developed and operated jointly with an established port.

Climate change, low carbon and "green growth"-related policy objectives

In future, the gateway will need to deal with international trade and transport requirements not only for the local population but increasingly for origins and destinations well outside the area as well.

As outlined earlier, there will be a large and sustained growth in demand in future years. Meeting the anticipated demand will require a ramping up in traffic movements to, from and through the port. There are likely to be adverse impacts, in terms of noise, CO_2 emissions, local pollution, traffic congestion and other environmental consequences.

Climate change, "low carbon" and "green growth"-related policy objectives are likely to require a focus on:

- reducing fossil fuel energy consumption, lowering CO_2 emissions;
- reducing pollution and noise impacts on local residents;
- reducing congestion and delays impacting on energy, pollution and transport efficiency;
- promoting the most environmentally friendly transport facilities and services, making best use of the range of modal and inter-modal services available.

With current policy interest in cutting CO_2 emissions and promoting "Green Growth", there will also be expectations that action will be taken to ensure infrastructure makes an appropriate contribution to the improved outcomes required.

There seem little doubts that the Mersin Container Port will make an effective contribution. Mersin Container Port is designed in accordance with EU regulations and standards, and complies with the very strict Turkish Environmental Impact Assessment (EIA) Regulations and EU Directives on EIA. Environmental sustainability is the first priority in performance of the Mersin Container Port project. Mersin Container Port is a port strictly designed for transportation, transhipment and handling of containers which is one of the least polluting modes of cargo transportation. As well, implementation of the Mersin Container Port project will increase use of maritime transportation and reduce the use of other transportation modes, which will contribute to climate change policy, reduce the loss of biodiversity and significantly reduce environmental pollution by conventional current transportation modes.

Mersin Container Port will make use of the latest advanced and environmental friendly technology in port equipment and operation, including mainly auto-controlled systems, all powered by electricity instead of diesel. This will be a major contribution to conservation of the environment and Green Growth. Moreover, the latest technology implemented in the port will result in minimisation of the liquid, solid and other types of wastes generated by the operation of the port. There will also be a very advanced waste water treatment plant on site, in the port to further minimise the adverse affects of the operation of the port on the environment and contribute to Green Growth.

Considering the existing Mersin Port operating on old technology, development of the new technologically and environmentally friendly port in the area will lead to the eventual modernization of the existing port and its use of environmental friendly technologies.

However, in a practical sense, it will be increasingly important to identify the exact contributions that the project can be expected to make to reducing CO_2 emissions and promoting "Green Growth".

Final remarks

The Mersin Container Port project will provide a gateway location not only for Turkey and its proximate hinterlands but also for some Middle East Countries (particularly Iraq) as well as Caucasian, landlocked Asian and some CIS countries.

The Mersin Container Port is an important strategic project that attempts to respond to the identified need for a Gateway port towards the eastern end of Turkey's Mediterranean coast, in a location close to the Suez Canal. With the additional potential to facilitate some cargo transport between the Mediterranean Sea and the Black Sea via Ankara, it could provide an alternative routing to help at least partially relieve congested shipping during periods of peak demand through the Bosphorus.

The timing of the development of the Mersin Container Port will be important. Like other countries, Turkey's international trade has been affected and its maritime container freight volumes have fallen. This has taken some of the immediate pressure off port capacity and led to some re-thinking of the timing of planned port developments. In future, it will be important for the timings of Turkey's tendering processes and port development work to continue to be tailored to the recovery of maritime freight and container markets and increases in container demand in particular.

ANNEX 2.A1
MERSIN CONTAINER PORT PROJECT
PROJECT PROPOSAL FORM PROVIDED BY HOSTS

1. Project description

- Title: **Mersin Container Port Project**
- Location: **Mersin**
- Sector: **Transport**
- Project Specification: **Container Port**
- Organisation: **Ministry of Transport (DLH General Directorate)**
- Responsible Person: **F. Ülker YETGİN, Head of Department, Tel.: 203 15 81, ulkeryetgin@yahoo.com**
- Proposal From: **Ministry of Transport (DLH General Directorate), 06338 Emek-Ankara, Tel.: 203 10 00, Fax: 212 38 47**

2. Objective, aim and target of the project

- Objective of the project: **To fulfill the port requirement in the Eastern Mediterranean and to provide Hub Port function.**
- Beneficiaries and influenced parties: **Middle and East Anatolia, Caucasian Countries, Mid-Asia Countries**
- General aim of the project: **To provide port and Hub Port function to Turkish, Central Asian and Middle Eastern hinterland.**
- Target of the project: **To provide 11.4 million TEU port handling function in 2035**

3. The background

- Reference plan, programme: **Development Plans, National Ports Master Plan Study (2000), Transport Infrastructure Needs Assessment for Turkey (TINA) (2007)**
- Methodology for the project proposal: **Demand forecast, cost-benefit analysis, EIA, feasibility analysis**

4. Detailed information

- Outputs: **11.4 million TEU annual container handling capacity**
- Components of the project: **Breakwater construction, terminal construction, dredging, superstructure, port equipment, highway and railway connections**
- Input requirement: **1 400 persons will be employed between 2010-2035**
- Project cost: **405 million euro (General budget and EU grant) + 2 600 million euro (B.O.T.)**
- Revenue and expenditure after investment period: **6 400 million euro revenue, 2 000 euro expenditure**
- Finance sources: **General budget, EU grant and B.O.T.**
- Project implementation schedule: **2010-2030 (five phases)**
- Risks and assumptions: **In the region high traffic demand exists. Yet geopolitical and socioeconomic parameters may have influence to a certain extent.**
- Applicability and sustainability of the project: **No major problem is foreseen.**

CHAPTER 3
NABUCCO GAS PIPELINE PROJECT

Project description, purpose and objectives

Project description and latest developments

The NABUCCO Gas Pipeline is a strategic project for gas supply from the Caspian and Caucasus and Middle East regions to South East and Central Europe. Nabucco is a Trans-European Network (TEN) project of European interest, as identified by the TEN-E Guidelines adopted by the European Parliament and the Council. The pipeline will be routed from Middle East and Caspian supply sources via Turkey/Bulgaria/Romania/Hungary to Austria.

The Nabucco transit countries (Austria, Hungary, Romania, Bulgaria and Turkey) signed an Intergovernmental Agreement (IGA) in Ankara on July 2009. The Intergovernmental Agreement was ratified by Turkish Parliament on March 2010. The Project Support Agreement (PSA) is being negotiated between the Nabucco International Company and the respective Nabucco transit countries.

The project was jointly proposed by the respective gas companies of the involved States and is currently being executed by Nabucco Gas Pipeline International GmbH (NIC) – which is directly owned by the Nabucco Partners and is responsible for the marketing of the pipeline capacity. It will be the only company in direct contact with the shippers (one-stop-shop principle), and will operate as an autonomous economic entity on the market, acting independently from its parent companies.

The full description of the Nabucco project, as provided by the hosts, is at Annex 3.A1.

Project Justification

The Nabucco pipeline project aims to open the fourth supply corridor for natural gas into Europe, after the North Sea, North Africa and Russia, enabling new suppliers from the Caspian and the Middle East regions to access the European gas market. The project offers source and route diversification for the demanding natural gas markets.

Project Objectives

Project objectives include to:

- diversify the gas supply sources on economic terms;
- establish secure energy infrastructure for transporting the gas between producers and consumers of gas.

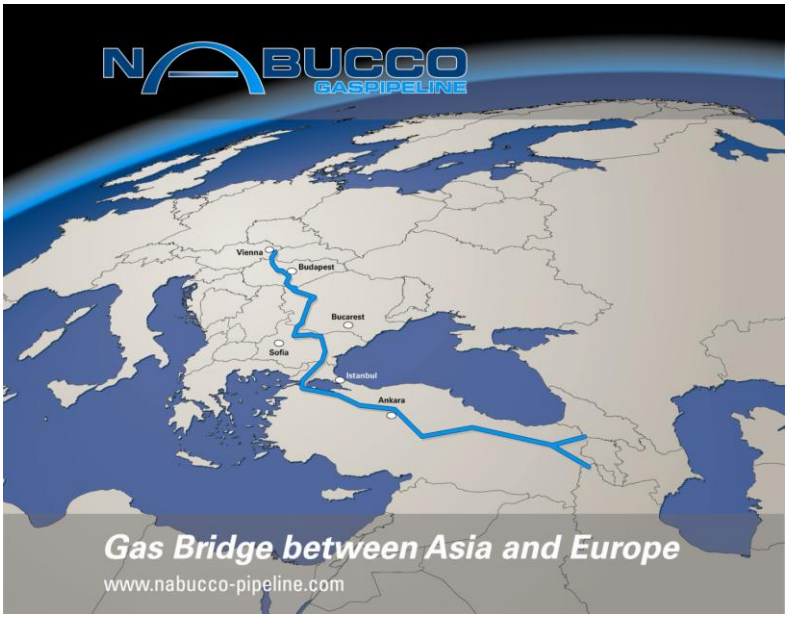
3. Presentation by Ministry of Energy on Nabucco project

Vahit ÇALIŞIR (Ministry of Energy) made a presentation on the third strategic infrastructure project put forward for consideration: the Nabucco Gas Pipeline project. He explained that demand for gas in Europe is expected to increase considerably in the upcoming two decades. Sufficient gas reserves are available in the regions around Europe to meet this expected future increase in demand. The biggest challenge, however, is how the gas can best be transported to consumers on an economic basis – and with the necessary security of supply.

At present sizeable enough capacity does not exist for transporting these gas volumes to European gas markets. Additionally the only region with rich gas reserves, and which is not yet connected with the European markets via pipeline, is the Caspian Region, Middle East and Egypt.

The Nabucco project will develop a new gas pipeline connecting the Caspian region, Middle East and Egypt via Turkey, Bulgaria, Romania, Hungary with Austria and further on with the Central and Western European gas markets. The proponents believe this is the answer to the challenges outlined above and consequently will open up a new, secure supply route for Europe. The proposed route is shown in the graphic below.

Figure 3.1



The pipeline length is approximately 3 300 km, starting at the Georgian/Turkish and/or Iranian/Turkish border respectively, leading to Baumgarten in Austria. A reasonable amount of the gas volumes reaching Baumgarten have to be further transported through Austria to the Central and Western European Countries.

According to market studies the pipeline has been designed to transport a maximum amount of 31 billion cubic metres per annum.

An Intergovernmental Agreement was signed in Ankara on 13th July 2009. Heads of Terms (HoT) of the Standard Transportation Agreement have been agreed upon between the Nabucco

Partners and will be used as a basis for shipping contracts to be entered into with shippers which book capacity under the open season procedure, as well as a Transportation Contract.

Expected timings of the different phases to completion are:

Project Activity	Planned Date
First Construction Phase (ANKARA and BAUMGARTEN)	2011-2014
Second Construction Phase [Turkish Border to Supplier(s) border]	2014-2015
Following Construction Phase II (Additional Stations to upgrade capacity for 31 bcm/y)	2017-

Nabucco Gas Pipeline International Ltd. is the company which has been set up to develop, establish and construct the Pipeline. The Pipeline will operate as a common user facility. The gas will be delivered by shippers, which will be buying transport capacities and the ones deciding where the gas comes from.

The tender has an "Open Season" procedure that contains two steps. In the first step, the offer is addressed to the project shareholders and associated companies for an amount up to 15 bcm – 50 per cent of Nabucco's maximum transport capacity. In the second step, Nabucco will offer the other 50 per cent to external companies ("third party access"), offering them the same conditions and transparency. In this procedure all market participants will have the possibility of securing long-term contracts. Open Season was expected to start in 2010. The entire "Open Season" process is expected to last around six months.

Estimated investment costs including financing costs for a complete new pipeline system amount to approximately 7.9 billion euro. Assuming a robust contractual structure and subject to the Project economics, the proponents consider a debt/equity ratio of 70:30 is achievable. The planned sources of funds are commercial banks, ECAs, EIB, and EBRD. The pipeline is scheduled to be in operation at least for 50 years.

Opportunities and challenges

Level of EU gas demand

Opportunities

The major opportunity that the project offers relates to the size and attractiveness of expected increases in European demand for gas. While demand for oil in Europe (and other developed countries) is not expected to increase significantly in future, demand for gas is generally expected to continue to increase for many years to come. In this context, there seems to be a clear need for an additional, long term source of supply that can make a major contribution to meeting anticipated levels of demand. The Nabucco gas pipeline project seems well placed indeed to respond to this strategic opportunity to meet the increasing demand and to improve diversification in gas supplies.

Challenges

At present, there is a gas glut in Europe, following a slowing of economic activity since the recession in 2009. The glut is expected to continue for some time to come. There has also been a

reduction in levels of gas import demand from the US. In future, US reserves of shale gas are expected to provide an alternative source of US domestic supply. Reduced international demand is likely to suppress market prices for some time to come.

Climate change-related action presents another potential challenge to the level of gas demand in future. There could be significant policy changes in future aimed at reducing CO_2 emissions. However, natural gas has lower carbon intensity as compared to other fossil energy sources and is subject to lesser pressure given the prospects for reducing CO_2 emissions.

Possible future policy changes could encompass emission trading schemes and policy measures such as future carbon taxes (and the level of such taxes). Projections of gas demand generally would not reflect all the changes that might occur in response to such policy priorities.

Some authoritative insights on the outlook for world gas demand – as well as projections for the European region, the EU and the US – are provided in the following extracts from the International Energy Agency's World Energy Outlook, 2009 – which was published in October 2009.

Outlook for World Gas Demand

- The resumption of economic growth from 2010, the favourable environmental and practical attributes of natural gas over other fossil fuels, and constraints on how quickly low-carbon energy technologies can be brought on line all point to steady growth in demand for gas worldwide over the Outlook period. The power sector is expected to remain the single largest driver of gas demand.

- The main drivers of gas demand – and thus the main sources of uncertainty – are economic growth, gas prices and government policies. The share of gas in power generation is very sensitive to the price of gas relative to other fuels and technologies. The introduction of carbon prices would most likely boost gas use through lower coal burn, other things being equal.

- Government policies will be a key determinant of the pace of demand growth in the medium-to-long term. In the Reference Scenario, in which energy policies are assumed to remain unchanged, global gas demand rises from 3.0 tcm in 2007 to 4.3 tcm in 2030 – an average rate of increase of 1.5% per year. The share of gas in the global primary energy mix increases marginally, from 20.9% in 2007 to 21.2% in 2030. Over 80% of the increase in gas use occurs in non-OECD countries.

- The outlook to 2015 differs markedly from the longer-term picture. Although only partial and preliminary data on gas demand are available for 2008 and early 2009, it is likely that, worldwide, primary gas demand will fall in 2009 – perhaps by as much as 3% – as a result of the economic contraction. On the assumption that the economy begins to recover by 2010, primary gas demand is projected to rebound, growing on average by 2.5% per year between 2010 and 2015.

- In the 450 Scenario, which assumes government action to curb greenhouse-gas emissions consistent with a 2°C global temperature increase, world primary gas demand in 2030 is 17% lower than in the Reference Scenario. Demand peaks soon after 2020 and then slowly declines, though it is still higher in 2030 than in 2007. Measures to encourage energy savings, improved efficiency and low carbon technologies, more than offset the effect on demand of the enhanced competitiveness of gas against coal and oil in power generation and in end-use applications (because of higher carbon prices and regulatory instruments).

- Gas demand in the OECD countries generally peaks by around the middle of the projection period in the 450 Scenario and then declines through to 2030, as generators switch investment away from coal- and gas-fired plants to plants using renewables and nuclear power. Demand continues to grow in most non-OECD regions through to 2030, though some regions see a decline after 2020.

Source: World Energy Outlook 2009, International Energy Agency, Paris, October 2009.

Table 3.1. Primary natural gas demand by region in the Reference Scenario *(bcm)*

	1980	2007	2015	2020	2025	2030	2007-2030*
OECD	**958**	**1 527**	**1 555**	**1 636**	**1 690**	**1 761**	**0.6%**
North America	659	813	818	841	863	892	0.4%
Canada	*56*	*96*	*104*	*112*	*122*	*133*	*1.4%*
United States	*581*	*655*	*635*	*635*	*639*	*649*	*–0.0%*
Europe	264	544	552	590	617	651	0.8%
World	**1 517**	**3 049**	**3 395**	**3 678**	**3 996**	**4 313**	**1.5%**
European Union	*n.a.*	*526*	*532*	*564*	*589*	*619*	*0.7%*

Note: *Compound average annual growth rate.

Source: World Energy Outlook 2009, International Energy Agency, Paris, October 2009.

Security of supply

Opportunities

The second major opportunity that the project offers is to provide an alternative major source of gas for Europe that is seen as more reliable and secure. At present, the major external source of gas for Europe is Russia, with shipments predominantly by pipeline routed via Ukraine. The Nabucco Gas Pipeline is seen by many as a lower risk source of supply – and the routing chosen is seen as more secure route than alternatives over the longer term. The Nabucco Gas Pipeline aims at introducing new supply sources, furthering diversification benefits.

Importantly, the Nabucco gas pipeline will also provide a more secure source of supply for the Nabucco project partners themselves. Given the volatility in major energy supply areas, and with increasing volatility in some energy markets (e.g. crude oil prices), a greater degree of stability in gas supplies will be very useful. In Turkey's case, the country is expected to develop quite rapidly, with economic growth around 5.5% per annum forecast for a number of years in future.. The increased security of gas supplies that the project will offer could be especially important to Turkey's economic development.

Challenges

Despite the improved security position for the project partners and other international beneficiaries, especially in the EU, security of supply risks will not disappear completely. There will always be some uncertainties about gas availability from major and minor gas sources. Economic, political and regulatory risks across the diversity of countries involved in the vicinity of one of the world's most volatile regions could also interfere with the security of supply.

There have already been some disagreements on aspects of supply (e.g. prices). There have also been attempts to use Nabucco for energy diplomacy, linking access to the pipeline's gas as leverage to further political aims in non-energy sectors. The challenge will be to ensure the project proceeds with the investment stability and certainty required – as well as the sustained level of international co-operation between project partners that will be central to its success. Signing of the IGA is an important step towards realisation of the project within a stable legal and regulatory framework.

Funds availability from lenders

Challenges

Clearly, the recent crisis and related developments have damaged financial markets and weakened government financial positions. Further challenges may be in prospect if future financial market developments are sufficiently adverse. Already, the recent recession has removed completely many of the sources of long term investment funding that were available before the recession. There is still great uncertainty in financial markets and indications that the current recovery is very fragile. In future, the availability of long debt funding and financing may fluctuate considerably, before the recovery is complete.

Assuming a robust contractual structure and subject to the Project economics, the proponents consider a debt/equity ratio of 70:30 is achievable. At the same time, it should be noted that some infrastructure owners and operators in other transport sectors have adopted more conservative debt / equity ratios (e.g. 50:50), to provide better protection against global shocks and the economic crises that can be expected to occur from time to time.

Final remarks

The NABUCCO Gas Pipeline is a clearly a transcontinental infrastructure project of great strategic importance. Nabucco is a TEN project of European Interest, as identified by the TEN-E Guidelines adopted by the European Parliament and the Council. It will provide a necessary supply-side addition to currently available means of satisfying growing European demand for gas. The pipeline will be routed from the Caspian Sea/Middle East supply countries via Turkey/Bulgaria/Romania/Hungary to Austria. It is being seen as a more secure source of supply than the major current alternative, which is Russian-sourced gas supplied by pipelines routed Ukraine.

According to the projections of IEA, oil and gas will remain major energy resources to meet growing energy demand in the medium term. In parallel, the dependency on imported oil and gas is leading to a steady increase in international energy trade. Rising fossil-energy use has energy security implications. Because of the concentration of resources in a small group of countries, the market dominance of these countries increases. In recent years, policy actions have aimed to minimise the exposure to resource concentration risks in fossil fuel markets and to diversify supply routes and it is an important part in the agenda of the Governments. Diversification of energy supplies and distribution- both by energy type and by source as well as route- has been and will continue to be an important measure to improve energy security.

Climate change is the most serious global energy-related environmental problem. Climate change-related action could present a potential challenge to the level of gas demand in future. There could be significant policy changes in future aimed at reducing CO_2 emissions. However, natural gas has lower carbon intensity as compared to other fossil energy sources. Hence, it is subject to lesser pressure given the prospects for reducing CO_2 emissions.

Despite a number of challenges, the project appears fairly robust in an organisational sense, given the level of co-operation to date. A possible ability to adjust the project construction start and completion dates in response to market demand would provide some useful project flexibility and reduce project risks.

Given its level of ambition, the challenges to be overcome and the final importance of the project internationally and to the European region and project partners in particular, the Nabucco Gas pipeline project appears a very suitable one for highlighting in the OECD report.

ANNEX 3.A1
NABUCCO GAS PIPELINE PROJECT
PROJECT INFORMATION FORM PROVIDED BY HOSTS

1. Project description information

- Name: **NABUCCO NATURAL GAS PIPELINE PROJECT**
- Location: **Turkey – Bulgaria – Romania – Hungary – Austria**
- Sector: **Energy Infrastructure (Natural Gas)**
- Project Type: **Nabucco is a TEN project of European Interest, as identified by the TEN-E Guidelines adopted by the European Parliament and the Council.**
- Project Executing Agency/Institution:

  Executing Institution: Nabucco Gas Pipeline International GmbH (NIC)
- Responsible Person for Project's Improvement (name, position, telephone, e-mail):

  Reinhard Mitschek, Managing Director,
  +43 (1) 2700 371-28661, info@nabucco-pipeline.com
- Institution that Proposed the Project Idea (name, address, telephone, fax):

  Jointly proposed by the respective gas companies of the involved States and currently being executed by Nabucco Gas Pipeline International GmbH (NIC).

2. Project's justification, purpose and objectives

- Project's Justification (why it is needed): **In view of the steadily increasing gas demand in EU, the Nabucco Project is being developed for meeting the part of this overall energy demand.**
- District the Project is targeting and other sides it is affecting: **NABUCCO is one of the ongoing projects in the Southern Corridor for gas supply to South East and Central Europe from the Caspian and Caucasus and Middle East regions.**
- Project's General Purpose: **NABUCCO is planned for enhancing the gas supply security of EU member states and Turkey.**
- Project's Objectives:
  - **To establish a secured energy infrastructure between producers and consumers of gas.**
  - **To diversify the gas supply sources on economic terms.**

3. Originator of the project and its supports

- The Plan, Programme and Researches that the Project is Endured/Related to:

  First phase construction will be started in 2011. In 2014, the first phase will be finished with 8 bcm capacity and at the same year, second phase construction will be started. In 2017, second phase will be finished and the capacity will be 31 bcm.

- The Method Applied for the Improvement of the Project Idea (demand analysis, problem analysis, possibility research-opportunity analysis etc.):

  The project idea had been based on the EU's energy demand indicators and project feasibility studies.

4. Detailed information about the project

- Expected Results/Outputs:

  – **To supply min. 25.5 bcm/year, max. 31 bcm/year gas to consumer markets**

- Project's Components:

  Line Valves : 103
  Take-off Valve : 8
  Pig : 21
  FMS : 14
  Compressor Station : 14 (586 MW)

- Input Needed (manpower, organisation, technical assistance etc.):

  The Nabucco Project is structured on a two-tier basis:

  Nabucco Gas Pipeline International GmbH, was established on 24 June, 2004 and is seated in Vienna. It is directly owned by the Nabucco Partners and is responsible for the marketing of the pipeline capacity. Nabucco Gas Pipeline International GmbH will be the only company in direct contact with the shippers (one-stop-shop principle), and will operate as an autonomous economic entity on the market, acting independently from its parent companies.

  The Nabucco National companies, which are wholly owned by Nabucco Gas Pipeline International GmbH, and which will be responsible for the operation and maintenance of the Nabucco Pipeline. Four Nabucco National Companies have been established in the respective Nabucco Country and the fifth will be established in Turkey soon. The ownership of the pipeline will belong to each Nabucco National Company for its respective country.

  The recruiting activities for NIC and NNCs are still ongoing.

- Project Cost (as internal and external money):

  7.9 billion € (CAPEX)

- Financial Sources Predicted (EU Grant, institution budget, general budget etc.):

  Assuming a robust contractual structure and subject to the Project economics, a debt/equity ratio of 70:30 is achievable. The planned sources of funds are commercial banks, ECAs, EIB, and EBRD.

- Project Implementation Plan (commencement and completion date etc.):

  First phase construction will be started in 2011. In 2014, the first phase will be finished with 8 bcm capacity and at the same year, second phase construction will be started. In 2017, second phase will be finished and the capacity will be 31 bcm.

- Assumptions the Project is Enduring and Risks it can Come Across:
  - **Gas availability from major and minor gas sources**
  - **Funds availability from lenders**
  - **Other economic, political and regulatory risks.**

- Project's Feasibility and Sustainability:

  Basic and Detailed engineering studies proved the feasibility of the project. The pipeline is scheduled to be in operation at least for 50 years.

ANNEX A
LISTING OF WORKSHOP PARTICIPANTS

MARMARAY WORKSHOP 19th APRIL 2010

NABUCCO and MERSIN CONTAINER PORT WORKSHOP 20th APRIL 2010

	Name	Position/Institution	Telephone	e-mail
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