3. Analysis of Collected Basic Data of Turkmenbashi Port and Review of Port Development Projects

3.1 Outline of Long Term Port Development Plans

In this section port development plans proposed by following studies and TMRL's revision of these plans are summarized.

(1) Feasibility Study and Basic Data Survey on the Modernization Project of Turkmenbashi International Seaport, MTLM Korea, 2009 (hereinafter referred as "Modernization Study")

(2) TRACECA Navigation Channel for Turkmenbashi Port, EU/TACIS, 2007 (hereinafter referred as "Channel Study")

3.1.1 Modernization Study

The study was carried out by the consortium headed by Hyein Engineering and Construction (Korea) based on the MOU concluded between the Government of Turkmenistan and Government of Korea. The study was funded by the Ministry of Land Transport and Maritime Affairs of Korea. The final report was submitted to TMRL in July 2009.

The objective of the study was to conduct a feasibility study for the modernization project of Turkmenbashi Port, which includes the construction of a cargo terminal, passenger terminal and shipyard, by analyzing and reviewing the basic data such as soil, bathymetry, wave climate, coastal topography. The study included analysis of socio-economic circumstances and review of environmental conditions.

The basic port development policies proposed by the Modernization Study are;

Creation of international logistics hub,
Creation of high efficiency port,
Construction of multifunctional port,
Improvement of the quality of waterfront and
Promotion of ship building industry.

In the Modernization Study, cargo traffic forecast was not carried out, and instead, growth scenarios of cargo volume were developed. Scenario 1, 2 and 3 assumed that 5%, 10% and 15% of the rail cargo volume in neighboring countries would be diverted to Caspian shipping cargo through Turkmenbashi Port respectively. Based on this assumption, the cargo volume of Turkmenbashi Port was estimated as shown in Table 3.1.1. Taking the tourism development project (Awaza) into account, passenger traffic was forecasted. Table 3.1.2 shows the result of the estimation.

Table 3.1.1 Estimated Cargo Volume

(unit 1000 tons)

		2008	2010	2015	2020	2025
Total Throughput (including Okarem and Alaja Port)	Scenario1	8,409	9,590	12,827	15,883	19,488
	Scenario2	8,409	9,590	13,446	16,621	20,404
	Scenario3	8,409	9,590	14,065	17,379	21,319
General Cargo, Dry Bulk , RORO, Rail Ferry (excl. oil) and Containers	Scenario1	1,585	1,808	2,920	3,606	4,417
	Scenario2	1,585	1,808	3,539	4,364	5,333
	Scenario3	1,585	1,808	4,158	5,122	6,248
Liquid Bulk (incl. Okarem and Alaja)		6,824	7,782	9,907	12,257	15,071

Source: MLTM

Note: Since the expression in the original report was not clear, the table was modified by the consultant.

Table 3.1.2 Estimated Passenger Traffic

(unit 1000 persons)

	2010	2015	2018	2020	2025
Estimated Passenger Traffic	14.9	34.5	49.6	61.0	90.5

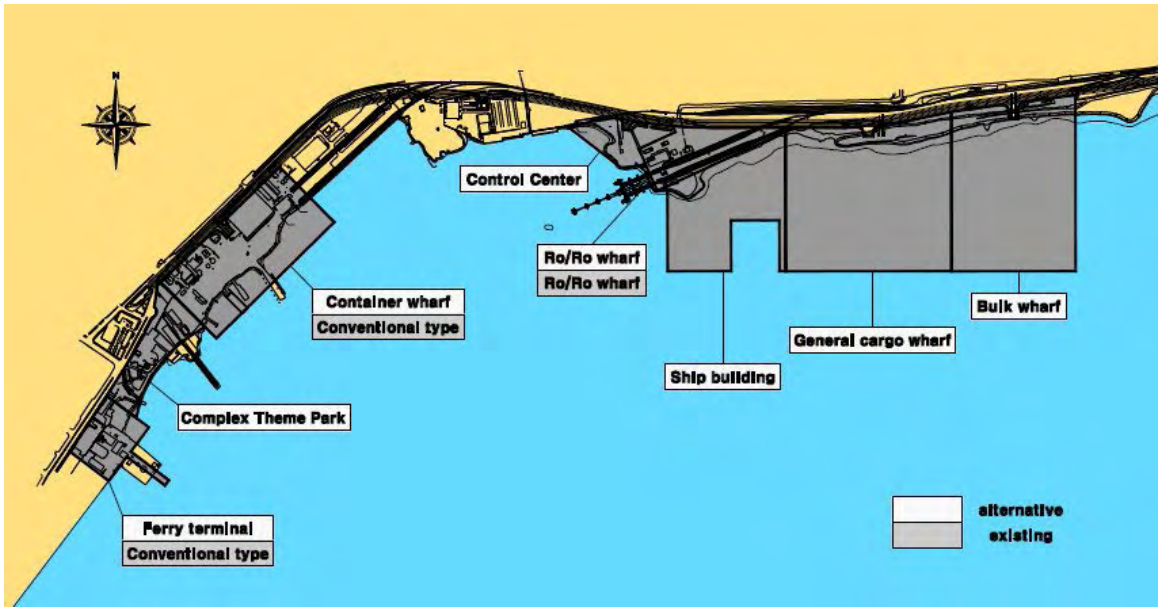
Source: MLTM

Based on the above mentioned traffic scenarios, the Modernization Study proposed an infrastructure development plan as shown in Table 3.1.3 and Figure 3.1.1. Although water depth of respective berths is not specified in the final report, a 5000 DWT tanker is assumed expediently as a design vessel of all cargo berths for which the report estimates required berth depth of 7.5 meters.

Table 3.1.3 Proposed Infrastructure Development

Passenger Ship Terminal	quay length 150 m x 2	
Container Terminal	quay length 520 m	area 13 ha
General Cargo Terminal	quay length 520 m	area 28 ha
Bulk Cargo Terminal	quay length 390 m	area 21 ha
Ship Yard		
Park		

Note: The areas of the terminals are not specified in the Modernization Study.
The areas shown in the table are measured from drawings of the report.



Source: MLTM 2009

Figure 3.1.1 Port Plan Proposed by the Modernization Study

The study proposed that the infrastructure development be implemented in the following three stages. According to the proposed investment plan, all of the construction work is planned to be completed in 2019.

Phase 1 (target year 2015)

Passenger Ship Terminal, Park, Shipyard, General Cargo Terminal (2 berths)

Phase 2 (target year 2020)

General Cargo Terminal (2 berths), Bulk Cargo Terminal

Phase 3 (target year 2025)

Container Terminal

The estimated construction cost for each phase is shown in Table 3.1.4. Total construction cost including VAT is 633,372,000 USD. Total project cost including design, inspection and miscellaneous expenses is 745 million USD.

Table 3.1.4 Estimate of Construction Cost

(unit 1000USD)

Phase 1		Phase 2		Phase 3	
Ship Yard	75,738	General Cargo Terminal	38,950	Container Terminal	54,903
General Cargo Terminal	38,518	Bulk Cargo Terminal	60,875	Dredging	3,790
Passenger Ship Terminal	10,549	Control Center	2,797	Subsidiary Facilities	8,571
Park	6,749	Dredging	9,009	Architecture	6,447
Dredging	19,756	Subsidiary Facilities	46,964	Related Construction	21,526
Subsidiary Facilities	43,017	Architecture	17,588	VAT	9,524
Architecture	16,505	Related Construction	27,439		
Related Construction	66,102	VAT	20,362		
VAT	27,693				
TOTAL	304,627	TOTAL	223,984	TOTAL	104,761
				Total Construction Cost	633,372

Source: MLTM 2009

Table 3.1.5 shows the result of the economic and financial analysis conducted in the Modernization Study. This indicates that economic feasibility of the whole port project (except shipyard construction) is questionable. When only two berths of the general cargo terminal are constructed, economic and financial performance will be improved to some extent, however it is not feasible without a very preferential finance scheme. As for the shipyard, the study evaluated that it would be feasible economically and financially only when "advanced" technology was applied. The study pointed out that the main obstacles were the high construction cost due to severe seismic conditions, difficulty in procurement of construction materials and soft ground condition.

The study evaluated that environmental impacts caused by construction and operation would not be significant, however it stressed the importance of countermeasures for pollution caused by construction machinery and container traffic.

Table 3.1.5 Results of Economic and Financial Analysis

		Whole Project except Ship Yard	Two Berths of General Cargo (Phase 1)	Ship Yard (case1)	Ship Yard (case2)
Economic Analysis	B/C	0.75	1.19	0.79	1.82
	EIRR	6.85%	12.04%	6.66%	23.30%
	NPV(M USD)	-120	4	-36	69
Financial Analysis	FIRR(Real)				1.59%
	FIRR(Nominal)	0.93%	1.30%		8.84%
	ROE	0.57%			7.91%
	Min DSCR	0.73	0.23	0.18	0.76
	Min Cum DSCR	1	0.23	0.18	2.06

Source: MLTM 2009

Case1 denotes the ship yards of which the productivity is at standard level of Caspian region. The productivity of Case2 is at the level of advanced nations such like Korea.

3.1.2 Channel Study

The study was carried out as a part of the TRACECA programme which was initiated by the European Commission aiming at improvement of the transport corridor. The study considered one

of the key elements in this transport chain, namely, the Navigational Channel in Turkmenbashi Port. The purpose of the project was to ensure safe and reliable access to Turkmenbashi Port according to international standards for all ships operating on the Caspian Sea, and to protect the environment.

The concrete activities undertaken in the study were:

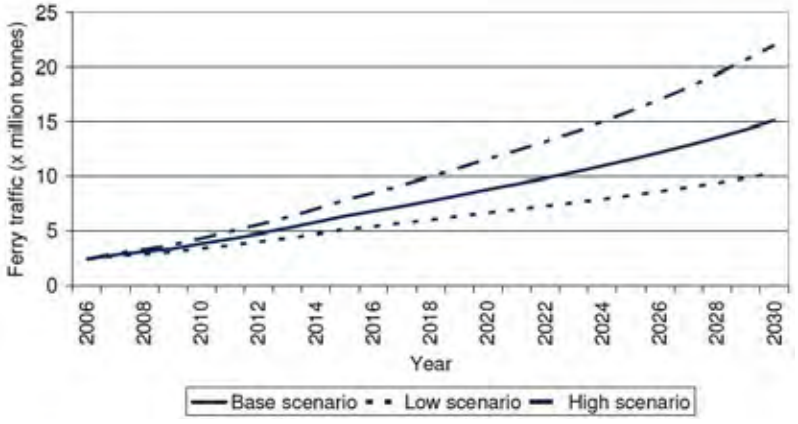
- Identification of alternatives for the access channel
- Review of existing channel measurement and existing dredging facilities
- Survey of existing dredging facilities
- Hydrographical survey and environmental testing
- Elaboration of a Dredging plan (capital and maintenance)
- Training
- Environmental Impact Assessment
- Economic Cost-Benefit Analysis and finance

The study developed scenarios for the future traffic handled at Turkmenbashi Port. Based on the economic growth scenarios and assumptions on transport demand elasticities, summarized results are depicted in the table and the graphs below.

Table 3.1.6 Average annual growth rates of Ferry transport, 2006 – 2040

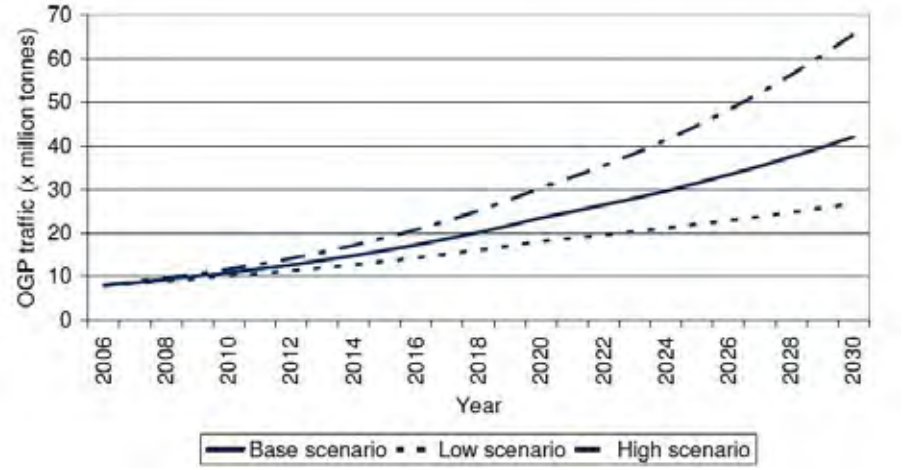
Scenario	2006 – 2015	2015 – 2025	2025 – 2040
Base	13.8%	6.2%	4.8%
Low	11.1%	4.9%	3.8%
High	16.5%	7.5%	5.8%

Source: TACIS 2007



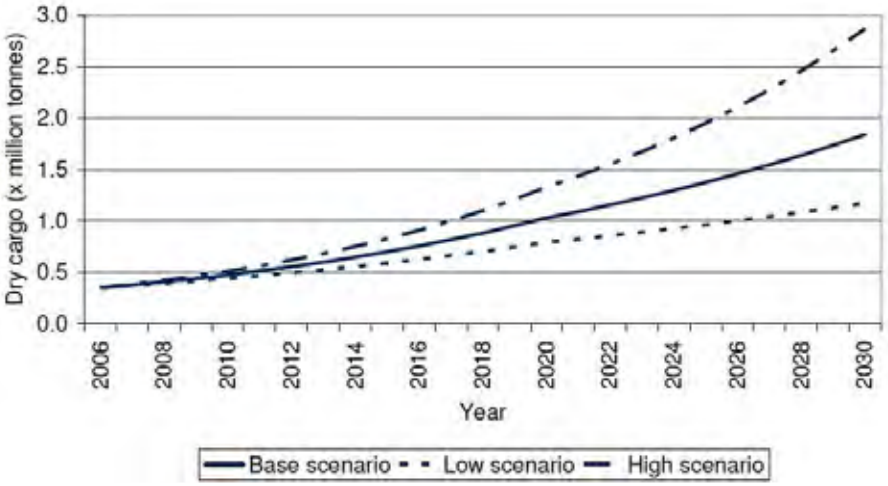
Source: TACIS 2007

Figure 3.1.2 Scenarios for ferry traffic at Turkmenbashi Port



Source: TACIS 2007

Figure 3.1.3 Scenarios for Oil, Gas, Products (OGP) traffic at Turkmenbashi Port



Source: TACIS 2007

Figure 3.1.4 Scenarios for dry cargo traffic at Turkmenbashi Port

The study assessed present and expected size of vessels calling at Turkmenbashi Port. As a result of the assessment, a clear evolution towards increased vessel capacity was noted especially for the tankers. A set of vessels for which the channel would be designed was identified. The principal characteristics of these vessels are presented in Table 3.1.7.

Table 3.1.7 Overview specifications of the design vessels

Type	DWT	Length over All [m]	Beam [m]	Draught [m]
Tanker	14,000	150.0	17.3	7.1
Tanker	8,000	141.0	16.9	5.1
Tanker	5,000	125.0	16.9	4.4
Dry cargo vessel	6,000	140.0	16.6	4.5
Ferry	3,950	154.5	18.3	4.7

Source: TACIS 2007

The study identified measures to be taken in order to bring the access channel to Turkmenbashi in compliance with international standards. The proposed source for such international standards was the publication "Approach Channels: A guide to design", final report of the Joint PIANC - IAPH Working Group in cooperation with IMPA and IALA.

The Channel Study proposed that the present basic alignment of the North Channel be maintained as shown in Figure 3.1.5.

Based on the characteristics of the design vessels determined in the traffic forecast, and on the prevailing conditions on the site, the required cross section for the channel was determined in accordance with international standards. The channel was designed with the following widths:

- Outer section: 170m
- Cut through the spit: 220m
- Inner section: 140m

The depth was determined as the sum of the vessels draught and the under keel clearance. A minimum keel clearance of 1 m was applied in the channel and 1.5 in the maneuvering basins. The channel depth was calculated for 3 different tankers and for the largest ferries. The study recommended that the channel be developed in two stages. In the first stage the maximum vessel would be the 8,000DWT tanker and in the second stage the 14,000DWT tanker would be the largest vessel. This resulted in the following channel depths:

Phase 1:

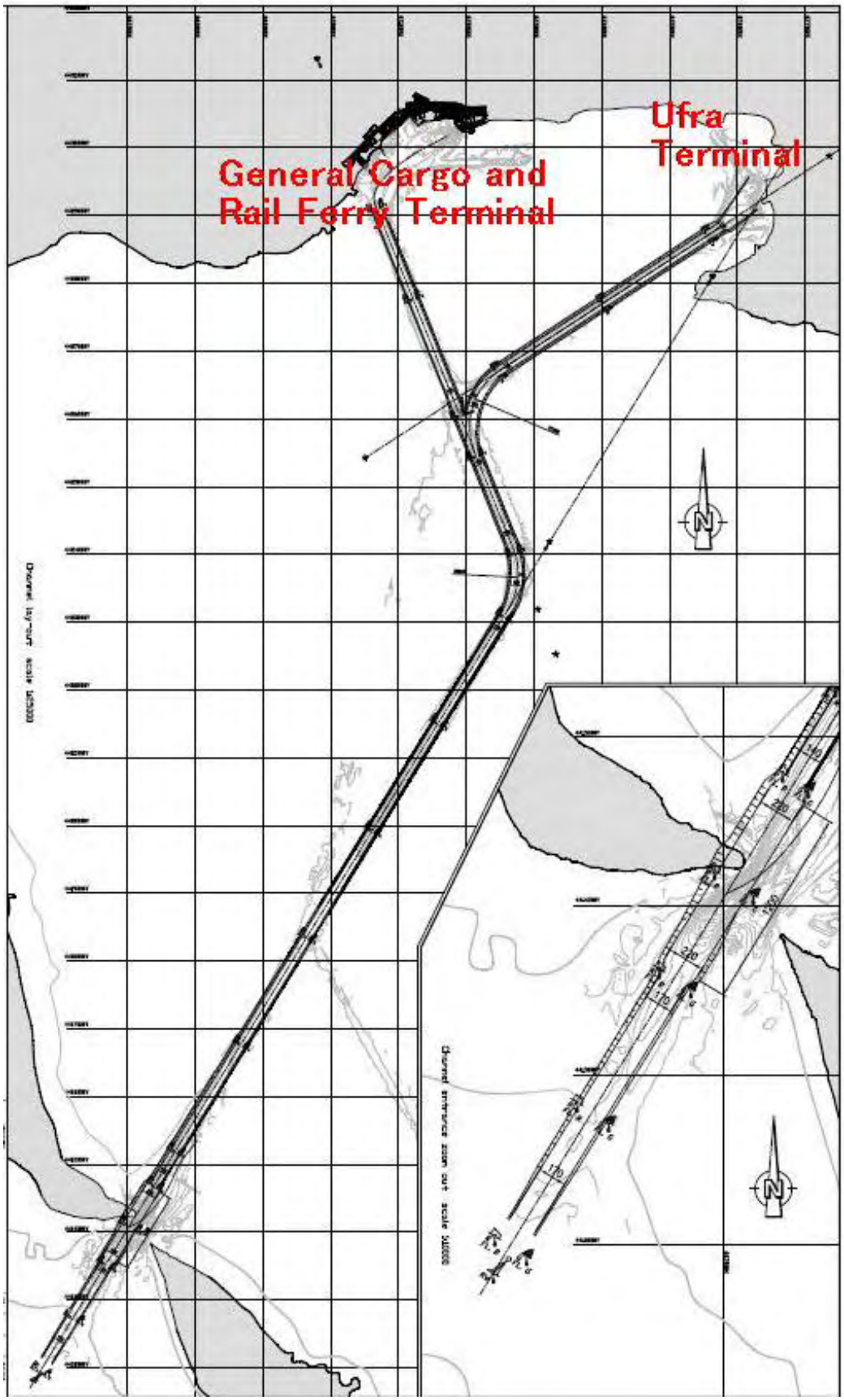
7.1m up to and including UFRA channel

6.8m for the channel section from the junction with the UFRA channel to the Ferry and General Cargo basin.

Phase 2:

8.6m up to and including UFRA channel

6.8m for the channel section from the junction with the UFRA channel to the Ferry and General Cargo basin.



Source: TACIS 2007

Figure 3.1.5 Channel Alignment

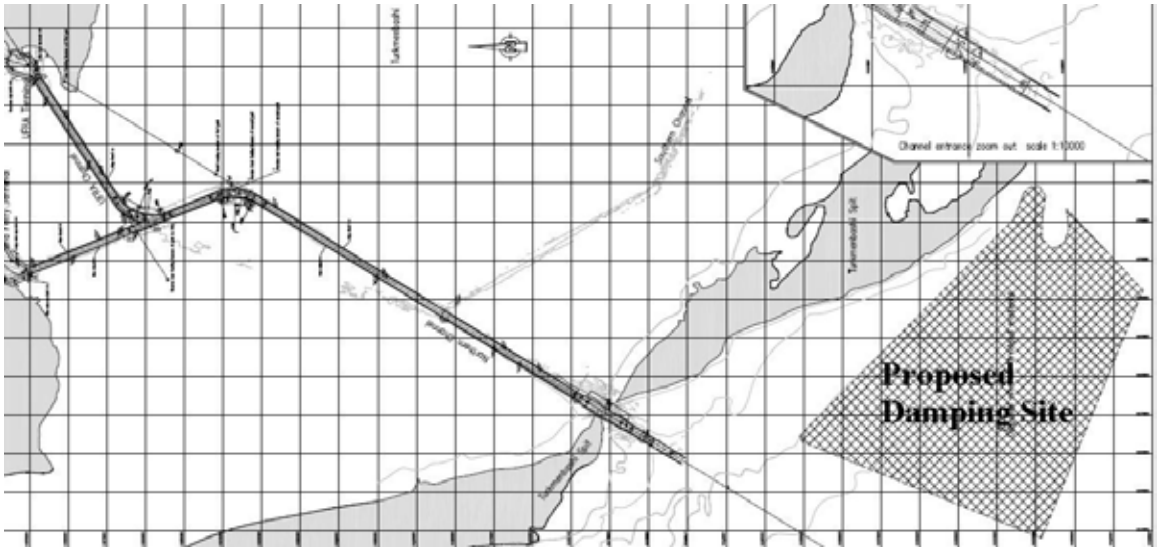
The total material to be dredged was assessed to be 10.2 million cum. Each phase requires dredging of:

- Phase 1: down to a level of BSL – 34.4m (7.1m water depth): 4.1 million cum
- Phase 2: down to a level of BSL – 35.9m (8.6m water depth): 6.2 million cum

The study assessed that the newer disposal site for dredged material, which is located to the south of the entrance through the spit as shown in Figure 3.1.6, is better than the older site because it is down drift of the natural longshore process and thus there is a lower risk of dumped material finding its way back into the channel. Since the centre of the newer disposal site is around 9km from the entrance through the spit, the study evaluated that the site would provide the most economic option for disposal of the dredged material.

The study assessed that the Khazar Nature Reserve was the most important ecological receptors to the potentially adverse water and sediment quality issues which are likely to emanate as part of the navigation channel dredging activities. Some numbers of humans (residents) were identified to be affected by noise at night-time only and more importantly, if a bucket dredger is employed on the contract. The study concluded that the proposed development of the navigation channel would have a number of impacts on ecological receptors but these were considered to be acceptable, subject to the successful implementation of mitigation measures.

Based on historical records of sedimentation rates and on the new channel design, the study estimated that the annual volume of sedimentation in the channel would be nearly 1 million cubic meters. The study concluded that a trailer suction dredger should be used and the options of contracting out both the capital and maintenance would give the best benefit to the port in terms of performance and economy. The study assessed that the capacity of the existing dredger (500,000 cubic meters per year) would not be enough for the maintenance dredging work.



Source: TACIS 2007

Figure 3.1.6 Proposed Damping Site

The total duration of the dredging works was estimated at about 5 – 6 years, as shown in the table below.

Table 3.1.8 Proposed time schedule

Activity	Time Period		
Receive Study and seek finance and approval to proceed with dredging	March 2008	to	October 2008
Appointment of Engineer	June 2008		
Pre-qualification of dredging contractors	August 2008	to	October 2008
Tender for dredging contractors	November 2008	to	January 2009
Evaluate tenders, report and obtain approvals	February 2009	to	April 2009
Award dredging contract	April 2009		
Mobilise for Phase 1	May 2009	to	October 2009
Phase 1 Dredge	October 2009	to	April 2011
Ground Investigation	May 2010	to	August 2010
Mobilize for Phase 2	September 2010	to	April 2011
Phase 2 Dredge	May 2011	to	October 2013

Source: TACIS 2007

The study estimated capital dredging costs as shown below. The estimated costs includes all preliminary mobilization, ground investigation works, allowance for second Phase mobilization and de-mobilization along with the general cost for undertaking the work. In addition to the cost for dredging, a provisional sum of 2 Million Euro was taken into account for the establishment of the Aids to Navigation along the channel.

Phase 1 – Cost of dredging = Volume for Removal 4,083,000 m³
@ Caspian Sea rate of 4.94 = 20.2 Million Euro
Phase 2 – Cost of dredging =Volume for Removal 6,211,000 m³
@ Caspian Sea rate of 4.94 = 30.7 Million Euro

For "central" project conditions (e.g. base forecast scenario), main contributors to the economic benefits in terms of Present Value (at discount rate of 10%) were evaluated as:

- Income from Diverted Traffic. 22 MEURO
- Reduced vessel delays. 54 MEURO
- Increasing ship size in particular for OGP transport. 68 MEURO

EIRR for central project conditions was estimated to be 22%. A sensitivity analysis confirmed that the project, under the adopted assumptions, was economically viable. Under the most pessimistic scenario, which is cost plus 50% and benefits minus 50%, the EIRR was still 12%. Maintenance dredging cost was excluded from the economic analysis since periodical maintenance dredging is required both in the with and without project case and the difference was considered not significant.

Financial analysis was not carried out in the study. The reason given in the Channel Study is that the Port of Turkmenbashi has no financial autonomy. (This is a misunderstanding of the financial structure of TMRL.)

3.1.3 Revised Plan by TMRL

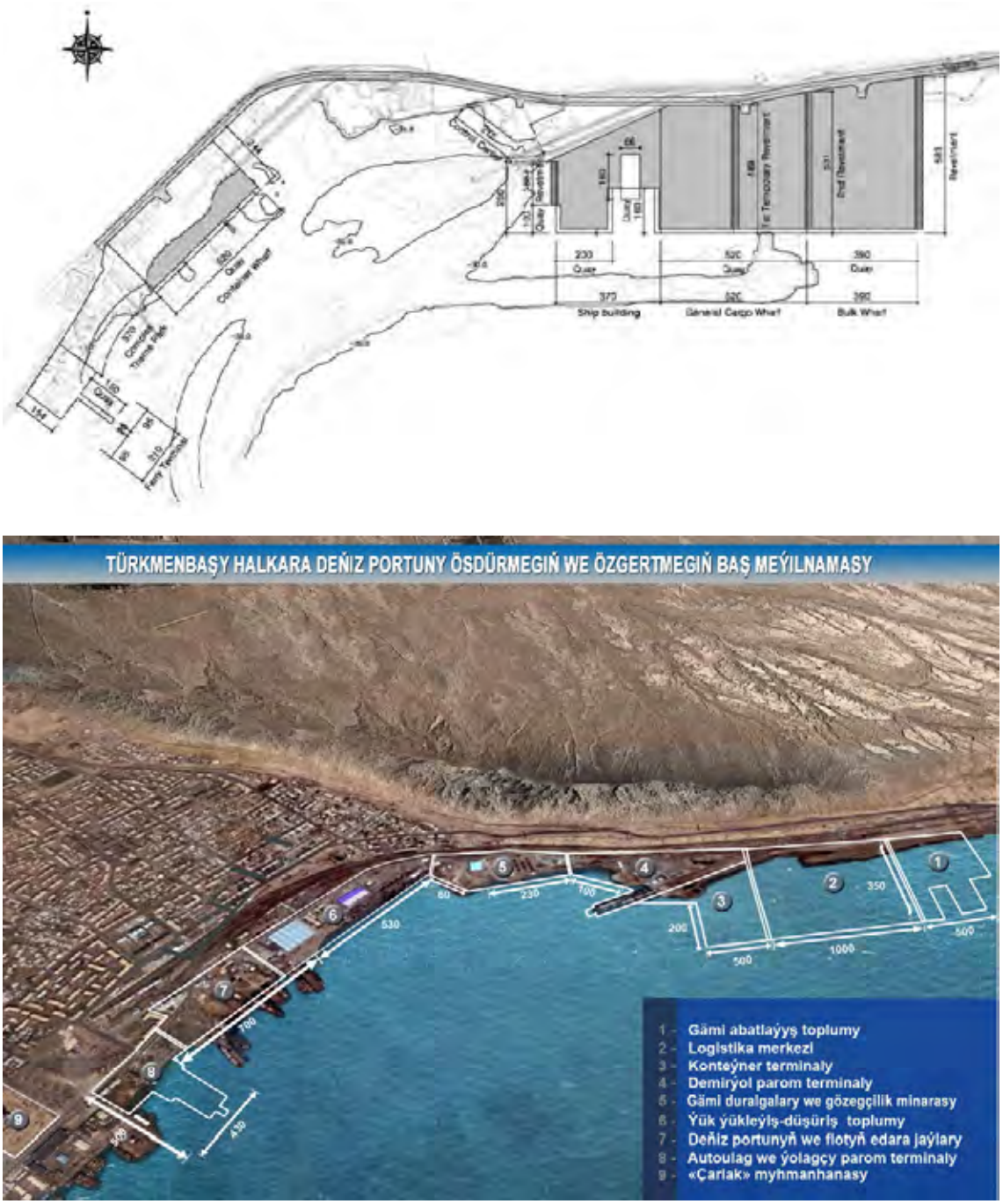
TMRL has revised port and channel plans proposed by the Modernization Study and the Channel Study. The revised plan is shown in Figure 3.1.7 compared with the original proposal. The revised plan has already been approved by the Cabinet of Ministers, however TMRL has confirmed that the Government of Turkmenistan was ready to accept a proposal for further revisions by the Consultant. The items revised by TMRL are as follows;

(1) The container terminal, which had been planned adjacent to the existing general cargo terminal, was moved to the east of the rail ferry terminal and was combined with the planned general and bulk cargo terminal.
(2) The extension of the existing general cargo terminal up to 530 meters was newly planned in order to facilitate the export of polypropylene which is produced in Turkmenbashi Refinery and stored in the polypropylene warehouse of the port.
(3) Total berth length of container, general and bulk cargo terminals was extended from 1430 meters to 1600 meters whereas inland depth of bulk and general cargo terminals was decreased from 500 meters to 350 meters.
(4) A Ro-PAX ferry terminal (see Figure 3.1.8) was newly planned instead of a passenger ship terminal between quay 17 and a state-owned fish processing factory which is planned to be relocated to Kiyanly, 30 kilometers north of Turkmenbashi. Two triangular Ro-PAX ferry networks are planned i.e. Turkmenbashi - Baku (Azerbaijan) - Bandar Anzeli (Iran) and Turkmenbashi – Makhachkala (Russia) – Actau (Kazakhstan). TMRL explained that initial talks toward the conclusion of a tri-party agreement for Ro-PAX transport had been started already and that they were confident that it would be finalized because of their good diplomatic relations with neighboring countries and the existence of a bilateral agreement on rail ferry transport with Russia and Azerbaijan. TMRL has a plan to procure two Ro-PAX vessels until 2015, which can carry 200 passengers and 80 trucks.
(5) Office buildings for port service and port administration were planned where the container terminal had been planned. Between the office buildings and the Ro-PAX terminal, a yacht harbor was planned.
(6) The ship yard was moved to the eastern extremity of the development area.
(7) Regarding channel improvement, TMRL put higher priority on widening rather than deepening. TMRL plans to widen it up to 170m in order to secure two-way traffic of tankers whereas the Channel Study had proposed to maintain the original width of 140 m which was designed in the Soviet era. TMRL explained that the phase 2 project proposed by the Channel Study, which deepens the channel up to 8.6 meters, is not urgent.
(8) TMRL estimates that the required volume of maintenance dredging is minimal, therefore they plan to do it by their own dredger although the existing dredger should be repaired or replaced, whereas the Channel Study had estimated that annual volume of maintenance dredging would be one million cubic meters and had recommended that the work be outsourced.

Based on above mentioned revision, TMRL plans the following infrastructure development and procurement of equipment until 2016 (I stage - 2010-2013, II stage - 2013-2016):

Improvement of the access channel;
RO-PAX (passengers and truck) terminal;
Equipment for the training and retraining of seafarers;
Facilities to respond to oil spills;
Logistics center with container terminal, general cargo terminal and bulk cargo terminal;
Polypropylene loading berth;
Control tower – ship traffic control centre;
Marine rescue service;
Reconstruction of the left ramp of the existing rail ferry terminal;
Supply and service base for offshore oil platforms;
Warehouses and stock area in the port territory;
Roads and Railways;
Port operation system;
Ship-repair complex and;
Auxiliary facilities and service centers;

By the completion of the above listed development plan, TMRL estimates that annual throughput of the port will increase up to 15 million tons.



Source: MLTM 2009 and TMRL

Figure 3.1.7 Original Plan (upper) and Revised Plan by TMRL (lower)

Source: TMRL

Figure 3.1.8 Plan of Ro-PAX Terminal

3.2 Review of Proposed Development Plan of Cargo and Ro-Ro Passenger Terminal

In this section, the port development plan proposed by the Modernization Study is reviewed. As mentioned in previous section, the plan has already been revised by TMRL, therefore the description below reflects it.

3.2.1 Basic Policy of Development Plan

The basic five concepts proposed by the Modernization Study are:

Creation of an international logistics hub,
Creation of a high efficiency port,
Construction of a multifunctional port,
Improvement of the quality of the waterfront and
Promotion of the ship building industry.

Though the proposed concepts are basically understandable, the development concepts should more clearly deliver the nation's intention toward port development, and the national strategy on socio-economic development should be fully reflected in them considering that Turkmenbashi Port is overwhelmingly the most important port in Turkmenistan.

First, the ultimate goal of port development should be clearly defined. It should be simple yet impressive and represent a goal which can be shared among all stakeholders of the port. The Consultant therefore proposes that the ultimate goal of Turkmenbashi Port be "*Creation of a State-of-the-art Port in Central Asia*".

Then, under this ultimate goal, strategic targets should be provided. Considering the national strategy of Turkmenistan and current regional socio-economy and the need for port development to improve people's life and industrial competitiveness, the Consultant would propose the following four targets as shown in Figure 3.2.1.

Gateway to Central Asia
Port of Fraternity
Port for Industrial Diversification
Port of Safety and Environmental Sustainability

Gateway to Central Asia

Turkmenbashi has been the gateway to Central Asia. It is geographically apparent and many historical facts support it. The links on the Caspian Sea from Turkmenistan comprised a part of the Great Silk Way and has been transporting people and goods since antiquity. Aleksander II built a fort in Ufra in Turkmenbashi to advance to Central Asia. In 1888 the origin of Central Asian Railway was constructed there. Today Turkmenbashi port plays a role of gateway to Turkmenistan as well as other Central Asian countries, China and Afghanistan. The rail ferries arriving at Turkmenbashi port carry transit cargos and irrigate landlocked countries.

At present, however the volume of cargoes handled at Turkmenbashi Port is rather small despite its extraordinarily favorable geographical condition. Turkmenistan with its political stability as a neutral nation recognized by the United-Nations possesses huge potential to attract a large amount of transit cargoes. Therefore it is important that Turkmenbashi Port be developed fully utilizing its potential as a logistics hub. Together with the strengthening the function of the port, improvement of overall efficiency of the nation's logistics system is required.

Port of Fraternity

Many Caucasian people live along the Caspian coast of Turkmenistan and many Turkmen people live in Caspian littoral nations since it was possible to move freely across borders of Republics in the Soviet era. At present however there is no safe and economically realistic way of traveling to their homeland. Although rail ferries are operated between Turkmenbashi and Baku, the authority restricts passenger transport by rail ferries due to deterioration of vessels. After the disintegration of the USSR, passenger transport across the Caspian Sea has been dropped from policies of new independent states.

It is important that Turkmenbashi Port provides opportunities for reunions of families and friends for the people whose homeland became a "foreign country" by creating a new passenger transport network across the Caspian Sea.

Furthermore, fraternal port of Turkmenbashi is expected to provide a safe and stable route for transporting humanitarian goods to Turkmenistan's eastern neighbor where people face serious difficulty.

Port for Industrial Diversification

Turkmen economy has been rapidly developed for its rich hydrocarbon resources. Although hydrocarbon will continue to be the most important industry in the country, the Government of Turkmenistan strategically plans to diversify its industry to accelerate the growth of the economy. For industrial development, one of the important factors is to secure efficient logistics. Central Asia is not blessed with access to the sea which enables efficient transport, but Turkmenbashi is an exception. Fully utilizing its exceptional advantage in the region, Turkmenbashi is expected to lead the diversification of Turkmen industry. For this purpose, the function of the port should also be diversified and the efficiency of its existing functions improved. The port must be a logistics center which can handle all types of cargoes; i.e. container, RORO (trucks and rail car) and dry bulk.

Furthermore the port should contribute to the development of tourism which is one of the prospective industries in Turkmenistan. Though the tourism industry remains at a very primitive level and it is frequently a headache for foreign travelers, Turkmenistan would be able to attract a large numbers of tourists for its history, culture, tradition and nature if some improvements were made. The port must provide tourists with a safe, reliable and comfortable way of traveling.

Port of Safety and Environmental Sustainability

In order that the port plays above mentioned important roles, safety and environmental sustainability are fundamental requirements. Without them a "state-of-the-art port" can not be realized.

Considering the future increase of passenger traffic and transport of hazardous cargo, safety in the port must be dramatically improved by developing channel and port infrastructure as well as capacity building of port workers.

Environmental sustainability is another key factor for the success of Turkmenbashi Port. The port is located in Turkmenbashi bay, a major part of which is designated as the Hazar Nature Reserve where important species live. Since the bay is environmentally vulnerable due to its shallowness and sheltered topography, due consideration on environmental aspects is required in the development of Turkmenbashi Port which handles a considerable amount of oil cargos.

In order to materialize above mentioned basic concepts, comprehensive port development master plan should be established based on detailed socio-economic data in the region. The master plan should be coordinated with all stakeholders of the port. Its harmonization with the regional development plan is particularly crucial.

Currently Turkmenbashi is a pure industrial city, therefore the Government of Turkmenistan as well as the municipality intends to diversify its functions. Awaza National Tourism Zone and Turkmenbashi New City (see Figure 3.2.2) are expected to materialize these functions. On the other hand, the strategy for further industrial development in Turkmenbashi city is not so clear at

least at the municipal level. The municipality explains that future industrial development will likely be in current territory of the refinery while expansion of the industrial zone is not planned so far. Therefore in the course of establishment of the port master plan, it is important to form a consensus on the importance of intensive industrial development in Turkmenbashi.

Turkmenbashi New City development is a national project in which an urban core in the west of the city (over the mountain behind Turkmenbashi Refinery) is planned to be created. The planned population of the new city is 25,000, which accounts for one third of current population in Turkmenbashi. Major public facilities will be moved from the existing urban district to the new city. The new city, which is currently bare land together with its surrounding area, will be surrounded by a huge green zone. The green zone will be extended to the coast line of Turkmenbashi Bay and Saymonona Bay, which is a part of Turkmenbashi Bay, will be reclaimed and converted to a green zone. The new city development will be launched in 2010 and the first phase project will be completed in 2020. In parallel with the new city development, redevelopment of existing urban district is planned.

Awaza National Tourism Zone is the first tourism zone development in Turkmenistan. A total area of 770 ha will be developed in the first stage project targeting 2013 and further 1000 ha will be developed by 2020. The project includes construction of many kinds of tourist attractions and state-of-the-art hotels. The concept of Awaza is multi-functional development which embraces education and health care in addition to tourism. Furthermore, the Government of Turkmenistan intends to make it the business hub in Central Asia and the Caucasus utilizing its preferential business environment, Turkmenistan's political stability and good diplomatic relationships with foreign countries. The government plans to introduce a simplified VISA procedure for Awaza visitors. Incentives are provided to the investors in Awaza.

A new trunk road is planned connecting Awaza, the new city, airport and the highway to Ashgabat. The new road bypasses the existing urban district and the port. The road connecting the port and the highway to Ashgabat is also being upgraded.

The municipality explains that the coastal zone between the rail ferry terminal and Ufra oil terminal is reserved for port development and no urban development is planned there.

Considering the master plan of Turkmenbashi city, it is recommended that the basic functional allotment of the port should be as follows:

- The western part of the port, where some old quays and a fish processing factory are located, should be redeveloped as passenger-tourist-citizen-oriented zone. In the development of the zone, synergistic effects with Awaza National Tourism Zone should be deliberated.
- The coastal zone between the rail ferry terminal and Ufra oil terminal should be developed as an intensive logistics zone and a coastal industrial zone. It is noted that this area is the sole available land and water for these purpose in Turkmenbashi bay which is

well-sheltered and has very preferable condition for port development. Therefore, well-planned coherent development is required.

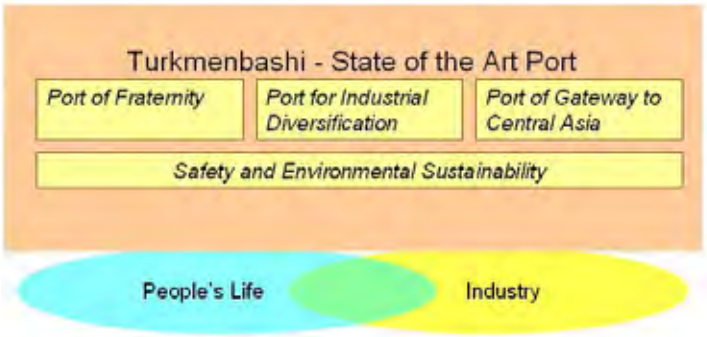


Figure 3.2.1 Concept of a State of the Art Port

Figure 3.2.2 Turkmenbashi New City Plan (left) and Awaza National Tourism Zone (right)

Source: Google

Figure 3.2.3 Zoning of Turkmenbashi Urban Development

3.2.2 Forecast of Cargo Transport Volume

Cargo statistics of Turkmenbashi Port are very complicated. In the port statistics, one ton of cargo denotes one ton of cargo movement. For example when one ton of cargo is unloaded, moved to stock yard and loaded on truck, then 3 tons of cargo throughputs are recorded in the statistics book. This led previous studies to misunderstand the status quo of cargo handling. Accordingly, the Consultant has started from scratch.

The difficulty in forecasting cargo in Turkmenbashi Port is mainly caused by two reasons. One is lack of reliable information and the other is fluctuation of data. It is so far impossible to remove the former difficulty for political reasons in Turkmenistan. Therefore, the Consultant had to accept it and had to do forecasting work based on some rather bold assumptions as previous studies had done. Regarding the latter, the cause of fluctuation can be described as follows:

- More than 60% of cargoes handled in Turkmenbashi Port are products and raw materials of Turkmenbashi Refinery. Therefore its production plan is the largest decisive factor of throughput of the port. Outputs of the Refinery are greatly influenced by the availability of raw materials.
- Total cargo volume and numbers of commodities handled in Turkmenbashi Port are rather small. Therefore accidental change in trade of a certain commodity can cause a large fluctuation in the total throughput.

For these reasons, the GDP elasticity method using historical data of cargo throughput in a lump cannot be used to accurately forecast future cargo. The Consultant therefore forecasts the cargo throughput of each terminal individually considering its characteristics.

PPK3

The cargos handled in PPK3 are solely cargos of the Turkmenbashi Refinery. The Refinery explained that they plan to increase offloading of crude oil up to 1,687,000 tons and to increase loading of oil products at an annual growth rate of 4.4%.

Although the annual increase rate of crude oil handling accounts for the rather high value of 14.5%, it seems reasonable considering that the share of offshore oil will increase with the advance of offshore development. TMRL is rapidly increasing its tanker fleet to respond it.

The Consultants accepts the data from the Refinery as a basis of the forecast, since it is moderate and reasonable though the Refinery did not provide much information.

PPK2

The rail ferry terminal PPK2 has handled some amount of cargoes, therefore GDP elasticity method using historical data can be applicable with some modifications.

The cargoes handled at PPK2 contain cargoes from the Turkmenbashi Refinery. In 2008

Refinery's cargoes amounted to 268,000 tons. This cargo can be estimated to increase 4.4% per annum, and will reach 450,000 tons in 2020.

The GDP elasticity method is applied to the remaining portion. In the calculation of the elasticity, the products of the Refinery and a large amount of crude oil occasionally transported by ferry are removed from the historical data. Table 3.2.1 shows the time series of rail ferry cargo throughput and GDP. Since oil cargo data in 2006 and 2007 were not available the data was linearly interpolated.

The GDP elasticity is calculated to be 0.90. It seems rather modest in a developing country, but considering that deteriorated ferry vessels and inefficient rail operation may restrain growth of cargo throughput, the calculated elasticity is reasonable. Since it is probable that this situation will continue, the Consultant applies this elasticity factor for the cargo forecast.

Referring to the forecast by Global Insight, the Modernization Study estimates that the average GDP growth rate of Turkmenistan from 2010 to 2020 is 4.9%. But this seems too modest. Figure 3.2.4 shows GDP growth rate in Turkmenistan and its forecast up to 2014 by IMF. Since further forecast was not available, the data was extrapolated by the least squares method as shown by the red line in the figure. The average GDP growth from 2009 to 2020 is 7.2%, then the cargo growth rate is estimated to be 6.5 % per annum by multiplying the GDP elasticity. Total cargo volume handled at PPK2 in 2020 is estimated to be 4,245,000 tons or 2.1 times larger than those in 2008 provided PPK2 has enough capacity.

Table 3.2.1 Time Series of Rail Ferry Cargo except Oil Cargo

PPK2	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average
Total Cargo (th,t)	1,079	1,662	2,229	3,028	2,386	2,326	2,737	2,670	2,051	
Oil Cargo (th,t)	315	617	830	1,415	420	575	473	371	268	
Cargo excl. Oil (th,t)	764	1,045	1,399	1,613	1,966	1,751	2,264	2,299	1,783	
CargoGrowth (%)		36.8%	33.9%	15.3%	21.9%	−10.9%	29.3%	1.5%	−22.4%	13.2%
GDP Growth (%)		17.3%	17.3%	17.3%	17.3%	13.0%	11.4%	11.6%	11.5%	14.5%

Source: TACIS, MLTM, IMF

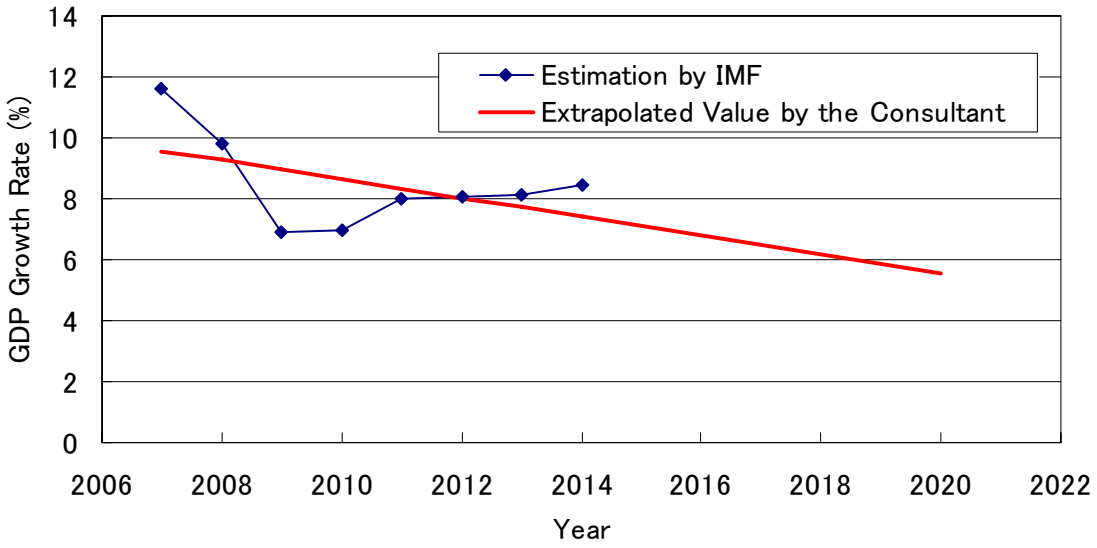


Figure 3.2.4 Time Series of GDP Growth in Turkmenistan

PPK1 and new berths

At present PPK1 handles a small amount of cargoes and their year-on-year rate fluctuates a lot due to occasional changes in the trade pattern of a commodity. For example throughput in 2009 is 2.3 times larger than that of the previous year due to a construction boom in the country. Therefore historical data could not directly be used in the cargo forecast for PPK1 and new berths, and the Consultant had to find an alternative approach though it was not an easy task given the very limited quantity of disclosed data.

The method employed by the Consultant is shown in Figure 3.2.5.

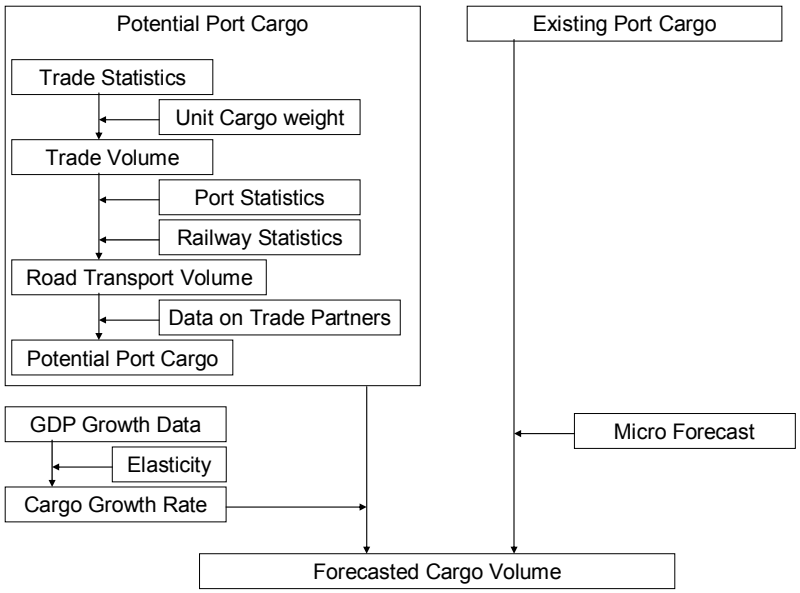


Figure 3.2.5 Cargo Forecast Method for PPK1 and New Berths

In the forecast, the volume of potential port cargo (the cargo which should be handled in Turkmenbashi Port if the port is equipped with proper facilities) is estimated. For the estimation of the potential cargo, the data on comprehensive international cargo flow in Turkmenistan is required, however it is not available. The Consultant instead estimates it based on various data. In the estimation, natural gas, LPG and crude oil were excluded, since they are shipped by pipelines or through specialized ports, and cannot be port cargoes of Turkmenbashi. The method employed in the estimation is as follows:

- Based on trade data provided by the Ministry of Economy and Development, total trade volume in the country is estimated. For commodities of which the weight is not specified in the list, the weight is estimated using unit prices calculated for Japanese customs statistics (NILIM 2005). The unit price for "vegetable" is applied for "other exporting goods" expediently since its unit price is close to that of coke which is the most probable "other exporting goods". Table 3.2.2 shows the result of the calculation.

- TRACECA report on international logistics center gives cargo throughput of railways in 2008 as follows:

  Import 2,291,000 tons
  Export 1,047,000 tons
  Transit 5,821,000 tons

- Since the transport volume by rail ferry is included in the above statistics, the data is divided into ferry and non-ferry by using port statistics provided by TMRL. As TMRL's data doesn't contain information on transit, the ratio of transit for rail ferry cargo is assumed to be the same as that of total rail cargo. In this calculation, net weight which excludes tare weight is used.

- Then, subtracting cargo throughput of PPK1, PPK3 (excluding domestic cargo) and rail cargo from the total cargo volume, import and export cargo by road is obtained. Finally, transit cargo by road transport is added assuming that the transit ratio is as same as that of rail cargo.

The result of the calculation is shown in Table 3.2.3.

Table 3.2.2 External Trade of Turkmenistan (2008)

2008	M USD	th. ton	
EXPORT			
Natural gas	6,408		
Liquefied gas	243		
Crude oil	1,759		
Petrochemicals	3,016	3,900	
Cotton-fabric	278	193	
Polypropylene	132	86	
Cotton yarn	122	46	
Textile products	130	58	2234 usd/ton (textile)
Others	320	494	648 usd/ton (vegetable)
Total Export excl. gas etc.		4,777	
Total Export,	12,408		
IMPORT			
Industrial sector	3,899		
Including:			
equipment	1,527	678	2252 usd/ton (machinery)
vehicles	426	262	1620 usd/ton (vechcle)
others	1,947	865	2252 usd/ton (machinery)
Consumer products	1,343	1,422	944 usd/ton (wheat + food)
Total Import	5,242	3,227	

Source: MED

Note: the underlined figures are estimated by the Consultant using the conversion factors listed in the right column.

Table 3.2.3 Estimated International Cargo Flow in Turkmenistan (2008)

(Thousand tons)

	export	import	transit	TOTAL
Port excl. Rail Ferry	3,218	91	0	3,309
Rail Ferry	153	323	833	1,309
Rail excl. Ferry	894	1,968	4,988	7,850
Road	512	845	2,366	3,723
TOTAL	4,777	3,227	8,187	16,191

Next, potential port cargo is extracted from the total international cargo flow in Turkmenistan. The Modernization Study provided the list of Turkmenistan's trade partners in 2007 referring to EUROSTAT as shown in Table 3.2.4. Here, the Consultant refers only to the "import" table because the share of export partners is greatly affected by gas and crude oil trade which cannot be expected to be port cargoes. In the table, trade direction, i.e. East-West or North-South is noted by the Consultant, and the sum of East and West trade which can be a potential port user is calculated. In case that both directions of trade can exist, a 50% share is simply assumed. As shown in Table 3.2.4 the percentage of E-W trade accounts for 52.1%. If proper facilities (i.e. Ro-PAX ferry terminal) were equipped in the port, some part of rail cargo would be diverted to port cargo. However, the Consultant doesn't count on rail cargo in the calculation of diverted traffic for the modest estimation. Only road cargo is considered as the candidate of diverted traffic. As a possible scenario, diversion of 50% of E-W road traffic is assumed, and the potential port cargo of 970,000 tons in 2008 is obtained. In the calculation, the proportion of E-W traffic for transit cargo was assumed to be the same as that of import/export cargo.

Finally, the Consultants forecasts growth of cargoes up to 2020. The information provided by the

Ministry of Economic Development contains trade forecast in 2020, however it seems to be more of a political slogan than a scientific forecast. Some commodities increase up to 10 times their current levels, others increase 20 times. Therefore, the Consultant hesitated to employ these figures in the cargo forecast. Instead, the GDP elasticity method was employed as in the forecast for PPK2. In the calculation it was assumed that GDP elasticity was 1.0 and the transit ratio would not change. This elasticity is a little modest in developing countries, but there is no reason to apply larger elasticity considering that the gas industry, which directly produces few port cargoes, will continue to be a main engine of Turkmenistan's economic growth. Then the cargo growth rate of 7.2% and the future throughput of 2,231,000 tons are obtained.

The cargo growth rate for the existing cargo was estimated to be zero. It is clear that the figure is too modest. Products of a single factory can largely increase port cargo. So the cargo forecast by the Consultant should be revised when the production and shipment plans of new factories are disclosed. The only available information on construction of new factories is that for a cement factory in Balkan Province, of which annual production capacity is one million tons. The factory plans to export its products to Azerbaijan and Russia. At the same time, however, its supply to domestic market can decrease cement imports. Major raw materials will be supplied to the factory domestically. Thus, at least for the short run, it is difficult to count on the cargo increase by the cement factory.

Table 3.2.5 summarizes results of cargo forecasts comparing with those of previous studies. Although the Modernization Study employed a completely different method, the estimated value is rather close to that of the Consultant. The Channel Study seems to overestimate the traffic, which probably exceeds the production capacity of Turkmenbashi Refinery and handling capacity of rail ferry terminal.

Table 3.2.4 Turkmenistan's Import Partners

Import Partner	Share (%)	Direction
EU	15.6	EW
UAE	14.7	NS
Turkey	10.5	EW
China	9.8	–
Ukraina	8.9	EW
Russia	8.3	EW+NS
Iran	7.2	EW+NS
USA	5.7	EW+NS
Uzbekistan	3	NS
Japan	2.9	–
Balarus	2.7	EW+NS
Georgia	2.2	EW
Saudi Arabia	1.7	NS
Kazakhstan	1.4	NS
India	0.8	NS
Romania	0.5	EW
Azerbaijan	0.4	EW
Brazil	0.4	EW+NS
Korea	0.3	–
Switzerland	0.3	EW
others	2.7	EW+NS
Total of East-West Trade	52.1	

Source: MLTM

Table 3.2.5 Results of Cargo forecast in 2020

		2008	2020		(ton)
			The Consultant's Estimates	Modernization Study	Channel Study
PPK1 and New berths					
	Existing Cargo	177,364	177,364		
	Potential Cargo	970,000	2,231,000		
	TOTAL	1,147,364	**2,408,364**		1,100,000
PPK2					
	inbound	1,290,785	2,748,205		
	outbound	760,030	1,496,884		
	TOTAL	2,050,815	**4,245,085**		8,000,000
PPK3					
	inbound	320,000	1,687,500		
	outbound	3,160,893	5,299,000		
	TOTAL	3,480,893	**6,986,500**		24,000,000
TOTAL		6,679,072	**13,639,949**	12,703,000	33,100,000
	excl. potential	5,709,072			

Note: Since the forecast by the Modernization Study includes the throughput of Alaja Port and Okarem Port, the listed figure has been modified by the Consultant.

3.2.3 Forecast of Passengers Traffic Volume

The Modernization Study forecasted passenger traffic based on current traffic assuming its growth rate. However, it underestimated the traffic volume because current traffic is heavily restricted by the capacity of rail ferry. According to the original registration, vessels deployed on the Turkmenbashi-Baku link were able to carry 202 passengers, however currently Azeri authority

restricts the number of passengers to 36 due to the deterioration of vessels. When the vessel carries dangerous goods, the number of passengers is restricted to 12. In 2008 a total of 10,500 passengers traveled by rail ferry which equates to 10 passengers per voyage. Considering the very high frequency of transport of dangerous goods on the ferry and restrictions on the number of passengers, current transport volume indicates very high occupancy rate regardless of uncomfortable travel and unreliable timetables. For this reason, the potential traffic demand is expected to be much larger.

The detailed data on passenger traffic in the 1980s, when the transport by the ferry link was most active, are not available. The only available data is in 1989. The total traffic of all ferry links served by the Caspian Shipping Line in that year was 315,000 passengers. (TACIS 1997) Considering that the cargo transport share of Turkmenbashi-Baku link was 83%, it is assumed that the total numbers of passengers departing from and arriving at Turkmenbashi Port in 1989 was around 260,000. The cargo transport volume in 1989 was 63% of that in the peak year of 1986. Therefore a greater number of passengers must have traveled on the Turkmenbashi-Baku ferry.

In this study, the Consultant forecasts the passenger traffic volume by considering the following facts:

- Current passenger traffic doesn't represent potential demands due to the restriction of the capacity as mentioned above.
- Many Caucasian people have lived in Turkmenistan for some generations, especially in Balkan province including Turkmenbashi City of which 20% of total population is Azeri people and Turkmen communities exist in Caspian littoral nations, however there is no safe and economically realistic way of traveling to their homelands. In the Soviet era the Rail ferry played this role and transported large numbers of people, but currently deteriorated ferry is neither a safe or reliable way of passenger transport. As a result, large volumes of traffic demand have not come to the surface. TMRL plans to deploy new Ro-PAX ferries connecting Caspian littoral cities in Russia, Azerbaijan, Iran and Kazakhstan by 2015 in order to respond to the traffic demand.
- Awaza National Tourism Area is under development in Turkmenbashi City. A total area of 770 ha will be developed in the first stage project targeting 2013 and a further 100 ha will be developed by 2020. The project includes the construction of many kinds of tourist attractions, state-of-the-art hotels, business complex and health/education-oriented facilities. The government plans to introduce simplified VISA procedure for Awaza visitors. By this policy, the number of inbound travelers to Turkmenbashi will increase.

In the forecast of passenger traffic, following prerequisite conditions are assumed.

- TMRL purchases Ro-PAX ferry vessels and deploy them on the trans-Caspian link. And international agreements necessary for the new ferry link are concluded.

- Awaza National Tourism Area Project is implemented as originally scheduled and the simplified VISA program removes practical barriers to travelers from Iran and the Caucasus to Awaza.

First, basic potential traffic volume is calculated based on the number of Caucasians living in Turkmenistan. According to the information from Turkmenbashi municipality, around 20% of population of the city is Azeri people. Percentage of Caucasian people in Balkan province is reportedly very high but the detailed data is not available. The Consultant therefore estimates the number of Caucasians in Balkan province using the percentage of Azeri in Turkmenbashi. Caucasians living in other provinces or Turkmen living in the Caucasus may be expected to be potential users of the Caspian Sea link, however these numbers are excluded from the estimation.

As a probable hypothesis, the Consultant assumes that "Caucasians living in Balkan province travel to their homeland every two years by using the new Ro-PAX ferry link". Then the basic potential traffic volume is calculated as:

Potential traffic volume (inbound and outbound)
= Population of Balkan Province x 0.2 x 0.5 x 2
= 540,000 x 0.2 x 0.5 x 2 = 108,000 (people per year)

Next, the Consultant forecasts the growth of traffic volume by the increase of tourists and business travelers generated by the Awaza National Tourism Zone Project. The data on forecasted or even planned numbers of visitors to Awaza is not available, therefore the Consultant estimates the numbers of visitors from the capacity of hotels in Awaza. According to the State Committee for Awaza Development, planned accommodation in Awaza in 2020 is 150,000. Assuming an average stay of 14 days and average occupancy of 50%, numbers of visitors are calculated as:

150,000 x 365 / 14 x 0.5 = 1,950,000 per year.

The Awaza Committee explains that the major market is Caspian littoral nations, the Caucasus and Central Asia, but detailed data is not available. Therefore, the Consultant estimates the number of visitors from the Caspian littoral region by applying a simplified gravity model. The gravity model describes traffic volume between A and B as follows:

$$S_{AB} = C \times Q_A \times Q_B / d_{AB}^{n}$$

where, S_{AB} : *Traffic Volume between A and B*
C, n: *Constant*
Q_A , Q_B : *Total Numbers of Inbound and Outbound Travelers of A or B*
d_{AB} : *Distance between A and B*

When assumed that *Qi* is in proportion to the population in the region *i* and the constant *n* is 1.0 for simplification, the numbers of visitors from B to A is calculated as:

$$V_{AB} = T_A \times P_B / d_{AB} / \Sigma(P_i / dA_i)$$

Where, V_{AB} : *Numbers of visitors from B to A*

T_A : *Total numbers of visitors to A*

P_i : *Population of the region i*

By using the above equation, the Consultants calculated the number of visitors to Awaza by region as shown in Table 3.2.6. In the calculation, the origin of visitors are assumed to be Central Asia, Caucasus, Russia, Ukraine, Turkey, Iran and EU referring to the information obtained from the State Awaza Committee. The distances are measured from capital cities of nations or states to Turkmenbashi. As to EU, the distance is from Brussels to Turkmenbashi. Considering ease of domestic travel and low airline fares, the distance from Ashgabat to Turkmenbashi is estimated at a quarter of the actual distance.

Table 3.2.6 Estimated Numbers of Visitors to Awaza by Region (2020)

Nation	Population	Distance (km)	Expected Visitors	
Turkmenistan	5,109,881	125	149,706	
Russia – astrakhan	1,005,000	800	4,601	Littoral
Russia – dagestan	2,580,000	560	16,872	Littoral
Russia – other region	137,288,647	2100	239,417	
Iran – gilan	2,410,000	430	20,525	Littoral
Iran – other region	71,785,741	500	525,785	
Uzbekistan	27,488,220	1400	71,905	
Kazakhstan	15,636,987	1900	30,140	
Azerbaijan	8,832,172	270	119,796	Littoral
Tadjikistan	6,952,223	1400	18,186	
Kyrgyz	5,482,200	1800	11,154	
Georgia	4,260,333	710	21,975	
Armenia	3,082,951	720	15,681	
Turkey	74,815,703	1700	161,170	
Ukraine	45,708,081	2100	79,710	
EU	499,794,855	3950	463,377	
Total			1,950,000	
Total from Littoral Region			161,794	

The total number of visitors from the Caspian littoral region (Azerbaijan, Gilan Province of Iran, Astrkhan and Dagestan Oblast of Russia) is calculated to be 161,794 persons in 2020. Although international flights will begin operating after the redevelopment work of Turkmenbashi Airport is completed, the principal means of traveling from littoral regions is expected to be ferry links. The Consultant therefore estimates that 50% of travelers from littoral regions use Ro-PAX ferry. Assuming that the number of travelers to Awaza shows a linear increase from 2010 to 2020, total number of passengers of Ro-PAX ferry departing from and arriving at Turkmenbashi is estimated as shown in Table 3.2.7.

Although the Consultant's estimation is based on rather bold assumptions, it is unlikely to overestimate the traffic volume considering peak traffic in the past. It is probable that the Modernization Study greatly underestimated the volume of passenger traffic mainly due to misunderstanding the current situation of rail ferry vessels.

Table 3.2.7 Estimation of Numbers of Ro-PAX Passengers from/to Turkmenbashi

	2010	2015	2018	2020	2025
Estimation by the Consultant		**196,000**	**240,000**	**270,000**	**270,000**
Estimation by the Modernization Study	14,900	34,500	49,600	61,000	90,500

3.2.4 Function Arrangement of the Port Facilities

In order to realize the target of "a state-of-the-art port", reorganization of functional allotment in the port is required. The Modernization Study proposed the functional reorganization as follows (see Figure 3.2.6):

- Allotment of passenger transport function at the site of the fish processing factory which will be relocated to Kiyanli.
- Converting temporary berthing quays to park and container terminal.
- Allotment of ship repair and building function next to the rail ferry terminal.
- Allotment of conventional cargo handling function in the eastern end of the port development area.

As discussed in 3.2.1, people-oriented function should be allotted in the western part of the port and logistics-industries-oriented function should be in the eastern part. In this context the basic idea of the functional allotment proposed by the Modernization Study is appropriate. The Consultant however proposes some revisions considering optimization of use of port land and waters as follows:

- Location of proposed passenger transport function is basically appropriate, however passenger transport may have to be combined with freight transport since pure passenger transport is not realistic in this region. Therefore Ro-PAX ferry terminal function should be planned and the planned area should be extended to the east where the Modernization has allotted a park.
- Though the Modernization Study proposed to convert all temporary berthing functions to other functions, it should be maintained as it is since temporary berthing is one of the important functions of ports. The land behind it should be reserved for logistics industry.
- The proposed location for the container terminal is not suitable because there is no room for expansion and container traffic can hamper urban traffic. Therefore, the container terminal, together with the conventional terminal, should be planned as a logistics center in the east of port development area. The logistics center should have enough quay length and inland depth, and good road/rail access enabling efficient cargo handling.
- Offshore supply base in Turkmenbashi Port will be very beneficial tot the offshore oil and gas industry because of the close proximity to the modern logistics industry and calmness of its water. At the same time supply base is financially very beneficial to the port. Therefore the function of the supply base should be extended to both sides of the current tentative facility.

- Though TMRL is considering the construction of a shipyard at the eastern end of the port development area, it seems to be better to build it in the location proposed by the Modernization Study considering future expansion of the logistics center. In the planning of the shipyard, the site for future expansion of rail marshaling yard should be reserved.
- If necessary, yacht harbor can be planned to the west of Ro-PAX terminal where better access to Awaza National Tourism Zone is available. This kind of facility should not be planned to the east of the Ro-PAX terminal for navigation safety. When a yacht harbor is planned, extension of Awaza's artificial river to the bay should be considered so pleasure boats would not enter into the main channel.

The above mentioned revision of functional allotment in the port is summarized in Figure 3.2.7.

Source: Google

Figure 3.2.6 Functional Allotment Proposed by the Modernization Study

Source: Google

Figure 3.2.7 Revised Plan of Functional Allotment in the Port

3.2.5 Necessary Facilities Development

Since the Modernization Study provides little information on the available capacity of port facilities, the Consultant has had to analyze capacity himself.

First, the capacity of the existing terminals and terminals to be constructed in the future is estimated as follows:

Liquid bulk terminal

Average parcel size in 2008 is 4532 tons per vessel. Although there has been no major change in parcel size for several years, recent tendency of deployment of larger tankers and future improvement of access channel of Turkmenbashi Port would increase average parcel size. Therefore the Consultant estimates the future average parcel size of 5000 ton per vessel, which corresponds with the estimated value in 2013 by the Channel Study.

Since the improvement of the access channel can reduce the downtime significantly, annual working days are estimated to be 360 days. The standard berth occupancy for four berths should be 60% as proposed by UNCTAD. (UNCTAD 1985)

At present, average berthing time is around 24 hours, however it contains a heap of waiting time. Time required for actual loading of 5000 DWT tankers is around 8 hours. So, it is estimated that berthing time can be shortened up to 16 hours by improving efficiency, which is equivalent to double of the loading time.

Peak ratio is normally around 1.2, but a slightly higher ratio of 1.35 is applied in the calculation considering closure of Volga-Don System in the winter. (In 2008 the peak ratio was 1.3. (monthly basis))

Then, the annual handling capacity of the liquid bulk terminal (PPK3) is calculated as follows:

(Handling Capacity)
= (Numbers of berths) x (Parcel size) x (working days) x (berth occupancy) x 24 / (berthing time) / (peak ratio)
= 4 x 5000 x 360 x 0.6 x 24 / 16 / 1.35 = 4,800,000 tons per year

General cargo terminal

Considering that the general cargo terminal (PPK1) is equipped with a sufficient number of cranes and the improvement of the access channel will reduce its downtime, the empirical standard unit can be applied. The approximate average unit productivity per converted berth length is 1000 tons per year, and the converted berth length is estimated to be two thirds of the actual berth length. Therefore the capacity of 430-meter-quays of PPK1 quays is estimated to be 287,000 tons per year.

The above mentioned productivity is equivalent to the following condition:

Numbers of berths:	3
Working days:	360 days per year
Berth occupancy:	55%
Average parcel size:	1500 ton
Berthing time:	55 hours per call
Peak ratio:	1.35

The above listed condition is a probable situation after the improvement of the access channel. Therefore the calculated value of 287,000 tons per year can be assessed to represent the actual capacity of PPK1.

It is noted that the simplified method mentioned above is only applicable for conventional general cargo handling. Container handling, RORO operation or bulk cargo handling with specialized unloader has much higher productivity.

Rail ferry terminal

The average parcel size (inbound plus outbound) per call in 2008 is 3,400 tons. Then if the practicable maximum numbers of vessel calls are estimated, the capacity can be obtained.

In 2008 actual cargo handling time was less than 10% of total berthing time, and there may be room to improve efficiency. But determining how feasible it is to raise handling efficiency is not so easy because it is affected not only by the productivity of the rail ferry terminal but also by the overall efficiency of Turkmen Railways and the efficiency of the rail ferry terminal in Baku, which is reportedly not so high due to curved rail alignment. So the Consultant estimates the capacity using the historical data of productivity of PPK2.

In 2003 a total of 980 ship-calls at PPK2 was recorded, which is 1.65 times larger than the numbers recorded in 2008, due to occasional excess supply of oil from Turkmenistan that could not be conveyed by the existing tanker capacity. It is also reported that at the peak operation in the mid 1980s this link was served with six or seven sails per day (in 2008 it was served with less than 2 sails per day). Since the detailed information of handling in the 1980s is not available, practicable maximum numbers of vessel calls are calculated based on the data in 2003 taking account of improved efficiency by channel improvement. By the channel improvement the downtime is expected to decrease approximately from 60 days to 5 days. Then, the capacity is calculated as follows:

(Handling Capacity)= (Numbers of Vessel Calls) x (Average Parcel Size)
= 980 x 360 / 305 x 3,400 = 3,900,000 tons per year

RORO (including Ro-PAX) terminal

At present, RORO vessels are accommodated in the general cargo terminal and a small numbers of trucks are transported on rail ferry vessels. As mentioned in 2.1.4, RORO operation, especially

Ro-PAX operation in such facilities is inefficient and unsafe, therefore current available capacity is estimated to be zero.

When a specialized Ro-PAX terminal is constructed, the capacity (net weight) per berth can be calculated as follows:

(Handling Capacity)= (Average Parcel Size of Vessels) x (Numbers of Vessel Call)
= (Loading Capacity of Vessels (Numbers of Trucks)) x (Loading factor) x (Average Parcel Size of Trucks) x (Numbers of Vessel Call)

Since the Ro-PAX link will be a liner service, peak ration is not considered. According to the vessel deployment plan of TMRL, the planned Ro-PAX vessel can accommodate 80 trucks. The loading factor of 0.8 is assumed, and considering current average parcel size of trucks transported by rail ferry, the parcel size of trucks is assumed to be 20 tons (40 tons for the total of inbound and outbound). Since the realistic daily number of vessel calls per berth is one, annual number of vessel calls per berth is 360 when the downtime of 5 days is assumed. Then the annual handling capacity per berth is calculated to be 920,000 tons.

Table 3.2.8 summarizes requirements of berths in 2020. Since the forecasted cargo traffic exceeds capacity of PPK1 and PPK2, two new berths for Ro-PAX and six additional berths for general cargo will be necessary.

It should be noted that the requirements of general berths are calculated on the premise of conventional cargo handling. Therefore, when container transport or dry bulk handling by pneumatic unloader is introduced, the required number of general cargo berths will be much smaller. It also should be noted that the growth of the existing type of general cargo was not considered in the cargo forecast, therefore, when a factory which generates a large amount of port cargo plans to start operation, the cargo forecast should be revised and the requirement of additional berths should be reconsidered.

The oil cargo also exceeds the capacity of PPK3, therefore additional one jetty (two berths) will be required.

Table 3.2.8 Summary of Requirements of Berths

(1000 ton)

	Throughput (2008)	Capacity (2008)	Estimated Throughput (2020)	Shortage of Capacity (2020)	Required Numbers of Additional Berths in 2020
PPK1	177	287	287	0	0
NEW RORO (Ro-PAX)	0	0	1,840	1,840	2
NEW General Cargo	0	0	626	626	6
PPK2	2,051	3,900	3,900	0	0
PPK3	3,481	4,800	6,987	2,187	2

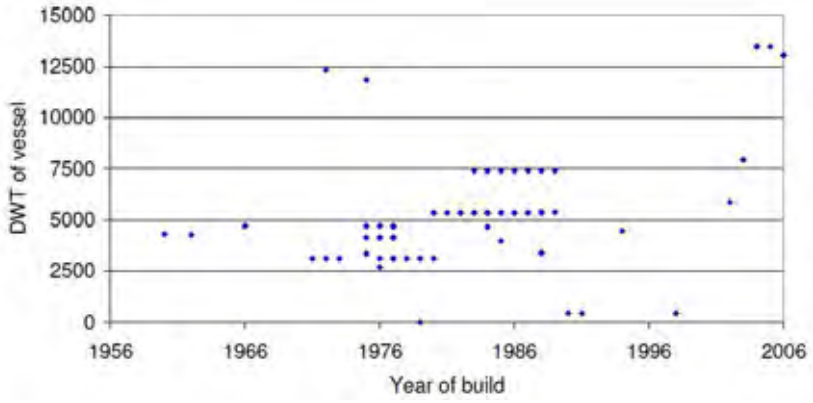
Finally the Consultant considers the capacity for passenger transport. The construction of two Ro-PAX berths enables 720 ship calls a year as mentioned above. Since planned passenger capacity by TMRL is around 300 persons per vessel, annual capacity is calculated to be 360,000

persons, assuming the peak ratio of 1.2. Therefore, the forecasted 270,000 passengers can be handled at the planned Ro-PAX terminal.

3.2.6 Assessment of Maximum Size of Ship Calling the Port

In this section the maximum size of vessels calling at the port in the future is assessed. Since the Modernization Study provides little information on vessel size and it overlooked important characteristics of dimensions of the Caspian fleet, the Consultant assesses it based on the review of the Channel Study. Dimensions of the Caspian fleet are strongly affected by the Volga-don river system, therefore, the standard dimensions of vessels are not applicable in port planning.

Unlike the world fleet, the increase in size of Caspian vessels is rather moderate. Figure 3.2.8 shows the relation between vessel size and construction year. The figure indicates that the increase of maximum vessel size in the last 30 years is very small. Therefore the maximum vessel size can be assessed basically on the basis of data of current vessel size.



Source: TACIS 2007

Figure 3.2.8 Vessel Size vs. Construction Year

The Channel Study summarized the current maximum size of vessels as shown in Table 3.2.9. The Consultant examined the listed data by the up-dated ship registration data in Turkmenistan, Azerbaijan and Kazakhstan. The data in Russia and Iran was not used because it was very difficult to extract data on the Caspian fleet from them. The Consultant confirmed that the data regarding tankers and dry cargo vessels were unchanged. Regarding ferries, a new 6000 DWT ferry was deployed in Azerbaijan in 2006, however the dimensions are exactly the same as listed data in Table 3.2.9. Another larger ferry vessel is 4673 DWT RORO ship of Olya Shipping in Russia, which currently calls at Turkmenbashi Port every ten days. Its LOA and beam are smaller than those of the listed ferry in Table 3.2.9, however its draft is 5.6 meters.

Therefore the data in Table 3.2.9 can be basically applied as a basis of port planning if due attention is paid to the existence of some larger vessels. It should be noted that the port facilities do not always have to accommodate vessels for full draft condition. This will be discussed further in 3.3.2.

Table 3.2.9 Overview specifications of the design vessels

Type	DWT	Length over All [m]	Beam [m]	Draught [m]
Tanker	14,000	150.0	17.3	7.1
Tanker	8,000	141.0	16.9	5.1
Tanker	5,000	125.0	16.9	4.4
Dry cargo vessel	6,000	140.0	16.6	4.5
Ferry	3,950	154.5	18.3	4.7

Source: TACIS 2007

Azerbaijan is about to start the construction of the Baku International Trade Sea Port at Alyat (70 km south of Baku). The new port is reportedly capable of accommodating the largest vessels currently operating in the Caspian Sea. Alyat will be a multipurpose terminal for bulk general cargo and containers. Since Baku is the most important trade partner for Turkmenbashi Port, the detailed information on dimensions of their design vessels should be gathered in the design of container or general cargo terminal in Turkmenbashi Port. The Consultants could not obtain information on the new port development through a telephone interview with Baku Port.

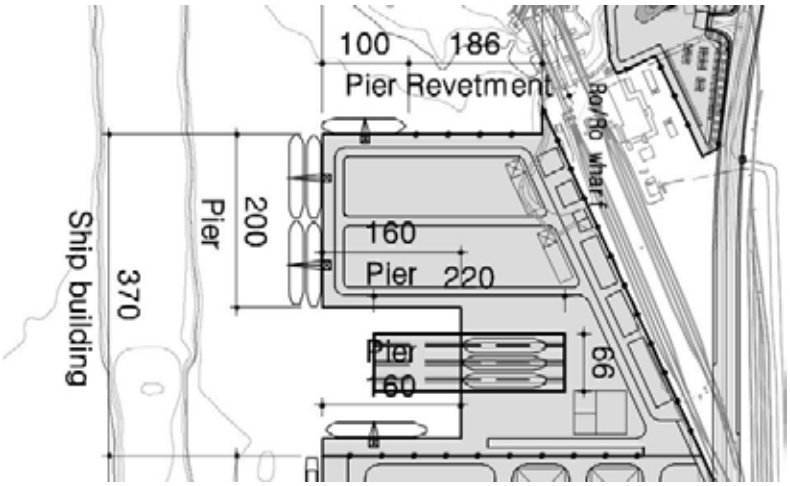
3.2.7 Ship Repair Facilities

The Modernization Study proposed the construction of a shipyard with two slip ways for ship repairing, one slip way for ship building, and four berths for rigging as shown in Figure 3.2.9. The capacity of the shipyard was estimated to be 33 vessels for ship repair and 3 vessels for ship building annually. Maximum ship size was 5000 DWT.

The Modernization Study elaborated the demand forecast of ship repair utilizing limited data, though it is based on a lot of assumptions. In addition, the Modernization Study provides very little information on shipyard planning. Thus it is very difficult to evaluate the proposal of the Study quantitatively. But the Consultant nevertheless assesses the plan of shipyard building affirmatively for the following reasons.

- The number of shipyards in the Caspian littoral region is insufficient; Turkmenistan, in particular, does not have any shipyards. Therefore the shipyard in Turkmenbashi can contribute to the promotion of Caspian maritime transport, the improvement of maritime safety and the prevention of environmental disasters. Safety is a crucial issue to be coped with considering future the increase of passenger traffic and transport of hazardous goods in Turkmen water.
- Further development of hydrocarbon resources is planned off the coast of Turkmenistan and much more traffic of offshore supply vessels is expected. An interview with an offshore service provider revealed that a modern shipyard in Turkmenbashi will be very beneficial for the offshore supply service which requires that vessel condition be of a very high standard.

- Development of shipbuilding industry accords with the policy of industrial diversification.
- Some foreign ship building companies have expressed interest in the shipyard in Turkmenbashi reportedly. This implies the financial viability of the shipyard project.



Source: MLTM 2009

Figure 3.2.9 Plan of Shipyard

3.3 Review of Channel Improvement Plan

In this section, the channel improvement plan proposed by the Channel Study is reviewed. As mentioned in the previous section, the plan has already been revised by TMRL, and the description in this section reflects TMRL's revision.

3.3.1 Demand Forecast for the Use of the Channel

Based on the cargo traffic forecast in 3.2.2, the numbers of vessel calls are estimated as shown in Table 3.3.1. In the calculation, average parcel size of tankers was assumed to increase up to 5000 tons, whereas others would not change. The service frequency of the Ro-PAX ferry link was assumed to be twice a day. For comparison, the estimation by the Channel Study is also listed in the table. It is noted that figures listed in the table are the numbers of ship calls, whereas numbers on use of the channel would normally be twice that listed in the table.

Table 3.3.1 Estimated Numbers of Vessel Calls

	2008	2020	
		By the Consultant	By the Channel Study
PPK1	124	**201**	550
NEW RORO (Ro-PAX)		**720**	
NEW General Cargo		**439**	
PPK2	592	**1,126**	2,200
PPK3	768	**1,397**	3,580
TOTAL	1,484	**3,883**	6,330

3.3.2 Design Ship Size

The Channel Study proposed that the design vessel should be a 14000 DWT tanker, the largest Caspian tanker. However, the number of large tankers exceeding 10000DWT is very small in this region, according to Lloyd's database, 10 vessels in Azerbaijan, 7 vessels in Kazakhstan and zero in Turkmenistan. Considering the length of the Turkmenbashi channel, the size of the design vessel should be more realistic in order to secure financial viability. Actually, TMRL has been very prudent in such prior investment even though they have had to accommodate partially loaded 13000 DWT tankers.

The Consultant proposes that the design vessel should be 8000 DWT tanker, the maximum size of Turkmen fleet. The dimensions of an 8000 DWT tanker are shown in Table 3.3.2. The rail ferry vessels which call at Turkmenbashi port every day should also be considered in channel design because their LOA and breadth are larger than those of 8000 DWT tankers.

The dimensions of the rail ferry are also shown in the same table. As mentioned in 3.2.4**,** the draft of RORO vessels coming from Olya is 5.7m, however they don't call at Turkmenbashi port with full draft since the maximum quay depth of their mother port is 6.0 meters. Therefore the Consultant uses the dimensions listed in Table 3.3.2. Considering the possible deepening of Olya port in the future, safety of their navigation in case that they call at full draft is also examined.

Table 3.3.2 Revision of the Dimensions of the Design Vessels

	DWT	Length over all (m)	Beam (m)	Draft (m)
Tanker	8000	141.0	16.9	5.1
Rail Ferry	3950	154.5	18.3	4.7

3.3.3 Plans of Channel Alignment

(1) Channel Alignments

In the Channel Study, only alternatives that make use of (part of) the existing dredged channels were considered taking into account the shallowness of the bay of Turkmenbashi and the dredging cost of a completely new channel. As shown in Figure 3.3.1, three basic options considered in the study were:

- Option A: the northern access channel: this is presently the main access channel to the port
- Option B: the southern access channel: this channel is presently used only rarely by vessels coming from Iran and for vessels with limited draft (4 – 4.5m) in case of closure of the northern channel due to bad weather
- Option C: the northern access channel, with a short-cut between a location at about halfway the spit and the junction of the two sections to the UFRA terminal and the ferry terminal

For the selection of the preferred alternative, a comparative evaluation of these alternatives was carried out by means of a Multi Criteria Analysis (MCA). The indicators selected for MCA applied to the comparison of the alternative channel alignments included:

- dredging cost
- sailing time through the channel
- environmental impact
- navigational issues
- ease of implementation

Taking into account the above, and attributing a score of 0 (worst) to 4 (best) to the performance of each alternative along each of the criteria, the Channel Study concluded that the preferred alignment was that of the present northern access channel (Option A) as shown in Table 3.3.3

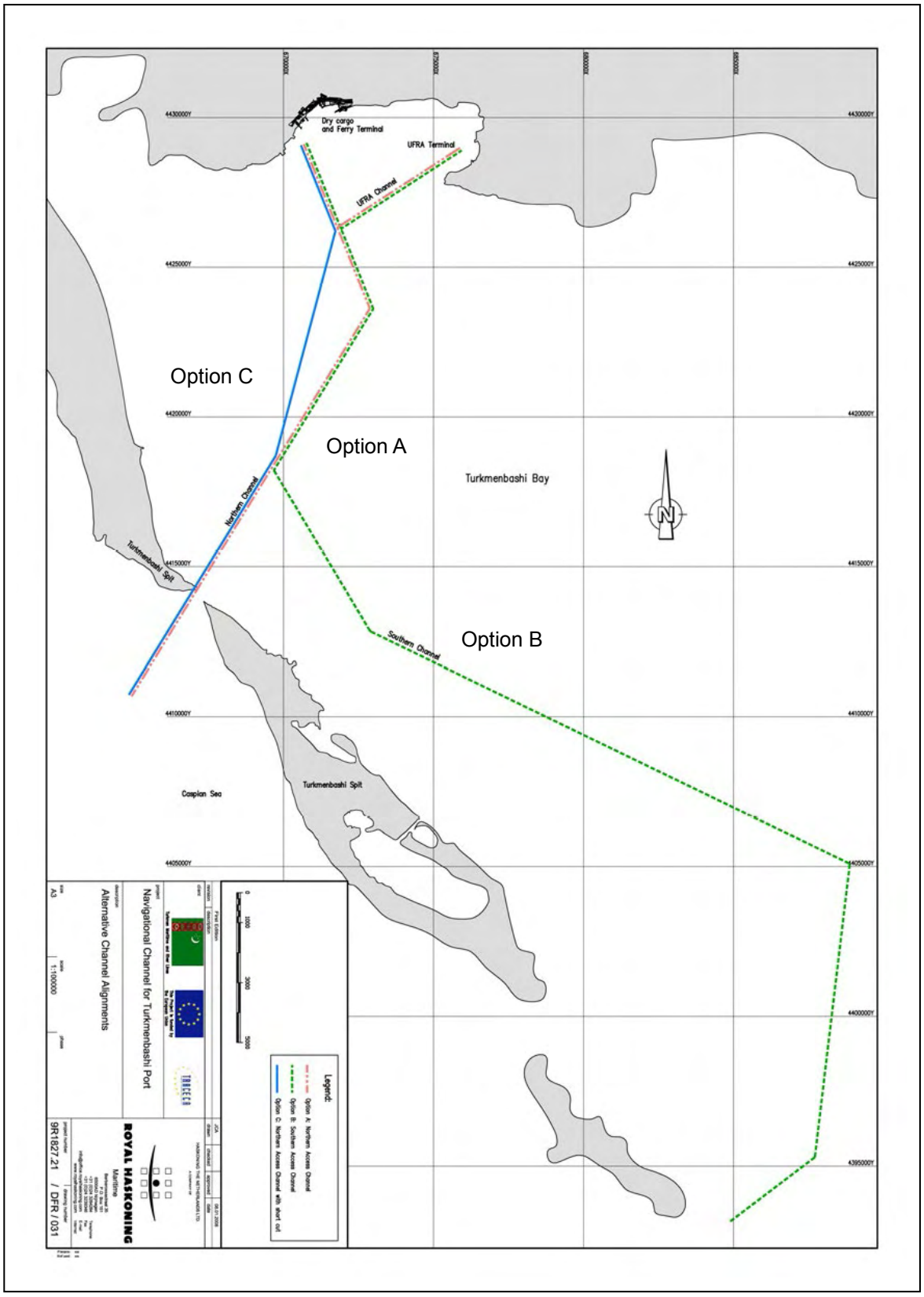
Table 3.3.3 MCA of alternative channel alignments

	Option		
Indicator	A Northern channel	B Southern channel	C Northern channel with diversion
1. Dredging cost	4	1	2
2. Sailing time	2	1	4
3. Environment	4	2	1
4. Navigation	3	1	3
5. Ease of implementation	3	2	2
Total score	16	7	12

It is apparent that Option B doesn't have any advantage. The Consultant thus examines the ascendancy of Option A over Option C. Since the MCA employed by the Channel Study can contain some arbitrary factors, the Consultant tries to remove them by converting each indicator into monetary terms.

Difference of sailing distances between Option A and Option C is 1.0 kilometer, which shortens the sailing time by 0.08 hours, assuming vessel speed of 7 knots. Considering annual traffic of 7,800 vessels (two-way), annual navigation time saving is estimated to be 26 days-vessels. Assuming average charter rate of 5000USD per day, expected annual benefit caused by the short-cut is 130,000 USD whilst roughly estimated additional dredging volume of 2 million cubic meters costs 14 million USD. This clearly indicates that Option C is not economically viable in addition to its environmental burden.

Therefore the Consultant evaluates that Option A is the preferred alignment as the Channel Study has proposed.



Source: TACIS 2007

Figure 3.3.1 alternative channel alignments

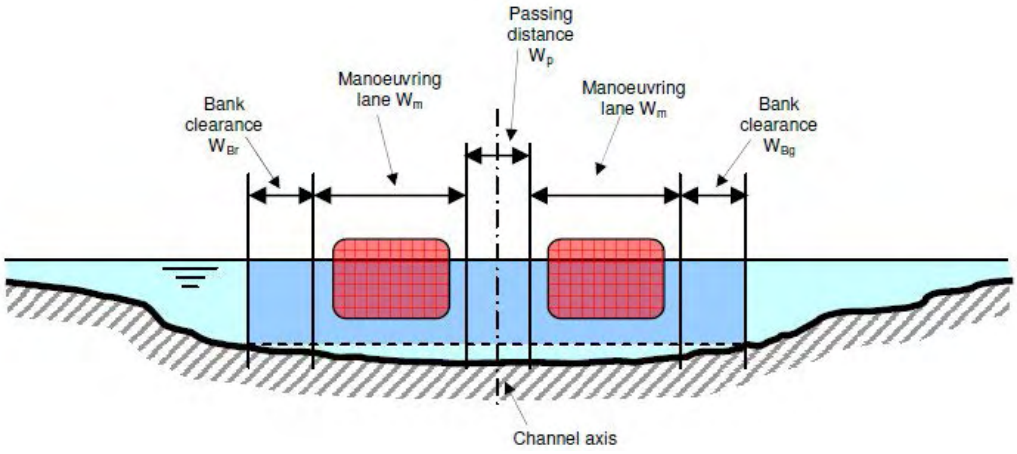
(2) Channel Width

The Channel Study determined the width of the channel using the PIANC guideline (PIANC 1997). The guideline defines the required channel width as a multiple of the beam of the design ship. The total channel width is the sum of different factors as presented in the following formulation:

For a one-way channel: $$w = w_{BM} + \sum_{i=1}^{n} w_i + w_{Br} + w_{Bg}$$

For a two-way channel: $$w = 2w_{BM} + 2\sum_{i=1}^{n} w_i + w_{Br} + w_{Bg} + \sum w_P$$

Where the basic maneuvering width w_{BM} as a multiple of the beam of the design ship is the width required by the design vessel to sail safely in very favorable environmental and operational conditions. *wi* are additional factors depending on environmental conditions, vessel speed, aids to navigation, bottom characteristics and the cargo hazard level. w_{Br} and w_{Bg} are the bank clearances on the 'red' and 'green' sides of the channel, Σwp is the passing distance (comprising the sum of a separation distance based on ship speed and an additional distance based on traffic density). In the figure below the required nautical cross section is marked in a dark blue color.



Source: TACIS 2007

Figure 3.3.2 Definition of channel cross section

The Channel Study proposed that the channel be divided into the "outer channel" and "inner channel", whereas current access channel had been designed without dividing. According to PIANC, their definition is as follows.

"An Outer channel is one exposed to wave action which is such as to produce important vessel motions. Usually these will be pitch, heave and roll and will be of a magnitude to reduce under keel clearance by a significant amount."

"An inner channel is one which is not subject to wave action of any significance and is generally sheltered".

Below a short explanation is given of the main parameters used by the Channel Study for the determination of the channel width.

(Basic maneuvering width w_{BM})

Considering the relatively large windage of the ferries and the often relatively small rudder area and engine power of a tanker, both vessels were classified as “moderate” maneuvering vessels resulting in a basic width of 1.5B. (hereinafter B denotes breadth of vessels)

(Additional widths *wi*)

Below an overview is given of the additional width defined by *wi*.

Table 3.3.4 Additional widths

	Condition	Outer section	Crossing section	Inner section
Vessel Speed	ALL	0.0B	0.0B	0.0B
Prevailing cross wind	Mild	0.0B	0.0B	0.0B
	Bad weather	0.4B	0.4B	0.4B
	Severe	0.8B	0.8B	0,8B
Prevailing cross current	ALL	0.7B	0.7B	0.0B
Prevailing longitudinal current	ALL	0.0B	0.2B	0.0B
Prevailing wave conditions	Mild	0.0B	0.0B	0.0B
	Bad weather	0.5B	0.5B	0.5B
	Severe	1.0B	1.0B	1,0B
Aids of navigation	ALL	0.2B	0.2B	0.2B
Bottom surface	ALL	0.1B	0.0B	0.1B
Depth of waterway	ALL	0.1B	0.0B	0.1B
cargo hazard level	ALL	0.5B	0.5B	0.5B
TOTAL	Mild	1.6B	1.6B	0.9B
	Bad weather	2.5B	2.5B	1.8B
	Severe	3.4B	3.4B	2.7B

(Bank clearance wBr and wBg)

For the inner and outer channel, sloping channel edges are present resulting in the following additional widths.

Table 3.3.5 Additional width for bank clearance

Condition	Outer section	Crossing section	Inner section
All conditions	0.5B	1.0B	0.5B

(Width for passing distance *wp*)

Considering future increases in traffic volume, the Channel Study proposed the passing distance as shown in Table 3.3.6.

Table 3.3.6 Additional Widths for Passing Distance

Item	Outer section	Crossing section	Inner section
Encountering speed	1.6B	1.6B	1.6B
Traffic density	0.2B	0.2B	0.2B
TOTAL	1.8B	1.8B	1.8B

The table below gives an overview of the required channel width for a double lane channel allowing encountering traffic.

Table 3.3.7 Two-lane channel width proposed by the Channel Study

Condition	Outer section	Crossing section	Inner section
Mild	9.0B	10.0B	7.6B
Bad weather	10.8B	11.8B	9.4B
Severe	12.6B	13.6B	11.2B

The table below gives the width of the channel expressed in meters for the three different channel sections for the three different environmental condition combinations when the breadth of the design vessel is 18.3m.

Table 3.3.8 Channel width for a two-way channel

Condition	Accepted Downtime	Outer section	Crossing section	Inner section
Unit	[days/y]	[m]	[m]	[m]
Mild	75	165	183	139
Bad weather	5	198	216	172
Severe	~1	231	249	205

The Channel Study proposed that the channel would be designed as a two-lane channel under mild conditions as shown in Table 3.3.9. In this calculation, the width of two beams was added at cut through section, considering the severe navigational condition.

Table 3.3.9 Proposal of channel width by the Channel Study

Condition	Accepted Downtime	Outer section	Crossing section	Inner section
Unit	[days/y]	[m]	[m]	[m]
Mild	*75*	170	220	140

The Consultant examined the above mentioned estimation of the channel width by the Channel Study and would propose some modifications on it as described below:

Reconsideration on parameters

The Channel Study evaluated that the cross current at the inner section was negligible however the measurement in the Modernization Study revealed the existence of a current exceeding 0.2 knots even in the vicinity of port facilities, for which PIANC's guideline requires additional width

of 0.1B. Therefore the Consultant proposes 0.1B as the additional width for the cross current at the inner section instead of 0.0B.

According to the Channel Study, the additional width for wave condition is the same quantity over all sections. But even when the outer section is exposed to rough sea, the inner section must be calmer and the wave length at the inner section is unlikely to exceed the length of ships considering the short wind fetch in Turkmenbashi Bay. For this condition PIANC's guideline recommends the additional width of 0.0B.

The Channel Study proposed 0.0B of additional width for bottom surface and water depth at cut through whereas the PIANC's guideline requires 0.1B. And the guideline prescribes 0.2B as an additional width for water depth at the inner section, for which the Channel Study estimated 0.1B.

The most important factor to be reconsidered is the cargo hazard level. TMRL has strongly requested that the channel should be designed so that the channel will enable two-way traffic of vessels carrying hazardous goods. Considering the substantial volume of hazardous goods traffic not only by tankers but also by rail ferries, the hazard level should be evaluated as "high" for which the guideline prescribes additional widths of 1.0B and 0.8B for the outer/cut through and inner section respectively.

Table 3.3.10 Oil cargos handled in Turkmenbashi Port (2008)

Terminal	Total Throughput (tons)	oil cargo (tons)	percentage of oil cargo
PPK1	177,364	0	0.0%
PPK2	1,281,849	431,243	33.6%
PPK3	3,480,000	3,480,000	100.0%
Total	4,939,213	3,911,243	79.2%

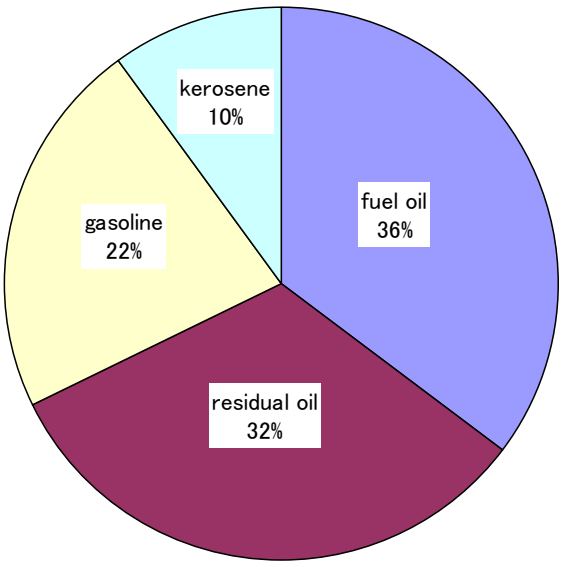


Figure 3.3.3 Breakdown of oil product handled at PPK3 in Turkmenbashi Port (2008)

According to the guideline, the passing distance at the inner section should be 1.6B.

The Tables 3.3.6 to 3.3.8 should be revised as shown below based on the above mentioned reconsideration by the Consultant. The underlined figures in the tables represent the revised ones.

Table 3.3.11 Revised Additional Widths

	Condition	Outer section	Crossing section	Inner section
Vessel Speed	ALL	0.0B	0.0B	0.0B
Prevailing cross wind	Mild	0.0B	0.0B	0.0B
	Bad weather	0.4B	0.4B	0.4B
	Severe	0.8B	0.8B	0,8B
Prevailing cross current	ALL	0.7B	0.7B	0.1B
Prevailing longitudinal current	ALL	0.0B	0.2B	0.0B
Prevailing wave conditions	Mild	0.0B	0.0B	0.0B
	Bad weather	0.5B	0.5B	0.0B
	Severe	1.0B	1.0B	0,0B
Navigation aids	ALL	0.2B	0.2B	0.2B
Bottom surface	ALL	0.1B	0.1B	0.1B
Depth of waterway	ALL	0.1B	0.1B	0.2B
Cargo hazard level	ALL	1.0B	1.0B	1.0B
TOTAL	Mild	2.1B	2.3B	1.4B
	Bad weather	3.0B	3.2B	1.8B
	Severe	3.9B	4.1B	2.2B

Table 3.3.12 Revised Additional Widths for Passing Distance

Item	Outer section	Crossing section	Inner section
Encountering speed	1.6B	1.6B	1.4B
Traffic density	0.2B	0.2B	0.2B
TOTAL	1.8B	1.8B	1.6B

Table 3.3.13 Revised two-lane channel width

Condition	Outer section	Crossing section	Inner section
Mild	10.0B	11.4B	8.4B
Bad weather	11.8B	13.2B	9.2B
Severe	12.6B	15.0B	10.0B

Reconsideration on the downtime

The Channel Study accepted a downtime of 75 days for two-way traffic, however the total of 2.5 months' closure of two-way traffic can cause substantial damage to the efficiency, reliability and profitability of Turkmenbashi Port. Therefore the Consultant proposes that the channel be designed as a two-lane channel under "bad weather" condition, for which the expected downtime is 5 days a year. Then, the Consultant calculates the channel widths as shown in Table 3.3.14. In

the calculation of the channel width, the design vessel is considered to be a 3950DWT rail ferry vessel (B=18.3m) except that for Ufra branch where an 8000DWT tanker (B=16.9) is considered as the design vessel.

Table 3.3.14 Proposal of channel widths by the Consultant

Condition	Accepted Downtime	Outer section	Crossing section	Inner section	
				Main	UFRA channel
Unit	[days/y]	[m]	[m]	[m]	[m]
Bad weather	5	220	240	170	160

The principal parameter in the above mentioned method is the breadth of vessels. But it is also important to confirm the adequateness of the calculation result considering the length of vessels. Caspian vessels are slender with relatively larger LOA (length overall) and smaller breadth. This characteristic gives them better maneuverability however this could lead to an underestimated channel width design when the design method in which the breadth of vessels is the principal parameter (such as PIANC's guideline) is employed.

An example of an empirical design method in which LOA is the principal parameter is introduced in Japanese technical standard (OCDI 2009) as follows.

In waterways where two-way navigation is expected, an appropriate width of 1.0LOA or more can generally be used. Provided, however, that;

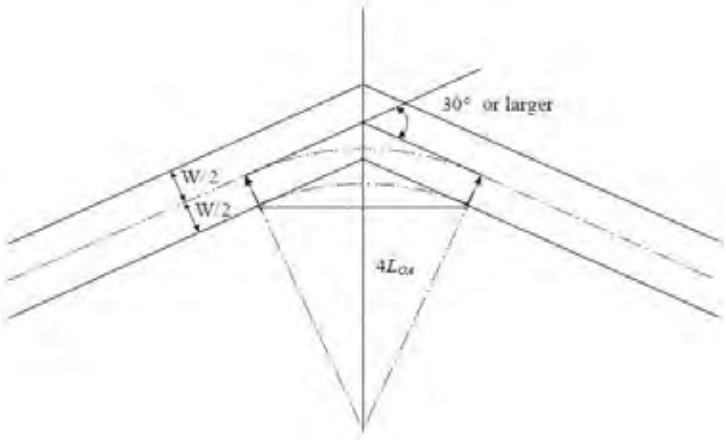
(a) when the length of the waterway is comparatively long : W=1.5LOA
(b) when design ships frequently pass during navigation of the waterway : W=1.5LOA
(c) when design ships frequently pass during navigation of the navigation channel and the length of the waterway is comparatively long : W=2.0LOA

where
W : width of navigation channel (m)
LOA : length overall of design ship (m)

It is clear that the access channel of Turkmenbashi Port is "comparatively long". Therefore the Channel Study, of which the proposed channel width is less than LOA of the design vessel (154 meters), could underestimate the design width of the channel. According to the Consultant's revision, the calculated channel width is between 1.0LOA and 1.5LOA. This supports the adequateness of the Consultant's revision.

For the single way traffic under "bad weather condition", the required channel width is calculated to be 5.3B. This indicates that even Ufra channel (width=160m), the narrowest part in Turkmenbashi channel system, can allow one way traffic of Caspian-max tankers (B=17.3m) with partial loading conditions.

The channel system of Turkmenbashi port has two bends exceeding 30°. At these bend sections channel width should be designed considering the corner cut as shown in Figure 3.3.4 (OCDI 2009).



Source: OCDI 2009

Figure 3.3.4 Corner Cut at Bend Section of Width W of Navigation Channel

(3) Channel Depth

The Channel Study calculated the required channel depth as shown in Table 3.3.15, and proposed design water depth of 7.1 meters for phase 1 considering a design vessel of 8000 DWT tanker under "severe condition", 8.6 meters for phase 2 considering a 14000 DWT tanker under "bad condition" respectively. For the channel to ferry and general cargo terminals, 6.8 meters of channel depth was proposed considering severe condition. The channel depths of inner, outer and cut through section were proposed to be uniform. The proposed values don't include dredging margins and sedimentation buffer.

Table 3.3.15 Calculation of Channel Depth by the Channel Study

Condition	Unit	Mild	Bad	Severe
Accepted downtime	*[days/y]*	*75*	*5*	*~1*
Ferry	[m]	5.8	6.3	6.8
5,000 DWT tanker	[m]	5.4	5.9	6.4
8,000 DWT tanker	[m]	6.1	6.6	7.1
14,000 DWT tanker	[m]	8.1	8.6	9.1

The description below is the Consultant's assessments on the channel depth design.

Inner Section

Although the final report of the Channel Study doesn't describe any detailed information on the methodology of channel depth calculation, it is said that consideration of severe condition for the inner section, where such condition would never be encountered, could cause an overestimation.

The Japanese technical standard (OCDI 2009) provides an empirical design method for channel depth as described below.

When the dimensions of design ship, navigational environments such as weather and sea condition and ship speed are not specified, the depth of navigation channel can be basically determined as follows.

(Class A) Waterway in a port where waves including swell does not affect ship motion : D=1.10d
(Class B) Waterway out of a port where waves including swells affect ship motion : D=1.15d
(Class C) Waterway in open water where waves including swells exist : D=1.20d

where
D : depth of navigation channel
d : full draft of design ship in still water

Table 3.3.16 shows a comparison of the estimated channel depths by the Channel Study and by the method given in the Japanese technical standard. The table indicates that the "severe" condition represents much harder condition than that the Japanese technical standard assumes for open water condition. The "bad" condition is still harder than that of open water. Therefore, as for the inner section, designing for the "bad" condition would provide enough navigation safety. The basic channel depth excluding dredging margins and sedimentation buffer should be 6.6 meters for the main and Ufra channel, 6.3 meters for the channel between the Ufra separation and PPK1/PPK2 respectively.

Table 3.3.16 Comparison of the Estimated Channel Depth by the Channel Study and Japanese Technical Standard

Design Ship	Draft of Design Ship	Design Depth of the Channel			
		"Channel Study"	Japanese Technical Standard (class A)	Japanese Technical Standard (class B)	Japanese Technical Standard (class C)
Tanker 14,000DWT	7.1 m	8.6 m (bad) 9.1 m (severe)	7.8 m	8.2 m	8.5 m
Tanker 8,000DWT	5.1 m	6.6 m (bad) 7.1 m (severe)	5.6 m	5.9 m	6.1 m
Rail Ferry 3,950DWT	4.7 m	6.3 m (bad) 6.8 m (severe)	5.2 m	5.4 m	5.6 m

Outer and Cut through Section

Navigation in the outer and cut through sections exposed to the open sea is very difficult due to their complicated hydraulic conditions. Therefore "severe" condition should be considered in the design of these sections. Since the detail of the "severe" condition defined by the Channel Study is not provided, the Consultant calculates the required channel depth by using the methodology for the performance-based design provided by the Japanese technical standard which is scheduled to be reflected in the revision of PIANC's design standard. According to the Japanese technical standard, the required water depth is given as follows. (OCDI 2009)

$D=d+D1+ Max\ (D2,D3)+D4$

where

D : depth of navigation channel

d : full draft of design ship in still water

D1 : squat (bow sink during underway)

D2 : bow sink due to heaving and pitching motion (in case of λ >0.45Lpp)

D3 : bilge keel sink due to heaving and rolling motion (in case of TR ≒TE)

D4 : allowance of depth

λ : length of wave including swell

Lpp : length between perpendiculars of design ship

TR : natural rolling period of design ship

TE : encounter period of design ship and design wave

D1 is calculated as follow.

$$D_1 = \left(0.75 + 1.5\frac{d}{D}\right)\cdot\left(\frac{C_b}{Lpp/B}\right)\cdot\frac{U^2}{g} + 15\frac{d}{D}\cdot\left(\frac{C_b}{Lpp/B}\right)^3\cdot\frac{U^2}{g}$$

where

d : full draft of design ship in still water

D : depth of navigation channel

B : breadth of design ship

Cb : block coefficient of design ship (=0.84 for tankers)

U : ship speed

g : acceleration of gravity

D2 is obtained by using Figure 3.3.5.

where

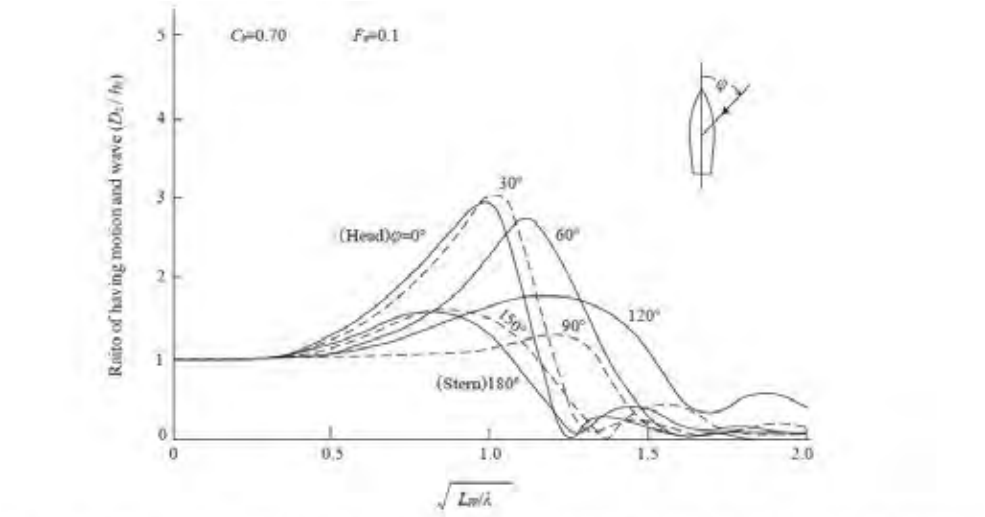
h0 : amplitude of wave (h0=H/2)

H : wave height

D4 is calculated as follows.

D4=0.5m *d≦10m*

D4=0.05d *d>10m*



Note: This figure shows only the case of C_b =0.7and F_n=0.1, but covers the case of deep sea where ship motion is bigger than one in shallow water. Therefore this figure can apply to all cases regardless of C_b and F_n.

Figure 3.3.5 Ratio of having Motion and Wave Amplitude (OCDI 2009)

For 8000 DWT Caspian tankers, D1 is calculated to be 0.23 meters, when vessel speed is assumed to be 7 knots. Although no data on wave period is available, considering wind fetch in the region, the Consultant assumes that the wave period is around 8 seconds and roughly calculates the wave length of 70 meters at the outer section. Figure 3.3.5 indicates that under this condition D2/h0 for 8000 DWT tankers (Lpp/ λ =2) will not exceed 2.0 even when the wave direction is the most pessimistic. Therefore it is estimated that D2 is equal to the wave height. D3 is required to be considered when natural rolling period of vessel is nearly equal to the encountered wave period, however as a preliminary assessment this report omits the evaluation of D3 considering it to be a very exceptional case. Assuming design wave height of 2 meters, then the required basic channel depth for outer and cut through sections becomes 7.8 meters excluding dredging margins and sedimentation buffer.

Considering the length of the access channel in Turkmenbashi, which make it difficult to carry out maintenance dredging of all sections in a single year, the Consultant proposes sedimentation buffers of 0.2 meters which are roughly equivalent to accumulation volume for three to four years in the inner section and one year in the vicinity of cut through as mentioned later. Although a considerable amount of sedimentation in both the inner and outer side of cut through section is anticipated, sedimentation buffers are planned to be uniform over all sections of the channel because intensive maintenance dredging work is expected where a great volume of accumulation is anticipated. In addition to the sedimentation buffers, dredging margin of 0.2 meters is recommended.

Table 3.3.17 summarizes the Consultant's proposal for channel depth including sedimentation buffers and dredging margin.

Table 3.3.17 Proposal for Channel Depth of Turkmenbashi

SECTION	Inner	Channel to Ferry and General Cargo Terminal	Outer and Cut Through Sections
Channel Depth (m)	7.0	6.7	8.2

Finally the Consultant assesses the navigation safety of RORO vessels to Olya, which have a larger draft (5.7 m) than the design vessel. The water depth of the shallowest section of the inner channel is larger than 1.15 times of their full draft. It is therefore evaluated that they would be able to enter Turkmenbashi Port safely except under very severe weather conditions even if they call at full draft in the future.

(4) Dredging Volume

Table 3.3.18 shows the estimated dredging volume by the Channel Study and by above mentioned Consultant's revision. In the Consultant's estimation of dredging volume, water depths of landward from channel junction, junction to bend, bend to spit, cut through (north bank) and open sea are roughly assumed to be 4m, 5m, 6m, 0m and 6m respectively. The dredging volume of Consultant's revision includes sedimentation buffers and dredging margin whereas that of the Channel Study excludes them. The Consultant estimates that the total volume for capital dredging is 5.5 millions cubic meters. It is noted that this is a very rough figure only for approximate cost estimation and examination of the viability of the project.

Table 3.3.18 Estimated Volume of Capital Dredging

Section	Notes	Channel Study (Phase 1)			Consultant's Revision		
		Width	Depth	Volume	Width	Depth	Volume
A – A	General & Ferry Berth	-	6.2	443,556	-	6.2	440,000
A – B		140	6.8	127,508	170	6.7	370,000
B – B	Channel Junction	140	7.0	690,167	170	7.0	690,000
B – C		140	7.0	51,783	170	7.0	184,000
C – D	Bend Tapers	180	7.0	43,052		7.0	43,000
D – F		140	7.0	1,035,529	170	7.0	1,335,000
F - H	Seaward through spit	170 - 220	7.0	817,151	220 - 240	8.2	1,257,000
U – U	Ufra Berth Area	-	6.6	116,498	-	6.6	116,000
B - U		140	7.0	757,659	160	7.0	1,020,000
TOTAL (cum)				4,082,903			5,455,000

Note: Locations of A to U are shown in Figure 3.3.6

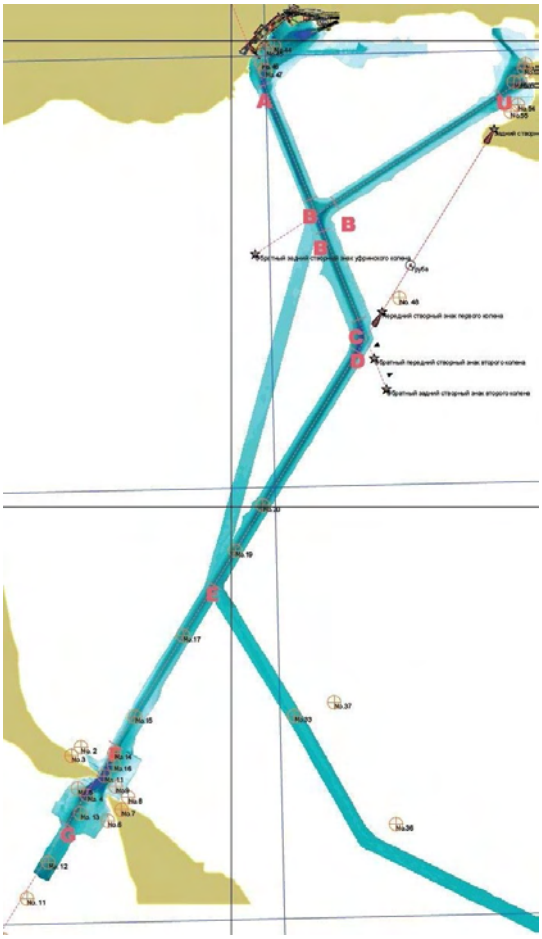


Figure 3.3.6 Indications of Channel Sections

3.3.4 Maintenance Dredging Plan

The Channel Study estimated that sedimentation rate would be 0.2m/year on average and required annual maintenance dredging volume would be a total of one million cubic meters. However, it is questionable whether such a large degree of sedimentation in the channel including the inner section will occur for following reasons.

- Turkmenbashi Bay has less probable sedimentation-generating or sediment-accumulating conditions, i.e. very low energy of waves and current, negligible tidal range, very little inflow and precipitation.
- Although no major maintenance dredging has been carried out since 1990 and the rather stable sea level in this period has not helped to increase the channel depth, the channel depth is nevertheless maintained to some extent. The Channel Study's explanation that this is due to propeller wash is not persuasive.
- The basis of the Channel Study's estimation is records of maintenance dredging in the Soviet era, of which detailed conditions are not clear. If the dredging work contained some channel improvement, such as deepening or widening of the channel to cope with

sea level fluctuation, besides pure and simple maintenance, it would cause Channel Study to overestimate the volume of sedimentation.

- The prior TRACECA study (TACIS 2000) assessed that the inner channel was stable and its frequent maintenance dredging was not necessary.
- TMRL, who must know the hydraulic characteristics of the channel better than anyone else, firmly denies the possibility of large scale sedimentation in the bay.

Since the mechanism of sedimentation is quite different between the inner section and outer/cut-through section of the access channel, the Consultant would estimate the required volume of the maintenance dredging for each section separately as follows:

Inner Section

Sedimentation inside Turkmenbashi Bay is caused by local movement of bed material, creeping and slumping of the silty banks, and its quantity is rather small provided that the slope of channel banks does not exceed the stability limit of the bottom material.

Though the information on channel depth after the last major dredging in 1990 is not available, even if 140m-width and 7m-depth of the channel is completely secured after that, the annual rate of sedimentation in the inner section can be roughly estimated as follows considering that the sea level fluctuation of this period was rather small.

(Annual accumulation) =

(Estimated dredging volume in inner channel excluding the Ufra channel and berth area by the Channel Study) / (Area of inner channel excluding Ufra channel and berth area) / (Period of accumulation) = 1,949,000 / (140 * 16,700)/17 = 0.05 meters/year

The original width of the Ufra channel is 90 meters and its original depth is 7m. Considering that the 6m-depth has been maintained over all section without dredging for 17 years, sedimentation rate of the Ufra channel is more or less equal to that of the main inner channel.

Based on above mentioned estimation, the required annual dredging volume in the inner section is calculated to be around 170,000 cubic meters.

Outer and Cut through section

Sedimentation in the outer and cut through section is much more dynamic, and more detailed consideration is required for it.

The bathymetric data shows the clear tendency of southward growth of the spit due to long-shore sediment transport. Although the prior TRACECA's study on the access channel in Turkmenbashi (TACIS 2000) rather than the Channel Study gives detailed information on the coastal process, its quantitative characteristics are still unclear and it is understood that removal or mitigation of impacts of long-shore sedimentation on the channel would not be easy. An attempt to prevent it has reportedly been made using submerged jetties. Although the prior study (TACIS 2000) gave

affirmative evaluation on their effect to some extent, it concluded that the construction of a new jetty was not feasible because of the difficulty in maintaining its function. The prior study recommended widening the cut through and outer section up to 300m, which is equivalent to the construction of a sand pocket. At any rate, it is important that experts assess all possible countermeasures in detail, such as construction of jetties, sand pocket or mere intensive maintenance dredging, based on precise hydraulic data at the basic design stage.

Besides long-shore sediment movement, cross-shore sand transport is also problematic in the cut through section due to the relatively strong current in the cut through and sudden reduction of the current both inside and outside of this section. This results in the erosion at cut through and considerable amount of accumulation at both sides. To prevent this kind of sedimentation is generally difficult and intensive maintenance dredging seems to be the only realistic countermeasure.

As mentioned above, sedimentation in the outer and cut through section has a very complicated mechanism. The consultant therefore recommends that assessment on sedimentation and its countermeasures by experts be implemented at the basic design stage. However, for the purpose of approximation of the maintenance cost and the evaluation of financial viability the Consultant roughly estimates required maintenance dredging volume in the inner section in the vicinity of the cut through and outer section.

First of all, the consultant assesses the effect of channel widening on current speed at the cut through section to confirm that the widening would not increase the sediment accumulation. By the analogy with hydraulic theory of uniform flow, the current velocity in the channel is considered to be proportional to n th power of hydraulic radius (R) of the channel. The value of n is considered to be less than 1.0. For a rectangular channel, R is calculated as follows.

$$R = B * d / (B + 2*d)$$

where, B = width of the channel
d = depth of the channel

Assuming that the cross section of the cut through section is rectangular and its average depth is 10 meters, increase of width from 140 m to 240 m results in an approximately 5 % increase of the hydraulic diameter and a less than 5% increase of current speed. Since the present maximum current speed is reported to be 2 knots, increase of current speed is calculated to be 0.1 knot at a maximum. Therefore the consultant evaluates that the improvement of the cut through would not cause significant increase of sedimentation.

Now that no major impacts on sedimentation by the channel widening are anticipated, the Consultant calculates the required maintenance dredging volume using the past bathymetric data.

Estimating that the average present channel depth between the inner end of the cut through and 2.5 km inner from that point is 5.5 m and assuming that the decrease of water depth from the

original depth of 7 m has been caused by the accumulation for 8 years since the last minor dredging, the annual accumulation is calculated to be 0.19 m and the required annual maintenance dredging volume of 80,000 cubic meters is obtained. By the same way, required annual maintenance dredging volume in the outer section is calculated to be 40,000 cubic meters. Thus the dredging volume in these sections is not so significant since the accumulated area is rather limited though intensive maintenance dredging work will be required due to the high accumulation rate.

Based on above mentioned analysis, the Consultant concludes as follows.

- Required annual maintenance dredging volume is less than one third of the volume estimated by the Channel Study. Therefore TMRL is able to maintain the channel using its own dredger of which annual dredging capacity is estimated to be around 500,000 cubic meters by the Channel Study if the dredger is repaired and if TMRL commits itself to carrying out efficient and safe dredging and proper maintenance of the dredger. As the Channel Study pointed out, the existing dredger requires anchors and cables to cross the navigation channel while it is working and it is most disruptive to vessel traffic. Therefore well-planned dredging work is required.
- Maintenance dredging in the inner section should be implemented at least once every four years whereas the outer and cut through section (including the inner section of its vicinity) requires annual intensive dredging.
- Further assessment on sedimentation and its countermeasures in the outer and cut through section by experts at the basic design stage is recommended.

3.4 Examination of Requests for Training Equipment Supply for Seamen at Maritime College

3.4.1 Back Ground and Necessity of Equipment Supply

(1) Present Situation of TMC

Marine transport will play a vital role to develop and sustain the economic activities for promoting their foreign trade in Turkmenistan and the hinterland of the Caspian Sea. The international shipping requires reinforcement in terms of their merchant fleet and seafarers. In the meantime, the IMO established the International Convention on Standards of Training, Certification and Watch keeping for Seafarers, 1978 (STCW-1978) which became internationally effective among their member countries. Further, the 1995 amendment to the STCW Convention is promulgated so as to upgrade the qualification and skills of seafarers. This convention regulates minimum requirements for certification and manning on ships under the flag of the member nations, set forth methods for demonstrating competence of seafarers with recommended training equipment and becomes the basis for the organizational structure of crews on ships.

Turkmen Maritime College (TMC) Turkmenbashi under TMRL, which is a branch faculty of the State Institute of Transport and Communications has been operating and educating seamen since

1992. TMC has 37 staff working in the Collage and nearly 800 students studied and were graduated since 1992. Out of 800 graduates about 400 were working in a marine specialty. However TMC does not equip facilities and equipment approved by STCW for the training curriculum. As a result, TMC can not provide graduated students with certification as qualified officers and higher officers. The national merchant fleet and international shipping industry is facing a serious handicap of a shortage of well trained maritime personnel of different levels and categories.

TMRL desires to educate well trained seafarers at its own training institute who have fully complied with the requirements of STCW. TMRL is determined to improve the quality of education and to upgrade the level of training facilities of National Seafarers Education and Training by providing necessary training equipment required by STCW.

The present education courses and training curriculums at TMC Turkmenbashi is recognized as junior high school graduate level, which is not enough to obtain internationally recognized certificates as seafarers.

Some of the graduate students from TMC go to the Water Transport Department of Turkmen State Institute of Transport and Communication, which is located at Ashgabat and organizationally controlled under the Ministry of Education to obtain higher education of engineering and navigation courses. The Water Transport Department of Turkmen State Institute of Transport and Communication was established in 1995 under the Ministry of Education for providing necessary education and training programs to the graduate students from TMC to be command staff of the national fleet, ship engineers, and navigators.

At present if graduate students of TMC desire to obtain qualified certificates as seamen, they have to apply directly for study abroad at an institute like the marine academy in Russia or Azerbaijan, which provide higher courses of education and practical necessary training with approved equipment for certification as master, or chief mates of ships, and officers in charge of a navigation watch utilizing approved equipment and facilities.

3.4.2 Present Condition of College Facilities and Requirement of STCW Certification

(1) Present Conditions of College Facilities

Turkmen Maritime College in Turkmenbashi (TMC) is the only educational institution in Turkmenistan which has trained maritime personnel for Turkmenistan Marine since October 1992 up to date.

The teachers in the college have high qualifications and experience and have educated and trained many maritime personnel in the basic courses of different specialties; such as: navigator, marine mechanical engineer, marine electrician, technician of sea transportation management, marine radiotelegraph operator, seaman, motor mechanic, dock engineer, slinger, port driver of load lifting vehicles, gantry-crane operator, ship repair mechanic, marine cook etc.

Currently, as a result, many college graduates have already been working as captains, ship mechanics, and captain's mates, demonstrating high professional levels, in inland waters, and offshore waters of Turkmenistan after practical experience on board for some years. In addition, the college provides retraining and upgrading qualifications for the International Sea port personnel, shipboard personnel such as navigators and ship engineers of small vessels can upgrade qualifications to navigators and ship engineers of larger-tonnage vessels (super ships) with navigation rights in inland and offshore waters.

TMC has some educational technological tools, marine maps, engine sectional drawings, sonic depth-finders, logs, gyrocompasses, vessel models, vessel magnetic compasses, models of navigation lights and signs, radar stations, ship's log parts, radio direction finders, samples of radio-technical communication components, navigator's protractors, marine watches, barographs, sextants, samples of marine diesel parts, samples of marine system parts etc for laboratory and practical works required for marine specialties.

The navigator’s room and ship engineer’s room are equipped with modern technological equipment such as projectors and the Internet.

(2) Requirements of STCW Certification

The International STCW Convention, 1978 regulates a number of standards of competence for different categories of officers in charge of a navigational watch and engineering watch, engineer officers, master and chief mates of ships.

The specification of minimum standards of competence and mandatory minimum requirements for certification for educating to be the following officers and engineers are extracted from the STCW Convention, 1978 document. TMRL desires to educate graduated students to be such personnel by procuring necessary equipment to meet the specified competence in STCW in the TMC.

- For officers in charge of a navigational watch on ships
- For masters, and chief mates on ships and
- For chief engineer officers and second engineer officers on ships and
- For officers in charge of an engineering watch in a manned engine-room

The required competence and methods for demonstrating competence by STCW of the major categories of officers are specified in Section A-II/1 for officers in charge of a navigational watch and 2 for Masters and chief mates on ships, Section A-III/1 for officers in charge of an engineering watch and 2 for chief engineer officers and second engineer officers on ships of 3,000 KW power or more as follows.

1) Officers in charge of a navigational watch on ships of 500 gross tonnage or more

Specification of minimum standard of competence for officers in charge of a navigational watch on ships of 500 gross tonnage or more are as follows. (Section A-II/1)

Competence	Methods for Demonstrating Competence
Plan and conduct a passage and determine position.	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approved simulator training, where appropriate 4. Approved laboratory equipment training. Using: chart catalogues, charts, navigational publications, radio navigational warning, sextant, azimuth mirror, electronic navigation equipment, compass and echo sounding
Maintain a safe navigational watch	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approved simulator training, where appropriate 4. Approved laboratory equipment training
Use of radar and ARPA to maintain safety of navigation.	Assessment of evidence obtained from radar simulator and ARPA simulator training plus in-service experience
Respond to emergencies	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approved simulator training, where appropriate 4. Practical training
Maneuver the ship	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approved simulator training, where appropriate 4. Approved training on a manned scale ship model where appropriate.
Ensure compliance with pollution prevention requirements	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience. Procedures for monitoring shipboard operations and ensuring compliance with MARPOL requirements are fully observed.

2) Masters and Chief mates on ships of 500 gross tonnage or more

Mandatory Minimum Requirement for Certification of Masters and Chief mates on ships of 500 gross tonnage or more are as follows. (Section A-II/2)

Competence	Methods for Demonstrating Competence
Plan a voyage and conduct navigation	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved simulator training, where appropriate 3. Approved laboratory equipment training. Using: chart catalogues, charts, nautical publications and ship particulars.
Determine position and the accuracy of resultant position fix by any means	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved simulator training, where appropriate 3. Approved laboratory equipment training. Using; radar, Decca, Loran, satellite navigation system and appropriate navigational charts and publications.
Co-ordinate search and rescue operations	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved simulator training, where appropriate 3. Approved laboratory equipment training
Establish watch-keeping arrangement and procedures	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved simulator training, where appropriate
Maintain safe navigation through the use of radar and ARPA and more navigation systems to assist command decision-making	Assessment of evidence obtained from 1. Approved radar simulator 2. Approved ARPA simulator training,
Maneuver and handle a ship in all conditions	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved simulator training, where appropriate 3. Approved manned scale ship model, where appropriate
Carriage of dangerous cargoes	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved simulator training, where appropriate 3. Approved specialist training
Maintain safety and security of ship's crew and passengers and the operational condition of life-saving, fire-fighting and other safety systems	Examination and assessment of evidence obtained from practical instruction and Approved in-service training and experience

3) Officers in charge of an engineering watch in a manned engine-room

Mandatory Minimum Requirements for Certification of officers in charge of an engineering watch in a manned engine-room are as follows. Every candidate for certification as officer in charge on a seagoing ship powered by main propulsion machinery of 750 KW or more shall be required to demonstrate ability to undertake at the operational level and the task. (Section A-III/1)

Competence	Methods for Demonstrating Competence
Use appropriate tools for fabrication and repair operations typically performed on ships	Examination and assessment of evidence obtained from one or more of the following: 1. Approved workshop skills training 2. Approved practical experience and tests
Use hand tools and measuring equipment for dismantling, maintenance, repair and reassembly of shipboard plant and equipment	Assessment of evidence obtained from one or more of the following: 1. Approved workshop skills training 2. Approved practical experience and tests
Use hand tools and electrical and electronic measuring and test equipment for fault finding, maintenance and repair operations	Assessment of evidence obtained from one or more of the following: 1. Approved workshop skills training 2. Approved practical experience and tests
Maintain a safe engineering watch	Assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approved simulator training, where appropriate 4. Approved laboratory equipment training
Operate main and auxiliary machinery and associated control systems	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approved simulator training, where appropriate 4. Approved laboratory equipment training
Operate pumping systems and associated control systems	Assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approval simulator training, where appropriate 4. Approved laboratory equipment training
Maintain marine engineering systems including control systems	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approval simulator training, where appropriate 4. Approved laboratory equipment training
Operate alternators, generators and control systems	Assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approval simulator training, where appropriate 4. Approved laboratory equipment training
Maintain seaworthiness of the ship	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approval simulator training, where appropriate 4. Approved laboratory equipment training

4) Chief engineer officers and second engineer officers on ships

Mandatory Minimum Requirement for Certification of chief engineer officers and second engineer officers on ships powered by main propulsion machinery of 3,000KW propulsion power or more are as follows. Every candidate for certification shall be required to provide evidence of having achieved the required standard of competence in accordance with the methods for demonstrating competence and the criteria for evaluation competence. (Sector A-III/2)

Competence	Methods for Demonstrating Competence
Start up and shut down main propulsion and auxiliary machinery including associated systems	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approved simulator training, where appropriate
Operate, monitor and evaluate engine performance and capacity	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approved simulator training, where appropriate
Maintain safety of engine equipment, system and service	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience
Operate electrical and electronic control equipment	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approved simulator training, where appropriate 4. Approved laboratory equipment training
Test, detect faults and maintain and restore electrical and electronic control equipment to operating condition	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approved simulator training, where appropriate 4. Approved laboratory equipment training
Organize safe maintenance and repair procedures	Examination and assessment of evidence obtained from one or more of the following: 1. Approved in-service experience 2. Approved training ship experience 3. Approved workshop training
Maintain safety and security of the vessel, crew and passengers and the operational conditions of life saving, fire-fighting and other safety systems	Examination and assessment of evidence obtained from practical instruction and approved in-service training and experience.

Source: International STCW Convention, 1978

3.4.3 Necessity of Equipment at TMC

As seen from the above clause 3.4.2, STCW requires that every candidate for certification of all categories shall demonstrate their ability to undertake specified tasks, duties and responsibilities and shall provide evidence of having achieved the required standard of competence as the minimum knowledge, understanding and proficiency required for certification in accordance with the methods for demonstrating competence and criteria of STCW.

At present TMC has a minimum educational model of marine equipment, but does not have any approved facilities or equipment to educate maritime students for certification required by STCW. TMC arranges a classroom space of about 250 m2 for installation of such equipment in the collage building.

TMRL plans to procure the following fleets newly in addition to the 2 Ro-Ro passenger ferries.

LPG transport ship	1 ship
Oil tankers additionally	7 ships
Supply boats for offshore drilling	5 boats
Some pilot boats	some boats
Fire and crane service boats	number is unknown

TMRL will develop educational and training curriculums for capacity building of graduated students of the TMC to be qualified crews, engineers and seafarers by certification in accordance with STCW regulations so as to operate and manage the above listed ships, instead of sending them to the marine academies abroad to obtain qualified certification or of recruiting foreign crews from other institutes abroad.

Considering such policies of TMC and TMRL, the survey team considers it reasonable that TMC shall equip approved facilities and equipment to upgrade the education and training courses of the TMC to meet the requirements of STCW. In the future, ships owned by TMRL shall be able to be operated and managed by Turkmenistan crews and engineers and captains graduated from TMC. The marine transport industry of Turkmenistan will be enhanced by such investment in education and transport services.

3.4.4 Proposed Scope of the Project

(1) Procurement of Equipment

In order to meet the requirements of competence of the respective categories of higher educated officers by STCW, TMC shall be equipped by procurement of the following equipment and facilities to go along with an approved training program in the present collage.

1) All equipment necessary to establish Computer Base Training (CBT), Training Packages and Question Bank referring to applicable IMO Model Course based on STCW 1978

including improvement of curriculum and teaching program for upgrading, refreshing and updating courses through the Technical Transfer Programs

2) Procurement of the training equipment and simulators shall comply with International Maritime Organization (IMO) standards as prescribed in the international convention on the STCW-1978. It is necessary to procure the following equipment of standard specification in the TMC.
   i) Radar Simulator
   ii) Fuel Tanker Navigation Training Machine, Ship Maneuvering Simulator
   iii) Engine Room Equipment
   iv) GMDSS Simulator
   v) Navigation Aids Simulator
   vi) Automatic Control Equipment
   vii) Computer Based Training System
   viii) Tanker Training Equipment

   As for training equipment, the STCW-1978 and its amendments, and SOLAS Consolidated Edition 2001 including its 1988 amendment on the Global Maritime Distress and Safety System (GMDSS) shall also be applied.
3) Renovation of some classrooms incidental to the installation of equipment
4) Training of staff on operation and maintenance of training equipment

(2) Scope of Consulting Service

Scope of Consulting Services for maritime education and training improvement at TMC is as follows:

1) Study on local conditions and preparation of design conditions
2) Preparation of basic design and detailed design
3) Preparation of Pre-qualification and Tender documents and assisting TMRL in evaluation
4) Supervision of construction works and installation of equipment
5) Conduct witness of factory in inspection and delivery at Site
6) Assistance for Oversea Training Arrangements and
7) Preparation of training programs of different levels and curriculum covering the followings:
   - Short-term Training Programs (Factory Inspection and Training, and Site Training)
   - Long Term Training Programs (Overseas Training for Upgrading of Instructors)
   - Periodical Dispatch of Engineer
   - Technical Assistance for the Preparation of the Curriculum
   - Assistance after the Delivery of Equipment
8) Improvement of Curriculum and Training for Trainers
9) To supervise training to students and teachers in TMC

(3) Executing Agency

TMRL, as Executing Agency is responsible to implement the project in consultation with authorities concerned including TMC as coordinator of the Water Transport Department of Turkmen State Institute of Transport and Communication.

(4) Estimated period of works

The expected period of the consulting service for the design stage to the L/C open for contractor is estimated 24 months;

- Engineering design will be 10 months, tender will be 10 months and LC opening in 4 months.
- The supervisory period of fabrication, factory inspection and installation of equipment is 24 months.
- The training period after the commissioning of equipment is 12 months.
- Thus total period is 60 months.

(5) Benefits

1) TMC has 15 teachers, out of which 5 teaches are qualified by graduating from the Russian academy, the remaining teachers will have opportunities to obtain such certificate by training at TMC.
2) TMRL requires 70 seafarers and crew immediately to operate tankers and Ro-Ro passenger ferry to be procured by TMRL. Such number of qualified crew and seafarers can be trained and receive certified qualifications at the TMC.
3) The experienced Turkmenistan crews will have opportunities to upgrading their qualification through TMC training.
4) In the future TMRL desires to have 100 highly qualified officers, which can be achieved through the training and education at TMC.

3.5 Urgent Port Development Projects

3.5.1 Necessity and Background of the Proposed Projects

As mentioned in the previous sections, all the projects proposed by previous studies or planned by TMRL are basically important for the development of the nation's socio-economy. In this section, the urgent port development projects are considered by evaluating the current situation of the port and the compatibility to the basic concepts of port development. Urgent project for technical cooperation including procurement of equipment will be described in the next section.

Firstly, the compatibility to the basic concepts of port development is examined. As mentioned in 3.2.1, the Consultant proposed the following four concepts under the ultimate goal of "Creation of a State-of-the-art Port in Central Asia":

Port which serves as a Gateway to Central Asia
Port of Fraternity
Port for Industrial Diversification
Port of Safety and Environmental Sustainability

The urgent projects should contribute to achieving the ultimate goal of "a state-of-the-art-port" and the urgent projects therefore must be indispensable in realizing one or more of the above listed concepts.

Secondly the availability of existing facilities is examined. As the Consultant has pointed out in 2.1.6, even when the occupancy of a port facility seems to be very high, sometimes the facility has enough remaining capacity to meet future increase of traffic demands because of the low efficiency in its present utilization. Therefore, in this subsection, the availability of the existing port facilities is evaluated considering their potential capacity.

Finally, the difficulty of implementation as a private-financed project is considered. Since one of the principal aims of this study is the consideration of an ODA-financed project for efficiency improvement in the transport sector in Turkmenistan, highly profitable projects which can be efficiently implemented by private investors are excluded from the urgent project.

The results of the above mentioned evaluation are summarized in Table 3.5.1. In the table, the numbers of "+" denote the compatibility to the basic concepts of port development. The "A", "B" and "C" in the right columns denote "high", "medium" and "low" scores for each item of the evaluation respectively. The descriptions of short-listed projects in the table are as follows:

Access Channel; The channel improvement project proposed by the Channel Study and modified by the Consultant as described in 3.3

Ro-PAX; The Ro-PAX ferry terminal construction project which is originally planned by TMRL and reviewed by the Consultant as described in 3.2. (The pure passenger terminal construction project proposed by the Modernization Study is not included in the evaluation because the economic and financial viability is very low as the Modernization Study describes.)

Container; The container terminal construction project as a part of the logistics center project planned by TMRL (The container terminal construction project proposed by the Modernization Study is not included in the evaluation because the planned location is not adequate as described in 3.2.)

General Cargo; The general cargo terminal construction project proposed by the Modernization Study and the cargo terminal project as a part of the logistics center planned by TMRL

Bulk Cargo; The bulk cargo terminal construction project proposed by the Modernization Study and the cargo terminal project as a part of the logistics center planned by TMRL

Supply Base; The offshore supply base project proposed by the Consultant as described in 3.2

Shipyard; The shipyard construction project for ship building and repair proposed by the Modernization Study

Table 3.5.1 Summary of the evaluation of urgent projects

Project	Basic Concepts				Shortage of Existing Capacity	Difficulty of Private Finance	Overall Evaluation
	Gateway	***Fraternity***	***Industrial Diversification***	***Safety and Environment***			
Access Channel	+++	++	+++	+++	A	A	Urgent
Ro-PAX	+++	+++	+++	++	A	A	Urgent
Container	+++	+	+++	+	C	A	
General Cargo	+	+	++	+	C	A	
Bulk Cargo			+++	++	B	A	
Supply Base				++	B	C	
Shipyard			+++	+++	A	C	

As shown in Table 3.5.1, the higher scores were given to "the improvement of the access channel" and "the development of a Ro-PAX ferry terminal" for the reasons described below, and therefore, they are selected as the urgent port development projects.

Access Channel

- The long access channel is indispensable for a well-sheltered Turkmenbashi Port. Without improving its capacity, none of the four concepts can be realized.
- In 2009, for example, the access channel was closed around every three days and each channel closure continued around ten hours. Thus, the frequency of channel closure is extraordinarily high. Generally, the frequency of interruption of port operation due to meteorological conditions should be less than around ten days a year.
- Frequent closure of the access channel makes the productivity of the port extremely low. If this situation is not improved, the port will not be able to serve as the Central Asian gateway, nor contribute to industrial diversification.
- It is clear that frequent closure of the access channel makes travelling extremely uncomfortable. Therefore, without improvement of the access channel, Turkmenbashi Port will not be able to serve for passengers as a port of fraternity.

- In the context of safety and environmental sustainability, improvement of the access channel is crucial considering the heavy traffic of hazardous cargo, future increase of passenger traffic and existence of nature reserve in the vicinity of the port.
- Therefore in terms of its contribution to achieving the basic concept, the scores are highly evaluated.
- As mentioned in 2.1.6, the present situation of the channel is very bad and accidents have happened in the channel especially near the cut through section. And the frequent closure of the channel seriously lowers the productivity of the port. Furthermore, even if the original design width were restored, the channel would not be able to allow two-way traffic for large vessels and it would leave the productivity of the port below the international standards. Therefore the capacity of the existing channel is quite insufficient in the context of efficiency and safety.
- Generally, profitability of channel projects is not high enough to attract the private sector. In particular, costly improvement of the very long access channel in Turkmenbashi Port would not be viable as a privately financed project. In addition, in public ports, the basic port facilities such as access channels and breakwaters should be owned by the public sector.
- Thus, the access channel improvement project, which includes not only restoring original design depths but also widening the channel than original design width, deserves to be an urgent project. Deepening the channel entrance should also be included in the urgent project.

Ro-PAX terminal

- Ro-PAX terminal project is crucial to realizing a "Port of Fraternity". Without the Ro-PAX ferry network, reunion of families and friends living in Caspian littoral nations is very difficult. It is also expected that the Ro-PAX network plays an important role in the transportation of humanitarian goods to Afghanistan.
- It is clear that Ro-PAX network will greatly strengthen the gateway function of Turkmenbashi Port. It is noted that unit loads, such as Ro-PAX cargo and containers, are generally distributed to a larger area of the hinterland than general cargos or bulk cargos. For example around 50% of inbound cargoes on Makhachkala-Turkmenbashi ferry link is transit cargo (oil products) to Afghanistan.
- In the interview survey to forwarding companies, it was revealed that a considerable amount of demand exists for the Ro-PAX transport across the Caspian Sea.
- Tourism industry is one of the prospective industries in the course of diversification of Turkmen industry. Turkmenbashi port, as a part of the free zone, is expected to support Awaza National Tourism Zone development by providing safe, reliable and comfortable Ro-PAX ferry service.

- By the introduction of Ro-PAX ferry network, travelers will not have to take unsafe voyages on a deteriorated rail ferry that is full of hazardous cargoes. And the construction of a specialized port terminal enables safe accommodation of Ro-PAX vessels.
- Thus, the Ro-PAX terminal project will greatly contribute to realizing the basic concepts of the port development.
- PPK1 has remaining capacity, and if the efficiency of rail operation is improved PPK2 can receive a greater number of vessels; however existing facilities in these terminals are not suitable for receiving Ro-PAX ferry in terms of efficiency and security.
- PPK1 is designed for lift-on lift-off operation and efficient RORO operation is not possible there, and this becomes clear when observing the inefficient RORO operation currently carried out in PPK1. Furthermore, the separation of passenger flow from cargo flow, which is internationally required for security and safety reasons, is not possible in PPK1.
- PPK2 which is dedicated to rail ferry operation is not suitable for efficient Ro-PAX operation. PPK2 is operated by the State Railways, therefore coordination of berth windows will be very difficult if Ro-PAX were accommodated there. In particular, extraordinarily fluctuating time table of cargo trains will make it much more difficult. Currently, rail ferry sometimes must wait for berthing for a couple of days outside the port due to delay of cargo train operation. If PPK2 were used by the new Ro-PAX link, the passengers would have to experience such incredibly uncomfortable sailing.
- Therefore, existing facilities are evaluated to be "NOT available" for Ro-PAX ferry vessels.
- In general, development of commercial seaports by the private sector is not viable except very profitable facilities such as container terminals in major ports. Although the Ro-PAX terminal in Turkmenbashi can be expected to handle a substantial volume of cargo throughput and passenger traffic, its implementation by the private sector would still be very difficult. The high construction costs in Turkmenbashi Port due to severe seismic conditions, difficulty in procurement of construction materials and soft ground condition would make it even more difficult.
- For these reasons, it is assessed that "the project of Ro-PAX terminal construction project" should be included in the urgent projects.

Although the development of a logistics center including a container terminal and other cargo terminals was not included in the urgent projects, its importance should not be underestimated. It is apparent that the existence of highly efficient logistics center with sufficient handling capacity is indispensable in realizing "a state-of-the-art port". Though the availability of the existing capacity put it on the second priority in the evaluation, it is noted that the capacity can run short in the future by rapid growth of the Caspian maritime transport. Large scale developments are on-going or planned in almost all major Caspian seaports including the new port construction in Baku which is the most important trade partner for Turkmenbashi. And each development plan includes container terminal construction. This can rapidly activate container transport in the

Caspian Sea. In addition, it should be also noted that in the cargo demands forecast the Consultant didn't consider the establishment of new factories in the hinterland. Therefore, when the establishment of new factories is materialized, the demand forecast should be revised and, if necessary, new bulk or general berths should be constructed.

The shipyard project is also important in terms of maritime safety, environmental protection as well as industrial diversification, and further development of supply base can strengthen the financial structure of the port supporting the nation's core industry. They are promising projects as private-financed projects rather than ODA-financed projects.

3.5.2 Scope of Works and Basic Design of Facilities of Proposed Project

(1) Ro-Pax Ferry Terminal Development

1) Scope of the Project

The scope of the proposed project includes but is not limited to the following items:

Development of the Ro-Pax ferry terminal at Turkmenbashi port consists of:

i) Consulting Service of detail design of facilities and construction supervisory service;
ii) Construction works
   a) Construction of berth facilities including dolphins, slipway for ferry ramp; for accommodating 5,000 DWT Ro-Ro passenger ferries.
   b) Land development for parking yards with retaining wall
   c) Dredging around berthing area and turning basin;
   d) Onshore terminal facilities:
      - Passenger Terminal building with port management office,
      - Gate control,
      - X ray monitoring equipment for checking contents of incoming and outgoing trucks in compliance with ISPS code,
      - Parking Areas and yard with weight gauge,
      - Utility supply facilities for water and power supply & bunkering supply fire fighting facilities.

2) Location of the proposed Ro-Pax ferry Terminal

Location of the proposed Ro-PAX terminal is planned in front of the TMRL head office in the Port area between quay no 17 and the aged fishery building that is to be demolished.

3) Layout plan of terminal facilities

i) The dimensions of the terminal facilities are planned tentatively as follows

a) 50 m (W) x 175 m (L) x 7m (D), both sides berthing and slipway (20 m (W) x 15 m (L) and slop 1:7) on both sides for ship ramp constructed with reinforced concrete with steel pipe pile support foundation.
b) Land reclamation area; in total around 11 ha consisting of 100m x 500m and 100m x 200m of the existing land area to be used and 150m x 270m by off-shore reclamation.
c) Passenger Terminal area of 10,000 sq.m, and
d) Truck and car parking area of 22,000 sq.m and 14,000 sq.m respectively and the total area of 36,000 sq.m are estimated for two berths considering Ro-Pax ferry dimension.

ii) The quantity of works is estimated based on the sounding survey and soil investigation at the planned site carried out by KOICA in 2009 for the feasibility study.

a) Land area is planned to develop approx.11 ha using the existing land area of approx 7.0 ha (100 m x 500 m &100 m x 200m) and by reclamation of 4.0 ha (150 m x 270 m) for parking capacity of 80 trucks per ship x 4 ships and of 200 sedans/ship.
b) Dredging works is required at the berthing area and turning basin up to -7.0M depth considering the trend of declining still water level of the Caspian Sea, which is established based on the Baltic Sea water level (BSL) from the time of USSR time. (The Baltic Sea is located at the entrance bay of St. Peterburg port of Russia) Approximatee dredging volume is estimated at the berthing area around 45,000 m^3 and at the turning basin area will be around 70.650 m^3 and access channel from the main channel will be around 46,000m^3 at 270 m x 170 m.

Based on the above planned facilities the layout plan of the proposed Ro-Ro passenger ferry terminal is prepared as shown in the Figure 3.5.1.

4) Preliminary design of terminal facilities

i) Design Criteria

a) Objective Ship size
TMRL plans to purchase the Ro-Ro passenger ferry with the dimensions below
Ro-Ro Passenger Ferry; 5,000 DWT
Length over all (L) 150m, Beam (B) 17.3 - 18.3 m, Draught (D) 4.25-4.7 m.
Loading capacity; 200 -350 passengers and 80 truck trailers or equivalent to about 200 sedans/cars. This ship size is used for the design of the new terminal facilities.

b) Natural Conditions for Preliminary Design of Project Facilities
The criteria and parameters of natural conditions for the preliminary design were

determined based on the results of the field surveys carried out by Korean study as shown in their study report.

- Tidal level: Still water level of -27.4 BSL Standard is taken as datum line for preliminary design of berth structure. (This means that the datum line level of Caspian Sea is 27.4 m lower than the mean sea water level of Baltic Sea)
- Design wave

Wave direction	Wave height	Period
E	0.8 m	2.9 sec

- Tidal current ; 0.22 m/sec
- Wind Speed ; Max wind speed; 34.0 m/sec, direction North
- Soil strength; unit weight of cohesive soil at 1.635 tf/m^3, sand and gravel at 1.8 tf/m^3 and reclamation material at 1.8 tf/m^3.
- Seismic coefficient; According to the published national seismic zoning classification with magnitude by the Research Institute of Seismology under the Ministry of Construction the project site is located in the zone at magnitude 9.8, the design seismic coefficient is therefore taken at Kh=0.25. The national seismic zoning map is attached and shown in Figure 3.5.2.

c) Design criteria of facility design

- Surcharge load; on Apron area at normal condition: 2.5 tf/m², stock yard and truck parking area; 2.5 tf/m^2 and at seismic condition:1.0 tf/m². (50% of the normal condition)
- Live load; The following wheel loads are considered:
  Standard Truck (H22 - 44): 8.0 tf/wheel
  Tractor Trailer (40') : 5.8 tf/wheel
- Ship berthing speed; 5,000 DWT, ; 30 cm /sec
- Ship pulling force on bollard and bit; 35 t/ bit installed every 20m
- Crest level of berth; Considering the height of adjacent structure of B 3 to 5 constructed by EBRD fund in 2003 is set -23.85 – BSL, which is taken for preliminary design of berth crest level.
- Length of berth is determined by Length of ship (L) + Beam, to make 175 m
- Depth in front of the berth is determined by Draft of ship (D) + Allowance (D*10%) and allowance to accommodate declining trends of still water level. -34.4m at BSL, water depth of 7.0m from still water level, which is the same as the level of the main channel.
- Slipway width is calculated from the breadth of vessel (18.3m) plus additional width to make 20.0m width.
- Length of slipway which slope is planned to be 1:10 is calculated from the level of the ship ramp from water level to ground level of -23.85 m. The length of the

slip way is tentatively set at 15 m length since the level of the ship ramp is not known yet.

d) Environmental Treatment Facilities

The following environmental treatment facilities will be provided.

- Drainage/sewerage outfall facilities
- Solid wastes management facilities
- Ballast and Bilge Waste Treatment System

ii) Preliminary design of berthing facilities

Based on the above design criteria, and berth requirements, the type of berth foundation is determined considering the site, topographic, hydrographic and soil conditions. The type of foundation is adopted from the same type of the steel pipe pile foundation of adjacent quay wall structure of Berth no 4, since precise soil investigation data of the proposed construction site is not available.

From the soil profile of the KOICA study report, the pile should be driven from the present sea bed level to around 30m of penetration length where the sandy layer is encountered. Typical cross section of berthing facilities is shown in Figure 3.5.3.

iii) Preliminary design of retaining wall facilities

The retaining wall for development of the backup area by reclamation for the Ro-Ro passenger terminal berth which is planned at the connection part with the berthing facilities/slipway on both sides in the length of about 250m will be designed with steel sheet pile (SSP) Type II or III according to the depth to be driven. The SSP will be anchored from the anchor wall to be constructed about 10 m behind the front wall.

5) Preliminary construction schedule of terminal facilities

The construction works schedule is worked out based on the assumption that an experienced marine construction contractor will carry out the construction and mobilize necessary equipment such as floating barges, pile driving equipment, concrete mixing plant and supervisory engineers experienced with marine works. There is no construction company experienced in marine works in Turkmenistan.

The period of works required for piling dredging, reclamation works, concreting works is estimated average time period of the similar construction projects in Asian and Bulgaria.

The total period of construction works of the Ro-Pax ferry terminal will take about 24 months as shown in the table below, considering the piling works from the land, dredging works by limited capacity of dredger and long distance to disposal area.

Table 3.5.2 Construction Schedule of Ro-Ro Terminal Works

	Description of Works	1 st year		2nd year		3rd year	
I.	Ro-Ro farry Terminal Construction Works						
1	Construction Works						
1.1	Mobilization						
1.2	Site survey and preparatory works						
1.3	Dredging works around berthing area, access channel area						
1.4	Construction of Revetment works for reclamation						
1.5	Construction of Retaining wall for berth connection area						
1.6	Piling works of berth and dolphins						
1.7	Conceting works of Berthing and Ramp Structure						
1.8	Concreting works of Dolphins structure						
1.9	Reclamation works						
1.10	Yard Pavement and drainage works						
1.11	Passengers walkway and Catwalk construction works						
1.12	Utility works						
	Water supply works						
	Electric power supply facilities						
	X ray equipment installation						
1.13	Building works						
2	Maintenace Period						

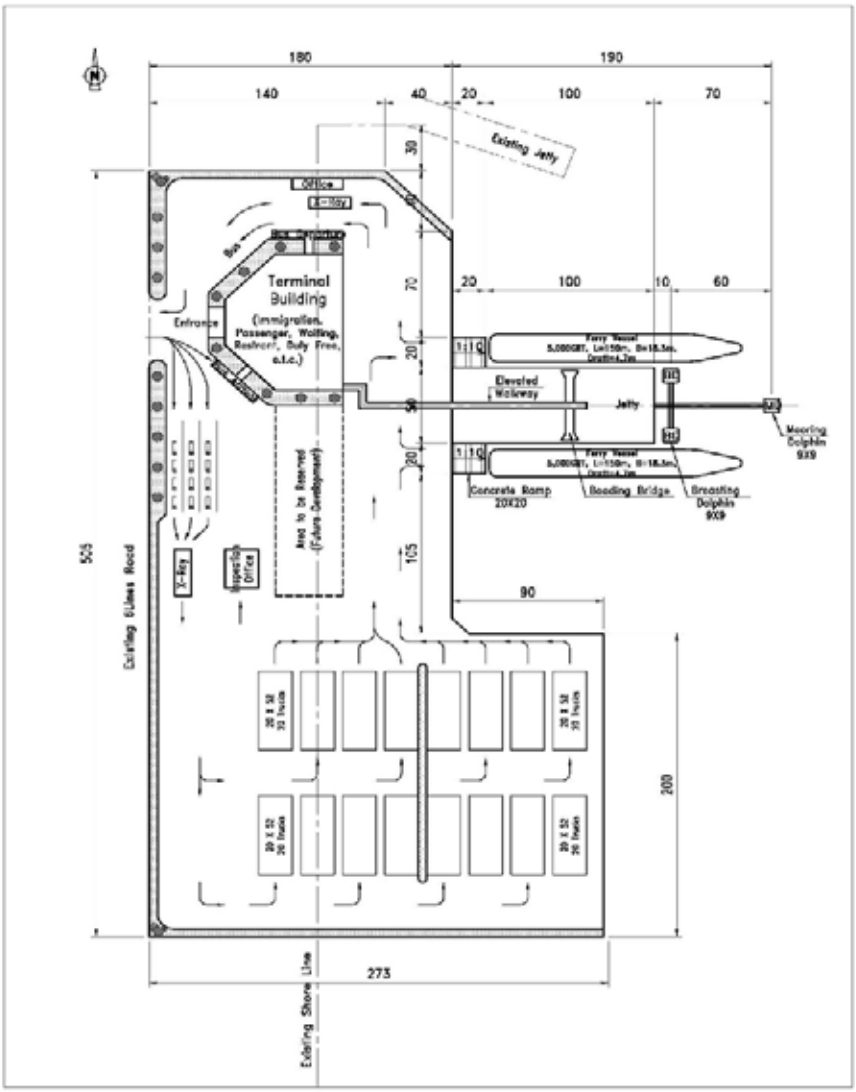


Figure 3.5.1 General Plan of Ro-PAX FerryTerminal Conceptual Development Plan

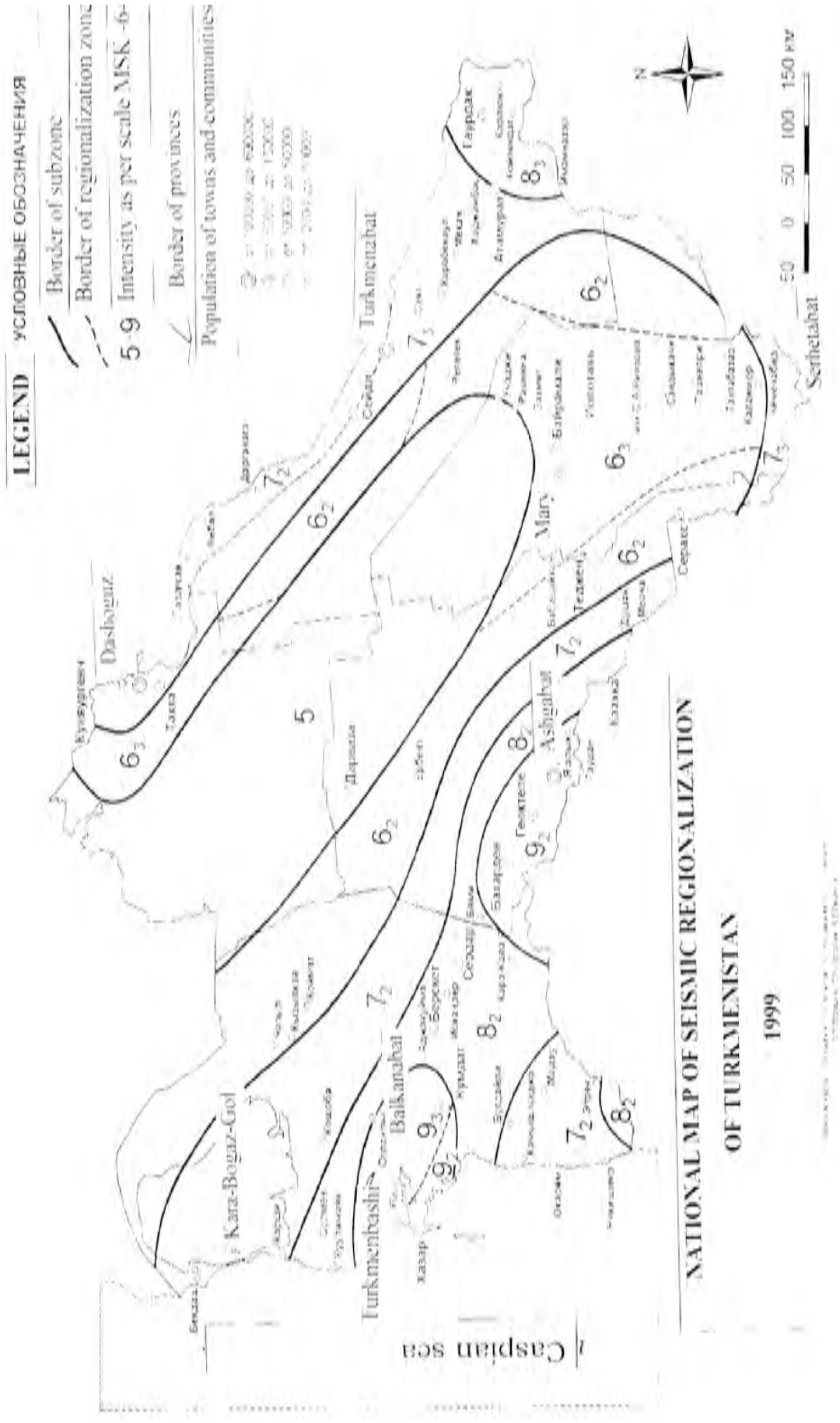


Figure 3.5.2 Seismic zone code in Turkmenistan

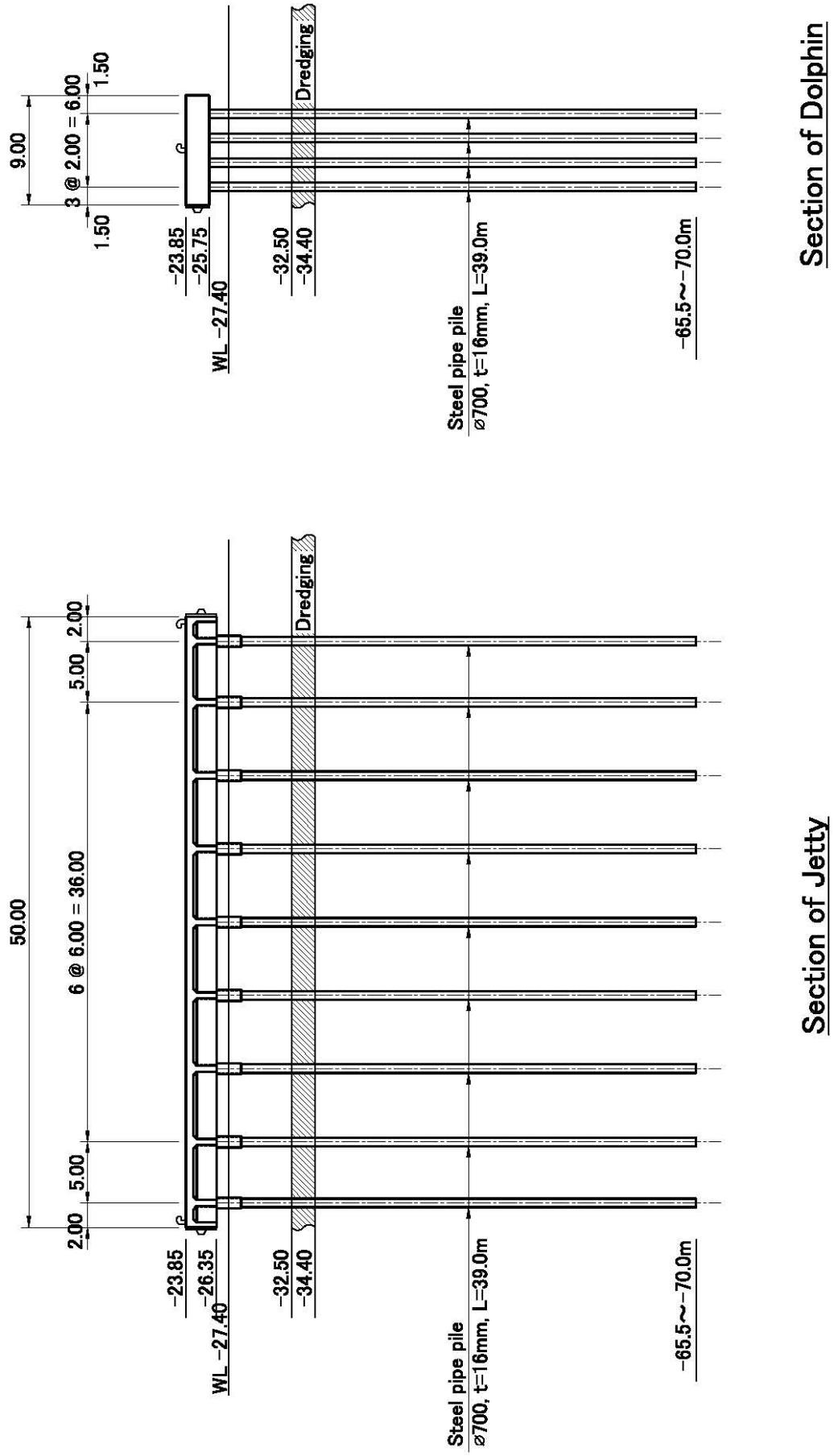


Figure 3.5.3 Typical Cross Section of Jetty Structure and Breasting and Mooring Dolphins

(2) Navigation Channel Dredging Works

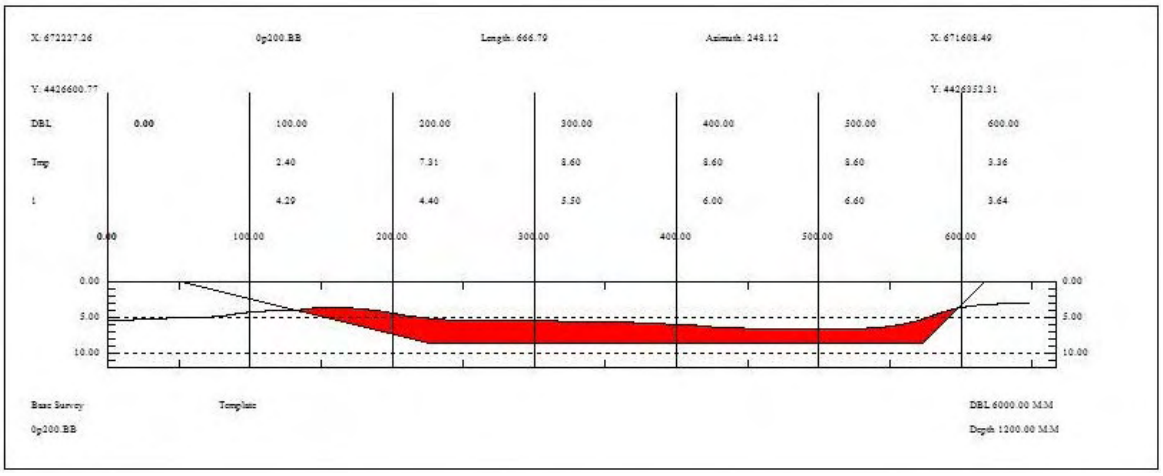
1) Capital Dredging Volume

The total dredging volume for widening the existing channel and basin of the Port is estimated to be around 5.5 million cubic meters based on the hydrographic survey map as part of the TRACECA report. (The extra dredging of 0.2 m in depth is considered as dredging margin in order to achieve the design depth of the channel and basin.) The dredging area and quantity calculation thereof is described in chapter 3.2.

Table 3.5.3 Dredging Volume for Channel Improvement

Section	Description	Dredging Volume
Access Channel to cut through spit	D: - 8.2 m, W: 170 m, L = 1.6km	0 m^3
Cut through spit area, Outer channel	D: - 8.2 m, W: 220-240m, L = 0.76 km	1,257,000 m^3
Inner channel up to point C/D	D: - 7 m, W ;170m, L =10.64 km	1,378,000 m^3
Inner Port Channel from Point C to Main port complex point A	D: - 7 m, W ; 170m, L = 6.0 k m	1,244,000 m^3
Port Complex area (PKK1)	D : -6.7m,	440,000 m^3
Inner Port Channel from B to UFRA Oil Tank yard & oil berth area	D; -7 m, Berth area D;-6.7m W ; 160 m, L=5.0 km	1,136,000 m^3
Total dredging volume		5,455,000 m^3

Source: Consultant Estimate



Source: TRACECA Report 2007

Figure 3.5.4 Typical Cross Section of Channel Dredging

2) Dredging fleet arrangement

In the initial dredging of the channel for widening to be newly excavated, the deposit material is consolidated. The use of Cutter Suction Dredger is considered more suitable than a Trailer Suction Hopper Dredger.

Hence, the combination of Cutter Suction Dredger and hopper barge is applied in the channel improvement as the economical dredging method with high productivity.

According to the Dutch dredging contractor who had contract PETRONAS Marine engineering co for an oil drilling project, they mobilized their cutter suction dredger (L=93m, Breadth=16.8m, D=3.5m Height of vessel =24.5m Ship weight 2,887 ton, 862 DWT) in 2008 through the following transport route to the Turkmenbashi port. Their cutter dredger was located at Dubai in the Gulf.

It is assumed that in this project a contractor will mobilize a dredger from the nearest location available such as around the Arabian Sea (Gulf region). She will be dismounted into pieces, which are loaded on a barge for transport due to limited width and depth through the Volga-Don River.

The dredger will travel from the Gulf to the Suez Canal- Mediterranean Sea - Black Sea – Don/Volga River to Astrakhan Port (Russia) on the Caspian Sea. The cutter dredger will be assembled at Baku port, and then mobilized to the Turkmenbashi port.

Considering such limitation of transport route the cutter suction dredger of similar size as above could be mobilized and output capacity is estimated around 800 m^3/hr and 2 hopper barges of 1,000 ^{m3} capacity will be utilized for dredging works.

3) Disposal Area

In the geotechnical considerations the material of dredging in the proposed channel area has clearly been categorized as being predominantly of marine borne silts with the bulk of the dredged material being mud, loamy soils and clays with the possible exception of that from around the spit again, around the spit area only will be a higher proportion of sandy material.

Transport and placement of such dredged material would be difficult and the land covered would unsuitable for any use for many years to come.

There have been sea disposal sites for the material arising from dredging operations in the past. Casperco control and license these sites and have recently established a new site to the south of the entrance through the spit. This new site is better than the old for the disposal of material because it is down drift of the natural along shore process and thus there is a lower risk of dumped material finding its way back into the channel. The site will have been evaluated for a particular quantity of material by Casperco control.

The centre of the sea disposal site is around 9km from the entrance through the spit and would provide the most economic option for disposal of the dredged material. The water depth of this disposal site ranges from 5 to 10 meters along the coast of Southern spit.

The specified disposal area had been observed to be shallower for a longer time usage. The careful monitoring of returning disposal material toward the spit of the channel area will be carried out.

4) Navigation Aids Works

i) Relocation and reinstallation of Navigation Buoys

After the channel is widen by dredging works and the dredged depth in the channel is checked and confirms the completion of works, the existing navigational buoys will be reinstalled at specified positions. According to TMRL originally in 1982 45 buoys were installed along the channel. At present in 2009, 24 buoys are installed. Out of which 16 buoys were replaced with upgraded buoys by TACIS EU assistance and of those sixteen, twelve are still in their original positions however, 3 buoys were damaged and placed on the shore and 1 (buoy no 35 near the entrance of UFRA port) was lost. The number of relocation buoys will be 16 including the 4 damaged buoys to be repaired.

ii) Reconstruction of collapsed Leading Light (L.L)

According to the TMRL, 2 Leading lights (L.L) were constructed on land and 5 LL were off shore on the extension alignment of centerline of the channel. During the heavy cold and rough winter in 2007-2008, 5 off shore leading lights were damaged and collapsed and lost.

The 5 leading lights lost shall be reconstructed in conformance to PIANC regulations for safe navigation of ships at specified locations after the channel dredging works. The following are the extracts from the IALA guidelines for design of leading lights.

- **Standard Leading Line Characteristics.** Fixed (F) characteristics should be used sparingly. Lights displaying a fixed characteristic, especially white light signals, can be difficult to identify against even minimal background lighting. Furthermore, lights displaying a characteristic with a three second flash duration provide approximately 92% of the intensity of a fixed light signal and yield longer lamp service.

- **Definition of a Leading Line** . A leading line is s defined in the IALA International Dictionary of Aids to Navigation as: “a straight line used for navigation produced by the alignment of marks (leading marks) or lights (leading lights) or by the use of radio transmitters.” Lights having intervals, have lower power consumption, and provide greater conspicuity than the fixed light signal. Leading marks must also be large enough to be visible from the far end of the channel. The structures must also be sturdy enough to support the leading mark under wind loads.

- **Design Visibility.** The design visibility was originally conceived as the median value of meteorological visibility for the site; that is, the value met or exceeded 50% of the time. Design visibility is used by the program to establish the recommended ratio of luminous intensity of the leading lights. As a practical consideration, use of a fixed value of 10 nm is recommended.

The foundation of the offshore front leading light shall be constructed on a pile supported concrete stage at the height of 4 m above the water level. And the rear leading light at the height of around 27m above the MSL. The locations of the 5 leading lights are shown in Figure 3.5.5. Two LL will be located on the extension of the alignment of the channel A-B-C and 2 LL on the extension of the alignment of B-UFRA and 1 LL on the extension of Channel of E-D.

Distance between towers is calculated by using IALA guideline and found the following as typical standards in the case of the Channel Length (C): 8 000 Meters, and Width (W): 170 Meters according to the IALA guideline for design of Leading lights. The figures below are shown for indication only, which shall be updated based on the field conditions and sea bed soil conditions and specify the lighting characteristics of each leading light during the engineering design stage.

Leading lights for channel length of 8.0 km and width of 170m	**Typical dimension calculated by IALA**
Distance between front and rear towers	2,201m
Distance to front tower from channel bending point	1,600m
Front tower day board height	15.5 m
Front tower night board height	16.5 m
Range rear tower light height	39.0m
Range rear day light height	38.0m

5) Work period of dredging and navigation aids works

Productivity of the proposed dredging works by the above fleet arrangement is examined to estimate the working period.

Considering the dredging volume of around 5,450,00 m^3 in the channel dredging, the dredging works thereof is planned to employ a cutter suction dredger having dredging capacity of 800 m^3 per hr and monthly productivity of 400,000 m^3/day with two hopper barges (capacity: 2,000 m^3) for transporting dredged material. The total period required for dredging work is worked out to be 14 months. Since there is no dredging company in Turkmenistan, it is assumed that the proposed dredging works will be carried out by an experienced foreign dredging company.

The total work period is worked out as follows:

- The contractor will mobilize the dredger and its working vessels outside of Turkmenistan. Mobilization of the dredger and its equipment to the site from tentatively assumed Middle East region; 2 months, assembling dredger at docks and take it in tow to project site; 3 months
- Pre dredging survey; about 2 months, to be done at the same time that the dredger is being reassembled at dry dock and transported to Turkmenbashi port.
- Dredging works ; 14 months

- Post dredging survey; 2 months till acceptance by the client
- Relocation of existing navigation buoys to the specified positions; 1 month.
- Construction of leading lights will be carried out in 10 months during the dredging works

No maintenance works is required.

Table 3.5.4 Work Schedule of Dredging Works

	Work Items	1st Year												2nd Year											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	**Preparatory Works**																								
	Domestic Preparatory Works																								
	Pre Dredging Survey																								
2	**Dredging works by Cutter suction dredger**																								
	Mobilization of Equipment to Site																								
	Reassmbling dredgers and towing to site																								
	Dredging works by Cutter Dredger																								
	Posr Dredging Survey																								
3	**Navigational Facilities Works**																								
	Construction of Off shore Leading Lights																								
	Relocation of Existing Navigation Buoys																								
	Demobilization of Equipment																								

(3) Equipment Supply for Maritime Academy College

1) Present Conditions

STCW requires that every candidate for certification of all categories shall demonstrate their ability to undertake specified tasks, duties and responsibilities and shall provide evidence of having achieved the required standard of competence as the minimum knowledge, understanding and proficiency required for certification in accordance with the methods for demonstrating competence and criteria of STCW

At present TMC has a minimum educational model of marine equipment, but does not have any approved facilities and equipment to educate maritime students for certification required by STCW.

The TMRL desires to develop capacity building of graduated students of the TMC Turkmenbashi, to be qualified crews, engineers and seafarers by certification in accordance with STCW regulations so as to operate and manage the ships to be procured, instead of sending to the Academies abroad to obtain qualified certification or of recruiting foreign crews from other institutes abroad.

Considering such desires of TMC, the Study team considered their desires reasonable and had discussions with TMRL and faculty of TMC. In order to operate and manage vessels owned by Turkmenistan by qualified Turkmenistan crews and engineers and captains, TMC shall equip facilities with equipment approved by STCW and upgrade the education and training courses of

the TMC. The marine transport industry of Turkmenistan will be enhanced by such investment in education and transport services.

2) Procurement of Equipment

TMC proposes to procure the required equipment and facilities in the present collage together with a training program approved by STCW as described in Chapter 3.4.

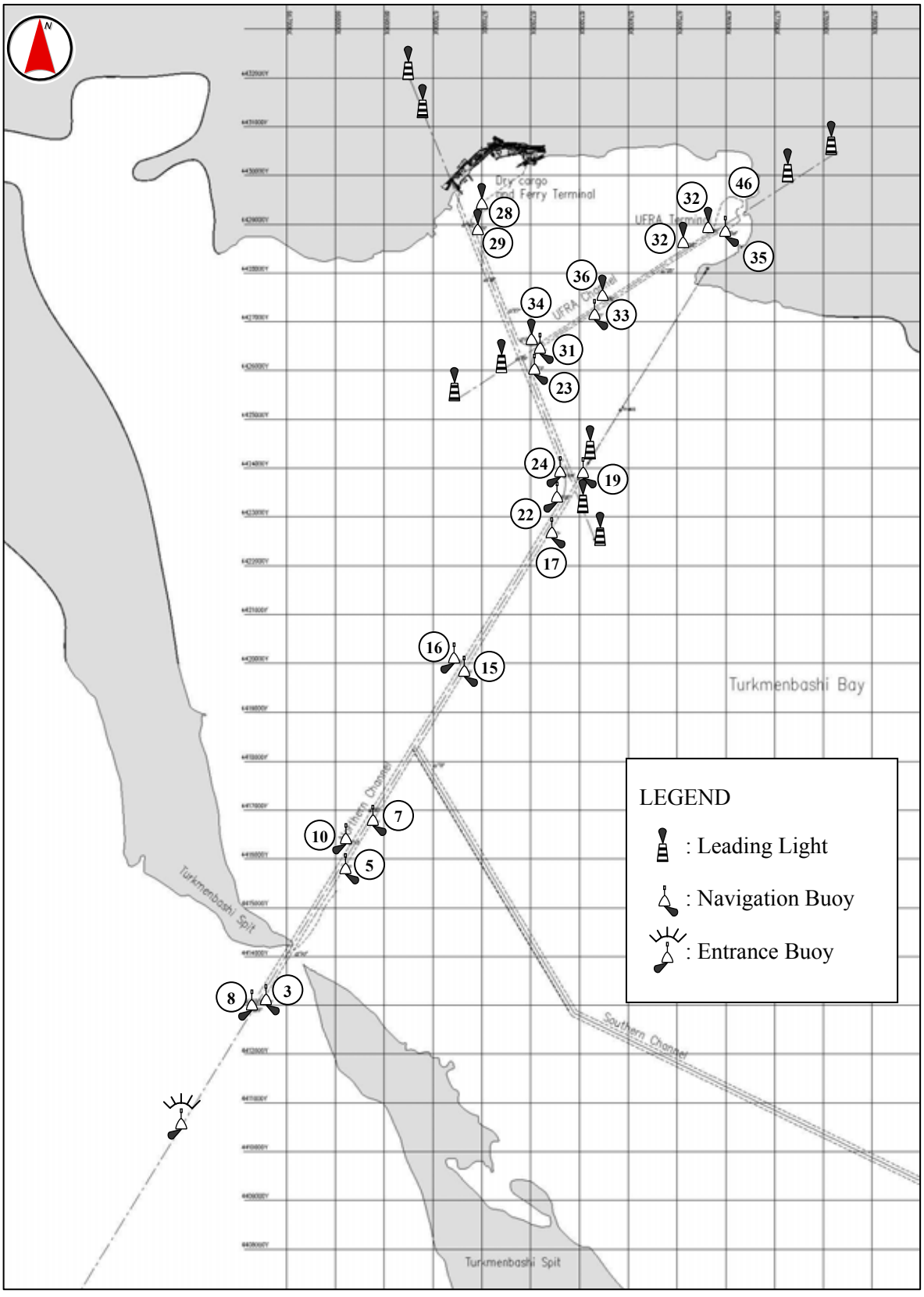
3) Location of equipment procured

TMC will arrange a classroom space of about 250 m^2 for installation of the proposed equipment in the collage building in Turkmenbashi.

4) Estimated period of works

The expected period of the consulting service for design stage to the L/C open for Contractor is 24 months;

- The supervisory period of fabrication, factory inspection and installation of equipment is 24 months.
- The training period after the commissioning of equipment is 12 months.
- Thus total period is 60 months.



Source: TMRL

Figure 3.5.5 Location of Leading Light and Navigation Buoy

3.5.3 Executing Agency and Operation and Management of Facilities

(1) Port development project

1) Executing agency

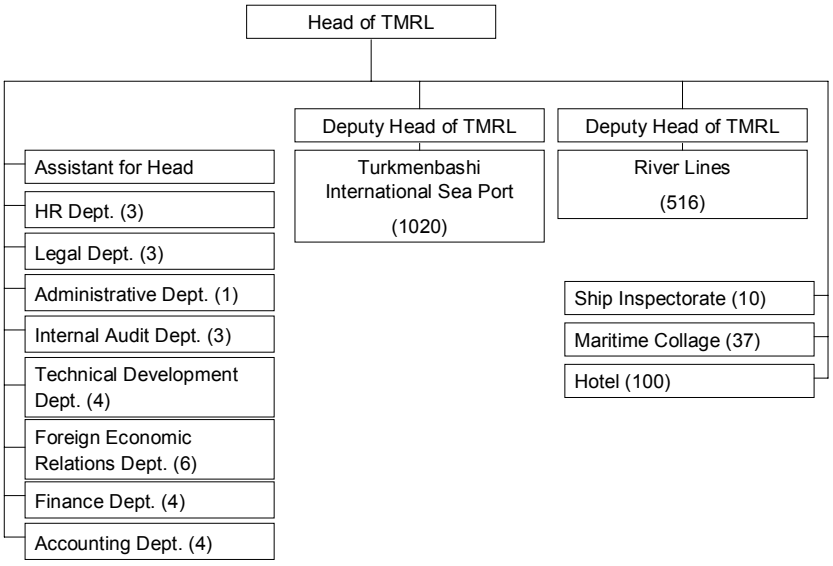
Executing agency of the port development project shall be the State Turkmen Maritime and River Lines (TMRL).

TMRL is a state owned enterprise established in 2003 merging the State Maritime Line and the State River Lines. TMRL is basically independent from ministries and is directly controlled by the President and the Cabinet of Ministers of Turkmenistan. TMRL has financial autonomy. Head and deputy head of TMRL are appointed by the President of Turkmenistan. Directors of TMRL are appointed by the head of TMRL however the approval by the Cabinet of Ministers is required. The headquarters of TMRL is located in Turkmenbashi.

The Presidential Resolution dated 15 April 2003 clearly prescribes that the activities of TMRL shall include port development and more specifically preparation of the design documents and cost estimation for port infrastructure and approach channel. Turkmenbashi International Sea Port (TISP) is a department of TMRL.

Organizational chart of TMRL is shown in Figure 3.5.6. Technical Development Department and Foreign Economic Relations Department of TMRL headquarters shall jointly form PMU mobilizing relating officers in TISP. TISP has an engineering section which consists of 6 engineers. TMRL has experience in executing a port development project funded by an international agency.

An organizational reform of maritime administration in TMRL is scheduled in the middle of 2010, however TMRL explains that organizational structure for port development will be unchanged.



Note: The figures in parentheses denote the numbers of employees in each department

Figure 3.5.6 Organizational Chart of TMRL

2) Operation and management

The operation and management of Ro-PAX terminal and access channel shall be carried out by TMRL, which is the sole organization designated as an administration body of international commercial seaports in Turkmenistan.

In the operation and management of facilities developed by the urgent project, following measures should be taken by TMRL in order to secure the sustainability of the project.

Periodical maintenance dredging based on appropriate plan

Substantial amount of sedimentation around the channel entrance of Turkmenbashi Port has been causing navigation problems. Therefore implementation of periodical maintenance dredging over the whole area of the channel is a basic requirement for the sustainability of the access channel improvement project. In particular, intensive maintenance work is required around the channel entrance.

The existing dredger of TMRL has enough capacity for maintenance dredging provided it is completely repaired or replaced and maintained in good condition. Since TMRL has not carried out major dredging works for long periods, the capacity development of its employees for safe and efficient dredging and maintenance of the dredger is required. The channel dredging is most disruptive to vessel traffic, therefore well-planned dredging works are required. It should be also noted that the measures for environmental protection shall be considered in the establishment of the dredging plan, since the port is located in the vicinity of the nature reserve.

Coordination for facilitation of passenger traffic and cargo transport

Efficiency is one of the most important indicators in evaluating terminal operation.

For the efficiency improvement in Turkmen port, coordination among related agencies is an important issue. At present, each agency seems to have some productivity targets and individual documentations and inspections seem to be processed within a certain period of time. However, lack of coordination among agencies (or departments in an agency) produces a large amount of waiting time and it makes the overall efficiency very low. Therefore TMRL, as a total coordinator, should set the overall target of efficiency improvement of each terminal including the new Ro-PAX terminal and coordinate with related agencies in order to reduce waiting time and to achieve the target efficiency.

Besides above mentioned coordination, TMRL, as a terminal operator, is required to make constant efforts to improve the efficiency of its own operation.

It should be noted that the efficiency improvement is a prerequisite for the Consultant's assessment on the urgent projects. Therefore unless the overall efficiency of the port is improved, the project cannot produce economic benefits nor will its financial viability be secured.

Capacity building of seafarers of TMRL

TMRL, as a ship operator, has operated tankers and dry cargo vessels, but it has no experience of international passenger transport. Therefore capacity building of seafarers of TMRL is very important for the safe navigation of passenger vessels. For this purpose, the education in the seafarers training facility in Turkmenistan should be upgraded to the level of internationally recognized standard as described in the following subsection.

Maritime environmental management

Although the environmental risk caused by oil spill from vessels in the port area will be reduced significantly by the channel improvement, the potential risk of oil spill outside the port would increase as a whole by the increased vessel traffic to/from Turkmenbashi Port.

The resolution of the President of Turkmenistan on the 15 April, 2003 designates TMRL as being responsible for maritime environmental protection against oil spill from vessels. Therefore, considering increase of traffic volume of tankers and existence of the ecological receptor of the nature reserve, TMRL should take necessary actions to respond it by:

Establishment of designated organization in TMRL for maritime environmental protection;

- Capacity building of personnel for maritime environmental protection;
- Procurement of equipment to respond to oil spills from vessels.
- This subject is described in detail in the following subsection.

3.5.4 Economic Assessment of the Immediately Required Facilities

(1) Method of Economic Assessment

Cost Benefit Analysis (CBA) is a method of economic assessment to quantify the effect of public investment in view of national economic benefit. In the analysis, future situation identified as "Without Project Case" is assumed which is the case that the concerned project would not to be achieved. The national benefit is calculated based on the comparison between the "With Project Case" and the "Without Project Case". All benefits and costs in market price are converted to the economic price in order to eliminate distortion due to political economic factors such as import duty or government subsidy, etc. The procedure of economic analysis is shown in the following figure.

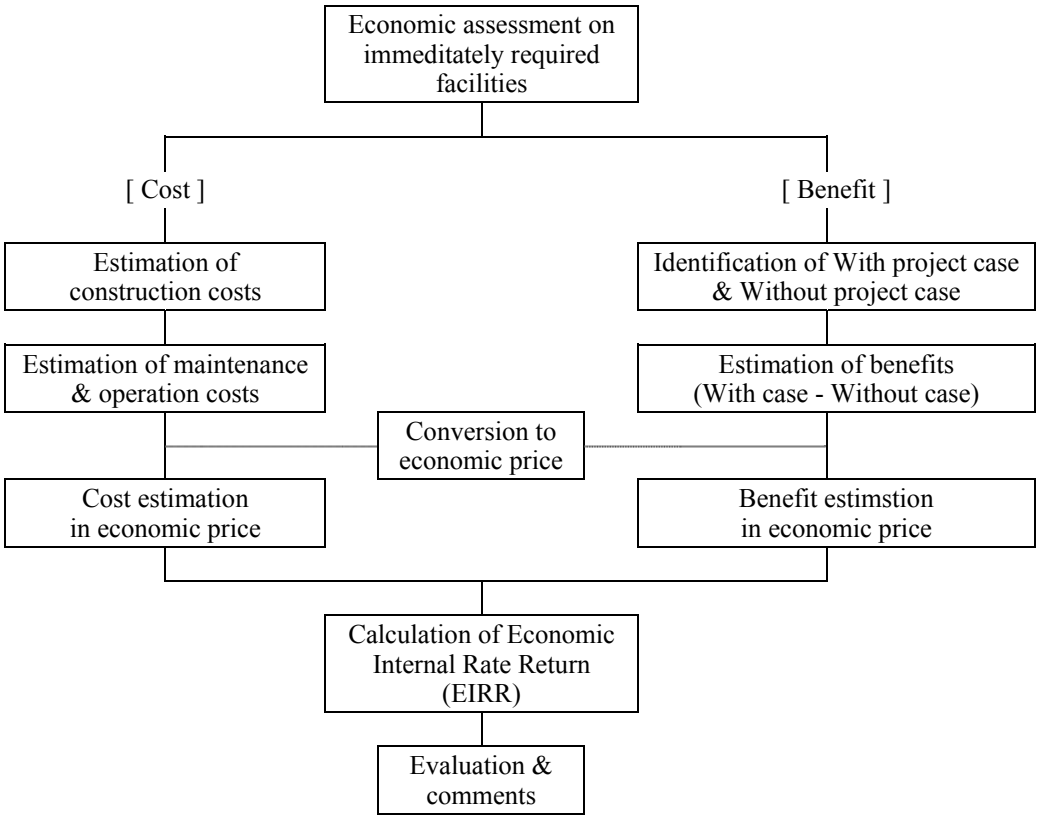


Figure 3.5.7 Flowchart of economic assessment

(2) Underlying Basic Assumptions

1) Implementation schedule

Implementation schedule of the projects is assumed from the feasibility study in 2010 to the commission of facilities in 2014 as per Table 3.5.5 below. All the benefits are deemed to take effect from the beginning of 2014.

Table 3.5.5 Implemetation schedule of the projects

Activities	Year of Works					
	2010	2011	2012	2013	2014	2015
Preparation of Project Finance						
Consulting Services						
Detailed Design Stage						
Tender Assistants Stage						
Construction Supervisory						
Maintenance Period						
Construction Works						
Channel Dredging						
Ro-Pax Terminal Development						
Oil Jetty						

2) Project life period

The project's life period is assumed for 30 years starting from 2014.

3) Exchange Rate of Foreign Currency

Exchange rate of foreign currency is assumed as below :

US$1= TMM2.834
US$1=¥90

(3) Demand Forecast

In Chapter 3, the actuals in the year 2008 and forecast for the year 2020 are given. Based on those figures, forecast for each year upto 2040 are calculated with "lenear interpolation" method.

1) Vessel traffics

Vessel traffics by category are assumed as per Table 3.5.6 below:

Table 3.5.6 Vessel traffics forecast

Year		PPK1	New Ro-Pax	New General Cargo	PPK2	PPK3	Total
	2008	124			592	768	1,484
	2009	130			637	820	1,587
	2010	137			681	873	1,691
1	2011	143			726	925	1,794
2	2012	150			770	978	1,897
3	2013	156			815	1,030	2,001
4	2014	163	564	343	859	1,083	3,011
5	2015	169	590	359	904	1,135	3,156
6	2016	175	616	375	948	1,187	3,302
7	2017	182	642	391	993	1,240	3,447
8	2018	188	668	407	1,037	1,292	3,592
9	2019	195	694	423	1,082	1,345	3,738
10	2020	201	720	439	1,126	1,397	3,883
11	2021	207	746	455	1,171	1,449	4,028
12	2022	214	772	471	1,215	1,502	4,174
13	2023	220	798	487	1,260	1,554	4,319
14	2024	227	825	503	1,304	1,607	4,465
15	2025	233	851	519	1,349	1,659	4,610
16	2026	240	877	535	1,393	1,712	4,755
17	2027	246	903	551	1,438	1,764	4,901
18	2028	252	929	566	1,482	1,816	5,046
19	2029	259	955	582	1,527	1,869	5,192
20	2030	265	981	598	1,571	1,921	5,337
21	2031	272	1,007	614	1,616	1,974	5,482
22	2032	278	1,033	630	1,660	2,026	5,628
23	2033	284	1,060	646	1,705	2,078	5,773
24	2034	291	1,086	662	1,749	2,131	5,918
25	2035	297	1,112	678	1,794	2,183	6,064
26	2036	304	1,138	694	1,838	2,236	6,209
27	2037	310	1,164	710	1,883	2,288	6,354
28	2038	317	1,190	726	1,927	2,341	6,500
29	2039	323	1,216	741	1,972	2,393	6,645
30	2040	329	1,242	757	2,016	2,445	6,790

2) Cargo volume

Cargo volume by category is forecasted as per Table 3.5.7 below:

Table 3.5.7 Cargo volume forecast

(unit: 1000 ton)

Year		PPK1& new berths			PPK2 (railway ferry)			PPK3 (oil berth)			Total
		Existing	Potential	Total	In-bound	Out-bound	Total	In-bound	Out-bound	Total	
	2008	177	970	1,147	1,291	760	2,051	320	3,161	3,481	6,679
	2009	177	1,075	1,252	1,412	821	2,234	434	3,339	3,773	7,406
	2010	177	1,180	1,358	1,534	883	2,417	548	3,517	4,065	8,096
1	2011	177	1,285	1,463	1,655	944	2,599	662	3,695	4,357	8,786
2	2012	177	1,390	1,568	1,777	1,006	2,782	776	3,874	4,649	9,476
3	2013	177	1,495	1,673	1,898	1,067	2,965	890	4,052	4,942	10,166
4	2014	177	1,601	1,778	2,019	1,128	3,148	1,004	4,230	5,234	10,855
5	2015	177	1,706	1,883	2,141	1,190	3,331	1,118	4,408	5,526	11,545
6	2016	177	1,811	1,988	2,262	1,251	3,514	1,232	4,586	5,818	12,235
7	2017	177	1,916	2,093	2,384	1,313	3,697	1,346	4,764	6,110	12,925
8	2018	177	2,021	2,198	2,505	1,374	3,879	1,460	4,943	6,402	13,615
9	2019	177	2,126	2,303	2,627	1,435	4,062	1,574	5,121	6,694	14,305
10	2020	177	2,231	2,408	2,748	1,497	4,245	1,688	5,299	6,987	13,640
11	2021	177	2,336	2,513	2,870	1,558	4,428	1,801	5,477	7,279	15,684
12	2022	177	2,441	2,619	2,991	1,620	4,611	1,915	5,655	7,571	16,374
13	2023	177	2,546	2,724	3,113	1,681	4,794	2,029	5,834	7,863	17,064
14	2024	177	2,651	2,829	3,234	1,743	4,977	2,143	6,012	8,155	17,754
15	2025	177	2,756	2,934	3,355	1,804	5,159	2,257	6,190	8,447	18,444
16	2026	177	2,862	3,039	3,477	1,865	5,342	2,371	6,368	8,739	19,133
17	2027	177	2,967	3,144	3,598	1,927	5,525	2,485	6,546	9,031	19,823
18	2028	177	3,072	3,249	3,720	1,988	5,708	2,599	6,724	9,324	20,513
19	2029	177	3,177	3,354	3,841	2,050	5,891	2,713	6,903	9,616	21,203
20	2030	177	3,282	3,459	3,963	2,111	6,074	2,827	7,081	9,908	21,893
21	2031	177	3,387	3,564	4,084	2,172	6,257	2,941	7,259	10,200	22,583
22	2032	177	3,492	3,669	4,206	2,234	6,439	3,055	7,437	10,492	23,272
23	2033	177	3,597	3,774	4,327	2,295	6,622	3,169	7,615	10,784	23,962
24	2034	177	3,702	3,880	4,449	2,357	6,805	3,283	7,793	11,076	24,652
25	2035	177	3,807	3,985	4,570	2,418	6,988	3,397	7,972	11,369	25,342
26	2036	177	3,912	4,090	4,691	2,479	7,171	3,511	8,150	11,661	26,032
27	2037	177	4,017	4,195	4,813	2,541	7,354	3,625	8,328	11,953	26,722
28	2038	177	4,123	4,300	4,934	2,602	7,537	3,739	8,506	12,245	27,411
29	2039	177	4,228	4,405	5,056	2,664	7,719	3,853	8,684	12,537	28,101
30	2040	177	4,333	4,510	5,177	2,725	7,902	3,967	8,863	12,829	28,791

3) Cargo value

Cargo value by category is forecasted as per Table 3.5.8 below:

Table 3.5.8 Cargo value forecast

(Unit: mil. US$)

		PPK1& new berths			PPK2 (railway ferry)			PPK3 (oil berth)			Total
		Existing	Potential	Total	In-bound	Out-bound	Total	In-bound	Out-bound	Total	
	2008	257	1,404	1,661	2,096	851	2,947	144	12,327	12,471	17,080
	2009	257	1,557	1,813	2,293	920	3,213	195	13,022	13,218	18,245
	2010	257	1,709	1,966	2,491	989	3,479	247	13,717	13,964	19,409
1	2011	257	1,861	2,118	2,688	1,058	3,746	298	14,412	14,710	20,573
2	2012	257	2,013	2,270	2,885	1,126	4,012	349	15,107	15,456	21,738
3	2013	257	2,165	2,422	3,082	1,195	4,278	400	15,802	16,202	22,902
4	2014	257	2,317	2,574	3,280	1,264	4,544	452	16,497	16,948	24,066
5	2015	257	2,470	2,726	3,477	1,333	4,810	503	17,192	17,695	25,231
6	2016	257	2,622	2,878	3,674	1,401	5,076	554	17,887	18,441	26,395
7	2017	257	2,774	3,031	3,871	1,470	5,342	606	18,581	19,187	27,559
8	2018	257	2,926	3,183	4,069	1,539	5,608	657	19,276	19,933	28,723
9	2019	257	3,078	3,335	4,266	1,608	5,874	708	19,971	20,679	29,888
10	2020	257	3,230	3,487	4,463	1,677	6,140	759	20,666	21,425	31,052
11	2021	257	3,382	3,639	4,660	1,745	6,406	811	21,361	22,172	32,216
12	2022	257	3,535	3,791	4,858	1,814	6,672	862	22,056	22,918	33,381
13	2023	257	3,687	3,944	5,055	1,883	6,938	913	22,751	23,664	34,545
14	2024	257	3,839	4,096	5,252	1,952	7,204	965	23,446	24,410	35,709
15	2025	257	3,991	4,248	5,449	2,020	7,470	1,016	24,141	25,156	36,874
16	2026	257	4,143	4,400	5,647	2,089	7,736	1,067	24,835	25,902	38,038
17	2027	257	4,295	4,552	5,844	2,158	8,002	1,118	25,530	26,649	39,202
18	2028	257	4,447	4,704	6,041	2,227	8,268	1,170	26,225	27,395	40,367
19	2029	257	4,600	4,856	6,238	2,295	8,534	1,221	26,920	28,141	41,531
20	2030	257	4,752	5,009	6,435	2,364	8,800	1,272	27,615	28,887	42,695
21	2031	257	4,904	5,161	6,633	2,433	9,066	1,323	28,310	29,633	43,860
22	2032	257	5,056	5,313	6,830	2,502	9,332	1,375	29,005	30,379	45,024
23	2033	257	5,208	5,465	7,027	2,571	9,598	1,426	29,700	31,126	46,188
24	2034	257	5,360	5,617	7,224	2,639	9,864	1,477	30,394	31,872	47,353
25	2035	257	5,513	5,769	7,422	2,708	10,130	1,529	31,089	32,618	48,517
26	2036	257	5,665	5,921	7,619	2,777	10,396	1,580	31,784	33,364	49,681
27	2037	257	5,817	6,074	7,816	2,846	10,662	1,631	32,479	34,110	50,846
28	2038	257	5,969	6,226	8,013	2,914	10,928	1,682	33,174	34,856	52,010
29	2039	257	6,121	6,378	8,211	2,983	11,194	1,734	33,869	35,603	53,174
30	2040	257	6,273	6,530	8,408	3,052	11,460	1,785	34,564	36,349	54,339

(4) Identification of Benefits

Among the development projects of "Immediately Required Facilities", following 2 projects are focused. The benefits of each project are identified by comparison between "With project case" and the "Without project case" from the viewpoint of contribution to the national economic.

1) Improvement of access channels

With this project, following benefits are envisaged.

i) Increase of vessels' size

The access channels with increased width will be able to accommodate larger vessels ; in average 5,000 deadweight instead of current 4,500 deadweight. With increased loading capacity, shipping lines' cost-competitiveness will be improved. Tangible benefit will be identified as the reduction of shipping lines' costs for fuel, crew and administrations per unit cargo ton. Turkmen flag tankers are assumed to be benefited mostly.

ii) Extinction of access channel closures

Currently access channels are closed due to bad weather at 128 times or 1,291.1 hours in a year. With the project, those closing time will be eliminated, which will reduce the charterage for Turkmen flag vessels' idle times.

iii) Reduction of vessels' waiting time

"Double lane traffics" with the project will enable the vessels to pass through the "cut through the spit" channel without waiting. Consequently, Turkmen flag vessels' charterage for waiting times will be reduced compared with those under current single lane traffics.

iv) Reduction of cargoes' waiting time

Reduction of waiting times given in c) will also have an effect on the distribution of cargoes with the largest amount of benefit among those listed above. As prices of export goods are under severe competition in the global market, any idle costs of exporters cannot be compensated by foreign buyers. From this viewpoint, benefit in With case is identified as the reduction of interest on the value of CIF export cargoes, which will improve price-competitiveness of export goods. Effective type of cargoes shall be limited to dry cargoes only, as oil cargoes can be brought to the berth through pipelines just upon the vessel's berthing.

2) Development of Ro-Pax terminal & oil jetties

With this project, following benefits are envisaged.

i) Securing potential Ro-Ro cargoes by Turkmen flag ferries

At present, no ferry service is virtually available for cargoes on trucks despite the potential needs of Ro-Ro carriage. If the situation was left unchanged, some foreign shipping line might sooner or later move to inaugurate a regular ferry service with a Ro-Ro facility at some ports out of Turkmenbashi, meeting the increasing demand. Contrarily with the project, those potential Ro-Ro cargoes can be secured by Turkmen flag ferries and profit thereof will contribute to increase GDP of the nation. Benefit will be identified as the profit from export Ro-Ro cargoes under CIF terms which ocean freight can be added on the price of goods.

ii) Securing potential oil cargoes by Turkmen flag tankers

In Without case, volume of oil cargoes will soon hit the capacity ceiling of PPK3 and those overflow cargoes might be carried by foreign flag tankers at some foreign ports out of Turkmenbashi. Benefit with the project will be identified as the profit from export CIF oil cargoes exceeding current handling capacity of PPK3.

(5) Calculation of Benefits

1) Improvement of access channels

i) Increase of vessels' size

Average operation cost of current calling vessels is assumed as follows. Freight rate is refered to the Traceca's report in 2007.

Fuel cost	US$ 6.0 / ton	or 40% of US$ 15.0 / ton of freight rate
Seafarers payroll & administrations cost	US$ 1.5 / ton	or 10% of US$ 15.0 / ton of freight rate

Based on the above, following amount of cost per ton is assumed to be saved by the increase of deadweight from 4,500 ton to 5,000 ton in average.

Saving of fuel cost	US$ 0.21 / ton
Saving of seafarers payroll & administrations cost	US$ 0.15 / ton

It is common understanding that fuel consumption of a vessel shall increase in proportion to the 2/3 power of its deadweight. Therefore, fuel cost per ton will decrease as the deadweight increases.

Current Turkmen flag portion is assumed as 20%, increasing at 1% every year as given by Traceca's report in 2007. Portion of 5,000 D/W vessels is assumed as 10%, yearly ncreasing at 10% during 10 years. The effective vessel type is focused on tankers only.

Table 3.5.9 is the calculation of total saving amount which is deemed as the benefit.

Table 3.5.9 Calculation of benefit on the increase of vessels' size

Year		Volume of oil cargoes (1,000 ton)	TM flag portion	5,000 D/W portion	Saving/ton (US$)
1					
2					
3					
4	2014	5,234	0.21	0.10	39
5	2015	5,526	0.22	0.20	87
6	2016	5,818	0.23	0.30	143
7	2017	6,110	0.24	0.40	209
8	2018	6,402	0.25	0.50	286
9	2019	6,694	0.26	0.60	373
10	2020	6,987	0.27	0.70	471
11	2021	7,279	0.28	0.80	582
12	2022	7,571	0.29	0.90	706
13	2023	7,863	0.30	1.00	842
14	2024	8,155	0.31	1.00	903
15	2025	8,447	0.32	1.00	965
16	2026	8,739	0.33	1.00	1,030
17	2027	9,031	0.34	1.00	1,096
18	2028	9,324	0.35	1.00	1,165
19	2029	9,616	0.36	1.00	1,236
20	2030	9,908	0.37	1.00	1,309
21	2031	10,200	0.38	1.00	1,384
22	2032	10,492	0.39	1.00	1,461
23	2033	10,784	0.40	1.00	1,540
24	2034	11,076	0.41	1.00	1,622
25	2035	11,369	0.42	1.00	1,705
26	2036	11,661	0.43	1.00	1,790
27	2037	11,953	0.44	1.00	1,878
28	2038	12,245	0.45	1.00	1,967
29	2039	12,537	0.46	1.00	2,059
30	2040	12,829	0.47	1.00	2,153
Total		243,849			29,003

ii) Extinction of access channel closure

Current channel closure is observed as 14.7% of total operational hours. Charterage of a vessels is assumed as US$ 4,000 / day.

Table 3.5.10 is the calculation of total amount of charterage for Turkmen flag vessels affected by the closures.

Table 3.5.10 Calculation of benefit on the extinction of access channel closure

Year		Ship callings	Closure ratio	Affected callings	Closure time (hours)	Affected charterage (US$1,000)	TM flag portion	Affected charterage for TM vessels (US$1,000)
1	2011							
2	2012							
3	2013							
4	2014	3,011	14.7%	443	1,291.1	261	0.21	55
5	2015	3,156	14.7%	464	1,291.1	274	0.22	60
6	2016	3,302	14.7%	485	1,291.1	286	0.23	66
7	2017	3,447	14.7%	507	1,291.1	299	0.24	72
8	2018	3,592	14.7%	528	1,291.1	311	0.25	78
9	2019	3,738	14.7%	549	1,291.1	324	0.26	84
10	2020	3,883	14.7%	571	1,291.1	337	0.27	91
11	2021	4,028	14.7%	592	1,291.1	349	0.28	98
12	2022	4,174	14.7%	614	1,291.1	362	0.29	105
13	2023	4,319	14.7%	635	1,291.1	374	0.30	112
14	2024	4,465	14.7%	656	1,291.1	387	0.31	120
15	2025	4,610	14.7%	678	1,291.1	400	0.32	128
16	2026	4,755	14.7%	699	1,291.1	412	0.33	136
17	2027	4,901	14.7%	720	1,291.1	425	0.34	144
18	2028	5,046	14.7%	742	1,291.1	437	0.35	153
19	2029	5,192	14.7%	763	1,291.1	450	0.36	162
20	2030	5,337	14.7%	785	1,291.1	463	0.37	171
21	2031	5,482	14.7%	806	1,291.1	475	0.38	181
22	2032	5,628	14.7%	827	1,291.1	488	0.39	190
23	2033	5,773	14.7%	849	1,291.1	500	0.40	200
24	2034	5,918	14.7%	870	1,291.1	513	0.41	210
25	2035	6,064	14.7%	891	1,291.1	525	0.42	221
26	2036	6,209	14.7%	913	1,291.1	538	0.43	231
27	2037	6,354	14.7%	934	1,291.1	551	0.44	242
28	2038	6,500	14.7%	955	1,291.1	563	0.45	253
29	2039	6,645	14.7%	977	1,291.1	576	0.46	265
30	2040	6,790	14.7%	998	1,291.1	588	0.47	277
Total		132,319		19,451	34,859.7	11,467		4,105

iii) Reduction of vessels' waiting time

Every calling vessel is assumed to take 1.1 hours of steaming for in & out traffic respectively between "cut through the spit" and the berth. Vessels' total daily steaming hours exceeding 24 hours is deemed as "bunching hours", and affected traffics thereof is deemed as "bunching traffics". As the integral number of bunching traffics increases, waiting hours of affected vessels will increase in arithmetic series at 1.1 hours per traffic.

Table 3.5.11 is the calculation of total amount of charterage for Turkmen flag vessels affected by the waitings.

Table 3.5.11 Calculation of benefit on the reduction of vessels' waiting time

Year		Vessel callings /year	Traffics /day	In/out hours	Bunching hours /day	Bunching traffics /day (Integer)	Waiting hours /day	Waiting hours /year	Affected charterage (US$1,000)	TM flag portion	Affected charterage for TM vessels (US$ 1,000)
1	2011										
2	2012										
3	2013										
4	2014	3,011	16.50	18.15	-5.85					0.21	
5	2015	3,156	17.29	19.02	-4.98					0.22	
6	2016	3,302	18.09	19.90	-4.10					0.23	
7	2017	3,447	18.89	20.78	-3.22					0.24	
8	2018	3,592	19.68	21.65	-2.35					0.25	
9	2019	3,738	20.48	22.53	-1.47					0.26	
10	2020	3,883	21.28	23.40	-0.60					0.27	
11	2021	4,028	22.07	24.28	0.28					0.28	
12	2022	4,174	22.87	25.16	1.16	1	1.0	365	61	0.29	18
13	2023	4,319	23.67	26.03	2.03	2	3.1	1,132	189	0.30	57
14	2024	4,465	24.46	26.91	2.91	3	6.3	2,300	383	0.31	119
15	2025	4,610	25.26	27.79	3.79	3	6.3	2,300	383	0.32	123
16	2026	4,755	26.06	28.66	4.66	4	10.6	3,869	645	0.33	213
17	2027	4,901	26.85	29.54	5.54	5	16.0	5,840	973	0.34	331
18	2028	5,046	27.65	30.42	6.42	6	22.5	8,213	1,369	0.35	479
19	2029	5,192	28.45	31.29	7.29	7	30.1	10,987	1,831	0.36	659
20	2030	5,337	29.24	32.17	8.17	7	30.1	10,987	1,831	0.37	678
21	2031	5,482	30.04	33.04	9.04	8	38.8	14,162	2,360	0.38	897
22	2032	5,628	30.84	33.92	9.92	9	48.6	17,739	2,957	0.39	1,153
23	2033	5,773	31.63	34.80	10.80	10	59.5	21,718	3,620	0.40	1,448
24	2034	5,918	32.43	35.67	11.67	11	71.5	26,098	4,350	0.41	1,783
25	2035	6,064	33.23	36.55	12.55	11	71.5	26,098	4,350	0.42	1,827
26	2036	6,209	34.02	37.42	13.42	12	84.6	30,879	5,147	0.43	2,213
27	2037	6,354	34.82	38.30	14.30	13	98.8	36,062	6,010	0.44	2,645
28	2038	6,500	35.61	39.18	15.18	14	114.1	41,647	6,941	0.45	3,123
29	2039	6,645	36.41	40.05	16.05	15	130.5	47,633	7,939	0.46	3,652
30	2040	6,790	37.21	40.93	16.93	15	130.5	47,633	7,939	0.47	3,731
Total		132,319	725.04	797.54	149.54	156	974.4	355,656	59,276		25,147

iv) Reduction of cargoes' waiting time

Waiting hours estimated in c) is applicable. Interest rate is assumed as 5% per anum. CIF portion is deemed the same as Turkmen flag portion.

Table 3.5.12 is the calculation of total amount of interest on CIF export dry cargoes affected by the waitings.

Table 3.5.12 Calculation of benefit on the reduction of cargoes' waiting time

Year		Waiting hours /year	Value of outbound cargo except oil (US$ 1,000)	Bunching portion	CIF portion	Interest amount on cargo value (US$ 1,000)
1	2011					
2	2012					
3	2013					
4	2014		1,959,592		21%	
5	2015		2,069,487		22%	
6	2016		2,179,381		23%	
7	2017		2,289,276		24%	
8	2018		2,399,171		25%	
9	2019		2,509,065		26%	
10	2020		2,618,960		27%	
11	2021	0	2,728,855	1.16%	28%	
12	2022	365	2,838,749	4.60%	29%	79
13	2023	1,132	2,948,644	7.81%	30%	446
14	2024	2,300	3,058,539	10.81%	31%	1,346
15	2025	2,300	3,168,433	13.63%	32%	1,813
16	2026	3,869	3,278,328	16.27%	33%	3,887
17	2027	5,840	3,388,223	18.75%	34%	7,201
18	2028	8,213	3,498,117	21.09%	35%	12,105
19	2029	10,987	3,608,012	23.30%	36%	18,980
20	2030	10,987	3,717,906	25.39%	37%	21,903
21	2031	14,162	3,827,801	27.37%	38%	32,180
22	2032	17,739	3,937,696	29.24%	39%	45,473
23	2033	21,718	4,047,590	31.03%	40%	62,268
24	2034	26,098	4,157,485	32.72%	41%	83,080
25	2035	26,098	4,267,380	34.33%	42%	91,661
26	2036	30,879	4,377,274	35.87%	43%	118,996
27	2037	36,062	4,487,169	37.34%	44%	151,732
28	2038	41,647	4,597,064	38.74%	45%	190,490
29	2039	47,633	4,706,958	40.08%	46%	235,922
30	2040	47,633	4,816,853	41.36%	47%	254,572
Total		355,656	91,482,009			1,334,132

2) Development of Ro-Pax terminal & oil jetties

i) Securing potential Ro-Ro cargoes by Turkmen flag ferries

Profit ratio of Ro-Ro carriage is assumed as US$ 4.5 / ton or 30% of US$ 15.0 / ton of freight rate given by the Traceca's report in 2007. All of outbound Ro-Ro cargoes is assumed to be carried by Turkmen flag ferries.

Table 3.5.13 is the calculation on the total amount of profit.

Table 3.5.13 Calculation of benefit on securing potential Ro-Ro cargoes by Turkmen flag ferries

Year		Volume of outboundl Ro-Ro cargoes (1,000 ton)	Profit from outbound Ro-Ro carriage by TM ferries (US$1,000)
1	2011		
2	2012		
3	2013		
4	2014	559	2,516
5	2015	596	2,682
6	2016	633	2,847
7	2017	669	3,012
8	2018	706	3,177
9	2019	743	3,343
10	2020	780	3,508
11	2021	816	3,673
12	2022	853	3,838
13	2023	890	4,003
14	2024	926	4,169
15	2025	963	4,334
16	2026	1,000	4,499
17	2027	1,037	4,664
18	2028	1,073	4,830
19	2029	1,110	4,995
20	2030	1,147	5,160
21	2031	1,183	5,325
22	2032	1,220	5,490
23	2033	1,257	5,656
24	2034	1,294	5,821
25	2035	1,330	5,986
26	2036	1,367	6,151
27	2037	1,404	6,317
28	2038	1,440	6,482
29	2039	1,477	6,647
30	2040	1,514	6,812
Total		27,986	125,936

ii) Securing potential oil cargoes by Turkmen flag tankers

Current handling capacity of PPK3 is assumed as 4.8 million ton / year. The capacity for outbound oil cargoes of 3,507 thousand ton is given in proportion to the inbound /outbound ratio in cargo forecast figures. Profit ratio is assumed at the same figure as a).

Table 3.5.14 is the calculation on the total amount of profit.

Table 3.5.14 Calculation of benefit on securing oil cargoes by Turkmen flag tankers

Year		Forecast of oil cargoes (1000 ton)	Capacity of PPK3 (1000 ton)	Overflow (1000 ton)	Profit from outbound oil carriage by TM tankers (US$1,000)
1	2011				
2	2012				
3	2013				
4	2014	4,230	3,507	723	3,252
5	2015	4,408	3,507	901	4,054
6	2016	4,586	3,507	1,079	4,856
7	2017	4,764	3,507	1,257	5,657
8	2018	4,943	3,507	1,435	6,459
9	2019	5,121	3,507	1,614	7,261
10	2020	5,299	3,507	1,792	8,063
11	2021	5,477	3,507	1,970	8,864
12	2022	5,655	3,507	2,148	9,666
13	2023	5,834	3,507	2,326	10,468
14	2024	6,012	3,507	2,504	11,270
15	2025	6,190	3,507	2,683	12,072
16	2026	6,368	3,507	2,861	12,873
17	2027	6,546	3,507	3,039	13,675
18	2028	6,724	3,507	3,217	14,477
19	2029	6,903	3,507	3,395	15,279
20	2030	7,081	3,507	3,573	16,081
21	2031	7,259	3,507	3,752	16,882
22	2032	7,437	3,507	3,930	17,684
23	2033	7,615	3,507	4,108	18,486
24	2034	7,793	3,507	4,286	19,288
25	2035	7,972	3,507	4,464	20,090
26	2036	8,150	3,507	4,643	20,891
27	2037	8,328	3,507	4,821	21,693
28	2038	8,506	3,507	4,999	22,495
29	2039	8,684	3,507	5,177	23,297
30	2040	8,863	3,507	5,355	24,098
Total		176,748	94,697	82,051	369,230

(6) Calculation of Costs

1) Components of costs

Costs are divided to 2 major categories; one is the investment cost and the other is operation & maintenance cost. Investment cost consists of consulting, construction and contingencies. Land acquisition cost can be neglected as entire project area is TMRL's property. Maintenance & operation cost is for maintenance & repair for the facilities and cargo handlings. This Costs spreads through all the period after commissioning of facilities.

2) Investment cost

Cost for consulting and construction are summarized in Table 3.5.15. As 3 oil jetties need to be added one by one after the initial commission, the cost for those constructions are shown as "post commission works". 15% of VAT is included in the amount below. Import duties are assumed to be exempted as the case is related to ODA..

Table 3.5.15 Investment cost

(unit: US$ 1,000)

	Access channels	Ro-Pax terminal & oil jetties	Total
Consulting	2,842	3,188	6,029
Construction	55,276	62,016	117,292
Initial investment total	58,118	65,204	123,321
Post commission works		7,333	7,333
Total investment cost	58,118	72,537	130,655

3) Maintenance & operation cost

Maintenance & operation cost per annum is assumed at 2% of total investment cost.

(7) Economic Price Conversion

1) Economic prices

For the economic assessment, prices of goods & services are defined as "economic prices". Economic prices are usually identical to the international market prices as those are exposed to severe global competitions. Contrarily, domestic prices are influenced by the government's interventions such as import/export taxes, domestic taxes or other government subsidies, etc. In general, those distortions need to be eliminated for the assessment by converting local prices into economic prices with "price conversion factors".

2) Price conversion factors

In this economic assessment, all the items of benefits are evaluated by using fair global market prices, such as charterage, freight rates, export goods value etc. Therefore those prices used for evaluation of benefits can be considered identical to the economic prices, that is, price conversion factors can be neglected for the calculation of benefits this time.

As to the investment cost, VAT needs to be excluded. The amount without VAT can be considered identical to the economic prices.

3.5.5 Financial Analysis of the Immediately Required Facilities

(1) Purpose of Financial Analysis

The purpose of financial analysis is to examine the viability of the projects for the Immediately Required Facilities. When evaluating financial viability of a project, financial soundness of the executing agency operating the facilities needs to be assessed. In this analysis, TMRL shall be assessed.

(2) Methodology of the Financial Analysis

Procedure of the analysis is shown in the following figure.

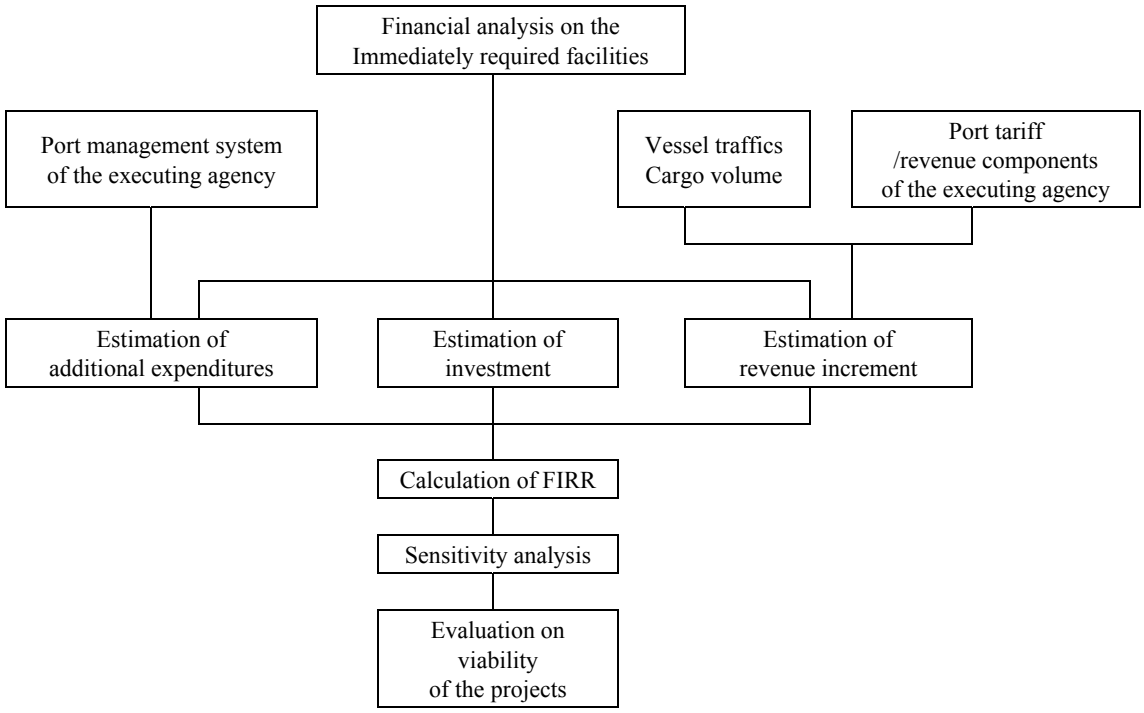


Figure 3.5.8 Flowchart of financial analysis

(3) Underlying Assumptions

1) Scope of the analysis

Viability of the project is assessed in terms of the additional revenues & expenditures relevant to the above-mentioned projects only. TMRL's activities concerned with existing setup and financial results derived from those activities are not considered.

2) Base year

All calculations are based on the prices as of the year 2011. Price escalation due to inflation is not considered in this analysis on assumption that the inflation of costs shall be recovered by increase of port tariff rates, not affecting the net profits and cash flows of TMRL.

3) Project life

The project life period is assumed for 30 years starting from 2011.

4) Covered projects in the analysis

The scope of the financial analysis is identical with that for economic assessment, covering 2 projects of Immediately Required Facilities i.e. improvement of access channels & development of Ro-Pax & oil jetties, with components & implementation schedule shown below.

Table 3.5.16 Implementation schedule of the projects

Activities	Year of Works					
	2010	2011	2012	2013	2014	2015
Preparation of Project Finance						
Consulting Services						
Detailed Design Stage						
Tender Assistants Stage						
Construction Supervisory						
Maintenance Period						
Construction Works						
Channel Dredging						
Ro-Pax Terminal Development						
Oil Jetty						

5) Exchange Rate of Foreign Currency

Exchange rate of foreign currency is assumed as below:

US$1 = TMM2.834 US$1 = ¥90 (As of December 2009)

6) Handling volume

The demand forecast figures used in the economic assessment are applicable to this analysis also. The figures of handling volume shall be used as “explanatory variables” for the estimation of incremental revenues and variable costs of the projects. Figures of vessel deadweight and Ro-Ro cargo volume need to be given respectively.

i) Deadweight of calling vessels

Since the deadweight of calling vessels is used as an “explanatory variable” for revenue increment on both projects, those volume figures are numerically divided into each project and case of “with” & “without” in order to eliminate double-counting between the projects and cases. Table 3.5.17 shows the matrix of distribution to the projects, cases and years.

Table 3.5.17 Vessel deadweight distribution

(unit: 1,000 ton)

Year		Additional deadweight **with** access channel project			Deadweight **without** access channel project			Total
		Access channel related portion	Ro-Pax /oil jetty related portion	Sub total	Additional **with** Ro-Pax /oil jetty project	**Without** Ro-Pax /oil jetty project	Sub total	
1	2011					8,764	8,764	8,764
2	2012					9,232	9,232	9,232
3	2013					9,565	9,565	9,565
4	2014				2,907	10,693	13,600	13,600
5	2015				3,260	11,044	14,304	14,304
6	2016				3,612	11,395	15,008	15,008
7	2017				3,965	11,746	15,712	15,712
8	2018				4,318	12,097	16,416	16,416
9	2019				4,671	12,449	17,120	17,120
10	2020				5,024	12,800	17,824	17,824
11	2021	152	64	216	5,263	13,056	18,318	18,535
12	2022	621	274	895	5,259	13,109	18,369	19,264
13	2023	1,082	497	1,579	5,256	13,162	18,419	19,998
14	2024	1,531	729	2,260	5,253	13,165	18,419	20,678
15	2025	1,970	970	2,940	5,250	13,168	18,419	21,359
16	2026	2,400	1,220	3,620	5,248	13,171	18,419	22,039
17	2027	2,823	1,478	4,301	5,245	13,174	18,419	22,720
18	2028	3,239	1,742	4,981	5,243	13,176	18,419	23,400
19	2029	3,648	2,013	5,661	5,241	13,178	18,419	24,080
20	2030	4,052	2,290	6,342	5,238	13,180	18,419	24,761
21	2031	4,450	2,572	7,022	5,236	13,183	18,419	25,441
22	2032	4,843	2,860	7,702	5,234	13,184	18,419	26,121
23	2033	5,231	3,151	8,383	5,233	13,186	18,419	26,802
24	2034	5,615	3,448	9,063	5,231	13,188	18,419	27,482
25	2035	5,995	3,748	9,743	5,229	13,190	18,419	28,162
26	2036	6,371	4,052	10,423	5,228	13,191	18,419	28,842
27	2037	6,744	4,359	11,103	5,226	13,193	18,419	29,522
28	2038	7,114	4,670	11,783	5,225	13,195	18,419	30,203
29	2039	7,480	4,983	12,464	5,223	13,196	18,419	30,883
30	2040	7,844	5,300	13,144	5,222	13,197	18,419	31,563
Total		83,206	50,420	133,626	132,540	373,229	505,769	639,395

ii) Ro-Ro cargo volume

Volume of potential Ro-Ro cargoes adopted for economic assessment is used as per Table 3.5.18.

Table 3.5.18 Volume of potential Ro-Ro cargoes

Year		Potential Ro-Ro cargoes (1,000 ton)
1	2011	
2	2012	
3	2013	
4	2014	1,601
5	2015	1,706
6	2016	1,811
7	2017	1,916
8	2018	2,021
9	2019	2,126
10	2020	2,231
11	2021	2,336
12	2022	2,441
13	2023	2,546
14	2024	2,651
15	2025	2,756
16	2026	2,862
17	2027	2,967
18	2028	3,072
19	2029	3,177
20	2030	3,282
21	2031	3,387
22	2032	3,492
23	2033	3,597
24	2034	3,702
25	2035	3,807
26	2036	3,912
27	2037	4,017
28	2038	4,123
29	2039	4,228
30	2040	4,333
Total		80,098

(4) Estimation of Revenue Increment

1) Port Tariff

TMRL's revenues for the project will be generated by receiving additional vessels through improved access channels and handling new Ro-Ro cargoes, applying their port tariffs thereon. In this analysis, TMRL's current port tariff is assumed to be applicable throughout the project period.

2) Revenue components of TMRL

TMRL has 4 different business units. Table 3.5.19 summarizes their unit-wise profit & loss statement for the year 2008. Among 4 units, "International Sea Port" shall be the business unit concerned with the projects.

Table 3.5.19 Business unit-wise Profit&Loss for 2008

(unit: US$1,000)

Sector	International sea port	River Lines	Maritime College	State Control	TMRL total
Revenues	18,645	4,561	132	1,796	25,133
Expenses	13,031	1,480	115		14,626
Gross profit	5,614	3,082	17	1,796	10,508

Source: TMRL

Revenue components of International Sea Port are categorized by applicable "explanatory variable" as per Table 3.5.20.

Table 3.5.20 Revenue components of International Sea Port unit for 2008

Explanatory variables	Type of service	Revenue (US$1,000)
Vessel deadweight	Vessel related services	3,274
	Channel dues	1,958
	Fleet supporting services	2,851
	Miscellaneous services (vessel-related portion)	2,089
	Sub total	10,171
Ro-Ro cargo volume	Dry cargo handling operations	1,471
	Miscellaneous services (dry cargo-related portion)	522
	Sub total	1,993
Others		6,480
Total		18,645

Source: TMRL

3) Calculation of revenue increment

i) Revenue increment related to additional vessel callings

Amount of revenue increment is calculated by project using additional vessels deadweight given in Table 3.5.17 as explanatory variable. Incremental revenues through project period are shown in Table 3.5.21

Table 3.5.21 Revenue increment related to vessel deadweight

Year		Additional revenue in with access channel project		Additional revenue in with Ro-Pax/oil jetty project	
		Additional D/W	Additional revenue (US$1,000)	Additional D/W	Additional revenue (US$1,000)
1	2011				
2	2012				
3	2013				
4	2014			2,907	4,427
5	2015			3,260	4,965
6	2016			3,612	5,502
7	2017			3,965	6,040
8	2018			4,318	6,577
9	2019			4,671	7,115
10	2020			5,024	7,652
11	2021	216	330	5,263	8,016
12	2022	895	1,364	5,259	8,011
13	2023	1,579	2,405	5,256	8,006
14	2024	2,260	3,442	5,253	8,001
15	2025	2,940	4,478	5,250	7,997
16	2026	3,620	5,514	5,248	7,993
17	2027	4,301	6,551	5,245	7,989
18	2028	4,981	7,587	5,243	7,985
19	2029	5,661	8,623	5,241	7,982
20	2030	6,342	9,659	5,238	7,979
21	2031	7,022	10,695	5,236	7,976
22	2032	7,702	11,732	5,234	7,973
23	2033	8,383	12,768	5,233	7,970
24	2034	9,063	13,804	5,231	7,967
25	2035	9,743	14,840	5,229	7,965
26	2036	10,423	15,876	5,228	7,962
27	2037	11,103	16,912	5,226	7,960
28	2038	11,783	17,948	5,225	7,958
29	2039	12,464	18,984	5,223	7,956
30	2040	13,144	20,019	5,222	7,953
Total		133,626	203,529	132,673	201,874

ii) Revenue increment related to potential Ro-Ro cargoes

Amount of revenue increment for Ro-Pax/oil jetty project is calculated as per Table 3.5.22, using Ro-Ro cargo volume given in Table 3.5.18 as explanatory variable. Revenue from oil cargo handling is not considered in this analysis, as its amount is estimated negligibly small.

Table 3.5.22 Revenue increment related to potential Ro-Ro cargo volume

Year		Potential Ro-Ro cargoes (1,000 ton)	Increment of revenue related to dry cargoes (US$1,000)
1			
2			
3			
4	2014	1,601	998
5	2015	1,706	1,063
6	2016	1,811	1,129
7	2017	1,916	1,194
8	2018	2,021	1,260
9	2019	2,126	1,325
10	2020	2,231	1,391
11	2021	2,336	1,456
12	2022	2,441	1,522
13	2023	2,546	1,587
14	2024	2,651	1,653
15	2025	2,756	1,718
16	2026	2,862	1,784
17	2027	2,967	1,849
18	2028	3,072	1,915
19	2029	3,177	1,980
20	2030	3,282	2,046
21	2031	3,387	2,111
22	2032	3,492	2,177
23	2033	3,597	2,242
24	2034	3,702	2,308
25	2035	3,807	2,373
26	2036	3,912	2,439
27	2037	4,017	2,504
28	2038	4,123	2,570
29	2039	4,228	2,635
30	2040	4,333	2,701
Total		80,098	49,926

(5) Estimation of Expenditures

1) Investment

In this analysis, VAT is included in the investment cost. Import duties for import materials are assumed to be exempted as the case is related to ODA.

2) Maintenance & operation cost for the facilities

Taking account of the government's subsidy for fuel, electricity, water etc., the annual maintenance & operation cost is assumed as 1.5% of total investment cost, while 2% is assumed for the economic assessment.

3) Variable cost for vessel & cargo handlings

Expenses of International Sea Port are shown on TMRL's financial statements for the year 2008 as per Table 3.5.23. Unit cost for vessel & cargo handlings is given in Table 3.5.24.

Table 3.5.23 Expenses of International Sea Port for 2008

(unit: US$1,000)

Operating expenses	Fixed costs	Payroll	2,578
		Others	29
		Sub total	2,606
	Variable costs	Vessel & cargo handlings	387
		Others	206
		Sub total	593
	Amortization		414
	VAT		1,627
	Total		5,240
Non-operating expenses	Currency operations		7,345
	Others		446
	Total		7,791
Expenses total			13,031

Source: TMRL

Table 3.5.24 Unit cost for vessel & cargo handlings

Variable cost for vessel & cargo handlings in 2008	US$ 386,711
Dry cargo volume in 2008	3,198,179 ton
Unit cost for vessel & cargo handling	US$ 0.121 /ton

Source: TMRL

4) Personnel cost

Payroll per head in International Sea Port is given as per Table 3.5.25. Additional number of personnel required for the projects is assumed as 100 persons.

Table 3.5.25 Payroll per head in International Sea Port

Payroll in 2008	US$ 2,577,825
Number of employees as of end 2008	926
Payroll per head	US$ 2,784 /head

Source: TMRL

5) Calculation of expenditures for the projects

Additional expenditures are calculated for each project and distributed to the project years as per Table 3.5.26.

Table 3.5.26 Expenditures by the project

(unit: US$ 1,000)

Year		Access channel project			Ro-Pax & oil jetty project					Total
		Investment	Maintenance & operation cost	Sub total	Investment	Maintenance & operation cost	Variable cost additional	Personnel cost additional	Sub total	
1	2011	817		817	917				917	1,733
2	2012	10,189		10,189	11,431				11,431	21,620
3	2013	39,121		39,121	43,891				43,891	83,012
4	2014	16,545	1,003	17,548	18,563	1,251	194	278	20,286	37,834
5	2015	163	1,003	1,166	183	1,251	206	278	1,919	3,085
6	2016		1,003	1,003		1,251	219	278	1,749	2,751
7	2017		1,003	1,003		1,251	232	278	1,761	2,764
8	2018		1,003	1,003		1,251	244	278	1,774	2,777
9	2019		1,003	1,003		1,251	257	278	1,787	2,789
10	2020		1,003	1,003	2,811	1,251	270	278	4,611	5,613
11	2021		1,003	1,003		1,251	282	278	1,812	2,815
12	2022		1,003	1,003		1,251	295	278	1,825	2,827
13	2023		1,003	1,003		1,251	308	278	1,838	2,840
14	2024		1,003	1,003		1,251	321	278	1,850	2,853
15	2025		1,003	1,003		1,251	333	278	1,863	2,865
16	2026		1,003	1,003		1,251	346	278	1,876	2,878
17	2027		1,003	1,003		1,251	359	278	1,888	2,891
18	2028		1,003	1,003	2,811	1,251	371	278	4,712	5,715
19	2029		1,003	1,003		1,251	384	278	1,914	2,916
20	2030		1,003	1,003		1,251	397	278	1,926	2,929
21	2031		1,003	1,003		1,251	410	278	1,939	2,942
22	2032		1,003	1,003		1,251	422	278	1,952	2,954
23	2033		1,003	1,003		1,251	435	278	1,965	2,967
24	2034		1,003	1,003		1,251	448	278	1,977	2,980
25	2035		1,003	1,003		1,251	460	278	1,990	2,993
26	2036		1,003	1,003		1,251	473	278	2,003	3,005
27	2037		1,003	1,003	2,811	1,251	486	278	4,827	5,829
28	2038		1,003	1,003		1,251	498	278	2,028	3,031
29	2039		1,003	1,003		1,251	511	278	2,041	3,043
30	2040		1,003	1,003		1,251	524	278	2,054	3,056
Total		66,835	27,068	93,904	83,418	33,784	9,685	7,516	134,403	228,307

Source: Team Estimate

3.6 Japan Cooperation and Assistants in the Past

The Japan International Cooperation Agency (JICA) has been operating in Turkmenistan since 1997. JICA provided support for policy and human recourses development to assist in the process of transition to a market economy. Grant assistance has been concentrated on the following projects:

- Medical re-equipment programmed (1997, € 4 mln);

- Sport equipment for the Turkmen State Olympic Committee (2001, € 0.34 mln);
- Audiovisual equipment for the National Library of Turkmenistan (2004, € 0.14 mln).

The following financial cooperation and assistance were provided.

- Japanese Bank for International Cooperation (JBIC) provided project loan for the Railway Transportation Modernization Project, which aimed to rehabilitate a diesel locomotive repair facility in the capital, Ashgabat (1997, € 33 mln).

JBIC provided three loans for Turkmenistan Bank for Foreign Economic Affairs for the textile industry (a cotton processing plant project) and business related to natural gas projects (2005, € 344 mln).

3.7 Outline of Regulation and System Related to Environmental Impact Assessment

3.7.1 Outline of Regulation and System Related to Environmental Impact Assessment in Turkmenistan

(1) Regulation and System Related to Environmental Impact Assessment

Turkmenistan has legislation, regulations and guidelines which stipulate the implementation of Environmental Impact Assessment (EIA). Outlines are shown below.

1) Outline of Legislation, Regulations and Guidelines

The legislation, regulations and guidelines related to EIA are as follows;

- Law on Nature Protection, 1991: One of the first laws adopted after the states independence. It stipulates general policy for nature protection under economic activities. Necessity of EIA is described legally in this legislation.
- Law on State Environmental Expert Review, 1995: EIA is described as mandatory in the process of investment, economic operations and other activities. Objectives, principles and competences of each organization, especially for appraisal of EIA, are stipulated.
- President's Decree No.2864 of 13 November 1996 on the Regulation of the Order of Conducting State Environmental Expert Review: It outlines EIA procedures; for example, what should be included in EIA reports and how to review and approve them.
- National Standard 579-2001 on EIA of the Planned Economic and Other Activities: A guideline which describes each step of EIA procedure concretely and practically. It was developed under the legislation and regulations shown above.

2) Project Types Requiring EIA

Referring to the National Standard 579-2001 and other regulations, EIA is required not only for new construction works but also for reconstruction and extension works which may impact the

environment. Furthermore, EIA is also obligatory for early planning stages such as feasibility study and developing new technology as well as establishing new legislation and policies.

The type of development project which requires EIA is not limited; however, the following project types are listed as ecologically dangerous types in the National Standard 579-2001.

Table 3.7.1 List of Ecologically Dangerous Types of Economic Operations and Other Activities

Category	Types of activities
Economic activities	Chemical, petrochemical, oil-refining industry: Building materials industry (glass, cement, asbestos items etc). Biochemical, biotechnical, pharmaceutical activities. Natural gas production, transportation and processing. Hazardous waste handling, transportation, storage and landfill. Mineral fertilizers, pesticides, weed and pest-killer chemicals production, transportation, storage and use. Combustible, highly explosive, toxic substance including combustion materials - storage and transportation: metallurgical production, cellulose and paper. Heat station and other firing facilities with capacity of 300 megawatts and greater.
Others	Trading ports, and also inland waterway and ports for internal navigation. Big dams and water-retaining structure. Construction of highways, express road, line for railway of long direction (above 700 km), and plane landing strip with length of 2100 m and greater.

Source: National Standard 579-2001 on EIA of the Planned Economic Operations and Other Activities

3) Procedure of EIA

i) Preliminary Assessment

National Standard 579-2001 stipulates that the declarant/developer shall submit an official application to the Ministry of Nature Protection at the early stage of the planning. The application should include description of the activity and the result of the preliminary assessment of the potential impact on the environment. The Ministry of Nature Protection has the right to request additional information to the declarant/developer if necessary. Within one month from the submission, the Ministry of Nature Protection shall conclude whether the project requires a full-scale EIA. In the case that it is not required, approval will be issued based on the preliminary assessment by the Ministry of Nature Protection.

ii) EIA Report

Declarant/developer shall submit the EIA report to the Ministry of Nature Protection three months prior to the activity in the case that EIA is deemed necessary as a result of the preliminary assessment. No activity can be started before obtaining the approval of the Ministry of Nature Protection.

Declarant/developer is responsible for financing the EIA. They also have to bear the expenses for the review by the Ministry of Nature Protection.

Standard contents of the EIA report are described as shown in Table 3.7.2 in the National

Standard 579-2001. Ecological, social and economic impacts should be assessed considering the site and the surrounding conditions that include climatic, hydrological, geomorphologic, geological features, air quality, water quality, under-ground water, soil, plants and animals, infrastructure, occupation, communication, demography, housing, archaeological heritages and project decision which guarantee the security on ecological risks. The impacts shall be described not only for the proposed plan but also for the alternatives including 'zero option'. Based on the prediction of environmental consequences, declarant/developer shall develop measures to minimize the negative impacts as well as monitoring and management programs.

Table 3.7.2 Standard Contents of EIA Report

Contents
1) Title page
2) Summary
3) Table of contents of EIA report.
4) Aim and necessity of planning economic operations and other activities
5) Description of alternative options of planning economic operations or other activities including proposed option and "zero option" (denial of the activity).
6) Possible discrepancy of planning activity and its alternative options with the aim and tasks of the state, regional and local policy.
7) Description of environmental elements which may be affected by planned activity and alternative options.
8) Description and comparative analysis of environmental consequences (effect) by planned economic operations or other activity and alternative options. In this section direct and indirect consequences shall be considered.
9) Description and comparative analysis (comparative description) of possible types of environmental impact of planned economic operations and other activity and alternative options and assessment of its scale.
10) Requirement and potential of renewable natural and power resources.
11) Measures to minimize possible negative environmental impacts.
12) Description of forecasting technique and its initial data as well as relevant used data as regards environment: assessment of reliability of forecasting consequences on environment.
13) Revealed deficiency of knowledge and uncertainty in the assessment.
14) Brief content of program of monitoring and management (and possible plans of post-project analysis).
15) Explanation of criteria and justification of proposed option of planning economic operations and other activity out of other alternative options.
16) Unethical summary, written in language understandable to non-professionals and in case of necessity supplemented with visual means (maps, schedules etc.).
17) Minutes of public consultation meetings for assessment of impact on environment.
18) Public comments and proposal review.
19) List of relevant information to be released to the public in all stages of impact assessment.
20) List of participants who prepare the EIA document.
21) List of delivery of final EIA document.
22) Index
23) Attachments including documents (data) which were specially prepared for EIA as well as data practically justifying conclusions of EIA and which have direct relations to analyses conducted.

Source: National Standard 579-2001 on EIA of the Planned Economic Operations and Other Activities

iii) Review and Approval

Submitted EIA report is reviewed by the experts of the Ministry of Nature Protection. Expert commission can be formed to review in the case of a large-scale and difficult project with the state and international importance. Personnel of the commission are approved by the

Turkmenistan Cabinet of Ministers. Furthermore, findings of the review can be discussed in a joint sitting with representatives of expert commission, project owner, designing organization who prepared the document and public representatives.

The Ministry of Nature Protection issues a report on their findings of the review within three months in the case of a difficult and ecologically dangerous project and within one month for other projects. The report shall include a list of environmental consequences, comments and recommendations for the project owner and relevant organizations. Without positive findings (approval), the project activities cannot be started. In case of negative findings, declarant/developer is obligated to work further on documents in accordance with requirements stipulated in the report.

The approval is valid for three years from the date of issue.

4) Monitoring

Declarant/developer shall develop an environmental monitoring program to monitor the environmental impact. The method and technique of the monitoring shall be approved by the Ministry of Nature Protection. Also, declarant/developer has to submit collected data to the Ministry of Nature Protection, who has a right to examine its reliability.

Declarant/developer has to inform the Ministry of Nature Protection of any observed notable change in the environment within three days. The Ministry of Nature Protection has the authority to stop financing the project activity based on the monitoring results.

5) Public Participation

Public participation in the EIA process shall be encouraged by declarant/developer in various ways that includes holding meetings with the stakeholders. National Standard 579-2001 states that public participation should be started in an early stage of the EIA process.

Any person or organization interested in the project can join the stakeholder meetings, which are mandatory for local authorities to attend. The minutes of meeting shall be included in the EIA report with the signature of the chairman and representative of local authority.

6) Compliance with JICA's Guideline

Referring to JICA's guideline for environmental social considerations, the system on EIA of Turkmenistan seems to satisfy most of the requirements from the guideline including assessment on both natural and social environment, considering alternative options and obligation of encouraging public participation. In case of assistance by the Japanese government, it is necessary to confirm the timing of stakeholder meetings which should be held in an early stage, as well as the relevance of the selected environmental elements to be assessed.

(2) Regulation for Dumping Dredged Materials

In order to undertake dredging activity at Turkmenbashi port and to dump the dredged materials at sea, permission from the following organizations is required according to TMRL.

- Local body of Sanitary-and -Epidemiologic Supervision, Ministry of Health
- Khazar Nature Reserve, Ministry of Nature Protection
- State Committee of Fish Industry

To obtain permission, environmental impact that may be caused by the activities shall be assessed as well as developing the technical work plans that include the volume of dredging materials, layout of working area and natural environmental conditions. The Hydrographical Service of the Ministry of Defense allocates the dumping site upon request. The area located on the west side of the spit, outside of Tukmenbashi Bay, has been allocated so far as the dumping site.

"Framework Convention for the Protection of the Marine Environment of the Caspian Sea" stipulates that appropriate measures shall be taken to prevent, reduce and control pollution of the Caspian Sea resulting from any human activities. In order to prevent pollution, assessing the contamination of dumping materials is important although Turkmenistan has not ratified the London Convention ("Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter").

(3) Management of Khazar State Nature Reserve

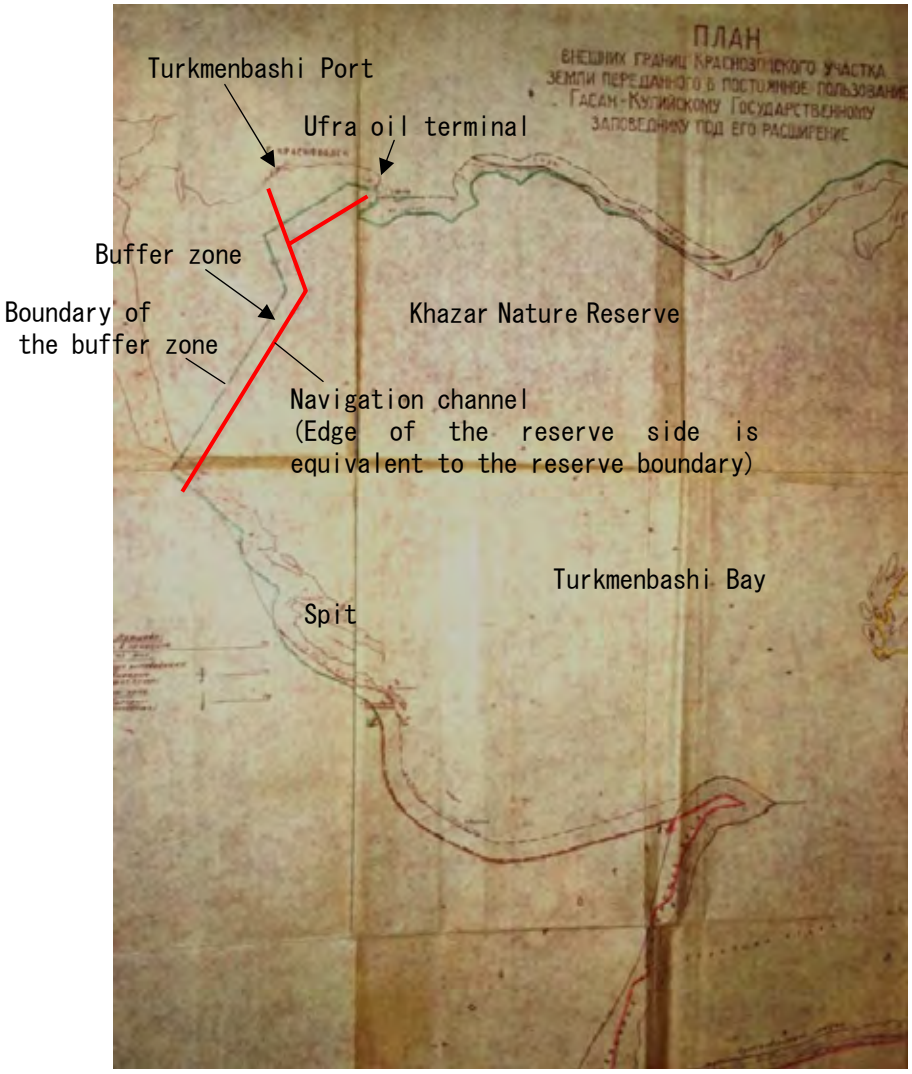
Khazar State Nature Reserve, which is located next to Turkmenbashi port, is one of the eight state nature reserves of Turkmenistan.

Khazar State Nature Reserve was originally set up as a protected area in 1932-1933. It was converted to the Krasnovodskii State Reserve in 1968, and then received its current name in 1994 according to the document provided by the Ministry of Nature Protection. The reserve consists of three parts: Khazar area located next to the port, Oguzjaly area which is an island and Esenguly area near the Iranian border. All of them are located along the coastal area of the Caspian Sea, and the total designated area is 268,000 hectares. The largest section, the Khazar area next to the port, is 192,300 hectares. It has been registered as a Ramsar Convention site ("The Convention on Wetlands of International Importance, especially as Waterfowl Habitat") since 1976.

Khazar area has a buffer zone one kilometer in width around the designated reserve area. Regarding the boundary of the port side, the edge of the north navigation channel is equivalent to the line between the reserve and the buffer zone (Figure 3.7.1).

The Khazar Nature Reserve Division, a local division of the Ministry of Nature Protection in Turkmenbashi, is responsible for environmental management of the reserve. According to the division, access to the reserve is restricted except for scientific purposes. Fishing and hunting activities are also prohibited and a penalty is imposed on offenders. In general, approval by the cabinet is required in the case of conducting a development project inside reserves. However, in

the case of dredging and expanding the channel at Turkmenbashi, both the Khazar Nature Reserve division and the head office of the Ministry of Nature Protection have commented that cabinet approval is not required because the channel is not inside the reserve and dredging does not constitute a new construction work.



Source: Khazar Nature Reserve

Figure 3.7.1 Boundary of the Khazar Nature Reserve

(4) Organization Structure and Role of Ministry of Nature Protection

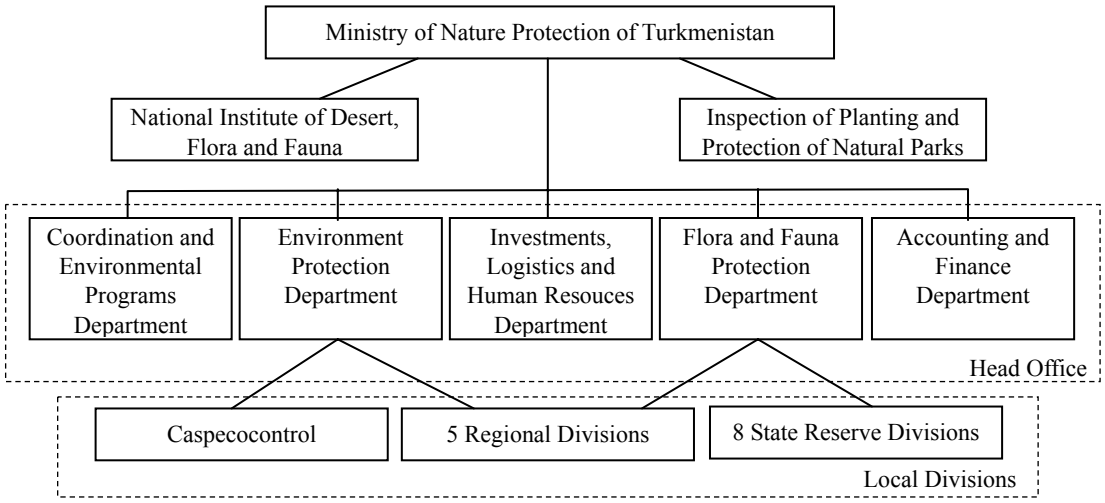
Ministry of Nature Protection is the main government agency that pursues environmental policy, implements ministerial control and coordination of the activities in the area of natural resources use and protection (quoted from "National Environmental Action Plan"). As shown in the organization chart (Figure 3.7.2), the head office presides over a number of local divisions.

There are three local divisions around Tukmenbashi port: Caspecocontrol (Caspian Ecological Service), Balkan regional division and Khazar Nature Reserve. Caspecocontrol has responsibility for the Caspian Sea environment and the coastal area within 2 km from the sea. It monitors

environmental conditions regularly and inspects pollution such as oil spills and wastes from vessels. The area beyond 2 km from the sea is the responsibility of the Balkan regional division which also conducts monitoring and general control of environmental issues. Khazar Nature Reserve division is in charge of managing the reserve.

Demarcation of the roles of each division which may be involved in the Turkmenbashi port project is shown in Table 3.7.3. In the EIA process, Environment Protection Department of the head office reviews and approves the EIA in the case of state projects including international projects, while Caspecocontrol and Balkan regional division are responsible for local projects. Therefore, EIA for the Turkmenbashi port project will be a matter for the head office.

Both Caspecocontrol and Balkan regional division are conducting environmental monitoring regularly to inspect environmental conditions. The monitoring items conducted by each division are summarized in Table 3.7.4. Both divisions have their own laboratory for chemical analysis of collected samples. Also, Caspecocontrol mentioned that they often undertake specific surveys related to development projects such as for EIA. For example, water and sediment analysis including heavy metals in the sediment was carried out by Caspecocontrol for the previous TRACECA study in 2007.



Source: Ministry of Nature Reserve

Figure 3.7.2 Organization Chart of the Ministry of Nature Protection

Table 3.7.3 Demarcation of the Responsibilities of Each Division of the Ministry of Nature Protection

Responsibility \ Divisions			Head office	Local Divisions		
				Caspecocontrol	Balkan regional division	Khazar Nature Reserve
EIA	State project		X			
	Other projects	Projects in or within 2km from the Caspian Sea		X		
		Projects inland over 2kim from the sea (in Balkan region)			X	
Environmental monitoring		Projects in or within 2km from the Caspian Sea		X		
		Projects inland over 2kim from the sea (in Balkan region)			X	
Management of the nature reserve						X

Source: Interviews to the divisions of Ministry of Nature Reserve

Table 3.7.4 Regular Monitoring Items Conducted by the Ministry of Nature Protection

Monitoring items \ Divisions	Caspecocontrol	Balkan regional division
Air quality	X	X
Water quality (ambient water)	X	
Water quality (potable water)		X
Sediment quality	X	
Plants and animals		X

Source: Interviews with the divisions of Ministry of Nature Reserve

3.7.2 Environmental Impacts by Development of Turkmenbashi Port

(1) Environmental Conditions

1) General

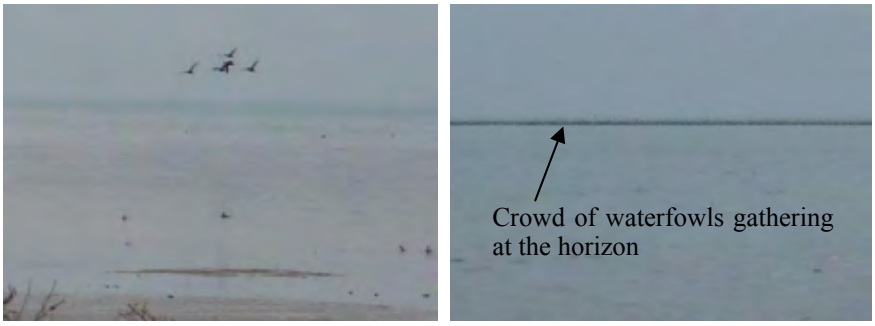
Turkmenbashi Bay is characterized by shallow morphological features. As the bay is separated from the Caspian Sea by the spit, inside the bay it is basically very calm. Most of the area is muddy flat, but not a 'tidal flat' because of the small tidal change in the Caspian Sea.

Most of the bay area is designated as part of the Khazar State Nature Reserve except the northwestern part including Turkmenbashi port. One of the most attractive species found in the Reserve is the waterfowls which migrate and stay at the Reserve during the winter season from October to March. Of the 372 species of birds observed here, almost half are waterfowls and near-water birds (TRACECA study report). According to the Khazar Nature Reserve Division, the habitat of the waterfowls extends also to coastal area between the port and Ufra terminal.

The Reserve also provides a habitat for fish including five endangered species registered in the Red Data Book of Turkmenistan (TRACECA study report). Some fish species including vobla,

mullet, bullhead and herring breed inside the bay. According to the Reserve division, fish concentrate along the northern coast of the bay during spring and summer.

Seagrass and seaweed beds are also widely distributed throughout the bay according to the Reserve division.



Waterfowls Observed in the Reserve

Seagrass Bed Observed near the Port

2) Water Quality

The water quality in the bay is generally in good condition. The previous survey results in 2002 indicated that ammonium nitrogen and nitrites, which can cause eutrophication, were lower than the maximum permissible concentration for fishery in Turkmenistan (Table 3.7.5). BOD (Biochemical Oxygen Demand) exceeded the criteria; however, it was not critically high. Concentration of suspended matters was recorded as 2.8 mg/l in the previous data, while it ranged between 1 to 6 mg/l in another TRACECA study conducted in 2007. Suspended matters may increase in accordance with the wave and current conditions because of the shallowness of the bay. In addition, it should be noted that levels of oil products and phenol exceed the maximum permissible concentration.

Table 3.7.5 Water Quality in the Bay Measured by Caspecocontrol and Maximum Permissible Concentrations for Fishery

(Unit: mg/l)

Parameters	Previous Survey Results in 2002	Maximum Permissible Concentrations / Criteria	Remarks
Oxygen	8.1	> 6.0	
BOD_5 (Biochemical Oxygen Demand)	2.4	< 2.0	
Suspended matters	2.8	+0.25 above pond waters	1-6mg/l in the TRACECA EIA study in 2007 (dep.0.5m)
Ammonium nitrogen	0.11	< 0.5	
Nitrites	0.18	< 0.08	
Oil products	0.073	< 0.05	
Phenols	0.003	< 0.001	

Source: TRACECA study report (EIA for Navigation Channel for Turkmenbashi Port)

3) Sediment Quality

Sediment contamination with harmful substances was examined through TRACECA EIA study conducted in 2007 which measured contamination at 47 points in the navigation channel and 3 points at the disposal site located west of the spit. Also, another previous survey in the navigation channel had been conducted in 1990 and summarized in the TRACECA EIA report.

Turkmenistan does not have criteria for sediment contamination; therefore, those above survey results are compared with the other countries' criteria for ocean dumping (Table 3.7.6). In the TRACECA study in 2007, all of the measured parameters satisfied European criteria. However, the previous data collected in 1990 shows that the concentration of Cadmium, Copper and Nickel exceeded at least one country's criteria (guideline or mandatory). Therefore, careful assessment is required for disposal of dredged materials.

Table 3.7.6 Comparison between Previous Survey Results and Criteria on Sediment Contamination with Harmful Substances for Ocean Dumping

(Unit: mg/kg)

Parameter	Measured maximum concentration		Criteria for ocean dumping in European countries								
	in 2007	in 1990	Belgium		Germany		Spain		Netherland	United Kingdom	
			Guideline	Mandatory	Guideline	Mandatory	Guideline	Mandatory	Mandatory	Guideline	Mandatory
Cadmium	0	ND	2.5	12.5	2.5	12.5	1.0	5.0	4	0.4	5
Chromium	-	**130.7**	60	300	150	750	200	1000	120	-	-
Copper	15.73	**25.7**	20	100	40	200	100	400	60	40	400
Mercury	0	0.1	0.3	1.5	1.0	5.0	0.6	3.0	1.2	0.3	3
Nickel	5.92	**26.3**	70	350	50	250	100	400	45	20	200
Lead	3.55	-	70	350	100	500	120	600	110	50	500
Zinc	0	ND	160	800	350	1750	500	3000	365	130	800
Arsenic	-	ND	20	100	30	150	80	200	29	-	-
Mineral oil	10.1	-	-	-	300	1000	-	-	1250 1500	-	-

ND: not detected, -: no data

Source: TRACECA study report (EIA for Navigation Channel for Turkmenbashi Port) and references for each country's criteria

4) Air Quality

In the Korean study, concentration of particulate matter in the air was measured at three survey points around the port. As shown in Table 3.7.7, particle matter smaller than 10 μ m (PM-10) satisfies the guideline of World Health Organization (WHO) although particle matter smaller than 2.5 μ m (PM-2.5) exceeds the criteria. In general, construction activities produce coarse particles larger than 2.5 μ m, while finer particles smaller than 2.5 μ m (PM-2.5) originate from combustion sources. Therefore, appropriate measures are required for construction works to keep satisfying the guideline on PM-10.

Table 3.7.7 Air quality around the port

(Unit: μ g/m^3)

Survey points Parameters	**Measured air quality**			**WHO guidelines for 24-hour mean**
	A-1 (Port area)	**A-2 (Port area)**	**A-3 (Residential area)**	
PM-10	37	40	30	50
PM-2.5	32	36	26	25

Source: KOICA study report and WHO air quality guidelines

5) Noise and Vibration

Noise and vibration levels are generally low around the port.

Measured noise levels recorded in the Korean study were slightly higher at the roadside; however, they were lower compared with the criteria of WHO for industrial and commercial areas (Table 3.7.8). Vibration levels were far below the standards of Japan.

Table 3.7.8 Noise around the port

(Unit: dB(A))

Survey points	Average of four measurements during daytime (6:00-22:00)	WHO guidelines during daytime (7:00-22:00)
NV-1 (Roadside)	57.6	55 (Residential area) 70 (Industrial / Commercial area)
NV-2 (Roadside)	66.6	
NV-3 (Residential area)	50.2	

Source: KOICA study report and WHO guidelines for community noise.

Table 3.7.9 Vibration around the port

(Unit: dB(V))

Survey points	Average of four measurements during daytime (6:00-22:00)	Standard of Tokyo Metropolitan District during daytime (6:00-22:00)
NV-1 (Roadside)	26.4	55 (General in residential area) 60-65 (Roadside in residential area)
NV-2 (Roadside)	33.6	
NV-3 (Residential area)	24.9	

Source: KOICA study report and Tokyo Metropolitan District

6) Fishery

According to the State Committee of Fish Industry, local people are carrying out small scale fishing activities in the northwestern part of Turkmenbashi Bay, outside of the Khazar Nature Reserve. They are catching mullet, herring, bullhead and crayfish for self-consumption mainly by set net using motorboats and canoes. The number of motorboats registered in Turkmenbashi for fishing and the other purposes such as leisure is 60.

There is no commercial fishing activity inside Turkmenbashi Bay. 'Balkanbalyk', a local organization of the State Committee which has a fisherman's wharf next to the Turkmenbashi Port, is catching sprat outside Turkmenbashi Bay, 20 miles away from the coast. Currently their fleet goes out of the bay through the navigation channel; however, they have a plan to relocate their wharfs outside of the bay. Number of employees of Balkanbalyk is 492 of which 290 are working in the fleet. They process collected fish in their factory in Turkmenbashi into products such as smoked fish and canned fish. Their products account for 50% of the total sprat production of the State Committee.

3.8 Debt sustainability of Turkmenistan after the implementation of the development project in Turkmenbashi port

In this chapter, debt sustainability of Turkmenistan after the implementation of the development project in Turkmenbashi port is analyzed based on the macro-economic data gathered in the study..

3.8.1 Macro economy of Turkmenistan

(1) Outlook of Turkmen Economy compared with other Central Asian Countries

Central Asian countries became independent without experiences of the market economy. Each country experienced economic difficulty soon after the independence and has recovered from the difficulty. During the period of nineteen years, economic situation of the region has been diversified.

The followings are the outlook of current situation of Turkmen economy compared with five nations in Central Asia.

1) Classification by income

According to the World Bank, a country of which GNI per capita in 2008 is 975 USD or under is classified as an a low income country; between 976 USD to 3,855 USD as a lower middle income country; between 3,856 USD to 11,905 USD as a upper middle income country.

Table 3.8.1 shows economic situations of Central Asian countries. The GNI per capita in Turkmenistan is 3,620 and falls into the lower middle income country. The GNI per capita in Turkmenistan is the third largest in the region after Kazakhstan and Azerbaijan.

Table 3.8.1 GNI per capita in Central Asian countries

	GNI (bn USD)	Population (million)	GNI per capita (USD)	Classification
Kazakhstan	96.7	15.7	6,140	Upper middle income
Azerbaijan	33.2	8.7	3,660	Lower middle income
Turkmenistan	14.3	5.0	3,620	Lower middle income
Uzbekistan	24.7	27.3	900	Low income
Kyrgyz	4.2	5.3	780	Low income
Tajikistan	4.1	6.8	702	Low income

Source：World Bank「Country Brief 2009」

2) GDP

Below description shows economic growth of each country in recent ten years. Under the Soviet system, only specific areas of the industry such as natural resources and cotton were developed in Central Asia. Many Russian who had administrative and technological knowledge went back to their homeland after the independence. And the facilities became deteriorated. Thus the competitiveness of the Central Asia industry was lost and the dependence of Russia continued more or less.

Nevertheless, oil and gas producing countries such as Kazakhstan, Azerbaijan, Uzbekistan and Turkmenistan experienced steady economic growth since 2003 by the world wide increase of

demands for oil and gas. This widened the gap between OG producing countries and others.

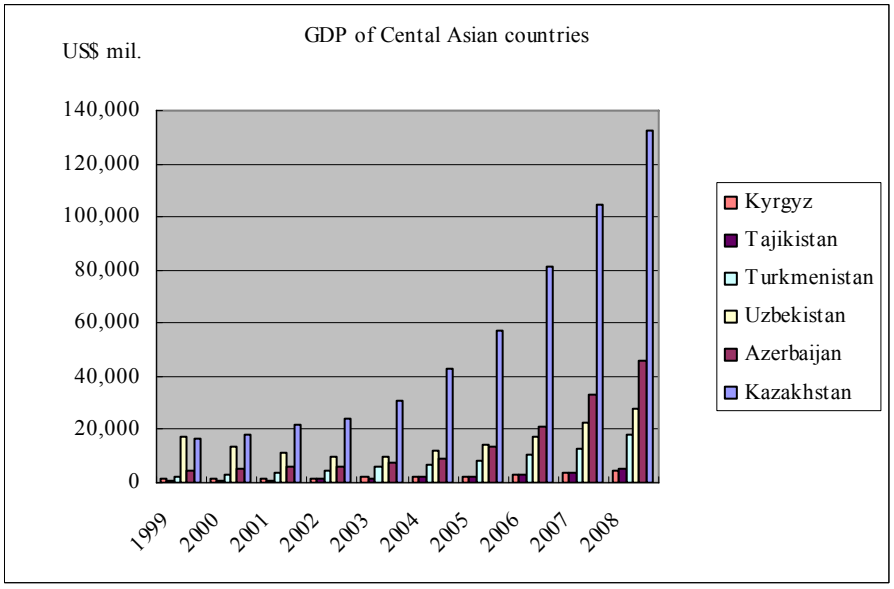
Table 3.8.2 and Figure 3.8.1 show the historical change of GDP of Central Asian countries from 1999 to 2008.

Table 3.8.2 GDP of Central Asian countries from 1999 to 2008.

(Unit:US$ mil.)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Kazakhstan	16,871	18,292	22,153	24,366	30,834	43,152	57,124	81,003	104,853	132,229
Azerbaijan	4,581	5,273	5,708	6,236	7,276	8,680	13,245	20,982	33,050	46,259
Uzbekistan	17,078	13,760	11,401	9,688	10,134	12,030	14,605	17,178	22,311	27,918
Turkmenistan	2,451	2,905	3,535	4,462	5,978	6,837	8,102	10,496	12,933	18,269
Tajikistan	1,087	980	1,104	1,238	1,554	2,076	2,312	2,811	3,712	5,134
Kyrgyz	1,249	1,370	1,525	1,606	1,919	2,212	2,460	2,818	3,745	4,420

Source：World Bank "World Development Indicators 2009"



Source：World Bank "World Development Indicators 2009"

Figure 3.8.1 GDP of Central Asian countries from 1999 to 2008.

3) Growth of Private sector

The GDP growth of Kazakhstan is outstanding in the region because the market economy was introduced for the first place in the region and the industry has been diversified to non-OG sectors. For the independence of the Central Asian economy from heavily dependent to Russia, introduction of market economy and development of competitive private sector are crucial.

Table 3.8.3 shows the ratio of private economy in each Central Asian countries.

Table3.8.3 Ratio of private economy in each Central Asian countries

(Unit：million USD)

	Ratio of Private Sector in GDP	Ratio of Private Sector in employment
Kazakhstan	70.0%	76.0%
Azerbaijan	75.0%	67.0%
Uzbekistan	45.0%	n/a
Turkmenistan	25.0%	n/a
Tajikistan	55.0%	n/a
Kyrgyz	75.0%	80.3%

Source：EBRD ”Transition Report 2009”

The ratio of private sector in GDP in Turkmenistan is the lowest in above-listed six countries. Thus, private sector in Turkmenistan is the least developed.

4) Foreign direct investment

Together with the development of private sector, FDI is crucial as leverage of economic growth. The amount of FDI in Azerbaijan increased since 2002 and widened the gap to Turkmenistan. This was mainly contributed by the policy which encouraged OG investors from United States and Europe.

Table 3.8.4 shows FDI in each Central Asian countries from 1999 to 2007.

Table 3.8.4 FDI in each Central Asian countries from 1999 to 2007（Net Inflow）

（US$ mil.）

	1999	2000	2001	2002	2003	2004	2005	2006	2007	Total
Kazakhstan	1,587	1,283	2,835	2,590	2,092	4,157	1,971	6,278	10,189	32,982
Azerbaijan	510	130	227	1,392	3,285	3,556	1,680	-584	-4,749	5,447
Uzbekistan	121	75	83	65	70	187	88	195	262	1,146
Turkmenistan	125	126	170	100	100	-15	62	731	804	2,203
Tajikistan	7	24	9	36	32	272	54	339	360	1,133
Kyrgyz	44	-2	5	5	46	175	43	182	208	706

Source：World Bank ”World Development Indicators 2009”

Though FDI in Turkmenistan increased to 730 million USD from 62 million USD in the previous year, the amount of FDI in Turkmenistan is still far behind that in Azerbaijan.

In 1999 FDI in Uzbekistan was larger than that in Turkmenistan, however the increase in recent ten years was rather small because of the unstable political situation.

(2) Macro economic trends in Turkmenistan

In this section, macro economic trends in Turkmenistan are analyzed based on the data issued by international financial organizations and the information provided by the Government of Turkmenistan.

1) Composition of GDP（expenditure side）

Data on domestic demands (private consumption expenditure, public consumption expenditure and investment), external demands (net exports of goods and services), which compose expenditure side of GDP, are available in the publications of international financial organizations. Table 3.8.5 and Figure 3.8.2 show these data and GDP growth rate in past nine years. The largest GDP growth of 41.3% was recorded in 2008. The average growth rate in nine years is 25.3%.

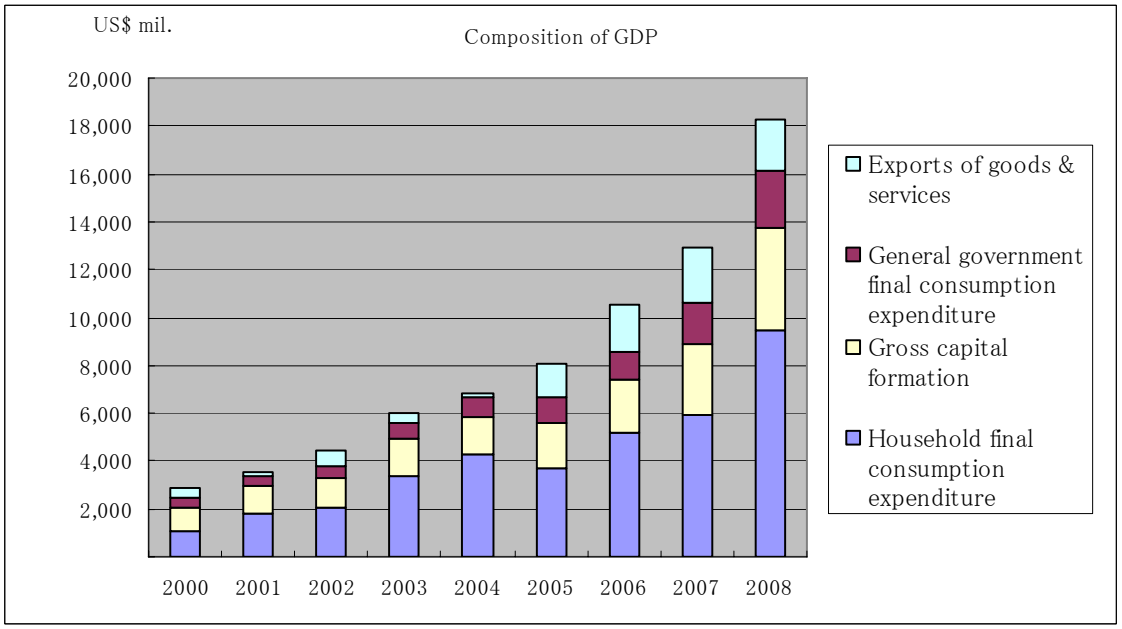
The YoY increase rate of gross domestic capital formation in 2008 was 44.8%. This accounts for rapid increase of investment in infrastructure development. The large YoY increase of 59.5% was also recorded in private final consumption expenditure in the same year.

Table 3.8.5 Composition of GDP (expenditure side) and GDP growth rate

（Unit：million USD）

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Private final consumption expenditure	1,060	1,850	2,039	3,398	4,248	3,745	5,172	5,946	9,485
Government final consumption expenditure	413	404	495	720	868	1,073	1,189	1,680	2,361
Gross domestic capital formation（investment）	1,009	1,121	1,230	1,519	1,576	1,887	2,236	2,973	4,301
Net exports of goods and services	423	160	698	341	145	1,398	1,899	2,327	2,123
Total（＝GDP)	2,905	3,535	4,462	5,978	6,837	8,102	10,496	12,926	18,269
GDP growth rate	18.5%	21.7%	26.2%	34.0%	14.4%	18.5%	29.5%	23.2%	41.3%

Source：World Bank ”World Development Indicators” (reorganized by OCDI)



Source：World Bank ”World Development Indicators” (reorganized by OCDI)

Figure 3.8.2 Composition of GDP

2) Trade balance

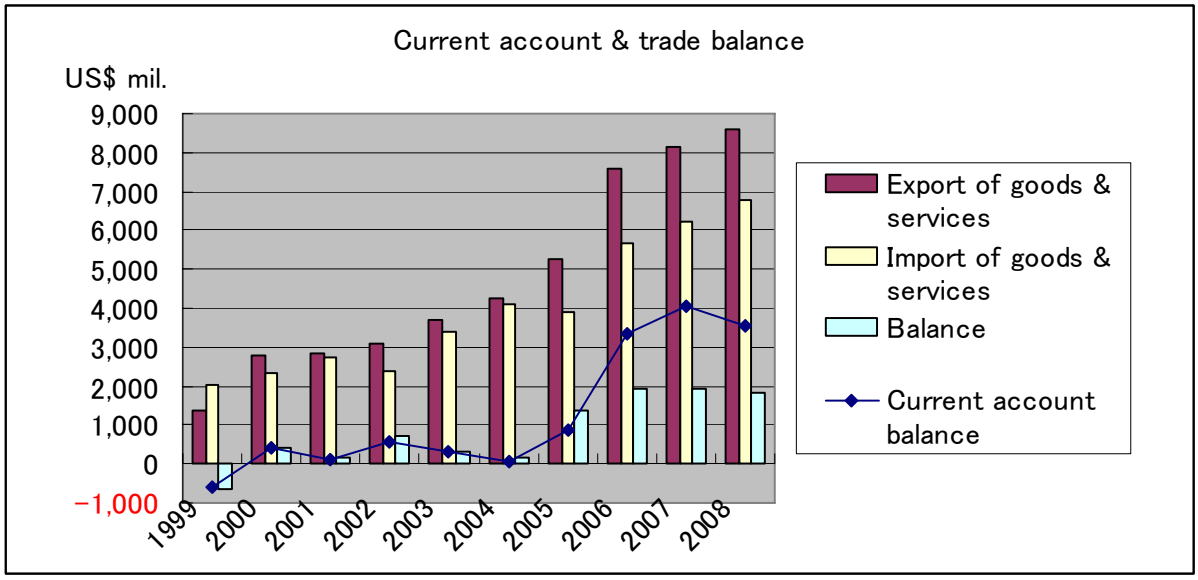
Table 3.8.6 shows current account balance and trade balance of goods and services. In 1998 both current account balance and trade balance were in the red. In 2008 the trade recorded the surplus of 1.8 billion USD and the current account recorded the surplus of 3.6 billion USD. The average annual growth rate of export is 25.5%.

Table 3.8.6 Current account balance and trade balance

(unit: US$ mil.)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Current account balance	-571	411	116	583	305	82	877	3,347	4,036	3,560
Export of goods & services	1,372	2,788	2,863	3,079	3,706	4,239	5,267	7,607	8,144	8,587
Import of goods & services	2,034	2,353	2,722	2,365	3,407	4,102	3,889	5,654	6,205	6,760
Balance	-662	435	141	714	299	137	1,378	1,953	1,939	1,827
Increase of exports		103.2%	2.7%	7.5%	20.4%	14.4%	24.3%	44.4%	7.1%	5.4%

Source：World Bank ”World Development Indicators” and EBRD “Transition Report 2009”



Source：World Bank ”World Development Indicators” and EBRD “Transition Report 2009”

Figure 3.8.3 Current account balance and trade balance

3) Data provided by the government of Turkmenistan

In Turkmenistan, the availability of data on macro economy is very limited. It is very difficult to understand actual situation of the economy and fiscal structure. The Consultant requested to the Government of Turkmenistan to provide macro economic data, however most of the request was declined. It is doubtful that the obtained data complied with the international standards of 93SNA. The table below shows the obtained macro economic data.

Table 3.8.7 Macro economic data provided by GOT

Data requested to GOT (for last 10 years, international standard format)		Data Provided by GOT
GDP	GDP in current prices	
	Real GDP	○
	GDP purchasing power parity	○
	GDP by industrial sector	
	Household final consumption expenditure	
	Government final consumption expenditure	
	Gross capital formation	
	Gross savings	
	Price index	○
Public Finance	Revenues（with breakdown by source）	△(only total amount, 2007-2009)
	Expenses（by sector）	△(only total amount, 2007-2009)
	Investment expenses（by sector）	
	Funds operated by government（by sector）	
Balance of Payments	Current account balance	
	Export/import goods & services	△(merchandise only)
	Top 20 commodities for export/import (latest year)	
	Top 20 countries for export/import (latest year)	
	Income account	
	Unilateral transfers	
	Financial account	
	Capital account	
	Foreign currency reserves	
	External debt	
	FDI	
	Disbursement of ODA	
Monetary Policy	Long-term interest rate	
	Short-term interest rate	
Development Plan	Full detail of "The Strategy of Economic, Politic, & Cultural Development of Turkmenistan up to Year 2030"	
	Full detail of "Oil & Gas Industry Development Program up to Year 2030"	
	Annual investment plan	

Responding to the request from international financial organizations such as IMF, the Government of Turkmenistan is standardizing macro economic data little by little. It is expected that the transparency of macro economic situation would improved in the future.

The description below is based on the data provided by the Government of Turkmenistan.

i) Real GDP

Table 3.8.8 shows the country's real GDP in past 10 years obtained from The State Committee of

Statistics of Turkmenistan. Real GDP is observed to have made 10 times more growth in 10 years. The most remarkable growth was achieved in 2008, with as much as 62% increase from the previous year. The average growth rate in ten years is as much as 30.9%. We couldn't verify whether those statistics figures conform to international standards, as real GDP & GDP deflator are not available in WB and any other financing institutes.

Table 3.8.8 Real GDP of Turkmenistan

(unit: US$ mil.)

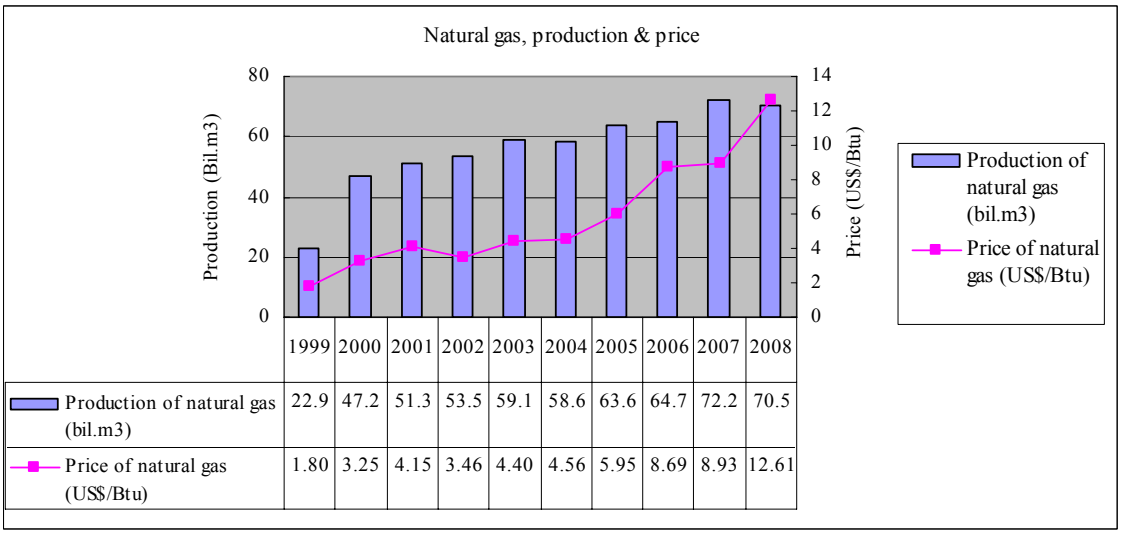
Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Amount	1,407	1,833	2,530	3,175	4,169	5,180	6,267	7,807	9,474	15,327

Source: The State Committee of Statistics of Turkmenistan, converted to US$ by OCDI at TMM2.85/US$.

Just like the other Central Asian countries, Turkmenistan experienced a sharp fall in GDP following independence. GDP for 1997 fell down to 60% of that for 1990. Since 1998, however, the economy has increased steadily and inflation has remained low because of tight monetary control and an extensive subsidy for basic consumer goods (source: ADB web site). The figures in Table 3.8.8 represents the passage of Turkmen economy from the bottom of post-independence to the highest growth in 2008.

According to The State Committee of Statistics of Turkmenistan, natural gas production has increased as much as 3 times in 10 years from 22.9 billion m3 in 1999 to 70.5 billion m3 in 2008. As EU CIF gas price has soared 7 times from US$1.8/Btu (British Thermal Unit) in 1999 to US$12.61/Btu in 2008 (source: Japan Oil, Gas and Metals National Corporation), the gas sales in Turkmenistan seems to have marked a drastic increase with multiplier effect of the increase in production volume and selling price, pushing up real GDP figures.

Figure 3.8.4 shows the production volume and EU market price index of natural gas



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Production of natural gas (bil.m3)	22.9	47.2	51.3	53.5	59.1	58.6	63.6	64.7	72.2	70.5
Price of natural gas (US$/Btu)	1.80	3.25	4.15	3.46	4.40	4.56	5.95	8.69	8.93	12.61

Figure 3.8.4 Natural gas, production of Turkmenistan & EU price index

ii) Trade balance

Table 3.8.9 shows the trade balance in past 10 years based on the figures provided by The State Committee of Statistics of Turkmenistan. In the table "Exports" denotes merchandise exports and "Import" denotes merchandise imports.

Export has made growth more than 10 times in past 10 years with contribution of hydrocarbon earnings. The export accounts for 78% of real GDP in 2008. Trade balance has been in strong surplus especially since 2006 which must allow the country to accumulate its foreign reserves rapidly. The exports of oil and gas products account for 90 % of the total exports.（The World Bank's Country Brief 2009）

Table 3.8.9 Trade balance of Turkmenistan

（Unit: US$ mil.）

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Exports	1,187	2,506	2,620	2,856	3,632	3,870	4,939	6,724	8,932	11,945
Imports	1,478	1,785	2,349	2,119	2,512	3,320	3,638	3,290	4,442	5,707
Balance	-291	721	271	736	1,120	550	1,301	3,434	4,490	6,238

Source：The State Committee of Statistics of Turkmenistan

iii) Fiscal balance

Table 3.8.10 shows the state budget balance in recent 3 years, while the figures might be different from actual result. The fiscal balance for 2008 amounted to US$1.6 billion, however in 2009, it decreased to US$0.6 billion as the expenditures increased at as much as 88% from the previous year. It is presumed that vital investment was made in 2009 to develop various infrastructures.

Table 3.8.10 State budget balance in Turkmenistan

（Unit：US$ mil.）

	2007	2008	2009
Income	1,644	3,537	4,129
Expenditures	1,273	1,886	3,552
Balance	370	1,651	577

Source: Ministry of Finance, converted to US$ by OCDI at TMM2.85/US$

Besides the official state budget above, some large scale of fiscal operations are said to be running with the revenue mainly from hydrocarbon sectors. This will be discussed later.

4) Result of IMF Article IV consultation in 2009

i) Background

Strong fiscal and external balances have kept Turkmenistan relatively protected from the global economy crisis. Real GDP growth was supported by large by large public investments in construction and infrastructure and high activity in transportation, communication and retail. Inflation peaked at 18.9% in July 2008, due to government's adjustment of prices and some

impact of the May 2008 unification of the exchange rate. for petroleum and transportation. However it moderated to 9 percent by year-end. The current account surplus continued to expand, reaching 18.75% of GDP in 2008.

ii) Foreign exchange, financing

Exchange rate unification was completed on May 1, 2008. Manat redenomination at 1/5,000 was implemented on January 1, 2009. Directors welcomed those progresses made by the Central Bank of Turkmenistan. Directors supported the authorities' intention to maintain the existing peg to the U.S. dollar in the near term, while keeping exchange rate policy under review. Greater flexibility could be considered as structural and macroeconomic reform progress. The authorities took initial steps at financial sector reforms. IMF encouraged authorities for further liberalization of banking activities and enhancement of independence of the CBT.

iii) State budget

Stuff estimates that a large positive balance from off-budget operations brought the overall fiscal surplus to about 1/3 of GDP. Directors welcomed the ongoing budget reform with EU assistance and stressed the importance of consolidating all government's operations in the national budget to improve budget execution and transparency and to enhance accountability in hydrocarbon revenue management and long-term fiscal sustainability. In October 2008, authorities created the Stabilization Fund where state budget surplus will be accumulated. The fund's priorities and functions are still being elaborated.

iv) Macroeconomic statistics

While welcoming the improvements in macroeconomic statistics, Directors noted that remaining weaknesses in national accounts and in the coverage of fiscal data continue to hamper surveillance. They recommended further improvements in these areas and called for wider public availability of economic and financial data.

5) Government's policy for developments and industries

Following is observed based on the knowledge obtained in the study.

i) Private sector

In Turkmenistan, major industries including hydrocarbon sector are still state-owned, having just made a first step for diversification. In February 2008, the president announced the policy to increase the share of private sectors in non-hydrocarbon from current 40% to 70% by the year 2020. The new constitution adopted in October 2008 recognizes the concept of market economy with private property and independent enterprises for the first time in Turkmenistan. It requires the state to affirm the right to own private property such as means of production, land and other material and intellectual items of value, and to support private enterprise.

The decree to encourage entrepreneurship and small-scale business was enacted, giving 5% of annual crediting for 10 years term for purchasing fixed assets. The government's policy of privatization so far seems focused on enlargement of existing small business sectors or privatization of small-scale state-owned business.

ii) Hydrocarbon sectors and Foreign Direct Investment

According to the Ministry of Oil, Gas & Mineral Resources, an agreement on increasing the sales price of gas to bring it in line with the international market level was reached with Russia in September, 2009. Current gas production with existing facilities is said to be only 30% of the potential productive capability of the entire nation. With strategic diversification of gas export routes to China and neighboring countries, hydrocarbon industries will continue to be a strong driving force behind the country's economic growth.

It is the government's policy on the newly concluded contracts with hydrocarbon buyers that the buyers shall finance the investment costs for production facilities by means of foreign direct investment (FDI). EBRD estimated that FDI for 2009 would be US$ 1.3 billion, a 65% increase from US$ 0.8 billion for 2008 (EBRD Transition Report 2009). This remarkable increase of FDI represents the country's strong bargaining power in attracting foreign buyers. As far as this scheme is working, the government will be free from financial burden on the increasing production facilities.

iii) Investment for infrastructures

Turkmenistan has large needs of investment, as the old infrastructures built in Soviet Union era such as railways and roads need to be rehabilitated, also rural infrastructures remain undeveloped. Installation of pipelines is a strategic agenda of the government in view of diversification of gas exports.

According to Ministry of Economy & Development, the government will continue to make aggressive investment in basic infrastructures such as railways, roads, pipelines and rural development for the years ahead in line with the state's development target of "The Strategy of Economic, Politic, and Cultural Development of Turkmenistan for the Period up to Year 2030". Detailed contents and budget of yearly investment plan was not disclosed.

iv) Stabilization Fund

As stated in 4) IMF IV consultation, the government established the "Stabilization Fund" in October 2008 as a part of budget reform, where state budget surplus such as foreign exchange revenues will be accumulated. According to the Ministry of Finance, current reserve of the fund amounts to US$ 3 billion. The fund is said to be used in the short-term to mitigate the impact of the global economic crisis, then in future, be used for investments in infrastructure, education and health, though clear rules have yet to be published.

3.8.2 Debt Sustainability analysis on Turkmenistan

(1) Current Status on External Debt

1) External debt stock

Total external debt exceeded GDP in 1999 but has been steadily reduced since then, down to 5.7% in GDP in 2007. Table 3.8.11 and Figure 3.8.5 show the amount of external debt stock in past 9 years.

Table 3.8.11 External debt stock

(Unit：US$ mil.)

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total external debt	2,636	2,518	2,271	1,975	1,743	1,522	1,058	881	739

Source：World Bank "World Economic Indicators 2009", The State Committee of Statistics of Turkmenistan

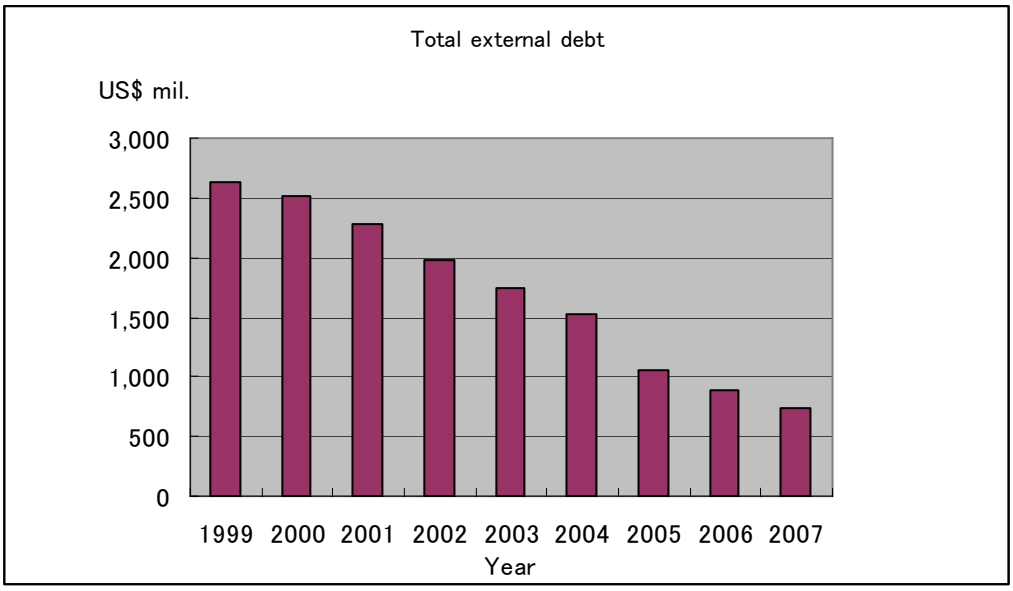


Figure 3.8.5 External debt stock

2) Comparison with Central Asian countries

Table 3.8.12 shows the comparison of total external debt for 2007 among Central Asian countries. Turkmenistan has the best scores among those 6 countries in every key indicator.

Table 3.8.12 Key indicators of external debt among Central Asian countries in 2007

	External debt				Debt service ratio	Present value of debt
	Long term (mil. US$)	Short term (mil. US$)	Total (mil. US$)	% of GNI		% of exports of goods, services & income
Turkmenistan	650	89	739	5.9%	3.9%	10.0%
Kazakhstan	84,388	11,745	96,133	103.7%	33.2%	218.0%
Azerbaijan	1,994	1,074	3,068	11.7%	0.8%	16.0%
Uzbekistan	3,680	191	3,871	17.3%	8.0%	51.0%
Kyrgyz Republic	2,325	76	2,401	65.0%	4.4%	65.0%
Tajikistan	1,152	76	1,228	34.0%	13.2%	33.0%

Source：World Bank "World Economic Indicators 2009", EBRD「Transition Report 2009」

3) Public debt

As private bank & industrial sectors dealing with foreign countries are not developed and financing from foreign countries is restricted in Turkmenistan external debt of private sectors is negligible small. According to WB's "World Development Indicators 2009", public debt for year 2007 amounts to US$ 648 million (99.7%) out of US$ 650 million of total long-term external debt. External debt of private sector (without government guarantee) is only USD 2 million.

4) Sovereign guarantee

Sovereign guarantee was furnished to all finance arrangements made by WB and EBRD before.

(2) Purpose and Method of Debt Sustainability Analysis

1) Purpose of debt sustainability analysis and definition of debt sustainability

Purpose of debt sustainability analysis is to examine ODA eligibility of a country in terms of financial soundness.

A country may be considered to achieve external debt sustainability when it is able to meet its current and future external debt-service obligations in full, without recourse to debt relief, rescheduling, or the accumulation of arrears.

2) Method of debt sustainability analysis

"The Debt Sustainability Framework for Low-Income Countries (DSF)" provided by IMF is widely used for the practical approach to debt sustainability analysis. This analysis applies the indicators in line with DSF provisions.

DSF gives 3 indicative thresholds for each debt burden indicator with respect to exports, GDP and revenues as follows.

	Present value of debt in percent of			Debt service in percent of	
	Exports	GDP	Revenue	Exports	Revenue
Weak Policy	100%	30%	200%	15 %	25 %
Medium Policy	150%	40%	250%	20 %	30 %
Strong Policy	200%	50%	300%	25 %	35 %

In this analysis, thresholds for Weak Policy shall be applied, as those are on the most conservative side. The debt should be sustainable only in case the country conforms to all 5 conditions below.

1) PV of debt-to-exports ratio is within 100%
2) PV of debt-to-GDP ratio is within 30%
3) PV of debt-to-revenues ratio is within 200%
4) Debt service-to-exports ratio is within 15%
5) Debt service-to-revenues ratio is within 25%

We shall examine how much amount of new loan the country can take in a future year provided above 5 conditions are all satisfied.

(3) Calculations of Debt Sustainability

1) Assumption

Following assumptions are applied to the calculations.

Interest	7% p.a. compound	
Loan period	20 years	
Repayment	Equal monthly payments with interest	
Discount rate for PV calculation	10%	
Increase rate of export, GDP & government revenues	2008～2013	8.0%
	2014～2023	6.0%
	2024～2030	3.0%

As shown in Table 3.8.11, Turkmenistan's PV of debt-to-exports ratio for 2007 is 10%; 1/10 of the threshold. Hence the country is doubtlessly deemed debt-sustainable at this moment.

To make calculations easier, the objective debt for analysis is limited to the new loans only. The new loan for each year is assumed to be the same amount with same condition throughout the period from 2011 to 2030.

US$ 8,587 million of exports goods & services and US$ 3,537 million of budget income for 2008 are used as the base of forecast simulation.

2) Result of calculations

i) PV of debt

PV of debt-to-exports, GDP and revenues shall be calculated for the 3 points of time; year of

2020, 2025 & 2030 respectively.

a) Year 2030

In case the loan amount p.a. exceeds **US$ 1,116 million**, PV of debt-to-GDP ratio for 2030 shall exceed the threshold of 30%. However in this case, PV of debt-to-exports ratio shall be 63.8%, not reaching the threshold of 100%. PV of debt-to-revenues shall be 132.7%, not reaching the threshold of 200％ also.

PV of debt	12,100		
	Exports	GDP	Revenue
Amount	18,971	40,362	9,122
Result	**63.8%**	**30.0%**	**132.6%**
Thresholds	100.0%	30.0%	200.0%

b) Year 2025

In case the loan amount p.a. exceeds **US$ 1,575 million**, PV of debt-to-GDP for 2025 shall exceed the threshold of 30%. However in this case, both PV of debt-to-exports and PV of debt-to-revenues shall not reach the thresholds.

PV of debt	15,279		
	Exports	GDP	Revenue
Amount	23,971	51,000	11,526
Result	**63.7%**	**30.0%**	**132.6%**
Thresholds	100.0%	30.0%	200.0%

c) Year 2020

In case the loan amount p.a. exceeds **US$ 1,680 million**, PV of debt-to-GDP for 2020 shall exceed the threshold of 30%. However in this case, both PV of debt-to-exports and PV of debt-to-revenues shall not reach the thresholds.

PV of debt	12,101		
	Exports	GDP	Revenue
Amount	18,971	40,362	9,122
Result	**63.8%**	**30.0%**	**132.7%**
Thresholds	100.0%	30.0%	200.0%

ii) Debt service

Debt service-to-exports ratio and debt service-to-revenues ratio shall be calculated at the point of time for 2030 when debt service comes to the maximum amount within 20 years period from 2011 to 2030.

In 2030, in case the loan amount p.a. exceeds **US$ 1,770 million,** debt service-to-revenues shall exceed the threshold of 25%. Debt service-to-exports shall be 12.0%, not reaching the threshold of 15.0%.

Debt service	3,342	
	Exports	Revenue
Amount	27,789	13,362
Result	**12.0%**	**25.0%**
Thresholds	15.0%	25.0%

iii) Conclusion

As shown in the calculations in i) and ii) above, if the loan amount p.a. is below US$ 1,116 million, all debt indicators shall never reach any thresholds. Therefore, if the amount of loan is kept within US$ 1,116 million p.a., Turkmenistan shall be debt-sustainable for future 20 years period.

The loan amount for ODA needs to be determined with reference to this result.

Table 3.8.13 shows the debt service matrix in case the loan amount p.a. is US$ 1,116 million.

Table 3.8.13 Shows the debt service matrix

(US$ mil.)

Fiscal year	Drawdown year																				Debt service total
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
2011	105																				105
2012	105	105																			211
2013	105	105	105																		316
2014	105	105	105	105																	421
2015	105	105	105	105	105																527
2016	105	105	105	105	105	105															632
2017	105	105	105	105	105	105	105														737
2018	105	105	105	105	105	105	105	105													843
2019	105	105	105	105	105	105	105	105	105												948
2020	105	105	105	105	105	105	105	105	105	105											1,053
2021	105	105	105	105	105	105	105	105	105	105	105										1,159
2022	105	105	105	105	105	105	105	105	105	105	105	105									1,264
2023	105	105	105	105	105	105	105	105	105	105	105	105	105								1,369
2024	105	105	105	105	105	105	105	105	105	105	105	105	105	105							1,475
2025	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105						1,580
2026	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105					1,685
2027	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105				1,791
2028	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105			1,896
2029	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105		2,002
2030	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	2,107

(4) Moody's / EIU reports

1) Moody's (Credit Opinion, June 8, 2009)

The ratings by Moody's are as follows:

Outlook	Stable
Country Ceiling: Foreign Currency Debt	B1/NP

Moody's long-term obligation ratings are divided into several categories ranging from "Aaa", reflecting the highest quality with minimal credit risk, over categories "Aa", "A", "Baa", "Ba", "B", "Caa", "Ca" to category "C", reflecting the lowest rated class of bonds which are typically in default with little prospect for recovery of principal or interest. Moody's appends numerical modifiers 1, 2 and 3 to each generic rating classification from "Aa" through "Caa". The modifier 1 indicates that the obligation ranks in the higher end of its generic rating category; the modifier 2 indicates a mid-range ranking; and the modifier 3 indicates a ranking in the lower end of that generic rating category.

Moody's short-term ratings are divided into several categories ranging from "P-1", reflecting a superior ability of an Issuer to repay short-term debt obligations, over categories "P-2" and "P-3" to category "NP", reflecting that an Issuer does not fall within any of the Prime rating categories.

2) EIU (Country outlook, January 1, 2010)

EIU evaluates Turkmen economy as follows:

GDP growth:	9% (2010), 6% (2011)
Inflation	12% (2010), 14% (2011)
Exchange Rates	Manat2.834:USD1 (2010-2011)

3.9 Effects and Merits of Using the Turkmenbashi Port

In this chapter the present cargo flow through Turkmenistan is described based on the information obtained by interview survey. It is found that the port of Turkmenbashi functions as transit port of the regional cargo flow movement. The effects on the present cargo flow are studied by comparing the merits of using the port and not using the port through the East-West corridor.

3.9.1 Present Situation of Regional Cargo Flow

(1) Present Cargo Flow through Turkmenistan

The information of the present cargo flow through this region is obtained by interviews from 2- railway ferry operating companies, 1- RO-PAX ferry company (State owned companies), 1- truck transporting company (private) and 2- forwarding companies (private) working the port by asking present cargo transport, future prospects and requests of the port development.

1) Railway ferry and RO-PAX ferry operation company

Three ferry operating companies provided the following information.

i) Present transport and cargo flow

a) RO-PAX ferry Company of Astrakhan of Russia

- The RO-PAX ferry operating between Turkmenbashi Port and Astrakhan Port (Olya Port) transport trucks loading vegetable, fruits and wheat for consumers in Russia, Ukraine, The largo volume thereof in spring and summer is particularly required in the west region because such commodities can not produce during winter and are consumed by the spring season and summer.
- The sailing time between two ports (Turkmenbashi port-Olya port) is 2 days and in case the weather is good, it takes 1 day and half. The ferry operates 2 trips in a month and carries about 15 trucks per trip. The vegetable and fruits were transported by 20 ft reefer containers on trucks from Turkmenbashi to Russia. While import commodities from Russia by RO-PAX ferry are construction material and equipment required for oil and gas products and its related projects, new and used cars and trucks, textile and garments, some of these commodities are transported by trucks to capital city (Ashgabat), and neighbor countries.
- The present RO-PAX ferry is operating once in every 10 days (2-3 trips per month) between the Turkmenbashi port and Astalakan port in Russia during March to December, which is very small number of trips throughout of the year. According to TMRL the Astalakan port is closed during winter season due to cold weather and frozen the access channel and basin. It will be difficult to operate regular ferry service throughout of the year.
- Under the present transport service system and logistic arrangement of sea transport through the Caspian Sea, the required demand volume can not be supplied to meet in Moscow and northern regions of Russia and Ukraine at the beginning of spring and summer seasons, because private trucks can be onboard at the last chance after railway wagons and government trucks are onboard. The company can not organize necessary number of trucks to transport required volume of demands.

b) Mahachkala railway ferry of Russia

- The railway ferry from Mahachkala transported sometime only 3 passengers, basically the ferry company does not carry passengers between Mahachkala and Turkmenbashi.
- The ferry operates 1-2 trips per a month and carrying 34 railway wagons.
- Main commodities on wagons from Russia are sugar, alumina powder for manufacturing aluminum products by refining, which are transported to Tadzhikistan by the railway in which there is aluminum fabrication factory. All imported cargo from Russia by the railway ferry is treated as transit cargo through Turkmenistan to destination of neighbor countries. Sometime the railway ferry transported vegetables to Russia.

- Sometime the railway transport kerosene to the border of Afghanistan and this cargo is unloaded on trucks for further destination, since the railway network infrastructure in Afghanistan is not yet developed to connect with neighbor countries.

c) Railway ferry from Baku, Azerbaijan,

- The sailing time between Baku to Turkmenbashi is 15-16 hours by railway ferry. The number of trips is 5-6 times in a month. The ferry occupies the berth for about 5-6 hours for unloading and loading wagons, depending on the number of embarkation and disembarkation wagons.

- The ferry transport 28 railway wagons and occasionally carry passengers about 30 or less. In case there are some space available in the ferry after loading railway wagons, the ferry ship allow some trucks to be on board. Railway wagons are coming from Georgia. The regular truck transport by the railway ferry is not made yet.

2) Truck operating company

i) Cargo Trade between Afghanistan

- The company import large volume of orange, potato, wheat from Pakistan and India through Afghanistan by trucks, in particularly in the beginning of spring March to summer. The cargo from Afghanistan is received in the neutral zone of both countries border at Tagtabazar city (about 215 km from Mary city) and border town called "Serkhetabat" (it was called as "Gushigi") in Turkmenistan about 3 km south from the border of Turkmenistan and the town called "Torghundi" in Afghanistan about 2 hrs drive from Heart city.
- Cargoes transported from Afghanistan by Afghanistan trucks are reloaded on the Turkmenistan Trucks due to security reason. Many parts of pavement of the national road from Tagtabazar to Serkhetabatis are damaged. The present width is 8m width and pavement is not strong for heavy loaded trucks. The roads are required to reinforce and widen for 12 m to make two ways traffic. Generally the local roads from the capital are poor conditions, which are required to be rehabilitated or reconstructed.
- The average import volume from Pakistan is 100 ton per day and 1,000 ton per month. In 2008 the average 2,000 ton of cargo per month, except in May 2008, the company delivered about 5,000 ton of goods to Uzbekistan and Kazakhstan by using railway.

ii) Destination of import cargo from Afghanistan

- Out of the imported cargo from India/Pakistan through Afghanistan 90 % are delivered for exporting to Uzbekistan and Kazakhstan by railway and 10% are transported by trucks to Kazakhstan and Turkmenistan for domestic consumption. The railway infrastructures in Turkmenistan and to Uzbekistan and Kazakhstan were developed for transport cargo from Afghanistan. The trucks will take around 5-6 days from the origin of Pakistan to

border town of Afghanistan, then to Kazakhstan it will take about 7 days.

- While Kazakhstan export about 50-60 ton of wheat per day and steel products, construction material like reinforcing steel bars about 10,000 ton in 2008 to Afghanistan through Turkmenistan by railway. There are big demands to railway transport for regional cargo transport by border crossing.

iii) Cargo movement with Iran

The company imports from Iran fruits like, grapes, mandarin, apples, apricots, melon and vegetable, textile products. About 250 -300 ton are imported this year 2010 for half month and transported them by trucks.

In case cargoes are imported from Iran and transported by Iranian railway, the rail line gauge is different between Iranian railway and Russian line. The wagons must be switched on the different wagon rail, which is taken more than 2-3 hrs per wagon and whole wagons of a train to be switched off will take one day 24 hrs. While custom clearance for border crossing will take only 2-3 hrs.

iv) Cargo Demands from Russia and North Ukraine

Since the vegetable, potato and fresh fruits can not be produced in the Russia, north Uzbekistan, Kazakhstan during winter season. At the beginning of spring season till summer there are large demands of such commodities from these regions. Every year the company imports such commodities from Pakistan and India through Afghanistan and transports by trucks to these regions by using RO-PAX ferry and Railway ferry through Turkmenbashi port and Astrakhan port in Russia.

3) Forwarding company

i) Company (1)

- At present cargo from Russia are transported mainly by railway ferry through the Turkmenbashi Port and transited to Uzbekistan and Kazakhstan by trucks.
- In the case of importing the general cargo from Asian countries (India, Vietnam, Korea, Japan, Malaysia etc) to Turkmenistan and Central Asian countries, there are number of options of routes to transport to Central Asian countries. One of them is to transport by ships to Dubai port in UAE and transfer to the Bandar Abbas port in Iran located at the Strait of Hormuz as the gate of the Arabian Sea (the Gulf), then cargoes are loaded on Iranian trucks to transport to Baku port in Azerbaijan, then the railway ferry transport to Turkmenbashi port.
- When cargoes are transported to Russian from south east Asian and middle east countries, cargo are shipped to Bandar Abbas port of Iran and delivered to the port of Bandar Anzali Iranian port located along the coast of the Caspian Sea by land transport of trucks or railway.

- The traffic volume from Asian to Turkmenistan by using Bandar Abbas port-Bandar Anzali port is increasing very much. The traffic volume from Bandar Anzali port to Russian ports is increasing also.
- The cargo are transported first to Russian ports by vertical crossing the Caspian Sea, then coming to Turkmenbashi port from Russian ports by cargo ships or RO-PAX ferry.
- The company anticipates that this route of Bandar Anzali Iranian port – Russia ports –Turkmenistan port – Baku in Azerbaijan will have bigger potential cargo demands than the other routes through Turkmenbashi port.
- The company forecasts the cargo movement of some routes as follows
  - There will be small traffic demand for RO-PAX ferry between only Turkmenbashi port -Bandar Anzali port route.
  - The railway ferry between Baku to Turkmenbashi port will be requested to transport containers, but at present the volume of container transport is vey small due to double handling at both ports and non availability of large lifting capacity of cranes for handling containers at Turkmenbashi port.

ii) Company (2)

The company transports cargo through different routes according to their origins to Turkmenistan as follows;

a) Import cargo from EU countries are transported by railway ferry and by cargo ships coming through Baku port of Azerbaijan,
b) Import cargo from Malaysia and Asian countries is transported to Dubai port by cargo ships and transferred to Bandar Abbas Port in Iran, then using trucks of Turkmenistan or Iranian to Turkmenbashi port. This is for the project of PETRONAS.
c) Other cargo from Turkey and Iran are carried by trucks to Turkmenbashi port.
d) According to the company's logistic survey of regional cargo flow, it is observed from the progress of the railway development projects of each country that the present cargo flow from Central Asian countries to East Asian and Indian Ocean countries are transported preferably through Turkmenistan bound for Bandar Abbas port in Iran. While it is observed that cargo volume from Central Asian countries to EU through Baku port is appeared to be small comparatively.
e) In case cargo from Uzbekistan are exported to Africa, India and China, the company considers that the route of cargo transport through the port of Bandar Abbas would be more efficient in time and cost than other routes like crossing Caspian Sea through Baku, Iran and Turkey ports to destination.
f) The cargo flow crossing Caspian Sea in vertically and horizontally by RO-PAX ferry will become very efficient and effective by simplifying and unifying the format of custom declaration and clearance procedures at each national border. As a result of such development of infrastructure and trade facilitation the regional cargo movement will be generated and activated.

g) According to the company, it has been often told that the transport cost by railway in Turkmenistan is relatively higher and longer time of transport than the neighbor countries, because it is caused by the shortage of locomotive and loading/unloading cargo handling equipment.

h) The unit cost of railway transport in Turkmenistan is same as neighbor countries, but due to shortage of such equipment cargo stays at the port for longer time. Particularly for crossing the border of Iran and Turkmenistan, the railway gauge of both countries are different. It takes nearly 20-24 hours to switch wagons from one to the other at the border. This is also one of main reason to use more trucks to transport import cargo from Iran to Central Asian countries.

4) Interview survey to truck drivers at the port

The Study team conducted interview survey on Dec 29, 2009 at the PKK2 truck parking area to truck drivers asking the following questions; commodities to transport, waiting time at port, origin and destination of cargo, how often coming to port and any requests to port office.

i) Findings by Interview survey

- The employment status of truck drivers are individual driver coming to the port for chance of job, owner/driver of truck received the request from cargo owners, driver of truck companies which got contract with cargo owner's company.
- The drivers come to the port 2-3 times to 3-4 times per month. They are generally waiting 1-3 days to 3-4 days, one driver waited 7 days at the port.
- To Awaza (Turkmenistan, near Turkmenbashi port), Ashgabat (capital of Turkmenistan), Berek (near Turkmenbashi), Mary, Balkanabat, all are domestic destinations. Occasionally some drivers had chances to transport import cargo directly to Uzbekistan and Kazakhstan by Turkmen truck without reloading at border crossing. e)
- Requests for development of port management office
- The drivers request the port office to build accommodation facilities like hotel at truck parking area. They like to have rest after long drive and for long time of waiting cargo.
- They can load about 30 ton of cargo per trip due to restriction of road structure by MOT in Turkmenistan and neighbor countries.
- According to them, trucks can wait at truck parking area of the railway ferry terminal area for cargo from cargo ships using multipurpose berths (PKK1). The summary of interview survey are as follows:

Table 3.9.1 Questions and response by interview survey

Questions	Response
Type of employment of driver	Individual (3), Truck owner/driver (1), Employee of trade company (1)
Transport commodities	Steel bars, Cement, filler material, steel pipe, woods, general construction material and equipment, dry cargo
Origin of cargo	Iran (4), Baku (Azerbaijan)(4), Astalakhan (Russia)(4), Kazakhstan (2),
Destination of cargo	Ashgabat (4), Awaza (2), Bereket (2), Mary (2), Balknabat (1), Turkmenabart (1)
Waiting time of cargo	1 day (0), 2 days (1), 3 days (1), 4 days (1) 6-7 days(1)
How often come to port	1-2 times/Month, (2), 3 times/Month (1), 3-4 times/Month (1) No answer (2)
Requests for Port office	Construction of Simple hotel (1), Cheap hotel to stay (2), Parking area(1), Canteen (1), toilet with bathroom (1)

Note; Figure in ( ) indicates the number of response

5) Road and traffic conditions of neighbor countries

The private truck operating company informed that recently in 2009 the Russian government introduced new regulation that trucks from Turkmenistan can not run on the roads of Russia. Since the agreement of free trade truck running between both countries (Turkmenistan and Russia) is not made yet. As a result cargo by truck arriving at Baku port or Astalakhan port shall be reloaded on their trucks, which is additional cost by double handling, time consuming at the pot and Turkmenistan trucks must find return cargo at these ports.

Before 2009 trucks of Turkmenistan can run on the roads of Russia, vice versa. It is desired to make such agreement as earliest as possible for smooth cargo flow by border crossing in this region.

The free trade agreement including truck running through roads of both countries between Iran and Turkmenistan has already been made. So trucks of both countries can run through border of both countries to their destinations.

The JICA study team checked the above difficulty of border crossing by trucks with the Ministry of Foreign Affair and found the followings:

"The Government of Turkmenistan ratified the bilateral agreement of Free Trade Agreement and allows practical free trade with neighbor countries. The Government of Turkmenistan had ratified FTA with the following 7 countries; Russia, Kazakhstan, Uzbekistan, Azerbaijan, Kyrgyz, Iran and Turkey. On the ground of Diplomatic relation, Turkmenistan trucks can run any roads of these countries."

However according to the MOFA, due to technical issues of different road construction standards between Russian and Turkmenistan such as heavy loaded conditions of highway, strength of road structures/bridge structure cargo from Turkmenistan are asked to reload on trucks of Russian. In

the case of cargo from Afghanistan, due to security reason, cargo by trucks of Pakistan/Afghanistan must be reloaded on Turkmen trucks.

6) Summary of present cargo flow and Characteristic of Corridors

The present cargo flow through Turkmenistan and characteristic of each corridor is summarized below based on the information obtained from the above agencies. Figure 3.9.1 shows the present cargo flow routs of East-West corridors and North-South corridors.

Table 3.9.2 Summary of Present Cargo Flow through Corridors

Corridors	Present Route and its Characteristic
East and West Corridor	From South East Asia/ China/India/ Pakistan/Afghanistan ⇔ to Black Sea region/European countries/Russia/Ukraine/Turkey. 1) Connecting to global communication networks at Black sea region. 2) The region including Turkmenistan will be able to receive benefits from the wide area network system. 3) Due to instability of regional security, under developing infrastructures of logistic networks and unconsolidated application of rules and regulations of trade facilitation, the regional economic development are hampered. 4) The development of smooth cargo flow traffic corridors will provide regional benefits for the economic development.
North and South Corridor	Cargo flow through the major city of Turkmenistan (Ashgabat- Dosoguz, Mary-Turkmenabat) ⇔ to Northern countries (Uzbekistan, Kazakhstan) and to Southern countries (Iran, Afghanistan, Pakistan). 1) This corridor provides benefits to the regional economy. 2) The present network system is fragile conditions due to restrictions of trucks running on multi national roads and non standardized railway infrastructure of the region. 3) The cargo flow volume increase between north and south due to large population in Iran and rich industrial products in north. 4) The infrastructures development to be tied together with regional benefit will be required.

(2) Future prospects of cargo movement,

1) Railway ferry company

RO-PAX ferry company of Astrakhan of Russia explained the future prospects as follows.

The company desires to increase number of trips per month and operate regularly this ferry transport service to meet the demands near future. In case there are cargoes to transport from Pakistan and India, the ferry company can increase number of trips. The company does not have means of access to such market information and does not have trading companies to collect such information of requesting for transporting such commodities and required volume.

Under the present logistic information system the company shall be required to have adequate means of access by information technology (IT) facilities for collecting information of Market demands and trends, and to expand trade business of exchanging commodities between east and west and north and southern region by increasing trips.

2) Truck operating company

The truck transporting company explained future prospect of regional trade as follows.

- It is difficult to foresee the future situation of trade with Afghanistan companies, but the company received strong demands of supply goods from both sides of west and east. Pakistan and India including Afghanistan want the steel and its products, construction materials, cotton and wheat from the west, while Kazakhstan, Uzbekistan wants fresh vegetable, fruits from east and south. The company prospects, if the security in Afghanistan is improved, to increase trade volume of cargo and people's traffic volume will increase by exchanging between west and east. The company foresees the improvement of business environment in Afghanistan in near future.
- Since the company has received strong demands of cement from Afghanistan, Turkey, Iran, Russia, Uzbekistan, Kazakhstan, especially strong demands from Russia. The company plans to develop cement factory in Turkmenistan for exporting to these countries,

3) Forwarding company

The forwarding **c**ompany (1) explained the future prospects of cargo movement in this region and the port as follows.

- The company started general cargo handling operation at Kiyanly berth in the supply base for oil and gas development project by PETRONAS (Malaysia). Occasionally they handle heavy and large equipment used for the oil and gas drilling works. The company procured necessary handling equipment and transporting trailers and its primer trailer heads.
- The company was asked number of times from customers in Baku port whether the Turkmenbashi port can handle 20 ft containers, because the customers consider that container transport is safer and protect goods during rough weather of winter season. At present the port do not have large capacity of lifting 20 ft containers, heavy forklift truck to lifting 20 ft container, and no mobile cranes at multipurpose berths. Containers are transported as a box without truck head by general cargo ship or RO-PAX ferry.

4) EBRD Comments on infrastructure development;

i) Necessary infrastructures development for efficient logistic supply and review for reshuffling of public and private aspects of the existing state organization of transport sector agencies of Maritime/river transport, Airport transport, road and railway transport ministry.

In order to function the existing logistic infrastructure and system for cargo flow as a whole through the road, railway and port, it is considered necessary to reinforce and upgrading loading capacity of existing local roads and poor facilities conditions of railway and road infrastructures connecting between provincial capital city and national capital city for accommodating heavy loaded trucks and railway wagons. The port facilities shall be reinforced/upgraded by equipped

with heavy loaded cargo handling cranes and parts of the port operation should be participated by private investors.

ii) Proposed development of cement exporting facilities by KOICA study

- The proposal by KOICA study to develop cement exporting facilities at the port is considered reasonable. The country has large resource of manufacturing cement, which shall be produced by domestic factories to be developed by inviting foreign direct invest (FDI) with JV of domestic state companies. The Government nominated the cement industry as a protection industry, which has potential of converting to exporting industry, instead of importing from Uzbekistan/Iran with higher cost of transport. There are strong demands of cement from Turkey, Iran and Russia. The government plans to develop a cement factory in the area of Balknabart of the port hinterland

5) Prospects of export cargo from Turkmenbashi Port by regional industrialzation

The following cargo will be produced from the industries and manufactures located in the hinterland of the port, which has prospective plan of exporting their products through the port.

- Petrochemical products such as Benzene, Kerosene, Diesel exporting through Baku port to EU by railway ferry
- LPG terminal is developing at Kiyanly supply base and planned to produce about 30 million ton per year by year 2030.
- Polypropylene products will increase exporting volume by enlargement of the present production capacity of 90,000 ton per year to be 300,000 ton per year. Out of this about 80% will be exported to Iran, Japan, Vietnam by trucks on railway ferry and trucks on RO-PAX ferry and cargo ships through the port.
- Cement is currently imported from Iran and Uzbekistan. The Government plans to product 5 million ton per year in future by development of cement factories, 40 % of this volume will be exported from the port.
- Fertilizers products is planned to produced from the natural gas

(3) Requests for port facilities development for cargo transport

1) Railway ferry transport service

- According to the railway ferry service from Turkmenbashi port, first of all, railway wagons about 32 wagons per ferry are onboard ferry, then trucks carrying governmental commodities, and at last if there is space available in the ferry, trucks carrying private commodities can be onboard.

- Under the present railway ferry service the direct cargo deliver by trucks to the destination will be very limited volume and can not make timely supply and deliver required volume of consumers because the trucks when arrived at the port would have

very limited chances to be onboard of railway ferry.

Requesting more spaces for trucks on board and of providing services of "first come, first service" basis

2) Requests for TMRL to develop RO-PAX ferry terminal by truck operating company

Fresh vegetable and fruits are transported by 8 ton reefer container trucks. Under the present transport arrangement to transport the fresh agricultural products cargo will be spoiled by long time travelling.

Therefore, an exclusive RO-PAX ferry for transport trucks with cargo and passengers are essentially required. In case the exclusive RO-PAX ferry is operated for crossing the Caspian Sea, the company can arrange required number of trucks to meet the seasonal changes of demands by collecting supply of goods from Pakistan and India by border crossing through Afghanistan.

It is requested to increase number of regular trips of the present RO-PAX ferry service by using the available multipurpose berths at PKK 1 of the port. Then, It is desired as earlier as possible to develop and operate exclusive RO-PAX ferry service for deliver cargoes from west and east by crossing Caspian Sea, since the truck transport can cover large area of demands from coastal countries of the Black Sea region and Northern parts of Russia to southern region of Pakistan and India, which can be made direct cargo delivery service from doors to doors

3) Requests for developing related RO-PAX ferry terminal facilities

- It is required to develop large truck working area inside the bonded area at PKK1 multipurpose berth for smooth truck flow in and out from the custom bonded area. Since the present truck working area is narrow, the trucks can not smoothly change the direction in case other trucks are blocked by loading /unloading cargo.
- The regular RO-PAX ferry from Astalakan port of Russia uses conventional cargo berths no 3-4 of PKK1 for unloading and loading trucks. The yard behind the berth is narrow and limited space for truck running and parking, as a result unloading /loading time by trucks take longer time by changing the direction of trucks. It is requested to widen the truck yard area behind the berth.
- Requests for activating containers traffic by forwarding company

The forwarding company (1) requested that the port should equip large cargo handling crane of 40 ton for containers and 110 lifting capacity of mobile crane shall be procured. There are big demands to handle containers to this port from Baku, and other ports of Iran and Russian

(4) Issues of Present Integrated Logistic System of Turkmenistan

1) For East and West corridor

The following counter measures will be required in this corridor.

i) Improvement by modernization and upgrading infrastructures facilities and equipment.
ii) Establishing well managed operation and management system for road, railway and port/RO-PAX ferry transport service.
iii) Open markets of logistic service to the market oriented economic system and to provide opportunities of participation of privatization in order to reduce cost of integrated logistic service between EU to regional corridor.
iv) Enhancement of sea transport capacity by providing punctual and regular service of RO-PAX ferry service connecting coastal ports in the Caspian Sea.
v) Rationalization of trade facilities system with neighbor countries and modernization of management system
vi) Incidental facilities related trade facilitation shall be replenished and operation of rules and regulations related trade facilities of each country shall be harmonized and standardized among multilateral countries.

2) For North and South corridor

The following counter measures will be required in this corridor.

i) Development and upgrading existing infrastructures facilities and equipment.
ii) Establishing well managed operation and management system for road, railway and port/RO-PAX ferry transport service.
iii) Enhancement of railway transport capacity by upgrading efficiency of railway equipment
iv) Establish efficient complex transport service with punctual and regular RO-PAX ferry service and railway/road connection to reach the ports in Iran as gate for inland countries.
v) Unification of trade facilities system with neighbor countries
vi) Establishing mutual trusts /agreement of free trade among countries concerned for creating regional benefits.

3.9.2 Merits of using Turkmenbashi Port

TMRL plans to launch RO-PAX ferry service to visit ports in the Caspian Sea into the north and south routes by two Ro-Ro ferries.

Fig 3.9.1 shows the planned Ro-Pax ferry sailing routes. One ship covers ports in Azerbaidjan and Iran as southern route. (Yellow color line in Caspian Sea; Turkmenbashi port - Baku – Bandare-Anzali) One ship covers ports in Russia and Kazakhstan as northern route. (Black color line in Caspian Sea; tie up port of Turkmenbashi port - Makhachkara port – Astrakhan (Olya) port. TMRL plans to procure R-Ro ferry ship loading capacity of 80 large trucks equivalent to 200 sedans and 300 passengers and sailing speed of 15 to 20 knots.

Based on information obtained from private truck operation company, Forwarding companies and railway ferry companies asking the requests of RO-PAX ferry transport service from Turkmenbashi port, present cargo flows, the effects on the present cargo flow by implementing

the proposed projects. Since North-South corridor is not crossing Turkmenbashi port, but it is developed by railway and road connection. The impacts on the East-West corridor only are studied.

(1) Comparison of Merits and Predominance of utilizing Turkmenbashi port

The merits and predominance of utilizing Turkmenbashi port is compared in two cases as follows.

1) Cargo from West European continent to Central Asian countries by trucks

At present, there is no RO-PAX ferry service between Baku to Turkmenbashi port. According to the information of truck drivers and observation of large trucks in the main highway near the border crossing point called at Sarah, it is presumed the following routes will be used from EU to the Central Asian countries.

i) Routes by Large trucks (case-1)

Some trucks are used RO-PAX ferry from Burgas Port and come to Poti port of Georgia, then trucks will drive through the highway of Iran to Borders of Afghanistan and Turkmenistan.

Figure 3.9.2 shows the routes of using the port route and of not using the port route as case -1.

Majority of truck drivers drive through EU corridor 8 and crossing Bosporus Strait, then driving through TRACECA corridor of Central Asian countries. Since they know there is no RO-PAX ferry between Baku-Turkmenbashi, they will drive through Tabriz and Teheran on the highway in Iran till Sarah border crossing point to enter the Turkmenistan. Because there is high mountains of Koppe Dag, Kuh-e Aladag Govein mountains in Iran side and there is not proper roads of high loaded trucks for crossing the border of Turkmenistan till Sarah.

ii) Comparison of merits of utilizing Turkmenbashi port according to destinations

The destination in the Central Asian region is selected at Ashgabat of Turkmenistan and Urgench of Uzbekistan since these cities are destination of major cargo through Turkmenbashi port and information of Truck operating company.

The merits of transport distance, time required and fuel consumption by truck transport is compared between using the Turkmenbashi port and not using. The predominance of using the port is identified.

In case the cargo is transported to Ashgabat by not using the port, the cargo must come back to Ashgabat from Sarah about 545 km west, and in case the cargo is transported to Urgench, the cargo will go from Ashgabat for about 600km north and crossing the Amyderya River to enter Urgench.

The distance between the destination and port and border crossing points is shown below, The distance is taken from the data supplied from State Committee of Turkmenistan for Tourism and Sport, Government of Turkmenistan and published World Maps in Japan.

From Bosporus Strait	Saraf (Border crossing of Turkme)	2,700 km
From Poti POrt	Baku Port (Azerbaijan)	720 km
From Baku Port	Turkmenbashi Port (Turkmenistan)	250 km
From Turkmenbashi Port	Ashgabat (Turkmenistan)	600 km
	Urgench (Uzbekistan)	600 km
From Ashgabat	Saraf (Turkmenistan)	545 km
	Urgench (Uzebekisutan)	600 km
	Serhetabat (Border cross of Afhanistan)	645 km
From Serhtabat	Turkmenabat (Turkmenistan)	645 km
From Turkmenabat	Astrahan (Russia)	1,700 km
Astrahan	Novorossijisk Port (Russia)	1,000 km

a) In the case of not using the Port (Destination, Ashgabat, Urgench)

Route: EU−Bosporus−Saraf−Ashgabat−Urgench

- Distance: (1) Bosporus−Saraf 2,700 km
  (2) Saraf−Ashgabat 545 km
  Total Bosporus−Ashgabat 3,245 km
  (3) Ashgabat−Urgench 600 km
  Total Bosporus−Urgench 3,845 km
  The above routes of (1), (2), (3) are shown in Figure 3.9.2.
- Time: 50km/hr by truck and daily driving distance 600 km
  (4) Bosporus−Ashgabat 5.4 days (129.6 hrs)
  (5) Bosporus−Urgench 6.4 days (153.8 hrs)
- Fuel Consumption: 12km/ liter
  (6) Bosporus−Ashgabat ; 270 liter
  (7) Bosporus−Urgench 320 liter

b) In the case of not using the Port (Destination, Ashgabat, Urgench)

Route: EU−Poti−Baku−Turkmenbashi port−Ashgabat
EU−Poti−Baku−Turkmenbashi port−Urgench、

- Distance: (8) Poti−Baku 720 km
  (9) Baku−Turkmenbashi port 250 km
  (10) Turkmenbashi port−Ashgabat 600 km
  Total 1,570 km
  (11) Turkmenbashi port−Urgench 600 km
  Total 1,570 km

The above routes of (8), (9), (10), (11) are shown in Figure 3.9.2.

- Time: 50km/hr by truck and daily driving distance 600 km and speed of New RO-PAX ferry at 15 knots/ hr, and time of 1-2 hrs for custom clearance

(12) Poti−Ashgabat	2.2 days (52.8 hrs)
(13) Baku−Turkmenbashi port by ferry	0.5 days (12 hrs)
Total	2.7 days (64.8 hrs)
(14) Poti−Urgench	2.2 days (52.8 hrs)
(15) Baku−Turkmenbashi port by ferry	0.4 days (12 hrs)
Total	2.7 days (64.8 hrs)

- Fuel Consumption at 12km/ liter, While trucks on board do not consume gasoline

(16) Poti−Ashgabat	110 liter
(17) Poti−Urgench	110 liter

Comparison of transport distance and time and fuel consumption is summarized in the table below.

Table 3.9.3 Comparison of transport, time and fuel consumption (from West to East)

Destination	Case of not use port (A)		Case of using port (B)		Ratio of Difference	
	Ashgabat	Urgench	Ashgabat	Urgench	Ashgabat	Urgench
Distance (km)	(1) 2,700		(8) 720			
	(2) 545		(9) 250			
			(10) 600			
Total	3,245		1,570	970	207%	
		(3) 600		(11) 600		
Total (km)		3,845		1,570		245%
Time (hr)	(4) 129.6	(5) 153.8	(12) 52.8	(14) 52.8		
			(13) 12	(13) 12		
Total	129.6	153.8	64.8	64.8	200%	245%
Fuel Consume (Liter)	(6) 270	(7) 320	(15) 130	(16) 130	208%	246%

Source: Study team

Comparing the merits of not using the port and by using the port through East-West corridor, it is found that difference of transport distance, time required and fuel consumption volume by not using the port are derived more than 200% to 246% by using the port. This difference brought by using the RO-PAX ferry transport service will give large impacts and merits on the present traffic flow.

For truck operating companies, trading companies, logistic service companies working in this region, the route using the Turkmenbashi port by the service of the RO-PAX ferry is more economical and financial predominant corridor for cargo transport between the European countries and Central Asian countries.

2) In the case of cargo transport from Afghanistan to Black Sea region (case-2)

In case cargo from East is transported through East-West corridor by not using the Port the following route is assumed to be taken. Figure 3.9.3 shows the routes of using the port and of not using the port as case-2.

Cargo will be trasited at the border of Turkmenistan/Afghanistan to transport to Astrakhan in Russia through Uzbekistan and Kazakhustan, then to Novorossijsk Port of Russia located along the coast of Black Sea.

This port is functioning as the gate port of the Central Asia and the RO-PAX ferry and railway ferry from Burgaria are regularly called for trade between Central Asia and Europe.

While in the case of using the Port cargo from Afghanistan will be directly transported by trucks to Turkmanbashi port through the Turkmenistan national highway, then cargo are carried to Poti port in Georgia through Baku port by crossing Caspian Sea with the RO-PAX ferry. From the Poti port trucks will be loaded on board RO-PAX ferry oming from Bulgaria. The merits between these two routes is compared to identify the predominance of using the port for cargo flow in this corridor.

a) In the case of not using the Port (Destination, Novorossijsk Port)

- Distance: (1) Serhetabat−Turkmenabat : 645 km
  (2) Turkmenabat−Astrahan ; 1,700 km
  (3) Astrahan−Novorossijsk Port ; 1,000 km
  Total 3,345 km

  The above routes of (1), (2), (3)are shown in Figure 3.9.3.

- AT present cargo from Afghanistan are transported by railway to Novorossijsk Port, however time of the railway to start and traveling time is unknown. For comparison purpose, the cargo is assumed to be transported by trucks through the highway in the same routes of the railway. Trucks will run with speed of 50km/hr and daily driving distance by truck is estimated at 600 km

  (4) Serhetabat−Novorossijsk Port 5.6 days (134.4 hrs)

- Fuel consumption 12 km /liter

  (5) Serhetabat−Novorossijsk Port 279 liter

b) In the case of not using the Port (Destination, Poti Port)

- Distance (6) Serhetabat−Turkmenbashi Port 1,245 km
  (7) Turkmenbashi Port−Baku 250 km
  (8) Baku−Poti 720 km
  Total 2,215 km

  The above routes of (6), (7), (8) are shown in Figure 3.9.3.

- Time is estimated by trucks running speed of 50km/hr and daily driving distance of 600 km and speed of New Ro-Pax ferry at 15 knots/ hr, and time of 1-2 hrs for custom clearance

  (9) Serhetabat−Turkmenbashi Port 2.0 days (48 hrs)
  (10) Turkmenbashi Port−Bakuby ferry 0.5 day (12 hrs)
  (11) Baku−Poti ; 1.5 days (36 hrs)
  Total 4.0 days (96 hrs)

- Fuel consumption; 12 km/liter、While trucks on board do not consume gasoline

  (12) Serhetabat−Turkmenbashi Port 104 liter
  (13) Baku−Poti; 60 liter
  Total 164 liter

Comparison of transport distance and time and fuel consumption volume is summarized in the table below.

Table 3.9.4 Comparison of transport, time and fuel consumption (from East to West)

Destination	Case of not use port (A)		Case of using port (B)		Ratio of Difference
	Novorossijsk Port		Poti Port		
Distance (km)	(1)	645	(6)	1,245	
	(2)	1,700	(7)	250	
	(3)	1,000	(8)	720	
Total		3,345		2,215	151%
Time (hr)	(4)	134.4	(9)	48	
			(10)	12	
			(11)	36	
Total		134.4		96	140%
Fuel Consumption (liter)	(5)	279	(12)	104	
			(13)	60	
Total		279		164	170%

Source: Study team

When cargo is transported through the East-West corridor from East to West, the merits of transport distance, time and fuel consumption volume is compared between the case of not using the port and the case of using the port.

It is found that difference of transport distance, time required and fuel consumption volume by not using the port are derived more than 140% to 170% by the case of using the port. The East-West corridor routes using port of Turkmenbashi by the service of the RO-PAX ferry are also same as the cargo transport from west to east, which is more economical and financial predominant for cargo transport than using other mode of transport between the European countries and Central Asian countries.

(2) Predominance of using Ro-Rax ferry through Turkmenbashi port for regional cargo flow

1) Improvement of Sea transport service and increase of transport volume

- Under the present railway ferry transport service, only 5-6 trucks per trip will be able to be onboard ferry and many trucks must wait next ships to destination. The capacity of railway ferry will be limited and can not meet future traffic demands beyond its capacity.
- While new proposed RO-PAX ferry service is introduced and provided in regular and punctual schedule of services, the maximum loading capacity will be able to transport 80 trucks equivalent to 200 sedans and about 300 passengers per ship to both directions. The estimated annual transport capacity will be approximately 11,520 trucks (80 trucks x 12 trips/month x 12 months assuming 1 round trip will take 2 days between Baku).
- The traffic demands of cargo and passenger traffic in 2010 are estimated at 2.23 million tons and 270,000 passengers respectively. The number of trucks required per year will be about 7,400 trucks and the ferry is required to call the port about 940 times and for transporting passenger, the ferry is required to call about 900 times to the Port. 2 Ro-Pax ferry ships are required for this service and shall be scheduled to call the port every two days to meet the traffic demands. However the characteristic of demands by region shall be analyses and the adequate and efficient sailing schedule shall be programmed by considering the sailing speed of ferry and loading/unloading time st each port. The number of Ro-Pax ferry will be adjusted depending on the future traffic demands.
- This is substantial increase of transport capacity in the regional sea transportation. The ferry users will not be asked to wait for indefinite schedule of next railway ferry, but thy can go to destination faster in schedule of ferry service.

2) Supporting development of industries for increasing export volume from the port

- Some Japanese manufacturers plan to expand production volume of petro chemical products (polypropylene) in the hinterland of the port, to develop new fertilizing plants and cement plant at Tejen in the Ahal province with JV of the state owned companies by promoting the government policy of privatization of state owned companies.
- Considering such trends of industrialization in the port hinterland, the proposed new RO-PAX ferry service is expected to play very important role of transit cargo and exporting products from plants by new Ro-Ro passenger ferry service to east and west of the region.
- The industries in the hinterland of the port plan to increase the export volume from the port including the petrochemical products.
- The transport capacity of the existing railway ferry and oil tankers have the limited capacity and reaching to the full capacity under the present port facilities conditions. They can not cope with the future trafic demands of export volume of industries.

- The Port handled about 3,480,000 tons of oil products in 2008. The average loading volume of a tanker is 5000 tons by 8000 DWT tankers. The number of tanker calls to the port was about 700 times using PKK3 for loading/unloading oil and oil products. PKK3 has two berths and berth available time is 365 x 2 berths = 730 day-berth. In 2008 two berths at PKK 3 were fully occupied by tankers. In order to meet the future traffic demands the following counter measures are required.
  - Enlargement of tankers and increase transport volume per tanker.
  - To increase operational days of the access channel and construct additional tanker berths

- In order to export such petrochemical products by using the railway instead of using the port the railway will travel to Russia bound by Ashgabat and through Uzbekistan. The railway travelling distance is estimated more than 3,000 km and tike required for will be more than 50 hrs with non stop services. This will cause substancial finacial burden to the industries of Turkmenistan.

- The development of the access channel by widening and introducing new RO-PAX ferry service port will minimize the presently annual closing days of the access channel and increase number of days to open the channel for accommodating more number of tanker ship calls to the port. The future demands of exporting volume by industries will be coped with proposed port development projects.

3) Contribution of sustainable growth of national economy by developing smooth logistic network

The economy of Turkmenistan is a transitional period of the central control economy to the market oriented economy. The Turkmenistan is categorized by the World by income as Lower Middle Income countries according to the IBRD "World Development Indicators 2009", since Gross National Income (GNI) per capita in 2005 of Turkmenistan is estimated between US$ 876 to US$3,465. The world by income of IBRD classify by GNI as follows;

Low (US$ 975 to less), Lower Middle income countries (US$ 975 to 3,855), Upper Middle income countries (US$ 3,855 to US$ 11,905) and High income countries (US$ 11,905 or more)

The fundamental of market economy is not established self sufficient manner. Developing a new Ro-Ro passenger terminal will assist actualization of smooth shifting from central control economy to market oriented economy by activating cargo movement in east and west direction and in north and south direction.

The economy growth of Turkmenistan has been depended on the growth of oil and gas export volume and foreign direct investment (FDI). According to records of EBRD, the growth rate of FDI has been 10% from 2006 to 2007, but from 2005 to 2006 it was 74.6 % and the net amount of FDI in 2003 was 226 million US$, which became 820million US$ in 2008. During this period the

GDP growth rate could be achieved at 5-6% per year. The government actively attracts and promotes FDI aiming to increase 20 % per year and to keep sustainable growth of the economy.

In order to attract and promote actively the investment by FDI, the Government of Turkmenistan plans to privatize state-owned companies of all the business fields. The privatized companies (petrochemical products, fertilizer and cement factories) request to develop intermodal transport with railway and highway, container/Ro-Ro terminal having efficient standards of service.

(3) Contribution for Restoration of Afghanistan by Development of East-West Corridor

The study team had exchanged the information of findings by the study with other team involved "The Study for Broader Area Transport Infrastructure Development in Afghanistan and the Surrounding Countries". The information of the potential development of east–west and north-south corridors is supplied as follows.

According to their findings by the study, the east-west corridor through Afghanistan – Turkmenistan - Caspian Sea will be more important than the north-south corridor development through Afghanistan. Since the corridor through the province of Baluchistan in Pakistan to reach candidate port "Guwadar" located near the border of Iran and Pakistan which was developed by assistant of the Chinese government is more dangerous for transport than Afghanistan. The port is not actively used and ship call is once in a month. The cargoes from Afghanistan are transported by trucks to Iranian port like Bandar-E-Abbas or alternatively at Chabahar port in Iran located closer to "Guwadar port" for exporting to east and west countries.

The east-west corridor will support restoration of Afghanistan by developing port facilities at Turkmenbashi port and to enhance sea transport capacity by engaging RO-PAX ferry service, which infrastructure will provide direct access with Black sea region and EU countries.

The development of east-west corridor will be beneficial for Afghanistan, which will provide opportunities to export major products, particularly dry fruits of Afghanistan to a big market in East European countries by using proposed RO-PAX ferry of Turkmenistan.

For exporting industrial products from Central Asian countries, it is forecasted that such products will be transported through East-West corridor through Turkmenistan to reach ports along the coast of Caspian Sea and Black Sea for accessing to the global markets connection, instead of transporting through Afghanistan and Pakistan to the port called "Guwadar" in Pakistan at the coast of Indian Ocean.

(4) The case of Tajikistan for Cargo flow by Infrastructure Development

The study team had exchanged the information of findings by the study with the team involved "The Study of Transport Infrastructure Development of Tajikistan".

The following information of the potential development of east –west and north-south corridors through Tajikistan is supplied.

Tajikistan is an inland country and surrounded by 4 countries, on the north and west sides are Uzbekistan and Kyrgyz respectively and on south is Afghanistan and on East is China.

Taking advantages of geopolitical location in the region, the Tajikistan has been considered potential to become crossroads of traffic movement between Central Asian countries and Middle East South west Asian countries by development of infrastructures, particularly development of Southern corridor in Tajikistan to reach the Indian Ocean for smooth cargo traffic flow. There are four major corridors crossing the Tajikistan, one East Corridor (access to China), West Corridor (access to Uzbekistan, EU, Caucasus through Turkmenistan), South Corridor (access to Pakistan, India, Iran, Turkey UAE through Afghanistan), North Corridor (access to Russia through Uzbekistan, Kazakhstan) .

The access bridge between Tajikistan and Afghanistan was developed through border town called "Pyanj" in 2007, which is formed as the South corridor. The previous access road to Afghanistan has been used through Pakistan.

It is expected that the logistic system will be improved from Central Asian countries to Afghanistan through this additional access, since development of Southern corridor in Tajikistan will provide access to reach Indian Ocean through Afghanistan, Pakistan for Central Asian countries.

The development of southern corridor will provide substantial regional economic benefits. In the case of completing the development of the Southern corridor to Indian Ocean, this infrastructure development will contribute the regional activation of investment and trade activities and regional security of energy supply.

There is no border crossing between Turkmenistan and Tajikistan. The traffic from Turkmenistan and from EU through Turkmenbashi port can be reached by road and railway through Uzbekistan. It is called the West corridor in Tajikistan connecting Uzbekistan, Turkmenistan, Caucasus and EU countries.

The railway ferry company at Turkmenbashi port informed that some wagons of railway in the ferry transported Alumina powders from Baku by Railway ferry are transited at the Turkmenbashi port to transport to the alumina factories of TALCO (State owned company) in Tajikistan by railway. According to the railway transport of Turkmenistan the cargo in the rail wagons is not reloaded at the border of Uzbekistan and Tajikistan to reach to the destination.

Tajikistan plans to develop railway of north corridors development in order to access to the East – West corridor of Siberia railway in Russia (from Asia to EU). In order to access to Indian Ocean, the south corridor is being developing. The cargo transport for Tajikistan will be mainly travelling through North-South corridor, which will be accessible to the Indian Ocean and China and Russia, instead of Uzbekistan and Turkmenistan.

ADB assists to develop the west corridor to promote economic activities between Middle East

countries and Central Asian countries, which will be indirect logistic benefits to the Turkmenistan.

This region is the production center of the most important agriculture and stock farming in the world, especially the production of grains, cottons, oil, horses and sheep. There are large volumes of deposits of mining resources of energy like coal, oil, natural gas. Tajikistan plans the long term development to develop railway and roads for logistic infrastructures.

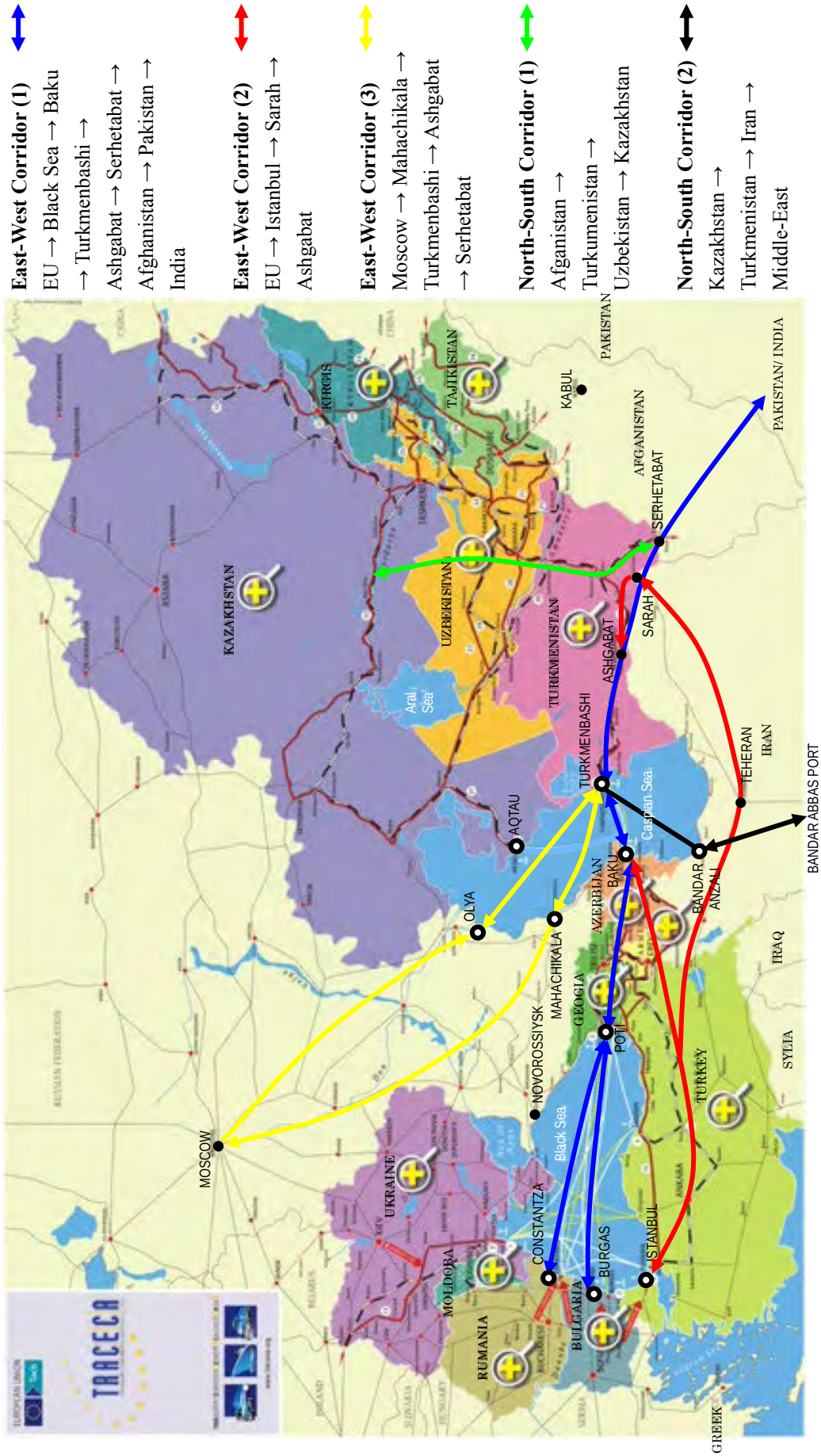
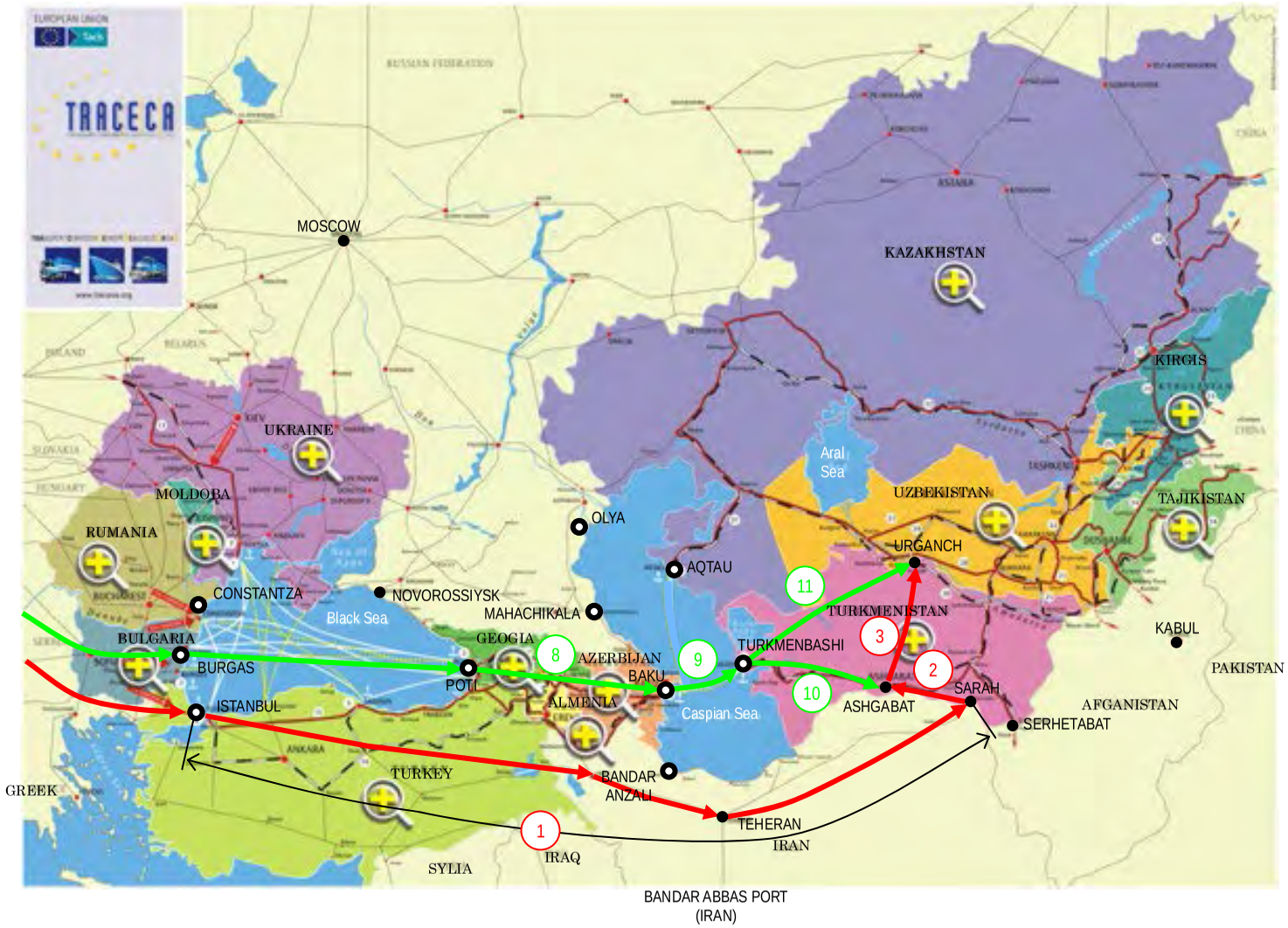


Figure 3.9.1 Present Cargo Flow through Corridors



Case-1

Not Using the Port:
EU →Bosporus → Teheran → Sarah → Ashgabat → Urganch

Using the Port:
EU → Burgas → Poti → Baku → Turkmenbashi → Ashgabat → Urgench

① Istanbul－Sarah
② Sarah－Ashgabat
③ Ashgabat－Urganch
⑧ Poti－Baku
⑨ Baku－Turkmenbashi
⑩ Turkmenbashi－Ashgabat
⑪ Turkmenbashi－Urganch

Figure 3.9.2 Comparison of Merits of Utilizing the Port in East-West Corridor (Case-1)

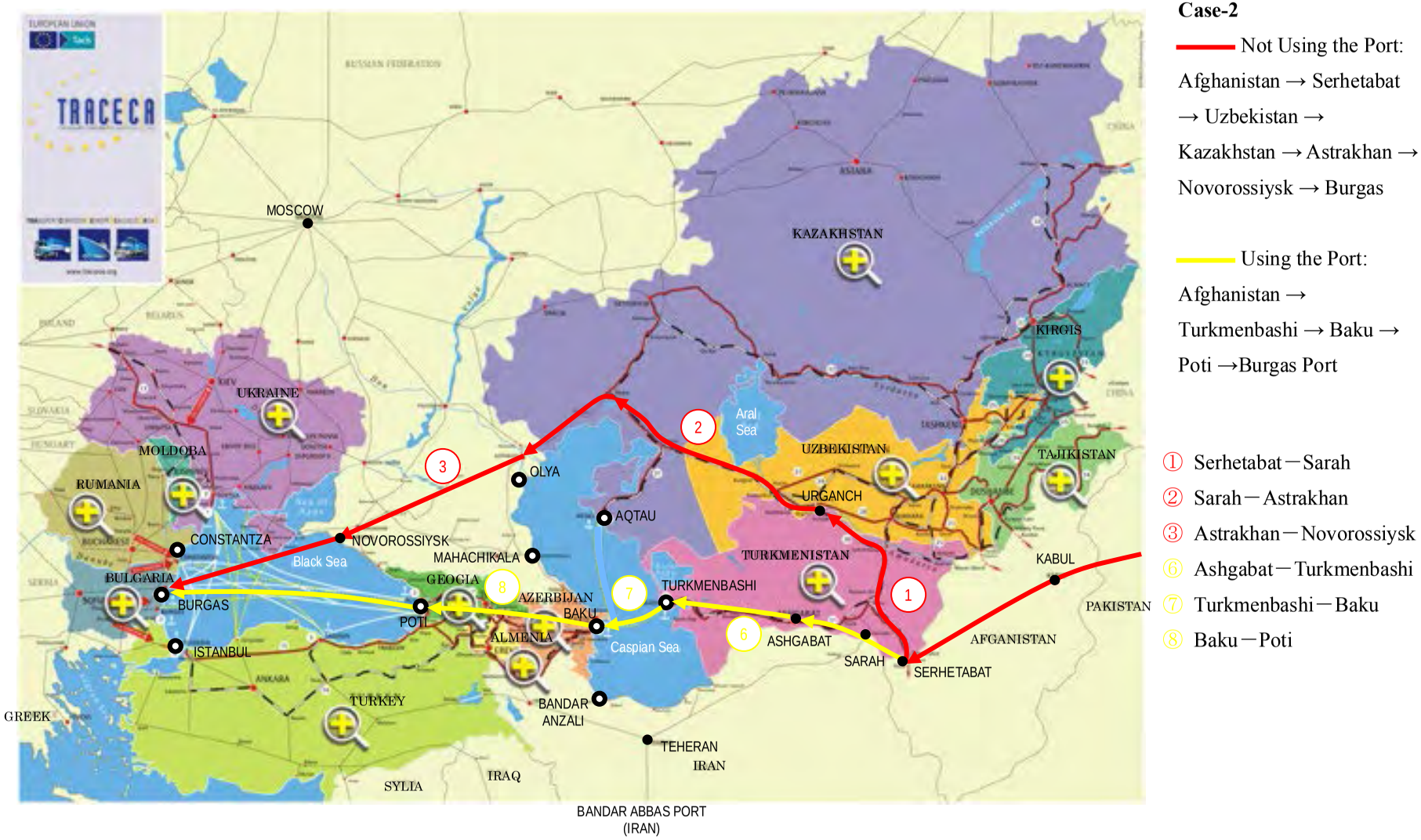


Figure 3.9.3 Comparison of Merits of Utilizing the Port in East-West Corridor (Case-2)

3.10 Scope of Practicable Components and Cooperation by JICA Assistants

3.10.1 Turkmenbashi Port Related Projects

The JICA Survey team has studied and reviewed the previous development study reports of the Turkmenbashi Port conducted by the technical assistance of the Government of Korean for "Modernization of Turkmenbashi Port" and TRACECA for "Navigational Channel for Turkmenbashi Port" and gotten principle understanding of the basic issues of the Port.

Based on that understanding, the JICA survey team and TMRL exchanged opinions of overcoming such issues and essential components of infrastructure development of port facilities. The JICA survey team visited a number of government agencies, municipality offices, private logistic companies, project sites at Kiyanly and observed the loading operation of the Ro-Ro ferry at PKK1, railway ferry terminal operation, interview survey with truck drivers coming to the port and the access channel to collect and confirm the basic data and information for which JICA can extend the cooperation and assistance in future. The following components of the project are considered as the highest priority projects to be implemented immediately for the port development and to be developed by ODA funds.

(1) Improvement of the navigational channel
(2) Development of Ro-PAX terminal facilities.
(3) Maritime Education and Training Improvement Project at Turkmen Maritime College (TMC),
    Including Technical assistance for the training program and operation of supplied navigational and mechanical simulation equipment for training
(4) Technical cooperation and Assistance;
    1) Assessment of the existing dredger of TMRL for mechanical/electrical repairs together with supply of spare parts for future maintenance dredging works.
    2) Assisting the improvement of maritime environmental protection facilities in TMRL including procurement of necessary equipment.

The detailed necessity and scope of the above components are described in Chapter 3.

3.10.2 Railway Sector

Issues to improve strategic function and networks of present integrated physical distribution system by railway sector were identified in 2.2.4 and construction of the two lines listed among planned new lines is important to strengthen railway network and increase physical distribution in Turkmenistan. The development study by technical assistance will be effective for implementing these two lines construction project.

(1) Construction of new line from Atamurat to Sarahks through Tagtabazar

Since construction of the bridge across Amu Darya River between Atamutrat and Kerkichi was

completed in 2009 and the line Turkmenabat – Atamurat has been connected to the unconnected line which is located at the part of Turkmenistan, it has been possible for Turkmenistan railway to operate their trains on the unconnected line not through Uzbekistan territory. As the result, it is expected that transport volume between Tahikistan and Iran by railway will be increased and it is important to construct short-cut line, Atamurat – Sarakhs. The length of Atamurat to Tagtabazar is approximately 300km and the length of Tagtabazar to Sarakhs is approximately 150km. The total length of the line is approximately 450km.

(2) Construction of new line Atamurat to Afghanistan

There is only one line connecting between Turkmenistan and Afghanistan. Since at present study on railway line between Mazar-e sharif and Herat in Afghanistan is in progress and it is expected to increase demand for physical distribution between Afghanistan and Turkmenistan and others, it will be required to construct a line from Atamurat to the line between Mazar-e sharif and Herat. It has not been determined that which track gauge should be adopted and bogie exchange facilities at the border between countries may be required.

3.10.3 Road Sector

The road sector works using its own funds and performs construction and maintenance of roads as a national enterprise. This is basic policy and it will continue in the future, so there is no matter to cooperate presently.

However, improvement of the railways and roads will be needed to service the anticipated increase of marine transportation in Turkmenbashi. Widening of the access road to the port is essential as it has only 2 narrow lanes and vehicles with containers are concentrated on the road.

Therefore it is proposed to build a new access road for the marine port at Turkmenbashi. It needs the following.

- Widening of road
- Structures that stand on narrow area
- It must conform to the program of the new center of Turkmenbashi and Awaza district.

3.10.4 Cooperation for Improve Trade Facilitation Aspects

State Committee for Statics wants to get a technical cooperation of JICA in the field of statics. The transparency and opening of information to the public is one of the most important policies for improving the trade and investment environment in Turkmenistan. In this sense, the provision of technical cooperation for making international standard of statics is regarded to be vitally important.

In the trade environment including the customs system, the improvement of customs system, in particular, the simplification of procedures, visa issues at the cross-border, diversification of

industrial sectors, and acceleration of privatization are also the important issues for Turkmenistan. These issues should be paid attention for the technical cooperation.

In the field of statics developed by multi-lateral organizations, the macro level indicators for the international cooperation are attached to "Country Assistance Strategy (CAS; World Bank)" and "Country Strategy and Program (CSP; ADB)". In the "Millennium Development Goals", United Nations provides 8 goals and 18 targets with about 40 indicators.

JICA also provides 26 indicators shown in the "Macro-Economy Indicator Manual" in terms of 7 aspects; Basic Indicators, Industrial Structure, Trade, Investment and Saving, Finance, Monetary Affairs, Balance of International Payments. In compliance with the targets of policies in Turkmenistan, the concrete content of technical corporations is expected to be discussed so as to make effective indicators.

4. Recommendation

Based on the above results and conclusions, the study team recommends that the following matters are followed up by TMRL.

(1) Management and Operation of the Ports–

For better management and operation of the port, the following measures should be taken by TMRL in collaboration with all stakeholders:

1) Status of Turkmenbashi Port

- The Turkmenbashi Port among commercial ports shall be clarified by the government ordinance as the particularly important infrastructure supporting industries activities and to contribute to the development of the Caspian Sea.
- The Port should collaborate its facilities development and marine transport service with neighbor countries in Caspian Sea.
- The Port should be given the status of International hub port of Turkmenistan.
- The port shall serve in operating and management administration by the international standard and management administration.

2) To formalize master plans as well as land-use plans by government regulation

TMRL should follow up the study results and stipulate master plans as well as land-use plans of the Turkmenbashi port authorized by government regulation at the earliest possible and to avoid disorderly development of the port and hinterland in future.

3) To activate promotion of the port

- TMRL should hold meetings with related parties such as shipping companies, shippers and consignees to exchange necessary information and viewpoints, to obtain precise information on the shipping market, and to grasp the needs of users.
- To clarify the sales points of the port and to reinforce port sales promotion activity to potential users
- To develop the hinterland and attract more cargo, especially for opening a new Ro-Ro ferry service
- It is important to coordinate port development with regional development of the Turkmennbashi city metropolitan development plan; especially special economic zone should be developed adjacent to the port.

(2) To implement the planed urgent projects at the earliest possible time

- TMRL should carry out the engineering study and environmental consideration survey for the Ro-Ro ferry terminal and access channel improvement projects and procurement of necessary equipment for Turkmen Marine College.

- TMRL shall implement the Ro-Ro ferry terminal development and access channel improvement as one packaged project and shall make their best efforts to implement and realize the proposed urgent projects for Turkmenbashi port development by the combination of soft loan and own budget.
- The improvement of the port access road should be carried out in collaboration with TMRL and Turkmen Highways State Concern Road sector.
- The development plan of the access road shall be prepared in harmony with the regional development plan of the Turkmenbashi city metropolitan.

(3) To follow up environmental matters

- TMRL should duly consider environmental affairs in carrying out port activities and/or new development. In particular, the following issues should be addressed:
- It is expected to increase noise and air pollution by exhaust gas of vehicles by users of Ro-Ro ferry terminal. Such environmental pollutions shall not become the environmental issues of the city.
- The terminal land use plan shall be prepared by coexistence with the existing trees and plants by protecting them.
- TMRL shall reinforce the existing section of maritime and environmental protection by recruiting engineers and necessary specialized staffs and procuring necessary equipment.

(4) To establish an appropriate operation scheme for the automobile terminal

A full fledged loading/unloading operation of international Ro-Ro ferry services and terminal requires special skills. Therefore, TMRL should establish an appropriate operation scheme for the international Ro-Ro ferry terminal immediately. The study team recommends the following:

- TMRL shall start the discussion with littoral countries to reach an agreement for trade by international Ro-Ro ferry service with all countries along the coast of the Caspian Sea
- Terminal operation itself should be conducted by applying vitality and know-how of experienced staffs of loading/unloading vehicles and passengers based on the global standard.
- Reasonable tariff should be set after examining the examples of other terminals in the region of Black Sea and Mediterranean Sea.
- The specification of Ro-Ro ferry shall be set by taking the port users' opinions into consideration
- The terminal should be operated under common use principle for various users and establish the adequate immigration, quarantine and custom system in the terminal area.
- TMRL shall establish the proper maintenance system of the port facilities and cargo handling equipment.
- To establish proper traffic control system in the port area and on land access road area.

(5) Improvement of the Channel

- TMRL shall prepare to carry out the maintenance dredging works of the access channel by own dredger by assessing the capability of the existing dredger whether damaged conditions of mechanics and electricity can be repaired for future maintenance dredging works.
- TMRL shall carry out periodically the hydrographic survey of the access channel area and port area in order to monitor the pattern of sedimentation deposited in the access channel and establishing the maintenance dredging strategy.

(6) To achieve efficient customs clearance by Introduction of EDI system

- EDI system expedites documentation procedures in ports including customs clearance. Some ports in the Caspian Sea have introduced this system. It is not fully utilized and optimized yet. The study team recommends the following actions:
- To introduce EDI system in the port operation and management by integrating the EDI system with close coordination and cooperation of customs office, railway ferry companies, forwarding companies, shipping companies, truck companies and other port users.
- TMRL should utilize an EDI service provider as a means of getting information on port activities to analyze berth performance and cargo handling efficiency.

(7) To enhance port security

- To set up a security committee composed of related organizations in order to prevent such incident as pilferage in the port. The committee will meet regularly to discuss problems reported from related offices as well as port users, measures and recommendations to improve the situation.
- To introduce sufficient hardware for port security such as fence and CCTV, which can be monitored from a central office, together with a constant surveillance system in actual site.

(8) Enhancement of Institutional Capacity

1) Establishment of effective training system

- TMC shall procure necessary equipment to provide internationally recognized certificate for qualified graduate students from the TMC. TMRL shall reinforce the existing capability of education program and training curriculum for seafarers and crews.
- To provide good training system for port workers/gangs
- To activate port related organization by introducing such system as Quality Control (QC) circle
- To enhance the function of the Port Training Center (PTC)

2) Setting up the information unit together with the development of effective database system

- To develop appropriate port statistical system and to establish the integrated database system
- To enhance the capability of planning as well as port performance evaluation utilizing the above database system.
- To conduct training for the enhancement of the capability of assessing/evaluating performance of the private sector

To achieve afore-mentioned improvements of soft-ware issues, it is recommended that

"Administrative & Management Skill Enhancement Program" should be implemented by TMRL with the support of external experts. The said program can provide various tools that are necessary to resolve the wide-ranging problems.