TRACECA Traffic and Feasibility Studies: Feasibility Study on the Rehabilitation and Modernization of Navigational Aids Systems in Caspian Sea Ports

Technical Report

December 2000

REPORT COVER PAGE

Project Title :	**Traffic and Feasibility Studies**	
Sub-Project Title:	**Feasibility Study on the Rehabilitation and Modernisation of Navigational Aids Systems in Caspian Sea Ports**	
Project Number:	**TNREG 9803**	
Countries:	**Azerbaijan, Kazakhstan, Turkmenistan**	
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Abbreviations and Acronyms

ACSP	Aktau Commercial Sea Port
ARPA	Automatic Radar Plotting Aids
AzM	Azerbaijan Manat
BISP	Baku International Sea Port
Cascor	Caspian Corporation
CSC	Caspian Shipping Company
CU	Co-ordination Unit
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ESCAP	Economic and Social Commission for Asia and the Pacific (an institution of the United Nations)
EU	European Union
GMDSS	Global Maritime Distress Safety System
GPS	Global Position System
IMO	International Maritime Organisation
KWh	Kilowatt hour
KzT	Kazakhstan Tenge
MoT	Ministry of Transport of Turkmenistan
MoTC	Ministry of Transport and Communications of the Kazakh Republic
MW	Medium Wave
nm	nautical miles
PCC	Port Control Centre
PCO	Port Control Operator
PSC	Port State Control
Racon	Radar transponder beacon
RADAR	RAdio Detection And Ranging
SOLAS	International Convention for the Safety of Life at Sea, 1974
t.p.a.	tonnes per annum
Tacis	The European Union's Tacis Programme
TAR	Trans-Asian Railway Corridor
tdw	tonnes dead weight
TEN	Trans-European Network
TmM	Turkmenistan Manat
TML	Turkmen Maritime Line
ToR	Terms of Reference
TRACECA	Transport Corridor Europe-Caucasus-Asia
VHF	Very high frequency

1 Project Synopsis for the Feasibility Study on the Rehabilitation and Modernisation of Navigational Aids Systems in Caspian Sea Ports

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Sub-project objectives

The ultimate objectives of the present study is to analyse the technical and economic feasibility of rehabilitating and modernising the navigational aid equipment in the Caspian ports of Baku, Aktau and Turkmenbashi. If the results of the feasibility analysis justify the investment, then a tender dossier with detailed technical specifications will be prepared.

Specific objectives are:

1. to investigate and analyse the existing Navigational Aids Systems in the ports of Baku, Aktau and Turkmenbashi
2. to set a frame for an efficient Navigational Aids System with clear responsibilities
3. to specify new equipment necessary to install an efficient Navigational Aids System in the ports of Baku, Aktau and Turkmenbashi
4. to provide a financial and economic evaluation for the proposed new investments
5. to prepare tender documents according to standards required by international financial institutions (if projected investment is technically feasible and economically viable)

Planned outputs

1. Inventory of the existing Navigational Aids systems for safe navigation based on existing studies and reports and on-site visits by the Consultants
2. Recommendations on possible improvement of services by:

- reconstruction of the administrational environment and
- reconstruction and modernisation of the technical equipment

3. List of equipment necessary to install an efficient Navigational Aids System in the ports of Baku, Aktau and Turkmenbashi
4. Financial and Economic Internal Rate of Return (FIRR and EIRR) for the projected investment
5. Tender dossier with detailed technical specifications for the procurement of a.m. navigational aids equipment (under separate cover)

Project activities

1. Review of existing studies and reports on current navigational aids equipment in the ports of Baku, Aktau and Turkmenbashi
3. On-site visits to verify the information obtain from desk-top research
3. Investigation of possibilities for a closer co-operation with other Caspian Authorities responsible for safe navigation on the Caspian
4. Estimation of cost and revenue elements related to the rehabilitation and modernisation of the Navigational Aids System.
5. Financial Investment Analysis for the installation of new equipment
6. Identification of social cost and benefit categories related to the rehabilitation and modernisation of the Navigational Aids System.
7. Economic analysis
8. Detailed specification of the technical requirements of equipment necessary for the modernisation of the Navigational Aids System in Caspian ports (if technical and economic analysis are positive).
9. Based on the (preliminary) results of the economic analysis (if considered feasible), preparation of comprehensive tender documents according to international standards that should stand up to potential financing parties' scrutiny.

Target groups	1. Sea Transport and Port Departments of the National Ministries of Transport or related political institutions in Azerbaijan, Kazakhstan and Turkmenistan.	
	2. Port Authorities of the ports in Baku, Aktau and Turkmenbashi	
Project starting date	Contract signature	30 August 1999
	Actual start of sub-project activities	11 October 2000
Project duration	8 weeks for the sub-project, counted from	11 October 2000
	24 months for whole project, including modules A, B, C, D and E	

2 Feasibility Study on the Rehabilitation and Modernisation of Navigational Aids Systems in Caspian Sea Ports

2.1 Introduction

The contract for the Traffic and Feasibility Studies Project (TNREG 9803) was signed between the EU Commission and BCEOM on 30 August 1999. The project consists of the following five modules:

Module A Traffic Database and Forecast

Module B New Caspian Sea Shipping Services

Module C Redevelopment of Aktau Ferry Terminal

Module D Navigation Channel of Turkmenbashi Port

Module E Transport of Crude Oil on the Caspian Sea

plus a Feasibility Study on the Rehabilitation and Modernisation of Navigational Aids Systems in Caspian Sea Ports.

The latter study has been later added to the Main Agreement of TNREG 9803 on request of the TRACECA co-ordinator Mr. Marc Graille and Mr. Daniel Stroobants of DG Relex, responsible for the Transport Sector in Tacis and TRACECA countries without amendments to the overall project's budgetary constraints. The necessary partly reallocation of resources from Module E to the additional study was agreed to and confirmed by the responsible EC Task Manager Mr. John Bradley and the EC Tacis Monitor Mr. Pieter Melissen during a meeting in Brussels on October 10th, 2000.

UNICONSULT Universal Transport Consulting GmbH was sub-contracted by BCEOM to provide consulting services related to the additional study, since UNCONSULT not only has considerable working experience in the ports and shipping consulting sector but also regional experience in Central and Eastern Europe and Central Asia.

The present feasibility study was officially launched very shortly after a.m. meeting due to the very tight time schedule requested by the EC, which foresaw the preparation of the tender dossier towards the end of November 2000.

On October 14th, 2000 Mr. Jochen Schmidt, the consulting team's maritime and nautical engineer started his on-site visits to the three ports selected for investigation. His intention was to verify information on existing navigational aids equipment gathered during previous visits and by desk-top research. Furthermore, Mr. Schmidt interviewed individuals responsible for safety in the named ports, i.a. harbour masters and chief engineers.

From October 23rd, 2000 the transport economist Mr. Marcel Sames visited the beneficiary countries to collect price and revenue data on the provision of vessel traffic services in Caspian ports and data supporting the assessment of social costs and benefits. In order to establish and profit

from close contacts to experts from the beneficiary countries, all financial and economic modelling and calculations have been conducted on-site in the TRACECA region.

The technical and economic on-site investigations took place as shown below:

Azerbaijan

Baku/Dubendi	14 – 24 October 2000 (Jochen Schmidt)
	29 October – 10. November 2000 (Jochen Schmidt)
	23 October – 11 November 2000 (Marcel Sames)
	28 November – 4 December (Marcel Sames)
	13 – 22 November 2000 (André Merrien)

Kazakhstan

Aktau	24 – 28 October 2000 (Jochen Schmidt)
	11 - 18 November 2000 (Marcel Sames)
Astana/Almaty	5 – 10 December (Marcel Sames)

Turkmenistan

Turkmenbashi/Ashgabat	5 - 12 October 2000 (Xavier Lefèvre)
	22 – 26 November 2000 (Marcel Sames)

During their missions the Consultants met several government officials, representatives of public and private institutions and companies and other transport experts from the beneficiary countries. A meeting schedule is attached in Annex 1.

Based on the results of the on-site investigations indicating that the projected investment is both technically feasible and economically viable, the procurement expert Mr. Hans-Otto Bistram supported by Mr. Jochen Schmidt elaborated the tender dossier for the procurement of the navigational aids equipment identified by the maritime and nautical engineer.

The information collected during the on-site discussions, in combination with additional information available to the Consultants constitute the basis for the present Technical Report on the Feasibility Study for the Rehabilitation and Modernisation of Navigational Aids Systems in Caspian Sea Ports.

2.2 Co-operation with Tacis and Counterparts

The Consultants held meetings with the following representatives

- Mr. Marc Graille, TRACECA Programme Co-ordinator in Central Asia, on 1 November 2000 in Baku to introduce the mission's purpose and co-ordinate further steps, and on 17 November in Aktau to report on progress.

- Mr. John Bradley, EU Task Manager SCR, on 17 November 2000 in Aktau

- Mr. Daniel Stroobants, DG Relex, responsible for the Transport Sector in Tacis and TRACECA countries, on 17 November 2000 in Aktau

- Mr. Brian Toll, Head of the Technical Assistance Section, Delegation of the European Commission in Kazakhstan, on 17 November 2000 in Aktau

- Mr. Alfred Supik, Tacis Co-ordination Unit in Astana, on 6 December 2000

- Mr. Michael Wilson, Tacis Co-ordination Unit in Turkmenistan, on 21 November 2000 in Ashgabat

- Mr. Mukhammet Artykov, International Technical Assistance Co-ordination Unit, Cabinet of Ministers of Turkmenistan, on 21 November 2000 in Ashgabat

With regards to the objectives of the present study, the consultants have identified and met the following counterparts in the beneficiary countries.

- Mr. I. Mammedov, General Director of the Baku International Seaport (BISP), Azerbaijan, on 19 October in Baku

- Mr. Talgat B. Abylgazin, Director of the Aktau Commercial Seaport (ACSP), Kazakhstan, on 16 November 2000 in Aktau.

- Mr. Bekmyrat A. Gurbanmuradov, General Director of Turkmen Maritime Lines, and a Deputy Minister of Transport, on 25 November in Turkmenbashi

2.3 Relation with other Projects

The present study is closely linked to Modules A, C and D of the TRACECA Traffic and Feasibility Studies since the results obtained there may have a considerable impact both on the technical feasibility and economic viability of the installation of new Aids to Navigation (AtoN) equipment.

Furthermore, the Consultants contacted Mr. Bodo Rössig; Team Leader of the Tacis study "Reorganisation of the Transport Sector Administration in Azerbaijan", in order to synchronise the Consultants' approaches for the restructuring of AtoN services in Azerbaijan.

In addition, the consultants have identified and reviewed i.a. the following studies, material and information related to the comprehensive fulfilment of the study's tasks:

- TRACECA Intermodal Services, 1999 (ongoing)

- Basic Multilateral Agreement on International Transport for Development of the Europe-Caucasus-Asia Corridor (including Technical Annexes on International Road Transport, Customs and Documentation Procedures, International Commercial Maritime Navigation, International Railway Transport), Baku 7-8 Sept 1998

- TRACECA Traffic and Feasibility Studies Module C: Redevelopment of Aktau Ferry Terminal, Kazakhstan, Inception Report 1999, Final Report 2000

- Joint Study on Caspian Oil Shipping, National Iranian Tanker Company and Shell International Trading and Shipping Co., SWAP Project 1999.

- TRACECA Traffic and Feasibility Studies Module D: Navigation Channel for Turkmenbashi Port, Inception Report 2000.

3 Vessel Traffic Forecast

The necessity of new Aids to Navigation equipment is more or less a question of coastal and port security, i.e. a technical matter, while the profitability must be assessed from a financial and economic angle. No matter how we look at the problem, one pre-requisite for both study items is some information on the likely development of future vessel traffic calling at the selected ports of Baku, Aktau and Turkmenbashi, all constituting an integral part of the TRACECA (Transport Corridor Europe-Caucasus-Asia) route (see Annex 2)

From a central European angle, the TRACECA route extends from the Ukraine via the eastern Black Sea ports of Poti and Batumi (Georgia) and via Tbilisi to the western Caspian Sea port of Baku (Azerbaijan). Here, the route splits into a northern lane across the Caspian Sea to the port of Aktau (Kazakhstan) and onwards via Aktybinsk to Chimkent, and a southern lane to the port of Turkmenbashi (Turkmenistan) and from that port via Ashgabat and Tashkent (Uzbekistan) to Chimkent. In Chimkent both corridors re-unite and the TRACECA route finally ends at the Kazakh-Chinese border at Druzhba (Kazakhstan).

3.1 Status-Quo

The following review focuses on the current transport situation in the beneficiary states of Azerbaijan, Kazakhstan and Turkmenistan. Where deemed necessary, information on neighbouring states (Russia, Iran, Uzbekistan, Georgia) have been included.

3.1.1 Regional Economic Situation

3.1.1.1 Azerbaijan

Following the disintegration of the Soviet Union, GDP in Azerbaijan steadily declined from 1988 and, by 1994, stood at about 37 percent of its 1988 value. Virtually all sectors of the economy were hard hit, with agricultural output falling by about 43 percent and industrial output losing some 60 percent during the 1989-94 period. Particularly affected were the oil and gas sectors, where production fell from 13.8 to 9.6 million tonnes between 1987 and 1994, as a result of growing problems with infrastructure, poor production practices, and the depletion of oil fields.

Since 1995, with the gradual stabilisation of the political situation and the cease-fire in the Armenian conflict, an economic program supported by International Financial Institutions has been implemented. Inflation, which ran at a staggering 1,664 percent in 1994, fell to less than 1 percent at the end of 1997 and became negative in 1998. GDP grew by 10 percent in 1998 compared to declines of 50 percent at the end of 1993 and another 22 percent in 1994.

The current account deficit of US$ 1.5 billion in 1998 was financed mainly through foreign direct investments of about US$ 1 billion. This was predominantly for the import of goods and non-factor services related to the expansion of the hydrocarbon sector. The exchange rate has consequently begun to appreciate. At the time of writing the national currency, the Manat, seems to be overval-

ued, thus local manufacturers even of low-priced commodities find it difficult to compete with imports. The industry is working at about 20 percent capacity utilisation.

A short- or medium-term improvement of the current economic situation in Azerbaijan is likely, if knowledge of the functioning of market mechanisms is further increased. Consequently, Azerbaijan's medium-term prospects are potentially good, depending on political stability, successful initiatives to address corruption, public sector governance, legal reforms and the business environment.

3.1.1.2 Kazakhstan

Kazakhstan possesses considerable volumes of natural resources, of which the most important are crude oil, gas and large deposits of coal, and iron and other metal ores. The major suppliers of coal, metal products, asbestos and grain are located in the north of Kazakhstan. Precious metals and oil are to be found in the west and copper and ferrous ores in the centre of Kazakhstan.

The disintegration of the USSR and the collapse of demand for Kazakhstan's traditional heavy industry products have resulted in a sharp contraction of the economy since 1991, with the steepest annual decline occurring in 1994. In 1995-97 the pace of the government program of economic reform and privatisation quickened, resulting in a substantial shifting of assets into the private sector. The December 1996 signing of the Caspian Pipeline Consortium agreement to build a new pipeline from western Kazakhstan's Tengiz oil field to the Black Sea increases prospects for substantially larger oil exports in several years. Kazakhstan's economy turned downward in 1998 with a 2.5% decline in GDP growth due to slumping oil prices and the August financial crisis in Russia.

The most important trading partners of Kazakhstan are the CIS (especially Russia, Ukraine, Belarus, Uzbekistan), China, Iran and Turkey. The fact that import substitution in Kazakhstan is growing (i.e. local goods are becoming more and more attractive for consumers) can be interpreted as a positive sign of the Kazakh industry gradually catching up.

Kazakhstan's medium- and long-term economic prospects are promising due to its vast hydrocarbon and mineral resources, low external debt obligations, and well-trained work force. New legislation concerning foreign investment, taxation, and oil and sub-soil rights are expected to improve the climate for foreign investment in the next few years. By early in the next century, Kazakhstan is expected to be able to finance its balance of payments through foreign investment, private capital and regular project finance, thereby eliminating the need for exceptional support from official sources. In the short-term, however, the country will need to continue its reform program and deal with a number of external shocks if it is to increase its growth rate to acceptable levels.

3.1.1.3 Turkmenistan

Until the end of 1993, Turkmenistan had experienced less economic disruption than other former Soviet states because its economy received a boost from higher prices for oil and gas and a sharp increase in hard currency earnings. In 1994, Russia's refusal to export Turkmen gas to hard currency markets and mounting debts of its major customers in the former USSR for gas deliveries contributed to a sharp fall in industrial production and caused the budget to shift from a surplus to a slight deficit. The economy bottomed out in 1996, but high inflation continued. Furthermore, with an

authoritarian ex-communist regime in power and a tribally based social structure, Turkmenistan has taken a cautious approach to economic reform, hoping to use gas and cotton sales to sustain its inefficient economy. In 1996, the government set in place a stabilisation program aimed at a unified and market-based exchange rate, allocation of government credits by auction, and strict limits on budget deficits. Privatisation goals remain limited.

Turkmenistan has a weak industrial base. A major proportion of Turkmen foreign trade is conducted on the basis of bartering: Turkmenistan imports from western Europe mainly consist of foodstuffs (incl. processed food), beverages, oilfield and gas treatment equipment, machinery, whereas Asia mainly supplies textiles. Turkmen exports to the west comprise oil, gas (to Europe, Turkey, Russia, Belarus, Ukraine) and raw cotton. In recent years the country has increased its trade with Iran and with Far Eastern countries.

Since Turkmenistan is a parental state (i.e. government subsidies in almost all sectors of the economy: e.g. free water and energy supply to households), state finances are not in a good shape, even though about 20 per cent of world energy resources are assumed to be buried in Turkmenistan. Turkmenistan is working hard to open new gas export channels through Iran and Turkey to Europe. Furthermore, the country started selling gas to Russia in late December 1999, thereby improving its feeble balance of payments. The problem remains to move export commodities to the world markets.

All in all, Turkmenistan has good long-term potential for development given its natural resource base, but the realisation of this potential would require not only a radical change in policies (Turkmenistan needs to mesh its ad-hoc policies into an internally consistent and coherent reform program) but also careful management of public expenditures and investments.

3.1.1.4 Common Problems

Being land-locked, the main beneficiary countries face the harsh fact that of their export revenues an excessive proportion is absorbed by transport costs. The current oil price of around 30 US-$ per barrel may justify transport routes and means however bizarre, but the world market prices for iron steel, cotton (and other agricultural) products do not. The price of oil is very volatile, and a weak oil market will further reduce the net proceeds from its principal exports. It would also reduce the number of financially viable transport routes. Such oil producing countries as e.g. Norway, the UK, Saudi-Arabia or Venezuela to name a few can move their crude oil and/or derivatives from oil wells close to or even in the open seas to the markets in large tankers with low unit costs whereas the location of oil deposits in the Caspian region causes considerably higher transport costs and consequently reduces the countries' net profit from oil. The same applies to other major export commodities.

3.1.2 Transport of Cargoes Within and Through the Caspian Region

3.1.2.1 Liquid Cargo

Of the oil produced in Kazakhstan (Year 2000 theoretical estimate: 32 million tonnes) and Turkmenistan (as above, 9 million tonnes), about 150,000 tonnes per month, mainly from the Kazakh Tengiz oil field are being carried in Azeri and Russian tankers to Baku (handled in Dubendi, about 45 km north of Baku). The oil is then transferred to rail tank wagons and transported through the Caucasus to the Black Sea port of Batumi. The capacity of this rail route is about 40 trains per day per direction. Currently 2.5 million tonnes p.a. of crude oil are transported over this route which has a capacity of at least five million tonnes p.a., possibly even twice that figure. The maximum capacity of a train on this route is some 2000 tonnes equalling 36 rail tank wagons of 60 tonnes payload.

Increasing quantities of crude oil (from Buzachi and other fields in the Mangyshlack county area) move from Aktau to Makhachkala where it connects with the pipeline from Baku to Novorossisk. From Turkmenbashi oil is being shipped not only to Makhachkala but increasingly also to Anzali (Iran), where a pipeline to Tabriz reportedly is under construction.

In summer, i.e. when the Volga-Don Canal is open to navigation, there are occasional tanker transports (vessels of max. 5000 tdw, Russian flag) from Aktau to Astrakhan and from there to Novorossisk by rail or via the Canal to the Black Sea. Furthermore, certain quantities of Turkmenistan oil are being carried by Russian tankers to Astrakhan and via the Volga-Don Canal to Black Sea destinations.

Carriage of oil across the Caspian Sea is dominated by the Caspian Shipping Company whose tankers moved about 5.7 million tonnes of crude oil and oil products across the Caspian Sea in 1999. CSC tankers serve the principal routes such as Aktau/Baku; Turkmen ports/Makhachkala, and Aktau/Makhachkala, and are also involved in domestic Turkmen tanker transports (Akarem/Alaja – Turkmenbashi). On the other hand, the Turkmenbashi/Anzali oil trade appears to be firmly in the hands of Russian operators.

Regarding alternative routes or transport modes, a trans-Caspian pipeline from Aktau to Baku is under consideration, and so are other more concrete projects (e.g. Baku-Ceyhan, Tengiz-Novorossisk) but the time scheme and detailed impact on transportation of these grand schemes is altogether uncertain.

3.1.2.2 Dry Cargo

A major feature of the TRACECA route is the incidence of multiple handling and of several border crossings. A perfectly normal transport, by container, from the EU to, say, Ashgabad will move by sea from Europe to Poti. The container will be discharged and placed on a railway truck to be railed to Baku. This entails customs formalities, including deposits payable but very difficult to recover, in Poti and at the Georgian/Azeri border. The truck will then go by ferry to Turkmenbashi and onward by road to Ashgabad. By that time the container has crossed four borders and has been handled at least three times. All the same, transport specialists reckon that this route is safer than transiting Russia and Kazakhstan and offers itself for the movement of consumer goods such

as foodstuff, beverages, tobacco, electronics, and the like. However, the cargo sometimes has to bear considerable waiting times.

Dry cargoes shipped from Aktau to Baku/Azerbaijan on the east-west route originate in Kazakhstan, Turkmenistan and also Uzbekistan and comprise i.a. ferrous and non-ferrous metals, cement, timber, grain, cotton (i.a. in containers) and some chemical products.

In the west-east direction from Baku/Azerbaijan to Aktau/Kazakhstan and Turkmenbashi/Turkmenistan the principal commodities are manufactured products mainly from Turkey and the EU, and building materials. The dry cargo trade is divided between two modes, i.e. conventional cargo ships; and rail wagons and road trucks shipped in ferries, with the commodities split between both modes in accordance with their physical nature. However, the movement of crude oil in rail tank wagons from Turkmenbashi, by ferry, to Baku is the one major exception to this rule. Dry cargoes from Aktau, i.e. grain and a large proportion of the metal products handled at that port, are almost exclusively destined to Iran. The Iranian demand for metals from Russia (Magnetagorski, Chelyabinsk) and Kazakhstan (Karagandar) currently amounts to some 200,000 t p.a. from Aktau which at present accounts for some 80 percent of ACSP's dry cargo throughput, but it is difficult to predict whether these volumes will be sustainable, since much depends on the rail tariff policy of the Kazakh government. Once the special Kazakh rail tariffs for exports through the port of Aktau revert to regular levels, some of these volumes may be re-routed to Astrakhan, which reportedly is making strong efforts to regain this traffic.

Before the disintegration of the Soviet Union, Baku served as the gateway to Iran. The dry cargo trade between the USSR and Iran amounted to an annual quantity of one million tonnes. Today, the traffic between the Iran and Baku consists of rather minor import quantities of bagged cement and of construction material. Also, the Baku-Russia trade is of very minor importance for the Port of Baku, in 1999 only minor quantities of slag and some equipment were shipped from Russia to Baku.

3.1.2.3 Ferries

CSC is currently the only ferry operator in the Caspian, serving Baku – Turkmenbashi and Baku – Aktau. Due to the fact that the Aktau terminal is under rehabilitation and cannot at present accommodate rail wagons but only cars and trucks, traffic volumes between Baku and Turkmenbashi are considerably higher than between Baku and Aktau. Currently the cargo from Baku to Aktau comprises some oilfield equipment, building material and certain consumer goods. There may be a future demand for the shipment of Kazakh grain from Aktau to Baku, plus minor quantities of non-ferrous metals, possibly in rail wagons. As of autumn 2000, the single ferry operating on this route has an extremely poor utilisation and would normally be found to carry no more than 5 to 6 trucks per voyage and up to 22 in peak times, but even that gives a capacity utilisation of only 50 percent. The ferry can accommodate 150 passengers but rarely carries more than 35 to 50. From the end of 2000 ferry service is suspended due to rehabilitation of the Aktau ferry terminal. After rehabilitation local experts expect a considerable increase in cargo volumes: part of today's (rail) cargo moving through Turkmenbashi may be routed via Aktau.

3.1.2.4 Alternative Routes to TRACECA

The TRACECA sea route across the Caspian (Baku – Aktau/Turkmenbashi) competes with routes by-passing Baku. An unspecified amount of dry cargo from Aktau, Turkmenbashi and Iranian ports transits the Volga-Don Canal. This is an area where for obvious reasons, Russian carriers take the lions share of the traffic. The competition of this route is felt in summer, but in winter the cargo is re-routed via Baku when the Volga-Don Canal becomes ice-bound. There is also the transport chain Aktau – (sea) - Makhachkala – (rail) – Novorossisk. This route will be further stimulated by Russian ideas for the construction of a ferry terminal somewhere between Makhachkala and Astrakhan, capable of accommodating 280-m ferries with a capacity of up to 150 rail wagons. There is no reason why regular ferry services between Turkmenbashi and Makhachkala should not similarly be introduced, always provided there is sufficient inducement.

Most importantly, there is the competition from land-bridges transiting Russia and Iran, which both are on the political level more and more offering alternatives routes to TRACECA, e.g. Russia grants considerable rebates on railway tariffs for cargo from Central Asia to western Europe, while the Iran stresses its existing infrastructure of oil refineries, pipelines and terminals.

Turkmenistan and Uzbekistan in particular are reported to increasingly using routes other than TRACECA. Turkmenistan which seems to favour trading with Asiatic partners prefers the (land) route through Iran or via Turkmenbashi to and from Makhachkala and Astrahkan. Uzbekistan moves more imports and exports via Aktau rather than Turkmenbashi but also uses routes through Iranian and Russian ports, to the detriment of Turkmenbashi, even though the rail distance to Aktau is about twice as long. The reason are the high railway tariffs charged by Turkmen Railways.

Currently about 95 percent of all Kazakh imports and exports are transported by rail. For transports to the west, Kazakh exporters have the choice of several alternative rail routes through Russia. Those routes are generally considered cheaper and more reliable for commodities moving in large quantities than the TRACECA route across the Caspian Sea. Large volumes of ferro-chrome (80,000 tonnes per month) from Aktybinsk and Pavlodar move by rail to Klaipeda (80 percent) and to some Black Sea ports (20 percent). The average size of a consignment of ferro-chrome is about 2000 to 3000 tonnes (50 wagons). Zinc produced in Ust-Kamenogorsk and copper produced in Dzhezkazgan mainly go to St. Petersburg, where there are companies specialised in handling these commodities. Occasionally zinc and copper is also moving eastwards to the Pacific coast, partly in containers to South-Korea, that being one way for the shipping companies to recover their empty boxes and obtaining a slight contribution towards the deadheading costs.

Closely related to the trust of transport users in the traditional railway connections is the expectation that the northern route of the Trans-Asian rail corridor will have a bright and busy future. TAR spans 1,500 km from east China to Europe. The central TAR route passes through Iran and Turkey, and is much shorter than the Transsib and partly uses Kazakh territory. Currently in a first phase a special ESCAP task group for customs and general rules and regulations is investigating this corridor, to be followed by a second phase dealing with aspects of costing and pricing. Today, cargo transport on the TAR is still quite expensive due to insufficient co-operation between the participating railway companies who seem to be totally unaware of the one stop shopping concept as a vital means of streamlining transit and of attracting clients.

At present a large proportion of cargo from Europe destined to Turkmenistan moves by land-bridges via Turkey, Iran, of which again a certain proportion would be shipped to Iran and discharged at Bandar Abbas. Even though road conditions are very poor, substantial quantities of building material are being trucked over this route because any delays in Caspian ports (due to administrative hindrances) are not acceptable to clients, who depend on timely supplies to keep their construction sites going, especially in Ashgabat. However, the sustainability of his itinerary remains in question once major construction works in Ashgabat are finalised.

Even cargo from East Asia destined to Azerbaijan only occasionally reaches Baku via the Caspian Sea. Sea shipment to Bandar Abbas or Poti are normally first and second choice, i.e. the TRACECA-route from the east is not highly frequented. But it is hoped that China will join the TRACECA corridor once the connection between Kyrgystan and China is in place. Cargo (mainly in 20/40 ft containers) will then be able to move from Asia via land-bridge.

3.1.3 Shipping Companies Operating in the Caspian Sea

Caspian Shipping Company (CSC, based in Baku), the major player on the Caspian Sea, owns 8 ferries, 34 tankers and a fairly large number of dry cargo vessels. Some of these vessels are currently operating in the Black and/or Mediterranean Seas, others are laid up due to lack of employment or to outstanding repairs. CSC vessels serve all Caspian Sea ports. The company operates all ferry services in the Caspian Sea (Baku - Aktau/Turkmenbashi), and has a monopoly in carrying oil from the east coast of the Caspian Sea to Baku.

Turkmen Maritime Line (TML, based in Turkmenbashi) owns four dry cargo vessels of about 3000 tdw each of which two are operating in the Black Sea due to cargo shortage in the Caspian Sea. The company has ordered a new tanker 5,000 tdw to be built in Turkey for delivery in 2001.

Kazmortransflot, based in Aktau, does not yet own any vessels, yet. The company has been established very recently and at the time of the Consultants' visit, it had a management but no operational staff. It is expected that operations with chartered tonnage will commence as soon as (political) decisions concerning a possible joint-venture with a Russian tanker operator have been taken.

Volga River Shipping is a Russian company owning dry cargo ships and mainly engaged in the trade to Iran.

Volgotanker, a Russian company owning suitably-sized river-sea tankers, calls at every port in the Caspian except Baku. Its main business is carrying oil and oil products from the ports on the eastern coast of the Caspian Sea to Russian ports but also to Iran

North Caspian Shipping, a Russian company owning some dry cargo vessels and some tugs, is a competitor of Volga River Shipping and operates mainly between Astrakhan and Iran.

Khazar Shipping, an Iranian company owns 3-4 dry cargo vessels and operates between Aktau/Turkmenbashi/Astrakhan and Iran. The company is mainly involved in carrying metal products.

The tonnage currently operating in the Caspian Sea is fully sufficient to accommodate the existing dry cargo and passenger flows. On short notice, the vessel operators in the Caspian Sea are able

to considerably increase their capacities, thus larger volumes of cargo (irrespective of commodity groups) than today can be transported.

Theoretically the maximum size of vessels sailing in the Caspian is 12.000 tdw, but due to shallow access channels in Dubendi and Turkmenbashi ships of that size cannot operate in a fully laden condition. The majority of vessels are around 3,000 to 4,000 tdw, that size guaranteeing full flexibility (including Iranian ports and the Volga-Don Canal). It stands to reason that ships of that size and cargo intake have higher unit costs than larger vessels which has a direct bearing on maritime transport costs in the Caspian Sea.

3.1.4 Some Remarks Concerning Transport Tariffs

The Kazakh government is highly interested to see ACSP prosper. Therefore, routing of cargo through ACSP is being rewarded by discounts of up to 50 percent off the official rail tariffs. Discounting is expected to remain in place for a long time, since not only does ACSP profit from this measure (the port expects in 2000 to double the 1999 dry cargo throughput enabling the port to start repaying the 150 million Euro EBRD loan from its own revenues) but also Kazakh Railways as the route via Aktau enables Kazakh Railways to sell more rail-km than on any other transit route, which looks good from a statistics angle.

Many transport users agree that as of today, moving cargo over the TRACECA route is very expensive by any standards. Local transport experts quoted typical prices: to ship a railway wagon from Turkmenbashi to Baku by ferry costs about US-$ 620 (US-$ 31 per metre), to ship a trailer including truck from Aktau to Baku costs about US-$ 560 (US-$ 35 per meter). From Aktau/Turkmenbashi via Baku to Batumi the total costs for transport and handling amounts to about US-$ 50 per tonne of crude oil.

3.1.5 Ports and Port Facilities in the Caspian Sea

The Caspian Sea ports of Baku, Turkmenbashi and Aktau are the key nodes in all transport chains on the TRACECA route across the Caspian Sea. It is not only important to improve the connection between port infrastructure and the relevant hinterland transport infrastructure but also to install modern and adequate superstructures (with regards to maritime safety) within the ports.

3.1.5.1 Baku

Baku Main Port

Baku Port is situated in Azerbaijan, at the western shore of the Caspian Sea at location 40°23' N, 49°51'E.

The Baku port system consists of the installations of BISP Baku International Seaport (Main Area, Ferry Terminal, Timber Port, Passenger Station), the fishing port, several ship yards and marine services installations, and a multitude of jetties of various ownership, all at the southern shore of the Apsheron peninsular. Also, the port of Dubendi (see next section) on the northern shore of the

peninsular is part of this port system. Altogether, the navigational district of Baku covers an area of approximately 12 nm by 50 nm.

BISP has a fully equipped container yard (funded by TRACECA).

In 1999, Baku handled the following cargo volumes

Terminal	Tonnes handled in 1999
Ferry terminal (exports + outgoing transit)	**410,502**
of which i.a.	
Soy beans	121,415
Aluminium + aluminium oxyd	84,806
Ferry terminal (imports + incoming transit)	**516,923**
of which i.a.	
Diesel fuel	191,865
Cotton	86,781
Coke	80,223
Fuel	43,870
Cement	29,034
Main cargo terminal	**58,509**
of which i.a.	
Salt	36,090
Cement	14,250
Total	**985,934**

Table 3-1: Handling Volumes at Baku

The largest part of port business is related to the ferry terminal. In 1999, the terminal handled 14,682 rail wagons (of which 7,944 import and incoming transit) and 2,325 trucks (of which 1,408 import and incoming transit). Consequently, (commercial) vessel traffic in the Baku Bay has been dominated by ferry services, especially between Baku and Turkmenbashi. The weekly service between Baku and Aktau started only in June 1999, but until today is unable to accommodate rail wagons due to the not workable rail ramp at Aktau, which is currently under rehabilitation, financed by TRACECA. In 2000, handling of mineral products started at the Port of Baku

Relation	Number of arrivals/departures in 1999
Ferry Baku – Turkmenbashi v.v.	369
Ferry Baku – Aktau v.v.	26
Dry cargo vessels Baku – Turkmenbashi v.v.	12
Dry cargo vessels Baku – Aktau v.v.	7
Dry cargo vessels Baku – Iran v.v.	6
Dry cargo vessels Baku – Russia (incl. Volga-Don Channel) v.v.	11
Total	**431**

Table 3-2: Number of Vessels Calling at the Port of Baku

Dubendi

The oil terminal at Dubendi, part of Baku International Seaport, is situated on the Northern shore of the Apsheron peninsular, at a land distance of 46 km from Baku.

In 1999, Dubendi handled the following cargo volumes

Commodity	Tonnes handled in 1999
Crude oil	2,427,127
Oil products	115,855
Total	**2,542,982**

Table 3-3: Handling Volumes at Dubendi

Since Dubendi handles only crude oil and oil products vessel traffic in the Baku Bay is almost exclusively tanker traffic, especially to and fro Aktau and Alaja.

Relation	Number of arrivals/departures in 1999
Dubendi – Aktau v.v.	271
Dubendi – Alaja v.v.	77
Dubendi – Baku v.v. (bunker transports)	28
Dubendi – Okarem v.v.	21
Dubendi – Neftechala	17
Total	**414**

Table 3-4: Number of Vessels Calling at Dubendi

Dubendi oil terminals, today working at about 55 percent capacity, can be refurbished to handle almost four times as much as today, since not all piers and terminals (especially those owned by SOCAR, the state-owned oil company) are in a working condition. The current annual throughput of about 2.6 million tonnes must be seen against the backdrop of an agreement between the State Presidents of Azerbaijan and Kazakhstan to target a maximum annual movements of crude oil between Aktau and Baku of 10 million tonnes.

3.1.5.2 Aktau Commercial Sea Port

Aktau Port is situated in Kazakhstan, at the north-eastern shore of the Caspian Sea, at location 43°41' N, 51°06'E.

ACSP has a capacity to handle 8 million t.p.a. of crude oil and oil products (but handled only actual about 2 million tonnes in 1999) and 1.5 million t.p.a. of dry cargo (about 300,000 tonnes in 1999).

As of the end of 2000 Aktau has insufficient storage facilities for metal products (i.e., not enough space to segregate various categories of metal products). These storage facilities can only handle

about 5,000-10,000 tonnes of metal products per month, thus much depends on the ports ability to co-ordinate and provide direct handling from rail/truck to vessel.

Aktau at present rehabilitates the ferry terminal, plans to purchase new oil storage facilities and to build a new grain terminal. A fully equipped container yard is projected

Today, Aktau suffers from an insufficient and expensive railway link with the main network (the land on which the 18-km rail connection between the port of Aktau and Mangyshlack is situated is owned by Cascor, which now as a privatised company charges a high transit fee). The problem has been acknowledged by the responsible decision-makers and is to be tackled in the very near future. Moreover, plans for the construction of a road from Aktau to Uzbekistan in parallel to the existing railway are under preparation. This will further increase the attractiveness of the Port of Aktau for cargo transports beyond the Caspian Sea.

In 1999, Aktau handled the following cargo volumes:

Commodity	Tonnes handled in 1999
Crude oil	2,066,751
Metals	235,383
Grain	7,582
Miscellaneous general cargo	37,996
Total	**2,347,712**

Table 3-5: Handling Volumes at the Port of Aktau

In 1999, the ferry between Aktau and Baku has not been consistently working during the whole year (only from June to November), thus dry cargo volumes are slightly biased (only about 2,700 tons in trucks). Nevertheless, the data clearly indicates that business in the port of Aktau is largely depending on the handling of export bulk cargo, of which crude oil (most of it is shipped to Dubendi) takes dominating position. Imports of both liquid and dry cargo sum up to only about 12,000 t in 1999 and represent a share of only about 5% on total handling volumes.

Consequently, vessel traffic in Aktau is dominated by tankers entering the port empty and leaving fully or in case of larger tankers partly loaded.

Relation	Number of arrivals/departures in 1999
Tanker: Aktau-Dubendi v.v.	271
Ferry: Aktau-Baku v.v.	17
Dry cargo vessels:	82
Total	**370**

Table 3-6: Number of Vessels Calling at the Port of Aktau

3.1.5.3 Turkmenbashi Port (incl Ufra terminals)

Turkmenbashi Port is situated in Turkmenistan, at the eastern shore of the Caspian Sea, just opposite of Baku, at location 40°01' N, 52°58'E.

Besides a ferry terminal with two berths and a new terminal building, some general cargo facilities and the oil terminal at Ufra Turkmenbashi Port has a fully equipped container yard (funded by TRACECA), which is currently under-utilised.

In 1999, Turkmenbashi handled the following cargo volumes

Commodity	Tonnes handled in 1999
Tanker transports	2,778,700
of which mineral products	2,552,100
crude oil	233,100
Dry cargo	150,000
of which salt	70,000
Ferry (tares excluded)	612,600
of which mineral products	249,000
food and beverages/consumer goods	142,000
Total	**3,541,300**

Table 3-7: Handling Volumes at the Port of Turkmenbashi

Type of vessel	Number of arrivals/departures in 1999
Tanker mineral products	704
Tanker crude oil	48
Ferries	369
Dry cargo vessels	148
Total	**1,269**

Table 3-8: Number of Vessels Calling at the Port of Turkmenbashi

3.1.5.4 Other Caspian Ports

Russian and Iranian ports are similarly making some efforts to increase their attractiveness . E.g., the port of Makhachkala plans to construct a ferry terminal and an access to the Baku-Novorossisk pipeline which by-passes the port, and Iran has converted an old gas pipeline from Neka oil terminal to Teheran into an oil pipeline.

So far, the Iranian ports not only suffer from their restricted navigational accessibility (e.g. Noushahr port is so small that vessels can hardly turn around), but also from insufficient hinterland accessibility since they neither have rail nor a sufficient oil pipeline connections (in the latter context, perhaps with the exception of Neka). Bandar Anzali, the biggest Iranian oil port in the Caspian

Sea only has a combined gas and oil pipeline connection with the interior. Crude oil is discharged from tankers and pumped into trucks for further transport, a costly and highly inefficient procedure.

3.1.6 Summary of the Status-Quo Analysis

To sum up, until the region has caught up with the industrialisation process it may appear to be difficult but not entirely impossible to generate and direct significantly higher volumes to the maritime routes across the Caspian and along with it to the ports. Kazakhstan and Turkmenistan are increasingly looking east for trade relations while Azerbaijan is more inclined to trade with the west. The cargo volumes exchanged between these states are nowadays fairly moderate. In addition, dry cargo movements in the east – west and west – east directions on the TRACECA route will constantly feel the competition through Russian and Iranian efforts to improve relations with the CIS states east of the Caspian Sea and their more or less aggressively attacking the TRACECA idea. It seems that dry cargoes increasingly endeavour to bypass the Caspian Sea, or at least the ports of Baku and Turkmenbashi, since this route is deemed time consuming and costly compared to the (subsidised) routes through Russia and the Iran. The rapprochement between Russia and Iran may stimulate the north-south/south-north trade across the Caspian of which the Port of Aktau may further profit. Furthermore, increasing trade relations between the Indian sub-continent and Russia may stimulate transport links east of the Caspian Sea, including Turkmenbashi

The transport of oil by tankers as an alternative to pipelines which are yet to impact on the trade, has repeatedly been mentioned as the obvious solution and seems to hold most promises for the business of Aktau and Baku. Moving oil and oil products in tankers of between 5,000 and 12,000 tdw is not very economic but there do not at present appear to be any other, and more viable, alternatives, pending the advent of new pipelines (the existing pipelines lack the capacities of coping with large quantities of oil and oil products). The idea of using considerably larger units (up to 50,000 or 60,000 tdw) would require major investments into port and terminal infra- and superstructure, for which funds will most likely not be available in the foreseeable future. Thus, shipping of crude oil in small tankers most probably will only be a strategic alternative to prevent the owners of existing pipelines to take advantage of their monopolistic position.

3.2 Vessel Traffic Forecast for Baku, Aktau and Turkmenbashi

For the purpose of the following traffic forecast, the consultants have made maximum possible use of existing forecast and results elaborated under the frame of previous studies, e.g. TRACECA Traffic and Feasibility Studies, especially Modules C and D, and data and estimations provided by the ports analysed within the frame of the present study.

Forecasting traffic in the Caspian port is not easy in the case of the newly independent states because changes are so fast that past trends cannot be used as reliable indicators. Moreover, economic changes in the region may have huge consequences on traffic:

- increase of oil and gas production, that results in a higher demand for sea transport;
- increase of oil prices, that leads to growth of import capacity and then increases inwards port traffic;

- development of new North-South axes of sea-borne trade on the Caspian Sea, that might affect land transport and consequently the port traffic itself;
- development of other regional countries that the Caspian states trades with.

Lastly, competition with other ports and routes to collect cargoes from land-locked areas, such as the Uzbek cotton, is an additional element to be taken into account for foreseeing traffic development.

In order to estimate the full range of possible economic and transport development and to cope with political impacts, which will highly influence the economic conditions in the Caspian region, three different scenarios for the development of vessel traffic in the ports of Baku/Dubendi, Aktau and Turkmenbashi have been formulated. These scenarios take account especially of the five following factors.

1. Demographic evolution: imports of food and beverages are directly correlated to this indicator.
2. Evolution of the Gross National Product (GNP): the GNP of the Caspian states mainly depends on the evolution of the energy industry, on world oil consumption and on the means which are used to solve transportation problems. According to the experts of International Financial Institutions the GNP around the Caspian Sea is forecasted to increase by 5-6 % per year for the next few years, due to the development of gas and oil exports. The import of equipment, engines and vehicles is therefore correlated with the GNP.
3. The level of competition between ports: e.g. cotton from Uzbekistan has always been a cargo that all ports of the region wanted to catch because they all consider that it is inside their hinterland. For the time being, cotton is still being exported through the Russian railways network via Riga, and it seems quite difficult to shift the route towards the Caspian ports.
4. Alternative routes: most shippers of cargo use the land corridors through Europe and Russia. The future trend is difficult to foresee.
5. Regional economies: the economic development of other Caspian and Caucasian countries is a determining factor for sea-borne trade. Today, trade between the three beneficiary states remains rather limited.

Before depicting the scenarios, the main conclusions of the past traffic analysis should be restated:

1. Ferry traffic: the ferry traffic between Turkmenbashi and Baku is essentially depending on the transport of oil products to the Caucasian countries and to the Ukraine, and of soja beans, food and beverages, as well as alumina to the east, while the cargo volumes on the ferry between Aktau and Baku are yet to evolve. In addition, the export of Uzbek and Turkmen cotton is stable and will probably not increase except if logistics conditions evolve in favour of the southern Traceca route.
2. General cargo traffic: Salt is a stable component of traffic, especially for Baku and Turkmenbashi. Machines, equipment and vehicles are the second group of important cargo. Metal is the main general cargo item for Aktau. The trade of chemicals is linked to the oil industry. The

shipment of construction material depends on the level of the demand in Azerbaijan and other Caucasian countries, shipments to Turkmenistan mainly use land corridors. Grain/wheat may become an important source of business for Aktau.

3. Oil and oil products: evolution of this trade is depending on the implementation of the future network of pipelines around 2004.

4. The future for trade on the Caspian Sea: Agreements have been or are close to be signed between Iran and Kazakhstan (for metals and wheat) on the one hand, and between Russia and Iran (for oil, metals, equipment and textile) on the other hand, which could result in a significant traffic of about 1.2 million tonnes of North-South sea-borne trade on the Caspian Sea. Such a situation would entail development of new fleets. In order to make scale savings, ship-owners might create new services calling at Aktau, Turkmenbashi, Iranian ports, Baku and Astrakhan on a regular basis. This regularity of sails might influence trade logistics and transport routes.

Optimistic Scenario

This scenario combines all favourable possible evolutions for each traffic category. In such a situation, oil and gas exports strongly increase thanks to an assumed high international demand for energy, and to construction of pipelines through neighbouring countries.

At the same time, Uzbek cotton exporters decide in 2005 to export to Mediterranean countries about 500 000 tonnes via the Caspian Sea. If they do not use containers, ferries will carry this tonnage in addition to the 100 thousand tonnes of Turkmen cotton.

The GNP in the Caspian Sea riparian states increases at a rate of 5-6% per year, even after 2004, resulting in a growth rate of income per capita of 4%; import of food and beverages increases faster than the expected demographic evolution, 3% a year, imports of equipment and vehicles increase very fast (+10%) because the investments in oil industry and in other industries create other activities for maintenance and miscellaneous businesses.

The refinery capacities around the Caspian Sea increase and the service for transport of crude oil, as well as export of products from east of the Caspian Sea to Iran and to Baku, significantly increase. The transport of tank-cars by ferry from Turkmenbashi to Baku will slightly increase.

Moreover, the creation of new shipping lines between Russia and Iran will give opportunities for ship-owners to set up triangular lines serving also the ports of Aktau, Turkmenbashi and Baku. New services will induce new general cargo traffic, currently hindered by the lack of flexibility of the ferries, that can serve only Baku, Aktau and Turkmenbashi.

Pessimistic Scenario

This scenario combines all pessimistic evolutions that may hinder traffic development. It is assumed that increases in the export of oil and gas will be restricted to low growth due to political difficulties. The export of cotton is limited to the present level, while the transport of building material increases only by 2 % because of the low development in the Caspian Sea riparian states.

Import of food and beverages increases at the pace of demographic development. Imports of equipment and vehicles evolve at a of about 4-5 for the coming few years and will drop to about 2% thereafter. Oil products are sea-borne from Turkmenbashi towards Baku and Iran only. The international demand limits the increase rate of demand to 1% a year. The current capacity of the refinery limits the export of oil products to 3 million tonnes.

Medium Scenario

This scenario is a combination of medium hypotheses for the various cargoes. In this scenario, oil and gas industries will be strongly developing after 2004 and the GDP growth rate on the long term will be about 4-4.5%.

The increasing standard of life, thanks to oil and gas revenues, will allow reduction of poverty and thus create an increase of consumption and import of food and beverages, which is estimated at 3%. After the import-boom of equipment and vehicles during the passed years of oil and gas investigation campaigns, volumes of import will grow at a cruise speed of about 3.5%.

The traffic forecast implicitly assumes that sufficient modern Aids to Navigation equipment has been installed in all ports. Consequently, the traffic forecast includes traffic volumes induced by improved navigational conditions. It is estimated that about 10% of additional port traffic can be attributed to these measures.

3.2.1 Baku/Dubendi

For purposes of the traffic forecast Baku and Dubendi are treated as one origin/destination point of the transport chain. While Baku can be seen as a universal port being able to handle almost any kind of cargo, Dubendi, as part of the Baku International Seaport, is specialised in handling crude oil and oil products. This specialisation is expected to continue up to the end of the forecasting horizon. Consequently, cargo traffic at Dubendi will be restricted to these two commodity classes.

The following quantities (in t) are expected to be shipped by rail ferry between Baku and Aktau (after rehabilitation of the rail ramp in Aktau) and Baku and Turkmenbashi:

Main Commodities	1999	2005	2010	2015	2020
Optimistic Scenario					
Diesel fuel	191,865	230,200	271,600	320,500	378,200
Cotton	94,281	104,100	122,800	144,900	171,000
Coke	80,223	96,300	113,600	134,000	158,100
Fuel	43,870	52,600	62,100	73,300	86,500
Cement	29,034	34,800	41,100	48,500	57,200
Soy beans	121,415	145,700	171,900	202,800	239,300
Aluminium + aluminium oxyd	84,806	101,800	120,100	141,700	167,200
Equipment	17,800	28,500	37,900	50,400	70,600
Others	311,911	367,200	429,000	500,500	579,500
Optimistic Sum	967,705	1,161,200	1,370,100	1,616,600	1,907,600
Pessimistic Scenario					
Diesel fuel	191,865	203,400	215,600	228,500	242,200
Cotton	94,281	92,000	97,500	103,400	109,600
Coke	80,223	85,000	90,100	95,500	101,200
Fuel	43,870	46,500	49,300	52,300	55,400
Cement	29,034	30,800	32,600	34,600	36,700
Soy beans	121,415	128,700	136,400	144,600	153,300
Aluminium + aluminium oxyd	84,806	89,900	95,300	101,000	107,100
Equipment	17,800	21,000	26,700	33,900	45,100
Others	311,911	349,500	370,500	392,700	416,300
Pessimistic Sum	967,705	1,025,800	1,087,300	1,152,600	1,221,800
Medium Scenario					
Diesel fuel	191,865	214,900	240,700	269,600	302,000
Cotton	94,281	97,200	108,900	122,000	136,600
Coke	80,223	89,800	100,600	112,700	126,200
Fuel	43,870	49,100	55,000	61,600	69,000
Cement	29,034	32,500	36,400	40,800	45,700
Soy beans	121,415	136,000	152,300	170,600	191,100
Aluminium + aluminium oxyd	84,806	95,000	106,400	119,200	133,500
Equipment	17,800	28,500	34,500	43,800	50,800
Others	311,911	369,300	413,600	463,200	518,800
Medium Sum	967,705	1,083,800	1,213,900	1,359,700	1,522,900

Table 3-9: Forecast of Cargo Volumes for the Ferry Terminal in Baku

Taking into account the maximum capacity of the ferry currently sailing between Aktau and Baku, an average capacity utilisation of 70% (giving enough room for accommodating peak load traffic), and the highly imbalanced nature of the traffic, it is expected that the calculated volumes for the Medium Scenario are requiring an extension of the current ferry schedule from one to two round trips per week, in case of the Optimistic Scenario even three round trips will be required, in order to cope with the relatively high empty vehicle quota. Consequently, about 100-150 annual ferry arrivals from Aktau are projected for Baku.

Taking into account the maximum capacity of the ferry currently sailing between Turkmenbashi and Baku and an average capacity utilisation of 70% (giving enough room for accommodating peak load traffic), it is expected that the calculated volumes for all scenarios can barely be transported with the existing about 400 round trips per year even in the pessimistic scenario. The optimistic scenario would call for about 600 round trips a year.

All in all, Baku is likely to experience ferry traffic of between about 600 and 800 arrivals/departures per year.

With respect to non-ferry traffic, Baku/Dubendi is expected to handle the following cargo volumes in 2005, 2010, 2015 and 2020.

Main Commodities	1999	2005	2010	2015	2020
Optimistic Scenario					
Crude oil	2,542,982	4,683,790	5,698,546	6,606,177	7,293,753
Mineral products		2,274,983	2,767,865	3,208,714	3,542,680
Salt	36,000	42,893	47,357	52,286	57,729
Sulphur	0	18,896	26,502	33,824	37,345
Cement	14,500	19,144	23,292	27,002	29,812
Others	8,000	11,375	13,839	16,044	17,713
Optimistic Sum	**2,601,482**	**7,051,081**	**8,577,402**	**9,944,047**	**10,979,032**
Pessimistic Scenario					
Crude oil	2,542,982	4,057,459	4,479,763	4,946,020	5,460,806
Mineral products		1,970,766	2,175,885	2,402,353	2,652,391
Salt	36,000	40,851	45,103	49,797	54,980
Sulphur	0	16,873	20,529	23,798	26,275
Cement	14,500	17,389	19,199	20,178	20,178
Others	8,000	10,342	11,989	13,236	13,912
Pessimistic Sum	**2,601,482**	**6,113,680**	**6,752,467**	**7,455,383**	**8,228,543**
Medium Scenario					
Crude oil	2,542,982	4,361,637	5,056,332	5,720,776	6,316,199
Mineral products		1,970,766	2,284,658	2,648,545	3,070,389
Salt	36,000	42,893	49,725	57,645	66,826
Sulphur	0	17,865	22,801	27,741	30,628
Cement	14,500	18,250	21,157	24,526	25,777
Others	8,000	10,848	13,199	15,301	16,893
Medium Sum	**2,601,482**	**6,422,259**	**7,447,872**	**8,494,534**	**9,526,713**

Table 3-50: Forecast of Non-Ferry Cargo Volumes for the Port of Baku

The following table presents the number and average size of vessels calling at Baku. The figures are directly derived from the cargo volumes by assumptions on the type of vessel and the average size of shipments.

Number of Vessels	Type	Av. Size	1999	2005	2010	2015	2020
Optimistic Scenario							
Crude oil	Tanker	7000	390	669	814	944	1024
Mineral products	Tanker	5000	320	455	554	642	709
Salt	Multi purpose ves.	3000	12	14	16	17	19
Sulphur	Multi purpose ves.	3000	0	14	16	17	19
Cement	Multi purpose ves.	3000	5	6	8	9	10
Others	Multi purpose ves.	1500	3	4	5	5	6
Optimistic Sum			*703*	*1,155*	*1,405*	*1,629*	*1,798*
Ferries			*407*	*442*	*572*	*572*	*780*
Total			***1,110***	***1,597***	***1,977***	***2,201***	***2,578***
Pessimistic Scenario							
Crude oil	Tanker	7000	390	580	640	707	780
Mineral products	Tanker	5000	320	394	435	480	530
Salt	Multi purpose ves.	3000	12	7	7	7	7
Sulphur	Multi purpose ves.	3000	0	3	4	5	5
Cement	Multi purpose ves.	3000	5	3	4	4	4
Others	Multi purpose ves.	1500	3	3	3	3	3
Pessimistic Sum			*703*	*1,002*	*1,107*	*1,223*	*1,349*
Ferries			*407*	*442*	*520*	*520*	*624*
Total			***1,110***	***1,444***	***1,627***	***1,743***	***1,973***
Medium Scenario							
Crude oil	Tanker	7000	390	623	722	817	902
Mineral products	Tanker	5000	320	394	457	530	614
Salt	Multi purpose ves.	3000	12	7	7	7	7
Sulphur	Multi purpose ves.	3000	0	4	5	6	6
Cement	Multi purpose ves.	3000	5	4	4	5	5
Others	Multi purpose ves.	1500	3	3	3	3	3
Medium Sum			*703*	*1,047*	*1,215*	*1,389*	*1,563*
Ferries			*407*	*442*	*546*	*546*	*676*
Total			***1,100***	***1,489***	***1,761***	***1,935***	***2,239***

Table 3-11: Vessel Traffic Forecast for Baku/Dubendi

3.2.2 Aktau

Taking into account the results of the TRACECA Traffic and Feasibility Studies: Module C, Final Report, in which a traffic forecast for the ferry terminal of the Port of Aktau has been generated the Consultants have elaborated a vessel traffic forecast of ACSP as a whole with a time horizon up to 2020.

In the near future, ACSP expects to handle significant quantities of sulphur, since in the near-by Kazakh Tengiz oil field considerable amounts of sulphur as by-products of oil producing are gener-

ated. This commodity may be shipped to Azerbaijan as input factor for the Azeri chemical industry as well as to Africa as a base for the fertiliser production.

The market analyses carried out within the frame of the a.m. Module C and Module B: New Caspian Shipping Services (of the same TRACECA study) lead to the following maximum market potential for ACSP:

Products	Routes	Annual Quantities
Crude oil	Export via Aktau Port	up to 4,000,000 t
Oil industry equipment	Import via Baku Port	10,000 t (of which 40% containerised)
Drilling mud	Import via Baku Port	1,200 t
Sulphur	Export to Azerbaijan	10,000 to 15,000 t
Cotton	Export from Uzbekistan to Baku Port	50,000 t
Fresh and deep frozen food	Import via Baku Port	20,000 to 40,000 t
Grain	Export to Iran	up to 200,000 t
Metal	Export to Iran	700,000 t
Ores	Export to Iran	200,000 t

Table 3-62: Market Potential for the Port of Aktau

The following quantities (in t) are expected to be shipped by rail ferry (after successful rehabilitation of the rail ramp).

Main Commodities	2005	2010	2015	2020
Optimistic Scenario				
Sulphur (ex)	11,000	15,400	21,600	30,200
Cotton (ex)	10,500	14,700	20,600	28,800
Mud for oil industry (im)	1,200	1,400	1,700	2,400
Equipment (im)	28,500	37,900	50,400	70,600
Food & construction (im)	21,000	27,900	37,100	51,900
Other (ex+im)	18,800	25,000	33,300	46,600
Optimistic Sum	91,000	122,300	164,700	230,500
Pessimistic Scenario				
Sulphur (ex)	7,000	8,100	9,400	12,500
Cotton (ex)	0	0	0	0
Mud for oil industry (im)	1,200	1,400	1,600	2,100
Equipment (im)	21,000	26,700	33,900	45,100
Food & construction (im)	13,800	16,000	18,600	24,700
Other (ex+im)	4,200	4,900	5,700	7,600
Pessimistic Sum	47,200	57,100	69,200	92,000
Medium Scenario				
Sulphur (ex)	10,500	12,700	16,100	18,700
Cotton (ex)	10,500	12,700	16,100	18,700
Mud for oil industry (im)	1,200	1,500	1,900	2,200
Equipment (im)	28,500	34,500	43,800	50,800
Food & construction (im)	16,400	19,800	25,100	29,100
Other (ex+im)	4,900	5,900	7,500	8,700
Medium Sum	72,000	87,100	110,500	128,200

Table 3-13: Forecast of Cargo Volumes Handled at Aktau Ferry Terminal

Taking into account the maximum capacity of the ferry currently sailing between Aktau and Baku, an average capacity utilisation of 70% (giving enough room for accommodating peak load traffic), and the highly imbalanced nature of the traffic, it is expected that the calculated volumes for the Medium Scenario are requiring an extension of the current ferry schedule from one to two round trips per week, in case of the Optimistic Scenario even three round trips will be required, in order to cope with the relatively high empty vehicle quota. Consequently, about 100-150 annual ferry arrivals are projected for ACSP.

With respect to non-ferry traffic, ACSP is expected to handle the following cargo volumes in 2005, 2010, 2015 and 2020.

Main Commodities	1999	2005	2010	2015	2020
Optimistic Scenario					
Crude oil	2,066,751	3,649,959	4,440,733	5,148,026	5,967,974
Grain	9,000	44,555	59,625	72,543	88,259
Sulphur	0	18,896	26,502	33,824	43,169
Oil equipment	3,000	5,000	5,000	5,000	5,000
Metall	235,000	811,492	940,741	1,090,577	1,264,278
Others	38,000	60,220	73,267	84,937	98,465
Optimistic Sum	**2,351,751**	**4,590,122**	**5,545,868**	**6,434,907**	**7,467,145**
Pessimistic Scenario					
Crude oil	2,066,751	3,477,822	3,839,797	4,239,446	4,680,691
Grain	9,000	19,326	21,338	23,558	26,010
Sulphur	0	17,364	21,126	24,491	28,392
Oil equipment	3,000	5,000	5,000	5,000	5,000
Metall	235,000	735,707	773,235	812,678	854,133
Others	38,000	52,167	57,597	63,592	70,210
Pessimistic Sum	**2,351,751**	**4,307,387**	**4,718,093**	**5,168,766**	**5,664,437**
Medium Scenario					
Crude oil	2,066,751	3,563,059	4,130,562	4,673,352	5,287,468
Grain	9,000	29,860	34,616	40,129	46,521
Sulphur	0	17,364	22,162	28,285	36,099
Oil equipment	3,000	5,000	5,000	5,000	5,000
Metall	235,000	772,857	853,296	942,108	1,040,163
Others	38,000	52,167	60,476	70,109	81,275
Medium Sum	**2,351,751**	**4,440,307**	**5,106,112**	**5,758,982**	**6,496,526**

Table 3-14: Forecast of Non-Ferry Cargo Volumes Handled at the Port of Aktau

The following table presents the number and average size of vessels calling at the ACSP. The figures are directly derived from the cargo volumes by assumptions on the type of vessel and the average size of shipments.

Number of Vessels	Type	Av. Size	1999	2005	2010	2015	2020
Optimistic Scenario							
Crude oil	Tanker	7500	276	487	592	686	796
Grain	Multi purpose ves.	3000	3	15	20	24	29
Sulphur	Multi purpose ves.	3000	0	6	9	11	14
Oil equipment	Multi purpose ves.	2500	1	2	2	2	2
Metall	Multi purpose ves.	4000	59	203	235	273	316
Others	Multi purpose ves.	1500	19	30	37	42	49
Optimistic Sum			*358*	*743*	*895*	*1,039*	*1,207*
Ferries			*17*	*52*	*104*	*104*	*156*
Total			***375***	***795***	***999***	***1,143***	***1,363***
Pessimistic Scenario							
Crude oil	Tanker	7500	276	464	512	565	624
Grain	Multi purpose ves.	3000	3	6	7	8	9
Sulphur	Multi purpose ves.	3000	0	6	7	8	9
Oil equipment	Multi purpose ves.	2500	1	2	2	2	2
Metall	Multi purpose ves.	4000	59	184	193	203	214
Others	Multi purpose ves.	1500	19	26	29	32	35
Pessimistic Sum			*358*	*688*	*750*	*818*	*893*
Ferries			*17*	*52*	*52*	*52*	*52*
Total			***410***	***740***	***802***	***870***	***945***
Medium Scenario							
Crude oil	Tanker	7500	276	475	551	623	705
Grain	Multi purpose ves.	3000	3	10	12	13	16
Sulphur	Multi purpose ves.	3000	0	6	7	9	12
Oil equipment	Multi purpose ves.	2500	1	2	2	2	2
Metall	Multi purpose ves.	4000	59	193	213	236	260
Others	Multi purpose ves.	1500	19	26	30	35	41
Medium Sum			*358*	*712*	*815*	*918*	*1,035*
Ferries			*17*	*52*	*104*	*104*	*104*
Total			***375***	***764***	***919***	***1,022***	***1,139***

Table 3-15: Forecast of the Number of Vessels Calling at the Port of Aktau

3.2.3 Turkmenbashi

Taking into account the results of the TRACECA Traffic and Feasibility Studies: Module D, Final Report, in which a traffic forecast for the Port of Turkmenbashi has been generated the Consultants have elaborated a vessel traffic forecast for the port as a whole with a time horizon up to 2020.

The following quantities (in t) are expected to be shipped by rail ferry between Baku and Turkmenbashi:

Main Commodities	2005	2010	2015	2020
Optimistic Scenario				
Diesel fuel	230,200	271,600	320,500	378,200
Cotton	104,100	122,800	144,900	171,000
Coke	96,300	113,600	134,000	158,100
Fuel	52,600	62,100	73,300	86,500
Cement	34,800	41,100	48,500	57,200
Soy beans	145,700	171,900	202,800	239,300
Aluminium + aluminium oxyd	101,800	120,100	141,700	167,200
Others	304,700	344,600	386,200	419,600
Optimistic Sum	***1,070,200***	***1,247,800***	***1,451,900***	***1,677,100***
Pessimistic Scenario				
Diesel fuel	203,400	215,600	228,500	242,200
Cotton	92,000	97,500	103,400	109,600
Coke	85,000	90,100	95,500	101,200
Fuel	46,500	49,300	52,300	55,400
Cement	30,800	32,600	34,600	36,700
Soy beans	128,700	136,400	144,600	153,300
Aluminium + aluminium oxyd	89,900	95,300	101,000	107,100
Others	302,300	313,400	323,500	324,300
Pessimistic Sum	***978,600***	***1,030,200***	***1,083,400***	***1,129,800***
Medium Scenario				
Diesel fuel	214,900	240,700	269,600	302,000
Cotton	97,200	108,900	122,000	136,600
Coke	89,800	100,600	112,700	126,200
Fuel	49,100	55,000	61,600	69,000
Cement	32,500	36,400	40,800	45,700
Soy beans	136,000	152,300	170,600	191,100
Aluminium + aluminium oxyd	95,000	106,400	119,200	133,500
Others	297,300	326,500	352,700	390,600
Medium Sum	***1,011,800***	***1,126,800***	***1,249,200***	***1,394,700***

Table 3-76: Forecast of Cargo Volumes Handled at Turkmenbashi Ferry Terminal

Taking into account the maximum capacity of the ferry currently sailing between Turkmenbashi and Baku and an average capacity utilisation of 70% (giving enough room for accommodating peak load traffic), it is expected that the calculated volumes for the Medium Scenario can barely be transported with the existing about 400 round trips per year even in the pessimistic scenario. In the optimistic scenario more than 600 ferry round trips will be required to accommodate the forecasted cargo volumes

With respect to non-ferry traffic, Turkmenbashi Port is expected to handle the following cargo volumes in 2005, 2010, 2015 and 2020.

Main Commodities	2005	2010	2015	2020
Optimistic Scenario				
Crude oil	787,000	912,000	1,057,000	1,057,000
Mineral products	2,950,000	3,420,000	3,965,000	4,000,000
Construction materials	45,500	58,000	65,300	70,700
Salt	63,800	73,900	88,300	99,300
Others	103,700	138,200	156,000	178,800
Optimistic Sum	*3,950,000*	*4,602,100*	*5,331,600*	*5,405,800*
Pessimistic Scenario				
Crude oil	742,000	780,000	795,000	795,000
Mineral products	2,782,000	2,924,000	3,000,000	3,000,000
Construction materials	44,200	48,800	53,800	59,400
Salt	58,200	63,300	68,900	75,000
Others	77,600	85,500	94,200	103,700
Pessimistic Sum	*3,704,000*	*3,901,600*	*4,011,900*	*4,033,100*
Medium Scenario				
Crude oil	764,000	795,000	795,000	795,000
Mineral products	2,865,000	3,000,000	3,000,000	3,000,000
Construction materials	45,500	58,000	64,100	70,700
Salt	60,600	70,300	81,400	94,400
Others	101,000	117,900	138,600	156,600
Medium Sum	*3,836,100*	*4,041,200*	*4,079,100*	*4,116,700*

Table 3-17: Forecast of Non-Ferry Cargo Volumes Handled at the Port of Turkmenbashi

The following table presents the number and average size of vessels calling at the Turkmenbashi. The figures are directly derived from the cargo volumes by assumptions on the type of vessel and the average size of shipments.

Number of Vessels	Type	Av. Size	2005	2010	2015	2020
Optimistic Scenario						
Crude oil	Tanker	5000	164	190	220	220
Mineral products	Tanker	5000	738	855	991	1,000
Dry cargo	Multi purpose vessel	1000	194	246	281	317
Optimistic Sum			*1096*	*1291*	*1492*	*1537*
Ferries			*390*	*468*	*468*	*624*
Total			**1486**	**1759**	**1960**	**2161**
Pessimistic Scenario						
Crude oil	Tanker	5000	155	162	166	166
Mineral products	Tanker	5000	695	731	750	750
Dry cargo	Multi purpose vessel	1000	164	180	197	216
Pessimistic Sum			*1014*	*1073*	*1113*	*1132*
Ferries			*390*	*416*	*416*	*468*
Total			**1404**	**1489**	**1529**	**1600**
Medium Scenario						
Crude oil	Tanker	5000	159	166	166	166
Mineral products	Tanker	5000	716	750	750	750
Dry cargo	Multi purpose vessel	1000	188	224	258	292
Medium Sum			*1063*	*1140*	*1174*	*1208*
Ferries			*390*	*442*	*442*	*520*
Total			**1453**	**1582**	**1616**	**1728**

Table 3-18: Forecast of the Number of Vessels Calling at the Port of Turkmenbashi

4 Technical Analysis

4.1 Status Quo Analysis of Aids to Navigation Equipment and Proposed Measures

The Consultants have conducted on-site investigations in Baku, Dubendi, Aktau and Turkmenbashi, the main objective being to evaluate the existing equipment and to propose measures improving the navigational safety in Caspian ports. The latter includes also the identification of potential savings with respect to equipment and rehabilitation by replacement of existing installations with higher-ranking material. Consequently, not every item that was found to be missing or out of order needs to be replaced (for pictures visualising and supporting the following analysis see Annex 5).

4.1.1 Baku

General

This area is not only used by vessels visiting the main cargo handling installations but to a great extend by offshore oilfields-related activities. The 50 nm approach to Baku International Seaport consists of a traffic separation scheme with four roundabouts. In the approach, courses must be changed five times and navigation is rather difficult due to shallows near the fairway and low, sandy shore areas, giving bad radar echoes.

The aids to navigation along the passage are insufficient and in a very poor condition. A great number of light buoys are extinguished, the lights are broken, radar reflectors have disappeared, top marks are missing, the buoys' colouring and identification marks (both important for correct identification) are unrecognisable.

The Port Control Centre, that is responsible for surveillance of traffic, navigational advice and traffic control, is unable to perform its tasks. It is in an unfavourable location with only a restricted view of the Baku Bay area, it does not have binoculars, it does not possess workable radar equipment (even if the equipment would be operational, it could not serve its purpose today because of its age and technical obsolescence), it lacks GMDSS VHF, medium wave and Inmarsat equipment, and its present VHF, distress and other communication equipment is obsolete and of poor condition.

Auxiliary vessels (pilot boat, tugs, etc) also lack appropriate navigational equipment.

Facilities and materials for environmental protection are not available, the same is true for safety and fire fighting installations.

Buoys in Baku Port

According to official nautical charts in the area close to the major berths of BISP are normally placed 16 buoys, of which the Consultants could only find 11.

Name	Navigation buoys on dredged channel
Owner	Caspian Seaways
Location	Baku Bay, access to ferry terminal, berths 10 and 20 for tankers, and new tanker terminal
Body	Steel
Power supply	Batteries
Lighting system	Lamps with transmitter and batteries
Condition	The bodies of all buoys are in bad order and condition. Top marks, signs, cables, switchboxes, batteries, transmitters and lamps in bad condition, but working. Some are not identifiable with respect to starboard and port side buoy due to deep corrosion and missing colour Five buoys are missing.
Important works to do	All buoys should be replaced with new high-ranking buoys, which could reduced the number of required buoys to 13.

Buoys and Sea Marks in Baku Approach

Most of the buoys and seamarks annotated in nautical charts are missing. Of the existing buoys the majority is not in working condition.

Name	Navigation buoys in Baku Approach (route from the Caspian Sea to Baku Bay)
Owner	Hydrographic Service of Navy
Location	South of the peninsula Apsheron
Body	Steel
Power supply	Batteries
Lighting system	Lamps with transmitter and batteries
Condition	The bodies of all buoys are in bad condition. Top marks, signs, cables, switchboxes, batteries, transmitters and lamps are in bad condition. Most of the buoys are not working. Some are not identifiable with respect to starboard and port side buoy due to deep corrosion and missing colour. Some buoys are missing. The lights of most of the seamarks (located on old drilling platforms) are out of order.
Important works to do	Remove all existing buoys and mark only the Traffic Separation Scheme with seven mid-channel buoys. These buoys should be fitted with lights, solar cells, radar reflector and Racon. It is suggested to mark in this area only the four roundabouts and one way point for altering course in the Traffic Separation Scheme.

Maintenance and repair, and buoy laying vessel

Caspian Seaways manages a maintenance and repair area in port South Cape, west side of Baku Bay and possesses two buoy laying vessels (in fact, two old tugboats are available for maintenance and repair).

In the repair yard there exist only two old buoys (without lights and batteries) for replacement. In addition, anchor chains with bridges as mooring lines and two moulds to prepare cement sinkers are available. Tools and some replacement lamps are stored of one of the little buoy laying vessels, which is not in good condition. A shore based workshop is not available.

Owner	Caspian Seaways
Location	South Cape, west side of Baku Bay
Important works to do	1. GPS for one of the buoy laying vessel, 2. tool set for maintenance and repair and set of spare parts (shore based) 3. a tool set for maintenance and repair and set of spare parts (vessel based)

Port Control Centre (PCC) and Harbour Master's Office, Baku

In Baku the Deputy Harbour Master is in charge of the PCC operations. Usually two operators are surveying and advising the vessel traffic in the port area, the Baku Bay and the Baku Bay entrance. In case of emergency and distress the PCC takes over command and organises the co-operation with other institutions and organisations. Under the present conditions the PCC is not adequately equipped to take over the required responsibilities. The existing equipment is very poor, partly not workable, and in any case insufficient.

Owner	Administration of Baku International Sea Port
Location of PCC and Harbour Master's Office	Northern part of Baku Bay, near ferry terminal Building of port administration
Important works to do, equip with:	1. Computer equipment 2. GMDSS and wireless equipment 3. Nautical equipment 4. Radar set with ARPA

Leading Lights Baku Port

In Baku Port there are three Leading Lights systems. Two of them are out of order/missing. Only the system directing the way to the tanker area of berth 20 is working.

Name	Leading lights berth 20
Owner	Caspian Seaways
Year of built	Beginning of 1960s
Location	Baku Bay, berth 20
Body	Lattice towers with planks
Power Supply	Shore power station
Lighting system	Transmitter
Bulb	220 Volt
Condition	The lattice towers are in normal condition. Cables and switchboxes are old and in bad condition, but working
Important works to do	No need for instant action

Beacon Tower "Puta"

Name	Beacon Puta
Owner	Hydrographic Service of Navy
Year of built	1950
Location	West of Baku Bay
Body	Lay bricks (sand limestone)
Power Supply	Shore power station, free air cable from nearby estate
Lighting system	Lamp with transmitter
Bulb	220 Volt
Condition	The body are in normal order and condition. The steel access ladder, cables, all switchboxes, transmitter and lamp are in bad order and condition, but working. A reserve lamp has been installed.
Important works to do	No need for instant action

Beacon Tower "Shikhov"

Name	Shikhov
Owner	Hydrographic Service of Navy
Year of built	1951
Location	South western part of Baku Bay, South Cape
Body	Lay bricks (sand limestone)
Power Supply	Presently no power supply, before electricity was supplied by a nearby estate
Lighting system	Lamp with transmitter
Bulb	20 Volt
Condition	The body is in bad condition. The steel ladder, cables, all switch-boxes, transmitter and lamp are missing.
Important works to do	Renewal of lamp, transmitter and cable

Beacon Tower "Shakhova Kosa"

Due to the rising of the Caspian Sea water level maintenance of the beacon is very difficult. Access is only possibly by small boat and under good weather condition.

Name	Shakhova Kosa
Owner	Hydrographic Service of Navy
Year of built	1951
Location	Southern part of peninsula Apsheron, east of Baku Bay
Body	Lattice tower with planks
Power Supply	Presently no connection to power supply
Lighting system	Lamp with transmitter
Bulb	20 Volt
Condition	The body is in bad order and condition. Cables, all switchboxes, transmitter and lamp are missing.
Important works to do	Installation of a radar reflector

Lighthouse Pirallahi

Name	Pirallahi
Owner	Hydrographic Service of Navy Azerbaijan
Year of built	1860
Location	South-east of Dubendi
Body	Stone
Power Supply Generator Batteries	Shore power station No generator For emergency case
Lighting system	Transmitter
Bulb	500 Watt, 220 Volt
Condition	The body is in good order and condition and inside well painted. Outside no protective coating. The cables, all switchboxes and the transmitter are old and in bad order and condition.
Important works to do	Installation of a new transmitter

Lighthouse Narjin

Name	Narjin
Owner	Hydrographic Service of Navy Azerbaijan
Year of built	1884
Location	South of Baku Bay, Island Boyuk Zira
Body	Stone
Power Supply Generator Batteries	No shore power station Three generators no
Lighting system	No transmitter, revolving system
Bulb	250 Watt, 32 Volt
Fog whistle	Not available
Condition	The body is from the outside and inside in bad order and condition. The cables, all switchboxes and the photocells are old and in bad order and condition. One of the generators is out of order.
Important works to do	No need for instant action

Lighthouse Djilov

Name	Djilov
Owner	Hydrographic Service of Navy Azerbaijan
Year of built	1879
Location	Island Djilov, west of peninsula Apsheron
Body	Stone
Power Supply Generator Batteries	Shore power station Two generators 144 units
Lighting system	No transmitter, revolving system
Bulb	110 Volt, 500 Watt
Fog whistle	Existing, but out of order. Powered by one generator
Condition	The body is from the outside and inside in good order and condition. The cables, all switchboxes are old and in bad order and condition. Photocells are not available, steering by hand One of the generators is out of order.
Important works to do	No need for instant action

Lighthouse Shuvalan

Name	Shuvalan
Owner	Hydrographic Service of Navy Azerbaijan
Year of built	1907
Location	North-west of Dubendi
Body	Stone
Power Supply Generator Batteries	Shore power station Two generators No
Lighting system	Transmitter
Bulb	220 Volt
Fog whistle	Existing, but out of order
Condition	The body is in normal order and condition. The cables, all switchboxes and the transmitter are old and in bad order and condition. One of the generators is out of order
Important works to do	Installation of new transmitter

4.1.2 Dubendi

General

The aids to navigation of the approach channel are in a very bad condition, though the light buoys are all working, while the approach leading lights are out of order.

The Port Control Office lacks even the most basic equipment and is not able to perform its tasks. On the other hand, approaching the harbour at night is very difficult at normal conditions, but in particular in windy conditions, where occasionally a dangerous ground swell runs. In very windy weather, with wind speeds over 17 m/sec which occurs about 30 days a year, the port is entirely closed for navigation.

The port installations are in a derelict condition, facilities and materials for environmental protection and fire fighting are damaged, totally disintegrating or non-existent. Even basic safety precautions concerning cargo handling are violated: neither emergency fire wires on the vessel for towing were rigged nor bonding wires as earth were used during discharge, neither spark-proof tools were used by the crew nor did they wear anti-static safety shoes and other protective clothing, and also the obligatory insulation flanges on the oil discharging arms could nowhere be found.

Acknowledging that the oil terminal handles about 250,000 tonnes of oil per month, the present conditions are clearly inviting casualties and disasters.

Buoys in Dubendi Approach

Of the six buoys marked in sea charts four are missing, two in bad condition.

Name	Navigation buoys on Dubendi Approach (route from the Caspian Sea to Dubendi Port)
Owner	Hydrographic Service of Navy
Location	North-east area of peninsula Apsheron
Body	Steel
Power Supply	Batteries
Lighting system	Lamps with transmitter and batteries
Condition	The bodies of two buoys are in bad order and condition, severely corroded and in lack of paint. Top marks, signs, cables, all switchboxes, batteries, transmitters and lamps are also in bad condition. The lamps of the buoys are working. Four buoys are missing.
Important works to do	The last two buoys will be de-installed. Four new high-ranking buoys equipped with lights, solar cells, radar reflector and one with Racon should be sufficient to re-establish navigational safety in the Dubendi Approach

Dubendi Port Entrance

All ten buoys marked in sea charts are in bad order and condition. Officials record that the lights all working well.

Name	Navigation buoys on Dubendi Port entrance.
Owner	Caspian Seaways
Location	Port entrance
Body	Steel
Power Supply	Batteries
Lighting system	Lamps with transmitter and batteries
Condition	The bodies of all buoys are in bad order and condition, severely corroded and in lack of paint. Top marks, signs, cables, all switchboxes, batteries, transmitters and lamps are also in bad condition.
Important works to do	Replacement of the ten existing buoys by eight new high-ranking buoys, equipped with solar cells, lamps, top marks, signs, radar reflector.

Port Control Centre (PCC), Dubendi

In Dubendi the Deputy Harbour Master of Baku is in charge of the PCC operations. Usually one operators are surveying and advising the vessel traffic in the port area and port access, the Baku Bay and the Baku Bay entrance. In case of emergency and distress the PCC takes over command and organises the co-operation with other institutions and organisations. Under the present conditions the PCC is not adequately equipped to take over the required responsibilities. The existing equipment is very poor, partly not workable, and in any case insufficient.

Owner	Administration of Baku International Sea Port
Location of PCC	Port Dubendi, administration building
Important works to do, equip with:	1. Office equipment 2. GMDSS and wireless equipment 3. Nautical equipment 4. Radar set with ARPA

Leading Lights Dubendi

In the Dubendi area there exists one leading light systems, which is out of order. It belongs to the Azerbaijan Oil Company Azneftyag. After finishing the construction of Dubendi port in the 1970s, the oil company wanted to transfer responsibility for this system to Caspian Seaways, but Caspian Seaways refused due to insufficient infrastructural access to the installations, hindering an efficient maintenance & repair service.

Name	Leading lights Dubendi
Owner	Azneftyag (Oil Company)
Year of built	In the 1970s
Location	NW of light house Pirallahi
Body	Lattice towers with planks
Power Supply	In former times shore power station
Lighting system	Transmitter
Bulb	220 Volt
Condition	The bodies are in normal order and condition. The cables, all switch-boxes, the transmitters and also the lamps are missing
Important works to do	Against the backdrop of new high-ranking buoys the rehabilitation of the leading light system is of second priority.

4.1.3 Aktau

General

The approach channel from the fairway buoy to the port is about 3.2 nm, of which 1.8 nm are dredged as approach channel. The buoys in the channel are painted properly and fitted with top-marks, lights, sun collectors and radar reflectors, but the landfall buoy is not fitted with Racon. The buoys are moored well and appear to be in good order and condition. The leading lights are new and working well.

Due to national security reason, the lighthouse in Aktau City cannot be inspected by foreign ex-perts. From outside, the building and equipment seems to be in workable condition. According to port officials the lighthouse is operating reliably.

A workshop for maintenance and repair of the buoys and leading lights is presently not estab-lished. A buoy laying vessel is not available, but also not necessary, since a tug boat is available.

Two oil berths are located at the lee side of the port's breakwater. These berths are presently not in use. Due to the raising sea level of the Caspian Sea, the breakwater is too low in the water and does not offer sufficient protection anymore. All installations on these berths seem to be damaged or corroded by seawater, including the fire fighting and pollution combating units.

Buoy System

Owner	Aktau Commercial Sea Port
Location	Port Aktau, harbour entrance
Body	Plastics
Power supply	Solar cells
Condition:	All buoys are new and equipped with latest technology, a repair yard dedicated for M&R of buoys is missing
Important works to do, equip with:	1. Equip the landfall buoy with racon 2. Container for repair yard 3. Tool set for maintenance and repair 4. Spare parts

PCC Aktau

The Port Control Centre is adequately equipped by today's international standards (incl. GMDSS and satellite telex), but the PCC has restricted oversight over the port, no radar and no binoculars.

Owner	Aktau Commercial Sea Port
Location of PCC	Port Aktau, administration building
Important works to do, equip with	1. Radar with ARPA and antenna 2. INMARSAT 3. Nautical equipment (binoculars, barometer, etc.) 4. Office equipment

4.1.4 Turkmenbashi

The port is reached via a 15 nm approach channel. After passing through an area of wrecks and entering the channel, vessels have to pass between a peninsular and an island. In the approach, the lighted beacon, one on the peninsula and the other on the island Kosa are missing since 1991. The leading lights are in very poor condition, some of them are extinguished. The light buoys in the channel are in a similar condition, most of them are extinguished, their solar batteries broken, their top marks and radar reflectors missing. Also, their colouring and their distinguishing marks are indiscernible.

It appears that there is no equipment or materials for fire fighting, safety and environmental protection.

Buoy System

According to sea charts, Turkmenbashi Port, Turkmenbashi Entrance and the approach channel should be equipped with 39 buoys. The Consultants found that 9 buoys are missing and 5 buoys are completely out of order.

Name	Turkmenbashi Port approach, port access and port area
Owner	Port of Turkmenbashi
Location	Bay approach, Bay and harbour
Body	Steel
Power Supply	6V Batteries
Lighting system	Lamps with transmitters and batteries
Condition	The bodies of all buoys are in bad order and condition, severely corroded and in lack of paint. Top marks, signs, cables, all switchboxes, batteries, transmitters and lamps are also in bad order and condition.
Important works to do, Equip with	1. Equip the landfall buoy with racon 2. Replacement of some existing buoys by 16 new high-ranking buoys, equipped with solar cells, lamps, top marks, signs, and radar reflector 3. GPS for buoy laying vessel 4. Tool set for maintenance and repair (shore based) 5. Spare parts (shore based) 6. Tool set for maintenance and repair (vessel based) 7. Spare parts (vessel based)

Port Control Centre

The Port Control Centre consists of narrow office on top of a two storey building near the waterfront. It lacks all the basic equipment. There is neither a radar for surveillance and traffic control, nor binoculars for visual observation, nor GMDSS, VHF and MW equipment for ship-shore communication. Under these conditions, vessels cannot approach the port nor leave it during darkness, and vessels normally await daylight hours for such activities.

Further navigational hazards are conditions of high wings, about 75 to 90 days per year, where the wind speed exceeds 17 m/sec (Beaufort 7). This is especially dangerous for high-board vessels (like the ferries) that tend to "sail" and need to maintain considerable speed in the fairway to keep the vessel steerable.

It is planned to transfer the PCC to the top floor of a new four-storey building to be finalised in summer 2002. It is expected that this will significantly improve PCC operators' oversight over the port and bay area.

Owner	Port of Turkmenbashi
Location	Port of Turkmenbashi, building near administration building, third floor
Important works to do, fit out with	Radar set with ARPA Nautical equipment GMDSS and wireless equipment Office equipment

Leading light system

Three leading lights systems (five shore-based towers, five off-shore towers) are reported

Name	Leading lights to berths
Owner	Port of Turkmenbashi
Location	Turkmenbashi Bay
Body	Steel construction (lattice towers)
Power supply	Shore based towers with shore power supply, off-shore towers are powered by batteries
Lighting system	Lanterns with transmitter
Condition	One of the off-shore towers is damaged and one is missing, consequently outgoing vessels have no leading lines. The existing towers are deeply corroded, the wooden identification boards have lost their colour and consequently their daylight visibility is seriously reduced, especially at Ufra approach. The shore-based leading lines are correctly operating at night with red and green lights respectively .
Important works to do, fit out with	No immediate action necessary since off-shore towers will be superfluous after the installation of the new buoy system. Of second priority is the rehabilitation of the bodies of the existing shore-based towers and which should be equipped with new lamps and transmitters.

4.2 Proposal for New Aids to Navigation Equipment

4.2.1 Baku/Dubendi

Item	Units
Buoys with marks, top sign, radar reflector, lamp and solar cell	35
Spare buoys	4
GPS for one support/buoy laying vessel	2
Workshop container for AtoN repair	2
Tool set for maintenance and repair (shore based)	2
Spare parts (shore based)	2
Tool set for maintenance and repair (vessel based)	2
Spare parts (vessel based)	2
PC with modem, MS- Windows compatible OS, MS-Office compatible software, 17" colour monitor, UPS, laser printer A4, CD writer for back-up	3

Telefax machine, normal paper	3
Desk + office chair	3
Copy machine, black and white, A3, incl. cartridge	1
VHF handheld radio with sea frequencies, with charger	5
VHF/MW transmitter and receiver (set)	3
Binoculars	3
Barometer, thermometer, watch (set)	3
Radar with ARPA and antenna	2
GMDSS VHF/MW decoder	2
INMARSAT station	2
Equipment for wind velocity and direction	3
Voice recorder	2
Racon (radar beacon transponder)	7
Lantern with solar module for beacons	2
Solar module for shore based lights	2
Radar reflector	1

4.2.2 Aktau

Radar with ARPA and antenna	1
Racon	1
Spare buoys	2
INMARSAT	1
GPS receiver for buoy syncronisation	2
Container for repair yard	1
Tool set for maintenance and repair (shore based)	1
Set of spare parts, incl two buoys (shore based)	1
Voice recorder	1
Binoculars	2
Equipment for wind velocity and direction	1
Barometer, thermometer, watch (set) (calibrated)	1
PC with modem, MS- Windows compatible OS, MS-Office compatible software, monitor, UPS, laser printer A4, CD writer for back-up	2
Telefax	2

Furthermore, Aktau should be supported in the purchase or leasing of a tug boat, which can also be used for maintenance and repair of the buoy system, since Aktau currently neither possesses a tug (the only tug in the Port of Aktau is rented from an Azeri company at an unusual high rate, nor owns adequate vessels for maintenance and repair of the AtoN system.

4.2.3 Turkmenbashi

Buoys with marks, top sign, radar reflector, lamp and solar cell	16
Racon	1

Radar with ARPA and antenna	1
GMDSS VHF/MW decoder, satellite telex (set)	1
INMARSAT	1
VHF and MW receiver and transmitter (set)	1
VHF handheld radio with sea frequencies, with charger	2
Equipment for wind velocity and direction	1
Barometer, thermometer, watch (set) (calibrated)	1
Binocular	1
GPS for one support/buoy laying vessel	1
Tool set for maintenance and repair (shore based)	1
Spare parts (shore based)	1
Tool set for maintenance and repair (vessel based)	1
Spare parts (vessel based)	1
PC with modem, MS- Windows compatible OS, MS-Office compatible software, monitor, UPS, laser printer A4, CD writer for back-up,	6
Voice recorder	1
Telefax	1
Desk + office chair	1
Copy machine A3 format	1

5 Responsibility for Aids to Navigation Services

5.1 Azerbaijan

5.1.1 Status-Quo

Currently, three different institutions and companies are responsible for the operation and maintenance of AtoN Equipment in the Baku Bay.

- The Hydrographic Service, part of and administrated by the Azerbaijan Navy, is in full charge of light houses, leading marks, beacons. Furthermore, the Hydrographic Service is responsible for the buoys without the leading lights and navigation buoys leading from the Baku Bay entrance to the entrance of the Baku International Sea Port.

- The Baku International Seaport (BISP) operates the radar surveillance of the Baku Bay

- Caspian Seaways, a subsidiary of the state-owned Caspian Shipping Company, is in Baku and Dubendi responsible for the operation and maintenance and repair of the buoys and leading lights from port entrances to the berthing places.

This unusual organisation of the vessel traffic management and surveillance system theoretically may encounter the following problems and inefficiencies:

Indistinct Responsibility

During the site-visit, it became obvious that even experts from Baku Port were not always able to identify the responsible organisation for single buoys. In case of malfunction of buoys, this indistinct responsibility may lead to delays in communicating the identified damage or breakdown to the respective institution responsible for maintenance and repair, and thus hinder an efficient and timely repair.

Maintenance and Repair

Since three different institutions are responsible for operation and maintenance and repair of their own AtoN equipment, there tends to be more than one repair yard in the Baku Bay, equipped with replacement buoys and spare parts (the Consultants were able to inspect the Navy yard at the Navy base in the western part of Baku Bay and the Caspian Seaways repair yard at South Cape (Yujny Kovsh), located in the south-west corner of Baku Bay). Also, all institutions may be forced to keep vessels equipped with special gears, cranes, bearing and sound accessories, and the respective crews. The Consultants are convinced that the focussing of activities on only one repair yard, equipped with all necessary floating and non-floating equipment may lead to the realisation of economies of scale and thus reduce the overall costs of AtoN services in the Baku Bay.

Remuneration

The provision of AtoN services is usually (indirectly) financed by some form of dues paid by the owners of vessels entering the port. These dues are seldom transparent with respect to the specific share of dues allocated to the provision of AtoN services but often are designed to cover aggregated infra- and superstructure costs borne by the port. Consequently, these dues also include costs for e.g. dredging and port administration.

However, departing from the one-stop shopping principle, it will not be very customer-friendly, if e.g. a tanker calling at berth 22 would have to pay to three different institutions separately: To the Hydrographic Service of the Azerbaijan Navy for the use of lighthouses, beacons and approach buoys, to Caspian Seaways for the use of the buoys and leading lights to the berthing places, and on top of that to BISP for the radar assistance from the Port Control Centre (furthermore, if a foreign tanker, she may have to pay to the Port of Baku for the use of pilotage services). Therefore, even if a special (single) due for the use of AtoN services, raised by port or terminal authorities, is designed there sill exists the problem of finding a stable and fair mechanism or key for the re-allocation of the respective earnings between the participating institutions/companies. E.g. AtoN dues raised by the Baku International Sea Port will have to be re-allocated also to the two other AtoN operators Caspian Seaways and the Hydrographic Institute. According to the Consultants' experience such inter-institutional compensation mechanism are difficult to find if reliable basic allocation criteria are not available or difficult to monitor, thus always having a potential for disagreement between the participating parties.

Moreover, if shipping operator or terminal operator and AtoN service provider are affiliated there may occur special circumstances giving room for price discrimination against other vessel or terminal operators.

5.1.2 International Experience

In Germany, sub-departments of the maritime administration of the Federal Ministry of Transport, named Wasser- und Schiffahrtsämter (Water and Shipping Bureau), are in charge of the Aids to Navigation equipment. They operate light houses, beacons, buoys, buoy laying vessels, maintenance and repair yards.

In the United States of America, the United States Coast Guard (USCG) is responsible for the operation, maintenance and repair of light houses, beacons and buoys. In peacetime the USCG is a sub-department of the Ministry of Trade, in case of international crises or wartime supreme command over USCG operations is transferred to the Navy.

5.1.3 Proposal for a Later Re-organisation of Aids to Navigation Responsibilities

According to international experience it crystallises that the responsibility for and provision of AtoN services should be delegated to a single institution, preferably to a civil state authority.

This institution may form an integral part of a maritime administration under the umbrella of the currently discussed Ministry of Transport, which is expected to be established in the very near future.

The property rights on the existing Aids to Navigation equipment should be transferred against acceptable monetary compensation to the new Ministry of Transport, which will be responsible for operations and maintenance and repair (at least in peacetime). Consequently, the new AtoN administration will have to build up their own institutional, material, and personnel infrastructure.

Institutional infrastructure: the AtoN administration should elaborate rules, regulations and standards governing navigational safety in the territorial waters of Azerbaijan and establish transparent procedures for monitoring and enforcing the compliance with these rules and regulations.

The Consultants' investigations have revealed that the institutional infrastructure will be developed as soon as the new Azerbaijan Ministry of Transport (and along with it a new maritime administration) has been established. Here, external consultants and Azeri experts should work closely together in order to synchronise international rules, regulations and standards with the existing Azeri legal framework and the special quality of the Azerbaijan territorial waters.

Personnel infrastructure: the AtoN administration should have a variety of qualified (interdisciplinary) personnel available, familiar with different aspects of navigational safety and AtoN, e.g. maritime regulatory and jurisdictional environment, law enforcement, technical specifications, environmental safety, as well as practical M&R and navigational qualifications.

The personnel infrastructure may to a large extent be recruited from the existing institutions and companies currently involved in the provision of AtoN services. The available qualifications were found to be highly sufficient, if updated to the requirements of the new AtoN systems. Here, the Consultants propose special training at existing western European AtoN training camps to familiarise chief technicians with operations and M&R procedures of the new equipment. Furthermore, a study tour for leading personnel of the new AtoN administration to an existing western European AtoN institution could provide valuable insight into the requirements of day-to-day working procedures.

Material infrastructure: the AtoN administration should possess full control over all necessary equipment and buildings (i.e. buoys, radar systems, lighthouses, landmarks, control centres, repair yard, maintenance vessels etc.).

The Consultants' investigation has resulted in the conclusion, that part of the existing equipment and buildings is in need of rehabilitation or replacement in order to guarantee safe navigation in Azerbaijan's coastal waters (see Chapter 4). Therefore, the Consultants propose immediate action to remove the existing technical deficiencies on behalf of the new Ministry of Transport and develop a mechanism guaranteeing a later transfer of the total equipment to the Ministry of Transport.

Alternatively, to avoid conflicts with the current owners of the navigational aids equipment, the maritime administration could restrict itself to only pass, monitor and enforce regulations concerning the provision of Aids to Navigation services, thus leaving the property rights on the equipment and the respective responsibility for maintenance and repair with the current operators. Effectively,

this alternative will be similar to an outsourcing solution: the current owners of the equipment will sign service contracts with the maritime administration and guarantee the constant availability of AtoN equipment and the compliance with all relevant rules and regulations governing its operation. Notwithstanding, these services should be contracted at competitive rates, forcing the current owners to thoroughly consider, if they are willing to participate in this business or prefer to transfer their equipment against acceptable monetary compensation.

5.2 Aktau

All Aids to Navigation equipment, i.e. the buoys in the port approach and the leading lights (the only exception is the lighthouse Melovoy) are property of the Aktau Commercial Sea Port. All equipment is of modern international standard and in good order and condition. Responsible for operations and maintenance and repair of the AtoN equipment is the Communication and Navigation Aids Department of the ACSP.

Only the lighthouse Melovoy, which was built in 1974 is under control of the Kazakhstan Coast Guard as part of the Kazakhstan Navy.

All dues designed to cover the cost of AtoN services are raised by and benefit directly the port.

5.3 Turkmenbashi

All AtoN installations in the Port of Turkmenbashi are owned and controlled by the port authority. Again, like in other Caspian ports the lighthouses are an exception to the rule. They are owned, operated and maintained by the Hydrographic Institute, a sub-department of the Turkmenistan Navy. Responsible for operations of the port-owned AtoN installations is the Port Control Centre headed by the Harbour Master while the Fleet Service Department takes responsibility for the maintenance and repair of the AtoN equipment.

All dues designed to cover the cost of AtoN services are raised by and benefit directly the port.

5.4 Legal and Regulatory Environment

The status of the Caspian Sea in international law has yet to be established, though there are some initiatives backed by Russia and the Iran to push for further negotiations. The key problem of such negotiations is not related to transport but to the allocation of natural resources that are confirmed or assumed to be located in the Caspian basin.

The status of the Caspian Sea has a bearing on the regional validity and enforceability of international shipping rules, regulations and conventions such as IMO to mention but one. All beneficiaries have adopted certain international shipping rules and conventions, but the consultants strongly feel that some efforts remain to be made to make those dealing with Aids to Navigation aware of the complexities and consequences of such rules and regulations.

The Caspian Sea may be described as being land-locked except for the navigable Volga-Don Canal linking the Caspian Sea with the Black Sea. Until such time as the status of the Caspian Sea has been permanently settled and the question of access to this large inland waterway satisfactorily resolved, Russia will continue to exercise complete control over ships using that Canal. Ships owned by Caspian littoral states and/or by ship owners residing in those states and wishing to transit the Canal are subject to Russian regulations, as are ships owned by EU and/or other ship owners. This is tantamount to flag discrimination as exemplified by the level of transit fees currently charged by the Russian administration (figures range between US$ 34,000 and 42,000 for a single passage of a 3,500 tdw dry cargo vessel, in ballast, i.e. not carrying cargo).

With respect to the legal basis for commercial shipping, both Kazakhstan and Turkmenistan are currently considering drafts for national commercial shipping codes in the respective Cabinets of Ministers and Parliaments. The consultants were advised that both countries have based their drafts on the existing Russian commercial shipping code but have modified them to suit the requirements and the specific situation of shipping in the Caspian basin. Both countries stressed that their proposals in the current draft form embrace internationally accepted rules, regulations and conventions.

Virtually all vessels at present operating in the Caspian Sea are registered in the Russian Register of Shipping, excluding of course those flying the Iranian flag. The same applies to classification. Port State Control (PSC) in the sense it is defined in the EU and elsewhere in the world is not being implemented in the Caspian region. Any inspections carried out in Caspian ports, by port authorities, are more concerned with administrative procedures and would appear to be cursory.

In Azerbaijan, CSC and BISP, both being state-owned, are formally independent entities since 1993. There appears to be an isolated interest advocating the re-merging of both institutions, but the Azerbaijan Cabinet of Ministers has not supported this idea. In the absence, to date, of an Azerbaijan Ministry of Transport, CSC and BISP both have the status of a maritime administration with CSC having more political influence and clout. Currently, a Tacis project on the "Reorganisation of the Transport Sector Administration in Azerbaijan", which aims at the establishing of a Ministry of Transport in Azerbaijan, is under way. The consultants expect substantial changes to the a.m. situation once the proposals elaborated in this Tacis project have been successfully implemented.

A similar situation prevails in Turkmenistan, where the old Comecon type of corporate structure is still in place. All ports in Turkmenistan are administered by the state-owned Turkmen Maritime Line, which is also serving as the national maritime administration and to that extent takes on the duties of the MoT.

Like certain other Caspian States Turkmenistan practices flag discrimination by charging concessionary port etc. dues to national-flag vessels but since the number of TML vessels is very small (currently only two dry cargo vessels are operating in the Caspian) the negative impact on competition can be considered negligible. In the Kazakhstan Ministry of Transport, all aspects of water transportation are being handled by a Sub-Department of the Department of Economic Regulations. All ports as well as the newly founded shipping line, Kazmortransflot report to this Sub-Department, but the grip does not appear to be very firm. Thus, there is a chance that the maritime and especially the shipping sector may develop under more commercial conditions. The ACSP as

a Government-sponsored project enjoys a high degree of preference. Thus, the port management is confident that soon the port will be given a degree of freedom when negotiating port etc. dues with clients.

To sum up, the maritime sector is strongly dominated by state-owned companies and institutions and subject to discretionary politico-strategic interests rather than governed by economic and commercial principles. Flag discrimination in the manner described is considered to be normal practice and an adequate means to promote the national shipping line. This should be seen against the background of countries rich in terms of mostly untapped oil and gas reserves but with very limited manufacturing capacities. The countries are far removed from potential markets for their main exports and face numerous and substantial difficulties to overcome this drawback. East-west movements of dry cargo currently tend to be restricted to imports of manufactured goods, mostly of European and United States origin, with very modest quantities going west. Multiple handling which is associated with trans-Caspian/trans-Caucasian/trans-Black Sea cargo routes increases overall transport costs, and border crossings are time-consuming and vastly more expensive than in other parts of the world. Iran in the south and Russia in the north of the region are strong competitors for cargo moving overland, both by road and by rail.

6 Financial Analysis

The following analysis focuses on the financial viability of the rehabilitation and modernisation of Aids to Navigation services and equipment in the Caspian ports of Baku, Aktau and Turkmenbashi. The purpose of the following analysis is to assess whether the provision of Aids to Navigation services may be deemed self-sustainable, i.e. generates not only enough revenues to cover investment and operation costs (incl. depreciation) but also an internal rate of return sufficient to justify the participation of private sector activity.

As already elaborated in the preceding chapter, private sector participation is only possible to a limited extent, e.g. with respect to outsourcing of maintenance and repair services, while the overall responsibility for the availability and functioning of the Aids to Navigation equipment should remain with a state-controlled authority.

6.1 Methodology and General Parameters

A short introduction to the methodology adopted to identify the financial viability of modernising and rehabilitating the AtoN equipment in the Caspian Sea is given here under:

6.1.1 Organisational Units Analysed

The financial analysis will be conducted on behalf of the institution, be it private or public, responsible for the operating of the AtoN installations in the ports selected for the purpose of the present study.

Its main costs comprise

- Investment costs of AtoN equipment
- Maintenance and repair of AtoN equipment
- Personnel
- Fuel and electricity
- General overheads.

Revenues will be generated from fees and dues laid on (commercial) vessels using AtoN services.

6.1.2 Development Scenarios and Time Frame

The financial analysis is based on three scenarios determining the future development of traffic in the three Caspian ports and defined in Chapter 3 (Traffic Forecast). Project start will be in the year 2001. Since the first year will be spent with the construction of basic civil works and the installation of superstructure and AtoN equipment, operational work will not be expected to start before 2002.

Normally, the financial analysis of an infrastructure project should be calculated over an operational period of not less than 20 years, in order to accurately as possible take into account the life cycle of (superstructure) investment. However, transport projections over a period of more than 20 years become highly speculative for obvious reasons. Consequently, the following financial analysis covers the time horizon of the traffic forecast, which is available for the years up to 2020.

6.1.3 General Principles

Any assumptions regarding real price changes over a long period of time are highly speculative and open to manipulation. Thus, the financial viability of the project activities has been calculated on constant price basis, whereby current prices are applied.

It is assumed that a "private operator" will accept the project if he can earn an IRR (see below) of approximately 20 percent on project level (before taxes and financing). If the financial analysis reveals an IRR considerably below this level, the private provision of AtoN services in the ports of Baku, Aktau and Turkmenbashi can be assessed as not financially viable (i.e. taking into account only the revenues and costs borne by the private operator). Consequently, these services necessary for the maritime security in coastal waters must be provided by public authorities, generally focussing other than mere commercial objectives. The economic viability (taking into account also effects on i.a. social life, the regional economy and the environment) of the new investments into navigational equipment will then be evaluated in a later cost-benefit analysis.

Financial evaluations are based on the projected investment programme and on the expected cash flow development. The analysis is done on project level, i.e. without financing and before taxes. In other words, the financial analysis has been carried out as if the project were funded entirely by equity. At the present stage this approach is suitable to assess the financial viability of the operator's business in principle. Finally, in order to assess the possible impacts of risks on the project profitability, a sensitivity analysis has been carried out.

To assess the commercial viability of the project the most commonly used financial indicators have been calculated.

- Internal rate of return (IRR) and
- Payback period

The internal rate of return (IRR) is the discount rate at which the present value of all outflows of cash (e.g. investment cost, operational expenses) is exactly equal to the present value of all inflows of cash. It indicates the actual return of the total investment outlay and is a good indicator of the profitability of the project. It offers the investor the possibility to compare projects quantitatively and the higher the IRR the higher the profitability of the project.

The IRR calculated from the project cash flow is an indicator for the overall viability of the project. It can also be used to determine the maximum interest the project can bear without incurring any losses to the investor.

The payback period is the time required to recover the original investment outlay through the profits earned by the project. It is sometimes interpreted as an indicator of the degree of risk attached to a project though this should be treated with caution since it does not take adequate account of any reward for the shouldering of the risk. It should therefore be regarded only as an additional indicator.

The first step of the financial analysis for private operation comprises the investigation into the following financial data:

- Port tariffs for the provision of AtoN services
- Salaries
- Maintenance charges for equipment
- Energy prices
- Investment prices for equipment

6.1.4 Service Charges (Tariffs)

The estimation of the operator's revenue is based on two different types of information: the number and average size of vessels entering the ports (as presented in the traffic forecast) and the tariff systems in the named Caspian ports.

For all ports printed tariffs are available. These tariffs usually differentiate between own national flag and foreign flag vessels (Kazakhstan does not own any vessels yet), the latter generally being charged with higher rates (the practice of flag discrimination is quite common around the Caspian Sea). Unfortunately, not all ports differentiate the fees and dues laid on vessels entering the ports for cost recovery of different services. While the ports of Aktau and Turkmenbashi raise a specific lighthouse fee for the use of AtoN, Baku has deleted this fee from the printed tariffs and recover the AtoN costs from vessel and channel dues (except for pilotage, which is mandatory for foreign flag vessels). Fees for the provision of AtoN are included in general items such as vessel dues and channel dues. Moreover, some ports grant discounts on dues significantly deviating from the printed tariffs. Last but not least, these general dues are usually only levied on commercial vessel. Military and coast guard vessels, sporting boats and yachts, service vessels etc. are regularly completely exempted from dues.

In Aktau and Turkmenbashi all dues have to be paid in US-$, while in Baku/Dubendi service charges to own flag vessels are collected in local currency, while foreign flag vessels are required to pay in US-$.

6.1.5 Investment Costs

Costs for equipment are based on suppliers information. Depreciation periods are chosen according to international standards, for the calculation of annual depreciation costs the Consultants have

linearly written off the equipment over the estimated lifespan. All costs are quoted in EURO. Import duties have not been taken into account as it is assumed that this equipment necessary for the security of coastal waters will be exempted from duties. Since the proposed equipment is not a green field investment, the equipment that is not replaced will go into the financial analysis with its estimated present value. The list of new equipment unit prices and the usual lifetime of the equipment is shown in the tale below.

Type of Equipment	Estimated Unit Price (in Euro, CIF)	Lifespan (years)
Buoys	8,000	20
Racon	40,000	10
Radar with ARPA, antenna and microwave transmitter	100,000	10
Radar with ARPA and antenna	20,000	10
Port Control Office Equipment (technical)	Depending on the composition of equipment	10
Tool sets and spare parts for M&R		20
Office Equipment		5
Replacement parts for leading lights		10

Table 6-1: Equipment Unit Prices and Lifespan of AtoN Equipment

To adjust the different types of investment along with their differing depreciation periods to the time horizon of the present financial analysis, the residual value of investment not written off at the end of the analysed period is incorporated via a special revenue in the last year of the analysis, 2020. In case of infrastructure investments, the operator e.g. could be compensated for this residual value via direct payment, depending on the actual condition of the infrastructure, by the port authority. The residual value of equipment will be depending on the then market value of second hand AtoN equipment. For the present analysis the residual value is calculated as investment costs for infra- and superstructure minus cumulated values of linear annual depreciation.

6.1.6 Operating Costs

6.1.6.1 Labour Costs

The estimate of labour costs is based on the

1. manning schedules derived from the requirements of AtoN operations and the respective maintenance and repair. These schedules classify the different occupations necessary to operate and maintain the respective AtoN services.

2. the salaries and social on-costs of the various types of staff. This data has been provided by the involved institutions currently involved in AtoN operations.

The rehabilitation and modernisation of the AtoN services is not considered to cause significant changes in the number and qualification of staff necessary for operation, maintenance and repair. Therefore, it is assumed that the data on the number and current costs of staff provided by the ports will also be applicable also to the future provision of services. For the purpose of the present

analysis all occupations suitable for employment at AtoN services are divided into manual and non-manual labour.

Manual (blue-collar) Work:

- high-skilled workers (e.g. workshop master)
- skilled worker (e.g. craftsman)
- semi-skilled workers (e.g. crew members)

Non-Manual (white-collar) Work:

- heads of units and chief specialists (e.g. manager of Port Control Centre)
- senior specialists and specialists (e.g. port control operator)
- clerks (e.g. support staff)

Since labour costs consists of two components, wages and salaries on the one hand and social insurance on the other, additional provisions must be made for the latter. Additionally an allowance of 5 percent for regular and sick leave has been made.

6.1.6.2 Maintenance and Repair

Maintenance and repair (M&R) costs of equipment have been estimated using a fixed percentage of the initial investment for each class of investment item based on international experience and suppliers' information. The table below sets out detailed figures.

Type of equipment	M&R Cost as proportion of original ex works price
Buoys	2%
Racon	2%
Radar with ARPA, antenna and microwave transmitter	3%
Radar with ARPA and antenna	3%
Port Control Office Equipment (technical)	2%
Tool sets and spare parts for M&R	3%
Office Equipment	2%
Replacement parts for leading lights	2%

Table 6-2: Estimated M&R shares

The estimated costs cover the purchase of spare parts and renewals and certain repairs at specialised workshops. They do not include associated personnel expenses which are included as part of wages and salaries (technical personnel, workshop) and energy and fuel costs. Forecast M&R expenses also include necessary cost for software maintenance through a standby agreement with

the software manufacturer. This will also include regular updates of the software and is forecast at usual levels for such agreements.

6.1.6.3 Power and Fuel

Estimation of energy cost is based on the average power and fuel consumption of each type of equipment. These are in turn calculated at price levels of energy in Azerbaijan, Kazakhstan and Turkmenistan as follows:

Azerbaijan:	Electricity	AzM 160 per KWh (= EURO 0.04 per KWh)
	Fuel (Diesel)	AzM 900 per litre (= EURO 0.23 per litre)
Kazakhstan	Electricity	KzT 2.33 per KWh (= EURO 0.02 per KWh)
	Fuel (Diesel)	KzT 35 per litre (= EURO 0.28 per litre)
Turkmenistan	Fuel (Diesel)	TmM 130 per litre (= EURO 0.03 per litre)

Estimates of the total energy costs for lighting buoys, lighthouses, maintenance vessels, trucks etc. are based on the number of annual operating hours and the number of seamiles sailed or kilometres driven per year. 5 percent of all fuel costs have been allowed for lubricants. Additionally, provision has been made for the power consumption of the office buildings (e.g. Port Control Centre).

6.1.6.4 Overheads

Overhead costs have been estimated at 20 percent of the aforementioned operating costs.

6.2 Results

6.2.1 Port of Baku/Dubendi

6.2.1.1 Revenue

In Baku and Dubendi, generally the same tariff systems apply. The port recovers its costs for the provision of AtoN services by levying vessel dues and channel dues on commercial vessels entering the port. It is estimated that about 5% of revenues from vessel dues and 60% of revenues from channel dues are allocated to the operation and maintenance and repair of AtoN equipment. The former lighthouse due (around 110 Manat per m^3) intended to cover the AtoN costs has been deleted from the tariff system due to the insufficient condition of the AtoN system.

Commercial vessels entering and leaving the port are charged according to the following tariffs (entry and departure are charged separately):

	Base parameter for calculation	Vessel dues (in Manat)	Vessel dues (in US-$)	Channel dues (in Manat)	Channel dues (in US-$)
Azerbaijan vessels	m^3 (GRT)	80 per m^3		130 per m^3	
Non-Azeri vessels	m^3 (GRT)		0.54 per m^3		0.05 per m^3

Table 6-3: AtoN Tariffs in Baku/Dubendi

Recently, in negotiations with the main user of the Port of Baku/Dubendi Caspian Shipping Company both institutions agreed to the following: The ferries travelling on regular service to Turkmenbashi and Aktau are charged with a lumpsum fee of 800 US-$ every time they enter the port. This fee includes all general vessel and cargo related dues. An extra fee for the departure is not levied on the ferries. The same rules basically apply to tankers calling at Dubendi (1000 US-$ per call) and dry cargo and multi-purpose vessels (1200 US-S per call) owned by Caspian Shipping Company. Tankers calling at Baku (mainly refined products) and all foreign flag vessels are charged according to a.m. printed tariffs.

The expected revenue from the provision of AtoN services in the first year of operation is approx. 130,000 EURO. This revenue is expected to increase to about 165,000 EURO in 2010 and 215,000 EURO in 2020 (medium scenario).

6.2.1.2 Equipment/Investment

With respect to the total investment cost calculated over the analysed investment period it should be noted that these cost do not include costs for the replacement of short-term equipment (like computers) purchased at the beginning of the investment programme. Replacements must be financed from project revenues. Therefore, provision is made by explicitly including depreciation costs in the analysis (see Chapter 6.1.6).

Type of Equipment	Budget Estimate (in Euro, CIF)
Buoys	283,000
Racon	320,000
Radar with ARPA and antenna	40,000
Port Control Office Equipment (technical)	100,000
Tool sets and spare parts for M&R	110,000
Office Equipment	20,000
Replacement parts for leading lights and lighthouses	10,000
Total	**883,000**

Table 6-4: Proposed Equipment and Budget Estimates for Baku/Dubendi

6.2.1.3 Operating Costs

Personnel

According to expert information the average wage factor is 0.75, i.e. total labour costs contain 75% wages and salaries and 25% employers contribution to social insurance etc. Thus, 33% of the calculated wages have been added as social insurance charges.

Qualification Groups	Average Annual Salaries (in EURO)	Average Annual Social Insurances (in EURO)	Average Annual Labour Costs (in EURO)
Manual Workers			
high skilled	800	264	1,064
skilled workers	650	215	865
semi-skilled workers	500	165	665
Non-Manual Workers			
heads of units and chief specialists	1,350	446	1,796
senior specialists and specialists	1,050	347	1,397
Clerk	700	231	931

Table 6-5: Labour Costs by Qualification Groups in Baku/Dubendi

The breakdown of staff by categories (number of staff in brackets) as well as total personnel costs are detailed in the following table.

Staff	2002	2010	2020
Head of Unit/Chief Specialists (1)	1,796	1,796	1,796
Senior Specialist/Specialist (9)	12,537	12,537	12,537
Clerks (2)	1,862	1,862	1,862
High Skilled Labourer (1)	1,064	1,064	1,064
Skilled Labourer (5)	4,325	4,325	4,325
Semi-Skilled Labourer (6)	3,990	3,990	3,990
Number of Total Workforce	**24**	**24**	**24**
Labour Costs	**25,574**	**25,574**	**25,574**
Allowances for Sick Leave (5%)	1,278	1,278	1,278
Total Labour Costs (in EURO)	**26,852**	**26,852**	**26,852**

Table 6-6: Total AtoN Labour Costs in Baku/Dubendi (EURO)

On the total labour costs as calculated above, a provision of 1% for training will be added.

Fuel and Energy

The key parameters of fuel and energy input are listed below. The total costs are calculated by multiplication with the average energy prices of Chapter 6.1.5.3. Energy consumption of the Port Control Centre has been estimated at an annual EURO 500.

Azerbaijan Equipment type	working hours p.a.	km travelled p.a.	Energy consumption
Lighting buoy	7836		Solar cells
Lighthouse	7836		500 W
Lighthouse Narjin	7836		250W
Narjin Generator	7836		3.86 litres per working hour
Beacon	7836		35 W
Truck		25,000	12 litres per 100 km
Vessel	1000		38 litres per working hour

Table 6-7: Energy Consumption Parameters Baku/Dubendi

Maintenance and Repair

Annual costs for Maintenance and Repair are derived from the amount of investment by category for Baku and Dubendi proposed in Chapter 6.2.1.2 and the general M&R share as proportion of original ex works price identified in Chapter 6.1.5.2.

Type of equipment	Annual M&R Cost (EURO)
Buoys	5,700
Racon	6,400
Radar with ARPA and antenna	1,200
Port Control Office Equipment (technical)	2,000
Tool sets and spare parts for M&R	3,300
Office Equipment	400
Spare parts for leading light	200
Total	**19,200**

Table 6-8: AtoN Maintenance and Repair Costs in Baku/Dubendi

Overheads

Overheads are calculated as a 20% add-on on labour, energy and M&R costs

Total Operating Costs

The total operating costs are detailed for the key years 2002 (first year of operation) 2010 and 2020 (last year of forecasting horizon) in the table below (in EURO).

Operating Costs	2002	2010	2020
Labour	27,100	27,100	27,100
Electricity, Fuel, Lubricants	14,000	14,000	14,000
M&R Equipment	19,200	19,200	19,200
Overheads	12,000	12,000	12,000
Total	**72,300**	**72,300**	**72,300**

Table 6-9: Total AtoN Operating Costs in Baku/Dubendi (EURO)

6.2.1.4 Cash-Flow Analysis

The detailed cash flow is shown in Annex 3. The key results are:

FIRR: 4.17 percent

Payback Period: 16.5 years

6.2.1.5 Sensitivity Analysis

If 20 percent FIRR are regarded as a critical benchmark for the financial project viability, this rate is reached if (see Annex 4 for the pertinent variations)

- tariffs are 62 percent above current rates, or
- investment costs are 44 percent below the estimate.

With respect to operating costs it can be stated, that even if these costs could be reduced to zero the AtoN investment fails to reach the key IRR of 20 percent. The maximum FIRR that can be expected by varying the operating costs is 13.27%

Variations of the traffic forecast as detailed in Chapter 3 of this report will lead to the following results:

Pessimistic Alternative:

FIRR: 1.75 percent

Payback Period: 18,5 years

Optimistic Alternative:

IRR: 7.64 percent

Payback Period: 9 years

6.2.1.6 Evaluation of the Result

The result of the financial analysis clearly indicates that Investment into AtoN equipment is a business with low expected rates of return. The payback period can be considered relatively long by any means. Variations of financial key parameters have shown that these unfavourable results are very stable with respect to operating costs, which play only an insignificant role. The main obstacle of this investment are the high initial investment costs (and along with it the high depreciation cost that have to be recovered) relative to the low revenues generated by the provision of AtoN services. A decrease in the investment costs leads to a significant improvement of the FIRR, but due to the low starting level of the FIRR in the medium scenario it takes almost a halving of investment costs before a private investor would be adequately rewarded for the risk of his engagement.

Variations of traffic volumes reveal only limited influence, since the FIRR is only slowly responding to increases of revenues. Even in the optimistic scenario the level of the expected FIRR is far from being sufficient to attract private funds.

6.2.2 Port of Aktau

6.2.2.1 Revenue

In Aktau, the port recovers its costs for the provision of AtoN services by levying a lighthouse due on all vessels entering the port (except for fishing boats and service vessels). Incoming and outgoing vessels are charged according to their size measured in m^3 (GRT). The current unit rate is 0.05 US-$ per m^3 (0.055 EURO), the port does not practise any flag discrimination. Generally, deviations from printed tariffs are negotiable, e.g. the ferry boat from Baku to Aktau v.v. pays a lump sum fee of about 3,100 EURO for every call at the port. This fee includes all general port dues regularly laid on vessels and cargo (but it does not include cargo handling).

According to the traffic forecast presented in Chapter 3, the expected revenue in the first year of operation is approx. 206,000 EURO. This revenue is expected to increase to about 260,000 EURO in 2010 and 340,000 EURO in 2020 (medium scenario). It should be noted, though, that half of the revenues from AtoN services are bound for interest and redemption payment of the current EBRD load to the Port of Aktau.

6.2.2.2 Equipment/Investment

With respect to the total investment cost calculated over the analysed investment period it should be noted that Aktau already possesses some AtoN equipment meeting international standards (e.g. new buoys equipped with GPS, modern PCC installations). This equipment will be included in the analysis with its estimated present value at the beginning of the analysed investment period. All replacements must be financed from project revenues. Therefore, provision is made by explicitly including depreciation costs in the analysis (see Chapter 6.1.6).

Type of New Equipment	Budget Estimate (in Euro, CIF)
Racon	40,000
Radar with ARPA and antenna	20,000
Port Control Office Equipment (technical)	16,000
Tool sets and spare parts for M&R	60,000
Office Equipment (lump sum)	8,000
Total	**144,000**

Table 6-20: Proposed Equipment and Budget Estimates for Aktau

6.2.2.3 Operating Costs

Personnel

According to expert information the average wage factor is approx. 0.8, total labour costs contain about 79% wages and salaries and 21% employers contribution to social insurance etc. Thus, 26% of the calculated wages have been added as social insurance charges.

Qualification Groups	Average Annual Salaries (in EURO)	Average Annual Social Insurance (in EURO)	Average Annual Labour Costs (in EURO)
Manual Workers			
high skilled	3,724	966	4,690
skilled workers	2,966	770	3,736
semi-skilled workers	2,483	644	3,126
Non-Manual Workers			
heads of units and chief specialists	4,552	1,184	5,736
senior specialists and specialists	3,448	897	4,345
Clerk	2,759	718	3,477

Table 6-31: Labour Costs by Qualification Groups in Aktau

The breakdown of staff by categories (number of staff in brackets) as well as total personnel costs are detailed in the following table.

Staff	2002	2010	2020
Head of Unit/Chief Specialists (1)	5,736	5,736	5,736
Senior Specialist/Specialist (4)	17,379	17,379	17,379
Clerks (1)	3,477	3,477	3,477
High Skilled Labourer (1)	4,690	4,690	4,690
Skilled Labourer (3)	11,207	11,207	11,207
Semi-Skilled Labourer (1)	3,126	3,126	3,126
Number of Total Workforce	**11**	**11**	**11**
Labour Costs	**45,615**	**45,615**	**45,615**
Allowances for Sick Leave (5%)	2,282	2,282	2,282
Total Labour Costs (in EURO)	**47,897**	**47,897**	**47,897**

Table 6-14: Total AtoN Labour Costs in Aktau (EURO)

On the total labour costs as calculated above, a provision of 1% for training will be added.

Fuel and Energy

The key parameters of fuel and energy input are listed below. The total costs are calculated by multiplication with the average energy prices of Chapter 6.1.5.3. Energy consumption of the Port Control Centre has been estimated at an annual EURO 1000. Since all buoys are located relatively close to the main port area, according to port officials inspection of the floating AtoN equipment usually takes only one work day. The port conducts this task with due diligence several times per month.

Kazakhstan Equipment type	working hours p.a.	km travelled p.a.	Energy consumption
Lighting buoy	7836		Solar cells
Leading Light	7836		35 W
Truck		10,000	12 litres per 100 km
Vessel	360		38 litres per working hour

Table 6-15: Energy Consumption Parameters for Aktau

Maintenance and Repair

Annual costs for Maintenance and Repair are derived from the amount of investment by category for Aktau proposed in Chapter 6.2.2.2 and the general M&R share as proportion of original ex works price identified in Chapter 6.1.5.2.

Type of equipment	Annual M&R Cost (EURO)
Existing buoys	1,300
Racon	800
Radar with ARPA and antenna	600
Port Control Office Equipment (including existing equipment)	700
Tool sets and spare parts for M&R	1,800
Office Equipment	200
Total	**5,400**

Table 6-16: AtoN Maintenance and Repair Costs in Aktau

Overheads

Overheads are calculated as a 20% add-on on labour, energy and M&R costs

Total Operating Costs

The total operating costs are detailed for the key years 2002 (first year of operation) 2010 and 2020 (last year of forecasting horizon) in the table below (in EURO).

Operating Costs	2002	2010	2020
Labour (incl. training)	48,400	48,400	48,400
Electricity, Fuel, Lubricants	5,000	5,000	5,000
M&R Equipment	5,400	5,400	5,400
Overheads	11,800	11,800	11,800
Total	**70,600**	**70,600**	**70,600**

Table 6-17: Total AtoN Operating Costs in Aktau

6.2.2.4 Cash-Flow Analysis

The detailed cash flow is shown in Annex 3. The key results are:

IRR: 56.43 percent

Payback Period: 1.5 years

6.2.2.5 Sensitivity Analysis

The results of the financial analysis are rather sensitive to variations of the revenue (tariff rates); see Annex 4 for the pertinent variations. If 20 percent FIRR are regarded as a critical benchmark for the financial project viability, this rate is reached even if

- tariffs are 43 percent below current rates, or

- operating costs are 136 percent above our estimate, or
- investment costs are 168 percent above the estimate.

Variations of the traffic forecast as detailed in Chapter 3 of this report will lead to the following results:

Pessimistic Alternative:

FIRR: 54.03 percent

Payback Period: 1.5 years

Optimistic Alternative:

FIRR: 59.56 percent

Payback Period: 1.5 years

6.2.2.6 Evaluation of the Result

A first glance at the results of the financial analysis for AtoN investment in Aktau should make investors queue up in front of the port authority building to offer their money: A high FIRR together with an incredible low payback period. The results prove to be very stable with respect to expected development of traffic even in the pessimistic scenario. Moreover, investment costs may increase by an stunning 170 percent and operating costs by a high 140 percent before the investment becomes more and more unattractive from a private financiers point of view. The sensitivity analysis further reveals that the level of the FIRR is very much reacting on variations of the tariff rates. A reduction of tariffs by 43 percent leads to a cut in the FIRR of more than 66 percent. At this level the FIRR barely reaches 20 percent, and a further reduction in tariffs may cause more and more investors to back up from the investment opportunity.

This last result points to a major drawback of the present financial analysis. The quoted tariffs are by no means cost-based (this observation is indicated by the fact that the lighthouse due is collected irrespective of the condition of the AtoN). The current high revenues from the lighthouse dues are most likely used for cross-subsidising other services provided by the port since a cost-based tariff system is still on the verge of being developed in all Caspian ports. It may well be that the restructuring of the current tariff system towards a system of service-based cost-recovery may have significant influence on the tariffs for the provision of AtoN services.

Moreover, it should be noted that the Port of Aktau is currently restricted in its investment policy by the conditions of a recent EBRD loan, for which the port has to pay interest and redemption from its own revenues. This may have two consequences:

- a large part of the AtoN revenues are included in repay schedules for the loan, which effectively means that the port is depending on raising these revenues for its own purposes and cannot completely outsource this service.

- the port cannot free financial resources for funding the necessary investment on its own.

6.2.3 Port of Turkmenbashi

6.2.3.1 Revenue

In generating revenues for the cost recovery of AtoN expenses, Turkmenbashi follows a similar approach as Aktau. Expenses for the provision of Aids to navigation services are recovered by charging lighthouse dues on the vessels calling at the Port of Turkmenbashi and Ufra oil terminals. Lighthouse dues are collected per m^3 (GRT) of vessel size, on which a tariff of about 0.023 EURO is levied. Ferries calling at Turkmenbashi enjoy a discount of 50% off this rate. Vessels owned by Turkmen Maritime Lines (TML) are exempted from dues, since TML and the port still form an organisational unit.

The expected revenue from the provision of AtoN services in the first year of operation is approx. 119,000 EURO. This revenue is expected to increase to about 125,000 EURO in 2010 and 135,000 EURO in 2020 (medium scenario). The moderate growth of lighthouse dues is partly due to the expected larger share of TML vessels. TML is on the verge of planning a major expansion of its sailing capacities.

6.2.3.2 Equipment/Investment

All replacements of AtoN equipment scheduled within the time frame of the present analysis must be financed from project revenues. Therefore, provision is made by explicitly including depreciation costs in the analysis (see Chapter 6.1.6). The proposed initial investments and related costs estimates are listed below:

Type of Equipment	Budget Estimate (in Euro, CIF)
Buoys	130,000
Racon	40,000
Radar with ARPA, antenna and microwave transmitter	100,000
Port Control Office Equipment (technical)	35,000
Tool sets and spare parts for M&R	35,000
Office Equipment	28,000
Total	**368,000**

Table 6-86: Proposed AtoN Equipment and Budget Estimates for Turkmenbashi

6.2.3.3 Operating Costs

Personnel

According to expert information the average wage factor is 0.83, i.e. total labour costs contain 83% wages and salaries and 17% employers contribution to social insurance etc. Thus, 20% of the calculated wages have been added as social insurance charges.

According to port information the annual wage sum for the crew responsible for maintenance and repair of the AtoN equipment (10 staff, consisting of two high-skilled, four skilled and four semi-skilled workers) is about 14,000 EURO, while the AtoN operations team (9 staff, consisting of Harbour Master and his deputy, four specialists and three clerks) earns about 12,000 EURO p.a. All in all, this sums up to an annual wage cost factor of about 31,000 EURO, incl. social insurance, to which 1% for annual training costs is added.

Fuel and Energy

The key parameters of fuel and energy input are listed below. The total costs are calculated by multiplication with the average energy prices of Chapter 6.1.5.3. Energy consumption of the Port Control Centre has been estimated at an annual EURO 500. Energy costs for lighthouses and beacons have been excluded from the analysis, since the lighthouses are owned by the Turkmenistan Navy while the energy costs of the beacons are paid by the City of Turkmenbashi.

Turkmenistan Equipment type	working hours p.a.	km travelled p.a.	Energy consumption
Lighting buoy	7836		Solar cells
Truck		25,000	12 litres per 100 km
Vessel	1000		38 litres per working hour

Table 6-97: Energy Consumption Parameter for Turkmenbashi

Maintenance and Repair

Annual costs for Maintenance and Repair are derived from the amount of investment by category for Turkmenbashi proposed in Chapter 6.2.3.2 and the general M&R share as proportion of original ex works price identified in Chapter 6.1.5.2.

Type of equipment	Annual M&R Cost (EURO)
Buoys	2,600
Racon	800
Radar with ARPA and antenna	3,000
Port Control Office Equipment (technical)	700
Tool sets and spare parts for M&R	1,100
Office Equipment (lump sum)	500
Total	**8,700**

Table 6-18: AtoN Maintenance and Repair Costs for Turkmenbashi

Overheads

Overheads are calculated as a 20% add-on on labour, energy and M&R costs

Total Operating Costs

The total operating costs are detailed for the key years 2002 (first year of operation) 2010 and 2020 (last year of forecasting horizon) in the table below (in EURO).

Operating Costs	2002	2010	2020
Labour	31,300	31,300	31,300
Electricity, Fuel, Lubricants	5,000	5,000	5,000
M&R Equipment	8,700	8,700	8,700
Overheads	9,000	9,000	9,000
Total	**54,000**	**54,000**	**54,000**

Table 6-19: Total AtoN Operating Costs for Turkmenbashi

6.2.3.4 Cash-Flow Analysis

The detailed cash flow for the medium scenario is shown in Annex 3. The key results are:

FIRR: 5.74 percent

Payback Period: 9.5 years

6.2.3.5 Sensitivity Analysis

The results of the financial analysis are rather sensitive to variations of the investment costs; see Annex 4 for the pertinent variations. If 20 percent FIRR are regarded as a critical benchmark for the financial project viability, this rate is reached if

- tariff rates are raised by 43 percent c.p., or
- operating costs are almost 53 percent below the estimate, or

- investment costs are 27 percent below the estimate.

Variations of the traffic forecast as detailed in Chapter 3 of this report will lead to the following results:

Pessimistic Alternative:

FIRR: 3.74 percent

Payback Period: 10.5 years

Optimistic Alternative:

FIRR: 10.60 percent

Payback Period: 8.5 years

6.2.3.6 Evaluation of the Results

Similar to Baku, the result of the financial analysis clearly indicates that Investment into AtoN equipment in Turkmenbashi is a business with low expected rates of return, although the payback period can be considered acceptable. Variations of financial key parameters show that the unsatisfactory results of the financial are relatively stable with respect to operating costs, tariffs and traffic volumes. Operation costs must be reduced or tariffs must be raised by 53 and 43 percent respectively in order to hit the target FIRR of 20 percent. Again, the main obstacle of this investment opportunity are the high initial investment costs (and along with it the high depreciation cost that have to be recovered) relative to the low revenues generated by the provision of AtoN services. A decrease in the investment costs leads to a significant improvement of the FIRR: a reduction of less than 30 percent in investment costs almost quadruples the FIRR.

Variations of traffic volumes reveal only limited influence, since the FIRR is only slowly responding to increases of revenues. Even in the optimistic scenario the level of the expected FIRR is far from being sufficient to attract private funds.

6.3 Conclusion

As it is clearly apparent from the results presented above the ports of Baku/Dubendi and Turkmenbashi are far from expecting an internal rate of return from new AtoN investment sufficient to attract any private operator to participate in the provision of AtoN services. In both cases the relatively high initial investment costs can be identified as the main obstacles leading to high depreciation costs, while the operating costs play a minor role.

The financial analysis for Aktau generates an extraordinary FIRR, but Aktau currently suffers from repaying a major EBRD loan which restricts their investment facilities. Furthermore, it may be assumed, that the tariff structure in Aktau is biased in favour of lighthouse dues generating revenues that are used for cross-subsidising other obligations and services within the port.

Tariffs for the provision of AtoN services, if these tariffs explicitly exist, are presumably not cost-based. Consequently, the revenue per vessel differs significantly in the analysed ports. While tariffs in Baku and Turkmenbashi appear to be on the low side (if regular conditions exist), does Aktau charge a relatively high lighthouse due on vessels calling at the port. It should be noted though, that the existing AtoN installations in Baku and Turkmenbashi are far from justifying the levying of any dues for the provision of AtoN services at all.

The basic results of the financial analysis have been rather invariant to the different scenarios of traffic development. Consequently, even the FIRR calculated from the Optimistic Scenario does not provide sufficient incentives for private investors to finance and operate the AtoN services.

All in all, from a financial point of view, the investment into AtoN equipment would be a misallocation of financial resources. Consequently, the market will not provide funds for the investment.

7 Economic Evaluation

The financial analysis presented in Chapter 6 has come to the conclusion that the provision of new AtoN equipment to the ports of Baku and Turkmenbashi is not financially viable though a small positive FIRR may be achieved. the situation in Aktau remains unclear due to the presumably highly biased lighthouse tariff and the budget restrictions imposed on the port by the a.m. EBRD loan. It is quite evident that private funds are unlikely to be attracted to this business, consequently the much needed measures will not be undertake, unless public funds fill the gap.

Public funding usually takes into account also other, much wider objectives then the mere focussing on financial profits. Besides direct financial costs and revenues a project may also inhibit quantifiable and non-quantifiable (or at least not straightforwardly quantifiable) positive and negative effects on the regional and national economy, on the social and ecological environment, on safety etc.

These effects are considered "external" to the production and consumption of a product or service, because the benefits (or disbenefits) stemming from them are regularly not internalised via market forces, and therefore neither reflected in the cost calculation of the producer nor included in the willingness-to-pay of the consumer, since the individuals producing or consuming the goods and services are neither forced to directly pay for benefits nor entitled for compensation for disbenefits. Consequently, the calculation of the financial IRR, which only reflects the outcome of the sheer market process cannot take account of these external effects.

If now the production of a good or service is not financially viable but there are expected to exist positive effects (benefits) to the economy from the provision of this good or service outweighing possible negative effects (disbenefits), then it should be analysed whether the so called economic IRR (EIRR), which extends the methodology of the financial analysis by a.m. external effects, justifies the engagement of public funds as a corrective for market failure.

Theory and practice give evidence that especially transport infrastructure projects regularly lack financial viability but generate considerable positive net benefits by promoting and facilitating regional and national economic development, improving safety or furthering social cohesion by improving accessibility of remote regions. The EIRR may than be much higher than the FIRR. Usually international financial institutions like Worldbank etc. require that (infrastructure) projects have an economic internal rate of return of about 10% to be eligible for funding. However, in the special case of AtoN systems many countries, e.g. the USA[1], do not require the investments to formally show an attractive economic return.

7.1 Effects

As participants in the provision of vessel transportation service, both the vessel operator and the user incur costs in the provision of the service. For example, the vessel operator at a port incurs

[1] US Coast Guard Short Range Aids to Navigation Devision (1994), Short Range Aids to Navigation Mission Analysis (SRAMA), Washington.

such time-related costs as vessel insurance and depreciation; the users or owners of cargo incur such time-related inventory costs as cargo insurance, depreciation, etc. Third parties may also incur costs in provision of vessel transportation service, e.g. ecological costs associated with marine mammal and bird losses, commercial fish species losses, and spill cleanups attributable to hazardous commodity spills of vessel accidents.

If vessel operators call at ports where new AtoN systems have improved the ports' navigation safety, then port-related safety costs incurred by vessel operators, cargo owners and third parties are expected to be less, than for other ports, all else held constant. Since the risk of vessel accidents is reduced, vessel damage costs, cargo damage costs and costs of hazardous spills from vessel accidents are expected to decline, all else held constant. If the new AtoN systems also help to improve port efficiency by reducing vessel traverse time, i.e. vessels are able to run at higher speeds and traverse port areas in inclement weather, vessel operators will also benefit from cost-savings for such time-related depreciation while in port. User time-related inventory costs such as obsolescence and depreciation costs will also decline, since the traverse time of vessel cargo in port has also declined. Further, if the vessel operator cost savings more than offset the AtoN user fees paid by the vessel operators, then the operators' competitive positions will have improved, all else held constant. Also, their competitive positions may improve from the decline in cargo damage and time-related inventory costs.

Consequently, the investment into AtoN equipment is eligible to promote the following objectives:

- Increasing nautical safety, thus preventing accidents with a) personal damages, b) ecological damages.

- Spurring the attraction of new trade to the port by offering safe navigational condition reducing the risk of damages to cargo and vessel. New trade and higher cargo volumes may lead to more employment in the port related transport sector, which in case of existing high unemployment rates may have a positive effect on the state budget by reducing welfare payment and at the same time increasing tax income.

- Avoidance of delays and greater reliability of time schedules, especially important in the light of growing traffic.

Significantly negative effects from the rehabilitation of the existing AtoN systems could not be identified.

7.2 Methodology

Since the effects identified in Chapter 7.1 all point into the same (positive) direction, they are potentially increasing the benefit side of the calculation. If considered an EIRR of 10% as the target rate for the present project, than it is very straight forward to see from the results of the financial analysis that Baku would need an additional contribution of an annual positive external net effect worth about 21 percent of the revenues generated by the provision of AtoN services to reach this target rate. Or in value terms, the provision of AtoN service must generate an annual (social) net benefit (in monetary terms) of about 46,000 EURO over the analysed period.

In case of Turkmenbashi, these figures are significantly lower. The AtoN investment must generate an additional positive net benefit of about 12% of AtoN revenues, or an annual 9,000 EURO worth of social net benefits.

In order to monetarise the a.m. external effects the following considerations have been mad:

With respect to punctuality, the difficulty consists in estimating the part of the delays which are caused by an insufficient AtoN system (or partly recoverable due to a modernisation), and the possible savings of the new installations compared to the existing ones. Currently, especially in Turkmenbashi delays are caused by vessels not able to enter or leave the port at night or foggy weather due to important AtoN installations out of work. This may considerably disturb the sailing schedules of e.g. the ferries between Turkmenbashi and Baku, but also between Turkmenbashi and Astrakhan (the latter service currently evolving), and reduce the attractiveness of these services. It has been noticed by the consultants that at times there are two ferries lying at berth with a third ferry waiting outside the Bay.

For the purpose of the current economic analysis it is assumed that delays are not only relevant to the ferry services but also to tanker and dry cargo vessels. Even though the current tanker and dry cargo transports are deemed to be not very time sensitive, the calculation of savings due to improved AtoN systems is also extended to them since cargo stuck at some port is bound capital in the calculation of the cargo owner. Furthermore, vessels are charged with extra costs (in form of some port dues) for every hour they spend at berth, which the transport operator will ultimately charge on the cargo via full cost pricing.

Delays should be estimated by a conservative approach because improvements in punctuality are difficult to measure, since a varying part of delays is often due to complicated customs or vessel management procedures, which may cause the vessel to miss an earlier departure at daylight.

According to recent studies the value of time for one hour of passenger transport in Hungary, Poland and Slovakia is about 1.8 EURO (average value over all travel purposes), which constitutes about 0.6% of the average monthly income in these countries. Since detailed data on the average value of time for the Caspian region is not available, it is assumed that the same proportions as in eastern European countries apply. If considered that a) sea passenger transport mainly takes place between Azerbaijan and Turkmenistan and b) the average wage in Azerbaijan and Turkmenistan is about 55 EURO, than a rough figure for the value of one hour of passenger travel can be fixed at about 0.3 EURO.

With respect to the value of one hour of travel time for cargo it can be stated that if not confronted with highly time sensitive cargo, e.g. fruits and fresh products shippers rank reliability and timeliness of transport ranks before actual travel time. It is required, that the cargo reaches its destination within a certain time frame, which is particularly important if onward carriage with a different transport mode is planned. The cargo must reach its destination at exactly the point of time, when the other transport mode is available.

Especially in case of long distance transports the value of one or two hours saved, as it may occur when a short stretch of the overall transport chain is improved, is barely measurable. If considering transportation in eastern Europe and Central Asia, major delays are not so much incurred by insuf-

ficient transport infrastructure as more institutional deficiencies and hindrances, especially at border crossings. Consequently, many transport operators attach a very low monetary value to one hour of time saved. Recent studies for the railway sector in eastern Europe have estimated the value at 0.01 EURO per hour and ton. Even though it should be noted, that "rail commodities" usually have a different structure than "ro/ro-ferry commodities" since the first are highly dominated by low-value bulk cargo, while the latter may be expected to have a higher proportion of high-value consumer goods transported by trucks, the consultants assume for the purpose of the current study that in principle this value is also applicable to the Caspian Sea.

Furthermore, the consultants estimate that about 10 percent of cargo volumes and passengers suffer from serious delays due to insufficient AtoN systems. The average delay time for these 10 percent is estimated at 4 hours for Turkmenbashi, 1 hour for Dubendi and Baku. For the remaining 90 percent it is assumed that new AtoN equipment will enable vessels to save about 20 minutes sailing time in the port access and port area. Since Aktau has a relatively short and navigationally not very difficult port access, and has already installed basic modern AtoN equipment, significant time savings from further installations of equipment are not expected.

Positive effects on employment and the regional port economy are depending on whether the benefits from the improved AtoN services in port outweigh the user fees for these services. As indicated above, only in this case the transport operators will face an improved competitive position and will be willing to ship more cargo via the port. In case of the Caspian ports analysed within the frame of the present study it can be assumed that tariffs will stay stable even after the new AtoN investments, since for the time being there does not exist any service-related cost recovery system. If so, cargo shippers will benefit because safer navigational conditions reduces their costs (lower insurance premiums on vessels and cargoes) and they will increasingly use the rehabilitated route. Therefore, it can be expected, that some of the expected growth in traffic volumes may be attributable to the improved AtoN system and along with in the positive effects on employment and regional economy. Direct employment effects from the rehabilitation of the AtoN system are not expected since the number of staff is invariant to the number of vessels served (within the frame of the time horizon, the traffic forecast and the size of the existing port capacities).

Again, it is very difficult to measure this effect because in some ports there exist considerable over-capacities with respect to equipment and staffing. Thus, part of the additional employment effect may be absorbed by these existing personal over-capacities. For the present study it is estimated that 10 percent additional vessel traffic induces an increase of port employment of one percent. This figure also reflects expected improvements in current labour productivity. Consequently, since 10 percent of the traffic growth are attributable to the installation of new AtoN equipment (cf. Chapter 3.2), a doubling of vessel traffic leads to a 10 percent increase in employment, of which one percent is induced by the AtoN investment. Furthermore, it is assumed that the same number of job opportunities are created in the transport business outside the port.

Another effects most difficult to measure is the contribution of new AtoN installation to the improvement of safety in port. Currently, there are no (reliable) statistics on the number of accidents in Caspian ports. All ports claim, that there have not been any accidents over the last decades, and in fact no information on the occurrence of major oil spills or injuries have been noted by the consultants. Nevertheless, the consultants are aware that smaller accidents are not always reported to

the supervising institutions. Furthermore, previous studies have pointed to the difficult and insecure navigational conditions in Caspian ports. Thus, under the current conditions it can be attributed to fortunate circumstances, the relatively low traffic volumes and the experience of the masters of the vessels sailing on the Caspian Sea (most of them have been sailing on the Caspian all their life and know every port by heart) that so far the Caspian has not experienced a major accident. In this context it should also be noted that Turkmenbashi and Baku currently do not possess the appropriate equipment to cope with oil spills, while Aktau has just purchased this equipment.

In the light of expected growing traffic volumes (especially in oil tanker transports) and a possible growing internationalisation of Caspian sea-borne traffic (which effectively means vessels calling at Caspian ports may have leading officers which are not familiar with "special conditions" in port) the risk of accidents considerably increases.

The measurement of positive benefits of increased safety is not only hampered by missing statistics on the status-quo but also by the problem of the time horizon of the investment analysis. Since (major) accidents are usually very rare incidents, the probability of an accident occurring within the calculated time frame may be very low (if it can be calculated with sufficient precision at all). On the other hand, if this accident occurs, its costs may be extremely high and sum up to a multiple of the investments in new AtoN equipment. Examples of damages to the environment caused by tanker accidents and the costly removal of these damages are legion. Not to mention the almost priceless value of human life.

Thus, for the present analysis the effects of improved safety are only included as a qualitative factor, against which the result of the quantitative economic analysis is evaluated should the project miss its target rate.

7.3 Results

In Baku/Dubendi the monetarisation and inclusion of the a.m. effects in the analysis leads to a more than doubling of the EIRR compared to the FIRR to reach 9.1 percent. However, the EIRR still fails to reach the economic target rate of 10 percent. This would need a further tariff increase of 3.5 percent or an additional average annual benefit of about 7,500 EURO. The latter may be interpreted as a premium the port pays for improved navigational and ecological safety.

The biggest contribution to the economic benefits stem from the time savings of cargo. Starting from 27,000 EURO in 2002 the annual savings increase to over 44,000 EURO in 2020. The time savings to passengers in 2002 amount to slightly over 4,000 EURO and increases to about 6,000 EURO in 2020. Benefits from increased tax income are estimated to reach an annual about 1,000 EURO in 2020.

In Turkmenbashi, the inclusion of economic and social benefits into the analysis leads to quadrupling of the rate of return from just over 5 of over 22 percent in the medium scenario. As in Baku, the increase is mainly induced by monetarised time savings in the cargo transport sector. Here, economic benefits from 32,000 EURO (in 2002) up to over 38,000 EURO (in 2020) can be expected. But also the passenger transport sector considerably contributes to the now satisfactory

result with benefits ranging from 7,000 EURO (in 2002) to 10,000 (in 2020). Again, the contribution of additional direct labour effects remains marginal.

For Aktau, no time savings are expected, consequently there are no quantifiable benefits in this category. Moreover, since Aktau is an efficient working port, the number of workers is relatively small, which leads to relatively small employment benefits from the increase in business due to this additional AtoN equipment of about 1000 EURO in 2020. All in all, quantifiable social and economic benefits are shy. But it can be expected, that the additional AtoN equipment (radar, INMARSAT etc) will significantly contribute to increasing safety in the port and access area which will help to prevent or at least reduce potential damages to man, material and environment from vessel accidents.

7.4 Conclusion

All in all, the economic analysis has demonstrated that the investment into AtoN equipment in the Caspian ports of Baku/Dubendi, Aktau and Turkmenbashi pays to the economy and to the society. Turkmenbashi reaches and economic IRR which is by far outpassing the target rate of 10 percent, while Baku/Dubendi fails to reach a spot landing but comes close to it. If taking into account the increased navigational safety and its expected positive effects on the ecological environment and personal safety, the "premium", which is paid for it seems highly acceptable.

Since for Aktau no significant time savings can be expected it could not be shown, that the EIRR is substantially higher than the FIRR, but the effects of additional safety may prove a sufficient insurance against any misspecifications and miscalculations due to a possibly biased tariff rate. Also, the financial investment into safety seems to be at a level, which can well be handled by public institutions, if only the socio-economic effects are taken into account.

8 Summary and Conclusion

The main objective of the present study has been to analyse the technical, financial and economic feasibility of rehabilitating and modernising the Aids to Navigation (AtoN) equipment and systems in the Caspian ports of Baku/Dubendi, Aktau and Turkmenbashi. If the results of the feasibility analysis justify the investment, then this study should form the base for the preparation of a tender dossier with detailed technical specifications.

The expected increases in cargo volumes transported across the Caspian Sea (especially in oil trade but also in ferry related cargoes) go hand in hand with an increase in vessel traffic density since the growth of vessel size will be moderate due to existing nautical restrictions on the Caspian Sea and in Caspian ports.

In the light of the future traffic volumes, the technical review of the existing AtoN systems has revealed that there is an urgent need for action in at least two of the analysed ports. Baku/Dubendi and Turkmenbashi lack basic equipment for guaranteeing navigational safety in the port approach area and the harbour basin, while Aktau has just recently taken measures to partly update their AtoN equipment to western European standards but still lack some facilities for efficient coverage and surveillance of the port and sea-side access area.

The institutional analysis pointed out that there may be efficiency gains from a reorganisation/centralisation of the AtoN system in Baku/Dubendi.

The financial analysis demonstrates, that the investment into AtoN equipment in Baku/Dubendi and Turkmenbashi can under the present conditions not be financed with private sector participation since the calculated financial rates of return (FIRR) are far from being satisfactory from a private investors point of view. In Aktau, the calculated FIRR reached a level, which casts doubts, whether the collected lighthouse dues are solely dedicated to the cost-recovery of AtoN services. Since until today, the ports analysed within the present study do not use a service-based accounting system, the setting of tariffs still appears to have some arbitrary traits. Furthermore, the Port of Aktau is limited in their capacities for any new investment, since it is bound by restrictions imposed on the port by the recently granted high-volume EBRD loan for terminal rehabilitation.

Nevertheless, the economic evaluation comes to the conclusion, that the social net benefits to be expected from the proposed measures will positive at a level, which raises the economic rate of return up to the level usually required by international financial institutions for the funding of public infrastructure investments.

Consequently, it can be stated that the proposed rehabilitation of the Aids to Navigation systems in Baku/Dubendi, Aktau and Turkmenbashi is not only technically feasible but also highly recommended to be executed in the very near future given the present condition. The investment should be financed from public funds, since the financial viability could not be demonstrated, but nevertheless, the economic evaluation provided enough evidence to suggest the economic viability of the measure.

Annex 1

Meeting Schedule

ANNEX 1: Meeting Schedule

Contact person	Position	Location
Mr. Mamedov	Director of BISP	Baku International Seaport, Baku Azerbaijan
Mr. Soltan Kazimov	Chief Engineer of BISP	
Mrs. Raya Gasimova	Head of Economic Department of BISP	
Mr. Elman Aliev	Head of Commercial Department of BISP	
Mr. Namik Agamalieyev	Deputy Harbour Master, Port of Baku/Dubendi	
Mrs. Emilia Agaeva	Tacis Intermodal Project, HPTI	
Mr. Kazim Guliev	Capt. First Class of Hydrographic Institute	Hydrographic Institute, Baku, Azerbaijan
Mr. Elbar Seinukov	Director of Kazmorput	Head Office of Kazmorput, Baku, Azerbaijan
Mr. Bodo Rössig	Team Leader of Tacis Project, Dornier Consult	Telephone Conference, Baku, Azerbaijan
Mr. Marc Graille	TRACECA Management Team	Project Office, Baku, Azerbaijan
Mr. Berik Baishev	Head of the Investment Policy Department, MoE	Ministry of Economics, Astana, Kazakhstan
Mr. Cheniz Kasimbek	Head of the Department for Water Transportation, MoTC	Ministry of Transport and Communication, Astana, Kazakhstan
Mr. Erken Aimurzaev	Director of Kazmortransflot	
Mr. Alexander Glock	Deputy Director and Financial Director, ACSP	Aktau Commercial Seaport, Aktau, Kazakhstan
Mr. Vladimir Konstantinov	Chief Engineer of ACSP	
Mr. Berik Ergaliev	Marketing Department of ACSP	
Mr. Talgat Abylgazin	Director of ACSP	
Mr. Evgeny Lamzin	Harbour Master of the Port of Aktau	
Mr. Igor Protsenko	Head of Communications and Navigational Aids Department	
Mr. Cheniz Kasimbek	Head of the Sub-Department for Water Transportation,	
Mr. Marc Graille	TRACECA Management Team	
Mr. John Bradley	EU Task Manager SCR	
Mr. Daniel Stroobants	DG Relex, Transport Sector, Tacis and TRACECA Countries	
Mr. Brian Toll	EU Delegation in Kazakhstan	
Mr. Batyr Hudaynazarov	EBRD Turkmenistan	EBRD Office, Ashgabat, Turkmenistan
Mr. Michael Wilson	Advisor, Tacis CU Turkmenistan	Tacis Coordination Unit, Ashgabat, Turkmenistan
Mr. Jaap Burger	Senior Port Engineer, Haskoning	Port of Turkmenbashi, Turkmenbashi, Turkmenistan
Mrs. Gulnara Sapardudyeva	Deputy Operational Planner, Haskoning	
Mr. Bekmurat Gurbanmuradov	Director of the Port of Turkmenbashi	
Mrs. Elena Stebbings	Project Implementation Unit, Turkmenbashi	
Mr. Simon Thomas		

Mr. Murad Atayev	Deputy Director of the Port of Turkmenbashi	
Mr. Akhmed Tahirov	Head of the Commercial Department, Port of Turkmenbashi	Port of Turkmenbashi, Turkmenbashi, Turkmenistan
Mr. Aleksey Terekhov	Harbour Master of the Port of Turkmenbashi	
Mrs. Lidiya Retunskaya	Senior Specialist, Technical Department of the Port of Turkmenbashi	
Mrs. Enegul Haidarova	Assistant to the Turkmenbashi Port Director	

Annex 2

TRACECA Route

European Union

Tacis

TRACECA

TRANSPORT CORRIDOR
EUROPE CAUCASUS ASIA

www.traceca.org

ST-PETERSBURG
VOLOGDA
KIROV
PERM
YEKATERINBURG
OMSK
PETROPAVLOVSK
PAVLODAR
SEMIPALATINSK
UST'-KAMENOGORSK
KOKCHETAV
CHELYABINSK
ASTANA
KARAGANDA
MONGOLIA
CHINA
NIZHNI NOVGOROD
KAZAN
MOSCOW
RUSSIAN FEDERATION
SMOLENSK
SAMARA
MINSK
BELARUSSIA
POLAND
BREST
GOMEL
KURSK
VORONEZ
URALSK
AKTYUBINSK
KAZAKHSTAN
ALMATY
BISHKEK
KYRGHYZSTAN
KIEV
L'VIV
UKRAINE
KHARKOV
POLTAVA
VOLGOGRAD
Volga
Don
Ural
Syrdarja
Aral Sea
SLOVAKIA
HUNGARY
VINNICA
DNEPROPETROVSK
LUGANSK
KRIVOJ ROG
ZAPOROZ'JE
DONETSK
ROSTOV ON DON
ASTRAKHAN
TAJIKISTAN
MOLDOVA
ROMANIA
CHISINAU
NIKOLAJEV
MARIUPOL'
MELITOPOL'
ODESSA
ILYICHEVSK
UZBEKISTAN
SAMARKAND
DUSHANBE
BUKHARA
AKTAU
KRASNODAR
NOVOROSSIJSK
SERBIA
BUCAREST
CONSTANTA
GROZNY
MAKHACHKALA
GEORGIA
TBILISI
AZERBAIJAN
TURKMENISTAN
TURKMENBASHI
ASHGABAT
KABUL
AFGHANISTAN
PAKISTAN
SOFIA
VARNA
BURGAS
Black Sea
BULGARIA
POTI
BATUMI
SAMSUN
ISTANBUL
GREECE
THESSALONIKI
TURKEY
YEREVAN
ARMENIA
Caspian Sea
Aegean Sea
ATHENS
ANKARA
TURKEY
THIRAN
IRAN
IRAQ
SYRIA

TRACECA INDEX

Section nbr.	Description
1	Port of ODESSA
2	ODESSA/POTI/BATUMI
3	Port of POTI
4	Port of BATUMI
5	POTI/BATUMI/TBIISI
6	TBIISI /YEREVAN
7	TBIISI/BAKU
8	YEREVAN/BAKU
9	Port of BAKU
10	Port of AKTAU
11	Port of TURKMENBASHI
12	TURKMENBASHI/CHARDZHOU
13	CHARDZHOU/BOKHARA/ SAMARKAND TASHKENT
14	SAMARKAND/TERMEZ/ DUSHANBE
15	KURGAN TUBA/ KULAB (rail only)
16	AKTAU BEINEU/ CHU ALMATY/ DRUZHBA
17	UGGOVAYA/BISHKEK/ BAYTCHI

LEGEND

0 50 100 km

- Highway
- Main road
- Other road
- Railway
- Major city
- City up to 500.000 Inhabitants
- City up to 50.000 Inhabitants

TRACECA LEGEND

- Ports
- Maritime route
- Rail Corridor
- Road Corridor

Annex 3

Cash Flow

Financial Analysis for the Implementation of Aids to Navigation Equipment in the Port of Baku

Forecast	Vessel size (m3)	1998 Average size (m3)	1999 No. of own flag vessels	1999 No. of frgn flag vessels	2001 1 own vess	2001 1 frgn vess	2002 2 own vess	2002 2 frgn vess	2003 3 own vess	2003 3 frgn vess	2004 4 own vess	2004 4 frgn vess	2005 5 own vess	2005 5 frgn vess	2006 6 own vess	2006 6 frgn vess	2007 7 own vess	2007 7 frgn vess	2008 8 own vess	2008 8 frgn vess	2009 9 own vess	2009 9 frgn vess	2010 10 own vess	2010 10 frgn vess	2011 11 own vess	2011 11 frgn vess	2012 12 own vess	2012 12 frgn vess	2013 13 own vess	2013 13 frgn vess	2014 14 own vess	2014 14 frgn vess	2015 15 own vess	2015 15 frgn vess	2016 16 own vess	2016 16 frgn vess	2017 17 own vess	2017 17 frgn vess	2018 18 own vess	2018 18 frgn vess	2019 19 own vess	2019 19 frgn vess	2020 20 own vess	2020 20 frgn vess
No. of vessels calling:	Tanker Dub	7000	323	0	315	0	330	0	346	0	363	0	380	0	381	0	403	0	415	0	427	0	440	0	453	0	466	0	479	0	493	0	507	0	521	0	535	0	550	0	565	0	580	0	596	0
pessimistic scenario	Tanker Baku	5000	320	0	350	0	361	0	372	0	383	0	394	0	402	0	410	0	418	0	427	0	435	0	444	0	453	0	462	0	471	0	480	0	490	0	500	0	510	0	520	0	530	0	540	0
	Ferry	11000	442	0	442	0	442	0	442	0	442	0	442	0	520	0	520	0	520	0	520	0	520	0	520	0	520	0	520	0	520	0	520	0	520	0	624	0	624	0	624	0	624	0	624	0
	Multi-Purpose	5000	19	13	11	8	14	12	15	13	15	13	16	13	16	13	16	13	17	14	17	14	18	15	18	15	18	15	19	15	19	16	20	16	20	16	20	17	21	17	21	17	21	17	21	17
No. of vessels calling:	Tanker	7000	363	0	522	0	546	0	571	0	596	0	623	0	642	0	661	0	681	0	701	0	722	0	740	0	759	0	778	0	797	0	817	0	834	0	850	0	867	0	885	0	902	0	920	0
medium scenario	Tanker	5000	320	0	350	0	361	0	372	0	383	0	394	0	406	0	418	0	431	0	444	0	457	0	471	0	485	0	499	0	514	0	530	0	546	0	562	0	579	0	596	0	614	0	632	0
	Ferry	11000	442	0	442	0	442	0	442	0	442	0	442	0	546	0	546	0	546	0	546	0	546	0	546	0	546	0	546	0	546	0	546	0	676	0	676	0	676	0	676	0	676	0	676	0
	Multi-Purpose	5000	19	13	11	8	15	12	15	12	16	13	16	13	17	14	18	14	18	15	19	15	20	16	20	17	21	17	22	18	22	18	23	19	24	19	24	20	25	20	25	21	26	21	26	21
No. of vessels calling:	Tanker	7000	363	0	590	0	562	0	596	0	631	0	669	0	696	0	724	0	753	0	783	0	814	0	839	0	864	0	890	0	916	0	944	0	963	0	987	0	1 002	0	1 022	0	1 042	0	1 062	0
optimistic scenario	Tanker	5000	320	0	360	0	382	0	405	0	428	0	455	0	478	0	492	0	512	0	532	0	554	0	570	0	587	0	605	0	623	0	642	0	655	0	668	0	681	0	695	0	709	0	723	0
	Ferry	11000	442	0	442	0	442	0	442	0	442	0	442	0	572	0	572	0	572	0	572	0	572	0	572	0	572	0	572	0	572	0	572	0	780	0	780	0	780	0	780	0	780	0	780	0
	Multi-Purpose	5000	19	13	12	9	15	12	15	13	16	13	17	14	18	14	18	15	19	15	20	16	20	17	21	17	22	18	22	18	23	19	24	19	24	20	25	20	25	21	26	21	26	21	27	21

Price per unit m3 (AZM)	own flag	foreign flag
vessel dues	80	3419
channel dues	139	229

Price per call (in AZM)				
CSC Ferries	3 664 000	AtoN Share	10%	366 400
CSC Tankers to Dubendi	4 580 000	AtoN Share	10%	458 000
CSC Dry Cargo Vessels to Baku	5 496 000	AtoN Share	10%	549 600

Total revenues (in EURO)

Pessimistic scenario		153 695	175 594	180 468	184 653	188 864	193 464	203 664	206 804	210 011	213 282	216 619	219 994	223 438	234 950	230 535	234 188	247 459	251 229	255 074	258 996	404 347
Medium scenario		153 695	176 491	182 329	187 565	193 004	198 652	212 992	217 901	222 959	228 170	233 536	239 434	243 872	249 258	254 794	260 486	277 769	283 229	288 821	394 564	441 813
Optimistic scenario		153 695	179 468	188 565	197 379	206 721	216 622	235 610	242 913	250 510	258 412	266 632	273 054	279 670	286 485	293 507	300 739	324 850	329 910	335 072	340 338	487 058
																					Residual Value	141 550

Cash Operating Costs (in EURO)

	Share																					
Personnel (incl. social insurance)		26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850	26 850
training (1% of personnel costs)	1%	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269	269
boat + vehicle operations, supplies		14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000	14 000
Maintenance of AtoN		19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270	19 270
Overheads	20%	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078	12 078
		72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466	72 466

Investment Costs (in EURO)

buoy launch		0																				
PCO Equipment (OMEISS etc)			100 000											100 000								
Racon			320 000											320 000								
New buoys			293 500																			
lighthouse, lighthouse equipment		0	10 000											10 000								
Spare Buoys, spare parts, tool sets			110 000																			
radar system			40 000											40 000								
computer equipment			20 000						20 000					20 000					20 000			
			883 500	0	0	0	0	0	20 000	0	0	0	0	490 000	0	0	0	0	20 000	0	0	0

Depreciation (in EURO)

Civil works	Depreciation period																					
buoy launch	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PCO Equipment (OMEISS etc)	10	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000
Racon	10	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000	32 000
New buoys	20	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175	14 175
lighthouse equipment	10	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000
Buoy spare parts, tool sets	20	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500	5 500
radar system	10	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000
computer equipment	5	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000
		70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675	70 675

Cumulative Cash-Flow (in EURO)

Pessimistic scenario		-883 500	-844 173	-804 662	-758 839	-708 576	-648 053	-604 388	-531 518	-487 378	-393 900	-317 047	-226 751	-642 942	-555 550	-464 505	-360 185	-272 591	-140 164	-44 309	216 897
Medium scenario		-883 500	-844 312	-799 888	-750 026	-694 515	-624 664	-569 904	-490 087	-405 058	-314 661	-219 169	-608 439	-502 321	-390 648	-273 323	-138 696	18 414	127 065	278 490	577 163
Optimistic scenario		-883 500	-838 076	-783 839	-720 258	-648 776	-554 308	-474 536	-367 167	-251 897	-128 406	1 506	-351 945	-208 621	-58 255	99 343	281 051	447 920	439 752	636 948	1 180 865

Financial Internal Rate of Return

Pessimistic scenario	1.39%
Medium scenario	4.17%
Optimistic scenario	7.84%

Financial Analysis for the Implementation of Aids to Navigation Equipment in the Port of Turkmenbashi

Forecast	Vessel size (m3)	1999 Average size (m3)	1999 No. of frgn flag vessels	1999 No. of own flag vessels	2001 1 frgn vess	2001 1 own vess	2002 2 frgn vess	2002 2 own vess	2003 3 frgn vess	2003 3 own vess	2004 4 frgn vess	2004 4 own vess	2005 5 frgn vess	2005 5 own vess	2006 6 frgn vess	2006 6 own vess	2007 7 frgn vess	2007 7 own vess	2008 8 frgn vess	2008 8 own vess	2009 9 frgn vess	2009 9 own vess	2010 10 frgn vess	2010 10 own vess	2011 11 frgn vess	2011 11 own vess	2012 12 frgn vess	2012 12 own vess	2013 13 frgn vess	2013 13 own vess	2014 14 frgn vess	2014 14 own vess	2015 15 frgn vess	2015 15 own vess	2016 16 frgn vess	2016 16 own vess	2017 17 frgn vess	2017 17 own vess	2018 18 frgn vess	2018 18 own vess	2019 19 frgn vess	2019 19 own vess	2020 20 frgn vess	2020 20 own vess
No. of vessels calling: pessimistic scenario	Tanker Crude	9000	48	0	42	0	150	0	152	0	153	0	155	0	156	0	158	0	159	0	161	0	162	0	164	0	166	0	166	0	166	0	166	166	166	0	166	0	166	0	166	0	166	0	166	0
	Tanker MiniProd	4500	704	0	675	0	675	0	614	68	620	69	626	70	632	70	638	71	645	72	651	72	656	73	664	74	671	75	675	75	675	75	675	75	675	75	675	75	675	75	675	75	675	75	675	75
	Ferry	11000	390	0	390	0	390	0	390	0	390	0	390	0	416	0	416	0	416	0	416	0	416	0	416	0	416	0	416	0	416	0	416	0	468	0	468	0	468	0	468	0	468	0	468	0
	Multi-Purpose	4000	35	4	37	4	38	4	38	4	39	4	40	4	41	5	42	5	43	5	43	5	44	5	45	5	45	5	45	5	46	5	46	5	47	5	48	5	48	5	49	5	49	5	50	6
No. of vessels calling: medium scenario	Tanker	6000	48	0	42	0	150	0	153	0	156	0	159	0	162	0	166	0	166	0	166	0	166	0	166	0	166	0	166	0	166	0	166	0	166	0	166	0	166	0	166	0	166	0	166	0
	Tanker MiniProd	4500	704	0	675	0	675	0	620	69	632	70	645	72	658	73	671	75	675	75	675	75	675	75	675	75	675	75	675	75	675	75	675	75	675	75	675	75	675	75	675	75	675	75	675	75
	Ferry	11000	390	0	390	0	390	0	390	0	390	0	390	0	442	0	442	0	442	0	442	0	442	0	442	0	442	0	442	0	442	0	442	0	520	0	520	0	520	0	520	0	520	0	520	0
	Multi-Purpose	4000	35	4	38	4	39	4	40	4	41	5	43	5	44	5	45	5	46	5	46	5	48	5	49	5	50	6	51	6	53	6	54	6	55	6	56	6	57	6	59	7	60	7	61	7
No. of vessels calling: optimistic scenario	Tanker	6000	48	0	42	0	150	0	155	0	159	0	164	0	169	0	174	0	179	0	184	0	190	0	196	0	202	0	208	0	214	0	220	220	220	0	220	0	220	0	220	0	220	0	220	0
	Tanker MiniProd	4500	704	0	675	0	675	0	626	70	644	72	664	74	684	76	704	78	725	81	747	83	770	86	793	88	816	91	841	93	866	96	892	99	900	100	900	100	900	100	900	100	900	100	900	100
	Ferry	11000	390	0	390	0	390	0	390	0	390	0	390	0	468	0	468	0	468	0	468	0	468	0	468	0	468	0	468	0	468	0	468	0	624	0	624	0	624	0	624	0	624	0	624	0
	Multi-Purpose	4000	35	4	38	4	40	4	42	5	43	5	45	5	47	5	49	5	51	6	53	6	55	254	56	6	58	6	60	7	62	7	64	7	66	7	68	8	70	8	72	8	74	8		

	foreign flag	own flag
Price per unit m3 (in EURO)		
light dues	0.023	0
Price per call		
CSC Ferries	253	Discount 50% 127

Total revenues (in EURO)

Pessimistic scenario		128 824	119 198	119 198	112 841	113 476	114 117	118 054	118 709	119 369	120 037	120 711	121 392	122 080	122 488	122 488	122 488	129 697	129 066	129 066	129 066	129 066		
Medium scenario		128 824	119 198	119 198	113 470	114 752	116 061	123 973	125 334	125 777	125 777	125 777	125 777	125 777	125 777	125 777	125 777	136 275	135 644	135 644	135 644	135 644		
Optimistic scenario		128 824	119 198	119 198	114 098	116 041	116 043	129 971	132 094	134 281	136 533	138 853	141 243	143 704	146 239	148 850	151 539	173 204	172 088	172 088	172 088	172 088		
																							Residual Value	62 860

Cash Operating Costs (in EURO)

	Share																							
Personnel (incl. social insurance)		31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000	31 000		
training (1% of personnel costs)	1%	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310	310		
boat + vehicle operations, supplies		5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000		
Maintenance of AtoN		8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702	8 702		
Overheads	20%	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002	9 002		
		$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014	$4 014		

Investment Costs (in EURO)

PCD Equipment (GMDSS etc)			35 000											35 000										
Racon			40 000											40 000										
New buoys			128 600																					
Spare buoys, spare parts, tool sets			35 000																					
radar system			100 000											100 000										
computer equipment			28 000						28 000					28 000							28 000			
			367 600	0	0	0	0	0	28 000	0	0	0	0	203 000	0	0	0	0	0	28 000	0	0	0	

Depreciation (in EURO)

Port Works	Depreciation period																							
PCD Equipment (GMDSS etc)	10			3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500	3 500
Racon	10			4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000
New buoys	20			6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480	6 480
Buoy spare parts, tool sets	20			1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750	1 750
radar system	10			10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000
computer equipment	5			5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600	5 600
				31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330	31 330

Cash-Flow (in EURO)

Pessimistic scenario			-302 416	33 854	27 496	28 132	28 773	32 710	5 364	34 025	34 692	35 367	36 047	-166 265	37 143	37 143	37 143	44 353	15 731	43 721	43 721	43 721		
Medium scenario			-302 416	33 854	28 125	29 408	30 716	36 629	11 990	40 432	40 432	40 432	40 432	-162 568	40 432	40 432	40 432	50 830	22 299	50 299	50 299	50 300		
Optimistic scenario			-302 416	33 854	28 754	30 697	32 696	44 626	18 750	48 936	51 189	53 509	55 898	-144 641	60 894	63 506	66 195	87 859	38 743	86 743	86 743	86 743		

Cumulative Cash-Flow (in EURO)

Pessimistic scenario			-302 416	-268 562	-241 066	-212 934	-184 161	-151 451	-146 087	-112 062	-77 370	-42 003	-5 956	-172 220	-135 077	-97 934	-60 791	-16 438	717	43 004	86 725	130 447		
Medium scenario			-302 416	-268 562	-240 437	-211 029	-180 313	-143 684	-131 695	-91 262	-48 829	-8 397	32 035	-130 532	-90 100	-49 668	-9 235	41 595	63 994	114 294	164 593	214 893		
Optimistic scenario			-302 416	-268 562	-239 808	-209 111	-176 413	-131 786	-113 037	-64 100	-12 912	40 597	96 495	-48 146	12 749	76 254	142 449	230 308	269 052	315 795	402 538	549 281		

Financial Internal Rate of Return

Pessimistic scenario	3.74%
Medium scenario	6.74%
Optimistic scenario	10.60%

Financial Analysis for the Implementation of Aids to Navigation Equipment in the Port of Aktau

Forecast	Vessel size (m3)	1999 Average size (m3)	1999 No. of own flag vessels	1999 No. of frgn flag vessels	2001 1 own	2001 1 frgn	2002 2 own	2002 2 frgn	2003 3 own	2003 3 frgn	2004 4 own	2004 4 frgn	2005 5 own	2005 5 frgn	2006 6 own	2006 6 frgn	2007 7 own	2007 7 frgn	2008 8 own	2008 8 frgn	2009 9 own	2009 9 frgn	2010 10 own	2010 10 frgn	2011 11 own	2011 11 frgn	2012 12 own	2012 12 frgn	2013 13 own	2013 13 frgn	2014 14 own	2014 14 frgn	2015 15 own	2015 15 frgn	2016 16 own	2016 16 frgn	2017 17 own	2017 17 frgn	2018 18 own	2018 18 frgn	2019 19 own	2019 19 frgn	2020 20 own	2020 20 frgn
No. of vessels calling	Tanker	7000	276		410		420		431		442		453		462		471		480		490		500		507		515		522		530		538		546		555		563		571		580	
	Ferry	11000	17		52		52		52		52		52		52		52		52		52		52		52		52		52		52		52		52		52		52		52		52	
	Multi-Purpose	3000	82		202		209		212		215		218		220		223		226		228		231		234		237		239		242		245		248		251		254		257		260	
No. of vessels calling	Tanker	7000	276		412		424		437		450		464		475		487		499		512		525		535		546		557		568		579		591		603		615		627		640	
	Ferry	11000	17		52		52		52		52		52		104		104		104		104		104		104		104		104		104		104		104		104		104		104		104	
	Multi-Purpose	3000	82		204		213		218		222		227		232		237		242		248		253		257		262		267		271		282		286		292		297		315	
No. of vessels calling	Tanker	7000	276		416		433		450		468		487		501		516		532		548		564		578		593		608		623		638		654		671		687		705		722	
	Ferry	11000	17		52		52		52		52		52		104		104		104		104		104		104		104		104		104		104		156		156		156		156		156	
	Multi-Purpose	3000	82		206		218		225		233		241		249		257		265		274		283		289		295		302		309		328		322		330		337		345		382	

Price per unit m3 (EURO)				
Lighthouse dues	0.06			
Price per call (EURO)				
CSC Ferries	3 100	Aktiv Share	5%	155

Total revenues (in EURO)

	1999	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Pessimistic scenario	122 250	199 228	204 405	208 904	213 513	218 234	222 146	226 135	230 201	234 348	238 571	241 906	245 290	248 724	252 208	255 745	259 334	262 977	266 673	270 425	298 632
Medium scenario	122 250	200 286	206 574	212 235	218 082	224 057	237 395	242 803	248 345	254 025	259 845	264 623	279 544	274 471	279 544	285 663	290 000	295 387	300 983	306 491	338 670
Optimistic scenario	122 250	202 226	210 586	218 484	226 697	235 236	250 193	257 301	264 628	272 180	279 965	288 425	293 046	299 831	306 785	316 054	329 276	336 761	344 433	352 296	389 602
																				Residual Value	24 400

Cash Operating Costs (in EURO)

	Share																				
Personnel (incl. social insurance)		47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900	47 900
training (1% of personnel costs)	1%	479	479	479	479	479	479	479	479	479	479	479	479	479	479	479	479	479	479	479	479
boat + vehicle operations, supplies		5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000	5 000
Maintenance of AtoN		5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380	5 380
Overheads	20%	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752	11 752
		70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511	70 511

Investment Costs (in EURO)

Existing buoys	65 000																				
PCD Equipment (INMARSAT etc)	20 000	16 000											36 000								
Racon		40 000											40 000								
Spare buoys, spare parts, tool sets		60 000																			
radar system		20 000											20 000								
computer equipment		8 000						8 000					8 000					8 000			
		229 000	0	0	0	0	0	8 000	0	0	0	0	104 000	0	0	0	0	8 000	0	0	0

Depreciation (in EURO)

Civil Works	Depreciation period																				
Existing buoys	20	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250	3 250
PCD Equipment (INMARSAT etc)	10	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600	3 600
Racon	10	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000	4 000
Buoy spare parts, tool sets	20	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000	3 000
radar system	10	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000	2 000
computer equipment	5	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600	1 600
		17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450	17 450

Cash-Flow (in EURO)

Pessimistic scenario	-229 000	116 444	120 943	125 552	130 273	134 185	130 174	142 240	146 385	150 610	153 945	53 329	160 763	164 346	167 784	171 373	167 016	178 712	182 464	216 671
Medium scenario	-229 000	118 613	124 275	130 101	136 097	149 434	146 843	160 385	166 064	171 884	176 663	77 537	186 510	191 583	197 702	202 039	199 426	212 923	218 530	250 709
Optimistic scenario	-229 000	122 625	130 523	138 736	147 275	162 232	161 340	176 667	184 219	192 004	198 464	101 085	211 879	218 824	228 093	241 315	240 800	256 472	264 335	301 641

Cumulative Cash-Flow (in EURO)

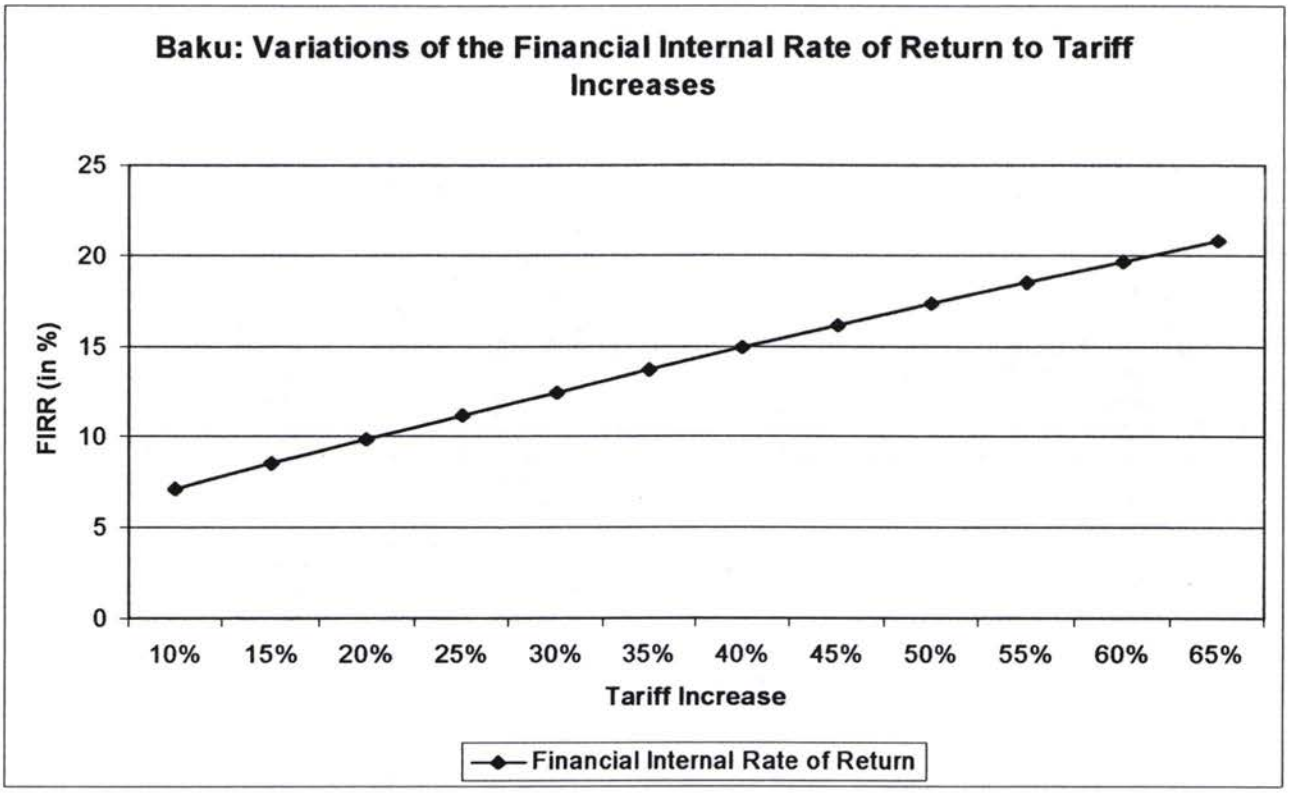
Pessimistic scenario	-229 000	-112 556	8 388	133 940	264 212	398 398	528 572	670 811	817 196	967 806	1 121 751	1 175 080	1 335 843	1 500 090	1 667 875	1 839 248	2 006 264	2 184 977	2 367 441	2 578 112
Medium scenario	-229 000	-110 387	13 887	143 988	280 085	429 519	576 362	736 746	902 810	1 074 695	1 251 357	1 328 894	1 515 404	1 706 987	1 904 690	2 106 729	2 306 155	2 519 078	2 737 608	2 988 317
Optimistic scenario	-229 000	-106 375	24 149	162 885	310 160	472 392	633 732	810 399	994 618	1 186 622	1 385 086	1 486 172	1 698 042	1 916 866	2 144 959	2 388 274	2 627 074	2 883 546	3 147 881	3 449 523

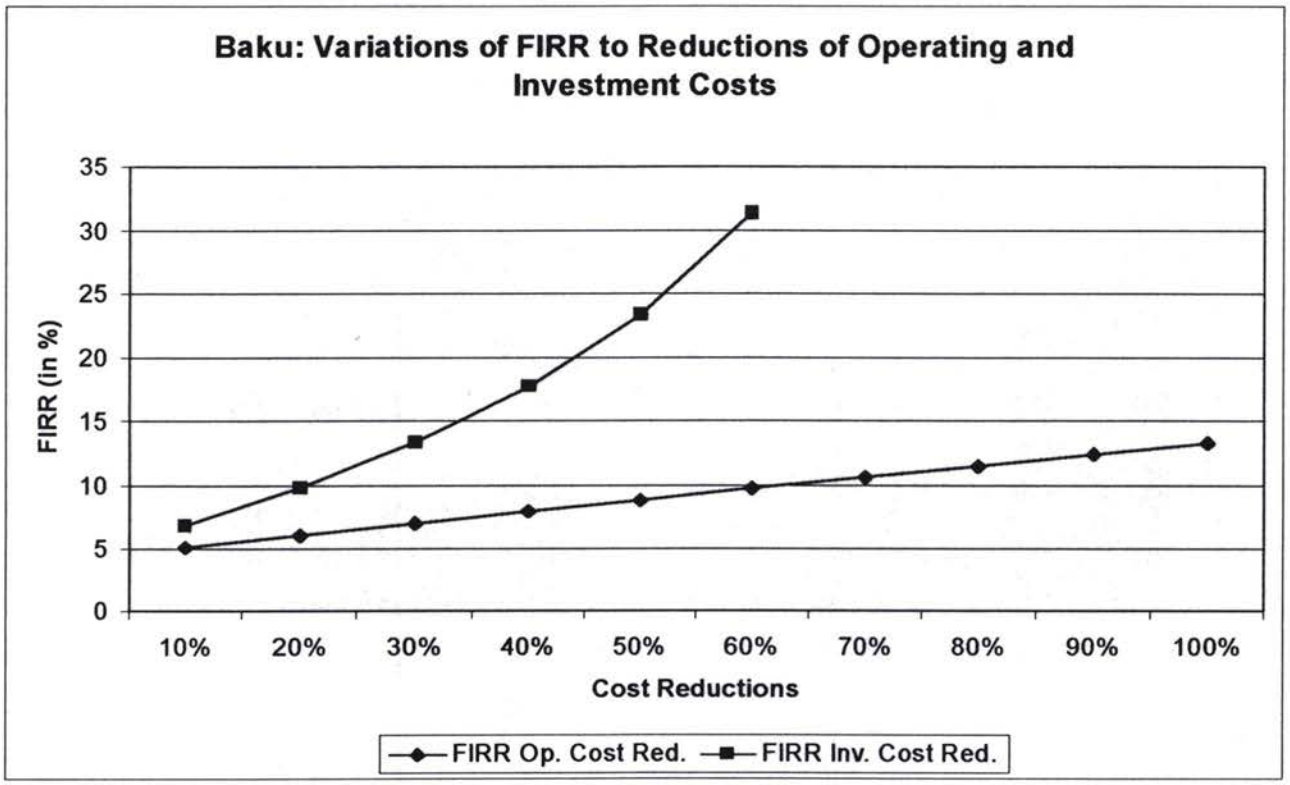
Financial Internal Rate of Return

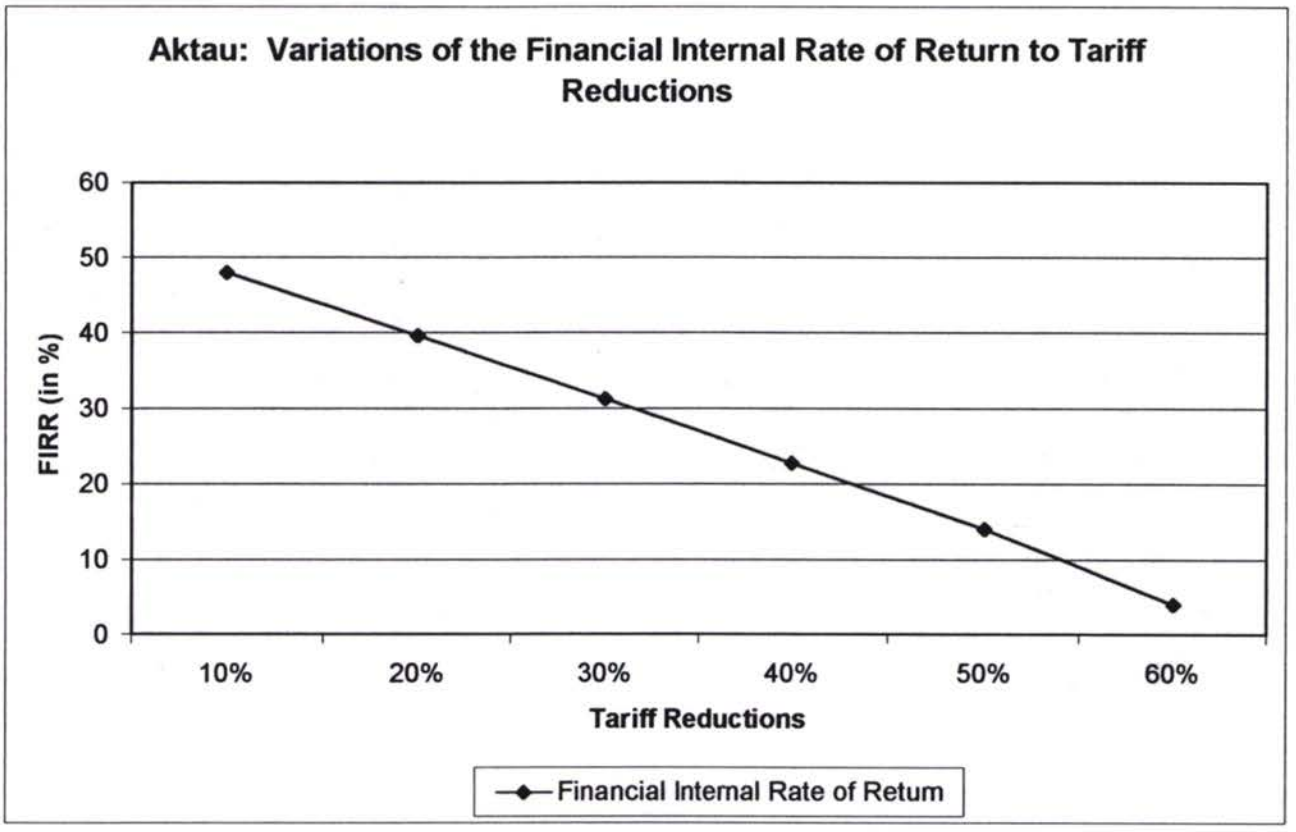
Pessimistic scenario	54.83%
Medium scenario	56.43%
Optimistic scenario	59.34%

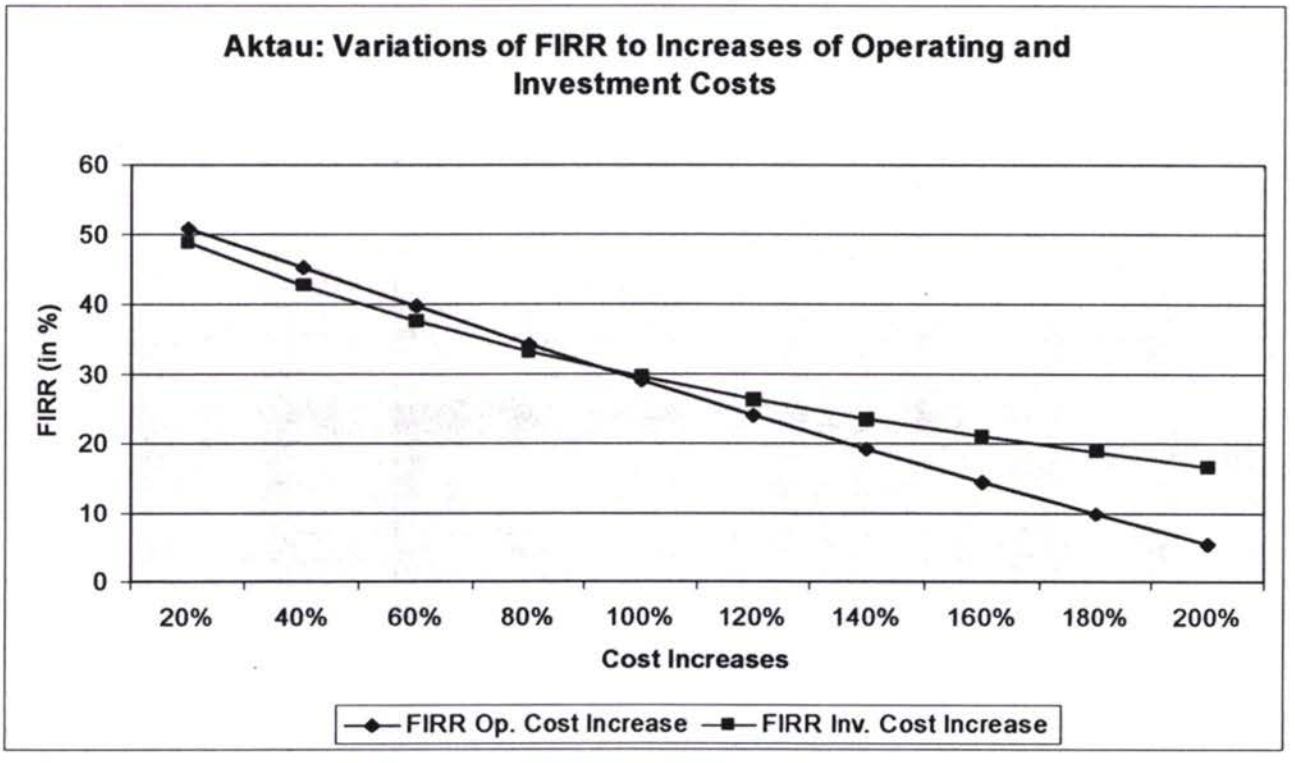
Annex 4

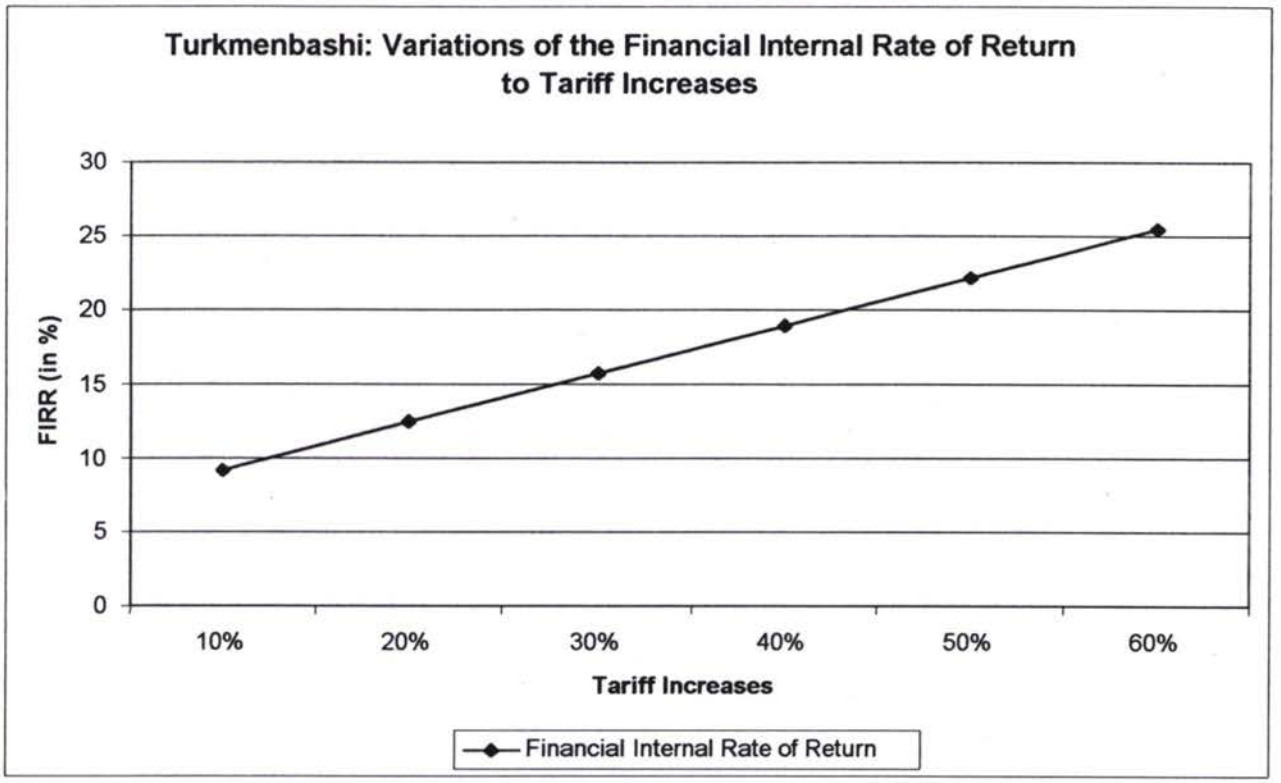
Variations of Financial Parameters

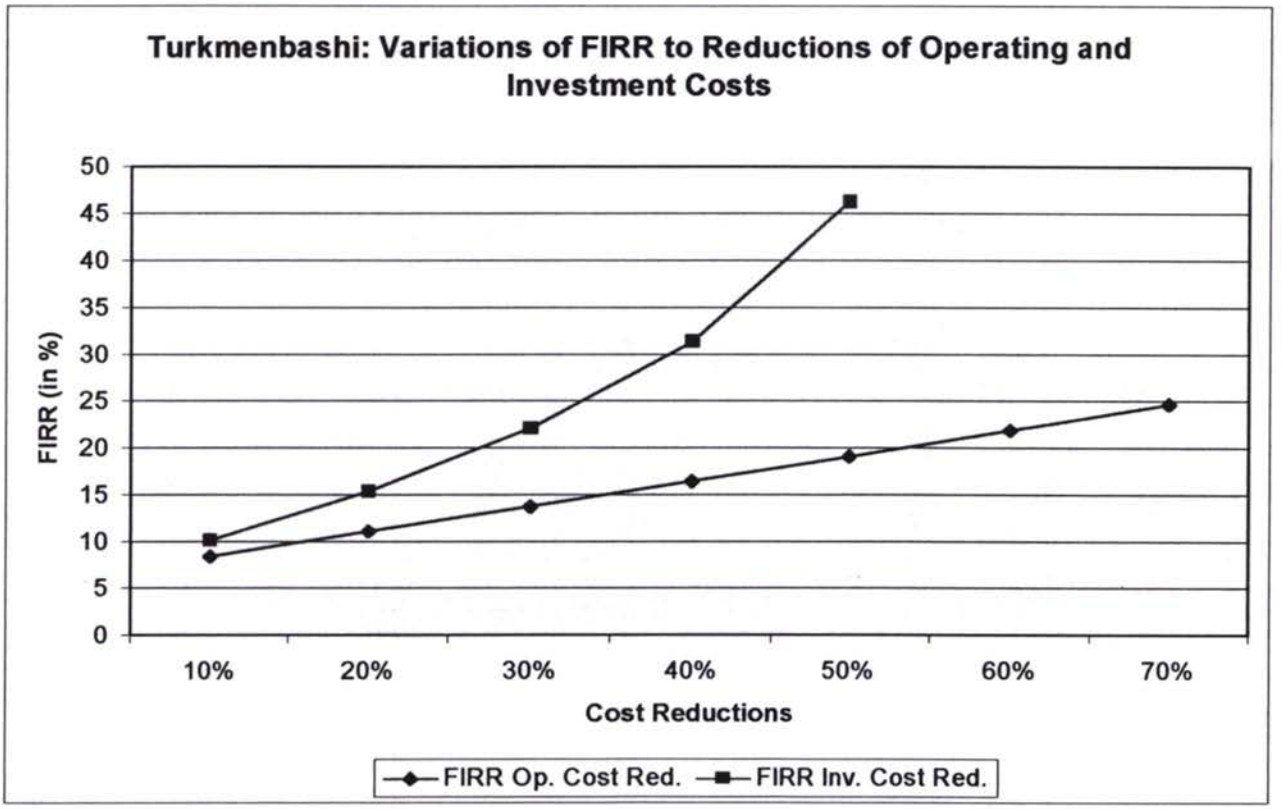

Baku: Variations of the Financial Internal Rate of Return to Tariff Increases
FIRR (in %)
25
20
15
10
5
0
10%
15%
20%
25%
30%
35%
40%
45%
50%
55%
60%
65%
Tariff Increase
Financial Internal Rate of Return


Baku: Variations of FIRR to Reductions of Operating and Investment Costs
FIRR (in %)
35
30
25
20
15
10
5
0
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Cost Reductions
FIRR Op. Cost Red.
FIRR Inv. Cost Red.


Aktau: Variations of the Financial Internal Rate of Return to Tariff Reductions
FIRR (in %)
60
50
40
30
20
10
0
10%
20%
30%
40%
50%
60%
Tariff Reductions
Financial Internal Rate of Return


Aktau: Variations of FIRR to Increases of Operating and Investment Costs
FIRR (in %)
60
50
40
30
20
10
0
20%
40%
60%
80%
100%
120%
140%
160%
180%
200%
Cost Increases
FIRR Op. Cost Increase
FIRR Inv. Cost Increase

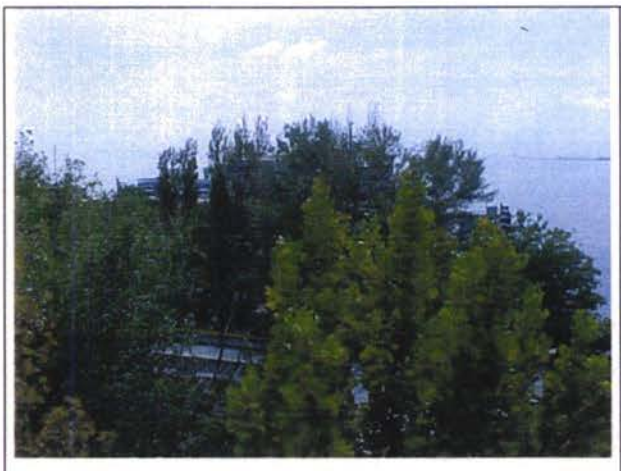

Turkmenbashi: Variations of the Financial Internal Rate of Return to Tariff Increases
30
25
20
15
10
5
0
FIRR (in %)
10%
20%
30%
40%
50%
60%
Tariff Increases
Financial Internal Rate of Return


Turkmenbashi: Variations of FIRR to Reductions of Operating and Investment Costs
50
45
40
35
30
25
20
15
10
5
0
FIRR (in %)
10%
20%
30%
40%
50%
60%
70%
Cost Reductions
FIRR Op. Cost Red.
FIRR Inv. Cost Red.

Annex 5

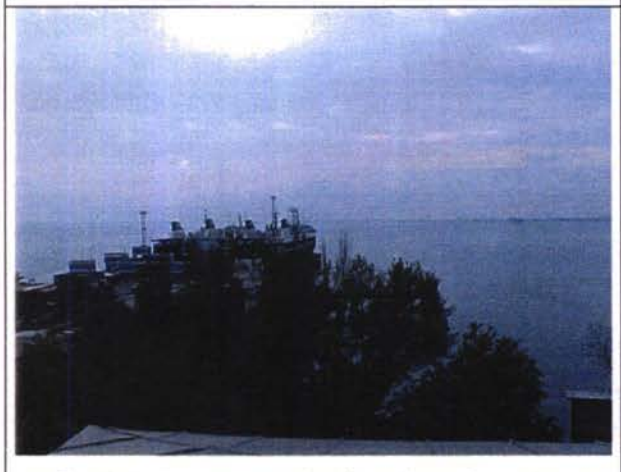
PICTURES OF AIDS TO NAVIGATION INSTALLATIONS AT THE PORTS OF BAKU/DUBENDI, AKTAU AND TURKMENBASHI

Baku/Dubendi (1)

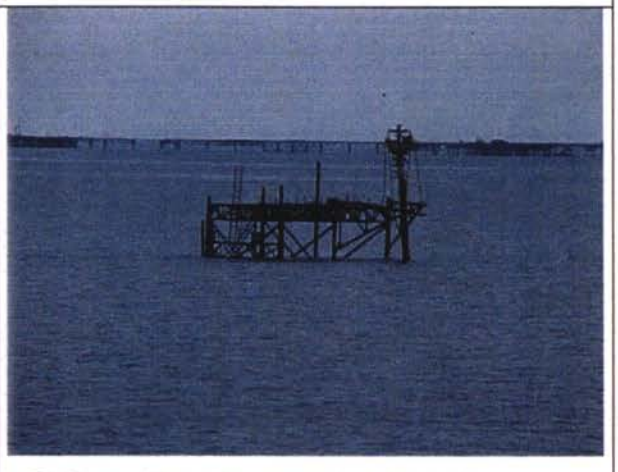


View from Baku Port Control office in direction to the ferry terminal and Baku Bay and port

Restricted panorama view from the radar antenna mast on the roof of the Port Control Centre, from the west side to the east side



Restricted panorama view from the radar antenna mast on the roof of the Port Control Centre, from the west side to the east side



Platform without fire at position 40° 14,6 ' N 50°39,8' E

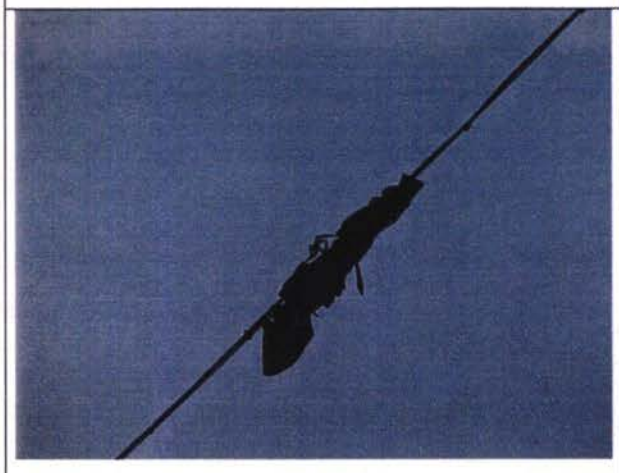
Buoy 13 is green painted, since it is dividing the channel it must be green-red-green coloured

Port buoy 10, without topmark and red colour nearly off, damaged fender

Baku/Dubendi (2)

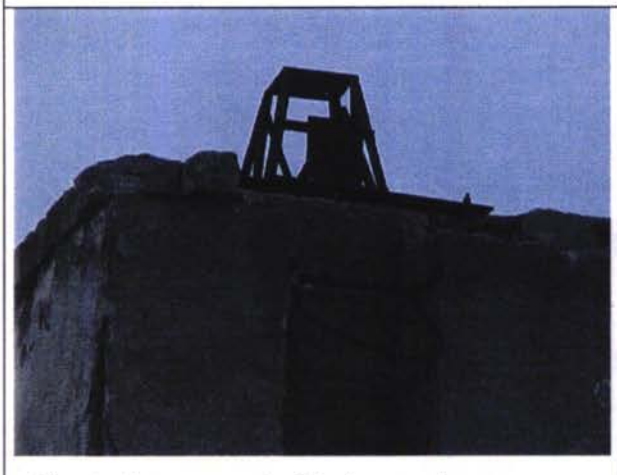
Baku Leading LightsTower 1: View from the south west side with look to the electrician supply cable

Tower 1: Distributing box



Repaired power supply cable

Beacon tower Shikhov, 10 metres height, westerly part of Baku Bay near South Scoop on a 180 metres height rock cliff: since 1998 out of order.



View to the upper part of the beacon tower Shikhov, damaged stone bricks (sand lime stone) construction and the lamp holder, lamp is off

M&R yard, Hydrographic Service of Azerbaijan Navy, area for used buoys.

Baku/Dubendi (3)

Area of used buoys and sinkers

M&R yard, Hydrographic Service of Azerbaijan Navy, view from the quay to the buoy area

Lighthouse Narjin: View to the upper part of the light house with broken window pane and damaged mantelpiece

Unconventional out door cable connection (220 Volt) between generator building and light house

Equipment of the Port Control Centre Dubendi, wind speedometer with container, alarm clock, wristwatch without bracelet, stopwatch log book and hand held radio with only VHF and limited channels

Additional equipment of Port Control Centre Dubendi, battery charger, telephone and radio for warnings

Aktau

Wireless station from Raython with telex, VHF, MW, GMDSS and hand held radio with restricted channels

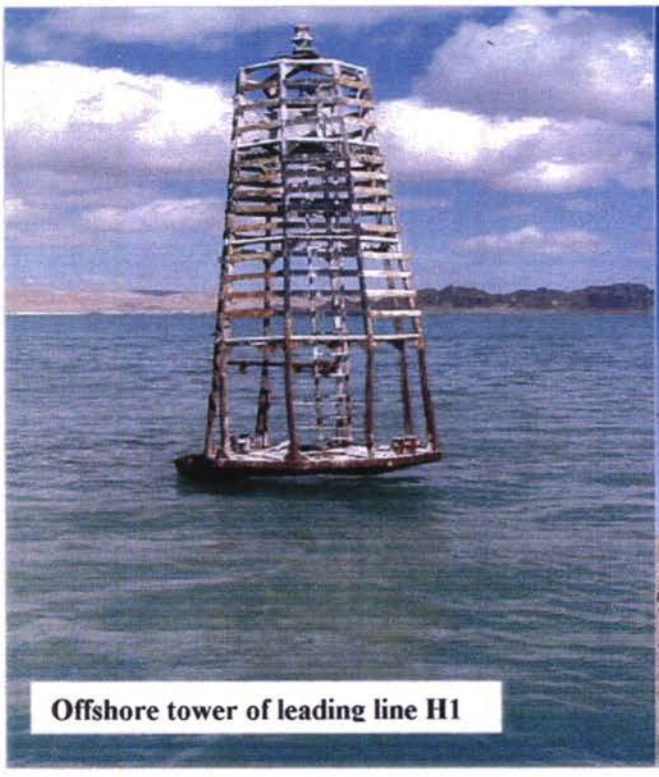
Computer for Buoys and Leading Lights control system

View south from the townside to lighthouse "Melovoy"

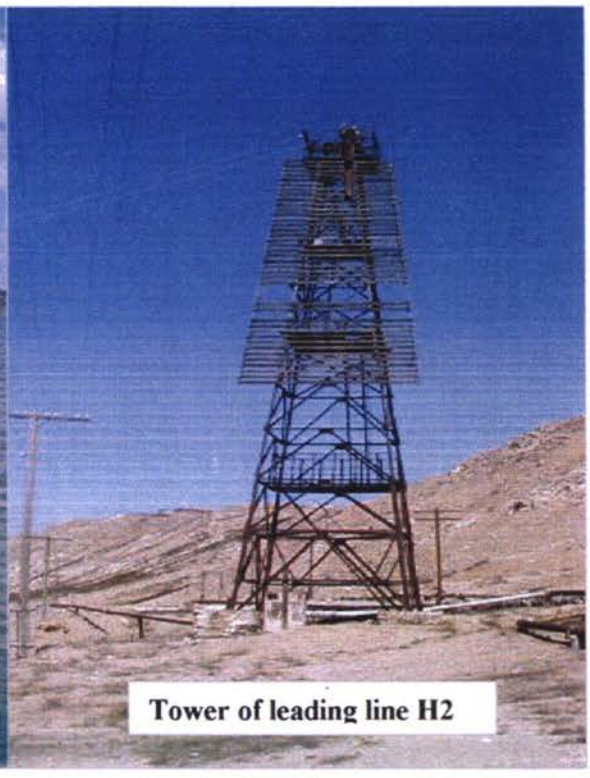
Leading lights

Mid-channel buoy 164 with white light, approximately 2 nautical miles in front of harbour entrance

Dark red coloured starboard beacon on the breakwater



Offshore tower of leading line H1



Tower of leading line H2

Turkmenbashi


Portside Buoy


Starboard Buoy


Buoy Tender


Maintenance operations

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