Tacis

Port Network Plan and Improvement Programme: Renovation of the Ferry Terminals of Baku and Turkmenbashi

Phase 1, Final Report, January 1997
Design Basis

RENOVATION OF FERRY TERMINALS IN BAKU AND TURKMENBASHI

PHASE 1, FINAL REPORT

January 1997

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Activities

Based in the project office in Baku and the representative office in Ashgabat project activities have mainly been carried out by the resident staff of these offices but supported by specialists on short-term visits.

The first phase, data collection activities, has comprised an extensive programme of meetings, and site surveys and inspections, which have comprised both the central authorities in Baku and Ashgabat, the ports authorities of the two ports, the operator and users of the ferry link and other Traceca programme projects. Besides the detailed examinations of the seaward and landward installations of the two ferry terminals the field investigations also comprised a crossing of the Caspian Sea by the ferry leaving a first-hand impression of operational aspects as well as approach conditions to the terminals.

Parallel to the data collection activities the initial planning activities concerning the general arrangement and layout of the renovated terminals, subject of phase 2, have been initiated.

Collaboration

The project is carried out in close collaboration between the consultant and the concerned EC/Tacis offices, the local governmental institutions and the port authorities of the two ports.

Context

The EBRD has recently expressed interest in providing a loan for the renovation of both the Port of Turkmenbashi and of Baku. This renovation should cover not only the ferry terminals, but to some extent the general cargo facilities.

In the light hereof, Tacis is considering to finance the additional consulting services required as an extension of the present technical assistance to the two ports through the Traceca programme. The aim should be to profit from parallel execution of the projects.

0. EXECUTIVE SUMMARY

0.1 Project Background and Context

Background

Regarded as successor to parts of the historical "Silk Route" between Europe and China, the ferry crossing of the Caspian Sea between the ports of Baku in Azerbaijan and Turkmenbashi in Turkmenistan today is a vital link of the Transport Corridor Europe-Central Asia (Traceca corridor).

Constructed in 1960, the ferry terminals, serving this sea link, today face various problems that are of major constraint to a proper and smooth use/operation of the ferry link and if not corrected in the near future even is a threat to the continuation of the ferry service on the sea route. These problems are due both to the change in natural and political environment since the construction of the terminals and the ageing of the terminal facilities.

Against this background the EC has committed itself under the Tacis Traceca programme to finance consultancy services for the rehabilitation and modernization of the two ferry terminals.

Project

The consultancy services awarded to an international group of consultants, led by RAMBØLL, Denmark, is divided into four phases the scope of which are:

- Phase 1 - to determine the design parameters for the modernization and rehabilitation of the two ferry terminals.
- Phase 2 - to prepare the design of the works.
- Phase 3 - to evaluate the economical and financial viability and prepare a financing plan.
- Phase 4 - to prepare tender documents for the works ready for international tendering.

The present report constitutes the reporting of activities and presentation of findings of Phase 1 of the study.

- Priority on the ferries continues to be given to rail transportation and the steadily increasing truck traffic experiences waiting time from two days up to seven to ten days.

- The lack of area and facilities for trucks is causing congestion at the terminals.

- The lack of well-functioning customs and border police operations is causing congestion at the terminals and dissatisfaction among users.

- Users of the ferry service have aired complaints over the cleanliness and general maintenance levels of the ferries operated

- The lack of a bow door on the ferries is slowing the loading/unloading operations in the terminal.

Ferries

The ferry link is serviced by ferries of the "Dagestan" type put into service in 1984-86. Out of a total of eight existing ferries of this type, currently six are available inside the Caspian Sea while two are operating on routes in the Baltic Sea and the Black Sea. Although the stated speed of the ferries is 17.15 Kn and a sailing distance between Baku and Turkmenbashi of 165 nautical miles the transit time at present is normally 12-16 hours.

The capacity of the ferries is 28 railwagons or 30 trucks (of semi-trailer type), 50 cars and 200 passengers.

Having been constructed primarily as railway ferries, the difficult access to the hold through the main deck and the lack of a bow door for driving through of trucks are major disadvantages to an efficient handling and fast turnaround time in the terminals.

Sea Level

The immediate reason for undertaking the renovation of the ferry terminals now is the direct threat that the increasing water level of the Caspian Sea is constituting to the continued operation of the ferry link.

The existing ferry terminals were designed in 1960 at which time the water level was -28.5 m (where zero is defined as normal sea level of the Baltic Sea (BSL)) compared to the current level of ~ -26.7 m. The direct problem is that the shore ramps now have reached the maximum level and further adjustment can only be obtained by ballasting of the vessel.

0.2 Present Context of Ferry Terminals

History

The transportation philosophy and policy of the former Soviet Union (FSU) was to use the inland waterways and the railroad system for long distance transportation, and trucks for short distance and local transportation and distribution. In line with this philosophy the rail ferry link between Baku and Krasnovodsk (Turkmenbashi), that started operations in 1963, was considered an important strategic connection linking the European rail system to the Middle-Asian railroad system serving the Central Asian republics and Western Siberia and the Far East. As a consequence, the terminals were constructed with the purpose of handling railcars, and facilities for trucks and automobiles are virtually non-existent.

Traffic

The break-up of the Soviet Union, hostilities and outbreak of open warfare, political differences, deteriorating infrastructure and transportation equipment and an overall decline in economic activity in all the republics of the former Soviet Union have all contributed to a dramatic decline in the trade of the former republics and the cargo flows on the trans-Caspian ferry service.

This is reflected in the cargo statistics of the ferry service which shows a decrease from a total of 3,717,000 tons in 1989 to a minimum of 522,000 tons in 1993.

The liberalization of transportation policies and new trading patterns have also opened alternative routes for cargoes to and from the republics in the hinterland of the trans-Caspian ferry, adding to this situation.

Despite the lack of proper facilities, both at the terminal and onboard the vessels, to handle truck traffic efficiently, the volume of trucks on the ferries have increased.

Operations

At the present time the ferry service is characterized by an overall deterioration of both physical facilities and the overall service level:

- The sporadic and ad hoc schedule is creating problems for the users of the ferry service. The ferries' schedule is based on the availability of cargo rather than on a preplanned fixed schedule.

maintenance dredging is not carried out which presently is a daily problem to the ferries and may lead to a stop of operations if no proper action is taken.

Environment

The terminal in Baku is located at the centre of the city immediately surrounded by industrial and other ports area. The marine environment is heavily polluted from oil spills etc. An environmental concern may be the increased (truck) traffic which at present has to go through populated areas of the city.

Sea areas for dumping of dredged material and provision of fill materials are already existing.

Turkmenbashi terminal is located in a remote area to the east of the city and the development of this area will in general not affect environmentally exposed areas.

0.3 Prospect of Future Developments

Trade

While local traffic always have been a feature of the trans-Caspian traffic, transit cargoes have always been important and constituted the major cargo volumes. With the exception of the access of Turkmenistan to the Caspian Sea and to the international waterway system through the Russian river and inland waterway system (which is only open seven to eight months of the year) the Central Asian republics are landlocked and are dependent upon transit through neighbouring countries to enable imports and exports with the rest of the world.

In this context it is worth noting that among users, the ferry route is considered highly cost and time effective (if properly operated) compared to other routings from Central Asia (Turkmenistan, Uzbekistan, Tajikistan, Kyrgyzstan) and western Europe (and the US).

Together with a re-dressing of the Central Asian economies as measured by the GDP, the expected developments of the cargo flows will to a large extent be determined by the ability of the respective governments to redirect its trade flows from their traditional orientation of trading within the former Soviet block countries to trade with the rest of the world.

In this overall picture, Azerbaijan will be an influence on the cargo flows only to the extent of its local trade with the other Central Asian republics on the other side of the Caspian Sea. The cargo flows will therefore be driven by the

However, during the last year a decline in water level has been recorded.

Facilities

The site surveys in both terminals have fully confirmed the urgent need for a renovation of the terminal infrastructure.

Probably due to lack of sufficient funds, the terminal facilities show all signs of a general neglect of proper maintenance and repair of damages from accidental events. This is particularly problematic as concern the seaward structures as these continuously are exposed to heavy wear from the continued operation of the ferries.

Besides the general bad state of repair the following major problems can be mentioned:

- Fendering of berthing structures either missing or in very bad shape.
- Superstructures of finger piers are damaged by ship collisions.
- Concrete cover in quay wall of central pier is missing in big areas.
- The superstructure of the head of central pier has been severely damaged (and repaired in Baku).

The ferry access ramps themselves generally appeared to be in good condition with the exception of the deck structures which need to be replaced. Machinery in lifting towers appear to be well maintained while electrical equipment and control equipment shall be replaced.

As pointed out earlier, the landward facilities are very poor and not at all designed for servicing the combined traffic of trucks, cars and passengers in an efficient way. The exceptions are the facilities for railway traffic as these facilities were designed to meet the much higher railway traffic during the former Soviet Union period. The tracks and signalling systems need rehabilitation although the rails themselves are generally in good condition.

Approach Channels

Seaside approach to both ferry terminals are through dredged and marked channels. While the channel to Baku is free from significant siltation and also has navigational aids functioning, this is certainly not the case in Turkmenbashi where the channel is exposed to heavy siltation and the markings along the channel are in a poor condition. Due to lack of funds, the necessary

0.4 Design Criteria

Standards

Within the European Community uniform standards for design and construction are under development these years, called Eurocodes. Presently, EC1, EC2 and EC3 have been prepared dealing with loads and concrete and steel structures respectively. Taking into consideration the modernization aspects of the present project, and the wish to orientate the project to the future, it is suggested that the Eurocodes shall be used for the main structures in the present project.

The areas in which it is most critical to adapt to local traditions and practices like utilities and installations (gas, water, electricity, sewerage, telephone/ communication) in connection with traditional building works it is envisaged that design shall be carried out by local engineers using local (Soviet) standards and norms. For this design it is the intention to make stagewise comparison to international well recognized practises to ensure the international standard of the project.

Design lifetime of infrastructure is 50 years.

Natural Conditions

Prevailing natural conditions both in Baku and in Turkmenbashi have been determined, mentioning - meteorological conditions - seismic conditions - soil conditions and hydraulic conditions.

With regard to the future variation in sea water level, a probabilistic analysis has been carried out, based on a litterature review. The minimum and maximum design water levels are determined to -25 m and -30 m. The maximum and minimum level proposed will also cover the effects from seasonality and irregular variations.

Requirements

Staying within the economic planning period (year 2015), the main planning features are for each terminal:

- Number of vessels: 7
- Number of berths: 2

trade developments and thus transit cargoes to and from Turkmenistan, Uzbekistan, Tajikistan and Kyrgyzstan.

Recent developments of positive influence to cargo flow of ferry link are - agreement on shipment of 1 million tons of cotton from Uzbekistan - assurance by Georgian authorities of safe transit of rail cargo through Georgia - expected opening of truck container transport (P&O) from the US/Europe via Georgia - establishing Baku as a major oil development centre - several major development projects in Turkmenistan (pipelines, refinery, sulphates and salt deposits, sulphur deposits, cotton industry, bauxite import).

Future Traffic

Although the heritage of the FSU transportation system and policies will linger, it is expected that the transportation developments in the rest of the world will increasingly influence the developments in these countries:

- As a result of the heavy investments in the railway infrastructure and rolling equipment for the long haul transportation, rail transportation will necessarily remain a major mode of transportation in the future.

- Trucking - including shipping of loose trailers - will increase significantly from a very low base.

- Passengers and cars will most likely remain relatively stable.

- Intermodal transportation of containers, which at the present time is virtually non-existent, will increase dramatically.

Noting the preliminary state of the traffic forecasts prepared a summary of the basic traffic forecast figures is given hereafter:

Service	1995			2005			2005			2010			2015		
	Low	Likely	High	Low	Likely	High	Low	Likely	High	Low	Likely	High	Low	Likely	High
Baku-Turkmenbashi	235	235	235	265	314	395	300	420	666	340	562	1123	384	753	1893
Turkmenbashi-Baku	344	344	344	389	460	580	440	616	977	498	825	1647	564	1104	2776
Ferry Total	579	579	579	655	775	976	741	1037	1644	838	1388	2771	949	1857	4669
Modal split															
Rail	330	330	330	262	310	390	222	311	493	251	416	831	284	557	1400
Truck	249	249	249	327	387	488	407	570	904	461	763	1524	522	1021	2568
Intermodal	0	0	0	65	77	97	111	155	246	125	208	415	142	278	700
Total	579	579	579	655	775	976	741	1037	1644	838	1388	2771	949	1857	4669
Passenger (´000)	48	48	48	54	64	80	61	86	136	69	115	229	78	153	387

The traffic forecast figures may be adjusted (refined) throughout the development of the present study if additional and more detailed information is obtained.

In addition, following areas have been identified for additional investigation:

- Supplementary geotechnical investigation.
- Supplementary topographic investigation.
- Submarine inspections.
- Independent navigation and safety study for the approaches to Turkmenbashi.
- Independent feasibility study of ring-road in Baku.

0.5 Implementation Context

Co-ordination

Due to the complexity of the terminal projects comprising partly seabased partly landbased facilities servicing various traffic categories, many different parties are concerned with the present project both with respect to planning and design of facilities, operations during and after implementation and financing of the project.

To take proper account of the different interests and requirements as well as necessary project approvals that the concerned parties represent a proper planning and co-ordination during the implementation becomes important in order to ensure a smooth and unproblematic implementation of the project. This becomes even more important in the present case of a multi-national project involving two separate ports projects in different countries.

Risk Areas

Certain areas have been identified which will require particular attention and co-ordination in order not to develop into potential conflict areas:

- Although the ports are the principal owners of the terminal areas it is disputed to which extent this covers the railway installations (tracks and ground).
- Traditional users which have occupied/rented areas in the terminals for many years seem to claim the right to keep occupying these terminal areas (Baku terminal).

- Berthing time: max. 4 hours (aiming at 2 hours)
- Railyards: Remain as existing but modernized
- Area requirement: ~5.6 ha (excl. rail) of which ~2.3 ha is container + loose trailer yard.

The planning of the ferry terminals shall further point out future development strategies allowing extensions of the terminals to match future traffic developments beyond the present planning period of 2015.

Constraints

In Baku, the ferry terminal area is very limited comprising about 2 ha excluding the area occupied by the railway. This area is already heavily occupied by buildings and installations. Additional land area has to be found which will require either important reclamation works or moving of the fence to the general cargo port or other adjacent areas. In all circumstances, existing structures (pier, quays, tanks) will have to be removed.

Due to the limited expansion possibilities and the environmental implications this questions the suitability of maintaining the present location of the ferry terminal.

In Turkmenbashi, the remote location of the ferry terminal leaves room for expansion both on land and by reclamation without significant interference with neighbouring facilities.

Lacking Information

Despite a huge amount of information collected, specific data which the consultant expects to exist in files already is lacking, concerning:

- Design loads and drawings of ferry ramps.
- Topographic survey plan of Turkmenbashi.
- Rule books of the railways (Azerbaijan and Turkmenistan).
- Geotechnical report of Port of Baku.
- Design report of ferry terminal, Baku.

- The extent to which the terminal projects (particularly in case of extensions) will have to comply to ordinary public/administrative procedures and approvals is still not clear.

- Agreement on necessary "external" project approvals and planning hereof.

Global Planning

At the end of the report an updated time schedule for both ongoing activities and possible extensions is presented aiming at a global conclusion ready to begin construction work by the begining of 1998.

- Phase 1 - to determine the design parameters for the modernization and rehabilitation of the two ferry terminals.

- Phase 2 - to prepare the design of the works. (Draft report planned to be issued by end of January 1997).

- Phase 3 - to evaluate the economical and financial viability and prepare a financing plan. (Draft report planned to be issued by end of January 1997).

- Phase 4 - to prepare tender documents for the works ready for international tendering. (Draft report planned to be issued by end of April 1997).

1.3 Reporting

The present Phase 1, Report constitutes the reporting of activities and presentation of findings of Phase 1 of the study.

The report follows the elaboration of the Inception Report issued May 1996 and it consists of one single volume with drawings and survey reports appendixed.

Following an Executive Summary and the present introduction, the report is divided into 7 sections as follows:

- An outline of the study activities undertaken during the first phase of the study is presented in chapter 2 with due consideration to the way of collaboration and its impact on the execution of this phase. Further, the overall context of the project development is discussed with reference to the possible project extension.

- Chapter 3 presents the general sea link aspects that are common to both ferry terminals, such as history of sea link, traffic aspects, traffic routes in the region and infrastructure, and vessel on the ferry route. The crucial issue of variation of the level of the Caspian Sea is also treated in this chapter.

- A thorough presentation and detailed survey of the present condition of the infrastructure and facilities of the ferry terminals are the subjects of the chapters 4 and 5 dealing with Baku and Turkmenbashi respectively.

- A first attempt to forecast the development opportunities of trade and the future traffic on the ferry route is presented in chapter 6 together

1. INTRODUCTION

1.1 Background

The present project is part of the EC financed Tacis Traceca programme which concerns the development of the Transport Corridor Europe-Central Asia. This corridor is an essential transport route in the region between the Black Sea and Central Asia. A vital link of this corridor is the ferry crossing over the Caspian Sea between Baku in Azerbaijan and Turkmenbashi in Turkmenistan.

Constructed in 1960, the ferry terminals, serving this sea link, today face various problems that are of major constraint to a proper and smooth use/operation of the ferry link and if not corrected in the near future even is a threat to the continuation of the ferry service on the sea route. These problems are due both to the change in natural and political environment since the construction of the terminals and the aging of the terminal facilities.

Against this background and following a preliminary survey of the operational conditions of the two ports the EC has committed itself under the Traceca programme to finance consultancy services for the rehabilitation and modernization of the two ferry terminals.

The execution of these consultancy services has been awarded to an international group of consultants, lead by RAMBØLL, Denmark and further comprising Booz Allen & Hamilton, UK, Probel of Belgium and local experts. Project work was initiated end March 1996 and the present assignment is planned to be concluded end April 1997 by preparation of tender documents. This report has been prepared by the consultant and does not necessarily reflect the policies or opinions of the European Commission.

1.2 Objectives and Scope of Project

The overall objectives of the ferry terminals project are:

Broad terms - to facilitate communication and trade between the countries of the Traceca corridor and neighbouring countries to the benefit of the growing economies of these countries.

Narrow terms - to safeguard the sea link between Baku and Turkmenbashi and renew and modernise the ferry terminal facilities.

The present assignment is divided into four phases the scope of which are:

with an identification of the associated future ferry terminal functions and services.

- Based on the outcome of the previous chapters, chapter 7 presents a summary of the design criteria and assumptions proposed as basis for the design of the future terminals. Needs for additional information to supplement the present design basis are described.

- The final chapter 8 describes similarly the basis on which the project shall be executed and the context in which the implementation is going to take place.

Comprehensive and detailed inspection reports of the various terminal infrastructures are presented in the Appendices of the report.

This report is the final version of the Phase 1 Report. The draft report was issued in July 1996 for commenting by the following organisations:

- Tacis Management Team, Bruxelles
- Tacis M&E Unit
- Tacis CU in Baku and Ashgabat
- Port Authorities in Baku and Turkmenbashi
- EBRD, London

The received comments have been included where found appropriate.

1.4 Acknowledgements

Special thanks are due to the staff of the two ports in Baku and Turkmenbashi, who, under the heading of the respective Port Directors, have provided assistance and support to the consultants during the whole of the present phase. Excellent co-operation has also been received from the EC Tacis Traceca administration and monitors, the various local ministries and authorities in the two countries as well as other Traceca consultants and individuals who have provided information and advice to the consultant.

Traceca projects have already been made in the Inception Report of May 1996.

It is the general impression that most projects have still not reached a level of advancement where input can be used in this project. An example is traffic forecasts which should be co-ordinated with the outputs of the other Traceca projects but where we at present have been forced to present forecasts based entirely on our own investigations.

During the initial meetings a large quantity of background material was identified and registered. This material has followingly been thoroughly reviewed and analyzed and main findings are presented in the chapters 3 through 5. A complete list of project documentation is given in Appendix 1. On account of the site visits to the Baku and Turkmenbashi Ferry Terminals, and the detailed examinations of the facilities both seawards and landwards, comprehensive inspection reports have been elaborated describing the works and installation of the two terminals and their present state of repair. As part of the field investigations a crossing of the Caspian Sea by the ferry has been undertaken, providing a firsthand impression of the operational aspects of the ferry link and constraints with respect to approach to the two terminals. Also the access roads to the terminals and the main road between Turkmenbashi and Ashgabat have been surveyed. The inspection reports are attached as Appendix 3.

During phase 1 an Inception Report was submitted, setting out adjustments to the work plan on account of the experiences encountered during the start-up of the project. These adjustments include a reduction in the number of companies in the consortium of consultants as well as substitutions in the staffing of the project.

At the time of preparation of the inception report mid-May, our project office in Baku was visited by the EC/Tacis Monitoring & Evaluation team with whom the status of the project and the future developments were discussed.

In the beginning of June, a meeting was organized in London, gathering representatives of EC/Tacis, EBRD, and the consultants of the port projects in both Baku and Turkmenbashi, in which case the financing of the projects was discussed.

The findings following the analysis of the basic project data have confirmed the serious need of modernization and renovation of the two ferry terminals. Despite the huge amount of background information collected, the analysis of the collected data has revealed that in certain areas the information is lacking in order to create a proper basis for the design phase. These needs for sup-

2. PROGRAMME UNDERTAKEN/STATUS OF PROJECT

The present report concludes Phase 1 of the project, which basically is concerned with the determination of the design basis of the project. Following an introductory meeting gathering the Traceca project contractors organized by Tacis in Bruxelles in February this year, the mobilisation of the project team started late March by the arrival of the project management in Baku. Since then, the execution of Phase 1 has comprised the following main study activities:

- Meetings and discussions with relevant authorities and parties concerned both in Azerbaijan, Turkmenistan and elsewhere.
- Identification and review of background material and documentation.
- Inspection and examination of terminal facilities.
- Evaluation and analysis of data collected.
- Elaboration of Inception Report and Phase 1 Report.

Parallel to these activities a project office in Baku and a representation/liaison office in Ashgabat have been established. Project activities are mainly carried out by the resident staff of these offices but supported by specialists on short-term visits.

2.1 Study Activities

The data collection was initiated by arrangement of meetings with various institutions and parties concerned and followingly the project sites were visited. Data collection activities have comprised both Azerbaijan and Turkmenistan.

The initial meetings have allowed the project team to establish a good working relationship with the various parties concerned with or having an impact on the project. Besides provision of necessary background information, this also will facilitate exchange of information and discussions of the project in the coming phases, all helping to secure a smooth and fast execution of the project to the satisfaction of all parties. A complete review of meetings held is attached in Appendix 2, where also a summary list of organizations and people met is given.

In addition to meetings with various authorities, also a number of contacts have been made to other projects under the Traceca programme, that might have an influence on the ferry terminal projects. A listing of other influencing

- **Concerning Turkmenbashi Dry Cargo Terminal**

  Preparation of detailed design and tender documents for first phase of rehabilitation projects for Turkmenbashi dry cargo terminal, and inclusion of this project in the prequalification, tendering and contracting activities for Turkmenbashi port project as mentioned above.

Although much information in the present report is of general value also to the general cargo facilities in the ports, it has been prepared only aiming at the renovation of the ferry terminals.

Despite the minor delays encountered during the execution of Phase 1 due to the settling of the co-operation issues, it is the aim, if these issues are settled soon, to keep the overall planning finishing in April 1997.

The overall time schedule for the execution of the project will be altered, though, in case of extension of the services as mentioned above.

plementary information, investigations and surveys are described in further detail in chapter 7.

2.2 Collaboration Issues

The project is carried out in close co-operation between the consultant and the concerned EC Tacis offices, the local governmental institutions and the ports authorities of the two ports. The consultants team already comprises local experts from both Azerbaijan and Turkmenistan and will be further strengthened by local experts who are envisaged to assist in an important way in the execution of the project.

At the initiation of the study, the participation of the local design institute, Kaspmornii-proekt, was envisaged for the execution of the local parts of the project. As explained in the inception report agreement on the participation of this institute had not been reached. On the request of Tacis, the discussions regarding the possible participation of Kaspmornii-proekt were reopened and they are still pending at the present time. Besides the time consumed during the discussions, the non-participation of Kaspmornii-proekt in the project team has had negative implications on the execution of Phase 1 of the project in various ways - data collection has been much more difficult and time consuming - not all existing background data has been identified and found.

2.3 Project Context

The EBRD has expressed interest in providing a loan for the renovation of both the Port of Turkmenbashi and of Baku. The renovation will cover not only the ferry terminals, subject of the present study, but also the general cargo facilities in the ports.

In the light of the above, Tacis is considering financing the additional consultancy services required as an extension of the present technical assistance to the two ports. It is the intention to integrate the preparation of the various projects up to the stage where construction contracts are awarded, aiming at following the same overall time schedule.

The additional consultancy services required will comprise two parts:

- **Concerning the Ferry Terminals in Baku and Turkmenbashi**

  Prequalification and shortlisting of contractors, issue of tender documents and follow-up during tender period, tender evaluation, negotiations and contracting, preparation for start-up of construction activities. The services also include environmental assessment and monitoring throughout the project activities according to EBRD standards.

- Baku - Krasnovodsk (now Turkmenbashi, Turkmenistan): The sailing distance is 165 nautical miles (nm), and the transit time is approximately 13 hours. At the peak operations in the mid 1980's this link was served with six or seven sailings per day. Currently the link is served by four to five sailings per week at a highly irregular sailing schedule, which is based on cargo availability.

- Baku - Aktau (Kazakhstan): The sailing distance is 253 miles and the transit time is about 22 hours. Regularly scheduled sailings were performed until the service was stopped in 1992.

- Baku - Bekdash - Krasnovodsk: This ferry link of 280 miles sailing distance with a transit time of 26 hours was maintained with daily sailings in the 1980's.

The transportation philosophy and policy of the FSU was to use the inland waterways and the railroad system for long distance transportation, and trucks for short distance and local transportation and distribution. In line with this philosophy the rail ferry link between Baku and Krasnovodsk (Turkmenbashi) was considered an important strategic connection linking the European part of the rail system to the Middle-Asian railroad system serving the Central Asian republics and Western Siberia and the Far East. As a consequence the terminals were constructed with the purpose of handling railcars, and facilities for trucks, automobiles, containers etc. are virtually non-existent.

At the present time the ferry service is characterized by an overall deterioration of both physical facilities and the overall service level:

- The sporadic and ad hoc schedule is creating problems for the users of the ferry service. The ferries' schedule is based on the availability of cargo rather than on a preplanned fixed schedule

- Priority on the ferries continues to be given to rail transportation, and the steadily increasing truck traffic experiences waiting time from two days up to seven to ten days.

- The lack of area and facilities for trucks is causing congestion at the terminals.

- Users of the ferry service have aired complaints over the cleanliness and general maintenance levels of the ferries operated.

As described in the following the break-up of the Soviet Union and with it disruption of historical trading patterns without the establishment of new ones,

3. GENERAL SEA LINK ASPECTS

3.1 History of the sea link

The ferry link was started in 1963, at which time the ferry terminals were completed in Baku, Azerbaijan and Turkmenbashi (previously Krasnovodsk), Turkmenistan. The ferry service and the terminals were planned and the construction supervised by Kaspmornii-proekt, the hydrotechnical and marine design and research institute for the Caspian Sea region headquartered in Baku, Azerbaijan.

The ferry service has since the inception been operated by the Caspian Shipping Company headquartered in Baku. The company can trace its history back to the formation of the "Kavkaz i Merkuriy" joint stock company in 1858. During the Soviet regime the company was developed into a conglomerate marine transportation and operations company comprising a varied fleet of tankers, dry cargo vessels, ro-ro vessels, passenger-rail ferries, offshore oil support vessels and ice breakers operating both in the Caspian Sea as well as on the Russian inland waterways and in worldwide trading. The company also controlled the ports of Baku, Bekdash and Krasnovodsk (now Turkmenbashi, Turkmenistan), Makhachkala (Dagestan), Aktau and Bautino (Kazakhstan), and four major shipyards organized as Kaspmorsudoremont. In addition the company also performed agency services through Transflot, dredging services through Kaspmorput and wholesale and retail trading through Torgmortrans.

Following the break-up of the former Soviet Union and the establishment of the independent republics of Azerbaijan, Turkmenistan and Kazakhstan the all encompassing influence of the Caspian Shipping Company was also divided between the respective newly independent republics. The company retained, however, control of most of its fleet of vessels, including the rail-passenger ferries operating in the Caspian Sea, the Port of Baku and the shipyards in Azerbaijan. The port of Baku was as of January 1, 1994 separated from the Caspian Shipping Company as an independent entity and is now operating as the International Sea Port of Baku.

The first ferry vessels that were operated were two Russian built passenger-rail ferries, which were retired and replaced with "Dagestan" type vessels, of which a total of eight vessels were built and operated starting from 1984 to 1986. These vessels were designed for the transportation of railcars, trailers, cars and passengers and to a small extend trucks.

The rail-passenger vessels of the "Dagestan" type were operated on three routes, all originating in Baku:

has caused a dramatic decrease in the overall cargo volumes carried by the ferries.

3.2 The Regional Transportation Infrastructure and System.

The current transportation infrastructure and system of the Central Asian republics is an inheritance from the FSU and was designed according to the centrally planned transportation requirements of the planners in Moscow. The system was designed to connect the Central Asian republics to the Central and European parts of Russia and the other European parts of the FSU (i.e. the Baltic republics, Belarus and Ukraine). Railway transportation was considered as the main mode of long distance transportation, while truck transportation was only considered for distribution and short distance transportation. The waterway system is also extensive and continues to play an important role in the transportation system. Major emphasis was, however, placed on the rail ferries across the Caspian Sea to serve the needs of the railway system.

The overall Central Asian transportation system is illustrated in Figure 3.1 and is commented below.

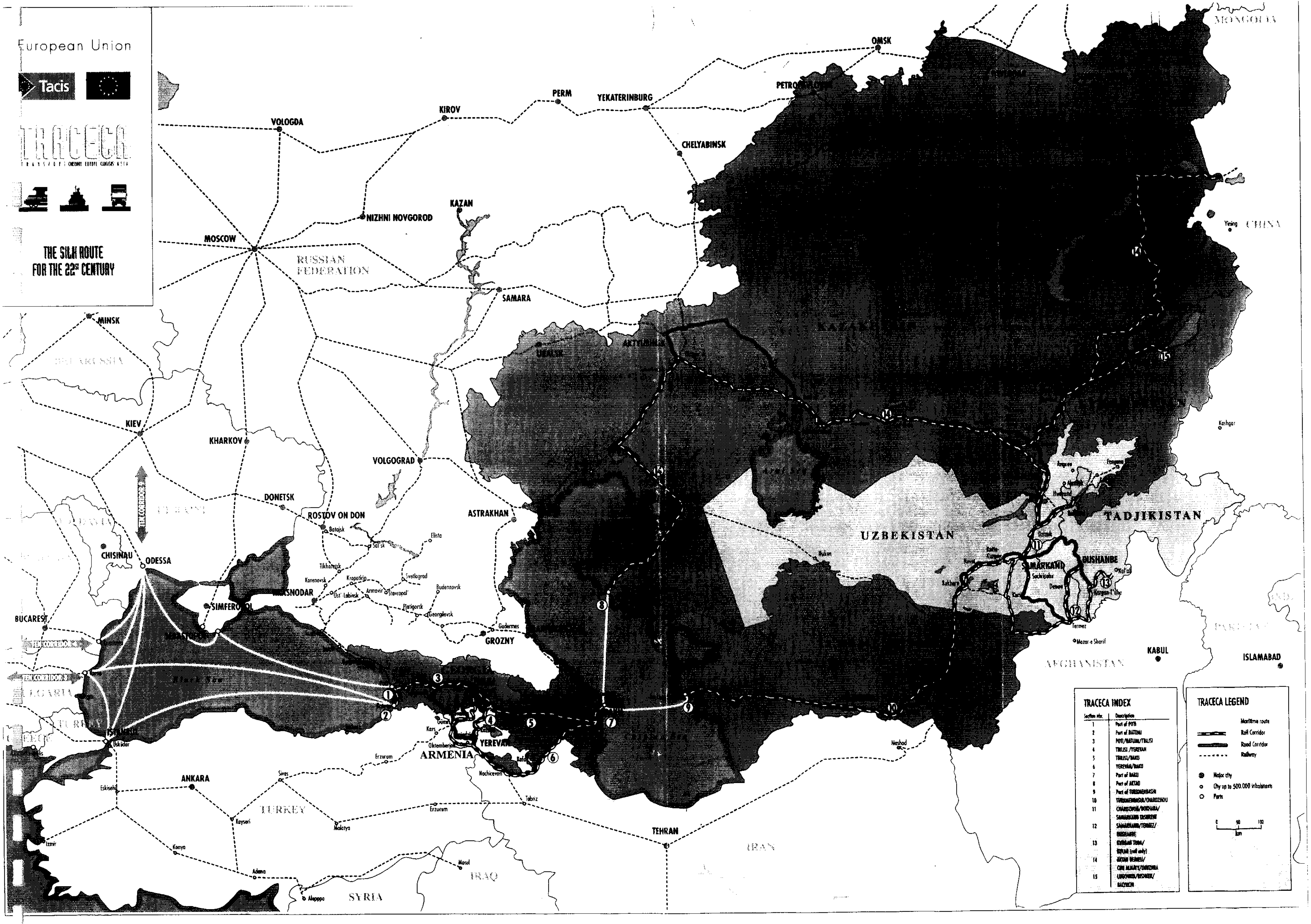
3.2.1 Railway Transportation Infrastructure and System

Following the break-up of the Soviet Union, the rail system was divided between railway administrations in respective countries with the exception of Uzbekistan, Kyrgyzstan and Tajikistan, which retained the old system based on the Srednaja Asiatskaya system minus the Turkmenistan system. The Baku port rail terminal is served by three main rail lines:

- The rail system between Azerbaijan and Georgia between Baku and the Black Sea ports of Poti and Batumi via Tbilisi. The system is also connected to the Russian rail system on the Black Sea coast and the ports of Sotchi and Tuapse and further to the Russian rail system via Krasnodar. From Tbilisi via Armenia it is also connected to the Turkish rail system.

- The rail system between Azerbaijan and Armenia between Baku and Yerevan, which at the Julfa border station in Nachicevan provides a link to the Iranian rail system. It is also connected to the Turkish rail system at Gumri.

- The rail system between Azerbaijan and Chechnya extending between Baku and Makhachkala and onto the Russian rail system both to the north to Astrakhan and to west to Grozny and Krasnodar.



European Union
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TRACECA
THE SILK ROUTE
FOR THE 22ST CENTURY
MOSCOW
RUSSIAN FEDERATION
VOLOGDA
KIROV
PERM
YEKATERINBURG
OMSK
CHELYABINSK
NIZHNI NOVGOROD
KAZAN
SAMARA
MINSK
KIEV
KHARKOV
VOLGOGRAD
DONETSK
ROSTOV ON DON
ASTRAKHAN
CHISINAU
ODESSA
BUCAREST
SIMFEROPOL
GROZNY
ARMENIA
YEREVAN
ANKARA
TURKEY
TEHRAN
IRAN
SYRIA
IRAQ
UZBEKISTAN
TADJIKISTAN
SAMARKAND
DUSHANBE
KABUL
ISLAMABAD
AFGHANISTAN
CHINA
Black Sea
TRACECA INDEX
Section nbr.
Description
1 Port of POTI
TRACECA LEGEND
Rail Corridor
Road Corridor
Railway
Major city
City up to 500.000 inhabitants
Ports
km

Nevertheless the road system is extensive, and long distance road haulage by truck is becoming increasingly important as more of the transport work is transferred from rail to road:

- Exports from Western Europe are trucked via Istanbul and through Turkey and Georgia to Azerbaijan and via the Baku - Turkmenbashi ferry link to Turkmenistan and the other Central Asian republics. Presently most of the trucks return empty either to Turkey or Southern Europe due to the lack of return cargoes.

- Exports from Turkey use the same route as the Western European trucks.

- Local cargoes to and from Iran and transit cargoes shipped through the port of Bandar Abbas in the Arabian Gulf are often trucked to and from all the Central Asian republics. The poor quality of the Central Asian road system prompted the Iranian government to construct a highway of international standard from Ashgabat, Turkmenistan to Gaudan to facilitate the use of modern trucks for cargo transportation between Iran and Turkmenistan. This road was completed in early 1995.

Georgian authorities has started to collect road taxes on foreign trucks transiting Georgian territory, the proceeds of which will be used to upgrade and maintain the road system.

3.2.3 The waterway system

Cargo transportation on the Caspian Sea and onwards through the Russian inland waterway system enabling navigation through to the Black Sea and the Baltic Sea has always been an important part of the transportation infrastructure of the Central Asian republics having ports in the Caspian Sea.

There are, however, limitations and restrictions reducing the importance of the inland waterways:

- The Volga-Don is closed four to five months of the year due to ice conditions. In 1993 the vessels of the following dimensions could navigate through the Volga-Don system: Length 140 m, draft 3.4 m, airdraft 14 m and beam 16.2 m. These dimensions correspond to vessels of about 2,500 DWT.

- The normal fully loaded draft of 3.5 meters of the typical inland waterway vessels cannot be utilized:

The Turkmenbashi port rail terminal is connected to the Central Asian railway system via Ashgabat and onto the other Central Asian republics. The system is linked to the Russian system via Kazakhstan providing connections to the Russian Far East and also to the Peoples Republic of China. With the recent opening of the last missing section, the Turkmenistan railway system is now also connected to the Iranian system at Sarakhs, which provides a link to Teheran and the port of Bandar Abbas.

There are also several east-west rail lines through Kazakhstan providing alternate routes between the Central Asian republics and Central and European Russia and northern Europe.

Two planned railway infrastructure projects could, if they are constructed, divert cargoes that currently are being shipped via the Baku - Turkmenbashi rail ferry service:

- A rail line round Lake Van planned by the Turkish government to improve shipments of cargoes to and from Turkey via Iran and the Central Asian republics.

- A rail line along the east shore of the Caspian Sea connecting Bandar Torkmen, Kizyl-Atrek via Turkmenbashi to Astrakhan would form a competitive alternative to shipping cargoes via the ferry to Baku connecting to the Russian rail system on the west side of the Caspian Sea.

3.2.2 Highway infrastructure and system

Road transportation has not been considered an important mode of transportation for long haulage. This fact is also reflected in the status of the highway system with a major portion of the system incapable of handling axle loads of 10 tons, which is the normal standard in Europe. The roads are also in a poor state of maintenance. This is clearly illustrated using the most important road artery in Turkmenistan, M37 between Chardzhou and Turkmenbashi as an example:

- This highway is a total 1,212 km

- Only 65 km allows a 10 ton axle load

- 121 km of the pavement was classified as "good", 336 km as "satisfactory" and 755 km as "unsatisfactory".

transportation (i.e. USD 151.30/ton by truck and ferry vs. USD 119.50 via all rail), it is reported that increasing volumes of general cargoes are shipped by truck from Western Europe via the ferry.

In the referenced study, the ferry alternative has not been considered an alternative for cargo transportation between Turkey and Turkmenistan. Turkish trucking companies have, however, confirmed that the ferry route is highly cost and time effective compared to the all road route alternatives, and a large proportion of the trucks using the ferry between Baku and Turkmenbashi are in effect Turkish.

3.3 Past and Present Traffic Flow Patterns and Alternative Traffic Corridors

The historical "Silk Route" between Europe and China passed through Azerbaijan and Turkmenistan, and the trans-Caspian ferry link can be regarded as the successor to and continuation of these old trading patterns. During the Soviet period old trading patterns were disrupted and new ones established, whereby extensive transit cargoes were shipped between the resource rich Central Asian republics and the European part of Russia.

The break-up of the Soviet Union, hostilities and outbreak of open warfare, political differences, deteriorating infrastructure and transportation equipment and an overall decline in economic activity in all the republics of the former Soviet Union have all contributed to a dramatic decline in the trade of the former republics and the cargo flows on the trans-Caspian ferry service.

With the liberalization of transportation policies and new trading patterns have also opened alternative routes for cargoes to and from the republics in the hinterland of the trans-Caspian ferry.

3.3.1 Macroeconomic Developments

The two dominant sectors of the Turkmenistan economy are gas and cotton. Turkmenistan ranks with proven reserves of over 3 trillion cu. meters as among the ten largest in the world. The Turkmenistan economy is highly dependent upon the gas sector, which in 1995 accounted for approximately half of the GDP, while cotton as the second largest sector accounted for one sixth. Key statistics on the recent development of the Turkmenistan economy is presented as Table 3.1.

- A water level of only 63 meters compared to the design level of 68 meters at the Cheboksary hydroelectric station presents draft restrictions on the Volga river in the Niznij Novgorod area. Full 3.5 meter draft is maintained only a few hours per day

- Channel erosion and a sinking water level at the Kochetovsky Lock and Dam on the lower Don river system allows a maximum draft of only 3.0 meters limiting the loading capacity of the vessels.

Russian authorities are reported to be undertaking construction of new ferry terminal in a new port at Olya near Astrakhan, that unlike Astrakhan, will be kept open and navigable all year. It is reported that Mr. Nikolai Petrovitch Zakh, Minister of Transportation of Russia has made a commitment to Turkmen government officials that the construction will be completed in the fall of 1996, and that ro-ro truck and rail ferry services are planned between this port and Turkmenbashi and Iranian ports at that time. If these plans are realized it will divert cargoes that historically were shipped via the Baku - Turkmenbashi ferry service (i.e. prior to the Chechnya conflict) and that potentially could be shipped on this ferry link in the future.

3.2.4 Transportation Cost by Mode of Transportation

In a feasibility study of the Turkmenbashi port development, ref. /5/, costs of transportation of both bulk and general cargoes via various modes of transportation between Turkmenistan and various origins and destinations are presented. Cost data has been collected based on actual transportation assignments and from operators active in the various modes of transportation. The main results are presented in Appendix 7, while the main conclusions that can be drawn from this analysis are:

- For all transportation routes where the Turkmenbashi - Baku ferry has been compared to alternative routings, the route using the ferry is highly competitive both in terms of costs and transit time compared to alternate routes and modes of transportation.

- The cost and transit time advantages of the routings are significant both for bulk and general cargoes.

- Between Turkmenistan and Western Europe represented by the Ashgabat - Frankfurt route, the Chechnya rail link using the ferry is the fastest and lowest cost alternative. While the Chechnya link is closed due to hostilities, the Transcaucasian route via Poti is still a competitive alternative, particularly for bulk cargoes. Despite the fact that the calculated cost of truck transportation of general cargoes is 39% higher than rail

The recent economic development of the Azerbaijan economy is summarized in Table 3.2.

Table 3.2 Recent Developments of the Azerbaijan Economy

	1990	1991	1992	1993	1994
GDP (% change)	-11.7	-0.7	-35.2	-23.1	-21.9
GDP index (1990=100)	100.0	99.3	76.9	59.1	46.2
Industry	100.0	99.3	75.4	59.2	43.9
Agriculture	100.0	97.1	72.8	61.2	53.1
Construction	100.0	102.7	76.5	51.1	27.1
Transp./communic.	100.0	90.3	43.0	28.8	23.0

Source: State Committee on Statistics, Republic of Azerbaijan

3.3.2 Recent History of Cargo Flows and Trade Patterns

While local traffic always have been a feature of the trans-Caspian traffic, transit cargoes have always been important and constituted the major cargo volumes. With the exception of the access of Azerbaijan and Turkmenistan to the Caspian Sea and to the international waterway system through the Russian river and inland waterway system, the Central Asian republics are landlocked and are dependent upon transit through neighbouring countries to enable import and exports with the rest of the world.

During the former Soviet regime the Central Asian republics were regarded as valuable sources of raw materials including hydrocarbons for the industries of central Russia. At the same time manufactured industrial goods and consumer products were shipped to the Central Asian republics.

The dependence on the other Soviet republics is indicted by the following statistics of trade with other republics of the Soviet Union in 1990 is presented in Table 3.3.

Table 3.3 Central Asian Republics' Trade with other Soviet Republics 1990

	Export	Import
Kazakhstan	89%	73%
Kyrgyzstan	98%	73%
Tajikistan	84%	75%
Turkmenistan	93%	81%
Uzbekistan	88%	84%

Table 3.1 Recent developments of the Turkmenistan Economy

	1991	1992	1993	1994	1995
	(percentage change)				
Real growth GDP	-5.0	-5.0	-10.0	-18.8	-13.8
Retail prices	155.0	644.0	9743.0	1461.0	N.A.
	(in percent of GDP)				
Industry	N.A.	N.A.	55.1	73.2	64.1
Of which: Gas	N.A.	N.A.	49.6	65.9	51.3
Agriculture	N.A.	N.A.	11.5	9.0	20.7
Of which: Cotton	N.A.	N.A.	9.8	7.6	17.6

Source: IMF, Recent Economic Developments, February 6, 1996

As a result of the pipeline distribution system, most of the gas output has been directed to the FSU states. The decline in the GDP is a direct result of decreased export to these countries.

The Azerbaijan economy has experienced a continued and dramatic decline of output since 1989, which is due to dislocation in trade links with the FSU Republics, reduced oil production as a result of depletion of exiting field and the effects of the continued conflict with Armenia over the Nagorno-Karabakh. According to Government estimates, Armenian forces currently occupy territory that used to produce more than 15% of the national output and had a population of 820,000. In addition the conflict with Armenia is estimated to have inflicted material costs of USD 5 billion on Azerbaijan. The economic difficulties were worsened by the closure by Russia of the border to Chechnya in September 1994, which further disrupted external trade with the FSU. The inflation has consistently been high, and despite constant wage increases, real wages have fallen dramatically.

The government has embarked upon a program to liberalize the economy and also to promote a transition to a market economy. Albeit the progress has been slow and piecemeal, a growing and buoyant private sector has also emerged.

Azerbaijan is rich in natural resources, and has vast reserves of oil and natural gas. Although a program has been implemented to stop the decline in oil and gas production through the use of modern technology and to explore new offshore fields in the Caspian Sea, several years will pass until the oil and gas industry will reverse the decline in production and ensure a positive economic growth.

umes of cargoes have already been shipped on this route due to both time and cost savings compared to alternative transportation routes.

- As a result of diplomatic differences between Azerbaijan and Russia concerning among other issues the rights to oil fields in the Caspian Sea basin caused Russian authorities to close the Volga-Don waterway system to Azerbaijani vessels effective November 1995. It was reported that the sanctions against Azerbaijani vessels were lifted on May 24 or 25, but this has not been confirmed.

Due to these disruptions of traditional transportation patterns, new transportation routes have been opened or enlarged:

- Cargoes to both Azerbaijan and Turkmenistan as well as the other Central Asian Republics have been shipped by ship through Bandar Abbas, Iran and then by truck to the ultimate destination. Cargoes to and from the United States cannot, however, be shipped on this route, and will have to be shipped on alternate routes.

- Use of the Volga/Don waterway system is being made. The major limitations are the fact that the system is closed four to five months of the year due to ice and draft limitations in the locks limiting the cargo carrying capacity of the vessels. An oil company engaged in oil exploration and production in Turkmenistan and Uzbekistan is reported to have shipped its supplies from Italian and Greek ports through the Black Sea and the Volga/Don river system to and from Turkmenbashi.

- Use of the Russian rail system through Kazakhstan. Food supplies to Azerbaijan from Europe is reported to have been shipped through Russia, Kazakhstan and Turkmenistan and then via the ferry from Turkmenbashi to Baku.

3.3.3 Cargo Statistics on the Ferry

The upheavals and disruptions both in the regional economies and as result of hostilities is also reflected in the cargo statistics of the ferry service. As shown in Table 3.5 there has been a dramatic decline in the ferry traffic up until 1994. From 1994 to 1995 the cargo volumes increased more than 27%. Despite the lack of facilities both at the terminal and onboard the vessels to handle truck traffic efficiently, the volume of trucks on the ferries have increased, which is illustrated in Tables 3.6 and 3.7.

Statistics for the overall trade pattern of Azerbaijan shows a similar pattern also at this time, as shown in Table 3.4.

Table 3.4 Azerbaijan Foreign Trade 1993 - 1994 (Millions of USD)

	1993	1994
Total Exports	**718**	**637**
Non-FSU	349	363
FSU	369	274
Total Imports	**817**	**814**
Non-FSU	334	328
FSU	483	486

The exports and imports of the Central Asian republics in 1994 by major commodity is presented as Tables I.5 and I.6 in Appendix 8. As shown in these tables the CIS countries continue to be the major trading partners of these republics even after independence.

Traditional trade flow patterns have over the past few years been seriously disrupted due to outbreak of hostilities or as a result of political actions:

- Azerbaijan's armed conflict with Armenia, and Armenia's occupation of the territory of Nagorno-Karabakh has according to government estimated cost the Azerbaijani economy losses of USD 5 billion. The region had a population of 820.000 and used to produce approx. 15% of the GDP of Azerbaijan.

- The very important border rail station between Azerbaijan and Iran located at Julfa, which prior to the outbreak of hostilities had a throughput capacity of 300 railcars per day. At any point in time more than 3000 Soviet railcars were in operation inside the territory of Iran. Currently the railway to this border station is blocked by Armenian forces.

- The outbreak of hostilities in Chechnya caused Russia to close the border with Azerbaijan in September 1994. This caused a significant disruption of the transit rail traffic between Russia and the Central Asian republics via the Caspian Sea rail ferry.

- Internal disruptions and armed insurgents in Georgia has prevented Georgian authorities from guaranteeing the safe passage of rail traffic through its territory. Only recently (spring 1996) Georgian authorities were able to guarantee safe rail passage through its territory. Large vol-

Table 3.7 Volumes of cargoes and passengers handled in the port of Baku (in thousands of gross tons where applicable)

	1992	1993	1994	1995	1996 (1. qtr)
Total in the port (1000 tons)	1783.3	1156.6	961.0	923.5	148.3
Ferry cargoes (1000 tons)	1094.8	638.5	553.7	781.5	116.2
Baku - Turkmenbashi (1000 tons)	533.5	234.9	232.7	317.7	22.8
d.o. Railcars	7113	2830	3277	3282	280
Turkmenbashi - Baku (1000 tons)	561.3	403.6	321.0	463.8	93.4
d.o. railcars	7531	4892	4532	4848	953
Number of vehicles leaving Baku					
Trucks	4524	5014	2767	6206	739
Cars	3745	5095	2423	4124	306
Number of passenger leaving Baku	54128	50213	23542	20715	2217

Source: International Sea Port of Baku

3.4 Recent developments and planned projects influencing the cargo flows on the Baku - Turkmenbashi ferry.

There are several recent developments which is expected to have a positive influence on cargo flows of the ferry link between Turkmenbashi and Baku. Some of the major developments are briefly described below.

3.4.1 Uzbekistan Cotton Exports

An agreement has been reached between the governments of Georgia, Azerbaijan, Turkmenistan and Uzbekistan on the shipment by rail of one million tons of cotton from Uzbekistan to the ports of Poti and Batumi in Georgia for further shipment to markets in Europe and America. The railcars will be transported on the ferry between Turkmenbashi and Baku. The Georgian government has assured the safe transit of the cargoes through Georgian territory.

An agreement has been reached between the railway ministries of the transit countries whereby the cotton will be transported at 40% of the tariff rates.

3.4.2 Guaranteed Safe Transport through Georgia

The Georgian authorities has assured the safe transit of rail cargoes through Georgian territory. Transportation users are starting to make use of this route.

Table 3.5 Ferry statistics for 1989 to 1. qtr 1996 Baku - Turkmenbashi (in thousands of gross tons)

Route	1989	1990	1991	1992	1993	1994	1995	1996 (1.qtr)
Baku - Turkmenbashi	1995.0	1312.0	913.0	525.0	208.0	241.0	314.0	30.6
Turkmenbashi - Baku	1722.0	903.0	712.0	333.0	314.2	309.6	458.0	85.6
Turkmenbashi - Bek-tash	192.0	182.0	162.0	143.0	108.2	36.8	21.0	0.0
Bektash - Turkmen-bashi	203.0	254.0	277.0	236.0	180.3	83.3	55.0	1.4
Baku - Bektash	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Bektash - Baku	392.0	321.0	276.0	235.0	116.3	1.9	0.0	0.0
Baku - Aktau - Baku	17.0	12.0	20.0	10.0	0.0	0.0	0.0	0.0
Ferries total	4521.0	2984.0	2360.0	1482.0	927.0	673.2	858.0	117.6
Passenger traffic on ferry	315	205	178	103	93	52	48	7

Source: Caspian Shipping Company

Table 3.6 Number of units carried by the ferry Baku - Turkmenbashi - Baku

	1990	1991	1992	1993	1994	1995	1996 (1.qtr)
Railcars	32510	23510	11941	6431	7788	8173	1206
Trucks and trailers					6661	12446	2210
Cars					5154	6370	955
Total trucks and cars				20234	11815	18816	3165

Source: Caspian Shipping Company

- The river system is open only seven to eigth months of the year, since ice conditions close the river system from November to April.

- Draft restrictions limits the cargoes to be loaded on river vessels to approximately 2,500 dwt.

- The overall cost of water transportation was found to be higher than transport on the shorter rail link.

3.4.3 Container Transportation via Georgian Ports

One of the world's largest container transportation companies, the UK-based P&O Containers has offices serving the Central Asian region in Ashgabat, Tashkent and Baku. All cargoes are currently shipped via Dubai and Bandar Abbas, and then trucked through Iran to and from their ultimate origin or destination. The major problems experienced by P&O are cargoes to and from the US, which cannot be shipped through Iran, the high cost of shipping through the Gulf and the relatively long transit time.

At the present time P&O has no cross-Caspian Sea traffic. Recently (May 1996) P&O has reached an agreement and made arrangements with the authorities in Georgia that will ensure the safe transport of their cargoes safely through Georgia. In this connection the port of Poti, Georgia will be transit port for all containers shipped to and from the Central Asian republics using the Baku - Turkmenbashi ferry link. All containers will be transported by truck.

By bringing cargoes to and from Europe through Poti, Georgia the transit time is expected to be reduced by 20 days and the overall freight charges by 40 - 45% compared to the Gulf route via Dubai and Bandar Abbas.

There are a number of customers waiting for the service to be opened. The expected cost and transit time reductions plus the possibility of handling containers to and from the US, expectations are that cargo volumes will increase significantly. Estimates of cargoes via the Caspian Sea ferry service is expected in the near term to be:

> Imports to the Central Asian Republic - approx. 100 TEU/month
> Export from the Central Asian Republics - potential of 250 TEU/month.

Imports consist of all types of consumer goods, electronics and foods (although reefer truck service is poor). Exports are cotton, metals (iron rods) and various chemicals.

Based on the assurances from Georgian authorities several freight forwarders have started to use Georgia to transit cargoes to and from Central Asia.

Through the Traceca programme a weekly block train service has been started in November 1996 between Poti/Batumi and Baku via Tbilisi. The trains carry a total of 60 TEU.

The British-owned and controlled freight forwarding company Bertling Caspian Ltd. in Baku has recently (May 1996) completed a shipment. When the Consultant visited their office, they had just completed a major contract to transport steel to the state oil company, SOCAR, in Baku:

- 8,000 tons of steel pipe from Quantan, Malaysia
- 2,500 tons of steel and equipment from Antwerp and London

These cargoes were shipped on two vessels via the port of Poti, Georgia. The vessel carrying the pipe from Malaysia was discharged in three working days using direct discharge from the vessel onto railcars, while the second vessel from Europe was discharged in approximately two days. The latter had a mixed load, which explains the lower productivity. A total of 200 railcars were provided in six days, all of which were organized into seven block trains. There were no delays, and everything worked perfectly. The discharging of the vessels started on May 15 and the first train arrived in Zikh outside of Baku at the SOCAR plant on May 19, 1996, in which all the pipes would be coated before being taken to its ultimate destination, i.e. the subsea pipeline from the Chirak oil and gas field to the Sangchal terminal.

Overall conclusions of the Bertling team were:

- The efficiency of the port of Poti and the ability of the Georgian railway to marshal and organize the necessary railcars and trains had impressed the local manager of the freight forwarding company.
- Bertling's local staff had ensured the full co-operation at all levels and stages of the operation, which was a major factor in the success of the operation.

Alternative routes for this type of cargoes had been considered based on experiences gained in 1994 using Ukrainian vessels on the Volga-Don river system. Based on their experience this alternative was not acceptable due to some major drawbacks compared to the overland rail link:

- The transit time via the waterway system is 11 to 12 days, versus 2 to 3 days by rail construction companies will be engaged. Although it is expected that the major volume of supplies will be shipped via India/Pakistan and Afghanistan, it is expected that supplies also will be shipped via the Baku - Turkmenbashi ferry.

- The contract for the reconstruction and modernization of the oil refinery near Turkmenbashi has been given to a German/French/Japanese consortium. Large volumes of cargoes will be shipped in for the reconstruction (including catalytic crackers and reformers). Following the reconstruction the plant will export large volumes of refined products and petrochemicals.

- Turkmenistan has rich deposits of natural chemicals in the Kara-Bogaz-Gol area. The potential exports of natrium sulphates and salts can exceed one million tons per year. Also large quantities of caustic soda are produced. The major problem reported by government officials is availability of transportation capacity, particularly railcars, to ship the cargoes.

- Sulphur is a major export of Turkmenistan. Currently approximately 200,000 tons per year is exported, while capacity is over 600,000 tons. In addition bentonite (cyalid) is mined in Nebitdag 130 km east of Turkmenbashi.

- The cotton industry is a major exporter. The government is expecting exports of approx. 200,000 to 300,000 tons per year, and increases are expected. The cotton is sold F.O.R. (free on railcar) ex. works, which implies that the buyer selects the mode of transportation. Destinations are primarily Turkey, Western Europe and the US. Most is shipped by rail, and the average load per railcar is 45 tons.

- Between 200,000 to 400,000 tons of bauxite is imported annually from Azerbaijan for the Turkmenistan aluminium industry.

3.5 Other Possible Ferry Links from Baku and Turkmenbashi

The reconstruction of the ferry terminals at Baku and Turkmenbashi also opens the possibility of establishing new ferry links, some of which have been operated before and have been discontinued or new ones. These are in the main:

- Baku - Aktau, Kazakhstan
- Baku - Olya/Astrakhan in the Volga delta in Russia
- Turkmenbashi - Olya/Astrakhan

The Georgian route would only be used for cargoes to and from the US and Europe. Cargoes to and from the Far East would continue to be shipped through the Arabian Gulf ports.

It is expected that also other container operators will follow the lead of P&O and ship their container traffic between the US and Europe and the Central Asian republics via the ports in Georgia and the Baku - Turkmenbashi ferry link.

3.4.4 Far East Rail Link

Major oil development projects in the Caspian Sea outside Azerbaijan is in the process of establishing Baku as a major oil development centre. Also Japanese companies have shown active interest in being selected as suppliers to the oil industry based in Baku. In this connection competitive transportation is a prerequisite. One major Japanese supplier of pipe and oil equipment has with their freight forwarders explored alternative routes to supply their products to the oil industry in Baku. Their conclusion was that for shipload lots (i.e. more than 3000 - 4000 tons) in bulk, shipment via Bandar Abbas in the Arabian Gulf was considered to be the most cost effective alternative. For less than shipload lots, however, shipment via a Russian Far East port and rail via the Central Asian republics to Turkmenbashi and the rail ferry to Baku was found to be highly cost effective. The freight forwarding company was actively working to open this rail link in connection with ongoing negotiations for delivery contracts.

The company expressed confidence that the Far East rail and ferry service link would be a competitive transportation alternative for cargoes between Japan and Azerbaijan to ship the cargoes via Bandar Abbas in Iran.

The Japanese government is considering giving grants to the Azerbaijan government in the form of medicines, food and equipment. The representative of the company expected the volumes to increase significantly.

3.4.5 Major Turkmenistan Development Projects

Several major development projects have been undertaken or are planned in Turkmenistan, all of which will create cargo opportunities for the ferry between Baku and Turkmenbashi:

- The construction of pipelines between Turkmenistan and Pakistan, and also a pipeline to Iran, which in stage two will be extended to Turkey. The construction is expected to start in mid 1997, and international

Opening of the link Olya-Turkmenbashi is planned for the next few months. First trucks will be transported via a ro-ro berth in Olya and later also railcars will be transported when the new ferry terminal in Olya is ready.

3.6 Potential and Existing "Bottlenecks" Impeding Trade/Traffic on the Ferry

There are several existing and potential "bottlenecks" or impediments to the future development of the ferry traffic, most of which are outside the control of the terminal and the ferry operator:

- The throughput and the cargo handling capacity of the ports of Batumi and Poti, Georgia
- The ability of the respective governments to assure the security of cargoes passing through their respective territories
- The capacity and state of maintenance of the infrastructure other than the port terminals to handle the expected throughput
- The capacity of the transport operators, i.e. railroads and trucking companies, to muster the necessary equipment to handle the expected cargo flows.
- Cargo carrying capacity of the vessels by the fact that two of the eight vessels are operating outside the Caspian Sea and may be prevented from returning due to restrictions imposed by Russian authorities.

At this stage it has not been possible to investigate these issues fully, and the assumption has been made that cargo will not be limited by such "bottlenecks" or impediments.

3.7 Vessels and Navigation

The existing ferry link between Baku and Turkmenbashi was opened in 1963. In the beginning, the route was serviced by vessels of the "Azerbaijan" type and from 1984-1986 eight new ferries of the "Dagestan" type were put into service, replacing the old ferries. The ferries are owned and operated by the Caspian Shipping Company, that is based in Baku, Azerbaijan.

Currently, six of the "Dagestan" type ferries are available in the Caspian Sea. Of these, five are currently servicing the Baku-Turkmenbashi route. At present, there are four to five weekly departures from each of the two ports, which

3.5.1 Ferry Service between Baku and Aktau

Although Aktau is considered a Traceca corridor link, no development of the port of Aktau has been included as part of the Traceca program. The development of the port of Aktau being supported at present by the EBRD will in addition to the possibility of establishing links to Baku also open the possibility of establishing links to Iranian ports and to Olya/Astrakhan in Russia. The development of this port will undoubtedly provide competitive alternative transportation routings for cargoes to and from Kazakhstan.

Significant oil development projects have been undertaken in the Aktau area both offshore in the Caspian Sea and onshore in the immediate hinterland of Aktau. It is expected that Baku will act as a staging area and base for the oil development projects in this area. To serve the needs of the oil industry, a ferry service between Baku and Aktau would be welcomed.

It is expected that the establishment of a ferry service between Baku and Aktau would be complementary to and not in direct competition with the ferry between Baku and Turkmenbashi.

3.5.2 Ferry Service between Baku - Olya/Astrakhan in the Volga Delta in Russia

This ferry link would be a substitute for the currently closed rail and truck routes through Chechnya. Once the Chechnya conflict is resolved, the infrastructure rebuilt and the rail and road links reopened, the cargo base for this ferry link would disappear.

3.5.3 Ferry Service between Turkmenbashi - Olya/Astrakhan in the Volga Delta in Russia.

This ferry link would be a very competitive alternative for cargoes to and from Central and Western Russia and Northern and Western Europe and Turkmenistan and the other Central Asian republics. Prior to the outbreak of hostilities in Chechnya, cargoes were transported by rail through Chechnya and via the Baku - Turkmenbashi ferry link.

As long as the Chechnya conflict is ongoing, this proposed ferry link is a competitive alternative to shipment via Kazakhstan. Once the conflict is resolved and the Chechnyan infrastructure rebuilt, it will be a competitor to the Baku - Turkmenbashi link and compete for cargoes from Central and Western Russia and Northern and Western Europe.

The ship is furnished with a double engine system, 2 x 4,350 kW, double pipes of semi-balance type and a bow propeller of 552 kW.

The ship is not equipped with an aft bridge for manoeuvring of the ship during reversing motions.

The general arrangement can be seen from dwg. 1.91.E.

3.7.2 Suitability of Vessel Type

The speed stated for the ferry is 17.15 Kn, distance of the route is 310 km, corresponding to 167 nautical miles. With a service speed of 15.5 knots it will be theoretically possible to carry out one turnaround trip each 24 hours with a lay time in harbour of one hour.

This will, however, imply a comparatively efficient loading and unloading of both rail-car deck and the hold, which is difficult with the present arrangement.

The development with more truck traffic in particular means that the arrangement of the deck with only an aft ramp and access to the hold through the main deck will considerably delay the loading/unloading operations.

In order to make the handling of trucks more efficient, it would be expedient to arrange a ramp in the front end of the main deck, principally as a bow door with an inner door, alternatively as a side door aft of the fore peak bulkhead. The cost of this work is estimated to USD 0.7 million per ferry.

The fact that the ship is only equipped with an aft ramp has another disadvantage than the slow handling of trucks: It makes it necessary for the ship always to go reverse into the harbour and the ferry berth. This manoeuvre is both slower and more sensitive to weather conditions than the opposite manoeuvre where the ferry goes forwards into the berth and then backs out again to turn around outside the berth/entrance respectively.

It may also be stated in this connection that the ship, in order to be optimum equipped for harbour manoeuvres, should be furnished with a total effect on the bow propellers of about 16 t. This may for example be reached by supplementing the existing bow propeller of approximately 8 t with another unit of 8 t. Depending on the difficulty of the harbour manoeuvre, it might also be considered to equip the ship with a cross propeller in the aft end.

It will be difficult to improve the loading/unloading of cars in the hold; a ramp in the front end similar to the one existing in the other end will occupy quite a large part of the serviceable space.

means that only three ferries are needed, and therefore most of the time two of the ferries are waiting at anchor in the port of Baku. One ferry is currently being repaired at the ship yard in Baku. The two remaining ferries are operating on other routes in the Baltic Sea and in the Black Sea.

The sailing distance between Baku and Turkmenbashi is 167 nautical miles and transit time normally is 15-16 hours.

3.7.1 Description of Ferry Vessel, Type "Dagestan"

The dimensions and layout of this ferry vessel type is shown in dwg. no. 1.91.

Conventional rail ferry with one deck, four lanes. Access over aft ramp, with two lanes. No access possible in bows.

Below the car deck is a hold used for stowing of cars. The access to this hold takes place through a flush deck hatch in the main deck and a ramp.

In the front end of the hold is mounted a turntable to turn the cars so that they do not have to reverse off board. The width of the hold is limited to 10.40 meter of the longitudinal bulkhead (double hull).

Main Features

Length overall	154.30 m
Length p.p.	147.00 m
Breadth of frame	17.50 m
Breadth of fender	18.30 m
Depth to bulkhead	7.30 m
Displacement draught, max.	4.50 m
Deadweight	3,950 t
Speed	~17 Kn
Rail wagons on deck	28
Alternatively	Approximately 30 semi-trailers with fore-carriage
Passengers	202
Cars in hold	50

It appears from the general arrangement that the ferries are comparatively closely divided below the bulkhead and that they are built with longitudinal bulkhead of one fifth of the breadth of the ship in the sides of the hold. Compared to the relatively big freeboard it may th 's be assumed that the ship complies to the international requirements foı ıeak stability for existing ships.

These stability requirements will only be complied with if future ferries for the route are built considerably wider than the present ones, and built with side casings in all of the length of the deck.

Size and weather conditions of the Caspian Sea justifies that the International Rules for Ship Safety (SOLAS) should generally be complied with. It is assumed that the authorities in the neighbouring states will also demand this. When building new ports for existing ferries, the breadth of the future ferries is therefore the most important factor to consider.

Without knowing precisely the capacity requirements to the future ferries, breadth up to 30 meter including fenders should be planned for ferries of similar lengths as the ones existing. The draught of the ships will typically be up to 6 meters if the conditions allows for it.

High Speed Vessels

When evaluating the requirements for future ferries, the Northern European development should also be taken into consideration, with a splitting-up of traditional ferry design in a high-speed ferry type (more than 30 knots) intended to the light traffic, passengers and cars, and a more traditional ferry type intended for the heavy traffic.

The high-speed ferries are typically built as aluminium double hull (catamaran type) or an aluminium single hull (frigate type). The ferries in question typically have high-speed diesel engines, alternatively gas turbines of 20-30,000 HP propulsion, and have a capacity of up to 200 cars and a passenger capacity of approximately 600. The operation of these new high-speed ferry types requires a highly developed maintenance system.

3.7.4 Environmental Requirements

Apart from the security requirements (SOLAS) it will most probably be required in the future that the ferries shall comply with the environmental requirements of MARPOL (see also chapters 4.8/5.8), comprising:

- Disposal of sewage (black and grey water) ashore or not closer than 12 n. miles from land.
- Collection of waste oil for ashore-pumping.
- Collection of oily bilge water for separation and ashore-pumping of oil.
- Collection of garbage and wastes for disposal ashore.

Another possibility would be to install a tween deck in a part of the main deck room to make it possible to stow cars in two levels with the smallest possible loss of space for trucks.

One truck lane, for instance, from the front edge of the casings to the front end of the hold will, with a moveable tween deck, make it possible to load either five trucks or 32 cars (per side) as needed.

As tween decks are rather heavy, such an installation will require a control check of the intact and leak stability of the ship.

3.7.3 Ferry Vessel Development Trends

Traditional Vessels

In spite of political goals to strengthen the railway traffic in order to relieve the European road network, the development has been steadily going in the opposite direction.

It may be assumed that this development will also influence the traffic across the Caspian Sea. The development within the ferry sector has therefore gone towards a more efficient goods handling, among others in the form of separation of railway and car traffic in each ferry/ferry harbour, and separation of trucks and cars on separate decks.

Car ferries today will normally always have possibility to access and exit in more deck levels so that cars and trucks may be loaded/unloaded simultaneously.

Decks for cars will in modern ferries almost always be situated above the truck decks, and holds below the deck are seldomly used for stowing of cargo as the use of space is normally bad and the access conditions are slow.

This change of cargo from holds below the main deck to the upper throughgoing deck means that ships today have to be built somewhat wider than similar older ferries, taking the stability into consideration.

Furthermore, the wreckage of the ferry "ESTONIA" in the Baltic in 1994 has entailed the introduction of much more rigorous requirements to the stability of damaged ferries, where water pouring into the car deck in case of damage on the ship shall be taken into consideration, too.

The maximum level at which the ferry ramps will function properly is -26.4 m. From September 1995 to September 1996 the water level has, however, fallen by 33 cm.

3.8.1 Previous Experience

Due to the apparent importance of the significant variations of the level of the Caspian Sea, the issue has been subject of numerous studies and investigations over the years but no definite explanation has yet been reached.

Information regarding the water level of the Caspian Sea has been obtained both from review of available documentation, contacts with the organizations involved in the monitoring of the Caspian Sea and by visiting the stations of measurement of the water level both in Baku and Turkmenbashi.

The following information is available:

a) Historical data from (accurate) measurements are available from the year 1900. A graph showing the yearly average water levels in Turkmenbashi is attached in figure 3.2. These data show a decreasing trend from the year 1900 (-25.7 m) to 1977 (-29.1 m) with some fluctuations. From 1977 to 1995 there is a clear increasing trend with a slope of approximately 15 cm per year. No full explanation can be given to these variations. It is a fact that large dams have been constructed at the contributing rivers in the period of decreasing water level. However, attempts to establish scientific evidence of this connection have failed. It should be noted that the water level in Baku as an average is 15 cm higher than in Turkmenbashi.

b) From 1991 to date monthly data are available. These are displayed in figure 3.3 (for Baku) and they show a seasonal variation in water level during the year. In the months of June to September the water level is higher than the yearly average, and in the months October to May, the water is lower than the yearly average. The rising water level in the summer is due to large amounts of melted water from the contributing rivers. Later in the summer evaporation of water from the surface of the sea takes place and therefore a decrease in water level is seen in the autumn. The seasonal variations as an average are between 20 cm higher and 10 cm lower than the yearly average. The irregular variations can be due to stowing of surface water during strong local winds. As for a), the monthly measurements are considered as accurate and reliable.

- Removal of hazardous products from the exhaust air.

- Sound reduction of main and secondary engines.

The compliance of the above-mentioned requirements totally depends on reception facilities being available onshore for collection of sewage water and waste oil.

3.7.5 Prices

The following prices for a single trip ticket using the ferry crossing Baku-Turkmenbashi apply to citizens of the CIS countries. Foreigners can be charged up to three times these prices.

Table 3.8 Ferry Crossing Fares

Customer group	Price
Passengers	(salon) USD 26 (4 person cabin) USD 39-44 (2 person cabin) USD 52
Trucks	USD 24 / meter
Cars	(moskowitch type) USD 83 (volga type) USD 116 (buses) USD 166
Railwagons	360-380 USD / wagon

Source: Turkmenistan State Shipping Organization

3.8 Sea Level of Caspian Sea

Throughout times the water level of the Caspian Sea has changed significantly. In recent years, one of the strongest raises in water level has been experienced. With an average increase in water level of approximately 15 cm per year the water level has raised 2.5 m from 1977 to 1995 and large low-lying coastal areas around the sea are being threatened by or subject to flooding.

The increasing water level is also threatening the continued operation of the ferry link across the Caspian Sea, connecting Baku and Turkmenbashi. The existing ferry terminals were designed in 1960, when the water level was -28.5 m (where zero is defined as the normal sea level of the Baltic Sea (BSL)) compared to the current level of -26.8 m.

Figure 3.3 Historical Data Showing the Monthly Average Sea Water Level at the Caspian Sea. Seasonal Variations 1991-1996

Source: Caspian Sea Research Institute

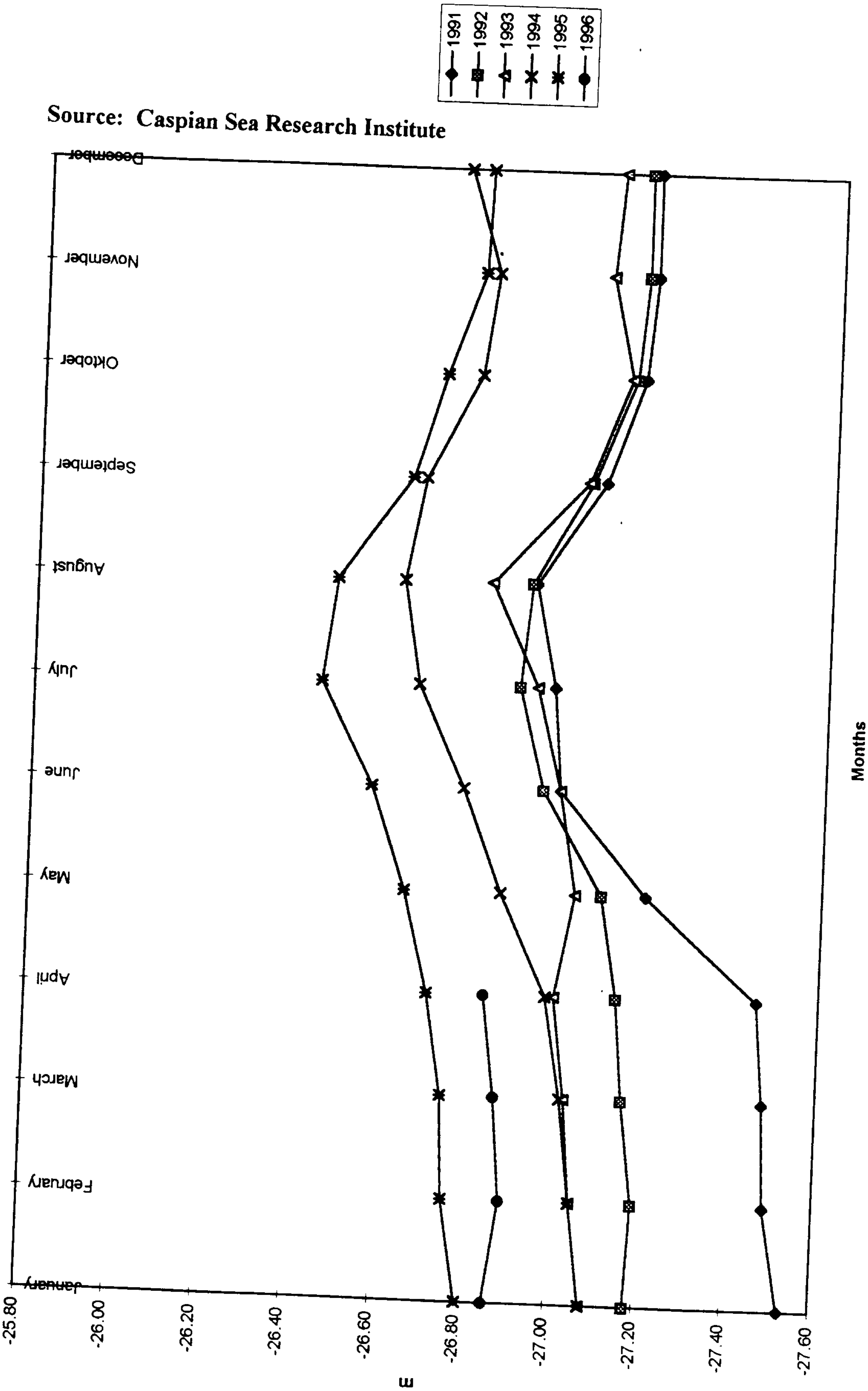
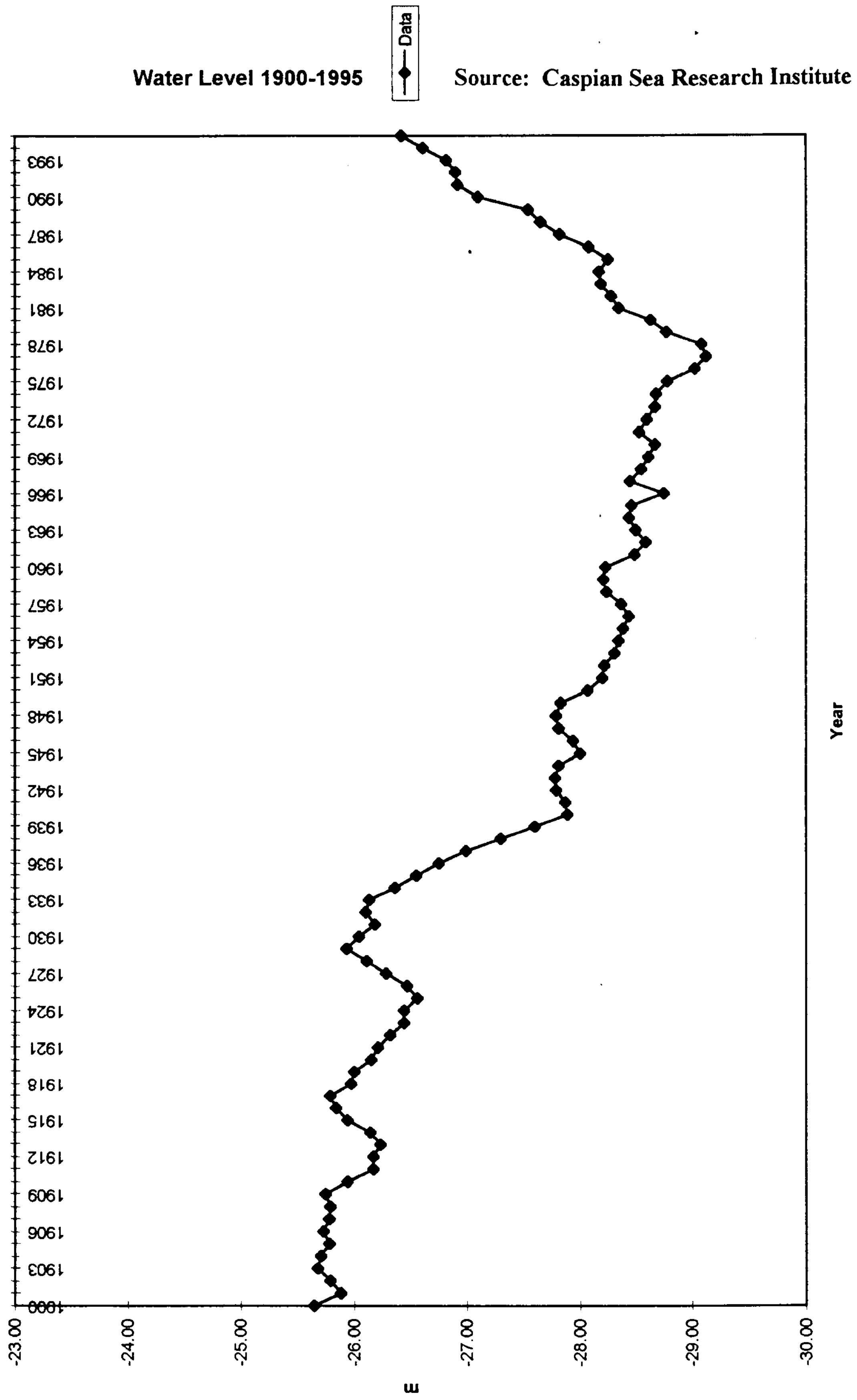


Figure 3.2 **Historical Data Showing Yearly Average Water Level in the Caspian Sea**



- shifting the above interval (= 5 m) with 1 m in each direction, the probabilities of exceedence will become about 10 times smaller at the extended limit and about 10 times larger at the other

These estimations have been made assuming that the impact of anthropogenic climate changes on the hydrological cycle at present and during most of the next half century are negligible. It is thus assumed that the high inflow and the low evaporation prevailing these years are caused by natural variations and do not represent a permanent change in the climate.

Comparison with other Forecasts for Rehabilitation of Port Infrastructure along the Coast of the Caspian Sea

According to forecast made by the State Hydrometeorological Committee of Azerbaijan, the sea level is likely to fall by 15 cm because of less inflow from the contributing rivers. Within the next 10 years the forecast predicts that the water level could rise 70 or 80 cm and thereafter a stabilization or lowering of the level could be anticipated. The Academy of Sciences has prepared a forecast setting out the maximum and minimum levels to -25.3 m and -28.3 m for the next 50 years.

In Turkmenistan no official forecast is available.

Forecasts made in ref. /4/ used for determination of the future Caspian Sea level suggest that the water level is likely to be varying between -24 m and - 28 m.

In the TOR for the present project it is recommended that the structures shall be designed for a maximum level of -24 m and a minimum level of -29 m.

Ref. /3/ describes a general expectation used for the Port of Aktau, that the Caspian Sea will find a temporary and short term stability around its present level, or up to 1.0 m above its present level, over the period to 2010. There is also an expectation, based on water balance modelling, that there will be a return in water level to its "long term average", which would imply a subsequent fall in water level to some -28 m. It is inevitable therefore that there is a degree of uncertainty over the accuracy of model results and other predictions. However, there is an apparent logic to the concept of a temporary and relative stabilization around current levels due to:

- Increased water outflow to Kara Bogaz Gol (expected to reach and stabilize at around 16-20 km^3 per annum)

c) Scientists indicate that the water level has varied throughout the last 1000 years in cycles of 80 to 145 years duration. The water level is said to have varied between -22 m and -31 m in this period. If this information is correct, the man-made influence can be excluded as single source to the variations. Then the climatic changes must play a deciding factor in the variation of water level in the Caspian Sea. Attempts to describe the water level during the Quaternary show even larger fluctuations, up to several hundred meters. In contradiction to the data given under a) and b), the information regarding cyclic behaviour is not reliable and should be taken as indications only.

Some main factors thought to be influencing the water level are:

- Climatic changes
- Water inflow and outflow
- Construction of dams and canals at the contributing rivers
- Variation in precipitation and ice intensity in the area of contributing rivers
- Wind/atmospheric pressure on water surface
- Evaporation and other consumption drawn on Caspian waters
- Tectonic movements of the sea bottom

These factors are described in more detail in Appendix 4.

3.8.2 Future Variations of Sea Level

A probabilistic analysis of the expected future sea water level has been carried out and is attached in Appendix 4. The analysis has been prepared by the Danish Hydraulic Institute, who has been involved in forecasting of the Caspian Sea water level on previous occasions. Following a literature review the analysis concentrates on a discussion of the factors influencing the sea level variations - inflow of water, - sea evaporation, - rainfall on sea, - outflow of water, - reservoirs and irrigation, - tectonic movements of sea bottom, - greenhouse effect and their importance for the water level. Based on the existing information and the above discussion on processes and factors influencing the sea level variation, it is concluded that

- the probability of the water level staying below -25 m until year 2050 is estimated to be 97 - 99 %

- the probability of the water level staying above -30 m until year 2050 is similarly estimated to be 97 - 99 %

- Further water outflow to the smaller Kulduk and Kaidak bays (north eastern Caspian Sea) as the flooding of low lying lands take place

Increased evaporation losses as a consequence of the increased surface area of the Caspian (due to flooding of low lying coastal zones)

3.8.3 Consequences for Ferry Terminals

Taking into account that the marine structures of the ferry terminal will be designed for a lifetime of 40 - 50 years and the unpredictable nature of the water level variations, it is considered acceptable to recommended design water level limits that may be exceeded with a probability of 1-2 %. For the design of the future ferry terminal structures, it is therefore recommended to adopt maximum and minimum design water levels of -25 m and -30 m respectively.

For the record, comparison to the design water level limits of the Caspian Sea recently recommended for other projects are shown hereafter:

Table 3.9: Design water levels for projects around the Caspian Sea

Source	Project	Forecast period	Max. water level (m)	Min. water level (m)
Last 67 years with measurements			-25.50	-29.00
Kaspmornii-proekt	Baku	1991-2010	-25.10	-
Sofremer et al.	Baku/Turkm	2030/2040	-24.00	-28.00
Posford-Duvivier et al.	Aktau	1993-2010	-26.00	-28.00
Louis Berger	Turkmenbashi	1996-2015	-24.45	-
State Hydrometerological Committee, Azerbaijan	Baku	-	-25.80	-28.00
Ministry of Environment, Turkmenistan	Turkmenbashi	N.A.	N.A.	N.A.
Ramboll et al.	Baku/Turkm	1996-2045	-25.00	-30.00

Source: The Consultant

A topographic survey from 1979 is available. Due to various construction works in the area of the ferry terminal since then a renewed topographic survey is strongly needed.

4.2.2 Bathymetry

In the port basin in front of the ferry terminal the water depth is between 6 (-33 BSL) and 9 (-36 BSL) meters. In the ferry terminal the water depth is between 8 and 9 metres. In 1972 a protecting stone layer was laid on the bottom of the ferry berth in order to protect against erosion from the use of the ferry propeller.

Bathymetric surveys are carried out every year and a dredger is available in the port of Baku.

4.2.3 Meteorological Conditions

Temperature

The climate is characterized by a dry and hot summer, mild winter, short spring and sunny autumn. The annual average air temperature is +14.4°C. The absolute maximum temperature is 40°C in July, and the minimum is -13°C in January. The average number of frosty days is 8.

Wind

Wind roses are available, giving probability for wind direction and wind speed interval. The roses show that northerly winds are prevailing (40.5 %), followed by southerly winds (18.4 %). The maximum wind speed from the north is 40 m/s and from south it is 28 m/s.

Navigation in the port of Baku is suspended when wind speeds exceed 20 m/s. Wind roses are attached in Appendix 5.

Precipitation and Humidity

The annual precipitation is 204 mm. Snow can occur. The average relative humidity is 72%.

Visibility

Fog can be observed mostly in February to April and basically in the morning hours. The average number of days with fog is nine. The duration of fog is approximately 12 hours.

4. PRESENT SITUATION, BAKU FERRY TERMINAL

4.1 Location of Terminal

The sea port of Baku is the only major port in Azerbaijan located on the western shore of the Caspian Sea. Baku is the capital of Azerbaijan with approximately 2 million inhabitants. From Baku there is road and rail connection to the Black Sea through Georgia, and road and rail connection to Russia and Iran. However, due to present bad relations and wars in the area, the connections to Russia and Iran are only seldomly used.

From the port of Baku, there is a ferry link to Turkmenbashi in Turkmenistan as well as some minor coaster routes to Russia, Kazakhstan and Iran. Through the Volga-Don system it is possible to reach the Black Sea. However, due to political reasons, at present, it is not possible for Azerbaijan vessels to use this route. The locations can be seen from Figure 3.1

Physically, the port of Baku is located on the southern side of the Apcheron peninsula, which provides natural protection against waves from northerly directions. The peninsula extends some 30 nautical miles to the east of Baku. The exact location is 40°22' North and 49°52' East.

The main port in Baku is located close to the city centre. The port consists of the following main quays and terminals:

- General Cargo Terminal
- Ferry Terminal
- Timber Terminal
- Oil Terminal (located outside the city)

The ferry terminal is located close to the city centre, just east of the general cargo terminal. The sea entry to the port is through a 9 km long dredged channel.

4.2 Natural Conditions

4.2.1 Topography

The ferry terminal is located on reclaimed land with a surface level of -25.4 m near the ramps, and -25 m further back at the railway shunting yard.

4.2.6 Soil Conditions

The information obtained indicate that some geotechnical investigations have been carried out at Baku Ferry Terminal area. Unfortunately the geotechnical report(s) documenting these investigations has not been made available at present. In the absence hereof it is not possible to determine neither the extent of the port area covered by the site investigations nor how detailed it has been covered. Drawings indicate, that borings have been carried out along the access bridge and central pier with a distance of app. 50 m.

In the absence of this report the soil conditions at the Ferry Terminal are described through the following available documents:

- Dwg. nos. 18371-18375, 18762, 21435 and 46278 from the original project document by Kaspmornii-proekt.

- Description of natural conditions from the original project document by Kaspmornii-proekt.

- Sofremer et. al.: Caspian Sea Water Level. Appendix 3. Calculations. (ref. /4/)

According to the above mentioned documents the soil conditions in the berthing area, with reference to M.W.L. in 1939 as level ±0, (level -27.57 m BSL) are described as the following quaternary deposits:

The seabed is in level -5 to -8

Seabed to level app. -7:	Organic silt	
	Bulk density	γ = 16-17 kN/m^3
	Drained shear strength	$c_u \approx$ 5 kN/m^2
Level app. -7 to -11:	Sand, fine, grey with thin clay layer	
	Effective friction angle	$\varphi \approx 30°$,
	Bulk density	γ = 20 kN/m^3
	Modulus of compression	$K \approx$ 15.000 kN/m^2
Below level app. -11:	Clay, silty.	
	Natural moisture content	$w \approx$ 23 %
	Index of plasticity	$I_p \approx$ 11 %
	Index of consistence	$I_C \approx$ 0,5
	Effective friction angle	$\varphi \approx 20°$,
	Drained shear strength	$c_u \approx$ 40 kN/m^2,
	Bulk density	γ = 20 kN/m^3
	Modulus of compression	$K \approx$ 9.000 kN/m^2

4.2.4 Hydraulic Conditions

Waves

Wave statistics are available for the Bay of Baku. The bay is sheltered from north by the Apcheron peninsula, and the maximum observed wave height from southern directions is 1.5 metres. The statistics are attached in Appendix 5.

Currents

Currents are dependent on the wind activity. There are no permanent currents in the Bay of Baku. The average speed of currents caused by wind effects is 0.2-0.3 m/s.

Tide

Tides in the Caspian Sea are negligible.

Ice

Sea ice can be considered as not appearing, as the average number of frosty days is 8.

4.2.5 Water Quality

The average annual salinity in the Caspian Sea is 1.27 %. The maximum salinity is 1.45 % and the minimum is 1.11 %. In the following table are given composition and content of pollutants in sea water for the region of Baku port.

Table 4.1 Water Composition, Baku

Pollutant	Unit	1990	1991	1992	1993	1994	1995	Limit
Dissolved oxygen	mg/l	8.82	7.66	7.80	7.46	7.45	7.34	6.0*
Oil products	mg/l	0.33	0.28	0.16	0.18	0.16	0.11	0.05
Phenols	mg/l	0.014	0.012	0.010	0.010	0.006	0.005	0.001
Mercury	µg/l	0.02	0.04	0.02	0.02	0.03	-	0.1
Temperature of water	°C	16.2	15.1	14.9	14.1	15.1	14.9	-
Salinity	%	1.19	1.12	1.18	1.14	1.14	1.12	-

*) in winter 4.0 mg/l and in summer 6.0 mg/l.

Source: Kaspmornii-proekt

4.3.1 Marine Works/Berthing Structures

Principal Site Inspections of the berthing structures as well as collection of data including drawings, written information and taking photos of the structures was carried out from 27th of April to 2nd of May. These inspections are subject of a detailed inspection report, see Appendix 3, and the main conclusions are summarized in this section 4.3.1. Appendix 3 also includes the findings of a underwater inspection of the structures carried out in October 1996 in the presence of the consultant.

The berthing structures surveyed consist of:

- Land base for ferry ramps
- Land base for access bridge
- Access bridge to central pier
- Lifting towers (first row from land side)
- Second span of ferry ramps
- Lifting towers (second row from land side)
- Third span of ferry ramps
- Lifting towers (third row from land side) and stop fenders
- Lifting towers (third row from land side) and base of central pier
- Finger piers
- Central pier on piles
- Head of central pier

The location of the various infrastructure elements is shown in survey plan, Appendix 3.

4.3.1.1 Land Base for Ferry Ramps

A rectangular box (10.50 m x 11.20 m) of steel sheet piles forms the substructure. The inside is filled up with mass concrete, which is formed to create support and anchorage for the main beams in the ferry ramp. A stone revetment runs across the land base to withhold the land reclamation.

The steel sheet pile structure is hidden in the sub soil and is not possible to see. The corrosion is normally insignificant for soil covered steel parts, and the substructure is anticipated to be in good state for reuse.

The concrete surface at the ramp support is worn and uneven and recommended to be rehabilitated in case of reuse.

According to one longitudinal soil profile, fairly uniform soil conditions within the berthing area are expected but whether this is valid for the terminal in general cannot be known without information regarding other parts of the terminal, e.g. made available through the geotechnical report.

4.2.7 Seismic Conditions

Baku is situated in a seismically active area. According to the Soviet Standards SNIP, the seismic force in Baku is 9.

4.3 Terminal Infrastructure

The Baku ferry terminal was constructed in 1963 as a double ferry berth facility with two identical berths of docking-type with access ramps for cars and railwagons. There is rail and road access to the site of the terminal. The ferry terminal is used by passengers, trucks, cars and railwagons. The general layout of the existing terminal infrastructure is shown on dwg. no. 1.01.

The ferry terminal infrastructure can be divided into the following main parts which have been used for the description and evaluation of the facilities presented hereafter:

- Marine Works/Berthing Structures
  - central jetty
  - two finger piers

- Ferry Access Ramps
  - two ramps with three spans each
  - lifting towers

- Land Works
  - railway shunting and marshalling area
  - marshalling area for trucks
  - passenger and welfare buildings

The description of the terminal infrastructure with respect to layouts and state of repair is based both on existing documentation and drawings made available and a thorough inspection of the facilities carried out by the consultant.

concrete units supports the guiding fenders. On top of the slab sand is filled in to top level of the pier. The finger pier was originally equipped with wooden guiding fenders supported by driven wooden piles. On the pier a lighting tower is placed.

The superstructures in both finger piers are damaged by ship collisions. The guiding fenders are in a very bad shape, and in a lot of places missing. Concrete in all quay walls is severely damaged. Reinforcement is visible. Original scaffolding has never been removed. It is recommended to demolish and reconstruct both finger piers.

4.3.1.5 Central Pier on Piles

The substructure consists of reinforced concrete piles 400 x 400 mm with toe levels varying from - 16.5 to - 17.5 m. The superstructure is a reinforced concrete slab 12 m wide and 139.1 m in length including pier head. A front wall of precast concrete units supports the guiding fenders. On top of the slab sand is filled in to top level of the pier. The pier is equipped with wooden guiding fenders supported by driven wooden piles. On the pier a lighting tower is placed close to the pier head.

Guiding fenders are in a very bad state and partly missing. The concrete cover in the quay wall is missing in big areas. Piles were not possible to inspect. Despite that new guiding fenders are being installed at present and support for new fender is being constructed, the fendering conditions have to be reconsidered.

4.3.1.6 Head of Central Pier

A rectangular box (7 x 12 m) of steel sheet piles filled with sand forms the substructure. A reinforced concrete quay wall is constructed on top of the sheet piles from level + 1.80 m to + 4.50 m.

The superstructure has been severely damaged from ship collisions. Repairs has been undertaken by making a new concrete superstructure. No fenders have been installed. Steel scaffolding at base of concrete superstructure, which could be dangerous for ferries, has not been removed after construction.

4.3.2 Ferry Access Ramps

This section describes the present state of the link span ferry ramps and the operating machinery for the ramps.

4.3.1.2 Access Bridge to Central Pier

The substructure consist of reinforced concrete piles 350 x 350 mm in lengths of 12 - 14 m. The superstructure is a reinforced concrete slab 6300 mm wide. Concrete piles condition is anticipated to be satisfactory. Apparently there are no damages. Surface treatment of the concrete slab is recommended in case of reuse.

4.3.1.3 Lifting Towers, Substructure

A rectangular box (10.6 m x 5.6 m) of steel sheet piles forms the substructure in the first and second row. The concrete front towards ramp side is drawn back from steel pile front, and steel piles are cut at low level to allow ramp movements.

An irregular but almost rectangular box (14.5 m x 11.85 - 15.50 m) of steel sheet piles forms the substructure at the base of finger piers. At the same time the structure forms the first part of the finger pier.

An irregular box (15.4 m x 13.0 - 18.0 m) of steel sheet piles forms the substructure at the base of the central pier. At the same time the structure forms the first part of the central pier. Also the building for the electrical system and control system is situated on the structure.

The inside of tower foundations are filled up with mass concrete, which is formed to create support for the steel structures, stop fenders, guiding fenders and pits for counterweights. The steel superstructures are towers for carrying the lifting mechanism and the counterweights.

Steel sheet piles are rather heavy profiles (Larssen IV) with a flange thickness of 15 mm. It is expected that in general, the foundation of the lifting tower can be maintained, but in a rehabilitation project the sheet piles should be protected from corrosion by sacrificial anodes. If pits for counterweights will be redesigned with bottom level below water level, the concrete structures must be rehabilitated and made watertight. All fenders should be replaced by new fenders. In some of the pits water had entered. In order to balance the ramp for the buoyancy additional counterweight had been added. Stop fenders are extended to a higher level and guiding fenders are missing.

4.3.1.4 Finger Piers

The substructure consists of reinforced concrete piles 350 x 350 mm with toe levels varying from - 15.0 to - 16.3 m. The superstructure is a reinforced concrete slab 6200 mm wide and about 28 m in length. A front wall of precast which supports the longitudinal auxiliary beams, on which the rail tracks are mounted.

The steel structures of the third span consist of four 2,35 m high longitudinal I-girders connected by steel cross beams with intermediate timber, which supports the rail tracks.

The ramps themselves generally appeared to be in a good condition.

The ramps need to be dismantled, thoroughly inspected for excessive corrosion and mechanical damages and rehabilitated to original condition and finally given a new corrosion protection.

The traverse assemblies at the end of the lifting beams, to which the counterweight wires and the spindles are attached are generally severely corroded, and some are possibly made from steel with inferior physical properties.

It is expected that these assemblies need to be replaced by new ones.

Wooden Deck:

The link spans are covered by a wooden deck of timber having a square cross section of 180 by 180 mm.

The timber are fitted in the longitudinal direction of the link spans.

At the landside and central span the timber is supported per 1,75 m by secondary steel cross beams.

At the seaside span the timber is supported by combined steel/timber cross beams per 0,55 m.

The deck of the ramps was in a very poor condition, and the complete deck of the ramps need to be replaced.

The timber should be replaced by hardwood timber, which have a strength considerably higher than the timber presently used

Land Side Spans (in Particular)

The spans are partly submerged, i.e. the lower flanges of the I-girders and the lower bracing are below the water level.

The principal inspections of the structures of the link span ramps, the lifting towers and the machinery was carried out on site from 29 April to 9 May 1996. These inspections are subject of a detailed inspection report, see appendix 3, and the main conclusions are summarized in this section.

The Ferry Access Ramp structures surveyed consist of:

- Link Spans (Landside, Central, Seaside)
- Lifting Towers (Landside, Central, Seaside)
- Lifting Machinery in the towers.

The location of the various ramp elements and towers as shown in the survey plan, appendix 3.

It was not possible to carry out a complete inspection of the general condition of the ramp structures because of the high water level, which prevented admission to the structures underneath the deck of the ramps.

Only the seaside ramp was actually operated during ferry call at the terminal, as the innermost ramps were elevated to the highest possible level to take account for the high water level.

Therefore, it was not possible to see the machinery for the innermost ramps in function.

4.3.2.1 Link Spans (in General)

Each of the two Ferry Access Ramps consist of three spans.

The landside span is 26 m long and seated upon pivot bearings at the landside and suspended from two spindles at the lifting towers in the first row.

The second span is 26 m long and seated upon pivot bearings fixed to the nose end of the first span, and suspended from two spindles at the lifting towers in second row.

The third span is 33 m long and seated upon pivot bearings fixed to the nose end of the second span, and suspended from two lifting wires at the lifting towers in the third row.

The steel structures of the first and second span are equal, the main parts being three 2,26 m high longitudinal I-girders connected by cross beams,

4.3.2.2 Lifting Towers

The lifting towers are steel structures placed upon concrete substructures.

The steel structure consists of a heavy substructure, which carries the weight of the spans and the counterweights and, as regards the towers in the first and second row, also the traffic load.

The superstructures of the towers are light weight steel structures with brick walls constituting the machinery houses.

Generally the substructures of the Lifting Towers seemed to be in a rather good condition, whereas the superstructures showed signs of corrosion and deterioration of the brick walls.

The towers need to be dismantled, thoroughly inspected for excessive corrosion and mechanical damages and rehabilitated to original condition and finally given a new corrosion protection like the ferry ramps.

By dismantling the towers, the brick walls shall be scraped and replaced by new ones, when the towers are reassembled after rehabilitation of the steel superstructures.

The substructures of the 8 towers for the innermost spans exhibited weldings of varying quality, but cracks in the weldings were found only in the struts forming the K-lattice under the deck structure of the towers.

These cracks were numerous, and it foreseen that all of the K-lattices under the decks of the 8 towers in question need to be replaced.

The substructures of the 4 towers for the seaward spans also showed weldings of varying quality, but no visible cracks.

In order to adjust the ramps to the highest possible elevation to compensate for the high water level, the lower flanges of the outermost beams in the deck structure of the towers had been cut to make room for the hoisting wires.

These beams and also some damaged structures at tower no. 23A need to be replaced.

The guide roller arrangement upon the lifting beam ends of all the spans were generally in a poor condition, and it is anticipated that these arrangement shall be replaced with new ones.

Further, the bearing arrangements at land side are just above the water level and are flooded by propeller water and waves each time the ferries call at the terminal.

This condition has caused severe corrosion of the bearings, the chock absorbers and the surrounding steel structures.

Even the cross beams and the auxiliary longitudinal beams seems to be rather corroded at the innermost part of the ramps.

At the outermost parts of the ramps the corrosion seems to be much less severe.

It is expected that the bearings, chock absorbers and the innermost structures of the spans need to be replaced.

Central Spans (in Particular)

The spans are positioned with the lower flanges of the I-girders just below the water level, and the lover bracing and lower parts of the I-girders are flooded by propeller water and waves each time the ferries call at the terminal.

The structure members, however, appeared to be in fairly good condition.

The upper parts of the span structures i.e. the cross beams and the auxiliary longitudinal beams etc. appeared to be in a good condition with almost intact paint coating.

It is expected that only a few structure members need to be replaced.

Seaside Spans (in Particular)

The spans are all above the water level in calm weather conditions.

These spans are in good condition although corrosion at the area of the innermost bends in the longitudinal I-girders have taken place.

The seaward ends of the I-girders and the cross beams at this end have been damaged from collision between the ramps and the ferry structure.

The seaward ends of the spans need to be repaired or replaced as appropriate.

All machinery shall be totally disassembled, and all gears, sheaves, bearings, spindles etc. carefully inspected for wear, deterioration and cracks, and worn and damaged parts shall be replaced.

All wires for counterweights and hoisting shall be replaced.

The electric equipment and control equipment together with the control desks and the electrical motors shall be discarded and replaced with new and modern equipment.

4.3.3 Land Works

4.3.3.1 Marshalling Area for Trucks

At present departing trucks are waiting along the access road, which is most unfortunate, as this slows the access to the ferry terminal. Only a small area at the terminal can be used for marshalling of trucks. This area just in front of the access ramps is currently being used for customs check of arriving trucks. The area has a capacity of only 6-8 trucks. As the terminal was not originally designed to be a border crossing station, no marshalling areas for trucks have been included in the original design. This is clearly an unacceptable bottleneck in today's operations.

4.3.3.2 Passenger and Welfare Buildings

A waiting hall for passengers is available at the Sea Station in the city center next to the general cargo terminal. From here passengers are transported by buses to the ferry terminal. The passenger building also contains ticket office, restaurant and police office.

At the ferry terminal temporary facilities has been set up for passport control and customs clearance. Again, these facilities were not included in the original design, as the terminal was not anticipated to be a border crossing station. Passport control and customs clearance is carried out from a small shed at the terminal. In addition to this, also cafés and the administration office of the ferry terminal management is located at the ferry terminal area. Currently, a toilet building is under construction.

A detailed description of the terminal buildings and their present condition is given in Appendix 3.

In general, the buildings are in a poor condition. Major repairs will be needed if they are to be re-used in the future layout.

4.3.2.3 Machinery

The machinery in the towers in the first and second row are almost identical, and are composed of an electrical motor of 7.5 kW, which through a gearbox is connected to the spindle bearing and drive arrangement.

The machinery in the towers in the third row are almost identical, and are composed of an electrical motor of 11 kW, which through a gearbox is connected to a winch to which the hoisting wire is fastened.

The hoisting wire is guided over a fixed sheave in the tower, through two sheaves on the bridle beam, two sheaves in the opposite tower, and fixed to the tension weight in the opposite tower.

Further, the machinery is equipped with an electromagnetic brake acting upon the through-going axle from the gearbox.

Two of the machinery's are further equipped with crank handle, which through a gear transmission and a manual clutch is connected to the through-going axle of the motor.

It was not possible to thoroughly inspect the machinery as it would require an extensive dismantling of the gearboxes, spindle drives etc.

However, a close view of all components of the machinery's revealed no damages or weaknesses, except for the brake drums of the electromagnetic brakes of the machinery's for operating the seaward spans, which were rather corroded due to the lacking regular use.

Also the machinery appeared to have been well maintained, as all moving parts were well greased, and bearings and spindles were covered by canvas for protection against the environment.

The electrical equipment upon the ramps and in the towers, however, was in a rather poor state, as many limit switches upon the ramps were damaged and clearly not in operational condition.

Also, the cubicles in the towers had been replaced by temporary installations.

The control equipment in the control tower no. 22C generally appeared to be out of date with open access to hazardous high voltage areas, and a rather simple control desk.

The unloading of trucks may take as long as 2-3 hours.

After trucks, any railwagons will leave the ferry. Not all ferries carry railwagons. Due to safety measures for balancing, railwagons will only be transported in lots of 14 to 28 wagons at a time. On board the ferry, the ferry's operations manager is responsible for the railwagons. When the ferry is at berth, the national railway authority takes over the responsibility. All operations regarding railwagons are carried out by the railways. In contradiction to the unloading of passengers and trucks, the unloading of railwagons is done relatively fast. Only 20-30 minutes are required. Two locomotives are used for the unloading of railwagons, and all operations are done symmetrically, in order to keep the ferry balanced. During the unloading, empty railwagons are used as a buffer zone to prolongate the train, because the engines are not allowed to enter the outer span on the access ramps. (However, during the field mission, a situation was observed where the engines were working on the first part of the seaside span). At the marshalling are for railwagons four rails are available. Arriving wagons use the two outermost rails, and departing wagons the two inner rails.

After the main cargo deck has been emptied, the cars are brought up from a hold below the main deck. Cars leave the ferry according to the same procedures as apply for trucks. When the last car has left the area, 3 to 4 hours may have gone.

4.4.1.2 Departure

When the ferry has been unloaded, the loading procedure can begin. Loading is done in the opposite order than unloading, viz. firstly cars are loaded, then railwagons and trucks and lastly passengers.

Passengers are brought from the waiting hall in the city to the ferry terminal by means of buses. This is normally done one or two hours before expected time of departure.

Currently, there are four to five weekly ferry departures. In principle, a ferry leaves when it is full or when the ferry on the other side of the Caspian Sea is leaving. Therefore there is no fixed time schedule for the ferries, which implies that passengers, cars and trucks are waiting for hours (or even days) without knowing when the ferry will leave.

The crossing time for the ferry is normally 15 to 16 hours.

4.3.3.3 Railway Shunting and Marshalling Area

Railway aspects as regards facilities and operations in the terminal are described together with outer railway access in chapter 4.6.

4.4 Terminal Operations and Organization

4.4.1 Operations and Services

The ferry terminal is servicing the international ferry links out of Baku. The traffic categories handled are:

- Rail wagons (cargo)
- Trucks and ordinary cars
- Passengers

The services provided at present in the terminal for handling these traffic categories are described as an integrated part of the description of terminal operations associated with the arrival and departure of ferries following hereafter. The outline of terminal operations is based partly on interviews of the terminal staff and partly on surveys of the operations.

4.4.1.1 Arrival

When an arriving ferry has been safely moored, the passengers are the first to leave the ferry (when the doctor has been on board). The border police check passports of passengers at the end of the access ramps. From there passengers proceed to the customs clearance (same shed). After customs check the passengers are checked by the water police, before they are allowed to the leave the area. Due to slow procedures, passengers can wait as long as two hours before they are able to leave the ferry terminal.

The first vehicles to leave the ferry are the trucks. The passport check is done at the end of the access ramp as for passengers. This implies a queue of trucks on the ramp, which slows the unloading of trucks and cars significantly. The reason for this waiting line is that the terminal has not been designed for border crossing operations and as such has no specific marshalling area for arriving trucks. After passport check the trucks proceed for customs check. As this is done 20 meters ahead of the passport check, this again creates a waiting line for the same reason as explained above. If any trucks are to be examined more carefully, they queue up at the area in front of the access ramps. This area can accommodate 6-8 trucks.

Siltation and Dredging

According to information from Caspmorput, who in the past undertook all dredging work in the Caspian Sea, some siltation takes place in the approaches to Baku Port. A record of dredging works shows that from 1974 to 1978 a total of 737,000 m^3 were dredged (same period water level fell ~ 0.5 m) while from 1979 to 1990 dredging amounted to 484,000 m^3 (in this period the water level rose by 1.8 m). Due to continued rising of water level and lack of financing the deepening works have not been carried out since 1990.

From 1974 to 1978 the dredging was almost equally distributed between access channel and the port area but since then the access channel has only been dredged once.

From this it may be estimated that only little sedimentation in the port area is taking place and according to the records should be around 50,000 m^3/year.

4.6 Railway Facilities and Access

4.6.1 General Description

The railway terminal consists of a shunting yard, a group of parallel access tracks, and connecting tracks to the two ferry berths. The shunting yard is connected to the railway network at Baku station. The physical layout is shown on the Terminal layout plan no. 1.01.

4.6.1.1 Connection Line

The terminal is connected to the railway system in Baku via a single track line. The line connects to the freight yard and the circular line. The line crosses the access road just before the terminal and rises up towards Baku.

4.6.1.2 Shunting Yard

The shunting yard is used for:

- Parking of wagons waiting for ferry transfer.
- Sorting of wagons arriving in the terminal before the shunting to the ferry.
- Inspection of wagons for defects.
- Forming of wagons arriving with the ferry to trains going to Baku freight yard.

4.4.2 Organization

Being part of the Baku Port organisational structure, the ferry terminal is presently organized as a separate department in the port with 33 employees. The terminal is headed by the Terminal Manager who refers to the Director of Operations in the port, who again refers to the Port Director. The ferry terminal department is generally divided in three staffing groups, namely: Mechanics, controllers and electro-mechanics.

As part of another Traceca project, the administrative and organizational aspects of the port is currently being reviewed. According to the new proposals, the ferry terminal will remain within the organisational structure of Baku Port.

4.5 Navigational Aspects/Approach to Baku

A dredged channel of 6 to 7 metres water depth leads to the ferry terminal and the general cargo terminal. The maintained width of the channel is 100 m. The dredged channels are marked by 11 light buoys, that are located according to the IALA A System. The dredged channels start just to the west of the Bayuk-Zira Island and is about 9 km long, see map showing the approach to Baku, dwg. no. 1.11.

The approach to Baku port starts when this island has been passed. A northern course of 3.3° is followed from green buoy no. 1 to green buoy no. 7. This channel is also marked by two land marks. From buoy no. 7 a course of 325° is taken. Also this channel is marked by two land marks. From green buoy no. 13 another turn is made following course 288.5° towards the dredged basin in front of the ferry terminal and general cargo terminal. This channel is marked by buoy no. 16, that defines the centre line of the channel. In the turning basin outside the ferry terminal, the ferry turns and berths at the terminal by means of the anchor.

Naval charts from 1980 are available for the approach to Port of Baku.

Pilotage service is available in Baku, but normally the captains of ferries choose to berth the vessel themselves. Maintenance of markings is carried out by the organization Caspmorput, which is a part of the Caspian Shipping Company.

Light posts on the central pier are not working, which makes berthing at night time difficult.

sidings the 43 kg/m is used. Some of the wooden sleepers have been replaced by concrete sleepers. The tracks are generally laid in stone ballast.

The tracks are in operational condition but show a lack of sufficient maintenance through several years. Most of the wooden sleepers are partially rotten providing bad suspension and fixing of the rails. The ballast is very weeded and dirty. The substructure is not drained. The rails are generally in a good condition from a wear point of view. Also the switches seem to be better maintained and are in operational condition.

The rails on the seaside span are mounted on wooden sleepers with spikes. On the other spans the rails are mounted on steel beams by bolted fastenings.

The signalling and interlocking system was not inspected in details but it is said to be operating except the signals for access to and from the ferries.

4.6.3 Operation

4.6.3.1 Present Procedure

Shunting to and from Ferry

When a ferry has arrived two shunting locomotives (of type TJME-3) are hauling wagons from both sides of the ferry using the double track on the ferry bridge. The shunting is carried out with simultaneous shunting movements in order to keep the ferry balanced at all times. The ferries have a balancing tank and pumping system but it is said not to be working. Locomotives are not allowed on the outer ferry bridge and shunting is carried out using intermediate wagons. However locomotives were observed on the outer bridges at some occasions.

The wagons from the two ferry tracks on each side of the ferry are parked on the inner tracks of the access tracks. Wagons parked on the outer access tracks waiting for the ferry are the shunted to the ferry by simultaneous shunting movements.

The shunting movements to and from the ferries are controlled by radio communication and managed by the port staff. The radios are unreliable and have no safe circuit operation.

Shunting Yard Operation

The wagons arriving from Baku station and freight yard are inspected for possible defects. Wagons for repair are shunted to a siding with a small work-

The shunting yard has 8 parallel tracks connected via a switch area to the connection line and to the access tracks. The length of the 8 tracks are between 323 and 456 m.

4.6.1.3 Access Tracks

The access tracks are used for parking of wagons waiting for shunting on board the ferry and for temporary parking of wagons from the ferry.

The access tracks are grouped with 4 tracks for each of the two ferry berths. Two of these four tracks are used for wagons *to* the ferry and the other two for wagons *from* the ferry. The length of the tracks varies between 233 and 300 m giving a capacity of 15 - 18 wagons corresponding to the capacity of 2 ferry tracks.

4.6.1.4 Ferry Connection Tracks

From each group of 4 access tracks two parallel tracks leads to the ferry via the ferry bridge for simultaneous shunting to each side of the ferry. On the outer bridge each track has a switch installed previously used for connection to the ferry tracks. However the present ferries has switches installed on the deck and therefore bridge switches are no longer used.

4.6.1.5 Signalling Equipment

Light signals are installed for control of all train movements as well for arriving and departing trains as for shunting movements. A relay operated interlocking system links the signals, switches and tracks isolations. The operation of the railway terminal is managed from a signal box at the shunting yard and another signal box at the ferry connection tracks from where all signals and switches are controlled. All switches are electrically operated. The signals for shunting movements to and from the ferries are not working and the shunting is controlled by radio communication.

The operation of the terminal is said to be able to be managed from only one signal box which should be the one at the shunting yard.

4.6.2 Condition of Installations

The tracks are equipped with the standard 65 kg/m, 50 kg/m and 43 kg/m rails (previous USSR standard) mounted on wooden sleepers by rail spikes. The rail size 65 and 50 kg/m is generally used, only on ferry bridges and on some

The signalling and interlocking equipment is also manufactured in the FSU following the safety rules and standards of signalling. These rules and standards being individual for each railway will be needed during the design phase. Components for modification of the interlocking may be difficult to get as they to some extend have to be imported from Russia.

Rulebook for permanent way design and safety rules and signalling standards has not been obtained from the Azerbaijan Railways.

4.6.5 Modernisation

As the complete railway terminal and part of the connection line has to be lifted to a higher position, all the present railway infrastructure has to be removed. This gives some possibilities for a modernisation of the general lay out of the complete ferry terminal and the railway part.

The overall lay out of the railway terminal with a shunting yard and access tracks is well suited for the purpose. Also the track lay out is generally adequate. The terminal is constructed for a much larger traffic than the present, and it could be considerably smaller if the present traffic was significant for the future. However the rail traffic is expected to increase again and there is also efforts to prioritise the rail traffic in the future for environmental reasons. Due to these considerations the present capacity should be maintained or at least prepared for in the future lay out. The re-construction of the infrastructure on a new level could be implemented in phases - according to the growth of the traffic.

The following modernisation or alterations could be identified on this stage:

- Change of shunting yard to a symmetric lay out.
- Construction of only one set of 4 access tracks with connections to both ferry berths and preparation for a later extension to two sets of access tracks.
- Reduced number of tracks on the shunting yard with possibility for extension.
- Control of operation, signalling, switches etc. from one signal box.
- New safe operating radio system for shunting.
- Complete draining system for permanent way.

shop. The wagons for transfer are sorted according to weight (because of correct balancing of the ferry) and shunted to the access tracks.

Wagons arriving from the ferry are similarly inspected for defects and shunted to one of the eight parallel tracks for departure to the Baku station and freight yard.

The present lay out of the yard has the disadvantage that it is not symmetric. This means that there is no direct access from track 5 - 8 to two of the ferry access tracks. The 8 parallel tracks are used for all purposes.

The shunting yard and the shunting movements to and from the access tracks is managed by staff from the railway.

4.6.3.2 Capacity

The capacity of the yard and the entire railway terminal is designed to meet the previous demand during the high traffic period in the FSU. The present size of traffic could be operated by a smaller yard of maximum 5 parallel tracks and only one group of ferry access tracks (4 tracks).

The present traffic varies over the year. The maximum number of wagons per month is about 700 arriving and 600 departing per month. The minimum is about 200 arriving and 200 departing wagons per month. Each ferry has a capacity of maximum 28 wagons or 26 in average.

4.6.4 Design Standards

The railway infrastructure is designed according to the standards of the former Soviet railways.

The track is designed to an axle load of maximum 22 tons. Rails are standard types 65, 50 and 43 kg/m. Sleepers are wooden with spike fixings. Concrete sleepers are used on newer tracks or for replacement and are used with bolt fastenings. Track components are all imported - mainly manufactured in the FSU according to standards. These components are likely to be difficult to get and replacements must then be considered.

Switches are of the standard types 1:9 and 1:11. Minimum curve radius is 200 m. Maximum speed on the terminal area is 60 km/h.

Design geometry and standards of the permanent way is laid down in a rule-book of the railway, which will be needed in the design phase.

will be complied with. During the data collection phase, the Ministry of Natural Protection, Committee of Ecology, Azerbaijan has been consulted and the procedures for approval of large projects were discussed. In general, projects are examined according to Law of Ecological Expertise and approvals are given by the Ecologic Committee of Azerbaijan, the general procedures comprising:

- During design phase - evaluation of influence of project on the environment.
- During construction - monitoring of impacts.
- After completion of construction - issue of ecological passport for exploitation.

These procedures are resumed in the summary of project approval, table 8.4.

Presently, the Government of Azerbaijan is participating in negotiations concerning the adoption of the International Convention of Rights of Sea in order to solve the questions regarding the distribution of the resources of the Caspian Sea. The signing of this convention will imply the ratification of all the UN rules and regulations of the sea and also two important regulations concerning the environment of the seas:

- MARPOL convention (International Convention for the Prevention of Pollution from Ships).
- The London Dumping Convention (International Convention for Prevention of Pollution of the Sea from Dumping of Waste).

Even though that Azerbaijan has not ratified these conventions yet, it is considered imperative that these regulations and recommendations are representing normal internationally well recognized pracises (see also chapter 3.7.4).

Throughout the project, contact will be maintained with the Ministries, in order to update these on the developments of the project. This contact will mainly be through the owner, here port of Baku, assisted by the Consultant, which will give the Ministry an opportunity to comment on environmental aspects.

4.8.3 Environmental Baseline Conditions

The physical and chemical baseline conditions in the environment of the ferry terminal in Baku are described in chapter 4. The description cover both the terminal facilities and approaches from sea and land side.

- Replacement of wooden sleepers with concrete sleepers.
- Possible extension of shunting yard tracks to minimum 400 m.
- Repair of balancing system on ferries.

4.7 Road Access

The road from the ferry terminal connects to Gajibekov Str./Yura Gagarin Str., from where there is connection to the eastern parts of the city (where most industries are located) and the airport, and to the west connection to the M-1 and M-4 highways, that lead to western parts of Azerbaijan and Georgia, M-2 to the northern part of Azerbaijan and M-3 to Iran. The main traffic enters the Baku area from the M-3 along the coast south of the city. At Khodzhasan there is a truck terminal. From there trucks follow the main road at the city limit to the north of Baku, where they follow the Moscow Boulevard to the port.

Only one access road lead to the ferry terminal. The road connects to the main road through Baku approximately 600 metres from the access ramps. The road is 6-10 metres wide and generally in a good condition. Within the last two years the pavement has been rehabilitated. On the part away from the terminal, the road is surrounded by warehouses and small workshops, that limits the widening of the road. When entering the terminal area (at the railway crossing) a gate house is located for checking entering vehicles.

4.8 Environmental Aspects

4.8.1 Environmental Impact Assessment Approach

The whole project planning and design sequence will be subject to an initial environmental examination (IEE) taking into account the requirements of the respective port authorities and to modern Western standards, such as those stipulated e.g. in the manual: "Environmental Procedures", issued by EBRD. These procedures are fully in line with normal environmental project follow up, practised e.g. in the Scandinavian countries and in the EU-countries in general. Special attention will be given to environmental aspects during the conceptual design period, as it is in this stage, that environmental directions will have the greatest impact on the project.

4.8.2 Legal Aspects and Approvals

In addition to international requirements from e.g. financing institutions (mainly the EBRD), also the national regulations related to environment in Azerbaijan

b. Future Operation and Exploitation

The ferry terminal will be equipped with facilities for reception of waste products from the ferries as recommended by the MARPOL Convention (see also chapter 3.7.4).

The expected increase in traffic to the terminal particularly with reference to the trucks will entail negative impacts to the surroundings of the traffic corridors as regards:

- Increase in noise and exhaust pollution.
- Increase in risk of traffic accidents.
- Contribution to traffic congestion in central area.

In this context it can be mentioned that no overall traffic master plan for the resolution of the future traffic planning of Baku exists. It is strongly recommended that such a plan is prepared looking at both the through-going traffic and local traffic, permitting to point out the most appropriate traffic corridor to be suggested for the ferry terminal traffic also.

Even though outside the scope of the present project, the presentation of such a traffic master plan is considered so important that it is further described in chapter 7.5.6.

4.9 Auxiliary Facilities and Utilities

Heating supply, heating and ventilation

The main source of heat is a boiler house located at the ferry terminal. In the future layout this will be demolished. The boiler house provides heating for the administration building and the workshops. The rest of the buildings on the territory of the ferry terminal have no water heating. In stead, these buildings are heated by electrical heaters.

There is no mechanical ventilation in the rooms. Some home air conditioners have been installed. However, they do not comply with the requirements set out in SNiP 2.04.05.-80 "Heating, ventilation and air conditioning".

The boiler house was constructed some 40-50 years ago and is equipped with the following equipment:

From the sea side it is noted that some sedimentation is taking place requiring already today regular dredging of the harbour basin. Baseline value for the composition of the bottom materials have not been obtained but some degree of contamination by heavy metals, chemicals, etc. may be expected. In particular, it is observed that the environmental condition is very poor in the port of Baku with regard to sea water quality, where oil spills from oil producing facilities have heavily polluted the marine environment.

Wetlands of natural importance is not found in the vicinity of the terminal (or the harbour).

Onshore, the terminal is located in an area surrounded primarily by other ports activities and industrial activities.

Rail access to the port is through a semi-industrial area while road access is through city roads with heavy traffic.

4.8.4 Environmental Impact and Remedial Measures

a. Project Execution Phase

An important activity in the execution of the project is the dredging component. Locations for disposal of present dredging spoils are assured to be available also for future dumpings, but they have to be approved. However, due to the special circumstance regarding the rising sea water level, it is expected that the volumes to be dredged will be limited.

During the project execution re-use of materials will be emphasized. With respect to new materials, paint etc. to be used, the most environmentally favourable options will be selected for the specifications. Possible use of quarry areas where rock, sand, gravel, earth fill etc. will be assessed with regard to environmental impact, especially if these are opened only for the purpose of this project.

Presently, fill materials for reclamation works normally are taken from an approved area at sea, 45 minutes of sailing from Baku.

The increase in noise and exhaustion levels from equipment during construction is not regarded as a problem to surrounding communities due to the location of the terminal.

No changes to have significant impact on the hydrodynamics of the bay/port area are envisaged.

The water supply system should be designed and constructed according to SNiP 2.04.02-84. Also environmental requirements shall be followed. Water pipelines will be of steel type and according to GOST 10704-80.

Watering taps and fire distinguishing hydrants should be foreseen in certain spots.

Sewerage

Presently, there is a working sewer system on the territory of the ferry terminal. Drainage is by gravity through the manifold partly into the city sewer system and partly into the sea. The inner sewer system is connected with the city system at Transportnaya Street.

The pipelines of the gravitation sewerage are made of asbestos-cement pipes with a diameter of 150-300 mm according to GOST 539-80. The pressure pipelines are made of steel with a diameter of 100 mm according to GOST 10704-80. Under the railway pipes are of cast iron with 100 mm diameter according to GOST 9583-80. Pits are made of pre-fabricated RC elements according to GOST 8020-90.

The re-construction of the sewer system in the port shall be carried out according to SNiP 2.04.02-84 and technical directions given by the Baku Sewerage Department. The consumer waste water from buildings are gathered by gravity. It is dumped through the inner pipelines into the city manifold.

The existing pumping station is going to work at full capacity. Gravitation sewer system should be made of asbestos-cement pipes with a diameter of 200 mm to 400 mm according to GOST 539-80.

- One low capacity boiler (imported), which is in bad condition, but in working order. The temperature of the hot water is 95-70^{O} C.
- One rotary pump for heating system, type 3k-18.
- One rotary pump for drainage, type 1/2k-6.

On the territory of the ferry terminal distribution nets are in bad condition.

In light of the above, it is necessary to renovate the boiler house and the distribution nets. Heating supply, heating, ventilation and air conditioning need to be completely re-designed.

Electrical installations

The main source of electrical supply in the ferry terminal is a substation of 6/0.4 kV named No. 275(6). There are two transformers with a capacity of 630 kVA in the substation. The high voltage is provided from the city network from substation No. 220 of BAGES (The city electrical network of Baku) by one cable line of 6 kV. This cable is laid in a trench of 800 m length. A second cable line is laid in a trench of 300 m length from distributor installation RU-6 kV of substation No. 248(4) of the general cargo port up to substation No. 275(6) of the ferry terminal. This works as a reserve substation.

Both of the 630 kVA 6/0.4 kV transformers are in permanent operation. They use 40 % of the total power of the transformer in maximum regime.

Customers of electric power in the ferry terminal (administration building, border police and customs facilities, lighting of the area, ferry ramp motors etc.) get power supply from the low voltage side of 0.4 kV of substation No. 275(6). The supply is distributed through cable lines laid in a trench. The voltage of the lines for the consumers is 380/220 V and the frequency is 50 Hz.

Telephone communication internally within the divisions of the terminal as well as communication inside Azerbaijan is reported to be good.

Water supply

Presently, the source of the water supply in the port of Baku is the city water pipelines. The net of water pipelines was constructed some 10-15 years ago. The pipes are in a bad condition and do not comply with the requirements of SNiP 2.04.01-85 and GOST 10704-80.

In the existing buildings steel water pipelines are with 50 mm and 100 mm diameter.

The oil terminal was built in 1968 and includes two wharves that can each accommodate ships with a capacity of 3000 to 5000 DWT on each side. The water depth is 6-7 m.

The ferry terminal is described in detail in section 5.3.

5.2 Natural Conditions

5.2.1 Topography

The ferry terminal is located partly on reclaimed land with a surface level of -25.4 m.

Recent topographic surveys have not been identified. Therefore a new topographic survey needs to the carried out.

5.2.2 Bathymetry

As bathymetric surveys are not carried out on a regular basis, there is no exact knowledge about the water depths in channels and at quays. Detailed data are available from 1975, but because of the high degree of siltation in the area, these are not reliable. In 1993 a Ukrainian company carried out some bathymetric surveys in connection with construction of a terminal for agricultural products just east of the ferry terminal. However, these data are not available in the port of Turkmenbashi. The above mentioned construction project has now been stopped.

5.2.3 Meteorological Conditions

Temperature and Precipitation

The climate of the Turkmenbashi area is characterized by hot, dry and sunny weather in the long summer period and by frost and small quantities of precipitation in the winter period. The region is the most dry in the former Soviet Union with a yearly average precipitation of 116 mm. The average relative humidity is 65%.

The annual air temperature is +15.9°C. The absolute maximum was +44.1°C and the absolute minimum -17.9°C. The average number of frost days is 18 and average number or days with snow is 3.

5. PRESENT SITUATION, TURKMENBASHI FERRY TERMINAL

5.1 Location of Terminal

The sea port of Turkmenbashi is the only major port in Turkmenistan located on the eastern shore of the Caspian Sea at a distance of approximately 550 km from the country's capital Ashgabat. The town has 70,000 inhabitants. The port is linked to the capital by road and railway. From Ashgabat similarly there are road and railway connections to the neighbouring countries of Iran, Uzbekistan and Kazakhstan. On the sea side of Turkmenbashi there are maritime connections to Azerbaijan, Iran and Russia. Through the Volga-Don-system, maritime transport can reach large parts of Western Russia and Eastern Europe. The locations can be seen from Figure 3.1.

The port was built as a result of construction of the Central Asian railway at the end of the 19th century. Physically the port is located in a sheltered bay, some 14 nautical miles from the open sea at 40°00' North and 53°01' East. The waterway entry to the port is through 25 km long dredged channels.

The main port is located close to the centre of the town of Turkmenbashi. The port consists of the following quays and terminals:

- General Cargo Terminal
- Dry Cargo Terminal
- Miscellaneous Auxiliary Quays
- Ferry Terminal
- Oil Terminal

The ferry terminal is located in the eastern part of the port, and the oil terminal is located 7 km east of the town of Turkmenbashi.

The sea port is organized under the State Shipping Organization of Turkmenistan. This organization has the status of a ministry.

The general cargo terminal consists of a 400 m quay equipped with nine cranes. The quay was re-built in 1964 and 1971. The water depth at quay is 7-8 meters.

The dry bulk terminal consists of a 290 m quay, of which only approximately 90 m are usable. The water depth at quay is 4-5 m and the quay is equipped with seven cranes.

5.2.5 Water Quality

Average annual salinity of the water in the bay is 1.57 %. The maximum is 1.71 % in September-October and the minimum is 1.19 % in June.

Further data on water quality has not been made available.

5.2.6 Soil Conditions

At Turkmenbashi Ferry Terminal a number of geotechnical borings have been carried out offshore as well as on-shore with a distance of 50 m to 100 m, covering the berthing area and part of the hinterland.

The soil conditions at the Ferry Terminal are described in the following available documents:

- "The Seaport in Krasnovodsk, Technical-Working Project of Reconstruction of the Ferry Terminal." Technical Report about Engineering Investigations. Part III. Engineering and Geological Conditions.
- Dwg. nos. 19767 and 21435 from the original project document by Kaspmornii-proekt.
- "The Technical Report about Engineering Investigations" describes results from 39 geotechnical borings carried out in the terminal area, onshore as well as off-shore, in the period 1956-1961. The report is dated 1979.

According to the above mentioned documents the soil conditions in the berthing area, with reference to M.W.L. in level -28 m BSL, are described as the following quaternary deposits:

The seabed is in level -34 to -37 m:

Seabed to level app. -37: Organic silt.

Natural moisture content	w = 74%,
Index of plasticity	I_p = 14 %
Index of consistence	I_C = 2,4
Effective friction angle	$\varphi \approx 10°$,
Drained shear strength	$c_u \approx 2$ kN/m^2,
Bulk density	γ = 16 kN/m^3
Modulus of compression	K = 1200 kN/m^2

Wind

Wind roses are available, giving probability for wind direction and wind speed interval. The roses show that northerly winds are predominant. Wind rose for Turkmenbashi is attached in Appendix 5. Too strong winds makes navigation at quays and in the channels difficult, and therefore a maximum wind speed of 17 m/s has been set out by the port authority as the limit for navigation. According to the Harbour Master, maritime traffic is interrupted during an average of 5 days per months due to too strong winds.

Visibility

Only ten days with fog are observed per year. In addition to this, haze and dusty storms can occur.

5.2.4 Hydraulic Conditions

Waves

Due to the sheltered location of the port of Turkmenbashi, wave heights are very limited. The fetch is a few km for northern winds and 20 km for western winds. It is very unusual to observe wave heights of more than 0.5 m in the bay.

Currents

Currents in the Bay of Krasnovodsk are characterized by the eastern drift. In general, the direction of the current is equal to the direction of the wind. Maximum speed of current is not more than 0.5 m/s according to natural measurements.

At the entrance to the northern channel in the opening in the Krasnovodsk split, the current can be very strong.

Tide

Tides in the Caspian Sea are negligible.

Ice

Ice can occur in strong winters. The average duration of ice periods in strong winters is 24 days and the average thickness of the ice is 3-10 cm.

5.3.1 Marine Works/Berthing Structures

Inspections of the berthing structures as well as collection of data including drawings, written information and taking photos of the structures was carried out from 22nd to 26th of April 1996. These inspections are subject of a detailed inspection report, see Appendix 3, and the main conclusions are summarized in this section.

The berthing structures surveyed consist of:

- Land base for ferry ramps
- Land base for access bridge
- Access bridge
- Lifting towers (first row from land side)
- Second span of ferry ramps
- Lifting towers (second row from land side)
- Third span of ferry ramps
- Lifting towers (third row from land side) and stop fenders
- Lifting towers (third row from land side) and base of central pier
- Finger piers
- Central pier on piles
- Head of central pier

The location of the various infrastructure elements is shown in survey plan, Appendix 3.

5.3.1.1 Land Base for Ferry Ramps

A rectangular box (10.50 m x 11.20 m) of steel sheet piles forms the substructure. The inside is filled up with mass concrete, which is formed to create support and anchorage for the main beams in the ferry ramp. A stone revetment runs across the land base to withhold the land reclamation.

The steel sheet pile structure is hidden in the sub soil and is not possible to see. The corrosion is normally insignificant for soil covered steel parts, and the substructure is anticipated to be in good state for reuse.

The concrete surface at the ramp support is worn and uneven and recommended to be rehabilitated in case of reuse.

The cover was missing over the anchoring of ferry ramp to land base.

Below level app. -37:	Clay, silty.	
	Natural moisture content	w = 28%,
	Index of plasticity	I_p = 14 %
	Index of consistence	I_C = 0,40
	Effective friction angle	$\varphi \approx 22°$,
	Drained shear strength	$c_u \approx 60$ kN/m^2,
	Bulk density	γ = 19,9 kN/m^3
	Modulus of compression	K $\approx$ 10000 kN/m^2

The on-shore borings show ground level at app. -25. The upper layer consist of app. 4 m sand (reclaimed sandfill) over 1 to 5 m organic silt. Near shore the organic silt is underlayered by the silty clay, but further in-shore an intermediate layer of sand and gravel was found, with up to more than 8 m in thickness.

5.2.7 Seismic Conditions

Turkmenbashi is locatad in a seismically active area. According to the SNiP building standard, the seismic force in Turkmenbashi is 9.

5.3 Terminal Infrastructure

The ferry terminal is located in the eastern side of the town of Turkmenbashi in an open area. It was constructed in 1963 as a double ferry berth facility with two identical berths of docking type with access ramps for cars and railwagons. There is good rail and road access to the site of the terminal. The ferry terminal serves passengers, trucks, cars and railwagons.

The ferry terminal infrastructure can be divided into the following main parts which have been used for the description and evaluation of the facilities presented hereafter:

- Marine Works/Berthing Structures
  - central jetty
  - two finger piers
- Ferry Access Ramps
  - two ramps with three bridges each
  - lifting towers
- Land Works
  - railway shunting and marshalling area
  - marshalling area for trucks
  - passenger and welfare buildings

to top level of the pier. The finger pier was originally equipped with wooden guiding fenders supported by driven wooden piles. On the pier a lighting tower is placed.

The superstructures in both finger piers are damaged by ship collisions. The guiding fenders are in a very bad shape, and in a lot of places missing. Concrete in all quay walls is severely damaged. Also the piles in the substructure are damaged to a certain extent. Reinforcement is visible on both sides and end of finger piers. It is recommended to demolish and reconstruct both finger piers.

5.3.1.5 Central Pier on Piles

The substructure consists of reinforced concrete piles 400 x 400 mm with toe levels varying from - 16.5 to - 17.5 m. The superstructure is a reinforced concrete slab 12 m wide and 139.1 m in length including pier head. A front wall of precast concrete units supports the guiding fenders. On top of the slab sand is filled in to top level of the pier. The pier is equipped with wooden guiding fenders supported by driven wooden piles. On the pier a lighting tower is placed close to the pier head.

Guiding fenders are in a very bad state. The concrete cover in the quay wall is missing in big areas. Piles were not possible to inspect. Reinforcement is visible in the upper part of quay walls.

5.3.1.6 Head of Central Pier

A rectangular box (7 x 12 m) of steel sheet piles filled with sand forms the substructure. A reinforced concrete quay wall is constructed on top of the sheet piles from level + 1.80 m to + 4.50 m.

The superstructure has been severely damaged from ship collisions. Repairs has been undertaken and damaged again. Fenders are missing. The sheet pile substructure is damaged by ship collisions in corner. Concrete superstructure is also damaged in the same corner. Rubber tyre fenders are installed on pier head. Steel sheet piles are damaged.

5.3.2 Ferry Access Ramps

The following description of the state of the link span ferry ramps is based on a site visit to the ferry terminal from 22 to 26 April 1996. The ferry access ramps at Turkmenbashi have been constructed at the same time and identical to the ramps in Baku, both with respect to - link spans, - lifting towers and -

5.3.1.2 Access Bridge to Central Pier

The substructure consist of reinforced concrete piles 350 x 350 mm in lengths of 12 - 14 m. The superstructure is a reinforced concrete slab 6300 mm wide.

Concrete piles condition is anticipated to be satisfactory. Apparently there is no damages. Surface treatment of the concrete slab is recommended in case of reuse.

5.3.1.3 Lifting Towers, Substructure

A rectangular box (10.6 m x 5.6 m) of steel sheet piles forms the substructure in the first and second row. The concrete front towards ramp side is drawn back from steel pile front, and steel piles are cut at low level to allow ramp movements.

An irregular but almost rectangular box (14.5 m x 11.85 - 15.50 m) of steel sheet piles forms the substructure at the base of finger piers. At the same time the structure forms the first part of the finger pier.

An irregular box (15.4 m x 13.0 - 18.0 m) of steel sheet piles forms the substructure at the base of the central pier. At the same time the structure forms the first part of the central pier. Also, the building for the electrical system and control system is situated on the structure.

The inside of tower foundations are filled up with mass concrete, which is formed to create support for the steel structures, stop fenders, guiding fenders and pits for counterweights. The steel superstructure are towers for carrying the lifting mechanism and the counterweights.

As the steel sheet piles were below water level, it has not been possible to judge on corrosion condition. However it is rather heavy profiles (Larssen IV) with a flange thickness of 15 mm. In a rehabilitation project the sheet piles should be protected from corrosion by sacrificial anodes. If pits for counterweights will be redesigned with bottom level below water level, the concrete structures must be rehabilitated and made watertight. All fenders should be replaced by new fenders. Pits are dry.

5.3.1.4 Finger Piers

The substructure consist of reinforced concrete piles 350 x 350 mm with toe levels varying from - 15.0 to - 16.3 m. The superstructure is a reinforced concrete slab 6200 mm wide and about 28 m in length. A front wall of precast concrete units supports the guiding fenders. On top of the slab sand is filled in

5.3.3.2 Passenger and Welfare Buildings

At the ferry terminal the main building contains waiting hall, administration building, ticket office, police office and rest rooms. In addition to this, a restaurant is present as well as temporary facilities for customs check.

A detailed description of the terminal buildings and their present condition is given in Appendix 3.

In general, the buildings are in a poor condition. The passenger terminal and administration building is currently under-going total repair.

5.3.3.3 Railway Shunting and Marshalling Area

Railway aspects as regards facilities and operations in the terminal are described together with outer railway access in chapter 5.6.

5.4 Terminal Operation and Organization

5.4.1 Operations and Services

The ferry terminal is servicing the international ferry links out of Turkmenbashi. The traffic categories handled are:

- Rail wagons (cargo)
- Trucks and ordinary cars
- Passenger

The services provided at present in the terminal for handling these traffic categories are described as an integrated part of the description of terminal operations associated with the arrival and departure of ferries following hereafter. The outline of terminal operations is based partly on interviews of the terminal staff and partly on surveys of the operations.

5.4.1.1 Arrival

When an arriving ferry has been safely moored, the passengers are the first to leave the ferry. The police check passports of passengers at the end of the access ramps. From there passengers proceed to the customs building (shed). After customs check the passengers leave the area. Due to slow procedures, passengers can wait as long as two hours before they are allowed to leave the ferry terminal.

lifting machinery. Therefore reference is made to chapter 4.3.2 with respect both to the detailed description and the general state of repair of the ramps.

Hereafter, however, some particularities observed during our site visit shall be mentioned.

The condition of the wooden deck is very bad and dangerous for the vehicles. In certain areas parts of the timber is missing.

The present ferries have only 2 tracks at the ramp connection and it should be considered only to make 2 tracks on the whole ramp. At present the outer span is equipped with 4 tracks at ramp/ship connection.

The general impression of steel structures in the ramps is, that all steel needs new corrosion protection. Some minor steel profiles should be replaced because of corrosion and/or mechanical damages. The main structures seems to be in good condition for reuse. The rehabilitation of ramp structures should be arranged according to this procedure:

- Dismantling of all ramp sections
- Transport to repair site on land
- Dismantling of wooden deck and rails
- A thorough investigation of all steel components
- Replacement of corroded and damaged parts
- Strengthening of steel profiles if calculations shows necessary
- Cleaning and sandblasting
- New corrosion protection shall be applied
- A hardwood timber deck should be installed

During our visit the deck timber on the North ramp was being replaced by new timber. In the first 2 spans from land additional cross beams were welded in between original cross beams for timber support. The rail tracks in the outer span was reduced to 2 tracks and points (switch) were removed.

5.3.3 Land Works

5.3.3.1 Marshalling Area for Trucks

A marshalling area for trucks is located on an area just north of the ferry berth. This area can contain some 25 waiting trucks. The area is unpaved and located at a very low level. Only construction of a temporary sloping bank has protected the area from being subject to inundation. This is clearly an unacceptable bottleneck in today's operations.

directly to the director of Turkmenistan State Shipping Company (the minister).

5.5 Navigational Aspects/Approach to Turkmenbashi

There are two access routes from the open sea to the port of Turkmenbashi. A northern route (length 22 km) going through the opening in the Cheliken peninsula and a southern route (length 35 km) going south of the peninsula. The northern route is normally used by vessels heading for or arriving from Baku or Russia, while traffic to and from Iran uses the southern route. For the ferry link to Baku, the northern route is 24 nautical miles shorter than the southern route. A map showing the approach to Turkmenbashi is attached as dwg. no. 2.11.

In the beginning of the 1970's the northern route was dredged to 7 meters water depth. The width of the channel is 140 m. Due to strong siltation at the entrance to the channel, major maintenance dredging works have been necessary. However, since the end of the Soviet Union, only minor "urgency" dredging has been carried out and now the water depth of the channel in parts is estimated to be closer to 4 than to 7 meters, see below under dredging. The minimum water depth in the southern route is 4-5 meters. There are plans regarding dredging of this channel and a high capacity dredger is ready to execute this work, but a political decision regarding this project is still pending.

Naval charts from 1979 and 1980 are available. These are showing the Caspian Sea, the approach to Turkmenbashi as well as the navigation channels in the bay of Turkmenbashi.

The northern channel is currently marked by 28 buoys. The green and red buoys are located at a distance of 500 to 1500 meters. Generally the channel is marked with pairs of buoys, but at various spots buoys are missing. Also, no positioning of buoys has been made recently, and therefore the position of buoys is not reliable. Buoys are equipped with lights and reflectors, however, many lights are not working properly. The navigational aids was originally arranged according to the IALA System A. One land mark is located at the entrance to the channel from the open sea and also land marks are marking the original alignment of the channel.

One the first part (closest to the port) the southern channel is identical to the northern channel. On the last part to the open sea, the southern channel is only marked by two centre line markers.

For the ferries the approach to Turkmenbashi starts at the first buoy outside the opening of the Cheliken peninsula. Through the opening and most of the

The first vehicles to leave the ferry are the trucks. The passport check is done at the end of the access ramp as for passengers. This implies a queue of trucks on the ramp, which slows the unloading of trucks and cars significantly. The reason for this waiting line is that the terminal has not been designed for border crossing operations and as such has no marshalling area for arriving trucks. After passport check the trucks proceed for customs check. As this is done 20 meters ahead of the passport check, this again creates a waiting line for the same reason as explained above. One more factor influencing the unloading time is the poor condition of the surface of the access ramp. Therefore unloading of trucks may take as long as 2-3 hours.

After trucks, any railwagons will leave the ferry. Not all ferries carry railwagons. Due to safety measures for balancing, railwagons will only be transported in lots of 14 to 28 wagons at a time. On board the ferry, the ferry's operations manager is responsible for the railwagons. When the ferry is at berth, the national railway companies take over the responsibility. All operations regarding railwagons are carried out by the respective railway companies. In contradiction to the unloading of passengers and trucks, the unloading of railwagons is done relatively fast. Only 20-30 minutes are required.

After the main cargo deck has been emptied, the cars are brought up from a secondary deck below the main deck. Cars leave the ferry according to these same procedures as apply for trucks. When the last car has left the area, 3 to 7 hours have gone.

5.4.1.2 Departure

When the ferry has been unloaded, the loading procedure can begin. Loading is done in the opposite order than unloading, viz. firstly cars are loaded, then railwagons and trucks and lastly passengers.

Currently, there are three weekly ferry departures. In principle, a ferry leaves when it is full or when the ferry on the other side of the Caspian Sea is leaving. Therefore there is no fixed time schedule for the ferries, which implies that passengers, cars and trucks are waiting for hours without knowing when the ferry will leave.

The crossing time for the ferry is between 12 and 16 hours depending on the time of day it is convenient to arrive.

5.4.1.3 Organization

The daily management of the ferry terminal is taken care of by the terminal manager assisted by the operations manager. The terminal manager refers

The Table 5.1 also confirms that dredging works carried out in the approaches to Turkmenbashi port since the break-up of the Soviet Union have been "urgency" measures at a level much lower than what should be done in order to maintain the depths of the approaches properly. The result is that today the water depth is much smaller than 7 m and, according to the captains of the ferry vessels, approaching the draft limitations of the ferries. In fact, some captains claim that they in some areas are maintaining a passage through in the access channell by the ferries. This was to some extent confirmed during the crossing of the Caspian Sea by the consultant, when bottom materials in some areas were heavily mixed with the water during passage by the ferry.

A particular problem has been mentioned concerning the northern ferry berth which should be suffering from inflow of sediments and materials from the reclamation just north of the terminal.

The lack of proper maintenance dredging is alarming and constitutes a threat to the operation of not only the ferry link but also other marine transport to Turkmenbashi port. The seriousness of the problem has been covered until now, partly because of the rising water level, partly due to "urgency" dredging carried out by Caspian Sea Route on request of the ferries, but mostly because of the margin of 2-3 m that was originally maintained. This "buffer" margin has been used by now in different parts of the channel system and the problems have now become obvious and of highest urgency.

Additional Investigations

The situation of the sea side approach to Turkmenbashi Port is very unsatisfactory and calls for immediate and proper actions.

As outlined above the major reasons of concern are:

- Limitation of navigational water depth and channel width due to continued heavy siltation.
- Missing or non-function of navigational buoys and markings.
- Limited manoeuvring areas in the port.

In addition shall be mentioned:

- Lack of vessel-port communication on traffic situation (VTS system).
- Traffic mix of passenger ferries and tankers using the same channel.

bay a course of 32.8° is used. At red buoy no. 22 the course is changed to 339.4° towards the city centre. At the last green buoy no. 29 in front of the general cargo terminal the course is changed to north-east to the turning basin in front of the ferry terminal, where the anchor is used to berth the ferry. According to the captains of the ferries, the manoeuvring bassin at the ferry terminal should be bigger.

Use of pilot is compulsory in the port and access channels of Turkmenbashi. However, the ferries servicing the Baku-Turkmenbashi line are often exempted from the use of pilot.

Sedimentation and Dredging

The heavy dredging carried out also during periods with rising water level of the Caspian Sea is proof of the important siltation that takes place in the approaches to Turkmenbashi port.

According to records of the Caspmorput, who has been carrying out the dredging works in Turkmenbashi, the volumes distributed on the different parts of the approach are as shown in Table 5.1.

Table 5.1 Dredging Works in Approach to Turkmenbashi Port

	Split and Sea Port Channel	Channel I and Channel II	Inside Port/Ferry Terminal
Year 1984-1991	1,743,000 m^3	5,369,000 m^3	260,000 m^3
Average	217,000 m^3/year	671,000 m^3/year	32,000 m^3/year
Year 1992-1995	250,000 m^3	273,000 m^3	50,000 m^3
Average	60,000 m^3/year	68,000 m^3/year	12,000 m^3/year

Source: Caspmorput

During the whole of the period shown in Table 5.1 the water level has been rising with approximately 0.11 m/year. Assuming that dredging has been carried out in order to maintain 7 m water depth, this indicates that the real siltation taking place is higher than the volumes shown in the table. By simply adding the rising of the water level will not change the order of magnitude of the figures in Table 5.1.

Taking the case of the Split and seaport area of the channel, the reported dredging corresponds to an average siltation in the channel of 0.4 m to 0.6 m, but this may not be evenly distributed.

5.6.1.3 Access Tracks

The access tracks are used for parking of wagons waiting for shunting on board the ferry and for temporary parking of wagons from the ferry.

The access tracks are grouped with 4 tracks for each of the two ferry berths. Two of these four tracks are used for wagons *to* the ferry and the other two for wagons *from* the ferry. The length of the tracks is about 225 m to 228 m giving a capacity of 15 - 18 wagons corresponding to the capacity of 2 ferry tracks.

This arrangement of access tracks is very like the arrangement in Baku terminal.

5.6.1.4 Ferry Connection Tracks

From each group of 4 access tracks two parallel tracks leads to the ferry via the ferry bridge for simultaneous shunting to each side of the ferry. On the outer bridge each track has a switch installed previously used for connection to the ferry tracks. However the present ferries has switches installed on the deck and the bridge switches are no longer used.

5.6.1.5 Signalling Equipment

Light signals are installed for control of train movements to and from the access tracks. All switches are manually operated and train movements are controlled by radio equipment.

On the new planned terminal a signalling system with relay interlocking and centralised electrically operated switches is planned to be installed.

5.6.2 Condition of Installations

The installations have not yet been inspected in detail. It appears, however, that the condition is alike the condition of the installations in Baku terminal.

5.6.3 Operation

5.6.3.1 Present Procedure

The operation procedure is in principle assumed to be very similar to the procedure already described for Baku. However the difference in lay out and in

- Lack of updated marine charts and maps due to the constantly changing situation.

The siltation of the channel is a direct threat to the continued operation of the ferries and in combination with the other problems identified the safety of the navigation is questioned.

Besides carrying out the immediate "urgency" dredgings this complex of problems calls for a detailed investigation of the navigation and safety aspects of the sea approach to the port to determine the most appropriate and economic long-term solutions. Such a detailed investigation would be the benefit of the whole of the Port of Turkmenbashi (including the oil terminal) and is further described in chapter 7.5.5.

5.6 Railway Facilities and Access

5.6.1 General Description

The railway terminal is situated close to the railway yard of Turkmenbashi main station. The terminal itself consists of a shunting yard, access tracks and ferry connection tracks, and it is connected to the railway system via two connection tracks as shown on the Turkmenbashi Terminal layout plan no. 2.01.

A new lay out of the terminal has been planned and the construction has already been started. One end of a new shunting yard is completed. The aim of the new lay out is to get a better flow of wagons to and from the ferries, improved access to the terminal and to increase the capacity.

5.6.1.1 Connection Line

The terminal is connected via one track to the track area of the port and via another track to the station yard.

5.6.1.2 Shunting Yard

Presently the shunting yard consist of 6 parallel tracks with a switch area in each end. The connection to the ferry access tracks is established from one of the parallel tracks (track 5). Track 1 to 4 have the length of about 500 m. Track 6 of 215 m has a blind end. The lay out of the yard is not very well suited for the sorting of wagons for the ferry as it gives several crossing shunting movements and has a considerably reduced capacity. The already constructed part of the new shunting yard is also used as a supplement of the old yard.

very similar to the infrastructure in Baku using the same type of components as both terminals were designed by the same institute.

Design geometry and standards of the permanent way as well as safety rules and signalling standards will be needed in the design phase taking notice of possible new standards of the Turkmenian railways.

These information have not yet been obtained from the Turkmenian Railways.

Maximum gradient and permissible angle between track and ferry bridge is assumed to be the same on both sides and must be clarified before or in the design phase.

5.6.5 Modernisation

A complete re-construction of the shunting yard of the ferry terminal has been planned. In the same time a new yard for arrival and for dispatching of freight trains beside the shunting yard has been planned. A realisation of this plan will move most of the freight train production away from the main station area, and it will provide a direct access to and from the main line to the new freight yard. It is an ambitious plan which will provide an excellent lay out for the production and a high capacity. Part of the new shunting yard has already been constructed.

The level of the terminal is very near the present level of the Caspian Sea giving problems with flooding. The necessary and planned lifting of the whole substructure will demand a removal of the complete railway installations and a re-construction. It is obvious to utilise the present modernisation plans for a new lay out as a basis for the re-construction. However it is doubtful if it would be feasible to realise the complete plan based on the present level of traffic. A division of the plan into phases, which can be realised along with a growth in traffic, should be discussed in details with the railway authorities.

5.7 Road Access

A 2-3 km long asphalt road leads to the ferry terminal from the main road between Ashgabat and Turkmenbashi. The access road is generally in a good condition, except for some holes that need repair close to the ferry terminal. The access road is crossing both the port railway and the main railway line. The width of the road is 6 to 8 meters. In connection with the railway crossings, there are sharp bends. Most of the access road is located in level - 25 m, which means only about 1.5 metres above the current sea level.

particular due to the already started re-construction of the terminal will give some variations.

Freight trains arrive to Turkmenbashi station and wagons for ferry transfer is shunted via the direct line from the incoming track to the terminal shunting yard.

Shunting to and from Ferry

When a ferry has arrived two shunting locomotives are hauling wagons from both sides of the ferry using the double track on the ferry bridge. The shunting is carried out with simultaneous shunting movements in order to keep the ferry balanced at all times. The ferries have a balancing tank and pumping system but it is said not to be working. Locomotives are not allowed on the outer ferry bridge and shunting is carried out using intermediate wagons.

Similar to the situation in Baku it is assumed that the wagons from the two ferry tracks on each side of the ferry are parked on the inner tracks of the access tracks. Wagons parked on the outer access tracks waiting for the ferry are the shunted to the ferry by simultaneous shunting movements.

The shunting movements to and from the ferries are controlled by radio communication and managed by the port staff.

Shunting Yard Operation

The shunting yard is used for parking of wagons to and from the ferry and for sorting of the wagons to the ferry in order to give the correct balance of the ferry. The completed part of the new shunting yard can also be used for parking or sorting of wagons.

It is not known if inspection of wagons takes place in the station area or in the ferry terminal.

5.6.3.2 Capacity

The capacity of the present terminal is very limited because of the reasons referred in 5.6.1.2. For the present traffic varying between 200 and 700 per direction each month however it is considered to be sufficient.

5.6.4 Design Standards

The railway infrastructure is designed according to the standards of the former Soviet railways. It has not yet been inspected in detail, but it is believed to be

- The increase in traffic is not expected to create any additional negative effects on populated areas.

5.9 Auxiliary Facilities and Utilities

Heating supply, heating and ventilation

The source for heating is the local boiler house located at the territory of the ferry terminal. In the boiler house there is one boiler of type NV-18 which uses fuel oil and can be inverted to use of gas. The capacity of the boiler is 0.33 Gkal/hour. The boiler house is in working condition and the capacity is sufficient for the consumers located inside the ferry terminal area.

Heating systems and ventilation in the passenger building and customs building are in working condition. All heating is by means of hot water radiators. Heating pipelines are temporarily located overgroung between the boiler house and the passenger and customs buildings. The rest of the buildings are not connected to the heating network.

It will be necessary to design and construct heating distribution nets for all buildings in the ferry terminal.

Electrical installations

The main source of power supply in the ferry terminal is the 35/6/0.4 kV substation named "Paromnaya". The high voltage side of the substation is supplied from the city network which passes at a distance of 150 m from the substation.

The transformer with a capacity of 3200 kVA for voltage of 35/6 kV is located in the open area outside the building. Distributor installation RU-6 kV located inside the building gets power supply from the low side of the transformer through the 6 kV cable. Two 630 kVA transformers for voltage of 6/0.4 kV located in the same building as the RU-6 kV, gets power from the RU-6 kV. One of these is for emergency only. Additionally, two substations of 6/0.4 kV for consumers in the adjacent general cargo port gets power supply from the cells of RU-6 kV through cable lines.

Consumers of electric power at the ferry terminal (passenger and administration building, customs building, lighting of the area, ferry ramp motors etc.) get power supply from the low voltage side of the "Paromnaya" substation. The supply is 380/220 V and the frequency is 50 Hz.

5.8 Environmental Aspects

The description regarding environmental aspects as presented in chapter 4.8 is valid also for Turkmenbashi, but with the following amendments:

- **Legal Aspects and Approvals**

  . The governmental department concerning environmental issues is the Ministry of Natural Resources and Environmental Protection situated in Ashgabat, but represented by a regional office in Turkmenbashi. The approval shall be according to Law of Turkmenistan, On Ecological Examination (and Expertise).

  . Like in Azerbaijan the Government of Turkmenistan is presentlig negotiating the adoption of the UN Convention on International Rights of the Sea.

- **Environmental Baseline Conditions**

  . Physical and chemical baseline conditions in the environment of the Turkmenbashi ferry terminal are described in chapter 5.

  . Regular dredging has been carried out in the port and dredged materials are already being deposited in the sea at a site 3 km off the coast north of the Split (outlet of approach channel) at about 10 m water depth.

  . The nature in the area of the terminal does not show high degree of pollution as is the case in Baku.

  . Special attention should be paid to an area just north of the terminal where the subsoil has been contaminated by oil due to a leakage of the pipeline on the hillside.

  . The location of the terminal is deserted from any population and so are rail and road access to terminal.

- **Environmental Impacts**

  . No site presently used for providing marine fill materials has been mentioned.

The condition of the substation is bad. Proper maintenance is almost impossible to carry out due to permanent water intrusion.

The outside lighting in the ferry terminal is in a poor condition. The internal telephone communication between divisions of the ferry terminal is good. The outside telephone lines are in a poor condition and therefore communication inside Turkmenistan and internationally is almost impossible.

Water supply

In the existing facilities, there is a water supply system of steel water pipelines with diameters of 50 mm and 100 mm according to GOST 10704-80. However, the system is not in a working condition and water is currently brought by tank trucks.

The net of water pipelines was constructed some 10-15 years ago. The pipes do not comply with the requirements of SNiP 2.04.01-85 and GOST 10704-80.

The water supply system shall be designed and constructed according to SNiP 2.04.02-84. It is recommended to design water pipelines of steel and according to GOST 10704-80.

Watering taps and fire distinguishing hydrants should be included in strategic spots.

Sewerage

No proper sewerage system is existing in the ferry terminal. The newly repaired passenger and administration building is equipped with sewerage installations and some wells. However, it is necessary to connect it to an outside sewerage system.

Currently, waste water is discharged into the municipal system, where it is pumped, untreated, to a large lagoon adjacent to the power plant. Garbage is removed by trucks.

The re-construction of the sewer system shall be carried out according to SNiP 2.04.02-84. The consumer waste water from buildings will be collected by gravity into a tank. From the tank waste water needs to be taken to a dumping site by vehicle or brought to the city manifold.

Pipelines for gravitation sewerage are made of asbestos-cement pipes with a diameter of 200-400 mm according to GOST 539-80.

- As a result of the heavy investments in the railway infrastructure and rolling equipment for the long haul transportation, rail transportation will necessarily remain a major mode of transportation in the future. Rail will however be challenged by other modes of transportation:

  - General cargoes will however increasingly be shifted to truck transportation and to containers.

  - For overseas transportation of general cargoes, a major share will be containerized within a time period of five to seven years.

  - Long haulage of bulk cargoes where bulk water transportation is available will take over some of the long haulage bulk trades.

  - General cargoes shifted to containers may be transported by block trains or by truck. Major limitation of the Central Asian railroads is the limited availability of container handling facilities, which will imply that containers will be transported by truck until railroads have acquired equipment to handle containers. Major investments in container handling equipment will be required for the railroads to be able to compete for container shipments

  Traditional rail traffic will experience moderate development, and increases in cargoes will primarily involve bulk cargoes.

- Trucking - including shipping of loose trailers - will increase significantly from a very low base. The major limitation in this respect is the poor condition of the road network and the limited availability of trucks of international standard. Long distance truck haulage will be handled by international trucking companies, most of whom will be based in Turkey and Iran, but also European truckers will participate in this haulage.

- Passengers and cars will most likely remain relatively stable. Since Turkmenbashi has a relatively limited population and the distance to Ashgabat is very long, most of the passenger traffic will for the foreseeable future continue be small traders with limited recreational travel.

- Intermodal transportation of containers, which at the present time is virtually non-existent, will increase dramatically. This will be driven by the shippers of imports of consumer goods, machinery and other manufactured materials to the Central Asian Republics, most of which will be containerized in the future in line with developments in the rest of the world. Container operators will offer container transportation for exports from the Central Asian republics at favourable rates in order to avoid having to return their containers empty.

6. FUTURE NEEDS AND CAPACITY REQUIREMENTS

6.1 Traffic Forecasts for Ferry Link

As has been pointed out in chapter 3 of the report, the cargo flows on the ferry service has experienced a dramatic decline over the past years. It should be noted that even under the most optimistic scenario described below the cargo flows in the year 2015 is not expected to reach the peak cargo flows of the mid 1980's (i.e. between 7 and 8 million tons). This is also supported by experience and forecasts for other economies in transition and under restructuring (e.g. Russia, Ukraine, Baltic States), all of which have not experienced and are not expected to achieve cargo growth above 10% per annum and thus will not reach pre-restructuring cargo flow levels till well into the next century.

It should be noted that the information, data and scenarios presented have been developed based on incomplete data and should be considered as preliminary. The forecasts will be refined and revised based on new data that is developed. It is, however, expected that the overall trends described in the scenarios will remain unchanged.

6.1.1 General Developments in Transportation Influencing Cargo Flow Development on the Ferry Route

The Central Asian economies have experienced dramatic changes, and the overall economic output as measured by the GDP and the industrial production has for many of the countries been more than halved. The expected developments of the cargo flows will to a large extent be determined more by the ability of the respective governments to redirect its trade flows from their traditional orientation of trading within the former Soviet block countries to trade with the rest of the world.

In this overall picture Azerbaijan will be an influence on the cargo flows only to the extent of its local trade with the other Central Asian republics on the other side of the Caspian Sea. The cargo flows will therefore be driven by the trade developments and thus transit cargoes to and from Turkmenistan, Uzbekistan, Tajikistan and Kyrgyzstan.

Although the heritage of the former Soviet Union transportation system and policies will linger, it is expected that the transportation developments in the rest of the world will increasingly influence the developments in these countries:

- The Olya/Astrakhan port development and start of alternative ferry services
- The Iranian connection through Bandar Abbas and overland transit through Iran
- The Chechnya overland connection

6.1.2.1 Likely Scenario

This scenario describes the overall situation expected by the majority of observers of the region, and should represent a development trend with a probability of more than 50%.

Macroeconomic Development

Under this scenario it is expected that the uncertainties associated with respect to key political issues, which has clouded the economic situation of Azerbaijan in the recent past, are resolved in the near future:

- Creation of peace with Armenia over Nagorno-Karabakh. The current cease fire agreement in the conflict, which has displaced more than 900,000 people and caused massive destruction of the infrastructure, is replaced with a permanent peace agreement brokered by international mediators. The lingering uncertainty and the possibility of resumption of open warfare is superseded by optimism and internationally supported program to rebuild the warzone.

- The Chechnya conflict is ended with a cease fire followed by lasting peace. The Russian government and the separatists is resolved by the republic gaining a more independent status while still being a part of Russia.

- Liberalization of the economy and attraction of foreign investments. With its long history of oil and gas exploration and strong influence of the private sector in the economy, the entrepreneurial spirit has survived the many years of communist regime, and the reform program of the government has rekindled the spirit. The private sector flourishes both as a result of the increased activities in the oil and gas sector and creates new employment opportunities and increasing incomes among the population. Economic output is, however, not at a level similar to the peak output of previous years until approximately 2005.

- Development of the oil and gas reserves. The agreement signed in September 1994 with an international oil consortium to develop the Azerr, Chirag and Guneshli oil and gas fields is followed by other similar

6.1.2 Expected Traffic Flows on the Ferry Link

Given the uncertainty and the major changes that have happened in the recent past and the major changes that can be expected in the near future the Consultant has found that traditional methods of cargo projections may not be able to describe these changes. Instead it is decided to use the method of scenario description. In this respect major issues that can be expected to influence the cargo flow and modal split developments on the trade, have been selected.

Key issues for scenario description of potential developments

- General macroeconomic developments. Since the economies of both Azerbaijan and Turkmenistan are highly dependent upon the petroleum industry, their ability to attract foreign investments for the development of oil and gas fields and infrastructure in the form of pipelines will to a large extent determine the rate of growth in the economies. The development of the oil and gas fields will initially create traffic in terms of the equipment and supplies brought in, and later the sale of oil and gas will create infusions of funds to the economy will contribute to the overall economic development and thereby increased trade and cargo flows. Major issues in this respect influencing this development will be:

  - Liberalization of the economic policies. The policies adopted in this respect will influence the attraction of foreign investments in the basic industries both in oil and gas and other industries.

  - Political stability and the ability to create peace. The development of the conflicts in Nagorno-Karabakh, Chechnya and other regions plus the overall political climate will influence or disrupt economic development and the expected cargo flows.

- Direction of the trade. The cargo flow of the ferry service will be influenced by the direction of the trade, e.g. to the FSU, the Far East, China and Iran/India/Pakistan or Western Europe and the USA. The success of the Central Asian republics of developing trade with Turkey, Western Europe and the US will clearly influence the cargo flows on the ferry.

  Development of alternative transportation patterns and routings including transportation infrastructure. The main alternatives that will influence the use of the ferry service are:

  - The Volga-Don canal upgrading

and major portions of the economy including the important gas and cotton sectors are under the control of government institutions.

In the coming years it is expected that the government will continue its policy retaining control of the economy and its limited efforts at privatization of government owned industries and agriculture and liberalization of the economy. This will tend to retard economic growth and foreign investments both in the gas industry as well as the traditional industries of Turkmenistan.

In the near future a continued low activity is expected in the gas industry, while the other industries are expected to have bottomed out in 1995, and real growth can be expected from 1996 onwards. Estimated annual growth of the GDP up until the year 2000 is expected to be approximately 3.5% per year, while after competition of the pipelines to Iran/Turkey and through Afghanistan to Pakistan the annual growth rate will increase to in excess of 5%.

The Direction of Trade

The strong ties to, the transportation infrastructure and the past history of trade with the FSU countries will continue at least for the first part of the scenario planning period (i.e. to the time period 2003 - 2005) to cement their relation as the major trading partners of the Central Asian republics. The close cultural ties and the close geographic proximities to Turkey and Iran, and to a lesser extent the Peoples Republic of China, will ensure that these countries will grow rapidly in importance as trading partners. The bulk of the growth, however, will be accounted for by Western Europe, United States and Japan, and by the end of the scenario planning period these countries will have surpassed the FSU in importance as trading partners.

Development of Alternative Transportation Patterns and Routings

The investments by the EU in the Traceca corridor including the ferry terminals, combined with the resolution of the Nagorno-Karabakh and the Chechnya conflicts ensure the success (utilisation) of the Traceca route as a major transportation routing of the Central Asian countries' foreign trade.

The main developments on the alternative routes that will influencing the use of the ferry service under this scenario are:

- The Volga-Don waterway is upgraded and is operational with the extended draft and improved locks ensuring minimal delays and the use of the full draft and loading capacity of the vessels. The waterway is also opened to international traffic. During the navigation season this route is primarily used for bulk shipments, while shippers and consignees of agreements with international oil consortia on the basis of the Caspian Sea oil producing countries reaching an agreement covering the sharing of the oil resources following the break-up of the FSU. The major issue of the investment in the construction of alternate pipelines to export the increased output countries outside the FSU is made, and the construction is started around the turn of the century.

The expected economic development of the Azerbaijan economy is summarized in Table 6.1.

Table 6.1 Azerbaijan: Projected Trends 1994-2003

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Percent changes in real output:										
GDP	-21.9	-8.9	-1.3	-0.8	-0.3	3.5	6.3	11.5	10.9	10.0
Oil and gas	-8.2	-3.5	-7.1	-7.0	-7.0	6.3	13.6	29.0	23.2	17.8
Rest of economy	-24.2	-10.0	0.0	0.5	1.0	3.0	5.0	8.0	8.0	8.0
Balance of payments (in millions of USD):										
Exports	637	613	464	468	512	577	891	1412	1982	2552
Imports	849	839	739	919	1139	1365	1800	2434	2863	3384
Resource gap	-212	-226	-275	-451	-626	-788	-908	-1010	-881	-831

Source: Azerbaijan, Economic Update, World Bank, April 24, 1995

The development of the Turkmenistan economy hinges on the success of the Turkmen government in attracting interest from Western oil companies in building pipelines to markets outside the FSU to diversify and increase its gas exports. Construction will be finalized in 1997 on a pipeline through to Iran, which as a stage two development will be extended to Turkey with completion in 1999. Plans are made for a pipeline through Afghanistan to Pakistan, and it is reported that construction may start on this pipeline already in 1997. The government is actively soliciting interest in and investments for its gas industry and the pipeline projects from major international oil companies and financial institutions.

Turkmenistan is also dependent upon attracting foreign investments to exploit its vast natural resources.

Although efforts have been made to redirect the economy from the inherited central control system of the Soviet times in the direction of liberalization and a market economy, the efforts have not produced significant visible results,

Table 6.2 Forecast of cargo flows on the Caspian Sea ferry service to 2015 most likely scenario (in thousands of net tons)

Service:	1993	1994	1995	2000	2005	2010	2015
Baku - Turkmenbashi	133.8	154.5	234.8	314.2	420.5	562.7	753.0
Turkmenbashi - Baku	231.4	205.7	344.4	460.9	616.8	825.4	1104.5
Ferry total	365.2	360.2	579.2	775.1	1037.3	1388.1	1857.6
Modal split:							
Rail	255.6	252.1	330.1	310.0	311.2	416.4	557.3
Truck	109.6	108.1	249.1	387.6	570.5	763.4	1021.7
Intermodal container	0.0	0.0	0.0	77.5	155.6	208.2	278.6
Total	365.2	360.2	579.2	775.1	1037.3	1388.1	1857.6
Passenger traffic ('000)	93	52	48	64.2	86.0	115.0	153.9

Source: The Consultant

With respect to the modal split it is expected that the development will follow the trend in most developed, open economies, whereby truck and intermodal container traffic will gradually increase its overall market share. Trucks, which carried almost 50% of the total cargo volumes in 1995 is expected to increase to approximately 55%, while intermodal containers will comprise approximately 15% of the total cargoes. Rail traffic, which under the command economy of the previous regime, totally dominated the ferry traffic is expected to decrease to approximately 30%.

6.1.2.2 Optimistic/High Growth Scenario

This scenario describes the more optimistic development compared to the likely scenario, and is assessed to have a probability of occurring of approximately 20%. The expected developments are similar to those of the most likely scenario described in Section 6.1.2.1.

Macroeconomic Development

Under this scenario it is expected that developments in Azerbaijan will be identical to that of the most likely scenario.

In Turkmenistan the development will be the same with the exception of privatization and liberalization of the economy in order to increase the level of for-general cargoes prefer the use of the trans-Caspian ferry both due to lower transportation costs and shorter transit times.

- The Russian government proceeds with the development of the port of Olya near Astrakhan and start of alternative ferry services from this port to Aktau, Turkmenbashi and Iran. The opening of the Chechnya route causes this route to be considered a contingency in the event that the more efficient route through Chechnya should for any reason be closed for political or other reasons in the future. The cargo volumes on this route are therefore relatively limited.

- The Iranian connection through Bandar Abbas and overland transit through Iran continue to be developed as an important route. Improved infrastructure between Turkmenistan both by rail and road makes this an attractive route primarily for local and Far East cargoes. Cargoes to and from Europe and the US are shipped on the more cost and time efficient Traceca route. The Iranian route is also experiencing increased competition from the rail connection via the Russian Far East ports, particularly for general cargoes to and from the Far East (primarily Japan and Korea).

- The peace agreement between Armenia and Azerbaijan enables the reopening of the Julfa border crossing station to Iran, and this route regains its importance as a border crossing.

- The Chechnya overland connection is reopened, and rapidly regains its previous importance as an important route for cargoes between the Central Asian republics and Central and Northern Russia, Ukraine and the Baltic countries. This route is preferred to the considerably longer route through Kazakhstan.

- The landbridge rail link between Central Asia and the Russian Far East ports is reopened and increasing volumes of general and containerized cargoes to and from the Far East markets are shipped on this route in competition with the Iran route via Bandar Abbas. Its popularity is spurred by both being faster and more cost effective compared to the Arabian Gulf route. Increasingly cargoes between Azerbaijan and the Far East are shipped on this route via the ferry.

The expected cargo flows under this scenario is expected to experience an average annual growth of between 5 and 7 %, and is presented as Table 6.2. Please note, that the cargo flow is given in net tons, in contradiction to chapter 3, where past cargo statistsics were given as gross tons.

The main developments on the alternative routes that will influencing the use of the ferry service under this scenario are:

- The peace agreement between Armenia and Azerbaijan enables the reopening of the Julfa border crossing station to Iran, and this route regains its importance as a border crossing.

- The Chechnya overland connection is reopened, and rapidly regains its previous importance as an important route for cargoes between the Central Asian republics and Central and Northern Russia, Ukraine and the Baltic countries. This route is preferred to the considerably longer route through Kazakhstan.

  The upgrading of the Volga-Don waterway and the planned developments of the Olya port near Astrakhan is postponed by Russian authorities, and resources are redirected to rebuild and upgrade the transportation infrastructure destroyed during the Chechnya conflict. Priority is given by the Russian authorities to use this route for cargoes both to and from Central Asia and Iran.

- The landbridge rail link between Central Asia and the Russian Far East ports is reopened and increasing volumes of general and containerized cargoes to and from the Far East markets are shipped on this route. This route is preferred by shippers and consignees for cargoes between Azerbaijan and the Far East both due to lower costs and faster transit times.

- The Iranian connection through Bandar Abbas and overland transit through Iran continue to be developed as an important route. Improved infrastructure between Turkmenistan and Iran both by rail and road makes this an attractive route primarily for local and Far East cargoes. The Iranian route is, however, experiencing increased competition from the rail connection via the Russian Far East ports, particularly for general cargoes to and from the Far East (primarily Japan and Korea).

- Cargoes to and from Europe and the US are almost exclusively (with the exception of major bulk cargoes) shipped on the more cost and time efficient Traceca route.

Under this scenario an average cargo growth of between 10 to 12% per year is expected. The cargo flow and modal split is expected as described in Table 6.3.

eign investments both to rejuvenate the industrial activities and to exploit the vast natural resources of the country:

At the behest of the IMF, major international lending institutions and the governments of major donor countries, the Turkmenistan government embarks on an earnest effort to privatize government held industries and institute decrees to liberalize the overall economic policies to implement a true market oriented system. Efforts are also made to liberalize the concession rules with respect to foreign oil companies access to explore and develop the vast gas and oil reserves of the country. Although efforts have been made to redirect the economy from the inherited central control system of the Soviet times in the direction of liberalization and a market economy, the efforts have not produced significant visible results, and major portions of the economy including the important gas and cotton sectors remain under the control of government institutions.

In the coming years it is expected that the government will continue its policy of retaining control of the economy and its limited efforts at privatization of government owned industries and agriculture and liberalization of the economy. This will tend to retard economic growth and foreign investments both in the gas industry as well as the traditional industries of Turkmenistan.

The results of the changes in policy with respect to privatization and liberalization started in late 1996 and 1997 will have a immediate, albeit small effect in the early years of the planning period, while significant effects will be felt from the year 2000 and onwards. Estimated annual growth of the GDP up until the year 2000 is expected to be approximately 5% per year, while after completion of the pipelines to Iran/Turkey and through Afghanistan to Pakistan and completion of the privatization of government held industries and liberalization of the economy, the annual growth rate will increase to in 8 - 10%.

The Direction of Trade

The development will in the main follow the trends of the 'Most likely scenario' described in Section 6.1.2.1 above. The more pro-Western and liberalization of economic policies of the Turkmenistan government will tend to redirect their trade more in favour of Europe and the United States, which will imply more cargoes via the Traceca route.

Development of Alternative Transportation Patterns and Routings

The investments by the EU in the Traceca corridor including the ferry terminals, combined with the resolution of the Nagorno-Karabakh and the Chechnya conflicts ensure the success (utilisation) of the Traceca route as a major transportation routing of the Central Asian countries' foreign trade.

- The Turkmenistan government fearing repercussions of the ominous developments in their neighbouring Azerbaijan slows down the process of privatization and liberalization of the economy. Increased efforts are directed at developing the ties with Iran and also the Peoples Republic of China.

- The international banks are becoming more restrictive with funding investment projects in the Central Asian republics, and Western government grants and aid funds are reduced considerably. Foreign investment activity in all the Central Asian economies slows down both in the important oil and gas industry as well as in other industries.

Although the downward trend is stopped by the year 2000, the overall economic growth of the region from the year 2000 measured by the GDP is maintained at a level between 0-3% per year.

The Direction of Trade

The development will in the main follow the trends of the 'Most likely scenario' described in Section 6.1.2.1 above. The more restrictive political and economic policies of both the Azerbaijan and Turkmenistan governments will tend to redirect their trade more in favour of Iran, China and the FSU, which will imply less cargoes via the Traceca route.

Development of Alternative Transportation Patterns and Routings

The investments by the EU in the Traceca corridor including the ferry terminals ensure the success of the Traceca route maintains its position as a major transportation routing of the Central Asian countries' foreign trade, despite the lack of a lasting resolution of the Nagorno-Karabakh and the Chechnya conflicts. The main developments on the alternative routes that will influencing the use of the ferry service under this scenario are:

- The continuation of hostilities between Armenia and Azerbaijan casts shadows over the stability of the Traceca route through Azerbaijan and Georgia, and possible sabotage and terrorist attacks reduces the cargo flows on this route.

- The Russian government allocates the necessary funds to upgrade and improve the navigability of the Volga-Don waterway with the extended draft and improved locks ensuring minimal delays and the use of the full draft and loading capacity of the vessels. The waterway is also actively marketed to and cargoes are solicited from both local and international

Table 6.3 Forecast of cargo flows on the Caspian Sea ferry service to 2015 optimistic scenario (in thousands of net tons)

Service:	1993	1994	1995	2000	2005	2010	2015
Baku - Turkmenbashi	133.8	154.5	234.8	395.7	666.7	1123.4	1893.0
Turkmenbashi - Baku	231.4	205.7	344.4	580.3	977.9	1647.8	2776.7
Ferry total	365.2	360.2	579.2	976.0	1644.6	2771.2	4669.7
Modal split:							
Rail	255.6	252.1	330.1	390.4	493.4	831.4	1400.9
Truck	109.6	108.1	249.1	488.0	904.5	1524.2	2568.3
Intermodal container	0.0	0.0	0.0	97.6	246.7	415.7	700.5
Total	365.2	360.2	579.2	976.0	1644.6	2771.2	4669.7
Passenger traffic ('000)	93	52	48	80.9	136.3	229.7	387.0

Source: The Consultant

6.1.2.3 Pessimistic/Low Growth Scenario

The pessimistic/low growth scenario presumes failure to reach a lasting peace agreement with Armenia with respect to the Nagorno-Karabakh area. At the same time the Russians fail to create a lasting peace in Chechnya, and continued guerrilla fighting prevents efforts to restart the peace negotiations.

Macroeconomic Developments

The macroeconomic development of the Central Asian republics is negatively affected by the failure to reach peace and political stability is the region:

- Under the pretext of the unstable political situation brought about by the failure to reach an agreement with Armenia over Nagorno-Karabakh and the continued fighting in the neighbouring Chechnya, the Azerbaijani government slows down the democratization process, the privatization of government enterprises and overall liberalization of the economy.

- The consortium of oil companies having committed themselves at developing the oil reserves of Azerbaijan continue to honour their commitment, but the rate of development is slowed down compared to the original plans. Plans for the construction of new pipelines are postponed pending a peaceful resolution of the conflicts in the region.

Source: The Consultant

6.2 Terminal Functions

The nature and type of terminal infrastructure, facilities and cargo handling equipment to be provided for depend on the services and activities to be carried out in the future terminals.

The terminal functions may be determined from the following key areas:

- Traffic handling.
- Border crossing.
- Customer services.
- Technical port services/maintenance

6.2.1 Traffic Handling

The principal function of the ferry terminal is to ensure the smooth and safe transfer of the various traffic categories between the ferry and the respective land traffic connections.

According to the traffic forecast in chapter 6.1.1, the traffic categories to be envisaged making use of the ferry terminals in the future will comprise:

- Ferry traffic - cargo and passenger transportation
- Rail traffic - for cargo transportation
- Trucks/trailers traffic - for cargo transportation
- Car/bus traffic - for passenger transportation
- Passenger traffic
- Inter-modal transportation of containers

The traffic handling activities will generally consist of

- Reception at/departure from terminal area
- Waiting/parking in terminal area
- Intermodal handling in terminal area
- Embarkation on/disembarkation from the ferry

In addition hereto the terminal shall service the ferries calling at the terminal.

liner and bulk operators, and the cargo volumes of both general cargoes and bulk cargoes are shipped on this waterway.

- As a result of the continued conflict in Chechnya the Russian government speeds up the development of the port of Olya near Astrakhan followed by the establishment of alternative ferry services from this port to Aktau, Turkmenbashi and Iran. The cargo volumes on this route are growing rapidly following the opening of the port of Olya.

- The reopening of landbridge rail link between Central Asia and the Russian Far East ports is followed by upgrading of the handling capacity of the border crossings with the Peoples Republic of China. Increasing volumes of both imports and exports are carried on these routes to compensate for the lowered trade volumes to and from Europe and the United States.

- The Iranian and Turkmenistan governments allocate additional resources to upgrade both rail and road links to Bandar Abbas, and overland transit through Iran is becoming a serious challenge to the Traceca route.

- The reduced cargo volumes to and from Europe and the US continue to be shipped on the more cost and time efficient Traceca route, although some shippers and consignees also select alternative routes due to the uncertainties surrounding the security situation on the route.

Under this scenario the cargo volumes are expected to grow at a low rate of 2 to 3% per year as presented in Table 6.4.

Table 6.4 Forecast of cargo flows on the Caspian Sea ferry service to 2015 pessimistic scenario (in thousands net tons)

Service:	1993	1994	1995	2000	2005	2010	2015
Baku - Turkmenbashi	133.8	154.5	234.8	265.7	300.6	340.1	384.7
Turkmenbashi - Baku	231.4	205.7	344.4	389.7	440.9	498.8	564.3
Ferry total	365.2	360.2	579.2	655.3	741.4	838.9	949.1
Modal split:							
Rail	255.6	252.1	330.1	262.1	222.4	251.7	284.7
Truck	109.6	108.1	249.1	327.7	407.8	461.4	522.0
Intermodal container	0.0	0.0	0.0	65.5	111.2	125.8	142.4
Total	365.2	360.2	579.2	655.3	741.4	838.9	949.1
Passenger traffic ('000)	93	52	48	54.3	61.4	69.5	78.7

cated in the terminal while the activities concerned with the maintenance of the facility shall be the responsibility of staff located in the general cargo port.

In Turkmenbashi, no changes compared to the present situation, see chapter 5.4, are envisaged.

6.3 Terminal Shore Operations

To ensure the terminal functions, as described in chapter 6.2, in a proper way the facilities as presented in Table 6.5 may be required associated with the shore-based operations:

Table 6.5 Requirements of Shore Operation Facilities

Subject	Operation	Facility	Observation Baku	Observation Turkm.
Railway traffic	. Access to/from hinterland	. Railway link line	+L	+(L)
	. Shunting	. Railway shunting area	+L	+L
	. Waiting for embarkation	. Railway marshalling area	+L	+L
	. Embarkation/disembarkation	. Railway ferry access ramp	+R	+R
Trucks/trailers	. Access to/from hinterland	. Access road	+	+
	. Ticketing	. Reception area, traffic lane	-N	-N
		. Ticketing shed	(+R)	+R
	. Waiting for embarkation	. Truck marshalling area	-N	+R
		. Waiting, utilities building	-N	+R
		. Trailer holding area	-N	+R
		. Area reserved for dangerous goods	-N	-N
	. Embarkation/disembarcation	. Ferry access ramp	+R	+R
		. Tractors for moving trailers	-N	-N
	. Customs, immigration	. Area for disembarkation of trucks	-N	-N
		. Covered drive through area with customs, immigration shed	-N	-N
Cars/buses	. Access to/from hinterland	. Access road	+	+
	. Ticketing	. Reception area, traffic lane	-N	-N
		. Ticketing shed	(+R)	+R
	. Waiting for embarkation	. Vehicle marshalling area	-N	+R
		. Waiting, utilities building	-N	+R
	. Embarkation/disembarcation	. Ferry access ramp	+R	+R
	. Customs, immigration	. Area for disembarkation of vehicles	-N	-N
		. Covered drive through area with customs, immigration shed	-N	-N
Passengers	. Ticketing	. Ticketing shed	(+R)	+R
	. Waiting for embarkation	. Waiting, utilities building	(+R)	+R

6.2.2 Border Crossing

With respect to the ferry link between Baku and Turkmenbashi the ferry terminals will function as border crossing points.

In this respect, border crossing activities will have to be undertaken, being

- Custom clearance procedures
- Border police and immigration procedures

Another Traceca project is dealing with the legal framework and customs procedures with the purpose of facilitating the trade and transport on the corridor. It is informed that the results of that project are not expected in any detail to deal with the operational procedures and facilities of the specific terminal points and that the results in all circumstances will only be available in a distant future.

6.2.3 Customers Services

Various facilities and services directed at the through passing customers may be provided. Among the most frequent met in transit terminals like for the present sea links may be mentioned:

- Information and ticketing services
- Waiting and public utilities/toilets
- Communication and telephone
- Restaurant, bank and small shops

To which extent these possibilities shall be provided in a particular terminal may depend on the location of the terminal. Also certain of these facilities are well adapted for private investments and may as such be left out from the project.

In Baku, a discussion shall reveal whether the role of the existing Sea Station located at the Boulevard with respect to passenger servicing shall be maintained or some activities shall be moved to the ferry terminal itself.

6.2.4 Technical Port Activities/Maintenance

A review of the ports administration in Baku is currently being carried out by HPTI. According to the preliminary proposals, the operational activities shall continue being the responsibility of the ferry terminal manager and staff lo-

Subject	Operation	Facility	Observation	
			Baku	Turkm.
	. Embarkation/disembar-kation	. Covered gangway from waiting building to ferry ac-cess point	-N	-N
	. Customs, immigration	. Covered waiting area with customs, immigration shed	-N	+R
	. Departure from port	. Covered departure area	(+R)	+R
Intermodal container traffic	. Reception and registration	. Reception area with rail and road access	-N	-N
	. Unloading and stacking	. Unloading and stacking area	-N	-N
		. Mobile toplift unloaders	-N	-N
	. Embarkation/disembar-cation	. Mobile toplift loaders with spreaders (20', 40')	-N	-N
		. Trailers/container mover	-N	-N
		. Loadmasters/tractor	-N	-N
Port Administration	. Traffic operators	. Administration building	+R	(+R)
	. Maintenance	. Workshop	(+R)	(+R)

+: exist
-: non exist
L: Level raise
N: New
R: Renovation

Source: The Consultant

6.4 Terminal Marine Operations

Considering the sea side operations the related facilities that may be required are listed hereafter.

Table 6.6 Requirements of Marine Operation Facilities

Subject	Operation	Facility	Observation	
			Balu	Turkm.
Vessel traffic	. Approach/departure	. Approach channel	+	+R
		. Manoeuvring port basin	+	+R
	. Docking/leaving	. Berthing structures	+R	+R
	. Operation/suppliers	. Oil/waste reception facili-ties	-N	-N
		. Bunkering facilities	(+R)	-N

Source: The Consultant

The areas in which it is most critical to adapt to local traditions and practices like utilities and installations (gas, water, electricity, sewerage, telephone/communication) in connection with traditional building works it is envisaged that design shall be carried out by local engineers using local (Soviet) standards and norms. For this design it is the intention to make stagewise comparison to international well recognized practises to ensure the international standard of the project.

To the extent that the facilities in the terminals in Baku and Turkmenbashi will be similar, they will be designed in parallel using the same norms and standards.

No matter what standard will be used, proper account of specific local natural conditions and loads as outlined in the following chapter will be ensured.

7.2 Natural Conditions

7.2.1 Sea Level

As discussed in detail in section 3.8, the structures will be designed for a water level variation between -25 m and -30 m. The maximum and minimum level proposed will also cover the effects from seasonality and irregular variations. These two phenomena are described in further detail in Appendix 4.

7.2.2 Preliminary Geotechnical Design Criteria

For quay structures during long-term conditions, the strength parameters mentioned in chapter 4.2.6 and 5.2.6 can be used for preliminary design.

When lay-out of future structures are known, additional geotechnical investigations may be necessary, depending on type and location of structures and available geotechnical information (see chapter 7.5).

7.2.3 Seismic Conditions

The available documents informs that the areas of both Baku and Turkmenbashi are located in regions with seismic activity 9 according to SNiP, which according to ref. /4/ are corresponding to area 2 in the Mercali scale. This intensity is in accordance with an acceleration of app. 0,1 g.

7. SUMMARY OF DESIGN CRITERIA AND ASSUMPTIONS

The purpose of this chapter is in brief to summarize the criteria and assumptions on which the design of the renovation works of the ferry terminals is proposed to be carried out.

The design basis is based on the results of the project analysis as presented in the preceding chapter supplemented by the general international experience of the consultant.

The present design basis shall be considered as a preliminary stage which may be complemented and adjusted during the subsequent design phases according to the developing needs. Important modifications to the design basis will be discussed and agreed with the parties concerned.

Already at the end of the present summary wishes and needs for additional documentation and investigations are presented.

7.1 Standards and Codes of Practice

Both constructed during the period of the former Soviet Union, the existing terminal infrastructure in both Baku and Turkmenbashi have been designed and built according to Soviet standards and codes of practice.

An extensive listing of these codes is presented in Appendix 9.

After the break-up of the Soviet Union, the same norms and standards are still used. Despite their wide application these standards and codes are not readily available from ordinary sources in Azerbaijan and Turkmenistan but have to be procured from Russia (Moscow). Also they are not available in English translation.

Within the European Union uniform standards for design and construction are under development these years, called Eurocodes. Presently, EC1, EC2 and EC3 have been prepared dealing with loads and concrete and steel structures respectively. Taking into consideration the modernization aspect of the present project, and the wish to orientate the project to the future, it is suggested that the Eurocodes shall be used for the present project in areas where they apply. In areas where they have not yet been developed, adequate and international well recognized standards shall be applied and in particular standards based on the same system of safety (partial coefficient system) as the EU codes.

	Present Vessels "Dagestan" type	Future Vessels
Dim. DWT	3950 tons	
Length o.a.	154.30 m	160 m
Breadth, max.	18.3 m	30 m
Draught, max.	4.50 m	6 m

It shall be noted, though, that the existing ferries are only 10 years old and that there are no known plans for replacing these vessels.

As outlined in chapter 3.7 and Appendix 6 it may be necessary to equip the existing ferries with bow gate in order to obtain acceptable low service time inports, aiming at 2 hours.

From the analyses of the future capacity requirements of the sea link, Appendix 6, it is seen that the present number of 8 ferries will have sufficient capacity to meet the demands of the likely traffic forecast up to around year 2020. At that time, the ferries will be 35 years old and may have been replaced due to need for modernization and cost of maintenance.

7.3.2 Lifetime

The general design lifetimes of the terminal infrastructure is 50 years as regards corrosion, fatigue of materials, statics, etc. This do not apply to mobile equipment and likewise with normal economic lifetime much shorter.

7.3.3 Operations

The renovated ferry terminals shall allow for the transfer of the following traffic categories (shore to/from sea):

- Ferry traffic (cargo and passengers)
- Rail traffic (cargo)
- Truck/trailer traffic (cargo)
- Car/bus traffic (passengers)
- Passengers

which may involve the following operations:

- Reception at/departure from terminal area.
- Waiting/parking in terminal area.
- Intermodal handling in area.
- Customs and immigration procedures.
- Public services, ticketing, waiting, restaurants.
- Embarkation on/disembarkation from ferry.

7.2.4 Meteorological Conditions

Wind Loads

Baku	:	Wind pressure = 0.60 kPa
Turkmenbashi	:	Wind pressure = 0.60 kPa

Snow Load

Baku	:	Snow pressure = 0.50 kPa
Turkmenbashi	:	Snow pressure = 0.50 kPa

Temperature

Baku	:	Extreme air temperatures	Max.	42°C
			Min.	-15°C
		Extreme water temperatures	Max.	35°C
			Min.	~0°C
Turkmenbashi	:	Extreme air temperatures	Max.	44°C
			Min.	-18°C
		Extreme water temperatures	Max.	35°C
			Min.	0°C.

Humidity

Baku	:	Average relative humidity	72%
Turkmenbashi	:	Average relative humidity	65%

Precipitation

Baku	:	Average yearly precipitation	219 mm
Turkmenbashi	:	Average yearly precipitation	116 mm

Ice Loads

Baku	:	Considered without importance.
Turkmenbashi	:	Considered of minor importance

7.3 Operational Requirements and Loads

7.3.1 Vessels

According to chapter 3.7 the ferry berths should be designed to accommodate the following vessel sizes:

- Arrival area/traffic lane: . area = 3,800 m^2
- Covered drive through areas with ticketing, customs, immigration shed: . area = 2,600 m^2
- Vehicle marshalling area: . area = 6,200 m^2
- Holding/parking area for semi-trailers: . area = 12,300 m^2 (net area = 9,500 m^2)
- Holding area for dangerous goods: . area = 2,500 m^2
- Interface traffic area: . area = 3,900 m^2
- Public services/toilets area: . area = 600 m^2
- Passenger arrival/ waiting area: . area = 6,500 m^2
- Vehicle disembarkation area: area = 3,800 m^2
- Covered passenger gangway: min. width = 4 m
- Loadmasters/tractors: . type - 200 HP

Intermodal Container Traffic

- Reception area with rail/road access: . -
- Container stacking area/yard: area = 10,500 m^2 (net area = 8,100 m^2)
- Mobile forklifts: . Toplifts type - cap. 30 t.
- Spreaders: . Type 20' and 40'.
- Trailers/container movers: . Type 20' and 40'.
- Loadmasters/tractors: . type - 200 HP

7.3.4 Infrastructure and Facilities

An outline of facilities to be made available for the terminal operations of the terminals are prepared based on chapter 6.3 and 6.4. The facilities shall be designed to accommodate on one side vessels with the capacities given in chapter 3.7 and on the other side the traffic forecasted in chapter 6.1. An analysis of the future capacity requirement of the sea link and terminal facilities is presented in Appendix 6 and the principal characteristics with respect to capacity and area requirements are mentioned hereafter.

A phased development at all times matching the forecasted traffic may be suggested if found economically viable.

Vessel Traffic

- Approach channel and port manoeuvring basin:
  - min. water depth = 1.3 x draft
  - min. channel width = 7.2 x B (double lane)
  - min. turning radius = 2 x L (3.5-4 x L wanted by the Port of Baku)
- Vessel berth including ferry ramp:
  - 2 berths recommended and requested according to TOR
- Oil/waste reception facilities:
  - garbage reception/exchange of container at quay side
  - oil spill (bilge water/sludge) container at quay side
  - sewage reception tanks or linkage to public system
- Bunkering facilities:
  - water supply from quay side
  - oil bunkering by vessel

Rail Traffic

- Railway link line:
  - as existing
- Railway shunting/ marshalling area:
  - as existing but phased modernization

Road/Passenger Traffic

- Road access/entrance:
  - min. width: 8-10 m

ficult as the reason for remaining at the present location would be the partly reuse of the berthing infrastructure.

- Difficult road access to the terminal due to the use of ordinary city roads through traffic dense areas and without direct connection to the national road network (to the west).

- Negative environmental impact from having heavy truck traffic passing through populated areas of the city.

The reasons why a relocation of the ferry terminal has not been subject of the present project may be the wish

- to reduce the costs of renovating the ferry terminal by making maximum re-utilisation of existing facilities, avoiding investments in new access roads/railway links/navigational channels, new land areas and new terminal facilities.

- to maintain the central location of the terminal at the centre of the city.

- to maintain the ferry terminal adjacent to the main port keeping the port infrastructure together allowing possible sharing of facilities.

In consequence hereof, the decision of maintaining the present location of the ferry terminal has the implication that the renovation and modernization project shall make maximum re-utilisation of existing facilities to reduce project costs.

7.4.1.2 Ferry Terminal Area

The present ferry terminal area is part of the main port but separated by fencing towards the general cargo port (to the west). The terminal area is very limited (7-8 ha) of which a major part is occupied by the railway tracks (shunting, marshalling) leaving only about 2 ha for other land works. A major part of this remaining area is already occupied by various building works and structures of which some are being used by/rented out to various activities directly concerned with the terminal activities - e.g. restaurant, hotels, sanitary station, base camp of technical services of fleet of the port.

Even if existing terminal area is completely liberated of all buildings, additional space will certainly be required for the planning and implementation of proper facilities for the envisaged future terminal operations as described in chapter 7.3.4.

Terminal Administration

- Traffic operation/admin. area: area = 2,600 m^2
- Workshop area: . in main port

From the above it follows that land area requirements of the rehabilitated terminals will be in the order of 5.6 ha (excl. rail track areas) of which about 2.3 ha are due to container yard and semi-trailer yard.

Besides providing the area requested by the facilities mentioned above the planning of the terminal shall point out future development strategies allowing extensions of the terminals to match future traffic developments beyond the present planning period of 2015.

It shall be noted that the figures above are presented to obtain a general impression of requirements and they may be subject to modifications during the detailed design of the project.

7.4 Physical Constraints

Due to the difference in location the physical environment and development opportunities of the ferry terminals in Baku and Turkmenbashi are different. In the following the more important physical aspects governing the development opportunities of the two terminals will be discussed.

7.4.1 Baku Ferry Terminal

7.4.1.1 Location of Terminal

As described in chapter 4.1, the present location of the ferry terminal is within the main port area at the centre of the city.

It may be questioned whether this location is the right one for the terminal. It is most certain that if an entirely new terminal should be set up, a more suitable location would be identified.

The present location presents several major drawbacks:

- Expansion possibilities to match the space requirements of a modern multi-traffic ferry terminal are very limited. This is due to the closing up of the city to the narrow land area of the port and that this land area shall be shared with the main port. Expansion to the seaside is also dif-

7.4.1.4 Access Road/Entrance

The access road connecting the terminal with the city road network consists of one single road.

The consultant to the general cargo port has expressed interest in changing the main entrance to the port. It will be investigated whether a new main entrance might be shared between the general cargo port and the ferry terminal at the same time providing more space and better access to the terminal. For this joint purpose, the existing access road to the ferry terminal is not considered suitable due to the inclusion of the road by existing warehouses, not allowing any expansion.

In this connection, mention shall be made of the plans of the port to acquire the open area just north of the fly over bridge adjacent to the port area which earlier was occupied by a branch of Odessa Sea Fleet Institute.

7.4.1.5 Railway Shunting/Marshalling Yard

Despite the fact that the railway tracks in the yards and rail access area to the ferry will have to be raised following the general levelling of the terminal area it may be expected that the overall positioning of these tracks will remain the same. Minor adjustments, though, may be introduced in this connection to save space.

7.4.2 Turkmenbashi Ferry Terminal

7.4.2.1 Location of Terminal

As described in chapter 5.1, the existing terminal is located in a separate area located to the east of the main port.

The present location is well suited for the terminal as it provides excellent access for road and rail traffic not having to cross populated areas, and excellent possibilities for extensions, if required.

The terminal location is exposed to waves from the bay being of minor importance.

Maintaining the present location of the ferry terminal has the implication that the renovation and modernization project shall make maximum re-utilisation of existing facilities to reduce project costs.

Further, the new terminal layout shall provide a certain flexibility to allow for possible future extensions approaching the end of the present planning period.

The creation of additional land meets the following difficulties:

- To the north, the terminal is limited by land owned by the Caspian Shipping Co. (CSC).

- To the east a service quay for pilot boats and tugs, a pier for CSC cargo vessels, a floating workshop of CSC and a concrete element factory are occupying the area. Although this land apparently belongs to the port (according to the passport), claims of the right to use the land are raised by those having occupied the area for a long time.

  Also the location of the area to the east of the railway track is not well suited for expansion of road traffic activities except if a completely new access road is constructed.

- To the south, expansion of the terminal area is limited by the location of the ferry berthing infrastructure which shall preferably be re-used. Also extensions into the sea will affect access to general port.

- To the west, as mentioned above, the ferry terminal is limited by the fencing towards the general cargo port area. It is being discussed with the consultant providing technical assistance to the general cargo port whether certain areas of this may be liberated from present occupation to be used by the ferry terminal. Also the possibility of sharing facilities with the general cargo port is being considered, e.g. intermodal container handling facilities, semi-trailer parking and workshops.

  Finally, it may be considered to reclaim land between the ferry berth and the general cargo berth presently being occupied by the pier for water tanker vessels which in this event should be shifted to another berth in the general cargo port.

7.4.1.3 Access Rail Line

The connection of the terminal to the railway system passing along the northern border of the ferry terminal area shall be maintained in the same position only subject to lifting in case this will follow general raise of the level of the terminal area.

ing of the project and that changes in the direction and phasing of the project may require new information.

The preparation of the present report has revealed certain areas where the basic information made available or collected is incomplete. In some cases, the information lacking is believed to exist due to comparison of the situation of Baku and Turkmenbashi respectively, but it has just not been possible to obtain at present. In other cases the information and data needed do not exist and may require new investigations and surveys.

7.5.1 Lack of Existing Information

Among the types of information lacking at present by the consultant but which is believed to exist already shall be mentioned:

a. Concerning the ferry ramp structure, Baku and Turkmenbashi.

- Design loads of existing ramps.
- Structural drawings of span 3, of lifting towers.
- Drawings of lifting, machinery, bearings and control equipment. (Possibly from Kaspmorniiproekt)

b. Concerning topography, Turkmenbashi

- The most recent topographic survey plan of the ferry terminal in Turkmenbashi like the one existing for Baku, should be obtained, see chapter 5.2 (possibly from Kaspmorniiproekt).

c. Concerning railway, Baku and Turkmenbashi

- The rule books of the railways in Azerbaijan and Turkmenistan regarding permanent way, safety rules and signalling (see chapters 4.6.4 and 5.6.4) (possibly from the national railway organizations).

d. Concerning soil conditions, Baku

- The geotechnical report(s) for the Port of Baku, see chapter 4.2.6 (possibly from Kaspmorniiproekt).

e. Concerning basic design conditions, Baku

- The document similar to the "Sea Port in Krasnovodsk, Technical - Working Project of reconstruction of Ferry Terminal" but for Baku terminal instead (possibly from Kaspmorniiproekt).

7.4.2.2 Ferry Terminal Area

The site occupied by the existing terminal is limited to the north by the access rail connection, to the east by the railway shunting yard and to the west by the bulk cargo berths of the main port. This area amounts to approximately 8 ha of which only a part is being used at present. The rail marshalling yard occupies 2.6 ha of the above mentioned area leaving 5.4 ha for other land works. Area for the collapsed water tank constitutes 0.7 ha hereof.

If required, some extension to the west will be possible and in direction south there are no known limitations to reclamation of additional new land area.

7.4.2.3 Access Rail Line

The connection of the terminal to the railway system passing along the northern border of the ferry terminal area shall be maintained in the same location only subject to lifting in case the general rise in level of the terminal area will require this.

7.4.2.4 Access Road

The road connection to the main road network crosses the railway at the entrance to the terminal area. Otherwise there are no constraints to either relocation or expansion of this road.

7.4.2.5 Railway Shunting/Marshalling Area

The general raise of the surface level of the terminal area will entail lifting of the railway tracks in the shunting/marshalling area as well. This occasion may be utilized for adjusting the layout of the tracks in order also to provide more/or save space for use of other terminal facilities. The general positioning of the yards, however, are expected to remain the same.

As proposed in chapter 7.4.1.5 a phased modernization of the yards may be proposed as there is no immediate need of the full yard existing today.

7.5 Supplementary Investigations and Surveys

The collection of data is a continuous process in a project like the present comprising detailed design and tendering. This is due to the fact that the need for information and data will be more and more detailed parallel to the detail-

7.5.4 Submarine Inspections

Periodically underwater inspections are being carried out in Baku Port. As pointed out in chapter 4.3, it is strongly recommended to carry out an ordinary underwater inspection in the presence and under the guidance of the consultant in order to be able to confirm or revise the assumptions made with respect to the conditions of the underwater parts of the marine structures.

Depending on the findings of the ordinary inspection parts of the submarine structures may have to be inspected in more detail.

Depending on the rehabilitation measures to be proposed for the renovation of the submarine parts of the structures detailed underwater inspections may have to be carried out anyhow at the initial stages of the construction period.

7.5.5 Bathymetric Surveys, Turkmenbashi

Due to the important siltation of dredged areas in the bay of Turkmenbashi, the navigational depths of both access channel and harbour basins may be subject of rapid changes and are therefore of major concern to the users.

To provide the vessels (and pilots) with updated information on the state of available navigational depth regular bathymetric surveys ought to be carried out which is not the case at present.

In the later years since 1991 the maintenance dredging carried out has not been sufficient and navigational water depths are becoming critical to the operation of the ferry traffic.

As pointed out in chapter 5.5, the limited water depth is not the only point of concern looking at the navigational conditions of the approach channel ant it becomes evident that there is certainly an urgent need for looking into the aspects of navigation and safety in connection with the sea side approach to the port of Turkmenbashi, considering among other:

- Hydraulic conditions.
- Optimum layout and geometry of the various sections of the channel and the port basin.
- Optimum dredging strategy.
- Navigational aids and markings.
- Mapping.

Such a study would be to the benefit of the whole of the port and suit the scope of the present project, but should be subject to a separate investigation/study.

7.5.2 Supplementary Geotechnical Investigation

When lay-out of future structures and reconstruction of existing structures are known, supplementary soil investigations most likely will be required to procure sufficient information to confirm or revise the geotechnical design basis on which the preliminary design has been based.

The extent and type of these supplementary soil investigations cannot be decided at present but will depend on the layout and type of structural works to be planned and the extent and quality of existing information made available at the time. Depending upon this, the time for the execution of the supplementary investigation may be either during detailed design or at the initial stage of construction.

This information is necessary in order to clarify to which extent the preliminary design parameters presented in chapter 4.2.6 and 5.2.6 may be used. Consequently it is important that the existing geotechnical report(s) for Baku Ferry terminal area is made available to the consultant prior to the design phase.

Indicative though, the design basis should be established on information from geotechnical borings with in situ testing and sampling, and laboratory testing of samples, in order to determine the strength (short-term as well as long-term) and deformation parameters of the soil types encountered in the borings.

The distance between off-shore borings should not exceed 50 m, distance between on-shore borings should not exceed 30 m.

7.5.3 Supplementary Topographic Investigations

Due to the various construction works in the area of the ferry terminal in Baku since the last topographic survey of 1979, it is highly needed to get the land surface information updated through a repeat of the topographic survey.

Whether the same is required for the Turkmenbashi terminal depends on the outcome of the request according to chapter 7.5.1 (item b).

The result of these surveys should be available at the detailed design phase of the project.

To determine the borders and depths of the present harbour basin at the ferry terminal a bathymetric survey of this area is recommended to be carried out under the present project.

7.5.6 Traffic Survey, Baku

The present location of the ferry terminal in Baku means that the traffic to the terminal has to cross the centre of the city.

No specific traffic corridor has been assigned to this traffic which for a major part is comprised of heavy trucks.

From both - a safety point of view, an environmental point of view and - a traffic flow point of view, it is desirable that the traffic is regulated according to a traffic plan, but to the best of our knowledge, no such overall traffic master plan for the Baku area exists.

Bearing in mind that a complete traffic master plan of Baku should be prepared, a first step could be a study for the establishment of a ring road (by-pass) of Baku which would directly serve also the ferry terminal.

An initial step might be the preparation of a feasibility study considering

- identification of major traffic connections and traffic pattern of Baku,
- proposal of ring-road system and recommendations on upgrading/rehabilitation of existing road sections, including budgeting,
- assessment of economic and environmental implications and viability,
- implementation strategy and plan.

Although highly recommendable from a ferry terminal point of view, a feasibility study of this kind exceeds the scope of the present project and should be subject of a separate investigation.

Table 8.1 Main Parties Concerned, Baku Ferry Terminal Project

Authority/Party	Main Area of Interest				Principal Intervention
	Owner-ship	Opera-tional	Adminis-trative	Financial	
. Government of Azerbaijan			X	X	Approval
. Baku Port Authority	X	X	X	X	Planning, approval
. EC/Tacis-Traceca			X	X	Approval
. EBRD			X	X	Approval
. Caspian Shipping Co.		X			Advisory
. Railway Authority	X	X			Planning, approval
. City Council of Baku, Architectural planning office			(X)		Approval, pass port
. State Ecology Committee of Azerbaijan			X		Approval, pass port
. Other Traceca Consultants		X			Advisory
. Other users of terminal area			X		-

Table 8.2 Main Parties Concerned, Turkmenbashi Ferry Terminal Project

Authority/Party	Main Area of Interest				Principal Intervention
	Owner-ship	Opera-tional	Adminis-trative	Financial	
. Government of Turkmenistan			X	X	Approval
. Turkmenistan Sea Administration (Port of Turkmenbashi)	X	X	X	X	Planning, approval
. EC/Tacis-Traceca			X	X	Approval
. EBRD			X	X	Approval
. Turkm. Shipping Co./CSC		X			Advisory
. State Railways of Turkmenistan	X	X			Planning, approval
. Turkmenbashi City Council			(X)		Approval, pass port
. Ministry of Environmental Protection			X		Approval, pass port
. Other Traceca Consultants		X			Advisory
. Other users of terminal area			X		-

8. IMPLEMENTATION CRITERIA AND CONTEXT

Further to the design criteria defining the basis on which the renovation works shall be designed, subject of chapter 7, it is deemed important also to consider the conditions and context governing the execution of the project.

Due to the complexity of the terminal projects comprising partly seabased partly landbased facilities servicing various traffic categories, many different parties are concerned with the present project both with respect to planning and design of facilities, operations during and after implementation and financing of the project.

To take proper care of the different interests and requirements as well as necessary project approvals that the concerned parties represent, a proper planning and co-ordination during the implementation becomes important in order to ensure a smooth and unproblematic implementation of the project. This becomes even more important in the present case of a multi-national project involving two separate ports projects in different countries.

The present chapter shall be seen in this light, attempting to point out different issues of importance to the smooth and controlled implementation of the project.

8.1 Implementation Criteria

The following criteria regarding the implementation of the project shall be observed:

- Throughout implementation the terminal shall be kept operational with respect to all present traffic categories.

- Implementation procedures shall ensure phased development of facilities where this is considered optimum.

- Implementation shall respect the various administrative regulations with respect to environmental protection, etc.

8.2 Authorities/Parties Concerned

For each of the two ferry terminal projects an overview of the parties concerned together with their main area of interest are presented hereafter in the form of a table for each project.

- Although the ports are the principal owners of the terminal areas it is disputed to which extent this covers the railway installations (tracks and ground).

- Traditional users which have occupied/rented areas in the terminals for many years seem to claim the right to keep occupying these terminal areas.

- The extent to which the terminal projects (particularly in case of extensions) will have to comply to ordinary public/administrative procedures and approvals is still not clear (see also chapter 8.4).

f) In the light of the above, it is strongly recommended to strengthen the local co-ordination and co-operation through a more formal involvement of the respective ports in the implementation of the project by covering the joint interests of all the dependants of the ferry terminal areas and ensuring that necessary local project approvals are obtained.

   Formal agreements with Baku and Turkmenbashi ports respectively will be established if project extensions covering these aspects are approved by the EC/Tacis.

g) Depending on the outcome of the ownership/rights discussions it will be evaluated whether regular project planning meetings gathering different groups will be necessary. It is most probable that during the construction period of the project it will be recommendable to establish a steering committee resolving disputes and frontier questions between possible different contractors and owners of land.

The actual project approvals (and monitoring activities being part of the follow-up and checking of the project activities are described in more detail in chapter 8.4 hereafter.

8.4 Project Approvals and Procedures

For the implementation of projects like the present numerous approvals and permits will have to be obtained dealing with

- technical content of project,
- implementation procedures,
- public/administrative regulation,
- project financing.

8.3 Project Co-ordination Aspects/Institutional Arrangements

Taking into consideration the many different authorities and parties involved in the present project an adequate co-ordination of the interests of these parties becomes a major issue. An adequate co-ordination will be essential to arrive at a project that is optimized with respect to the various conditions and requirements and also for a smooth and timely execution/implementation of the project.

The co-ordination of the design of the project is presently taking place under different forms - project meetings and visits - written communication and reporting - and through monitoring activities. To allow for a discussion of the appropriateness of the present co-ordination activities and arrangements, an outline of the set-up and characteristics of the present co-ordination aspects together with experience drawn by the consultant are listed hereafter.

a) To carry out design activities and support a close co-ordination with the ports and local authorities the consultant has established a permanent project office in Baku and a representation office in Asghabat.

b) During the first part of the project period contacts and working relationships have been established with all presently identified parties, concerned with the present project, besides ports this comprise local authorities, financing institutions and other relevant Traceca programme consultants (reference is made to list of institutions met, Appendix 2).

c) The first part of the project covering the design basis has been carried out in close and regular contact with the port of Baku while contacts to the port of Turkmenbashi have been less extensive due to difficult communication lines even between Ashgabat and Turkmenbashi.

d) It is recommended that a closer and regular contact is established also to the port of Turkmenbashi which can be done in two ways - by undertaking more frequent project visits to the port and - by establishing a permanent representation of the consultant equipped with working communication system. This is even more important taking the expected extension of the project with the rehabilitation of the general cargo facilities in the port of Turkmenbashi into consideration.

e) Certain areas have been identified which will require particular attention and co-ordination not to develop into potential conflict areas:

Table 8.4 External Public Administrative Procedures and Approvals

Phase	Ordinary Building/Construction Project (Acc. to SNiP 1.02.01-85)		Application to Ferry Terminal Projects
	Activity	Responsible	
Design Phase	Project definition, land requirements	: Owner	Port authority (+ railway authority)
	Approval . Land Allocation . Technical Passport	: City Council, architectural planning office. : Government (Depending on importance of project.)	
	General layout and outline design of project works	: Owner/designer	Port Auth. (+ railway auth.), Group RAMBØLL
	Approval	: City Council, architectural and planning office	
	Final and detailed design of project works	: Owner/designer	Port auth. (+ railway auth.), group RAMBØLL
	Approval, general and specific	: City council, architectural planning office : Organizations specifically concerned[1] : State committee for ecology and natural resources	
Construction Phase	Building/Construction Works	: Contractor	
	Supervision of Works	: . Commission of owner/designer . Commission of city council . Commission of government (major public building works)	
	Reception/Approval of Works	: Commission of owner/designer	
	Approval of Works . Passport for use	: Commission of city council, organizations specifically concerned[1], state ecology committee	

1) Example of potential specifically concerned organisation in Baku:

The approvals will concern both the design phase and the construction phase and they will have to be obtained in order to clear the ground for the following steps in the implementation process towards project completion.

The project approvals and agreements on project content will have to be obtained from different sides of which the most important are presented in table 8.1 and 8.2. As the project approvals are essential to a smooth and timely implementation of the project it has been considered important that an agreement on requirements with respect to necessary project approvals is obtained. For this purpose the following overview of the project approvals identified and envisaged at present is prepared. The overview is divided into "internal" approvals and "external" approvals.

By "internal" approvals, subject of table 8.3, we consider approvals that are cleared according to contractual obligations between parties directly involved in the project, e.g. ports (covering also dependants of ferry terminal areas), financial institutions and consultant. By "external" approvals, subject of table 8.4, approvals from the side of public authorities according to public administrative regulations are understood.

Table 8.3 "Internal" Project Approval

Phase	Project Activity	Project Documentation	Approvals Formal	Approvals Informal
Design Phase	Phase 1 - Project basis	. Inception Report. Phase 1 Report	. Tacis . Ports, Tacis	Dependents[2]
	Phase 2 - Detailed design	. Report	. Ports, Tacis	
	Phase 3 - Economic Evaluation	. Report	. Ports, Tacis	
	Phase 4 - Tender Documents	. Tender Documents	. Ports, Tacis, EBRD[1]	
	Prequalification of Contractors	. Shortlist	. Ports, EBRD[1]	
	Tender Evaluation	. Tender Report	. Ports, EBRD[1]	
	Contract Negotiation and Preparation	. Works Contract	. Ports, EBRD[1]	
	Environmental Assessment	. Environmental Report	. Ports, EBRD	
Building Phase	Supervision of Works	. Progress Report	. Port, EBRD	
	Commissioning	. Completion Report	. Port, EBRD	

1) Under the assumption that EBRD will provide financing for construction works.
2) Railway authority and other depending on project outcome.

Technical terms for connection with outside engineering communications must be enclosed in submitted materials by client from Bakvodoprovod, Bakkanalizatya, Bakteploset, PTS and VK of Azglavenergo, BaGes, Azglavenergo, POBTS (the undertaking of Baku's Phone Network, BGRU (Baku's City Broadcasting Point), Baku's department for Protection of Underground gas Pipelines of Bakgas, Point), Baku's Department for Protection of Underground Gas Pipelines of Bakgas, Department of Fire Guard of MVD (Ministry of Internal Affairs) of Azerbaijan.

It is the hope of the consultant that the above presented tables will be subject of discussion among the parties concerned and proper corrections proposed in order to arrive at the final list. Only the correct list of approvals can provide the basis for a proper planning and serve as check list for obtaining the necessary approvals and permissions that will be required to a smooth and timely implementation of the project.

To allow for a distribution of the various project approvals in time, an update of the time schedule showing the main project activities during the design phase only is presented in Table 8.5 hereafter. The time schedule takes account of the project extensions as envisaged at present. It shall be noted that this time schedule at present time still is lacking the final approval of EC/Tacis.

Table 8.5 Updated Time Schedule

Time Schedule of Project Activities
Renovation of Baku and Turkmenbashi Terminals
On-going and Suplementary Consultancy Services

Sn.	Activity	1996: 7	8	9	10	11	12	1997: 1	2	3	4	5	6	7	8	9	10	11	12
	Ferry Terminals of Baku and Turkmenbashi (on-going)																		
01	Project basis																		
02	Detailed Design																		
03	Economic/Financial Evaluation																		
04	Planning and Preparation of Tender Documents																		
	Turkmenbashi Dry Cargo Terminal Study (on-going)																		
05	Master Plan and Financial Analysis																		
06	Approval of Master Plan																		
07	Conceptual Design																		
	Extension project																		
08	Integration of Ferry Terminal and Dry Cargo Terminal Planning																		
09	Prequalification of Contractors and Suppliers																		
10	Detailed Design, Drawings and Specifications																		
11	Prep of Tender Documents for Turkmenbashi Dry Cargo Terminal																		
12	Approval of Tender Documents																		
13	Issue of Tender Documents, Follow-up and Tendering																		
14	Tender Evaluation Selection, Contract Negotiation, Contracting																		
15	Environmental Assessment and Follow-up on Project Development																		

Appendix 1

Project Documentation and References

Available	**Missing**
Wind, Waves, Water level etc.:	
- Meteorological conditions, Baku and Turkmenbashi - Wind statistics, Baku - Wind statistics, Turkmenbashi - Wave statistics, Baku - Yearly water level, Turkmenbashi, 1900-1995 - Yearly water level, Baku 1977-95 - Monthly water level, Turkmenbashi, 1991-1996 - Monthly water level, Baku, 1991-1995 - Seismic data, Baku and Turkmenbashi - Currents, Baku - Salinity, Baku and Turkmenbashi	- Water quality, Turkmenbashi - Currents, Turkmenbashi
Bathymetric surveys:	
- Turkmenbashi, 1:1000, 1975 (3 drawings) - Baku ferry berth, 1995	- Updated info, Turkmenbashi
Coastal protection etc.:	
- Turkmenbashi, coastal protection - Baku coastal protection - Baku, scour protection, 1972	- Turkmenbashi, scour protec.
Geotechnics:	
- Geotechnical report with annexes, Turkmenbashi, 1979 - Map of borings, Turkmenbashi, 1956-1961 - Drawings of piles and soils, Baku and Turkmenbashi, 1960 - Drawing with soil parameters, Baku, 1960	- Geotechnical report, Baku
Topography:	
- Baku Ferry Terminal, 1979 (partly)	- Turkmenbashi Ferry Term.
Access Roads:	
- See General maps, Baku - See General maps, Turkmenbashi	
Railway:	
- Schematic plan, Turkmenbashi - Wagon Profiles - Railway layout, Turkmenbashi (schematic) - Turkmenistan Railway Plan	- Detailed info, Turkmenbashi - Maps, Baku

Appendix 1 - LIST OF PROJECT DOCUMENTATION AND REFERENCES

Available	Missing
Maps:	
- General TRACECA map	- Good quality map
Organization:	
- Organization diagramme, Baku	
- Organization diagramme, Turkmenistan	
Statistics:	
- General statistics, Turkmenbashi 1980-1993	
- Ferry statistics, Departure + Arrival 1980-1995, Turkmenbashi	
- Goods statistics, Turkmenbashi	
- Goods statistics, Baku	
- General statistics, Baku	
- Ferry statistics, Departure + Arrival, Baku	
- Azerbaijan in figures, 1994	
General maps:	
- Baku ferry terminal, 1:2000	
- Baku port incl railway shunting area, 1:1000 (2 drawings)	
- Baku port area, 1:5000	
- Baku (from Sofremer report)	
- Turkmenbashi ferry terminal incl railway area, 1:2000	
- Turkmenbashi ferry terminal, 1:1000	
- Turkmenbashi port, 1:5000	
- Turkmenbashi (from Sofremer report)	
Geographical maps:	
- Turkmenistan, 1:1,000,000	
- Azerbaijan, 1:500,000	
- Baku, 1:10,000	
Nautical maps:	
- 32015, Outside Krasnovodsk 1:200,000	- Caspian Sea
- 35080, Bay of Krasnovodsk 1:50,000	
- Port pilots, Baku and Turkmenbashi	
- Approach to Baku	

LIST OF REFERENCES

/1/ "Port Network Plan and Improvement Programme. Renovation of the Ferry Terminals of Baku and Krasnovodsk - Technical Proposal, November 1995". RAMBOLL, Booz-Allen & Hamilton, Acquatecno, Probel Consulting and Kaspmornii-proekt.
November 1995.

/2/ "Port Network Plan and Improvement Programme. Renovation of the Ferry Terminals of Baku and Krasnovodsk - Inception Report, May 1996". RAMBOLL, Booz-Allen & Hamilton and Probel Consulting.
May 1996.

/3/ "Port of Aktau Masterplan Study, EBRD - Final Report". MERC, Rotterdam.
February 1994.

/4/ "Caspian Sea Water Leve - Final Report". SOFREMER, HPC, DETI.
July 1995.

/5/ Port Facilities for Ferries, Practical Guide - PIANC, 1995.

/6/ Approach Channels, Preliminary Guidelines - PIANC,1 995.

/7/ Environmental Procedures - EBRD, 1992.

/8/ Aktau Port Master Plan - EBRD, MERC Rotterdam, 1994.

/9/ About the establishment of rules and regulations of Baku International Sea Trade Port - Resolution N407, Cabinet of Azerbaijan Republic, 1994.

/10/ MARPOL Convention 73/78.

/11/ The London Dumping Convention.

/12/ SOLAS Convention - IMO, 1986.

/13/ Caspian Sea Water Level, Final Report - SOFREMER et al, 1995.

/14/ Turkmenbashi, Port Development Plan (preliminary communication) - 1996.

/15/ Port Planning - UNCTAD.

/16/ Havnebygning - NST, 1988.

Available	**Missing**
Buildings:	
- Buildings, Turkmenbashi	
- Buildings, Baku	
Auxiliary:	
- Water supply, Turkmenbashi, 1:1000	- Water supply, Baku
- Electricity diagram,	- Power supply, Baku
- Electricity supply, Turkmenbashi Ferry Terminal	
- Electricity supply, Turkmenbashi Port	
- Water supply, Baku Ferry Terminal	
- Sewerage, Baku	
Ferry berth:	
- Plans and cross sections, 1964	
- Construction details	
Access ramps:	
- Plans and cross sections	- Electrical info
- Construction details	
Ferry:	
- Technical brochure	
- Cross section	
- Longitudinal section	
Miscellaneous:	
- Standards (GOST, SNiP, RST)	
- Info on traditional building techniques in Azerbaijan	

Appendix 2

List of Persons and Organizations Met

Hydrometeorological Committee	Mr. Musayev, Director Mr. M. Mansimov, Deputy Director Mr. A. Aliyev, Head of Department for Caspian Sea
Railway Authority	Mr. V. Nadirli, Ministry of Railways Mr. M.S. Panahov, Deputy Chief of Railways Mr. Gosanov, A. Dep. Chief of Railways Mr. R. Zeinalov, Head of International Links Mr. N. Nagyev, Chief of Operations Mr. V.I. Gorbachov, Chief Design Engineer
The World Bank	Mr. Faik Husseinov, Local Representative
HPTI/Uniconsult Consortium	Mr. Arlt, Project Manager Mr. Lentsch, Assistant to the General Manager Mr. Pechmann, Assistant to the Operations Director Mr. Huebner, Assistant to the Financial Director
TEWET Consortium	Mr. Freitag, Senior Railway Expert Mr. Karl J. Adler, Railway Systems Engineer
Makro-Trans	Mr. Rovshan Housseinov, President
Militzer & Münch, Intl. Forwarders	Mr. Olaf Metzger, Managing Director
P&O Containers	Mr. Houshang Shahroudi
Bertling Caspian	Mr. Jeff Watkin, Operations Manager
Caspian Sea Routes Office	Mr. G. Gasanov, Manager Mr. E.Azainakov, Operations
W.S. Atkins Consortium	Mr. Paul Pezant, Regional Project Leader
BCEDM Consortium	Mr. Bernard Frakcow, Planning Expert
Baku City Council Executive Committee	Mr. Naim Fataliev, Deputy Chief Executive
Ministry of Natural Protection Committee of Ecology	Mr. A.T. Ismailov
Scott Wilson Kirkpatrick	Mr. Mark Booker, Team Leader Mr. Allan Erwing, Transport Consultant

Appendix 2 - List of Persons and Organizations Met During Phase 1

Turkmenistan:

Cabinet of Ministers, Ashgabat	Mr. M.S. Yazberdiyev, Head of Transport Dept.
Tacis CU, Ashgabat	Mr. Jaap Sprey, Team Leader Mr. J. Stuart Ballard, Project Manager
Turkmenistan State Shipping Organization, Turkmenbashi (Port of Turkmenbashi)	Mr. K.D. Durdiev, Director Mr. Badamov, Chief Engineer Mr. Terekhov, Harbour Master Mr. Atayev Yazmurad, Ferry Terminal Director Mr. Tulegen Bekdjanov, Operations Manager
State Railways of Turkmenistan	Mr. K.K. Khalykov, Director Mr. Z. Bakhalov, Head of Cargo Traffic Dept. Ms. S. Kuzeleva, Deputy Head of Railway, Turkmenbashi
Ministry of Automobile Transport	Mr. S. Rakhmanov, Minister Mr. V. Elantsev, Dolphin Project Manager
Ministry of Use of Natural Resources and Environmental Protection	Dr. K.I. Atamuradov, Deputy Minister Mr. V.A. Glazovski, Head of Board for Env. Protect. Ms. L. Danilova, Head of Ecological Exploitation Mr. A.A. Starikov, Dpty. Head of Hydrometeorology
Turkmenbashi City Council	Mr. S.M. Ambartsumyan, City Architect

Azerbaijan:

Cabinet of Ministers, Baku	Mr. T.K. Mansurov, Head of Transport Dept.
Tacis CU, Baku	Mr. Kasimov, Director Mr. J. Efendiev, Deputy Director Mr. D. Charpentier, Team Leader Mr. Boris Smolin, Project Manager Mr. Kiazimov, Transport Expert
Tacis M&E, Caucasus	Mr. Hennie Maters
Baku International Harbour	Mr. A. Mamedov, General Director Mr. M. Mamedov, Manager of Execution of Works Mr. Sultan, Chief Engineer Mr. Azadov, Head of Hydromarine Structures Mr. Aliyev, Ferry Terminal Manager Ms. E.F. Lomova, Deputy Head of Economics Dept. Mr. Vybornov, Group Electromechanic of Ferry Terminal
Ministry of Economy	Mr. I.M. Sadikhov, Head of Transport Department
Caspian Shipping Company	Mr. A.A. Bashirov, President Mr. F.G. Rasulov, GM of Operational Department Mr. M.M. Mirzoyev, Manager of Ferry Lines Section Mr. A. Nagiyev, Manager of Planning Department

Meeting no.:	5
Institution:	**State Railways of Turkmenistan**
Place:	Turkmenbashi, Turkmenistan
Date:	24.04.1996
Persons met:	Ms. S. Kuzeleva, Deputy Head of Railway, Turkmenbashi Station
Summary of discussions:	

Meeting no.:	6
Institution:	**Ministry of Automobile Transport, Turkmenistan**
Place:	Ashgabat, Turkmenistan
Date:	17.04.1996
Persons met:	Mr. S. Rakhmanov, Minister Mr. V. Elantsev, Dolphin Project Manager
Summary of discussions:	The Minister informed about the past and present road traffic statistics in Turkmenistan and explained about the on-going road construction and rehabilitation programmes. Mr. Elantsev explained about the Dolphin project concerning establishment of transport centres along the main road of Turkmenistan. This project is financed under the Traceca programme and the consultant promised to take this project into account when designing the facilities in Turkmenbashi.

Meeting no.:	7
Institution:	**Ministry of Use of Natural Resources and Envoíronmental Protection, Turkmenistan**
Place:	Ashgabat, Turkmenistan
Date:	17.04.1996
Persons met:	Dr. K.I. Atamuradov, Deputy Minister Mr. V.A. Glazovski, Head of Board for Environmental Protection Ms. L. Danilova, Head of Department for Ecological Exploitation Mr. A.A. Starikov, Deputy Head of Hydrometeorology
Summary of discussions:	The Deputy Minister explained about the variation of sea level in the Caspian Sea and provided the consultant with data regarding the variations. Mr. Glazovski informed about the environmental standards governing construction projects in Turkmenistan and urged the consultant to inform the ministry about any environmental problem in connection with the ferry terminal project, in order to obtain a permission for carrying out the works.

Meeting no.:	8
Institution:	**Turkmenbashi City Council**
Place:	Turkmenbashi, Turkmenistan
Date:	23.04.1996
Persons met:	Mr. S.M. Ambartsumyan, City Architect
Summary of discussions:	The City Architect informed that there were no other construction plan in the area of the ferry terminal and therefore the consultant can, in principle, do with the area whatever he finds right. The City Council will be kept informed about developments in the project by the Turkmenistan State Shipping Organization.

MEETINGS HELD DURING PHASE 1

Meeting no.:	1
Institution:	**Cabinet of Ministers, Turkmenistan**
Place:	Ashgabat, Turkmenistan
Date:	17.04.1996
Persons met:	Mr. M.S. Yazberdiyev, Head of Transport Department
Summary of discussions:	Mr. Yazberdiyev explained about the transport system in Turkmenistan and informed about on-going transport projects, such as the Turkmenbashi Port Master Plan Study, which is likely to be finalized in the second part of 1996. Also the plans regarding a new ferry link between Astrachan in Russia and Turkmenbashi was discussed. Furthermore, Mr. Yazberdiyev helped to establish contact to the Turkmenistan State Shipping Organization and other relevant ministries.

Meeting no.:	2
Institution:	**TACIS Coordination Unit**
Place:	Ashgabat, Turkmenistan
Date:	16.04.1996
Persons met:	Mr. Jaap Sprey, Team Leader Mr. J. Stuart Ballard, Project Manager
Summary of discussions:	The TACIS CU informed about their projects in Turkmenistan and provided contact names to other relevant organizations. The consultant promised to establish a good communication link to the Turkmenistan CU, taking into account that the consultants office will be located in Baku. The consultant also has a representative office in Ashgabat.

Meeting no.:	3
Institution:	**Turkmenistan State Shipping Organization**
Place:	Turkmenbashi, Turkmenistan
Date:	22.04.1996
Persons met:	Mr. K:D. Durdiey, Director Mr. Badamov, Chief Engineer Mr. Terekhov, Harbour Master Mr. Yazmurad Atayev, Ferry Terminal Manager Mr. Tulegen Bekdjanov, Ferry Operations Manager
Summary of discussions:	During the period 22 to 26 April, a number of meetings were held with the Turkmenistan State Shipping Organization, which is also the port authority of Turkmenbashi. Information regarding the ferry terminal was collected and discussions held regarding the current and future operations at the terminal. In addition, a detailed inspection was carried out at the site of the terminal.

Meeting no.:	4
Institution:	**State Railways of Turkmenistan**
Place:	Ashgabat, Turkmenistan
Date:	18.04.1996
Persons met:	Mr. K.K. Khalykov, Director Mr. Z. Bakhalov, Head of Cargo Traffic Department
Summary of discussions:	The Director informed about the railway transport agreement between the Central Asian and Caucasus countries, which will result in one million tons of transit cargo from Uzbekistan to Azerbaijan and further on to Georgia. This transport will commence in the beginning of June 1996, and make use of the railways and ferry terminal in Turkmenbashi. In addition contact was provided to the Turkmenbashi Railway Staionn. Mr. Bakhalov explained about the existing and future railway system in Turkmenistan.

Meeting no.: 13
Institution: **Ministry of Economy, Azerbaijan**
Place: Baku, Azerbaijan
Date: 21.05.1996
Persons met: Mr. I.M. Sadikhov, Head of Transport Department
Summary of discussions:

Mr. Sadikhov informed about the main transport corridors in and around Azerbaijan and about the main flows of goods. He explained that a report regarding import and export between the Central Asian and Caucasus countries is available in the COMSTAT office and that all good statistics regarding the ferry terminal would be available in the port or with the Caspian Shipping Company.

Meeting no.: 14
Institution: **Caspian Shipping Company**
Place: Baku, Azerbaijan
Date: 08.05.1996
Persons met: Mr. A.A. Bashirov, President
Mr. F.G. Rasulov, General Manager of Operational Department
Mr. M.M. Mirzoyev, Manager of Ferry Lines Section
Summary of discussions:

Mr. Bashirov informed that the Shipping Company is the owner of the eight ferries, of which six are in the Caspian Sea. Four are servicing the route to Turkmenbashi and two are currently in the shipyard for repairs. According to a Russian decree, vessels from Azerbaijan are not allowed to enter the Volga-Don river system. He confirmed the plans regarding a ferry link to Astrachan in Russia. Mr. Mirzoyev provided the consultant with design data of the ferries.

Meeting no.: 15
Institution: **Hydrometeorological Committee, Azerbaijan**
Place: Baku, Azerbaijan
Date: 12.05.1996
Persons met: Mr. Musayev, Director
Mr. M. Mansimov, Deputy Director
Mr. A. Aliyev, Head of Department for Caspian Sea
Summary of discussions:

The Director informed about a committee established in 1995 under World Meteorological Organization for collaboration on environmental and sea level problems in the Caspian Sea. The members of the committee are from the five countries around the Sea. The Hydrometeorological Committe has got available information regarding wind, waves, currents and water quality in the Caspian Sea. After numerous discussions regarding possible renumeration for making the information available to the consultant, the consultant has now received parts of the available information free of charge.

Meeting no.: 16
Institution: **Railway Authorities of Azerbaijan**
Place: Baku, Azerbaijan
Date: 14.05.1996
Persons met: Mr. M.S. Panahov, Deputy Chief of Railways
Mr. R. Zeinalov, Head of International Links
Mr. N. Nagyev, Chief of Operations
Mr. V.I. Gorbachov, Chief
Summary of discussions:

The railway authorities were asked to provide information regarding technical details as well as traffic statistics. Again, numerous discussions regarding possible renumeration for making the information available took place. After having taken the help of the TACIS CU, the consultant has now received a small part of the available information free of charge.

Meeting no.:	9
Institution:	**Cabinet of Ministers, Azerbaijan**
Place:	Baku, Azerbaijan
Date:	12.05.1996
Persons met:	Mr. T.K. Mansurov, Head of Transport Department
Summary of discussions:	Mr. Mansurov informed that he personally participated in all Traceca programme meetings. He further explained about the transport corridors in the area and about on-going transport projects in Azerbaijan.

Meeting no.:	10
Institution:	**TACIS Coordination Unit, Azerbaijan**
Place:	Baku, Azerbaijan
Date:	?
Persons met:	Mr. Kasimov, Director Mr. J. Efendiev, Deputy Director Mr. D. Charpentier, Team Leader Mr. Boris Smolin, Project Manager Mr. Kiazimov, Transport Expert
Summary of discussions:	

Meeting no.:	11
Institution:	**TACIS Monitoring & Evaluation Unit, Caucasus**
Place:	Baku, Azerbaijan
Date:	18.05.1996
Persons met:	Mr. Hennie Maters
Summary of discussions:	Mr. Maters informed that the M&E Unit of Caucasus, located in Kiev, will be monitoring the Ferry Terminal projects. The consultant gave him a draft version of the Inception Report, which was discussed in another meeting two days later. On account of the statements in the Inception Report, Mr. Maters urged the consultant to give the collaboration with Kaspmornii-proekt another chance.

Meeting no.:	12
Institution:	**Baku International Harbour**
Place:	Baku, Azerbaijan
Date:	29.04.1996 - 10.06.1996
Persons met:	Mr. A. Mamedov, General Director Mr. M. Mamedov, Manager of Execution of Works Mr. Sultan, Chief Engineer Mr. Azadov, Head of Department for Hydromarine Structures Mr. Aliyev, Ferry Terminal Manager Ms. E.F. Lomova, Deputy Head of Economics Department
Summary of discussions:	During the period 29 April to 10 June, a number of meetings were held with the Baku International Harbour. Information regarding the ferry terminal was collected and discussions held regarding the current and future operations at the terminal. In addition, a detailed inspection was carried out at the site of the terminal. The General Director efficiently arranged all meetings with authorities in Baku and in general an excellent working relationship has been established between the consultant and the employees of the port authority.

Meeting no.:	17
Institution:	**The World Bank, Azerbaijan**
Place:	Baku, Azerbaijan
Date:	22.05.1996
Persons met:	Mr. Faik Husseinov, Local representative
Summary of discussions:	The consultant informed the World Bank representative about the ferry terminal project. Mr. Husseinov explained about the political relationships between Azerbaijan and its neighbouring countries and informed about on-going WB projects in Azerbaijan. The consultant was provided by an economic report on Azerbaijan.

Appendix 3

Inspection Reports

INSPECTION REPORT

MARINE WORKS

Table of contents

2.3 Ferry ramps

The ramp has 2250 mm high main beams. The ramp is made in steel with a wooden deck. The deck is equipped with 2 rail tracks, which in the third span divides into 4 tracks at ship connection.Top level of rail fits with top level of wooden deck. Measured gauge between rails is 1520 mm. Rail height is measured to be 140 mm. Length of first span is 26 m between supports and width is about 10 m including foothpaths.

2.4 Access bridge

The substructure consist of reinforced concrete piles 350 x 350 mm in lengths of 12 - 14 m's. The superstructure is a reinforced concrete slab 6300 mm wide.

2.5 Lifting towers (first and second row)

A rectangular box (10.6 m x 5.6 m) of steel sheet piles forms the substructure. The inside is filled up with mass concrete, which is formed to create support for the steel structures and a pit for counterweights. The concrete front towards ramp side is drawn back from steel pile front, and steel piles are cut at low level to allow ramp movements. The steel superstructure is a tower for carrying the lifting mecanism and the counterweights.

2.6 Lifting towers (third row) and stop fenders

An irregular but almost rectangular box (14.5 m x 11.85 - 15.50 m) of steel sheet piles forms the substructure. The inside is filled up with mass concrete, which is formed to create support for the steel structures, the stop fender, a guiding fender and a pit for counterweights. At the same time the structure forms the first part of the finger pier. The steel superstructure is a tower for carrying the lifting mecanism and the counterweights.

2.7 Lifting towers (third row from land side) and base of central pier

An irregular box (15.4 m x 13.0 - 18.0 m) of steel sheet piles forms the substructure. The inside is filled up with mass concrete, which is formed to create support for the steel structures, 2 stop fenders, 2 guiding fenders and 2 pits for counterweights. At the same time the structure forms the first part of the central pier. The steel superstructure is a tower for carrying the lifting mecanism and the counterweights. Besides the building for the electrical system and control system is situated on the structure.

2.8 Finger piers

The substructure consist of reinforced concrete piles 350 x 350 mm with toe levels varying from - 15.0 to - 16.3 m. The superstructure is a reinforced concrete slab 6200 mm wide and about 28 m's in length. A front wall of precast concrete units supports

1. Introduction

The present report describes the state of repair for port structures at the ferry berths of Turkmenbashi and Baku.

Inspections of the structures as well as collection of data including drawings, written information and taking photos of the structures was carried out on a site visit from 22th to 26th of April 1996 in Turkmenbashi and from 27th of April to 2th of May in Baku.

2. Structures Surveyed

Enclosed main drawing 56182 is a plan of the ferry terminal in Turkmenbashi. As the port structures are equal in Baku, the numbers in the drawing refers also to the same structures in Baku. This report treats the survey of port civil structures from land base to pier head. In the drawing the different structures are numbered as follows:

1, 3:	Land base for ferry ramps
2:	Land base for access bridge
4,6:	First span of ferry ramps
5, 12, 19:	Access bridge
7, 8, 9, 10:	Lifting towers (first row from land side)
11, 13:	Second span of ferry ramps
14, 15, 16, 17:	Lifting towers (second row from land side)
18, 20:	Third span of ferry ramps
21, 23:	Lifting towers (third row from land side) and stop fenders
22:	Lifting towers (third row from land side) and base of central pier
24, 26:	Finger piers
25:	Central pier on piles
27:	Head of central pier

Enclosed par opies of main drawings shows all main structures from the list above. All plans and sections are numbered according to the list:

2.1 Land base for ferry ramps

A rectangular box (10.50 m x 11.20 m) of steel sheet piles forms the substructure. The inside is filled up with mass concrete, which is formed to create support and anchorage for the main beams in the ferry ramp. A stone revetment runs across the land base to withhold the land reclamation.

2.2 Land base for access bridge

The land base is not different from the general structure in the access bridge. The slab is stopped at the top of the stone revetment running across all land bases.

3.3 Ferry ramps

3.3.1 General for both berths

The condition of the wooden deck is very bad and dangerous for the vehicles. In certain areas parts of the timber is missing.

The present ferries have only 2 tracks at the ramp connection and it should be considered only to make 2 tracks on the whole ramp. At present the outer span is equipped with 4 tracks at ramp/ship connection.

The general impression of steel structures in the ramps is, that all steel needs new corrosion protection. Some minor steel profiles should be replaced because of corrosion and/or mechanical damages. The main structures seems to be in good condition for reuse. The rehabilitation of ramp structures should be arranged according to this procedure:

- Dismantling of all ramp sections
- Transport to repair site on land
- Dismantling of wooden deck and rails
- A thorough investigation of all steel components
- Replacement of corroded and damaged parts
- Strenghtening of steelprofiles if calculations shows necessary
- Cleaning and sandblasting
- New corrosion protection shall be applied
- A hardwood timber deck should be installed

3.3.2 Turkmenbashi

During our visit the deck timber on the North ramp was being replaced by new timber. In the first 2 spans from land additional cross beams were welded in between original cross beams for timber support. The rail tracks in the outer span was reduced to 2 tracks and points (switch) were removed.

Photo no. 2: Destroyed deck timber.
Photo no. 3: Timber in North ramp being replaced.
Photo no. 4: First span of South ramp and inclined stone revetment at land base.

3.3.3 Baku

The wooden deck is in certain areas covered by steel plates.
Photo no. 5: Corrosion on main beam.
Photo no. 6: Ramp/ship connection.
Photo no. 7: Center of ramp/ship connection.

the guiding fenders. On top of the slab sand is filled in to top level of the pier. The finger pier is equipped with wooden guiding fenders supported by driven wooden piles. On the pier a lighting tower is placed.

2.9 Central pier on piles

The substructure consist of reinforced concrete piles 400 x 400 mm with toe levels varying from - 16.5 to - 17.5 m. The superstructure is a reinforced concrete slab 12 m wide and 139.1 m's in length including pier head. A front wall of precast concrete units supports the guiding fenders. On top of the slab sand is filled in to top level of the pier. The pier is equipped with wooden guiding fenders supported by driven wooden piles. On the pier a ligthing tower is placed close to the pier head.

2.10 Head of central pier

A rectangular box (7 x 12 m) of steel sheet piles filled with sand forms the substructure. A reinforced concrete quay wall is constructed on top of the sheet piles from level + 1.80 m to + 4.50 m.

3. State of Repair

In the following sections the state of repair for all structures is described. As both ferry berths are constructed similar as concerns the port structures both the structures at Turkmenbashi and Baku are treated parallel.

3.1 Land base for ferry ramps

3.1.1 General for both berths

The steel sheet pile structure is hidden in the sub soil and is not possible to see. The corrosion is normally insignificant for soil covered steel parts, and the substructure is anticipated to be in good state for reuse.

The concrete surface at the ramp support is worn and uneven and recommended to be rehabilitated in case of reuse.

Photo no. 1: Anchoring of ferry ramp to land base in **Turkmenbashi**. The cover was missing. Note the concrete surface.

3.2 Land base for access bridge

3.2.1 General for both berths

Concrete piles are hidden in the subsoil and condition is anticipated to be good. Surface treatment of the concrete slab is recommended in case of reuse.

Photo no. 15: Third row tower.
Photo no. 16: Third row tower. Stop fender and guiding fender.

3.6.3 Baku

In some of the pits water had entered. In order to balance the ramp for the buoyancy additional counterweight had been added.
Photo no. 17: Third row tower. Stop fender made higher and guiding fender is missing.
Photo no. 18: Third row tower. Outer ramp span.

3.7 Lifting towers (third row from land side) and base of central pier

3.7.1 General for both berths

The condition of the structure is satisfactory for reuse. In a rehabilitation projekt the sheet piles should be protected from corrosion by sacrificial anodes. If pits for counterweights will be redesigned with bottom level below waterlevel, the concrete structures must be rehabilitated and made watertight. All fenders should replaced by new fenders.

3.7.2 Turkmenbashi

Photo no. 19: All 4 third row towers and controlbuilding (behind the 2 central towers).

3.7.3 Baku

Photo no. 20: 3 third row towers and controlbuilding (in fron at the right). Finger pier and stop fenders.

3.8 Finger piers

3.8.1 General for both berths

The superstructure in all fingerpiers are damaged by ship collisions. The guiding fenders are in very bad shape, and in a lot of places missing. It is recommended to demolish and reconstruct all finger piers.

3.8.2 Turkmenbashi

Concrete in all quay walls is severely damaged. Also the piles in the substructure are damaged to a certain extent. Reinforcement is visible on both sides and end of

3.4 Access bridge

3.4.1 General for both berths

Concrete piles condition is anticipated to be satisfactory. Apparently there is no damages. Surface treatment of the concrete slab is recommended in case of reuse.

Photo no. 8: Access bridge in **Turkmenbashi**.

3.5 Lifting towers (first and second row)

3.5.1 General for both berths

As the steel sheet piles were below waterlevel, it has not been possible to judge on corrosion condition. A divers inspection was planned for by the port authorities, but was not carried through during the visit. However it is a rather heavy profile (Larssen IV) with a flange thickness of 15 mm. In a rehabilitation projekt the sheet piles should be protected from corrosion by sacrificial anodes. If pits for counterweights will be redesigned with bottom level below waterlevel, the concrete structures must be rehabilitated and made watertight.

3.5.2 Turkmenbashi

Photo no. 9: First row tower.
Photo no. 10: Second row tower.
Photo no. 11: Standing on counterweight down in pit.
Photo no. 12: Lifting Screw.

3.5.3 Baku

Photo no. 13: First and second row towers to the West. Ramp deck.
Photo no. 14: First row tower to the Est. Land base stone revetment.

3.6 Lifting towers (third row) and stop fenders

3.6.1 General for both berths

The condition of the structure is satisfactory for reuse. In a rehabilitation projekt the sheet piles should be protected from corrosion by sacrificial anodes. If pits for counterweights will be redesigned with bottom level below waterlevel, the concrete structures must be rehabilitated and made watertight. All fenders should be replaced by new fenders.

3.6.2 Turkmenbashi

Pits are dry.

3.10 Head of central pier

3.10.1 General for both berths

The superstructure has been severely damaged from ship collisions. Repairs has been undertaken and damaged again. Fenders are missing.

3.10.2 Turkmenbashi

The sheet pile substructure is damaged by ship collisions in corner. Concrete superstructure is also damaged in the same corner.

Photo no. 33: End of pierhead. Rubber tyre fenders installed. Corner damage.
Photo no. 34: End of pierhead. Corner damage. Concrete destroyed.
Photo no. 35: End of pierhead. Corner damage. Steel sheet piles damaged.

3.10.3 Baku

Photo no. 36: Pier head repaired. No fenders installed. Dangerous steel scaffolding at base of concrete superstructure.

fingerpiers.

Photo no. 21: Finger pier. Reinforcement visible. Fenders missing.
Photo no. 22: Damaged quay wall.
Photo no. 23: Damaged piles and superstructure.
Photo no. 24: Damaged piles and superstructure.

3.8.3 Baku

Concrete in all quay walls is severely damaged.

Photo no. 25: Finger pier. Concrete quay wall damaged. Reinforcement visible. Fenders missing.
Photo no. 26: Back of finger pier. Better condition. Original scaffolding has never been removed.

3.9 Central pier on piles

3.9.1 General for both berths

Guiding fenders are in a very bad state. The concrete cover in the quay wall is missing in big areas. Piles were not possible to inspect.

3.9.2 Turkmenbashi

Reinforcement is visible in the upper part of quay walls.

Photo no. 27: Top view of central pier.
Photo no. 28: Reinforcement in quay wall visible.
Photo no. 29: Fenders.

3.9.3 Baku

New guiding fenders as shown in photos are installed at present.

Photo no. 30: Top view of central pier. New fender installed. Original fenders are missing.
Photo no. 31: Side view of central pier. New fenders installed. Original fenders are missing.
Photo no. 32: Support for new fender being constructed.

From the pier head the diving boat was moved to the two strong points **(base of finger pier and base of central pier)** at the ship/ram connection. At the bottom a lot of scrap and building materials material were found.

Steel sheet piles was cleaned in certain areas. The cleaned surfase showed an even corrosion. No holes were found.

In a normal section of the pier a concrete pile was cleaned in a part of its surface. No cracks were found. Under side slab was totally covered by scaffolding. No visible damages on piles above water level was found except some peeling at pile corners.

In general it could be seen from the boat, that side walls in the pier structure have severe damages, and it is not recommended to reuse any parts of these in a rehabilitation project.

Yours faithfully
RAMBØLL

Jørgen Lisby

MEMO

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E-mail: jli@ramboll.dk
Web: http://www.ramboll.dk

To:
TACIS

From:
JLI

RENOVATION OF THE FERRY TERMINALS OF BAKU AND TURKMENBASHI
DIVING INSPECTION OF BAKU TERMINAL

Date	1996-10-24
Revised	
Initials	JLI/jli
Job	963324
Ref.No.	bb960291.jli

The diving inspection was performed 1996-10-10 by a local company normally used by the Ports Authority. Visibility below water level was about 35 cm.

The inspection started at the **pier head**. A new steel sheet pile wall has been installed around the pier head in front of existing sheet piles. However it has not been possible to drive piles at the land side of the **strong point** as this would have included a demolition of the concrete bridge behind the strong point.

At the bottom a lot of scrap and building materials material were found. Remains from former wooden piles (probably for fenders) are rising over the bottom. In front of pier head a steel sheet profile rises 1.5 m out of bottom.

In general it was concluded, that remains from piles, former bearing piles for the fender system, building materials and scrap should be removed before driving new piles / sheet piles. It might also be a hindrance for the berthing of ferries.

In certain areas the surface of the steel sheet piles was red of corrosion. When cleaned the surface seemed relatively smooth, which indicates an even distribution of the corrosion. No holes were found.

In one position a spilt in the interlocking was found from bottom to 1.5 m above bottom.

While at the **pier head**, the **concrete piles, rear sides of side walls and under side concrete slab** in a normal pier section was inspected. The concrete slab was about 1 m above water level. Visible reinforcement bars was seenas well in the slab as in side walls. In most areas the scaffolding from construction could still be seen. By touching a pile some concrete fell off. Break down of concrete in the piles was seen.

Affilialted to FIDIC
Company Reg.No. DK 46035

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0.61-1.00	0.04	0.5	0.4	0.2	0.04	-	-	1.78
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Сумма	2.54	10.13	16.32	8.9	1.94	53.77	5.8	100%
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0.61- 1.0м

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Максим. Выс. Волны

2. Максимальная высота волны отложена от центра круга.

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6-12			22
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Сумма	35.64	3.03	2.01
Макс.ск	40	20	14

План

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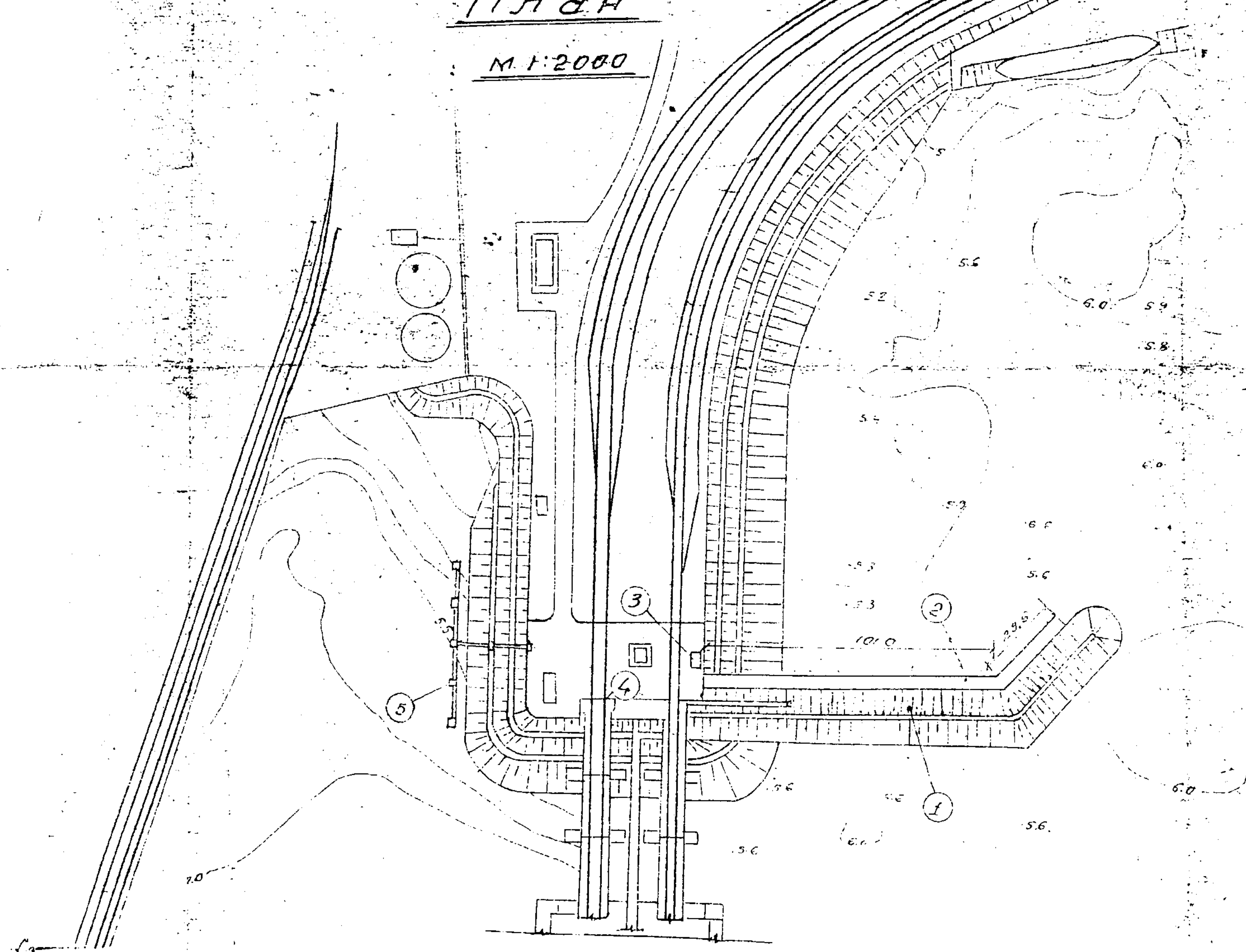

Усло

(S51) Штиль

Повторя

Максимал

Масштаб: Для пов
Для макс

Примеча

1. Штиль показан в
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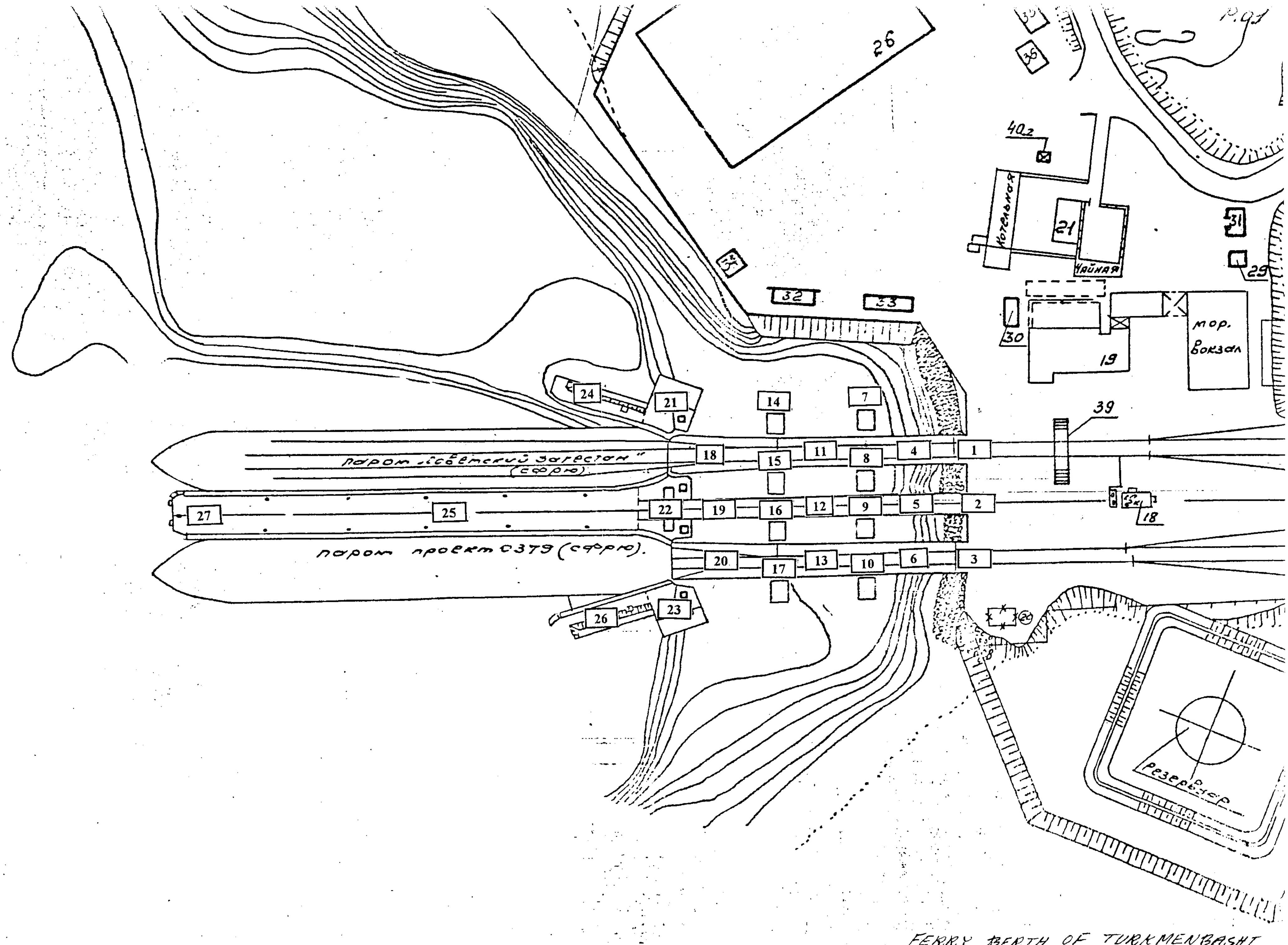
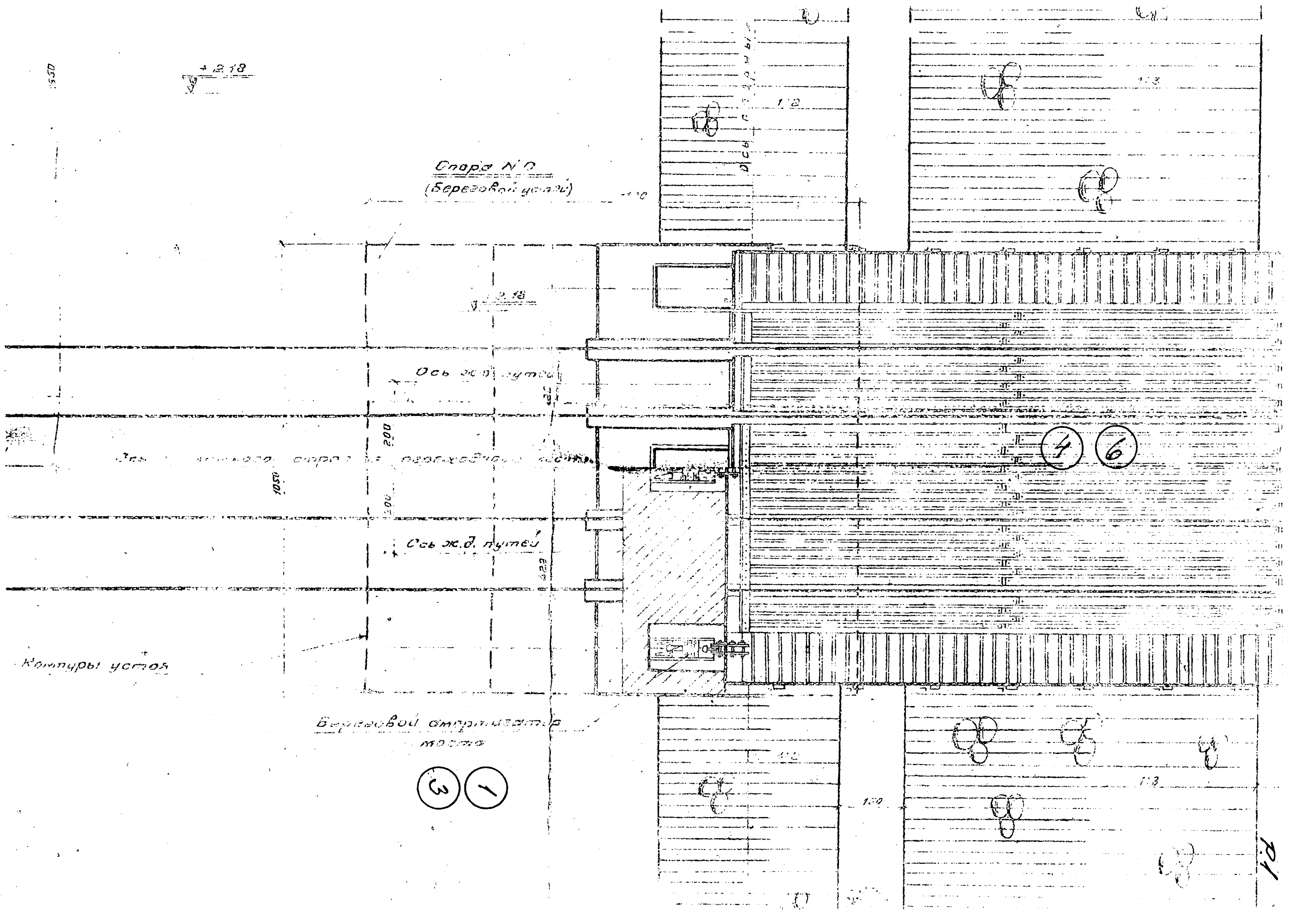


FERRY BERTH OF TURKMENBASHI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Береговой амортизатор
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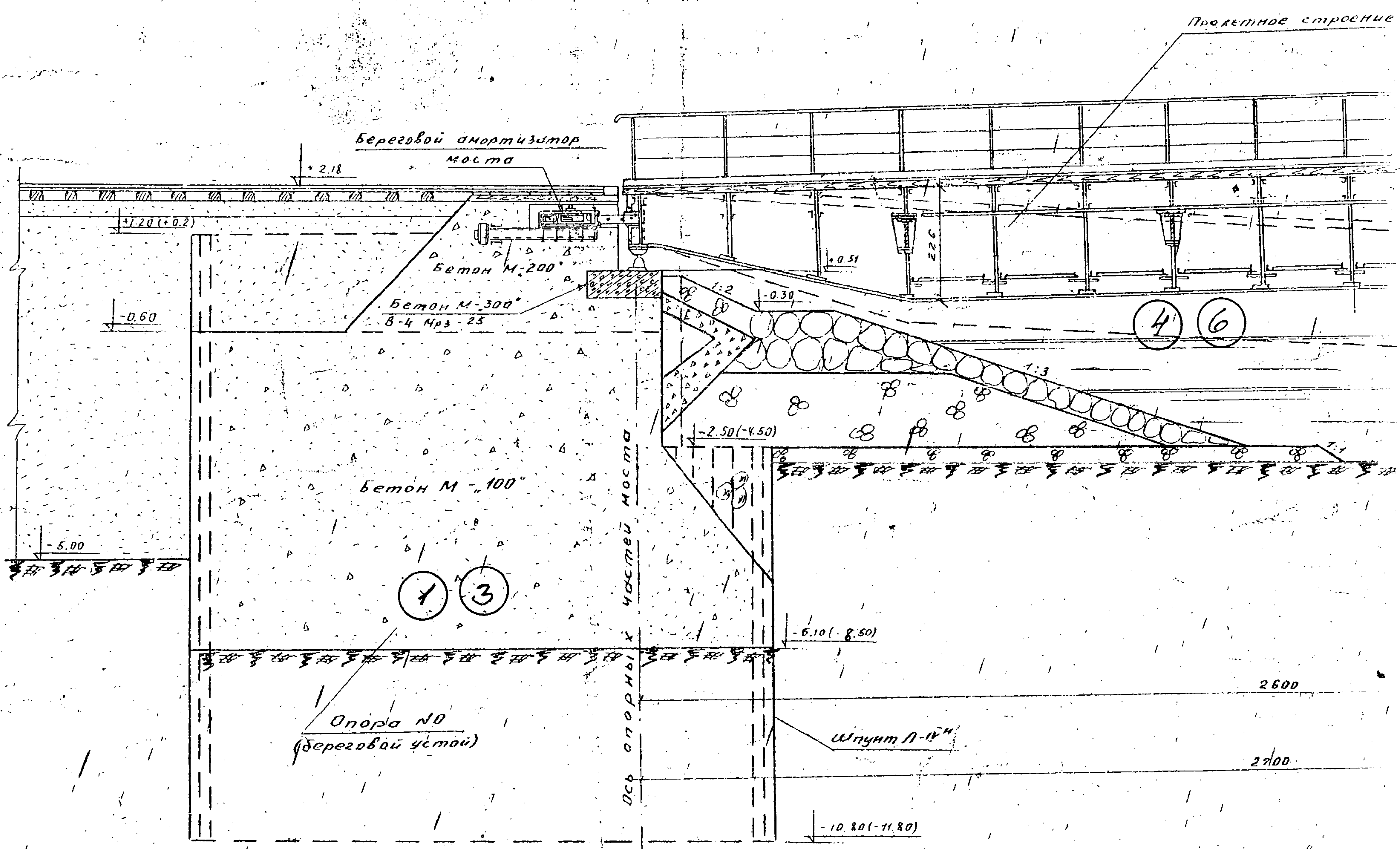

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+1.20 (+0.2)
-0.60
-5.00
Бетон М-200"
Бетон М-300"
В-4 Мрз-25
Бетон М-„100"
1:2
1:3
1:1
-0.30
+0.51
226
-2.50(-4.50)
-6.10(-8.50)
-10.80(-11.80)
2600
2700
Ось опорных частей моста
Шпунт Л-IV"
Опора N0
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Физико-технические свойства грунтов.

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План соединительного "

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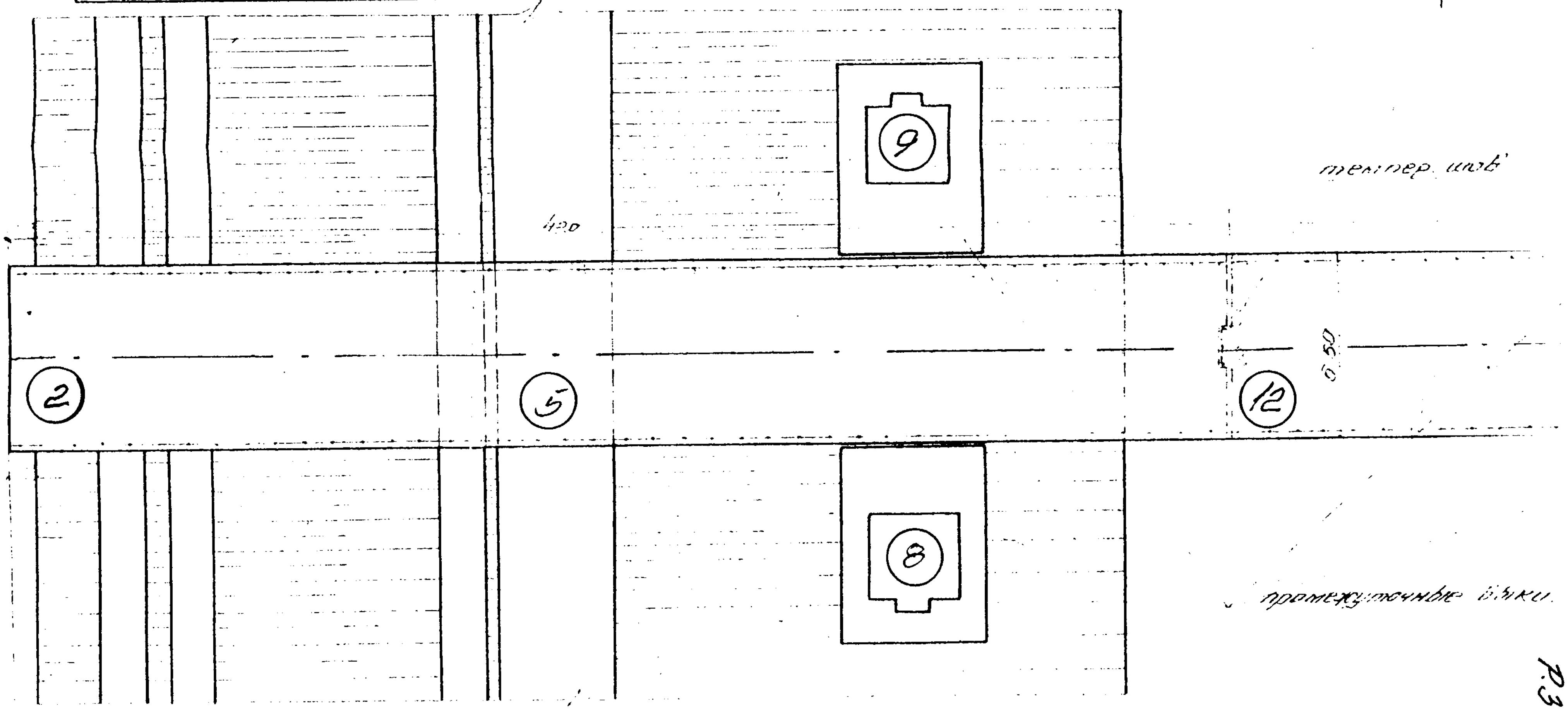

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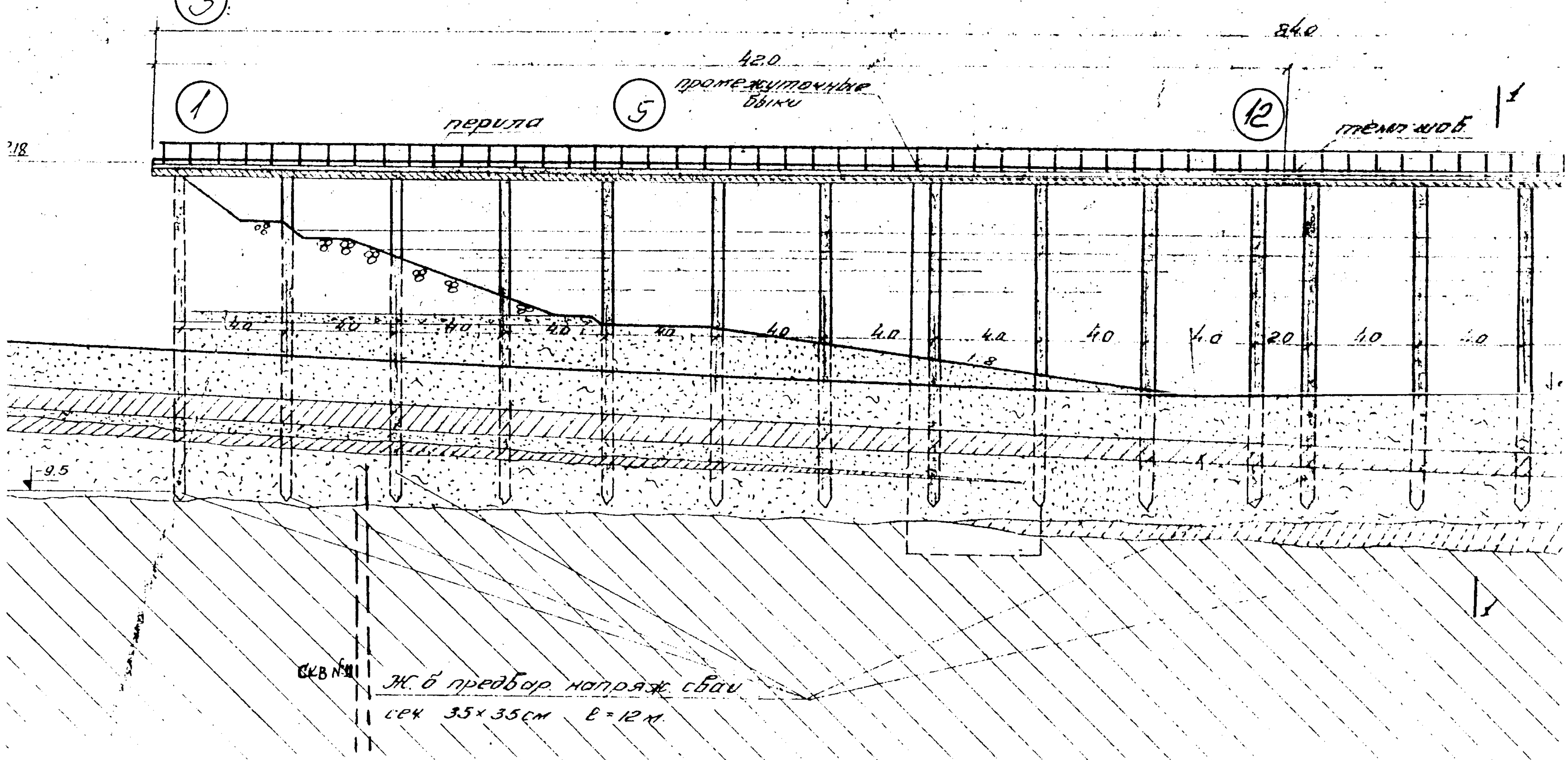

Физико-технические свойства грунтов.

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						>1.0	1-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05	0.05-0.005	0.005
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Разрез 1-1

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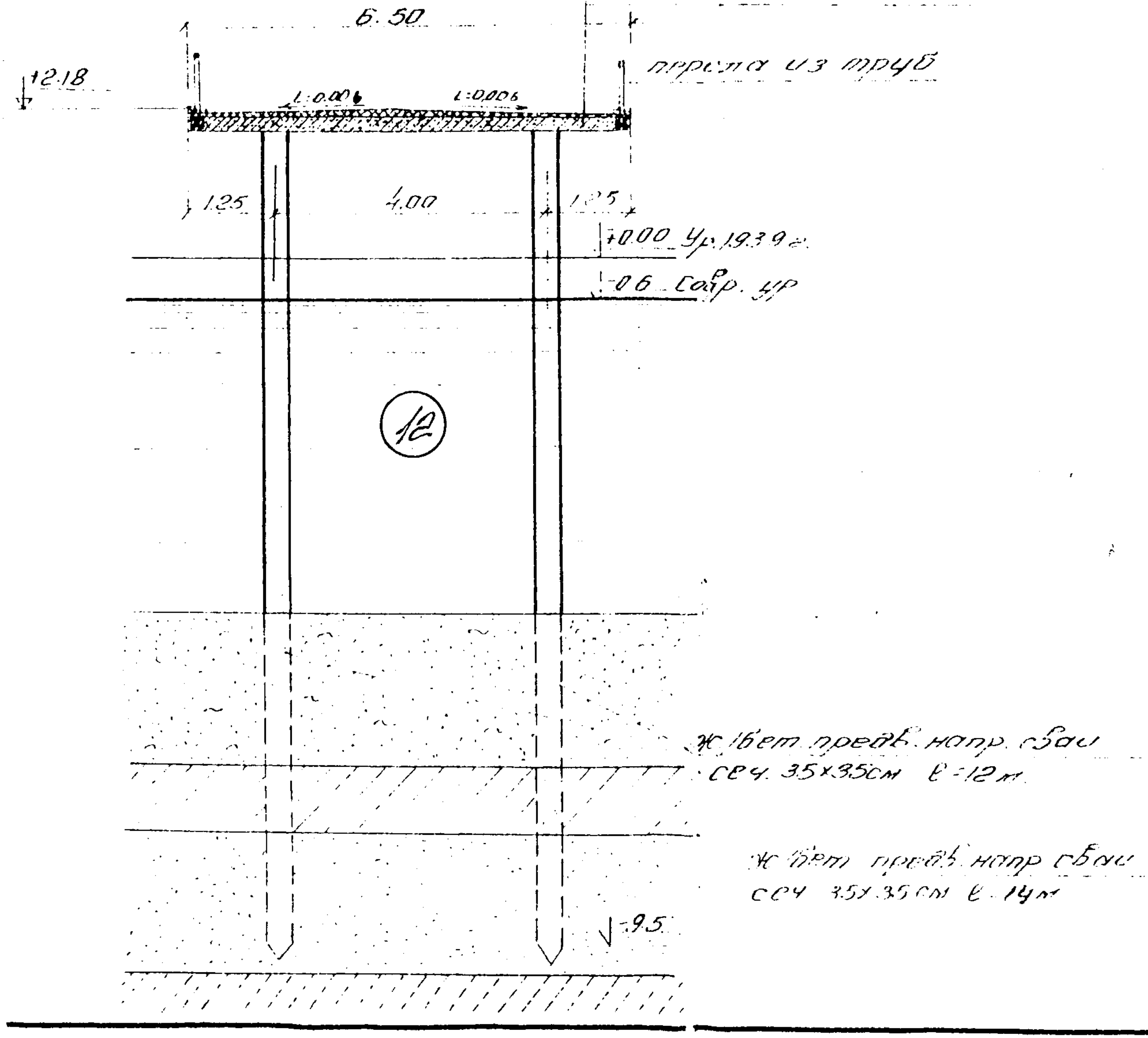

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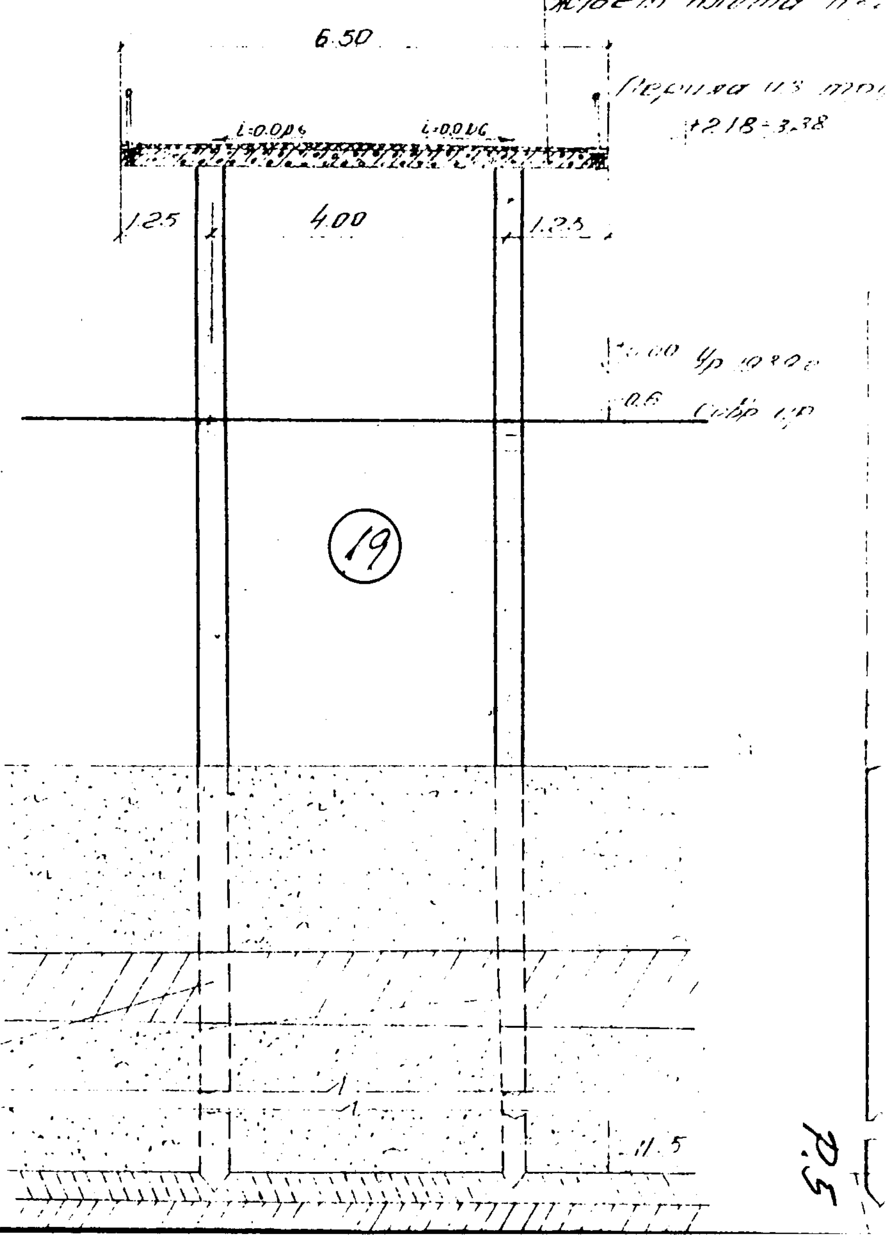

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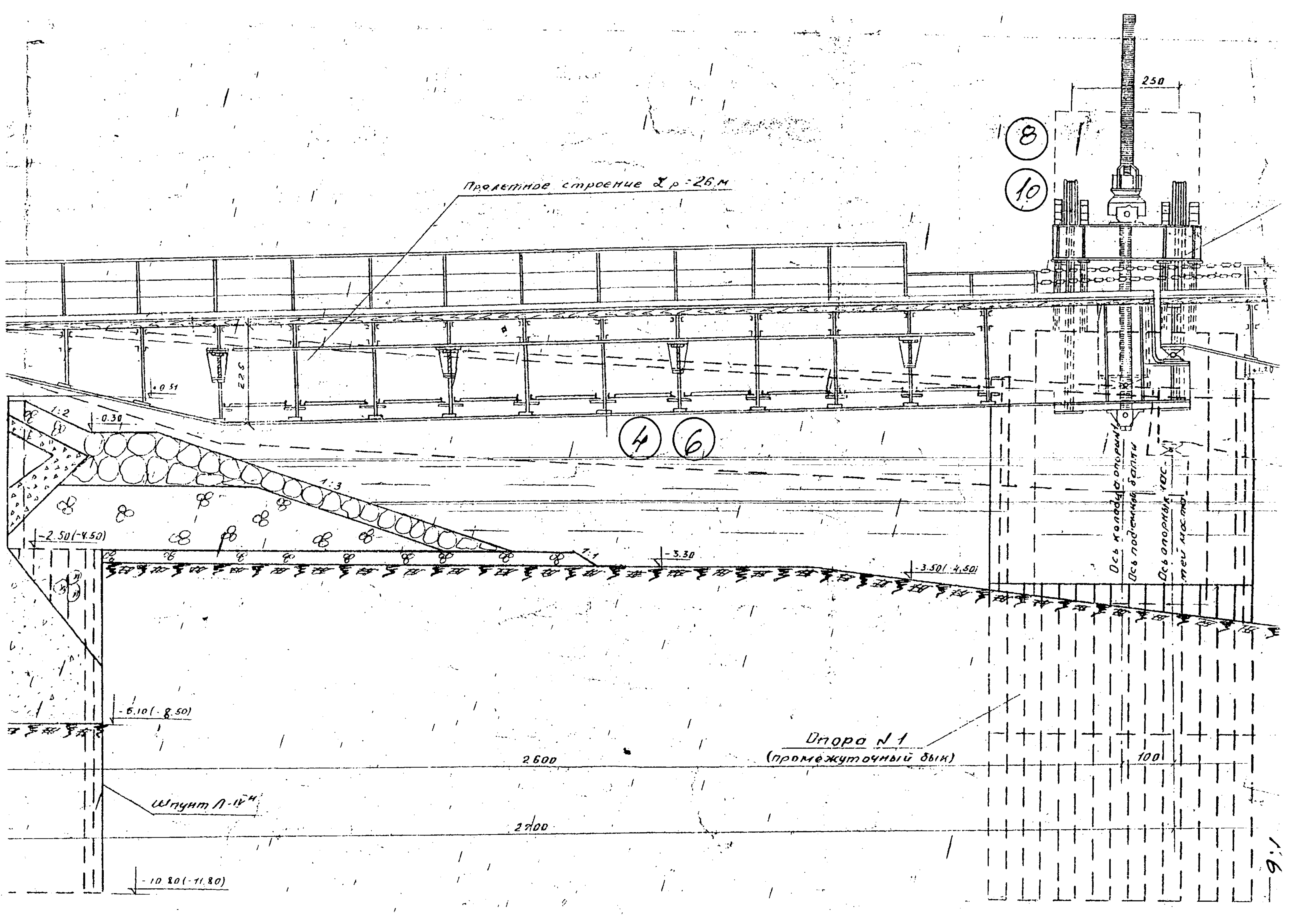

Пролетное строение ℓр-26м
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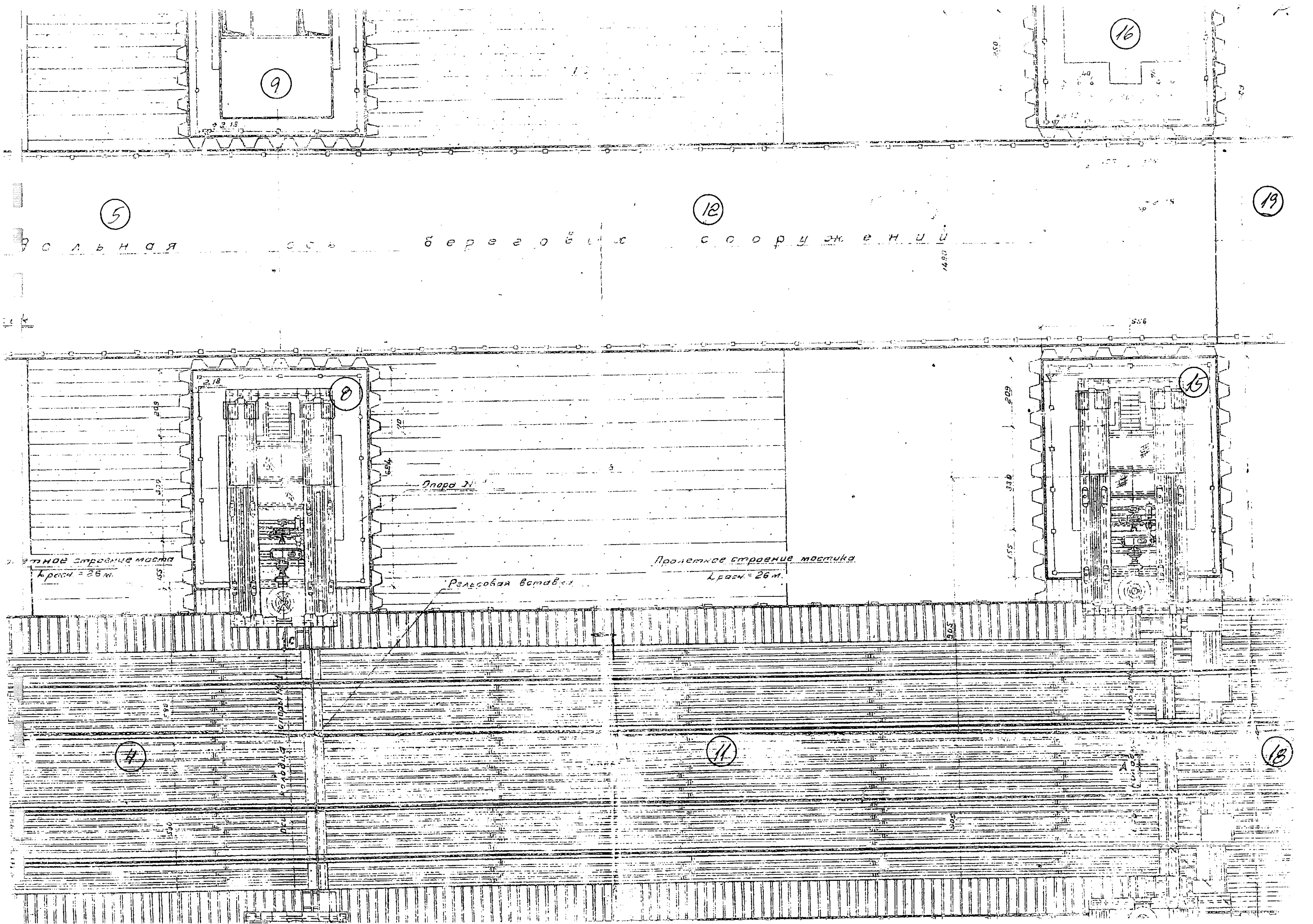
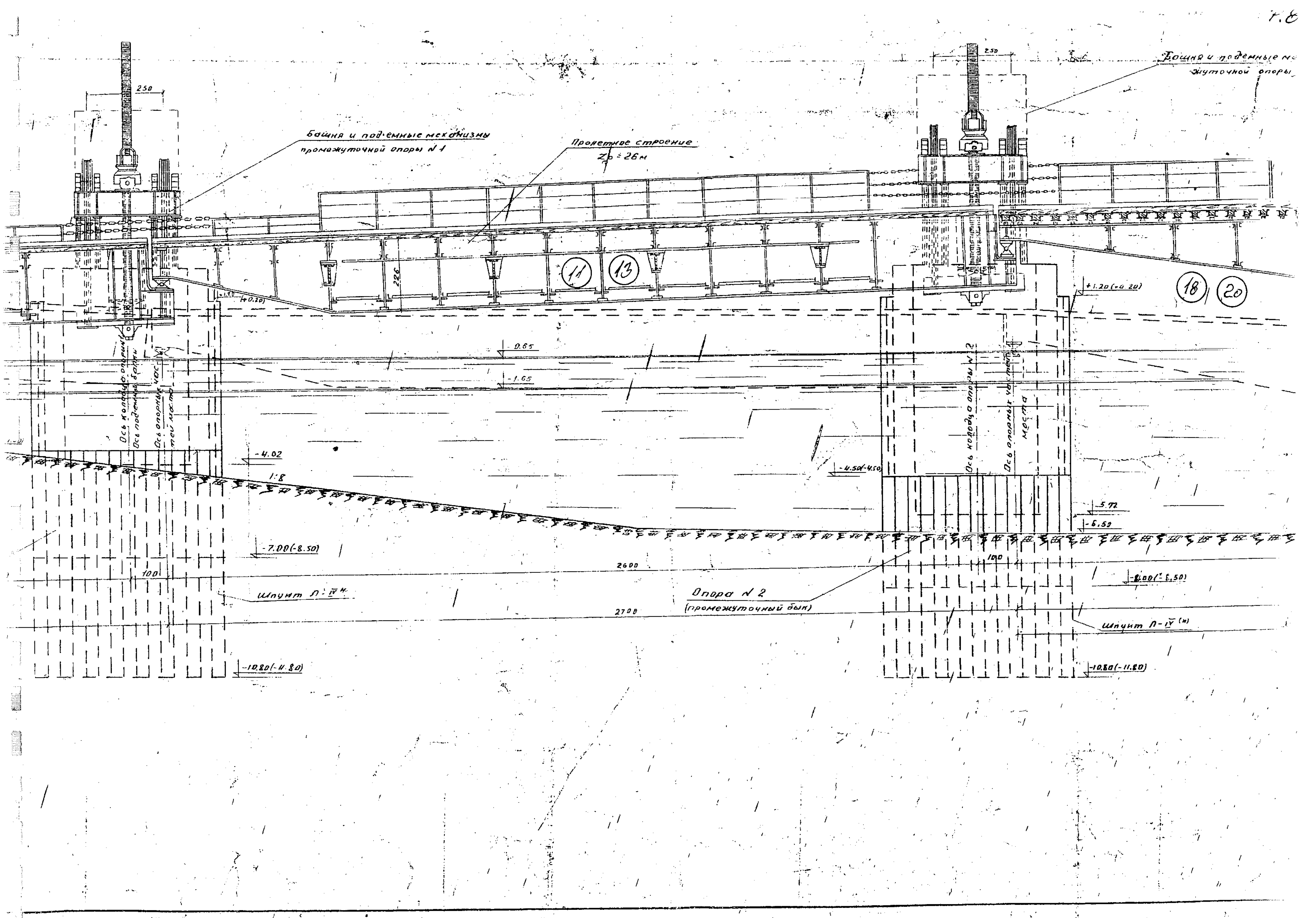
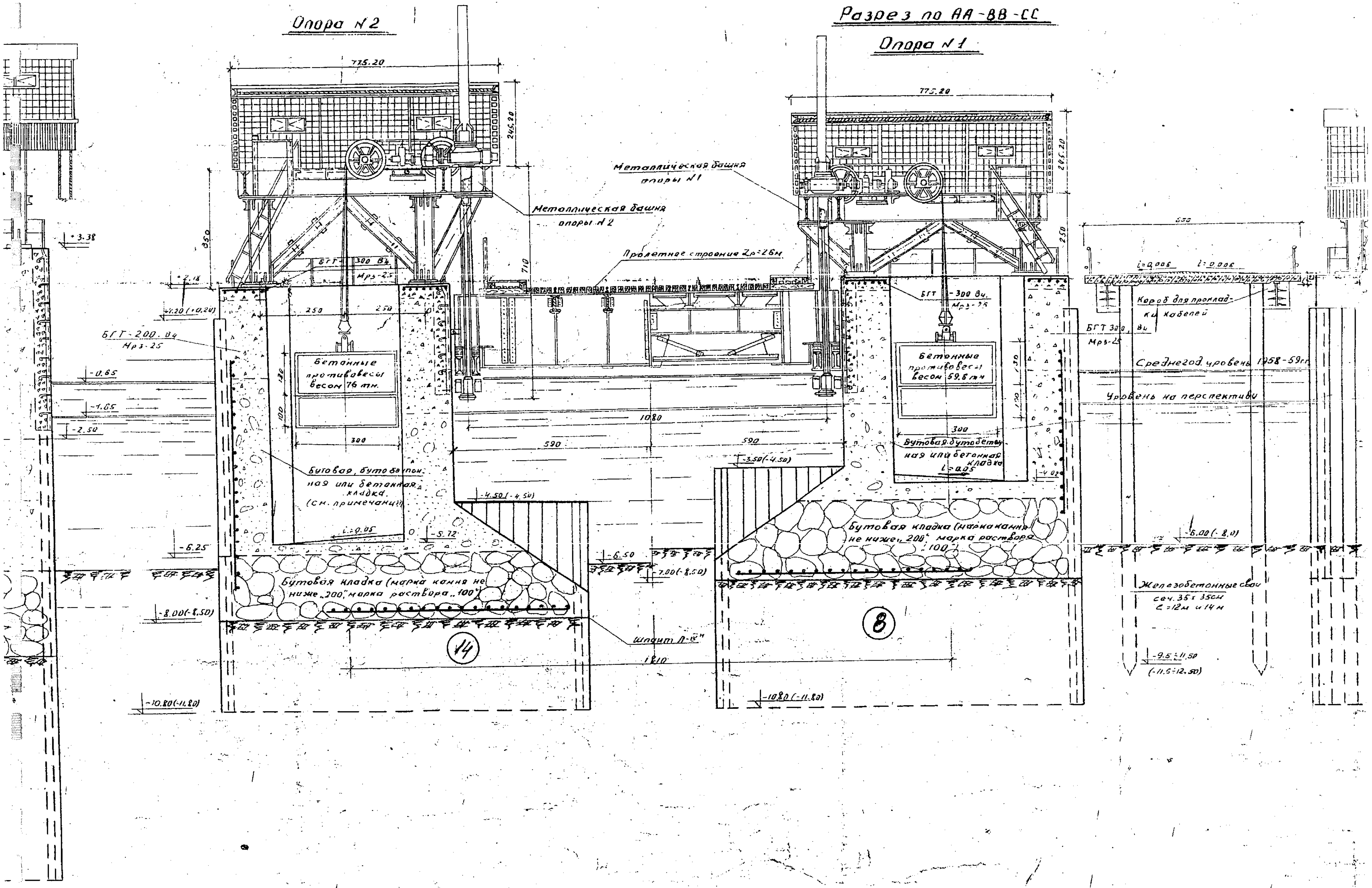
4
6
+0.51
225
1:2
-0.30
1:3
1:1
-2.50(-4.50)
-3.30
-3.50(-4.50)
+1.20
Ось колодца опорн.
Ось подъемной балки
Ось опорных частей моста
-6.10(-8.50)
Опора №1
(промежуточный бык)
2600
100
Шпунт Л-IVн
2700
-10.80(-11.80)
1:6

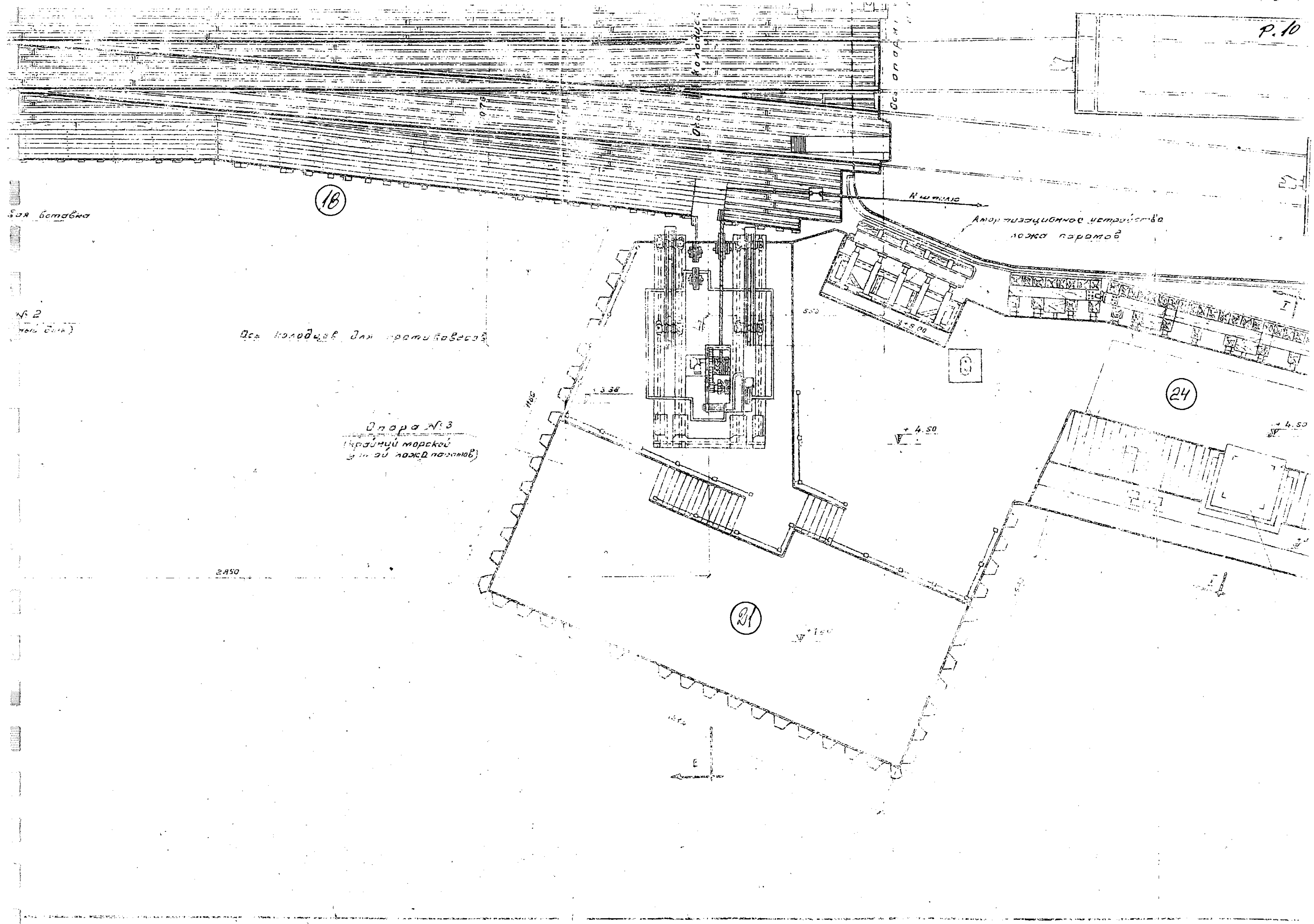

9
16
5
12
19
...ольная ось береговых сооружений
1490
8
15
Опора №
...етное строение моста
L расч. = 26 м.
Пролетное строение мостика
L расч. = 26 м.
Рельсовая вставка
11
18
209
330
155
905



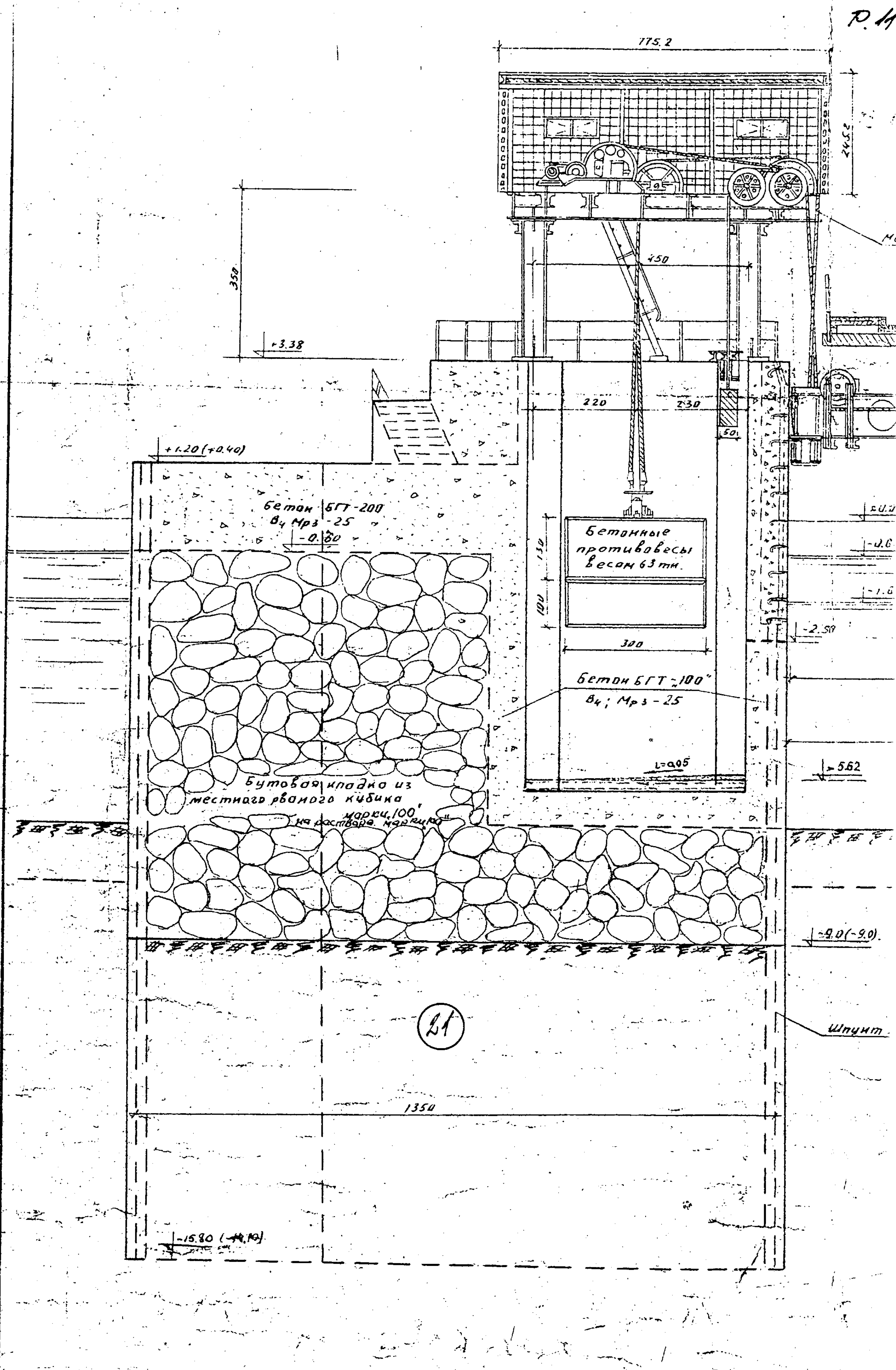
7.8
Башня и подъемные механизмы промежуточной опоры № 1
Пролетное строение
l_p = 26м
Башня и подъемные м… …жуточной опоры
250
250
226
11
13
18
20
+1.20(+0.20)
(+0.20)
0.65
-1.65
-4.02
1:8
-4.50(-4.50)
-5.72
-6.50
-7.00(-8.50)
100
100
2600
2700
-8.00(-5.50)
Шпунт Л-IV
Шпунт Л-IV
Опора № 2
(промежуточный бык)
-10.80(-11.80)
-10.80(-11.80)
Ось колодца опоры № 2
Ось опорных частей моста
Ось колодца опоры
Ось подъемной балки
Ось опорных частей моста

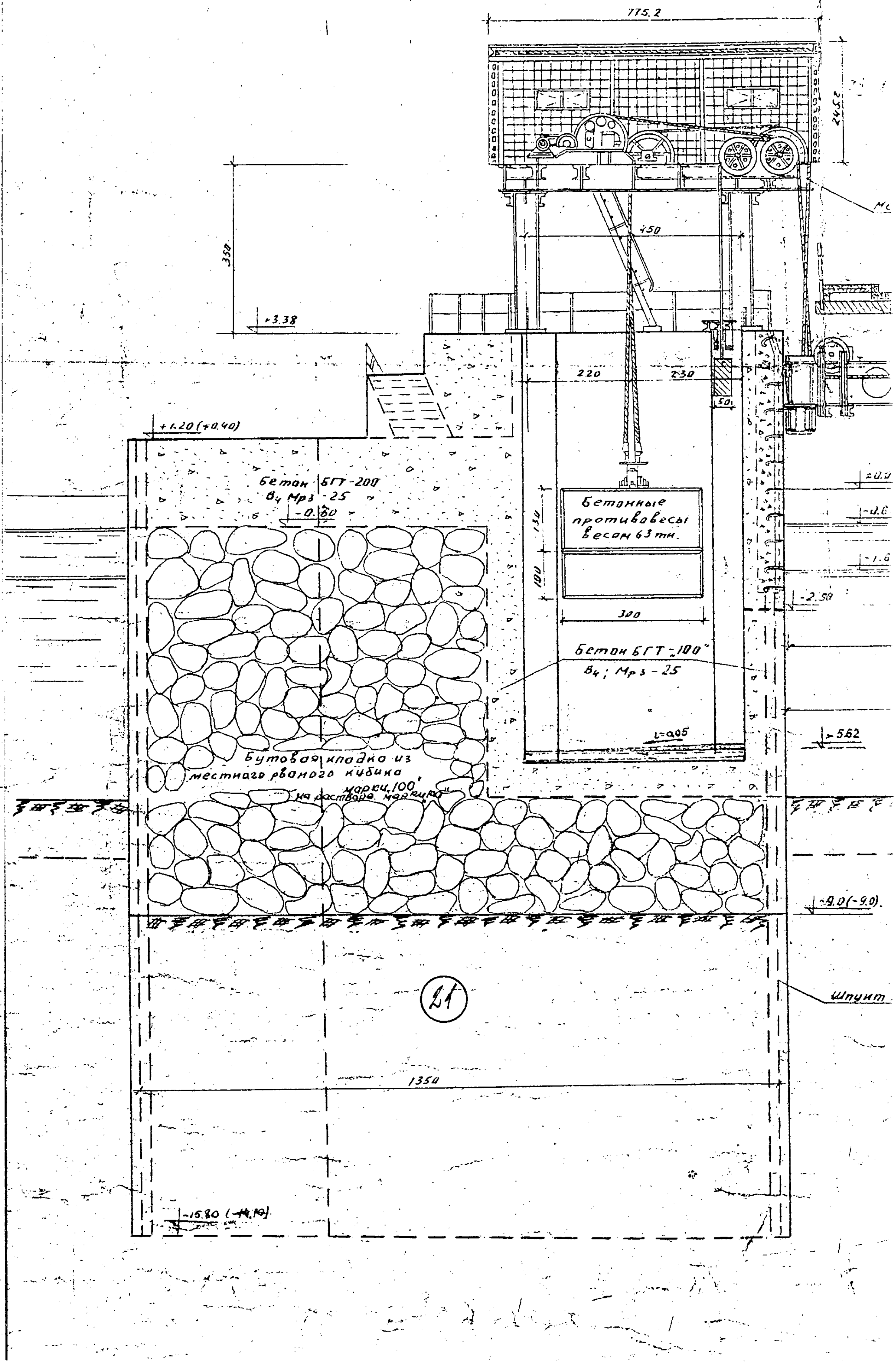
Разрез по АА-ВВ-СС

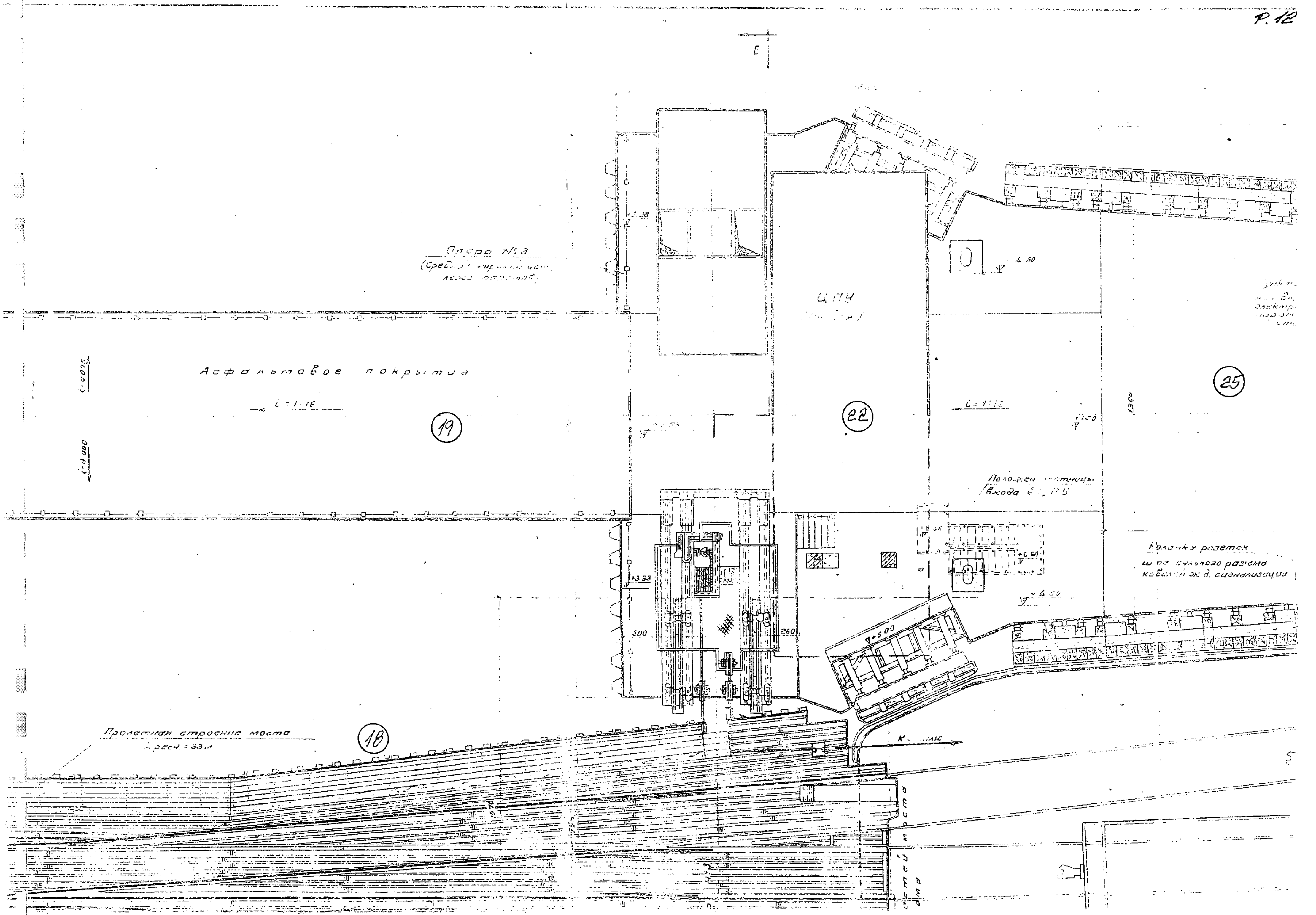


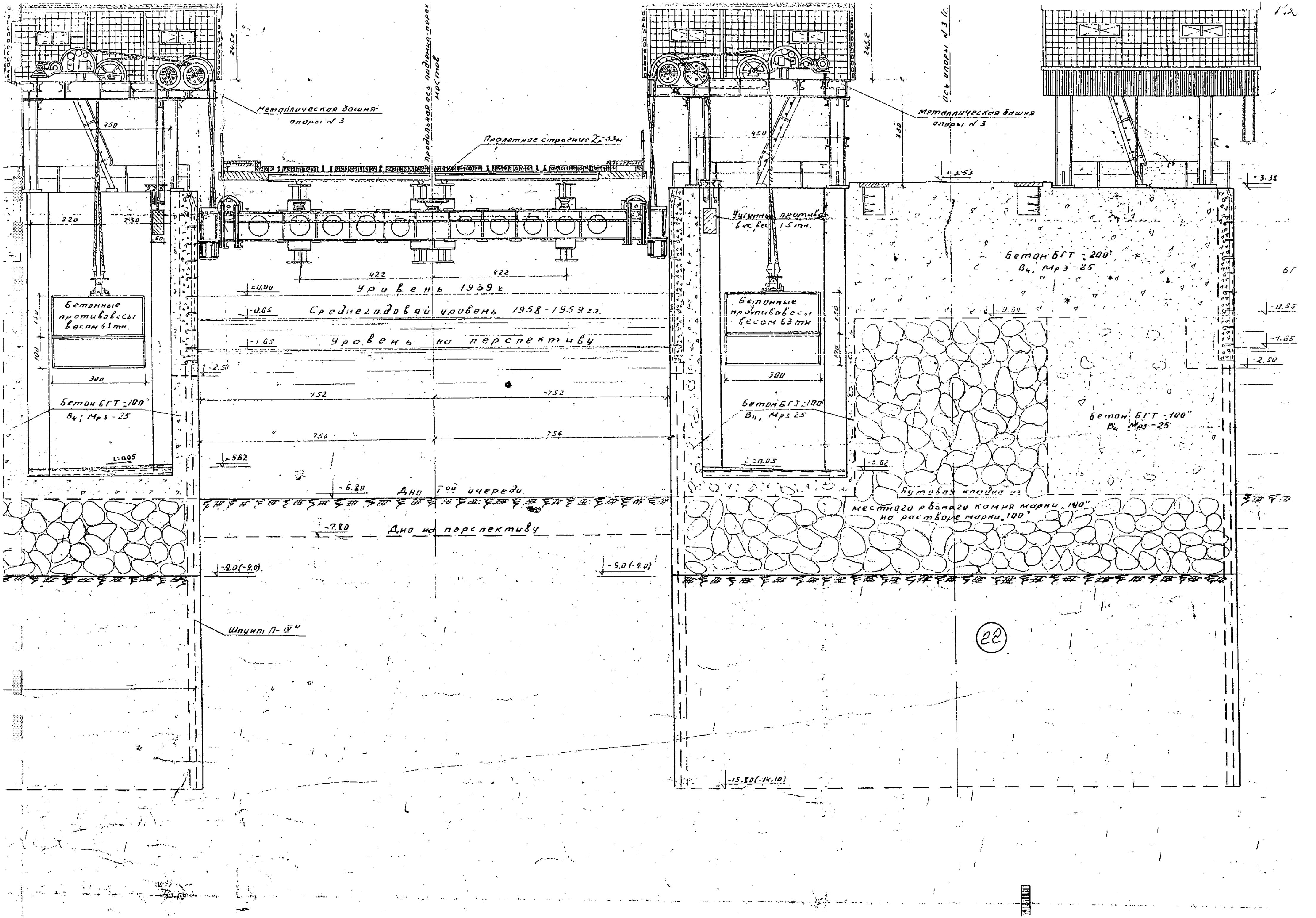


P.10
Ось опоры
Ось колодцев
К шпилю
Амортизационное устройство ложа паромов
+4.50
24
18
21
+1.60
2.850
3.36
Ось колодцев для противовеса
Опора № 3
(крайний морской у ... ложа паромов)
№ 2
...ая вставка

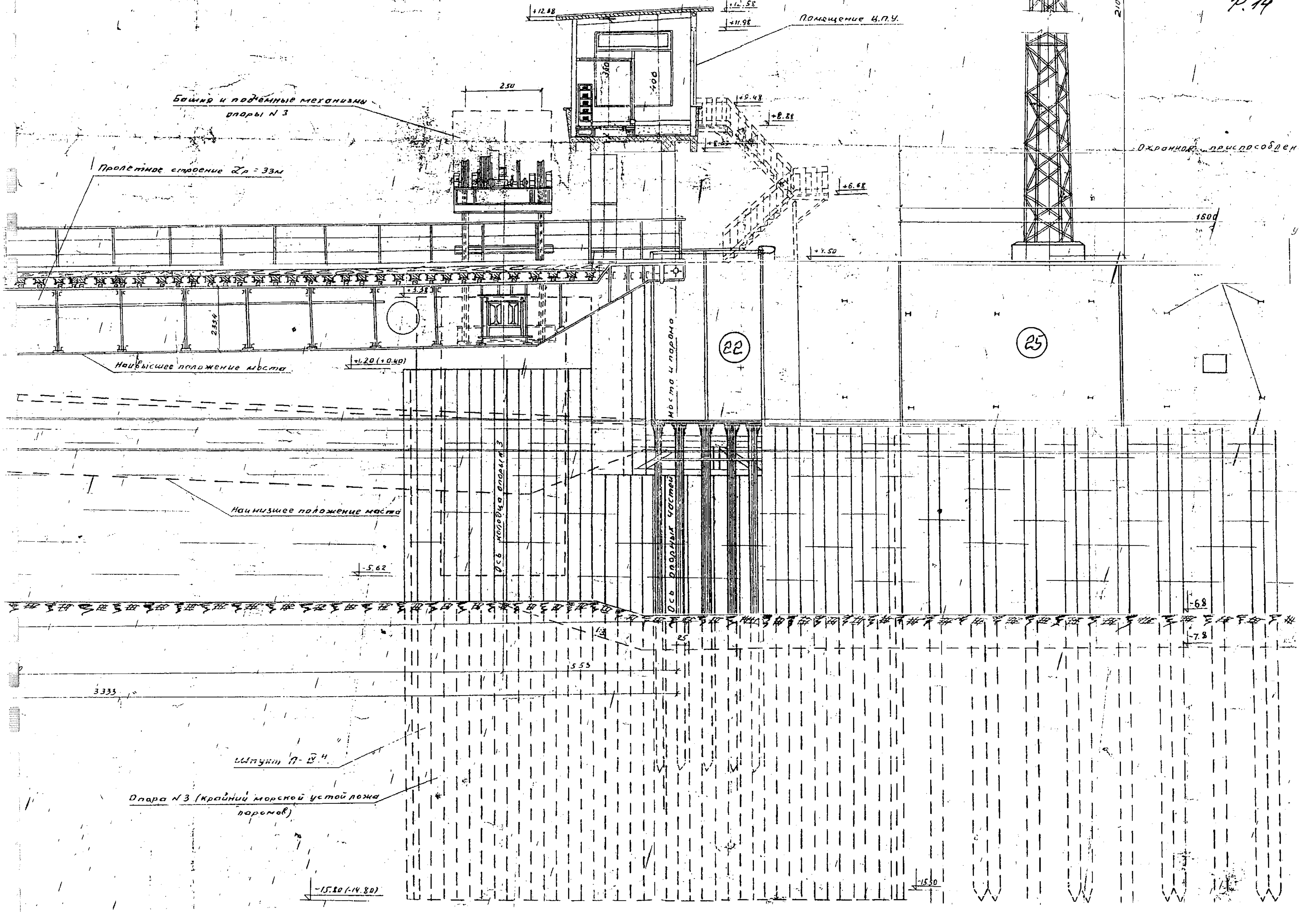

Р.11
775.2
245.2
350
450
+3.38
220
230
50
+1.20 (+0.40)
Бетон БГТ-200
В4 Мрз-25
-0.80
Бетонные противовесы весом 63 тн.
130
100
300
Бетон БГТ "100"
В4; Мрз-25
L=0.05
-2.50
-5.62
Бутовая кладка из местного рваного кубика марки "100" на растворе марки
-9.0(-9.0)
21
Шпунт
1350
-15.80 (-14.10)


775.2
245.2
350
+3.38
450
220
230
50
+1.20 (+0.40)
Бетон БГТ-200
В₄ Мрз -25
-0.80
Бетонные противовесы весом 63 тн.
130
100
300
Бетон БГТ "100"
В₄; Мрз -25
-2.50
-5.62
i=0.05
Бутовая кладка из местного рваного кубика марки 100 на растворе марки
-9.0(-9.0)
Шпунт
21
1350
-15.80 (-14.10)

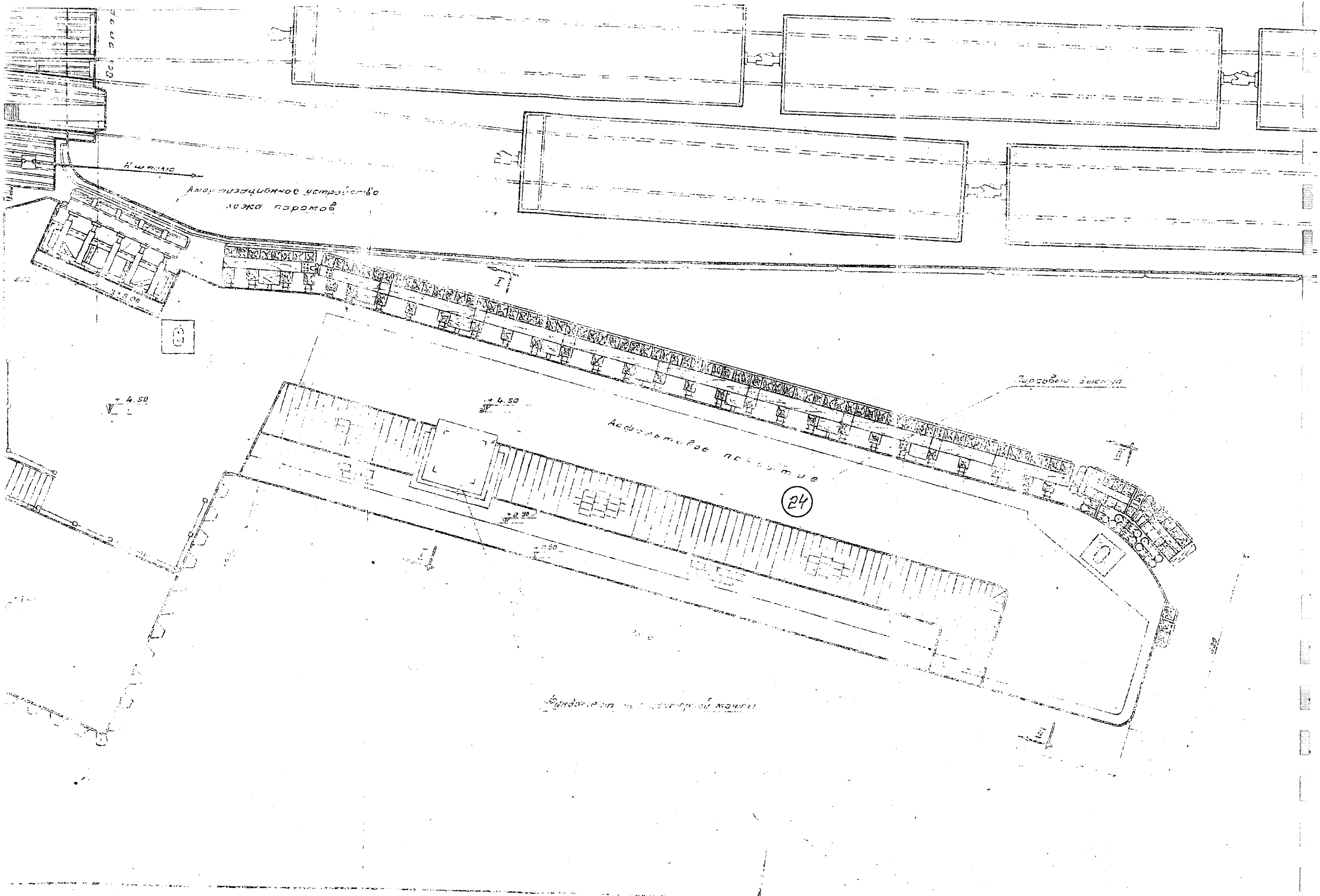

Опора №3
Асфальтовое покрытие
i = 1:16
19
22
25
ЦПУ
i = 1:13
Положен... входа
Колонка розеток
Кабель ж.д. сигнализации
Пролетная строение моста
18
+3.38
+3.33
300
260
4.50
+4.50
+5.00
+6.60


Металлическая башня опоры N 3
Продольная ось подъемно-перек. мостов
Пролетное строение l_p 33м
Металлическая башня опоры N 3
Ось опоры N 3 (с.
Чугунные противовесы вес 15 тн.
Бетонные противовесы весом 63 тн.
Бетонные противовесы весом 63 тн.
Бетон БГТ "100" $В_4$; Мрз-25
Бетон БГТ "100" $В_4$, Мрз 25
Бетон БГТ "200" $В_4$, Мрз-25
Бетон БГТ "100" $В_4$ Мрз-25
Уровень 1939 г.
Среднегодовой уровень 1958-1959 г.г.
Уровень на перспективу
Дно 1-ой очереди.
Дно на перспективу
Бутовая кладка из местного р-на Бахаги камня марки "100" на растворе марки "100"
Шпунт Л-IV
22

P. 14



Помещение Ц.П.У.
Башня и подъемные механизмы опоры N 3
Пролетное строение l_p = 33м
Наивысшее положение моста
Наинизшее положение моста
Ось колодца опоры 3
Ось опорных частей моста и парома
Охранное приспособлен
Шпунт Л-V н
Опора N 3 (крайний морской устой ложа паромов)
2100
1600
250
380
400
2334
555
3333
+12.88
+12.58
+11.98
+9.48
+8.88
+6.68
+4.50
+3.38
+1.20 (+0.40)
-5.62
-6.8
-7.8
-15.50
-15.80 (-14.80)
22
25

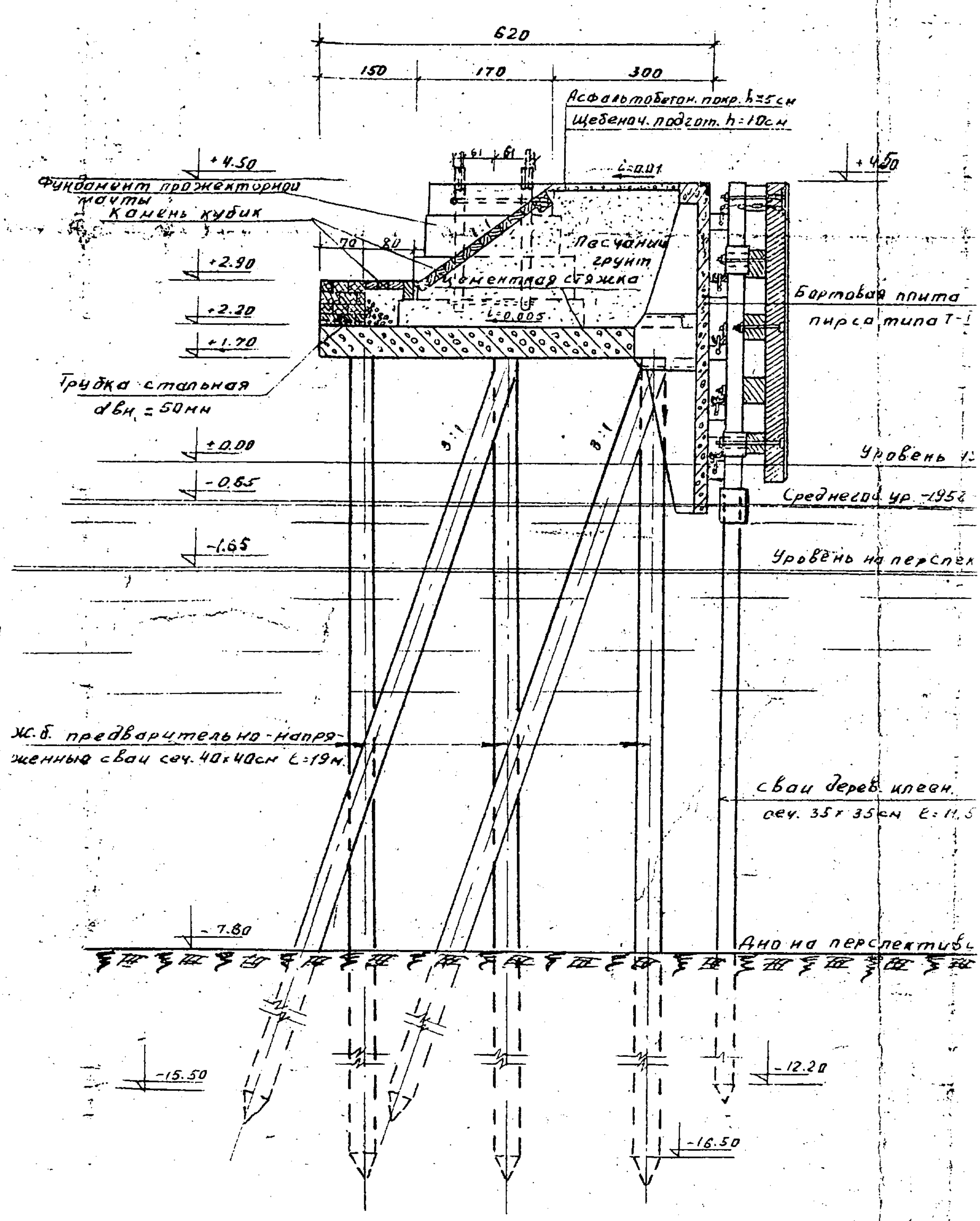

К шпилю
Амортизационное устройство ложа паромов
I
+4.50
+4.50
Асфальтовое покрытие
24
II

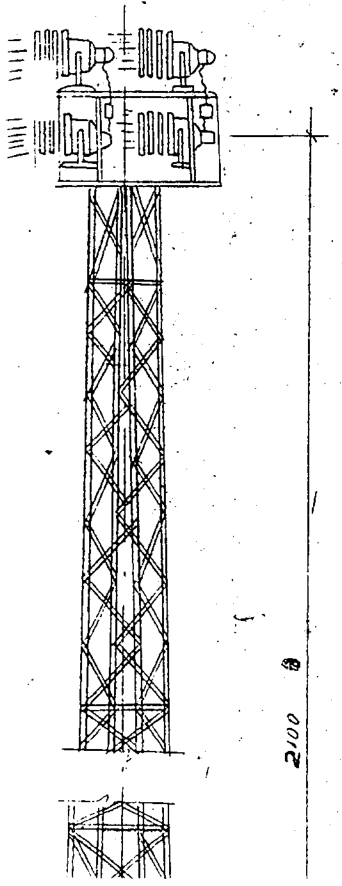
Пирсовый выступ крс

Поперечн

Разрез I-I

М



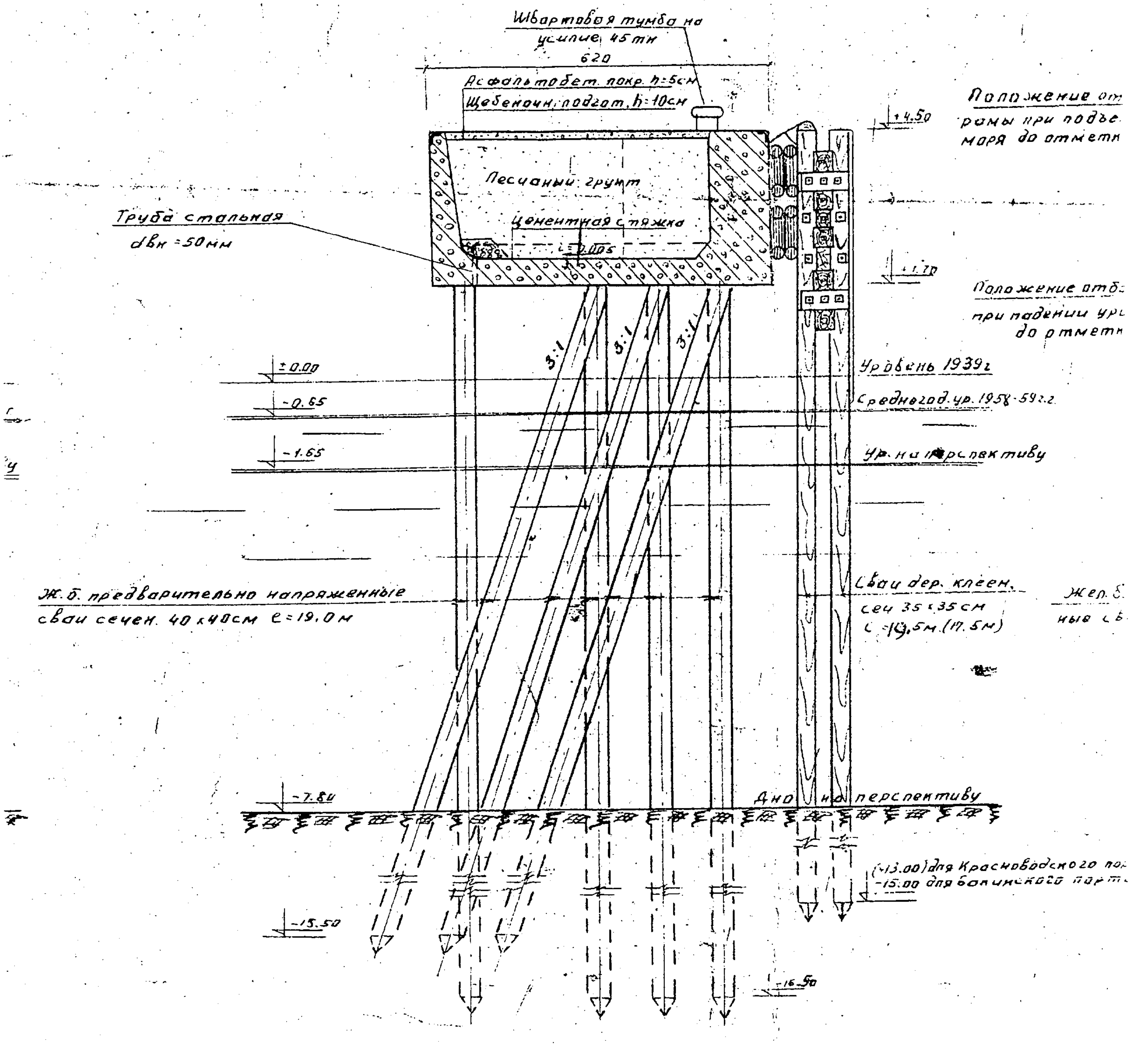


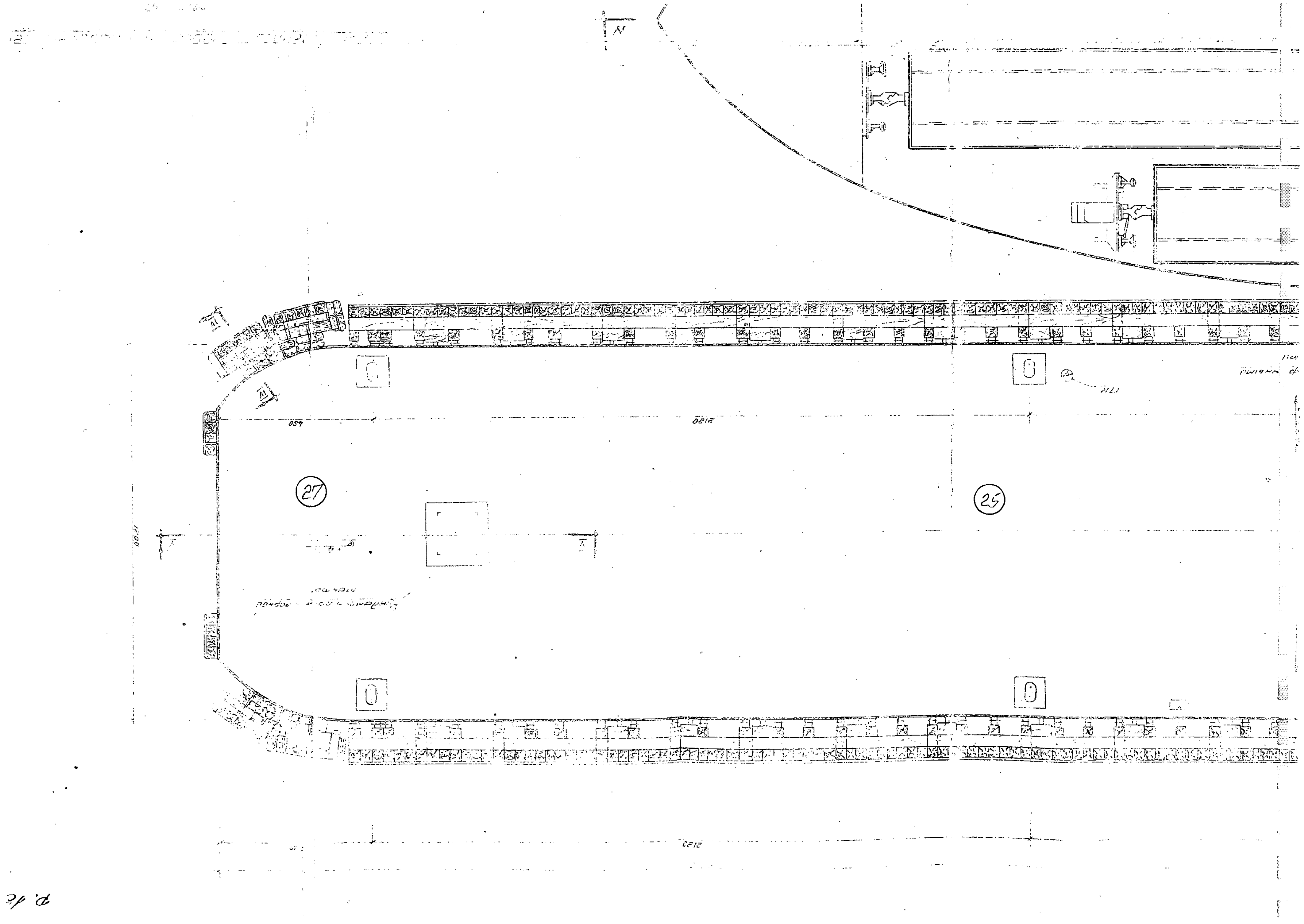
…го морского устоя.

…разрезы.

1:100

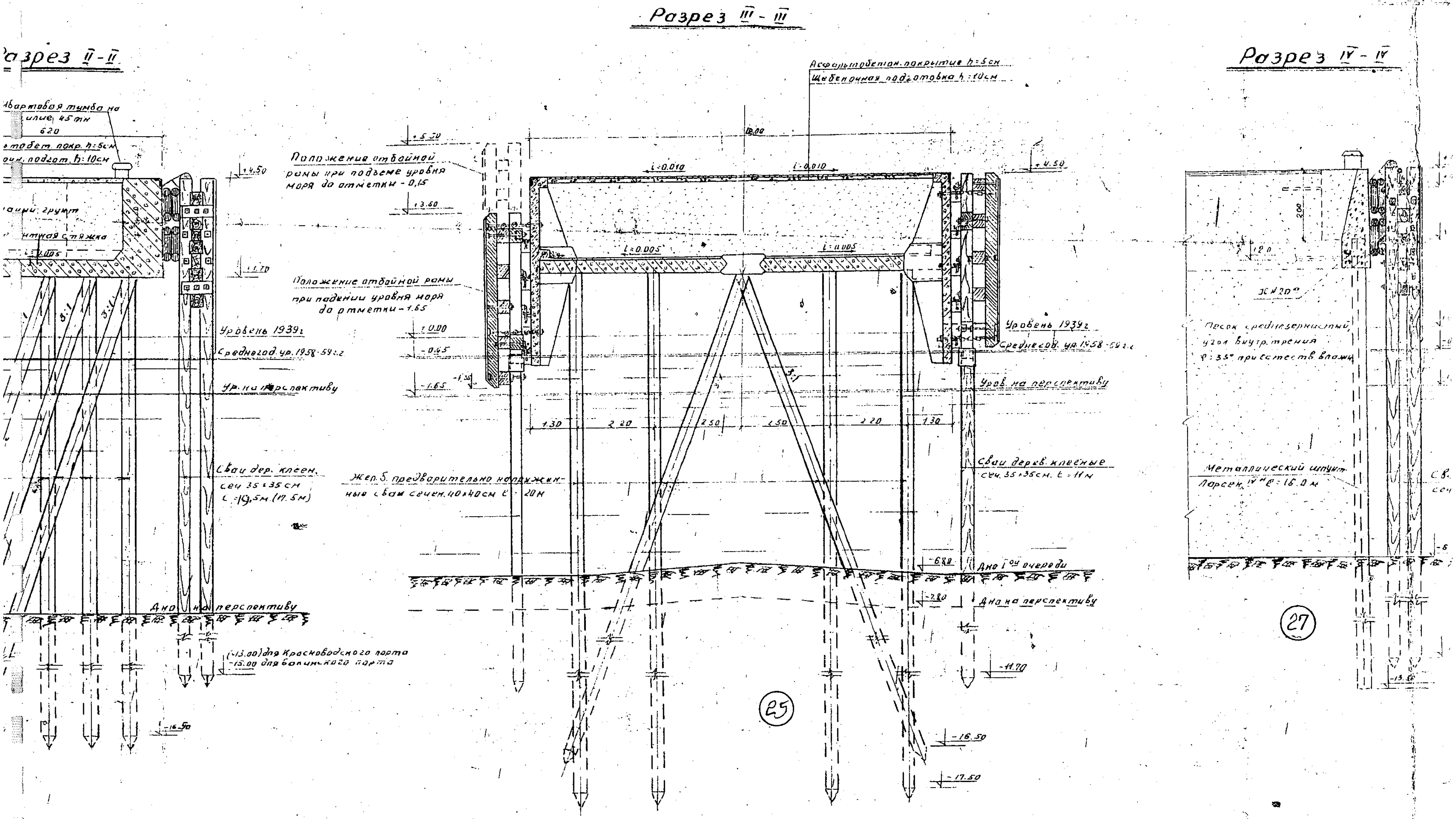
Разрез II-II




27
25

P.19

Паромный пирс.



Паромный пирс.

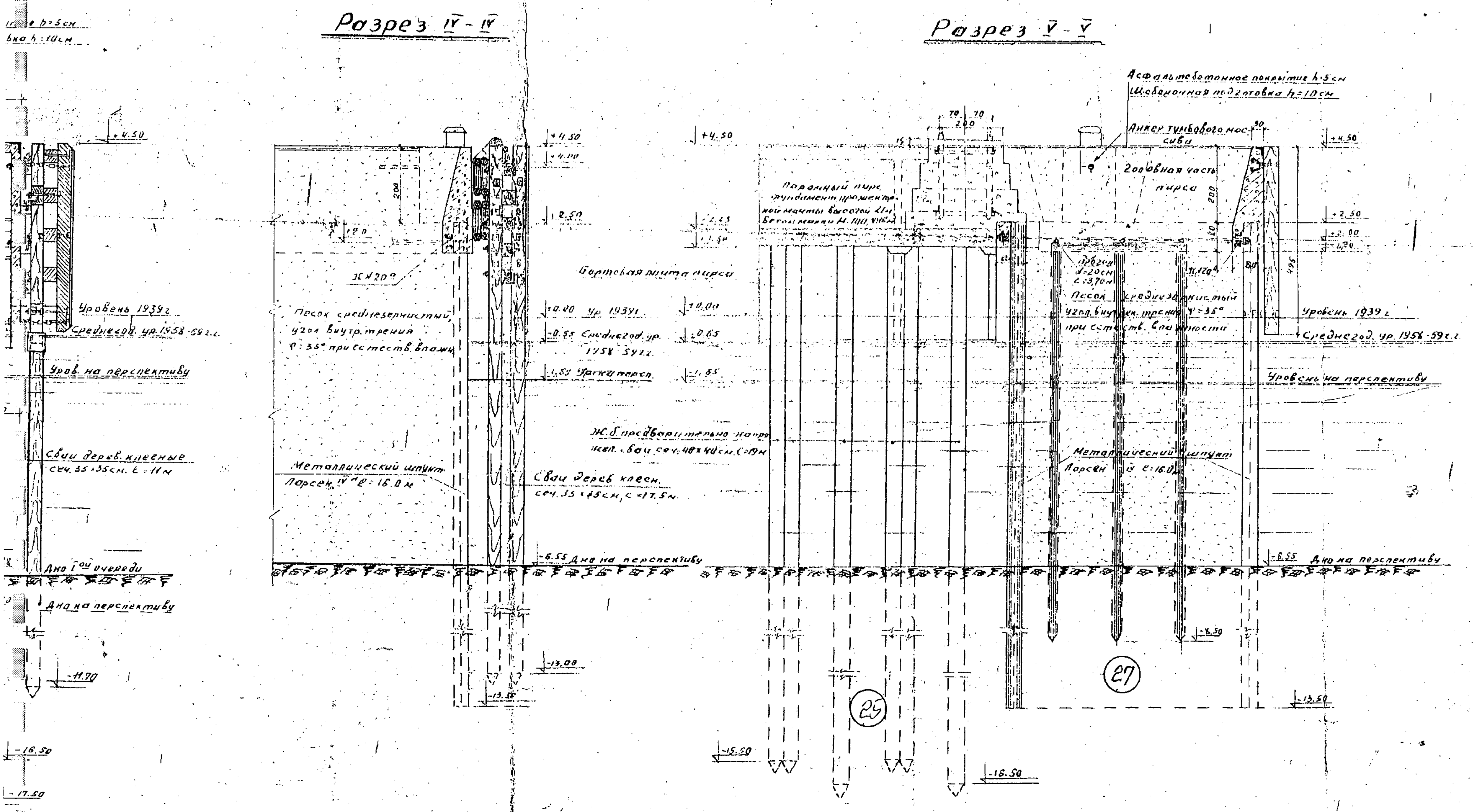
Разрезы головной части пирса.

Попереч

ус

Разрез IV - IV

Разрез V - V



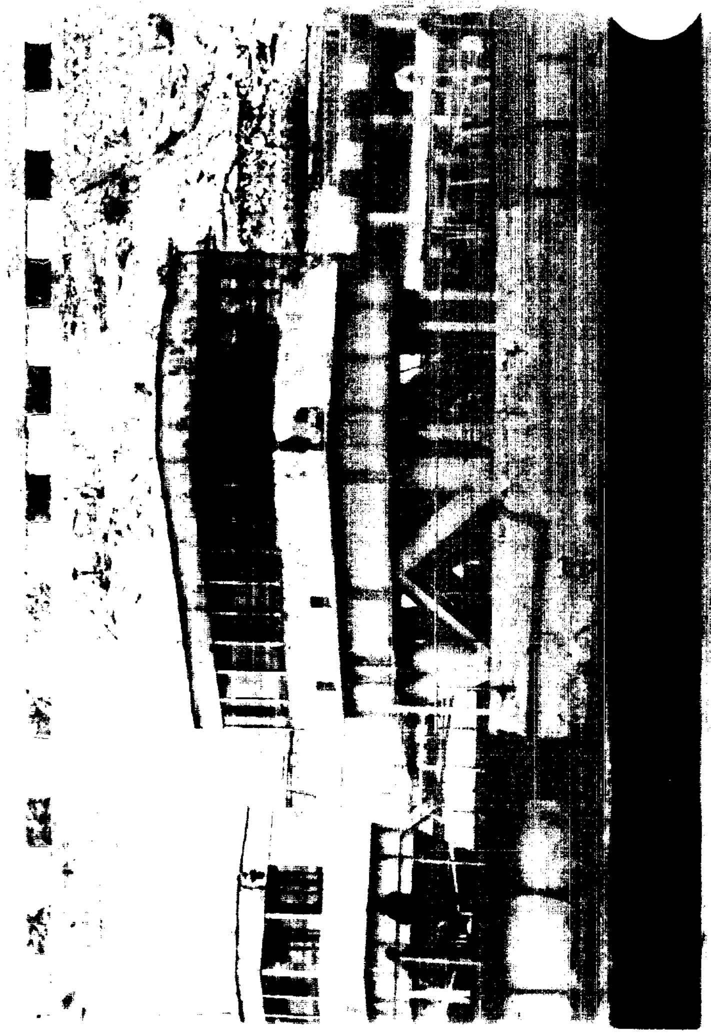

2


3


4

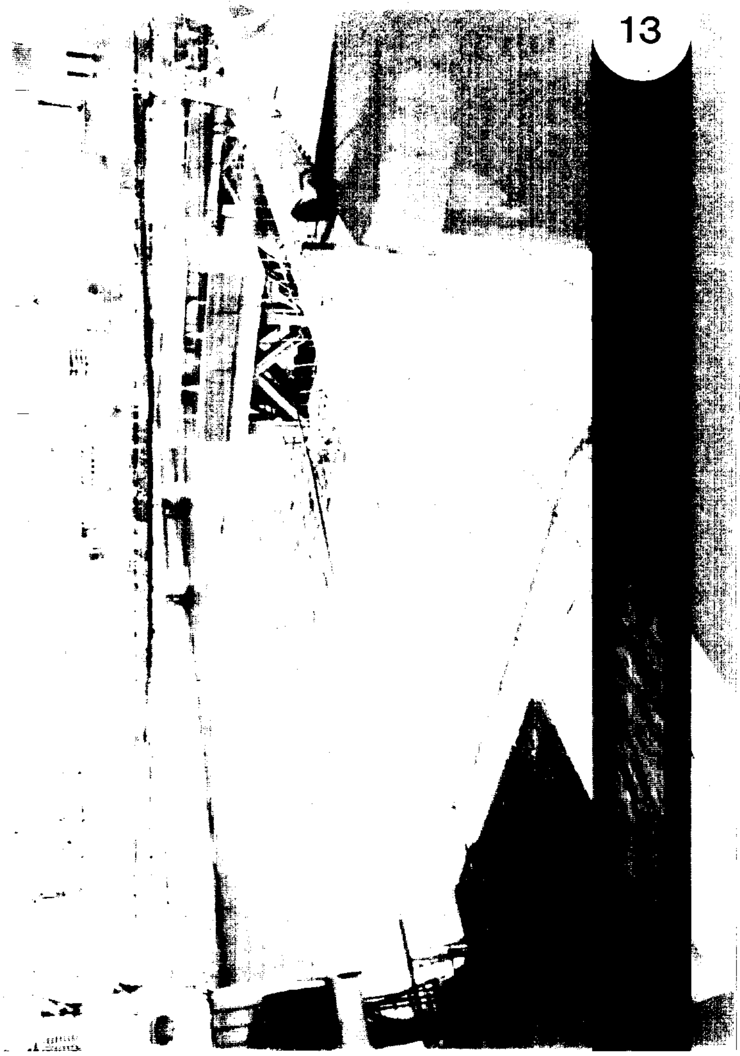
7

8



11

12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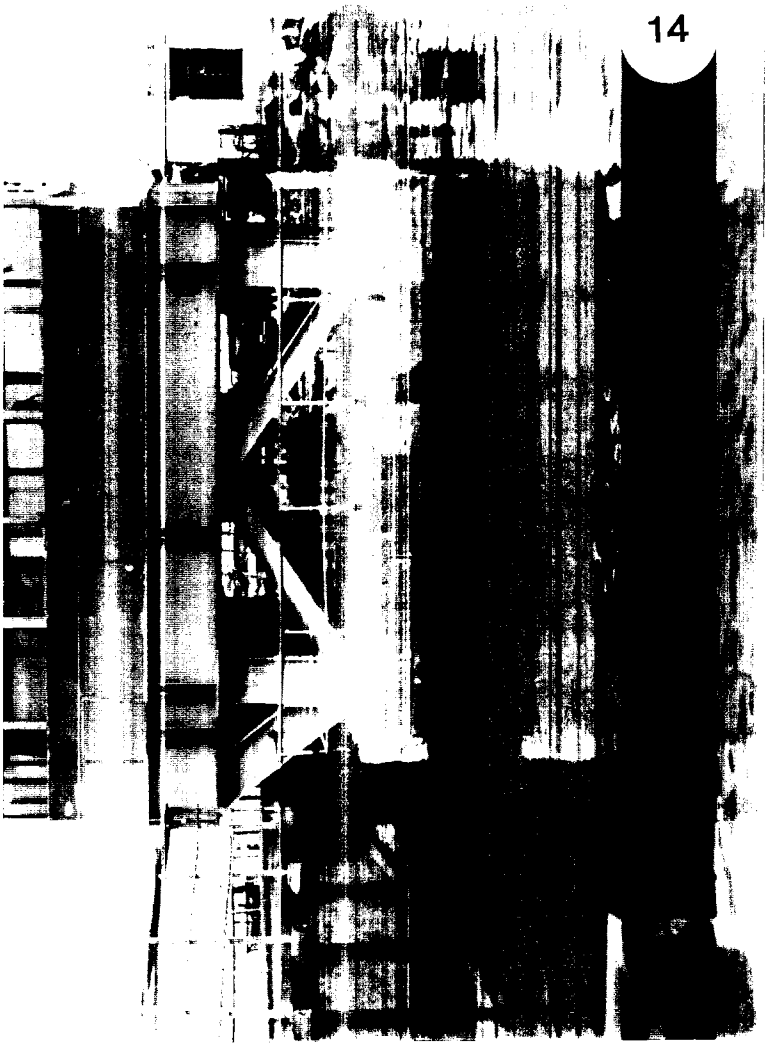
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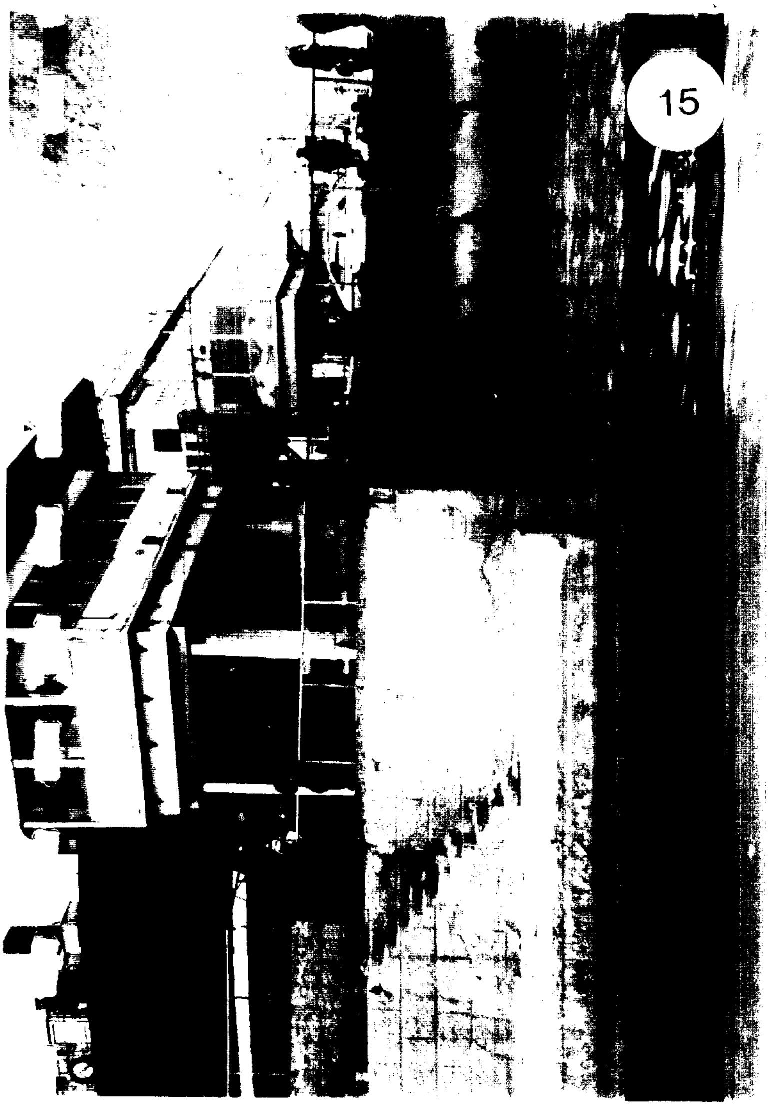
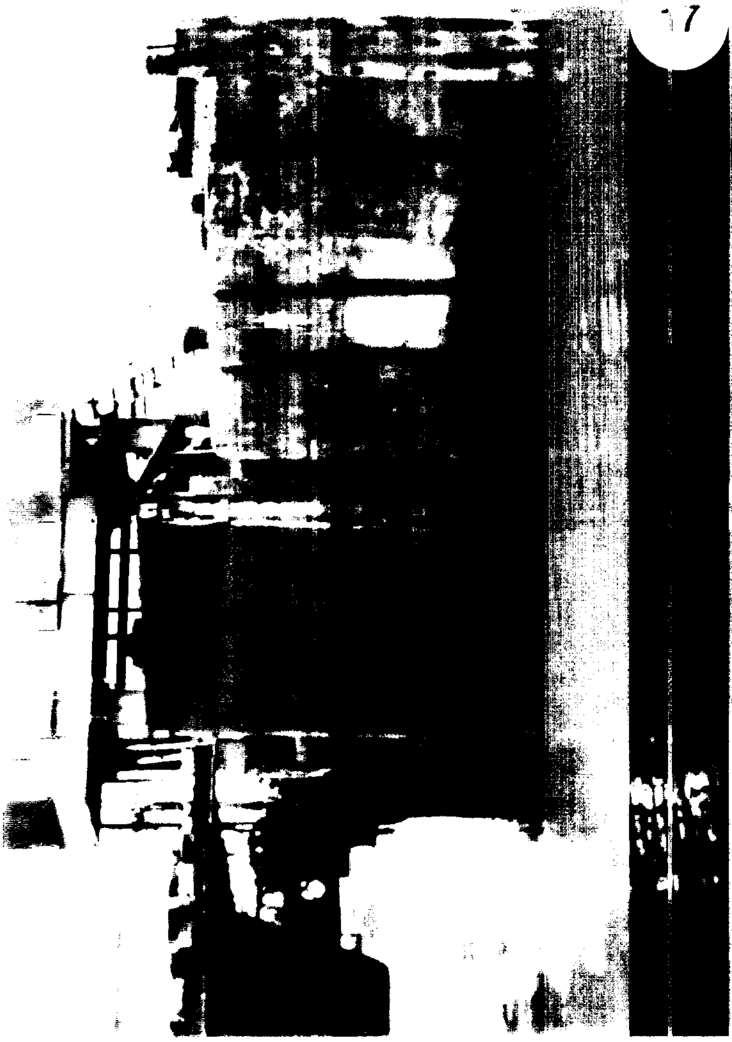

15


16

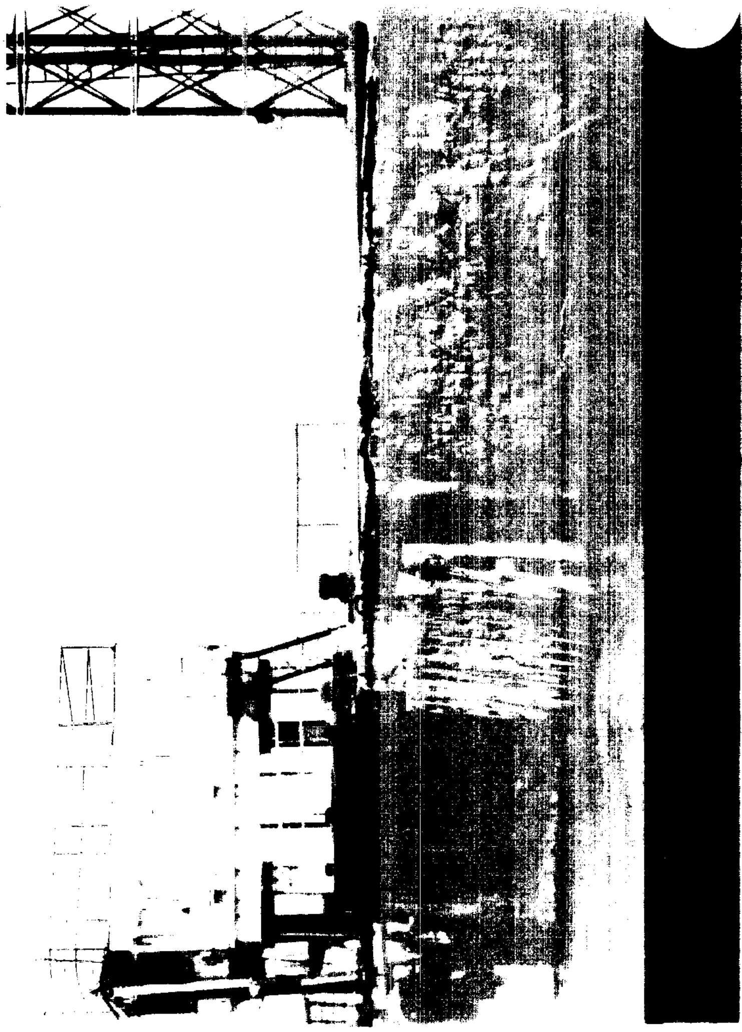


17

18

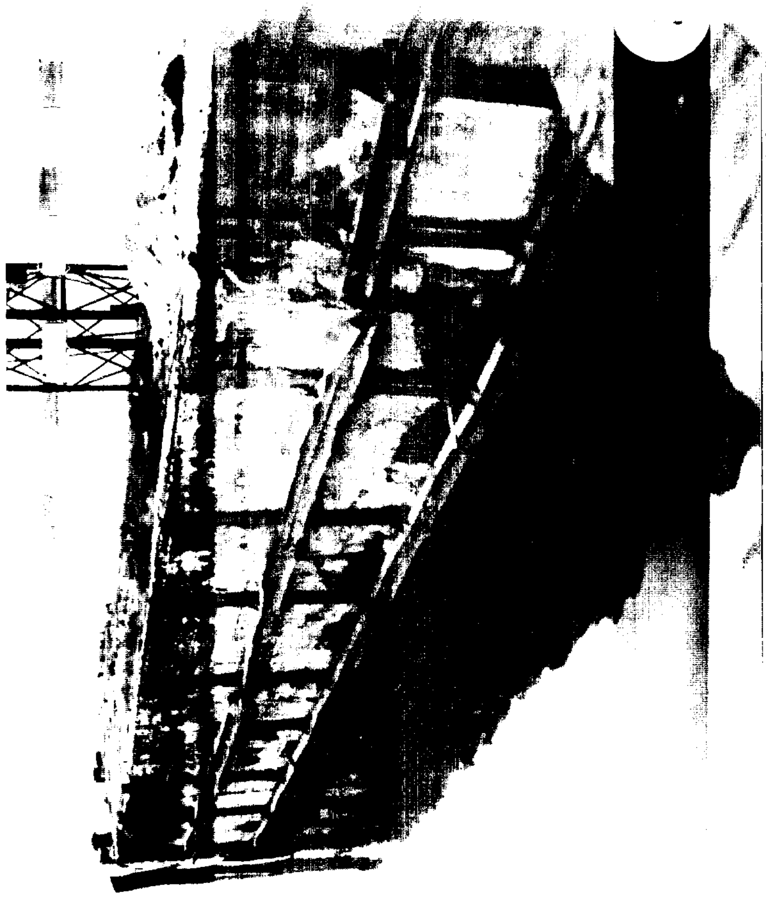
19

20



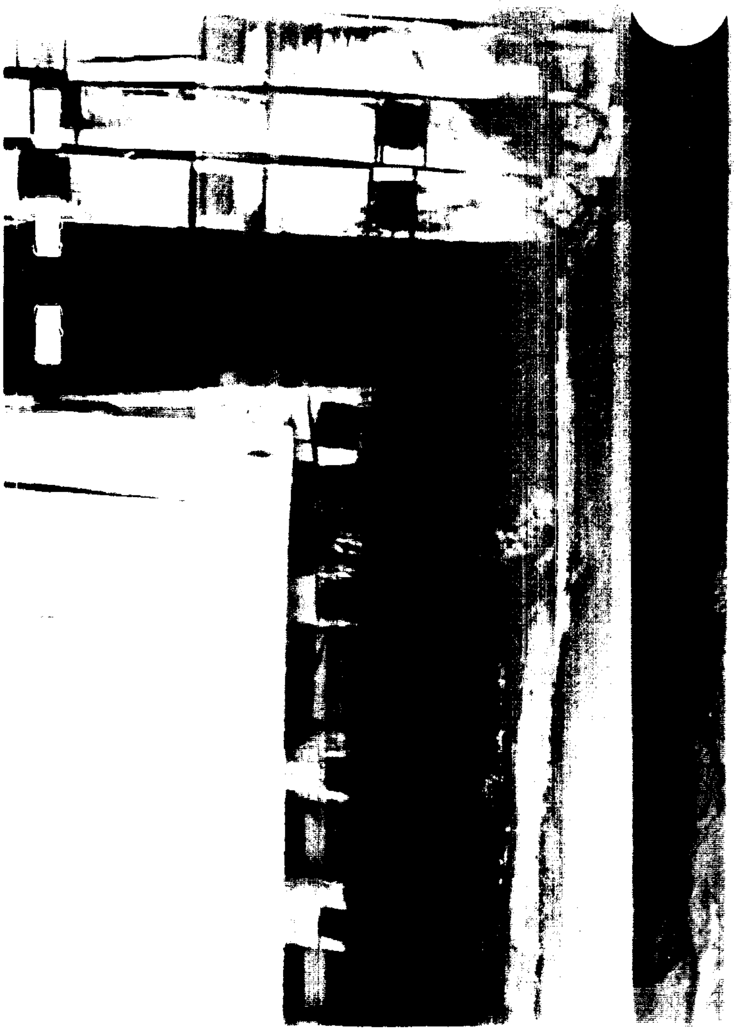
23

24



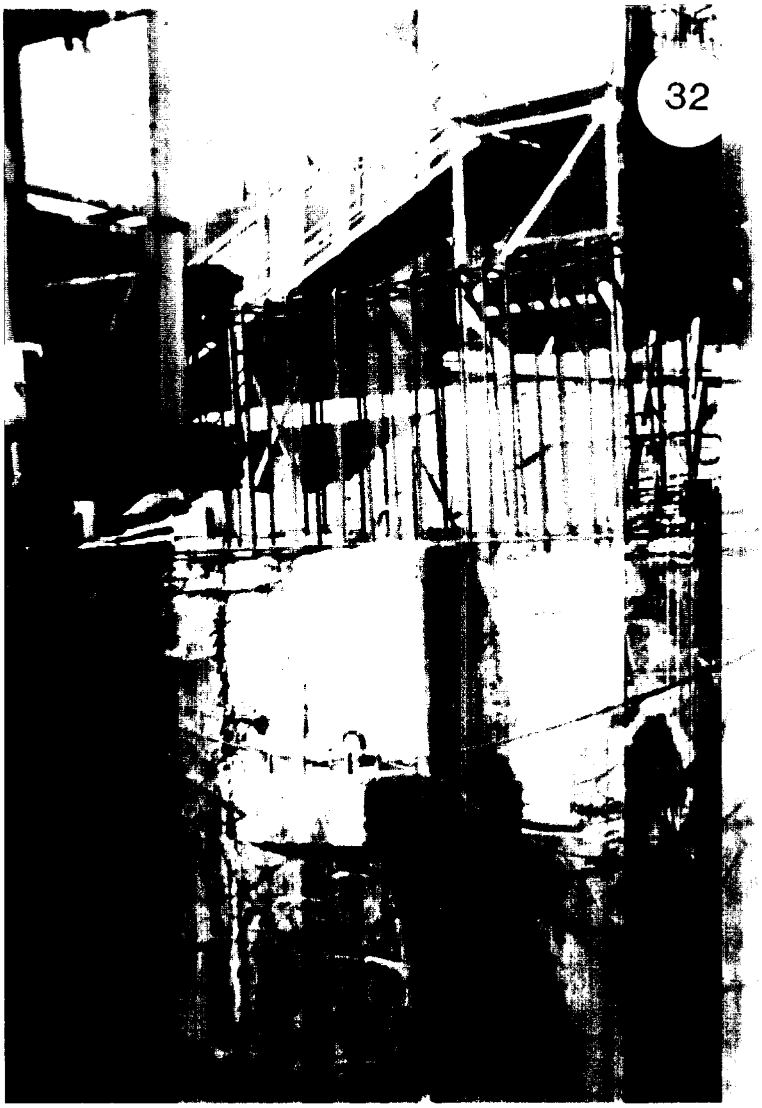
27

28

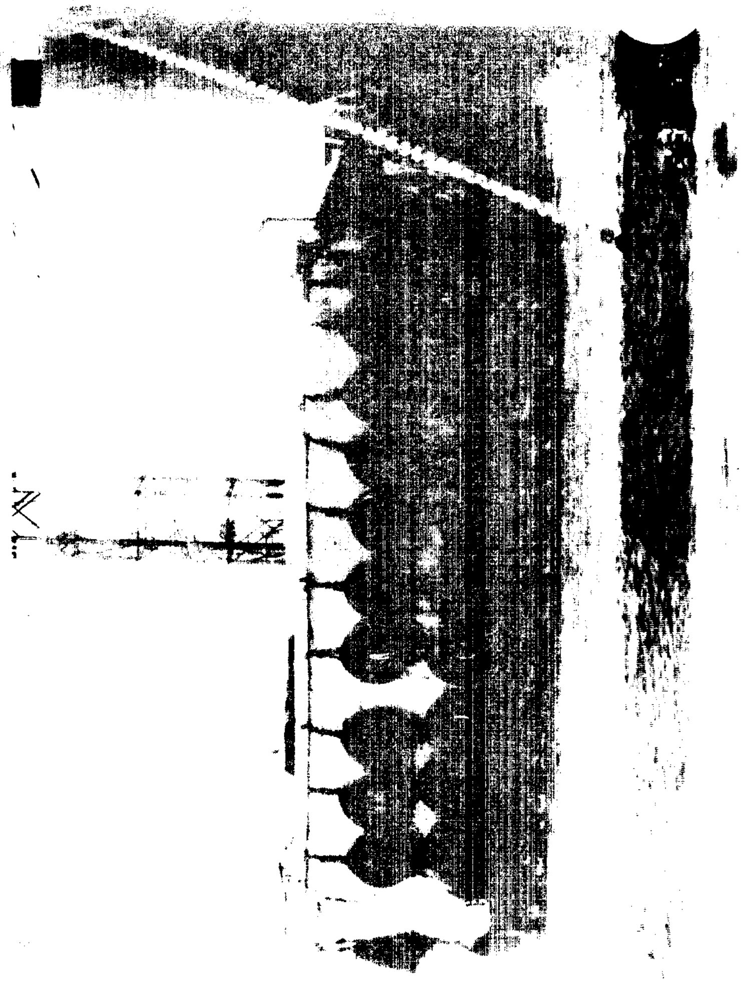


30

31



32



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INSPECTION REPORT

RAMPS AND MECHANICAL SYSTEMS

Table of contents

Enclosures

DRAWINGS

PHOTOS

All three spans are counterbalanced by counterweights placed in pits under the lifting towers and connected to the spans by steel wires (Dwg. no. 9 and 10).

The structures of the first and second span are equal (Dwg. no. 3), the main parts being three longitudinal I-girders connected by cross beams, which supports the longitudinal auxiliary beams, on which the rail tracks are mounted.
The stability and rigidity of the spans are secured by bracing connecting the main girders below the cross beams.
The spans are covered by a wooden deck supported by secondary cross beams suspended between the longitudinal main girders and auxiliary beams.

The structures of the third span differ from that of the first and second span, due to the greater length, the requirement for a more flexible structure, and the required adaptation to the ferry structure.

The main parts of the third span (Dwg. no. 4) are four longitudinal I-girders connected by steel cross beams with intermediate timber, which supports the rail tracks.
The stability of the span is secured by bracing connecting the main girders below the cross beams.
The span is covered by a wooden deck supported by the timber on the cross beams.

2.3 Lifting towers and Control tower

The lifting towers are steel structures placed upon concrete substructures, which contain the pit for the counterweights (Dwg. no. 9).

The steel structures consists of a heavy substructure (Dwg. no. 6, 7 and 8), which carries the weight of the spans and the counterweights and, as regards the towers in the first and second row, also the traffic load.

The superstructures of the towers are light weight steel structures with brick walls constituting the machinery houses.

The control tower is a concrete building, which is not included in this survey.

2.4 Machinery

The machinery in the towers in the first and second row are almost identical, and are composed of an electrical motor of 7.5 kW, which through a gearbox is connected to the spindle bearing and drive arrangement (Dwg. no. 11 and 12).

Further, a secondary output shaft from the gearbox is, through a secondary transmission gear train, connected to the control box containing the limit switches etc. for the control system.

1. Introduction

This Annex describes the present state of the link span ferry ramps and the operating machinery for the ramps at the ferry terminal of Baku.

The ferry terminal at the Port of Turkmenbashi was inspected by another team at an earlier date, and the findings are very similar to the findings at the Baku terminal.

Inspections of the structures and the machinery as well as taking photos of the same was carried out on a site visit from 29th of April to 9th of May 1996.

2. Structures Surveyed

2.1 General

Enclosed drawing no.1 is a plan of the ferry terminal in Baku. This report treats the survey of the link span ramps, the steel structures of the lifting towers, and the machinery for raising and lowering the ramps. Upon the drawing the different structures are numbered as follows:

4, 6:	First span of ferry ramps
7, 8, 9, 10:	Lifting towers (first row from land side)
11, 13:	Second span of ferry ramps
14, 15, 16, 17:	Lifting towers (second row from land side)
18, 20:	Third span of ferry ramps
21A, 22A, 22B, 23A:	Lifting towers (third row from land side)
22C:	Control tower

2.2 Ferry ramps

Each of the two ferry ramps consists of three spans (Dwg. no. 2) .

The first span is seated upon three pivot bearings fixed to the land side concrete substructure (Dwg. no. 5) and suspended from two spindles at the lifting towers in the first row (Dwg. no. 9).

The second span is seated upon three pivot bearings fixed to the nose end of the first span, and suspended from two spindles at the lifting towers in second row.

The third span is seated upon three pivot bearings fixed to the nose end of the second span (Dwg. no. 5), and suspended from two lifting wires at the lifting towers in the third row (Dwg. no. 10).

One of the documents obtained is a report of an inspection of the condition of the ramps carried out in the period of August through December 1990 and issued in 1991: "Inspection of the technical condition of the lifting transitional bridge (2-step, moor no. 13)".

The conclusion of this inspection, which also included calculations of the carrying capacity of the ramps, was that the ramps are able to sustain the passing of all types of freight trains with a speed of 5 km/hour.

Obviously the worst case of loading considered is a freight train of wagons weighing 10.5 ton/meter pulled by the locomotive type TEZ.

Without knowing the type TEZ engine, we reckon that this is a rather heavy load, and that the report strongly supports the general impression, that the ramps are in good condition

3.2 Ferry Ramps

The ramps themselves generally appeared to be in a good condition.

The traverse assemblies at the end of the lifting beams, to which the counterweight wires and the spindles are attached, are partly submerged, and some of them had been replaced by new assemblies due to failure caused by severe corrosion and mechanical damages.

The workmanship of the new assemblies was clearly not satisfactory, and we were informed that the physical properties of the steel material used were inferior to that of the original assemblies.

Wooden deck:

The deck of the ramps was in a very poor condition, and it was clearly only a matter of time before one of the heavy trucks would break through the timber (Photo no. 2).

Obviously the cross beams of the first and second span are too widely spaced to render sufficient carrying capacity of the square timber used for the deck.

Temporary measures were taken to avoid accidents by placing steel plating on top of the wooden deck and mounting additional cross beams to the structure.

Land side spans:

The ramps no. 4 and 6 are partly submerged, i.e. the lower flanges of the I-girders

The machinery in the towers in the third row are almost identical, and are composed of an electrical motor of 11 kW, which through a gearbox is connected to a winch to which the hoisting wire is fastened (Dwg. no. 13).

The hoisting wire is guided over a fixed sheave in the tower, through two sheaves on the bridle beam, two sheaves in the opposite tower, and fixed to the tension weight in the opposite tower.

Further, the machinery is equipped with an electromagnetic brake acting upon the through-going axle from the gearbox.

Also these machinery's are equipped with a control box containing the limit switches etc. for the control system.
The control box is connected to the axle of the winch through a secondary gear transmission.

Two of the machinery's are further equipped with crank handle, which through a gear transmission and a manual clutch is connected to the through-going axle of the motor.

3. State of Repair

3.1 General

It was not possible to carry out a complete inspection of the general condition of the ramp structures because of the high water level, which prevented admission to the structures underneath the deck of the ramps (Photo no. 1).

The two innermost ramps were elevated to the highest possible level, and the wooden deck had been fitted in that position, so that these ramps performed almost as a fixed ramp.
Only the seaside ramp was actually operated during ferry call at the terminal.

Therefore, it was not possible to see the machinery for the innermost ramps in function.

The documentation (drawings, calculations and operational descriptions) for the ramps and machinery is present at the Port of Baku, but located in different offices at the Port Authorities and at the ferry terminal.

However, the team did not succeed in obtaining all of the necessary documentation during the visit.
It is anticipated though, that a full copy of the documentation may be obtained at a later date.

Further, the vertical motions of the ferry, owing to waves during rough weather especially with wind from south-west, causes the aft end of the ferry to accelerate faster than the ramp in the downward direction thus separating from the ramp and later collide with the ramp, when the ferry end moves upward while the ramp is on its way down.

The reason for this affliction is probably the unfortunate water filling of the counterweight pits.
Because of this water filling, it has been necessary to increase the weight of the counterweights to compensate for the buoyancy, as an attempt to pump the water out of the pits were not successful.
However the increased weight of the counterweights will tend to decrease the downward acceleration of the ramps, when the counterweights are above or partly above the water.
Further the water filling will cause a dampening effect upon the moving counter-weights and therefore will also dampen the motions of the ramps.

The separation of the ramp from the ferry naturally disconnects the retainer pin in the nose end of the ramp from the ferry, which again transfers the reaction forces from the ferry totally to the wires which connects the ferry to the middle span of the ramp.
The wires are not designed for total transmitting of these forces, and a situation where the wires might break is very possible, and very hazardous.

3.3 Lifting Towers

All Lifting Towers were inspected from the outside and those open for access also from the inside.
The Towers not open for entrance were no.'s 7, 8 and 9.

Further the lifting beam ends and the consoles for the roller guides were inspected at each tower.

Generally the substructures of the Lifting Towers seemed to be in a rather good condition, whereas the superstructures showed signs of corrosion and deterioration of the brick walls.

Towers in the first and second row

The substructures exhibited weldings of varying quality, but cracks in the weldings were found only in the struts forming the K-lattice under the deck structure of the towers in the first and second row (Photo no.15, 16 and 17).
The numerous cracks were all found in the weldings at the intermediate plates connecting the two U-bars forming the struts, and the cracks had totally separated the plates from the U-bars.

and the lower bracing are below the water level (Photo no. 2).

Further, the bearing arrangements at land side are just above the water level and are flooded by propeller water and waves each time the ferries call at the terminal. This condition has caused severe corrosion of the bearings, the chock absorbers and the surrounding steel structures (Photo no. 3, 4 and 5).
Even the cross beams and the auxiliary longitudinal beams seems to be rather corroded at the innermost part of the ramps.

At the outermost parts of the ramps the corrosion seems to be much less severe, even though it was not possible to conduct a thorough inspection.

Middle spans:

The ramps no. 11 and 13 are positioned with the lower flanges of the I-girders just below the water level (Photo no.6), and the lover bracing and lower parts of the I-girders are flooded by propeller water and waves each time the ferries call at the terminal.

The lower parts of the ramps are overgrown with seaweed and are almost constantly moist (Photo no.7, 8 and 9).
Inspection checks at the seaward structures which were accessible showed, however, that when the seaweed, corrosion products and oil were scraped off the surface, the structure members underneath appeared to be in fairly good condition.

Taking a look through the timber decking, where possible, and along the ramps from the seaward end, the upper parts of the structures i.e. the cross beams and the auxiliary longitudinal beams etc. appeared to be in a good condition with almost intact paint coating.

Seaside spans:

The ramps no. 18 and 20 are all above the water level in calm weather conditions (Photo no. 10 and 11). The landward bend in the lower flanges of the I-girders are, however, positioned just at water level and are repeatedly flooded when the ramps are lowered to position upon the ferries.

These ramps are in good condition although corrosion at the area of the above mentioned bend in the I-girders has taken place.

The seaward ends of the I-girders and the cross beams at this end have been damaged from collision between the ramps and the ferry structure (Photo no. 12, 13 and 14).

The reasons for these collisions are due to the poor state of the fendering, which makes it difficult to correctly position the ferry when the ramps are lowered, and to hold the ferry in the correct position during the stay.

During the mounting of these structures, the existing structures had been damaged, but not severely.

3.4 Machinery

It was not possible to thoroughly inspect the machinery as it would require an extensive dismantling of the gearboxes, spindle drives etc.

Further, the innermost ramps had been parked at the highest possible level, and an operation of the machinery would possibly have displaced the timber deck.

However, a close view of all components of the machinery's revealed no damages or weaknesses, except for the brake drums of the electromagnetic brakes of machinery's in the third row, which were rather corroded due to the lacking regular use (Photo no. 28 and 29).
Also the machinery appeared to have been well maintained, as all moving parts were well greased, and bearings and spindles were covered by canvas for protection against the environment (Photo no. 22 through 31).

The electrical equipment upon the ramps and the in the towers, however, was in a rather poor state, as many limit switches upon the ramps were damaged and clearly not in operational condition.
Also, the cubicles in the towers had been replaced by temporary installations.

The control equipment in the control tower no. 22C generally appeared to be out of date with open access to hazardous high voltage areas, and a rather simple control desk (Photo no.32 and 33).

4. Future needs and capacity requirements

The ferry ramps will need to be elevated to a level where the full length of the ramps can be utilised.

It is imperative, that ramp no. 3 is able to follow the motions of the ferry to avoid damages to the ramp and the ferry.

Further the ramps need to be strengthened in order to be able to accommodate the future loading from trucks and lorries.
The strengthening may possibly be obtained by using hardwood timber rather than the low strength timber presently used.

The loading from locomotives need to be reconsidered as the existing rules prohibits the engines from entering the third ramp, while it was observed, that this rule is not always obeyed.

The cracks prevents the U-bars from acting as a coherent column, and the carrying capacity of the struts is considerably reduced.

These cracks were observed in the K-lattice of the towers no. 7, 8, 14, 15, 16 and 17. Most of the cracks appeared at only one of the two intermediate plates in one strut, but at tower no. 15 cracks at both plates separated the U-bars totally from each other in the south-west strut.

The lifting beam ends upon which the roller guide arrangements are mounted seemed to have been repaired or reworked, and the general workmanship lacked in quality showing bad welds and often also cracks in the welds.
This applies especially to the lifting beam ends at tower no. 9 and 10 (Photo no. 19).

The existing guide bars for the guide rollers had been heightened to allow for higher elevation of the ramps by welding an extension member to the existing guide bar forming a console on top of the concrete substructures.

The weldings connecting the console to the existing guide bar were generally of poor quality. This applies especially to the consoles at tower no. 9, 10 and 16.
At tower no. 16 the weld was cracked all through, which leaves ramp no. 13 without transverse support in the north-west direction (Photo no.18).

The guide roller arrangement upon the lifting beam ends consists of two cylinders with springs fixed to each side of the beam end.
The cylinder rods are connected by an axle, on which the guide roller is held in position in the middle of the axle by spacing tubes.

The cylinder rods were generally severely attacked by corrosion and some seemed unable to function as spring buffers.
At tower no 7, the roller axle was bend, indicating that ramp no. 4 had been exposed to excessive transverse forces.

Towers in the third row

The substructures of the third row i.e. towers no. 21A, 22A, 22B and 23A also showed weldings of varying quality, but no visible cracks.

In order to adjust the ramps to the highest possible elevation to compensate for the high water level, the lower flanges of the outermost beams in the deck structure of the towers had been cut to make room for the hoisting wires (Photo no. 20).

This of course weakens the beams resulting in a reduced carrying capacity.

At tower no. 23 A the substructure of the tower had been equipped with auxiliary structures for a travelling crane (for lowering a pump into the counterweight pit).

- New corrosion protection application
- Installation of new hardwood deck, rehabilitated bearings, rails and new hand railing.

5.3 Lifting towers

The superstructures of the towers should be rehabilitated according to the rehabilitation project.

The substructures are generally sound and suited for continued use, if the level of the concrete foundation structure is increased.

If so, the steel substructures of the towers may be reused after a thorough examination, rehabilitation and corrosion protection following the same procedure as described for the ferry ramps.

The struts in the K-lattice of the towers in the first and second row should probably be replaced as the cracked weldings have damaged the members, and as it is impossible to apply a good corrosion protection to the struts having the present shape.

The outermost beams in the deck structure of the towers in the third row shall be replaced.

As regards the beam ends of the ramps with guide roller arrangements these arrangements probably needs to be totally replaced.

5.4 Machinery

All machinery's shall be totally disassembled, and all gears, sheaves, bearings, spindles etc. carefully inspected for wear, deterioration and cracks, and worn and damaged parts shall be replaced.

All wires for counterweights and hoisting shall be replaced according to the rehabilitation project.

The electric equipment and control equipment together with the control desks shall be discarded and replaced with new and modern equipment.

According to the operators of the ferry terminal the new control gear should be based upon relay techniques rather than electronics for the sake of local availability of spares and ease of repair.

Possibly the ramps will need only two rail tracks upon ramp no. 3, as the existing ferries only have two tracks at the aft. end at the ramp connection, while the rail switches are positioned aboard the ferries.

If only two tracks are needed for existing and for future ferries, ramp no. 3 may be simplified, and the weight of the ramp slightly reduced.

The operating speeds of the ramps are considered to be sufficient also for future use, and the existing mechanical machinery, therefore, need only to be replaced in case of damages or excessive wear and tear.

5. Suggested Recondition

5.1 General

The rehabilitation shall be planned and performed in such a way, that the ferry terminal remains in operation throughout the rehabilitation period.

The existing structures and machinery shall be reused wherever possible and economically feasible.

Electrical wiring and controls shall be replaced with new and modern equipment for safe and reliable operation.

5.2 Ferry Ramps

The timber decking of all spans is in such poor condition, that all of the decks need to be replaced.

The steel structures are generally sound and suited for continued use after a thorough examination, rehabilitation and corrosion protection.

The rehabilitation of the ramps should be arranged as follows:

- Dismantling of one ferry ramp at a time incl. of all three spans
- Transport to a selected site on land, where sandblasting may take place, and rehabilitation can be performed
- Removing of wooden deck, rails, bearings, electric's and hand railing
- Total sandblasting of all steel structures
- Thorough examination of the structures including X-ray and ultrasonic testing for cracks and lamination
- Replacement of damaged parts and rehabilitation according to project
- Finishing sandblasting and cleaning

The stool shall be interchangeable with other stools of different heights, so as to allow for increasing or decreasing of the overall level of the entire ramp.

Slope and angles of the ramps

The maximum slope of the ramps as well as the maximum differential angle between the spans of the ramp and between the ramp and the ferry shall be determined by the Railway Authorities of Azerbaijan.

The Authorities have been asked these questions, and the answers are expected in the near future.

Often used figures for these parameters are:
- Max. slope: 6%
- Max. differential angle: 4.4% (i.e. 2.5 degrees)

6.3 Specification of Loads

Rail wagons and locomotives

The loading from rail wagons and locomotives should be determined by the Railway Authorities of Azerbaijan to whom the questions have been put.
The answers have not yet arrived.

Often used figures for these parameters are:
- Max. axle load: 22 ton.
- Max. load per meter of track: 8 ton.
- Max. speed upon the ramp: 5 km/hour

Motor Vehicles

The loading from motor vehicles should be determined by the Motor Vehicles Authorities of Azerbaijan.

However, the specification of loads may be adopted from the European Standards mentioned below.

Often used vehicles for design of ferry ramps are:
- Semitrailer with tractor having 3 axles each with an axle load of 8 ton upon the trailer and 3 axles upon the tractor with one axle load of 11 ton and two axle loads of 6 ton, equalling a total load of 47 ton.
- Roller with 3 axles each having an axle load of 13 ton.

Other loads

Other loads such as loads for pedestrians and nature loadings such as snow and

6. Design Parameters and standards

6.1 General

During the site visit, the team did not succeed in obtaining the standards and codes used for the design of the existing ferry ramps.

These standards and codes will be acquired at a later date prior to the commencement of the rehabilitation project.

One important code is: "Rules for Definition of Carrying Capacity of Metallic Spanal Structures of Railway Bridges", which obviously defines the loading from locomotives and wagons applied.

The loadings given in these standards shall be compared to those commonly used in the standards of the European Community, and the loadings to be used for the rehabilitation project will be determined from this comparison in co-operation with the Authorities.

6.2 Geometric Constraints

Ships

It is anticipated that the ships to be used in the future will be similar to the Azerbajdzan and Dagestan ferries owned by the "Caspian Shipping Company".

This means, that:

- The maximum trim forward and afterward will be max. 1.8 % during loading and unloading
- The maximum and minimum draught will be as for the existing ships
- The geometry of the connection between the ramp and the ship will be as the existing one
- The ramps need not be equipped with shunting tracks, i.e. only two straight tracks are needed upon the ramps.

Water level

With reference to the Baltic Sea, the maximum water level used for the design shall be -24 meter and minimum -29 meter.

Using the existing ramps under constraint of the maximum slope and maximum differential angles between the spans of the ramps, and between the ramp and the ferry, it may prove necessary to design a stool or pedestal, upon which to place the bearings of the first span.

wind loads shall be adopted from the standards mentioned below.

6.4 Standards for Design of bridges

The carrying capacity of the ramps and towers shall be calculated using the principles of limit state design according to the European/British standard BS 5400 for "Steel, concrete and composite bridges" where appropriate as follows:

BS 5400:
- part 2: "Specification of Loads"
- part 3: "Code of practice for design of steel bridges
- part 9: "Code of practice for bearings

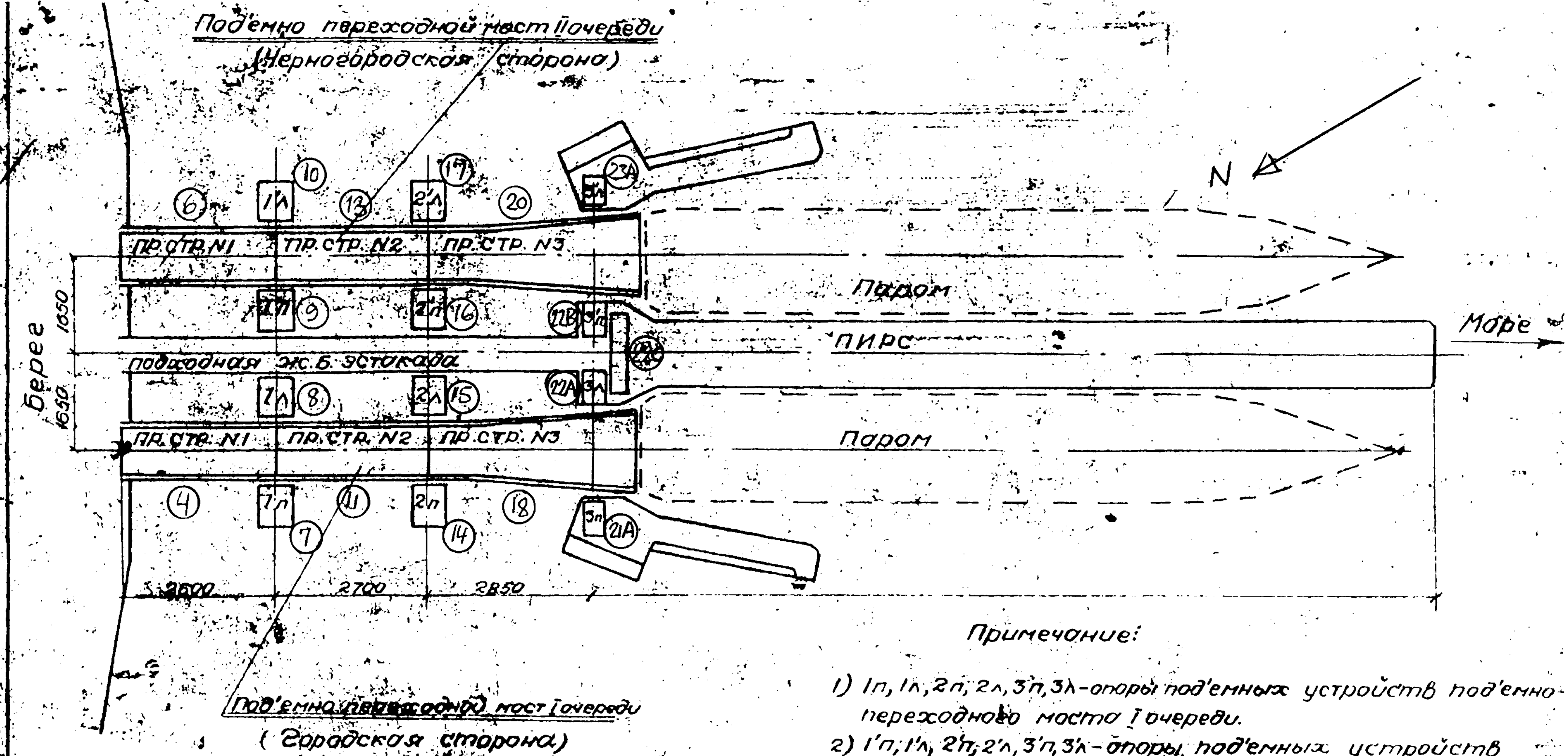
6.5 Standards for Materials and Workmanship

The standard used for the materials in the existing structures shall be acquired, and the material properties stated herein shall be used in the calculation of the carrying capacity of the existing structures.

The workmanship and specifications for new materials to be used in the rehabilitation project shall follow the specifications in:

BS 5400:
- part 6: "Specification for materials and workmanship, steel"

DRAWINGS



Примечание:

1) 1п, 1л, 2п, 2л, 3п, 3л - опоры под'емных устройств под'емно-переходного моста I очереди.

2) 1'п; 1'л, 2'п; 2'л, 3'п, 3'л - опоры под'емных устройств под'емно-переходного моста II очереди.

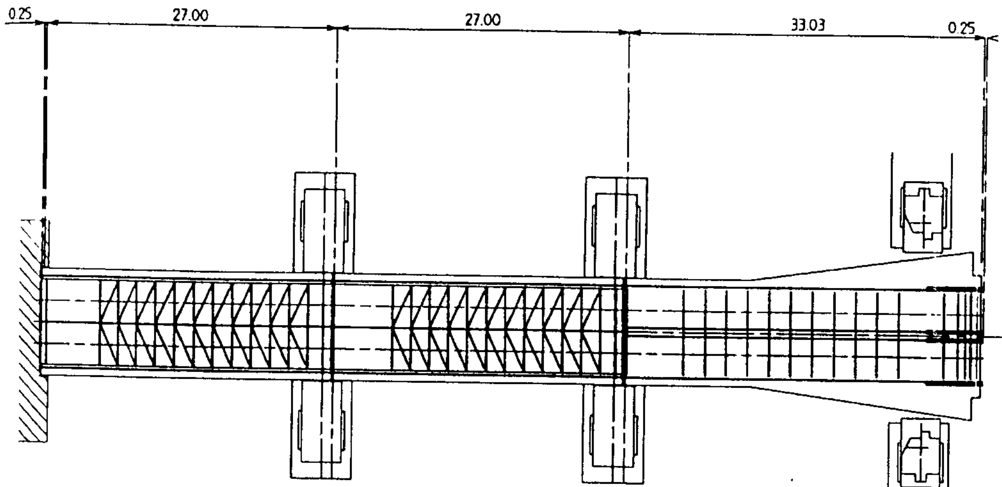
Рис. 1.1. Эскизный план причальных сооружений паромной переправы

8

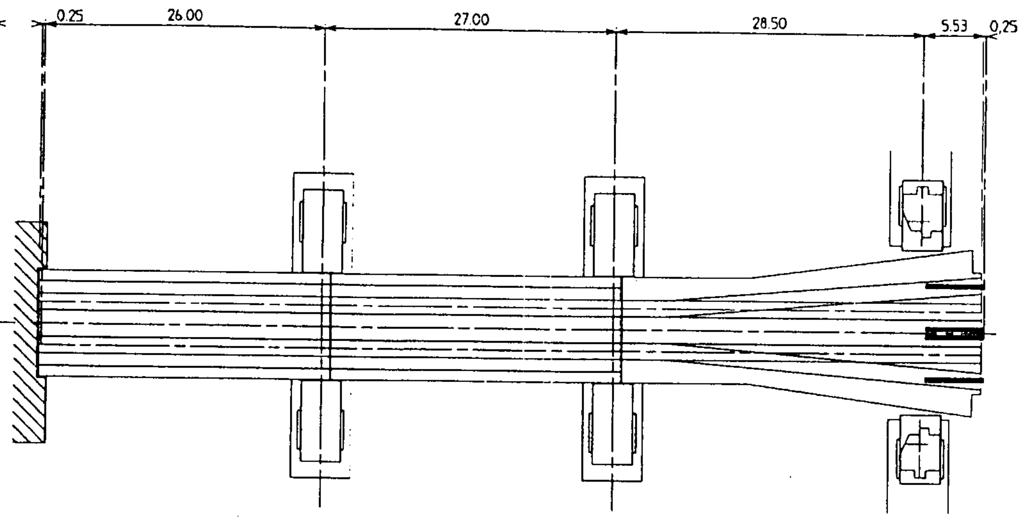
FERRY TERMINAL, BAKU

1

PLAN VIEW



PLAN VIEW



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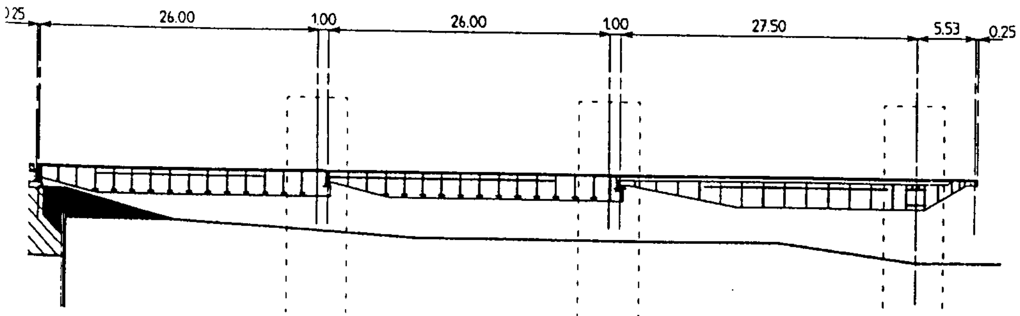
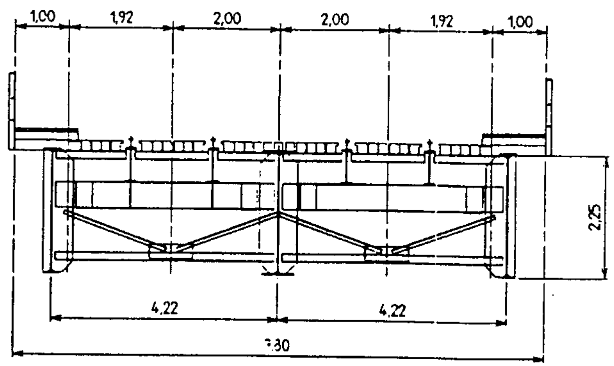


CROSS SECTION
Scale · 1/100



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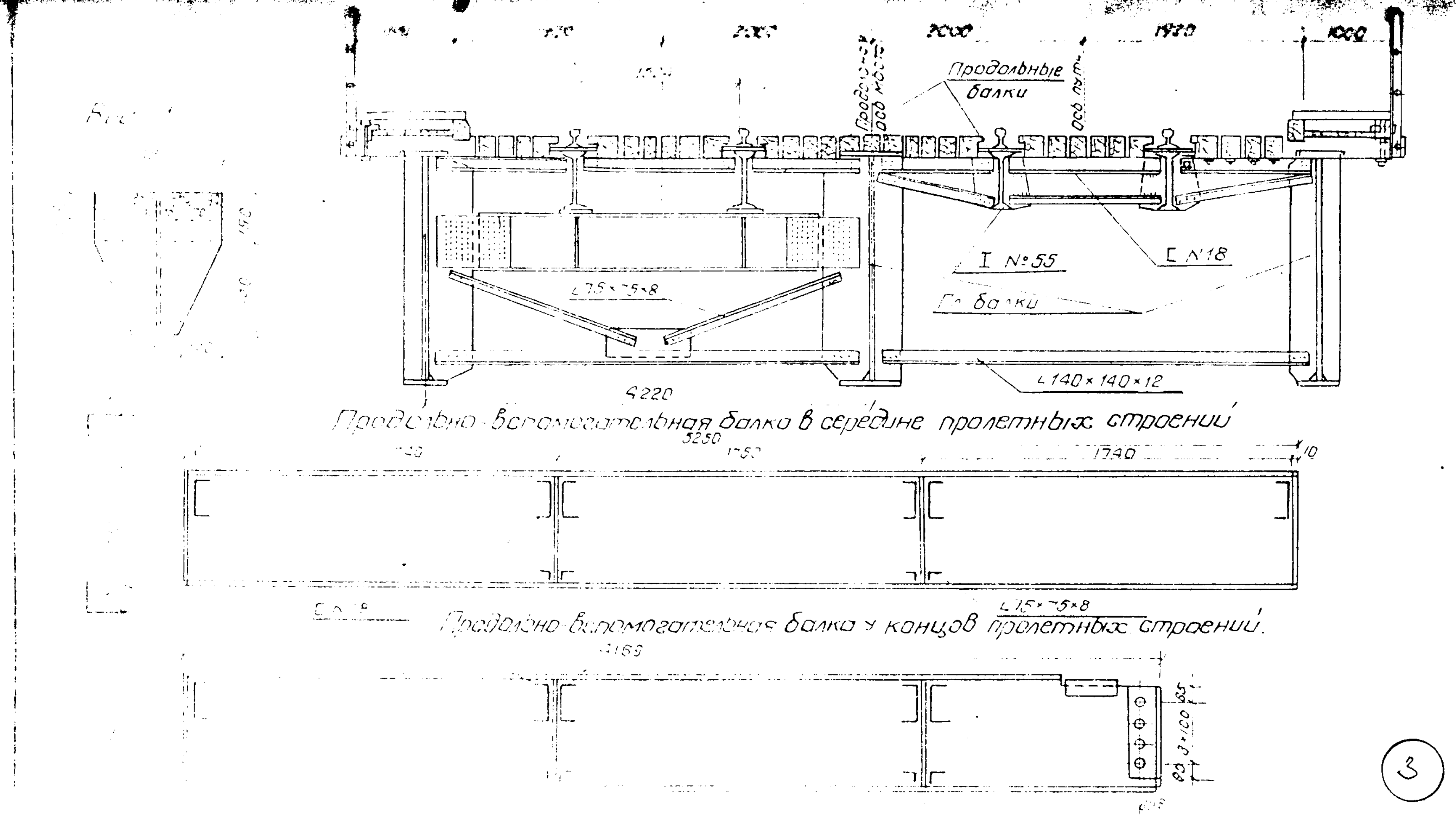
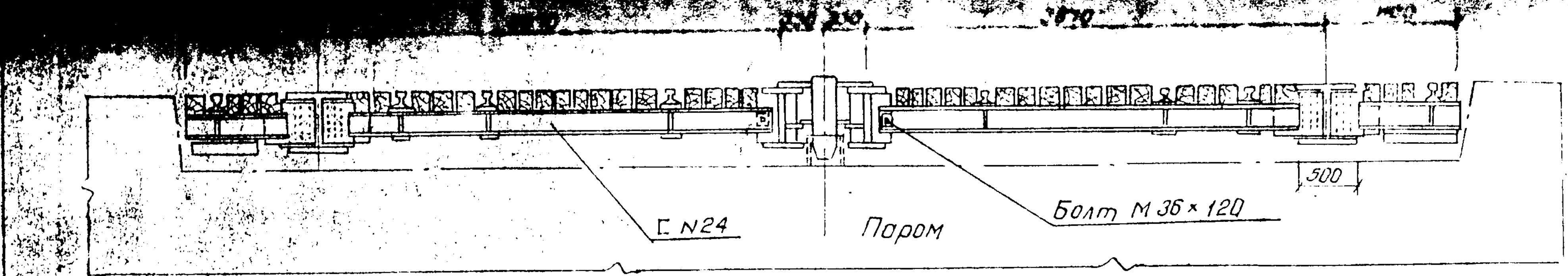

Продольные балки
ось пути
ось моста
I №55
[№18
Гл балки
∟75×75×8
∟140×140×12
4220
2000
1920
1000
5250
1740
10
∟75×75×8
3×100
85
80
3
Продольно-вспомогательная балка в середине пролетных строений
Продольно-вспомогательная балка у концов пролетных строений.



Поперечный разрез пролетного строения N3 в пролете

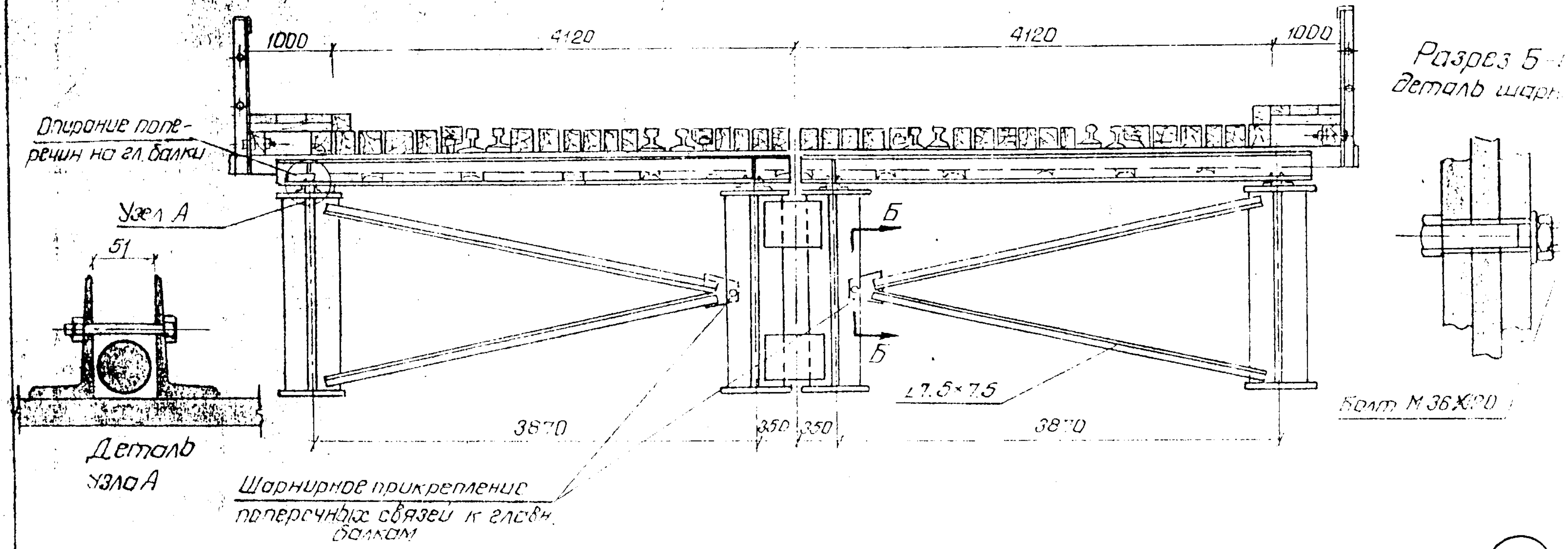
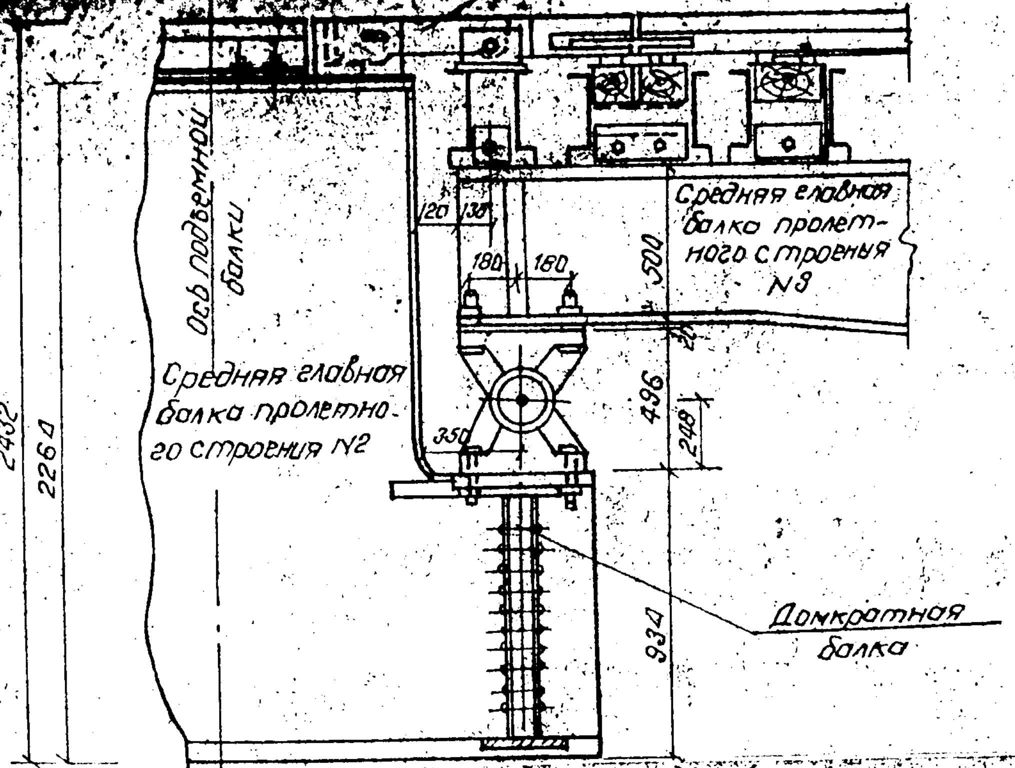
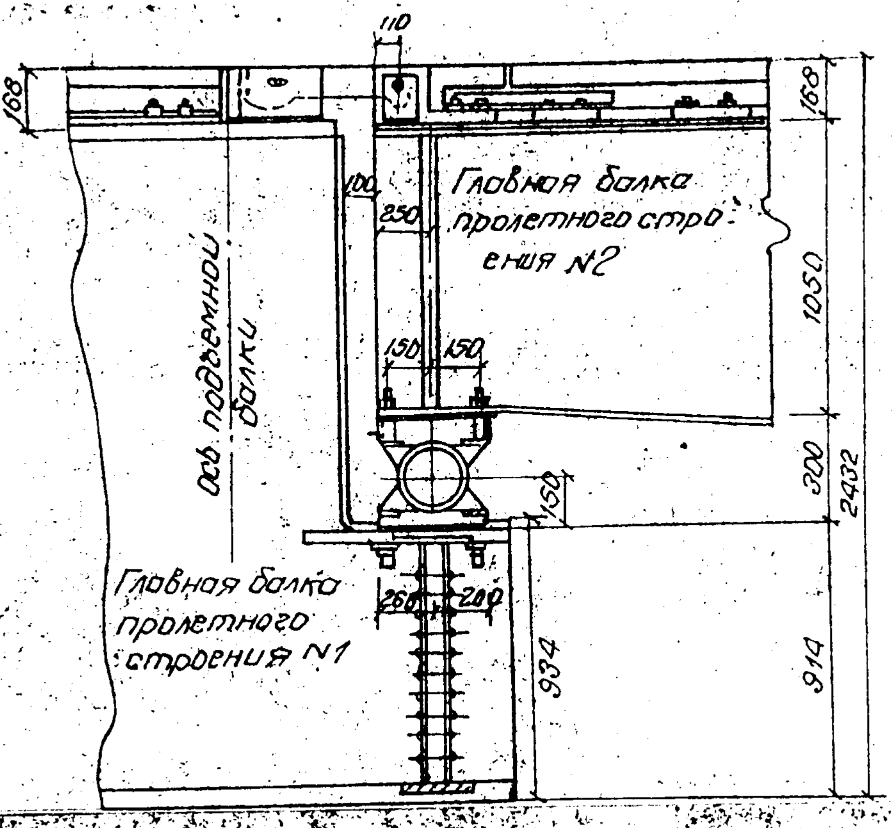
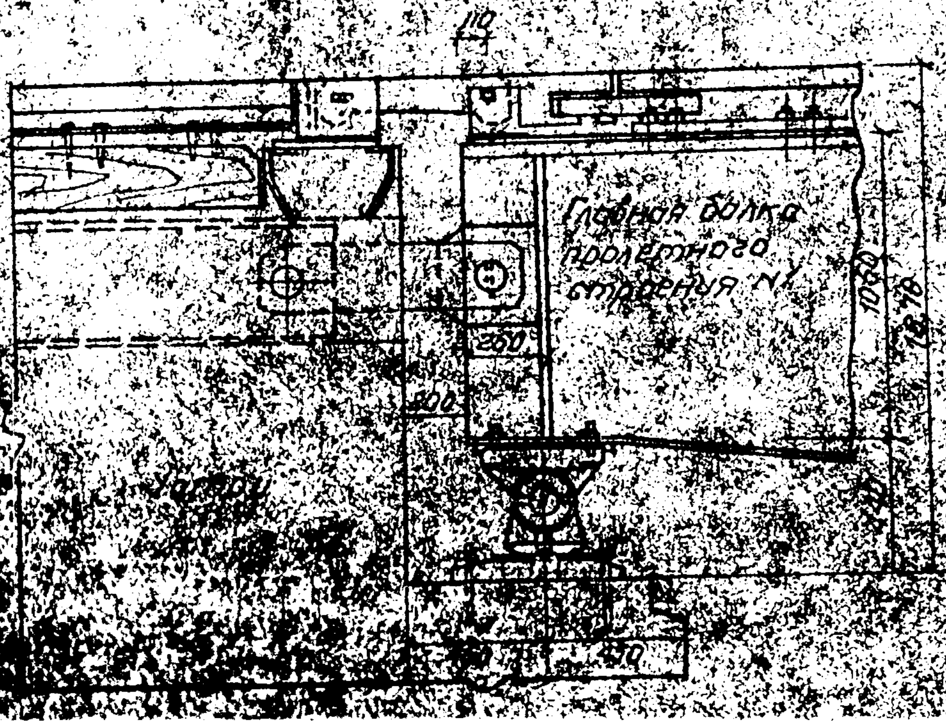


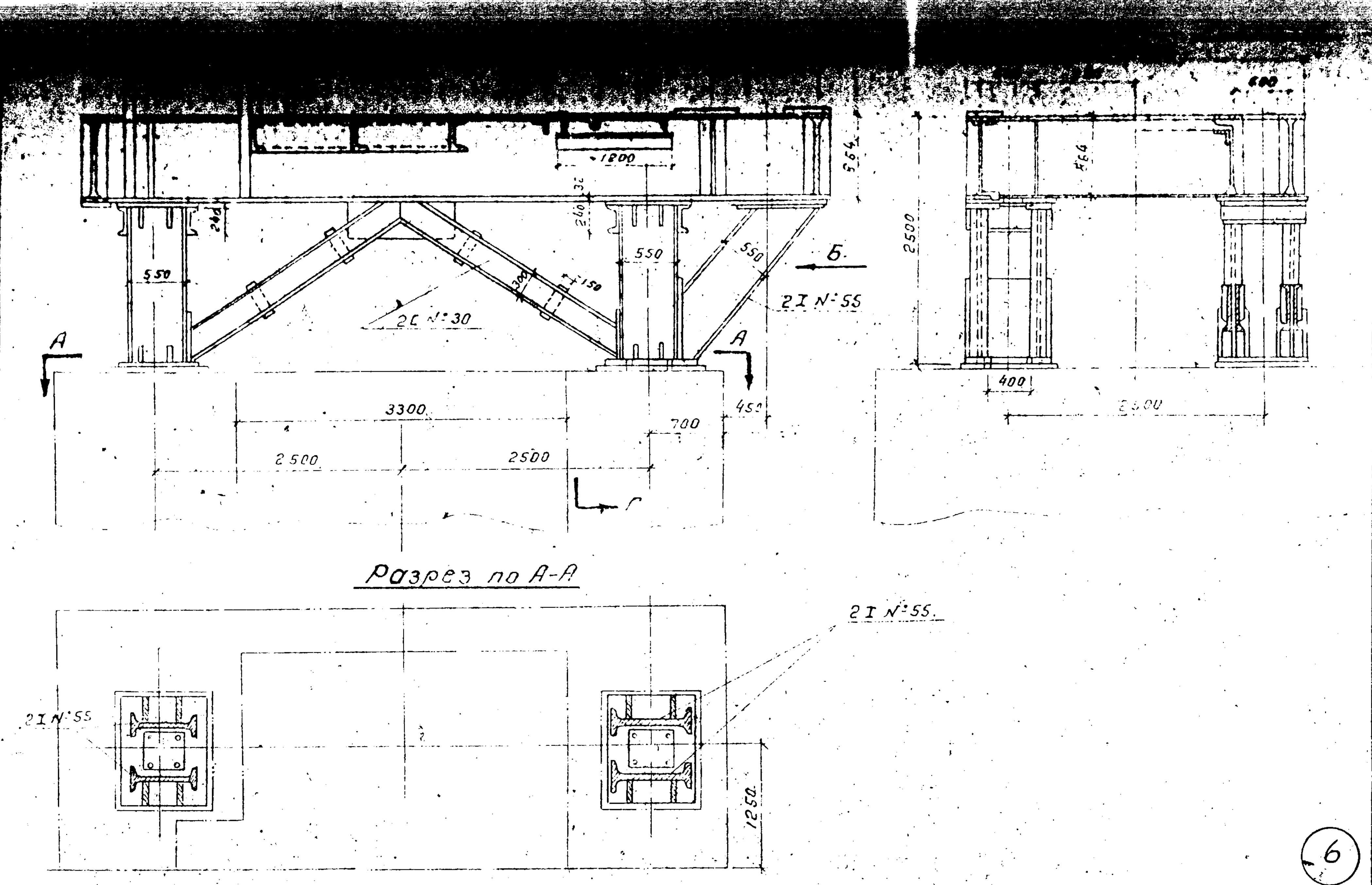
Рис. 8 Пролетное строение N3. Поперечные разрезы

4


Ось подъемной балки
Средняя главная балка пролетного строения N2
Средняя главная балка пролетного строения N3
Домкратная балка
2432
2264
120
130
180
180
500
496
248
350
934


110
168
168
Главная балка пролетного строения N2
Ось подъемной балки
Главная балка пролетного строения N1
100
250
150
150
150
260
200
1050
300
914
934
2432

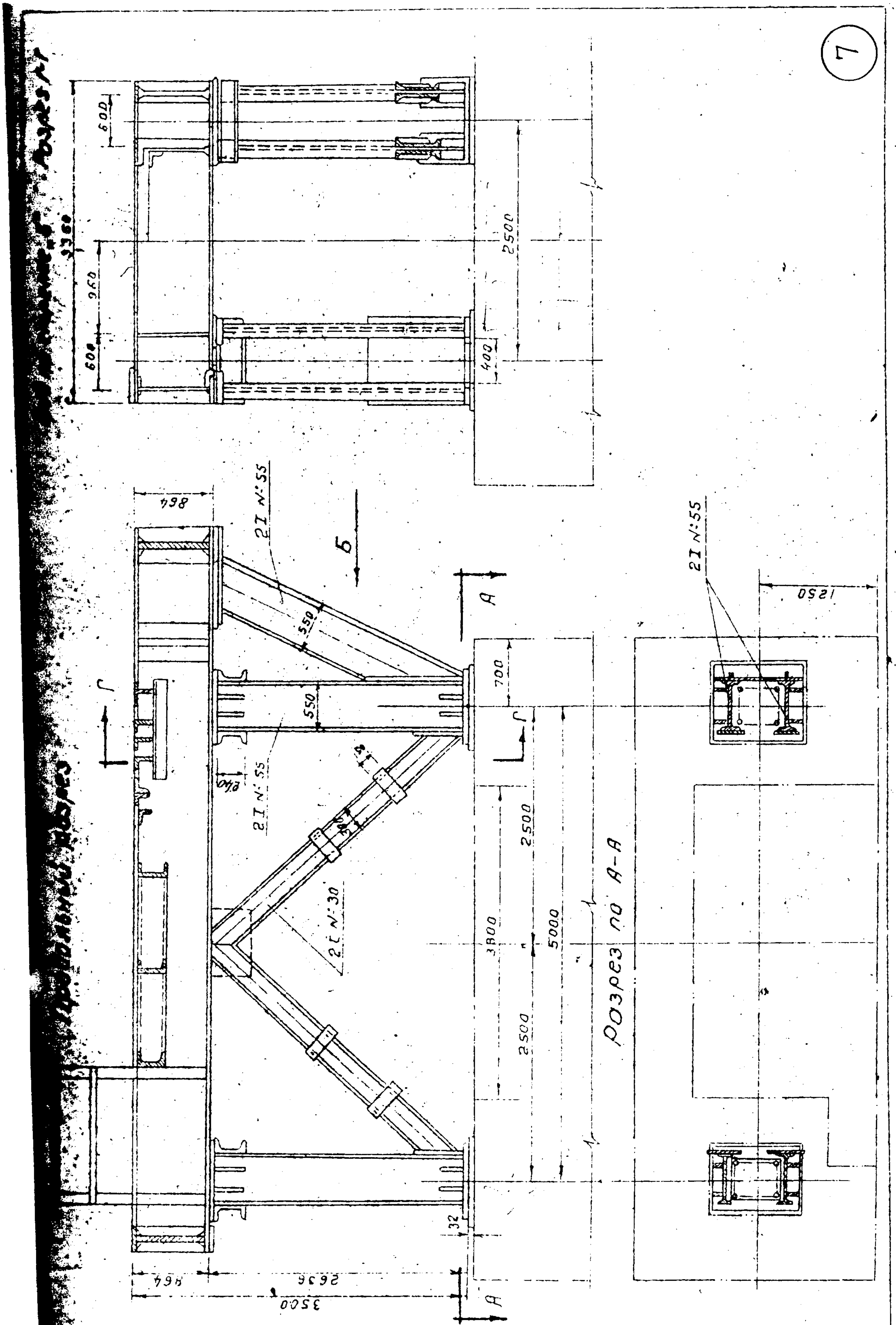

110
Главная балка пролетного строения N1
1050
260



...еская башня опоры N:1

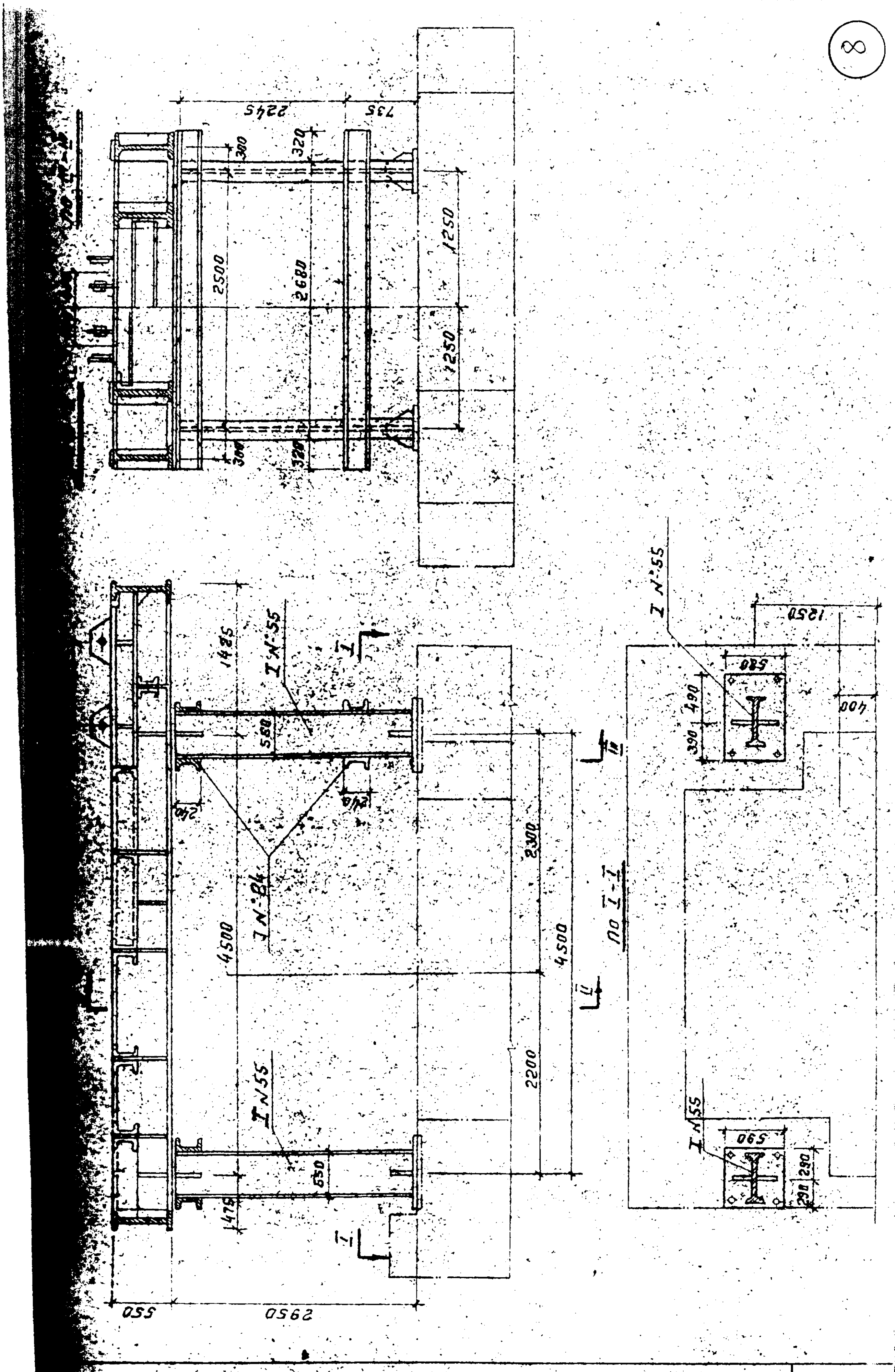
Лист 10

6



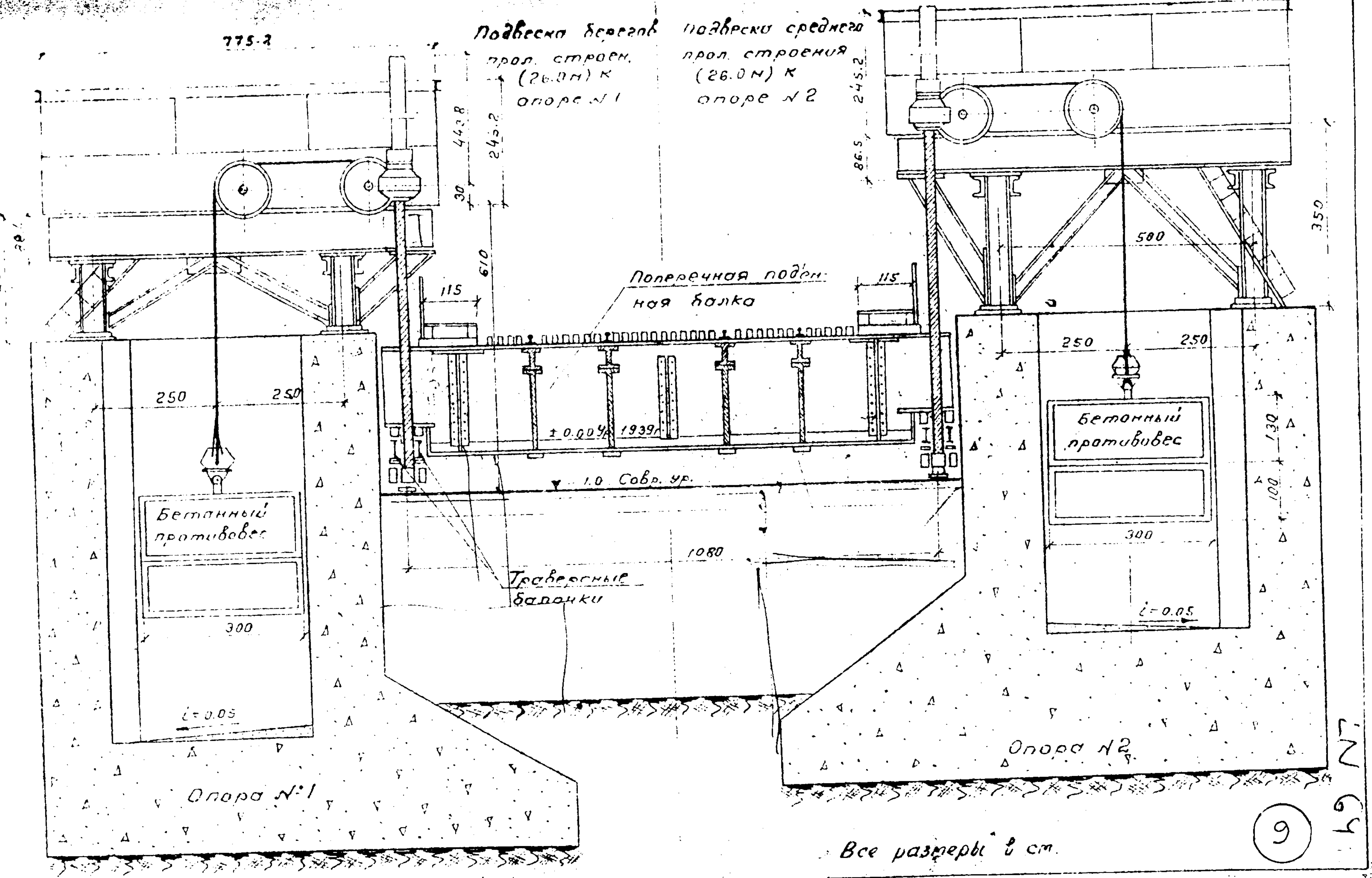
Металлическая башня опоры №2

Лист 11



Металлическая башня опоры N 3

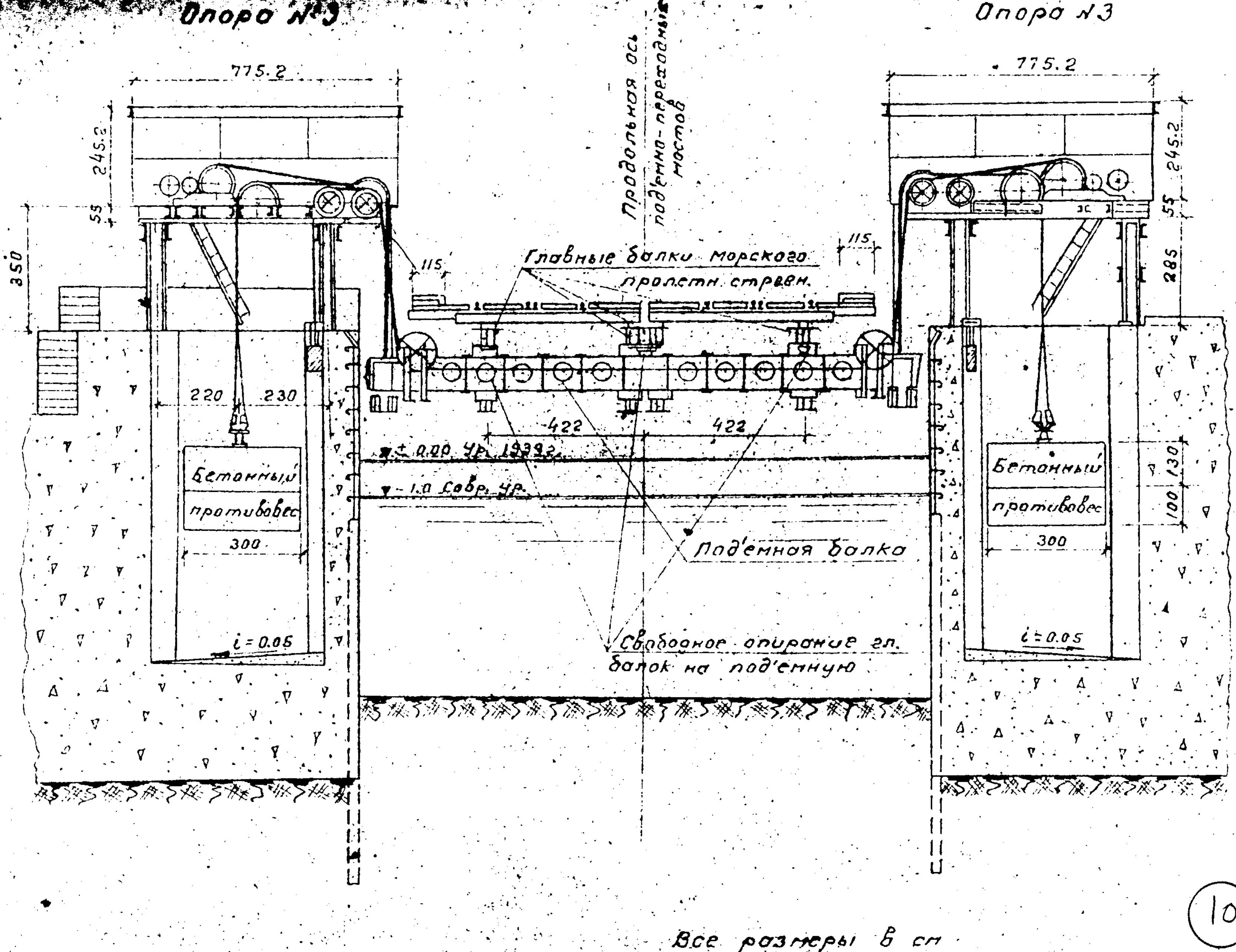
Лист



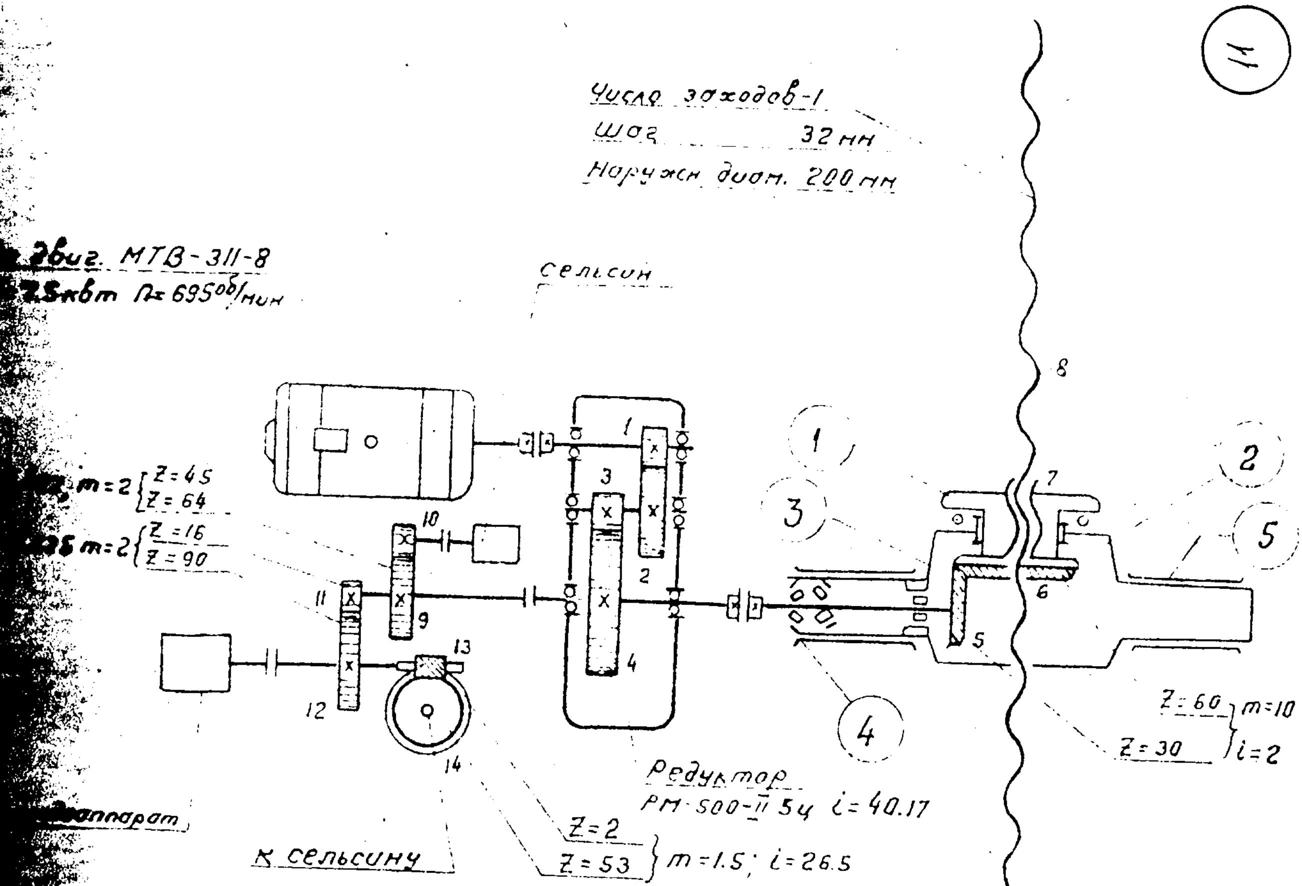
Все размеры в см.

9

№ 64

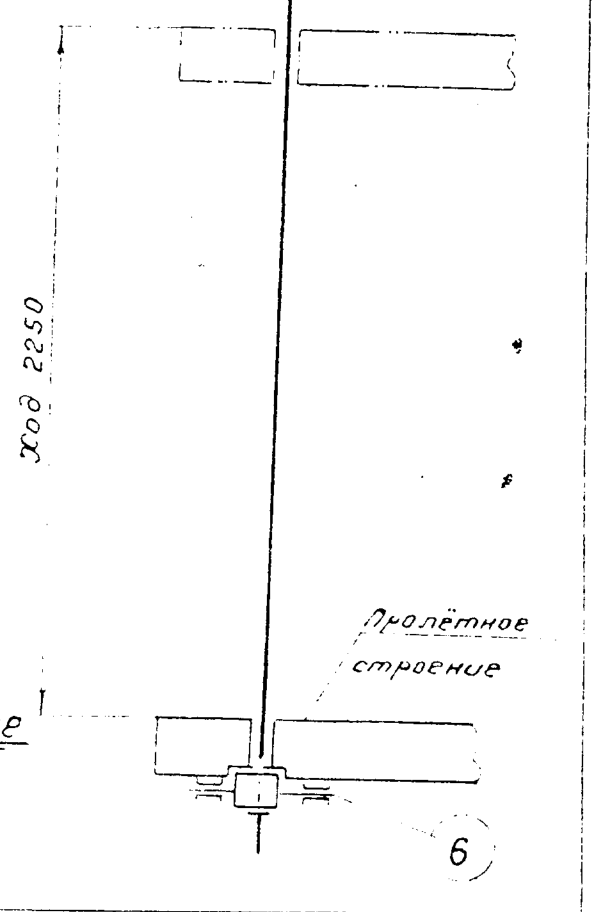

Опора №3
Опора №3
775.2
775.2
245.2
245.2
55
55
350
285
115
115
Продольная ось подъемно-переходных мостов
Главные балки морского пролетн. строен.
220
230
422
422
± 0.00 Ур. 1939 г.
- 1.0 совр. ур.
Бетонный противовес
Бетонный противовес
300
300
130
100
Подъемная балка
Свободное опирание гл. балок на подъемную
i = 0.05
i = 0.05
Все размеры в см

10



Примечание:

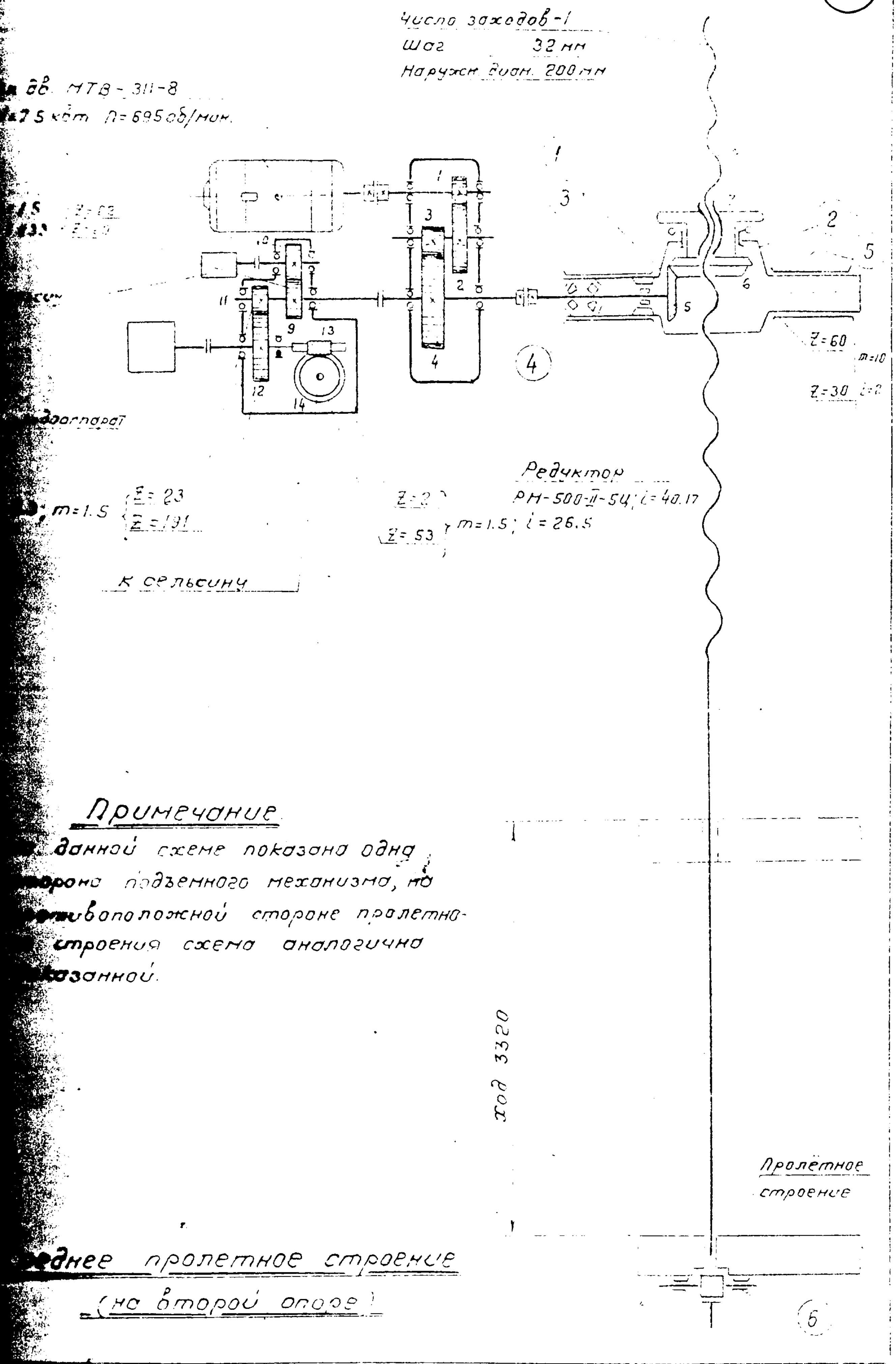
На данной схеме показана одна сторона подъемного механизма, на противоположной стороне пролетного строения схема аналогична показанной



Береговое пролетное строение
(на первой опоре)

Схема подъемного механизма

Лист 14



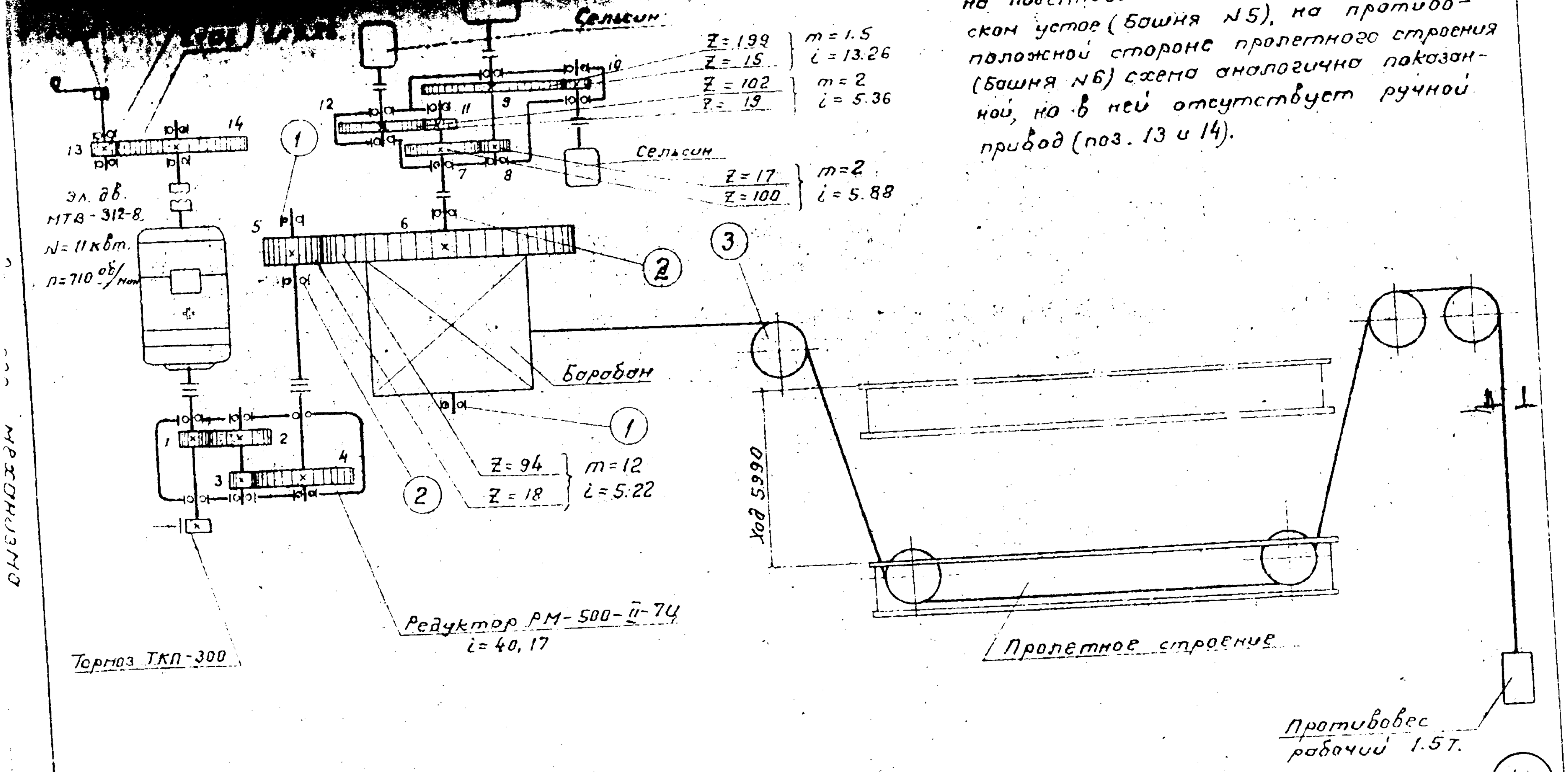
Примечание.

...данной схеме показана одна сторона подъемного механизма, на противоположной стороне пролетного строения схема аналогична показанной.

...днее пролетное строение (на второй опоре)

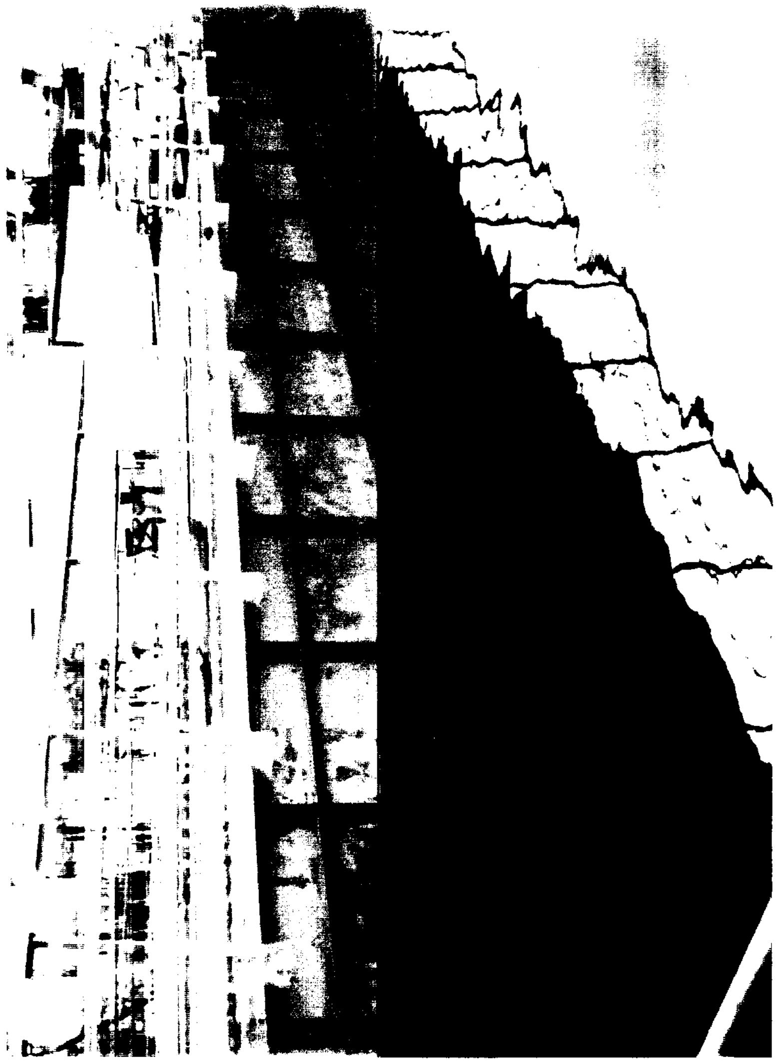
Схема подъемного механизма

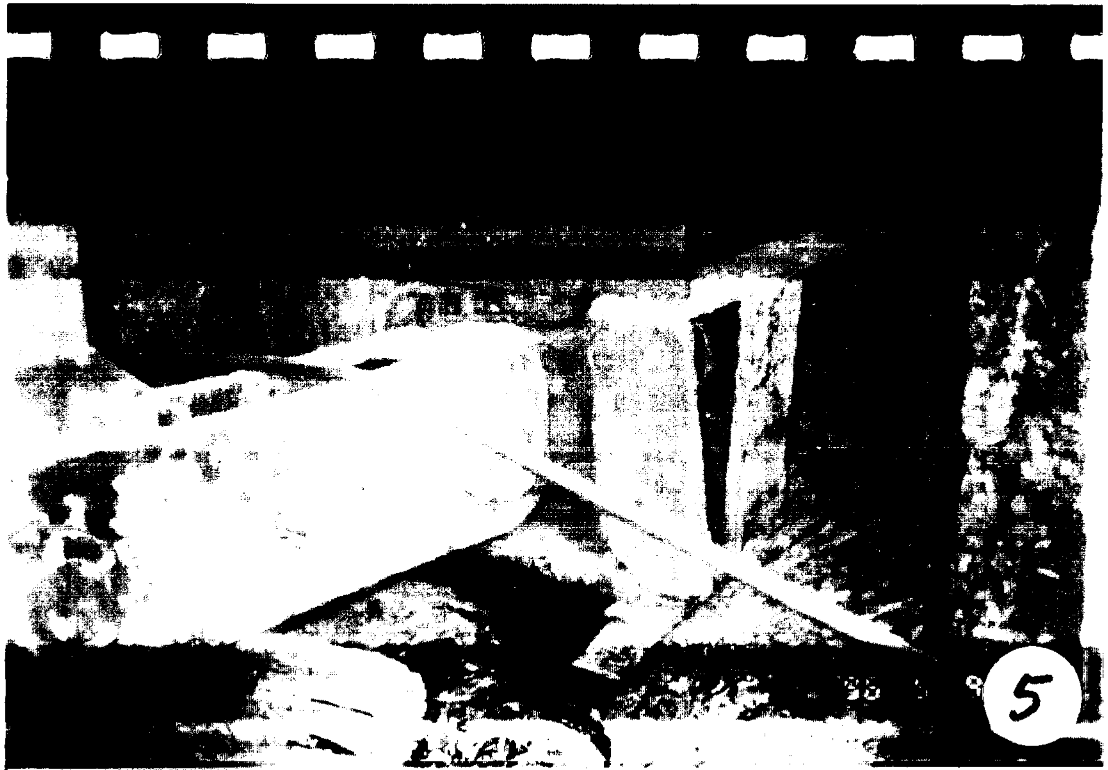
На данной схеме показана одна сторона подъемного механизма на среднем норском устое (Башня №5), на противоположной стороне пролетного строения (Башня №6) схема аналогична показанной, но в ней отсутствует ручной привод (поз. 13 и 14).



Морское пролетное строение
(… третьей опоре)

PHOTOS

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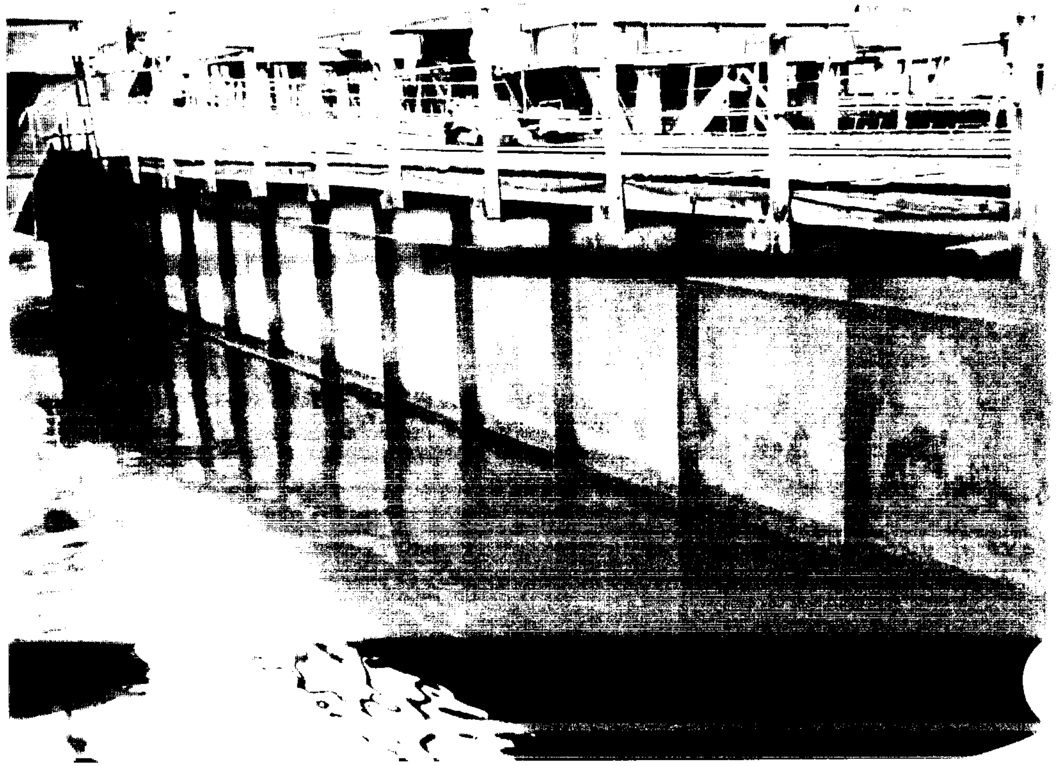

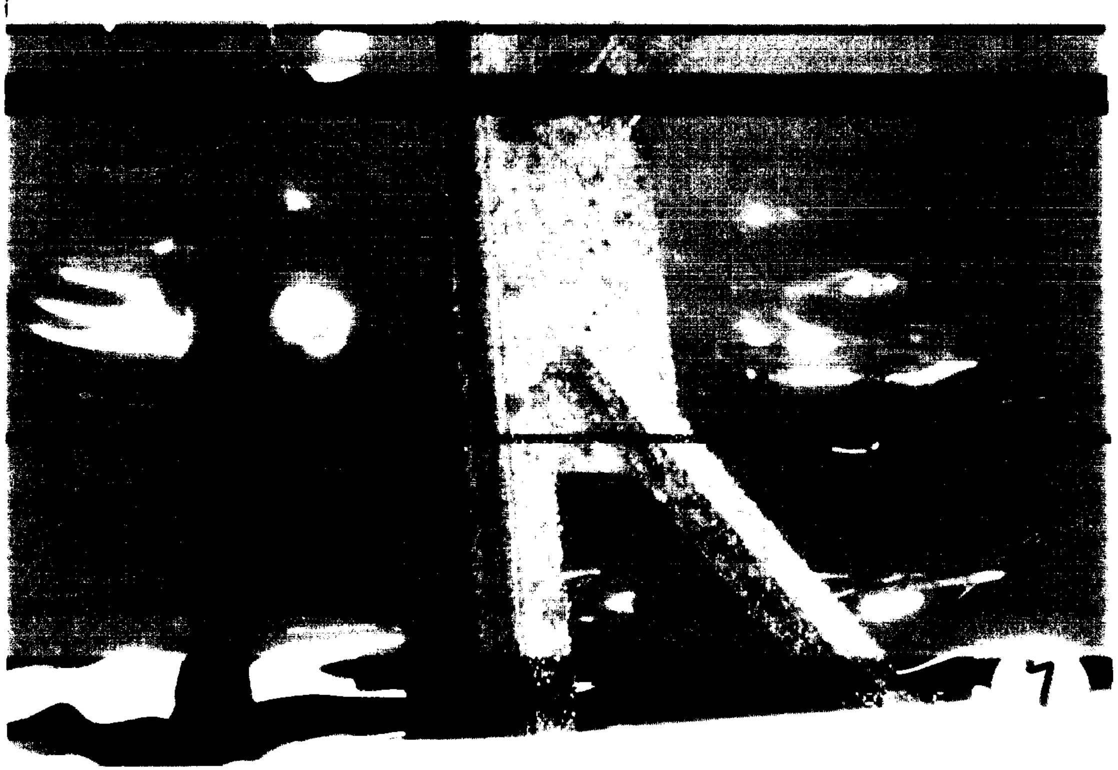
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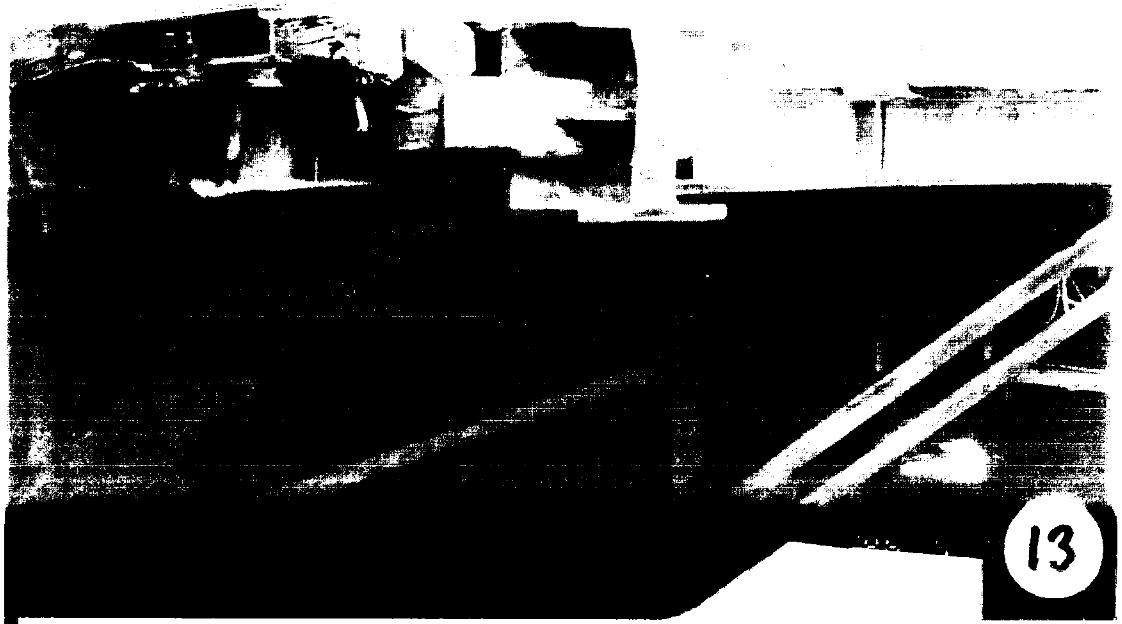
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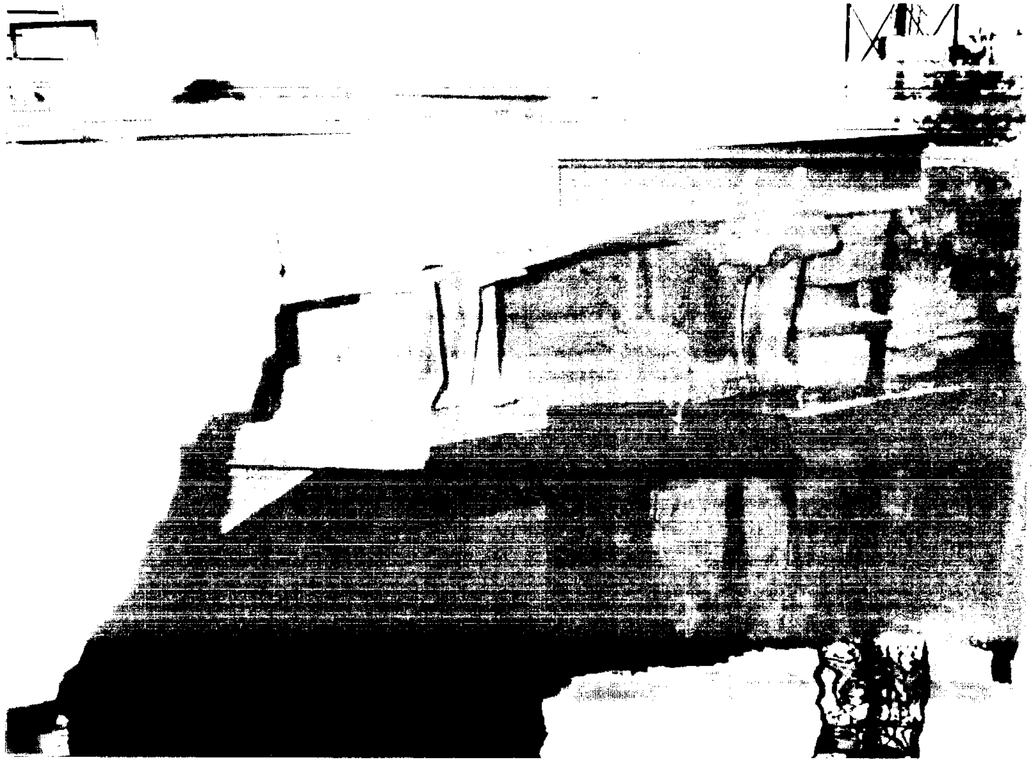

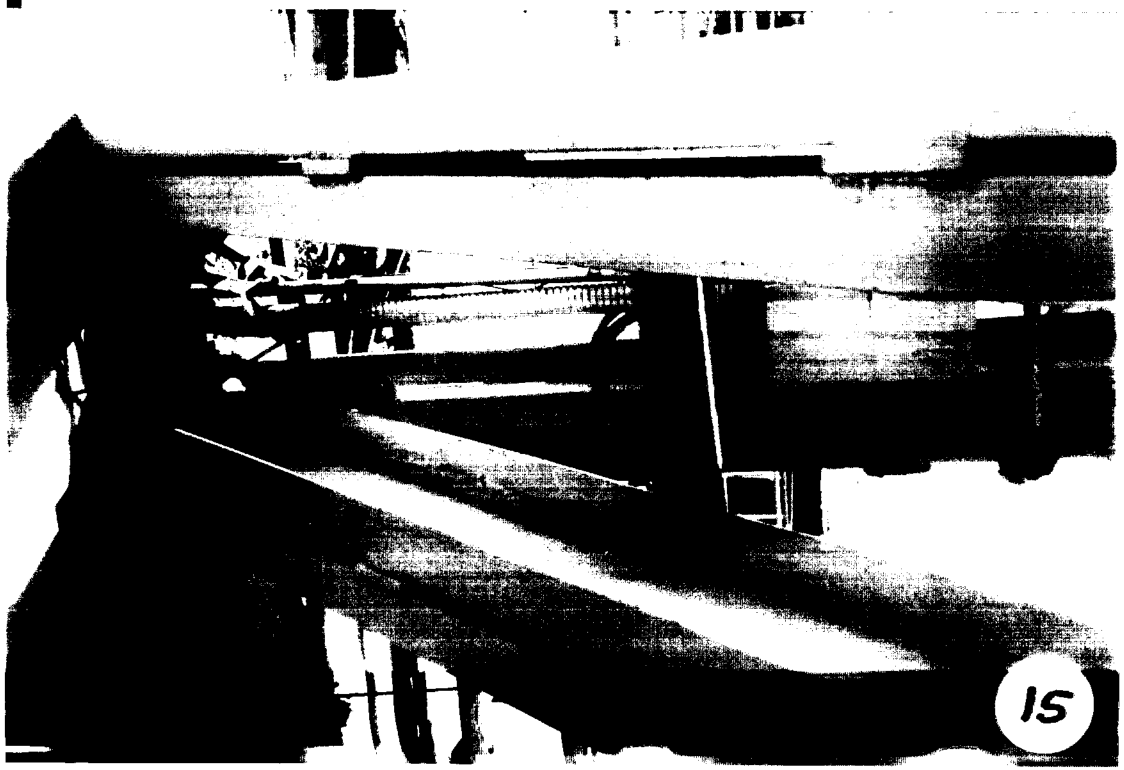
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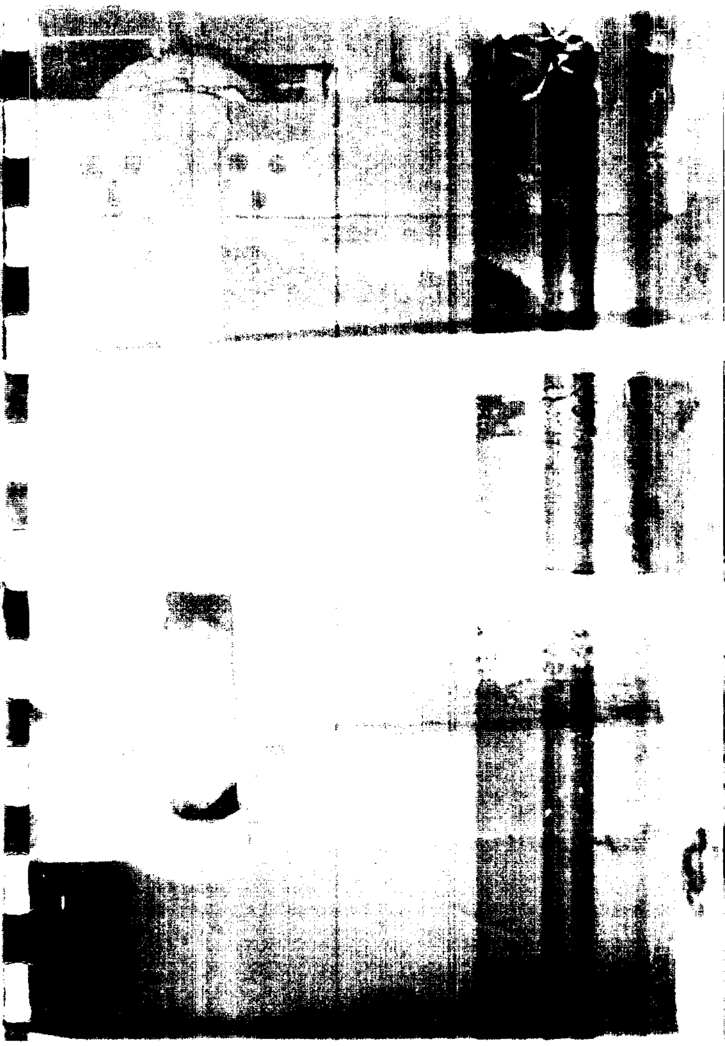

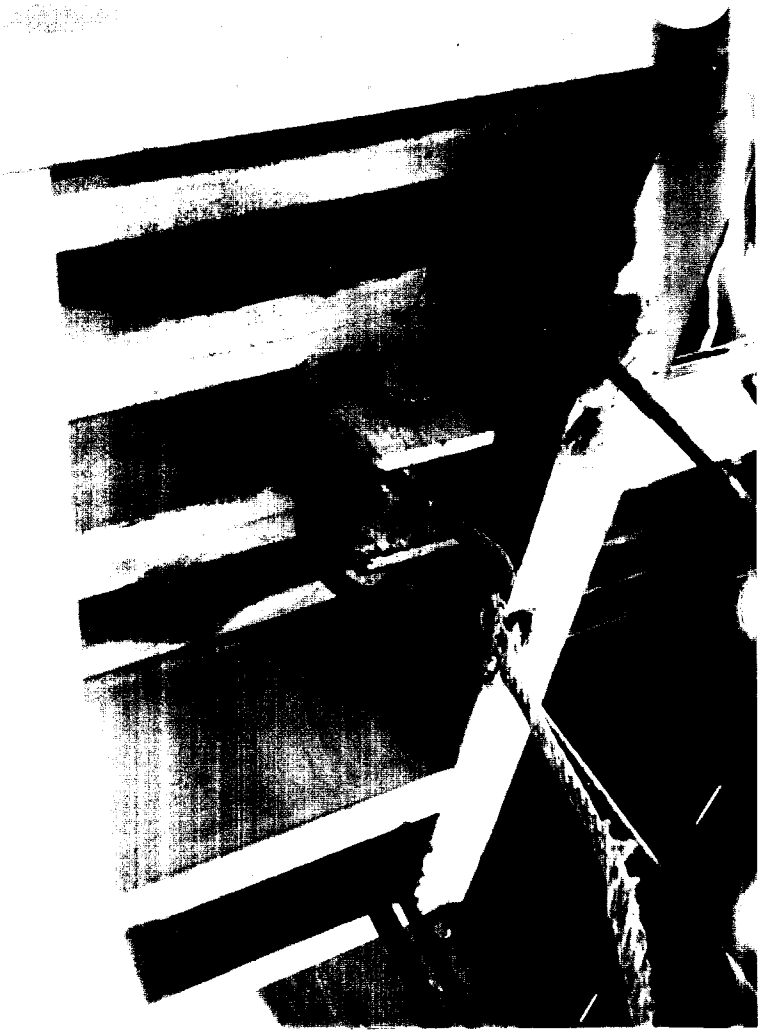

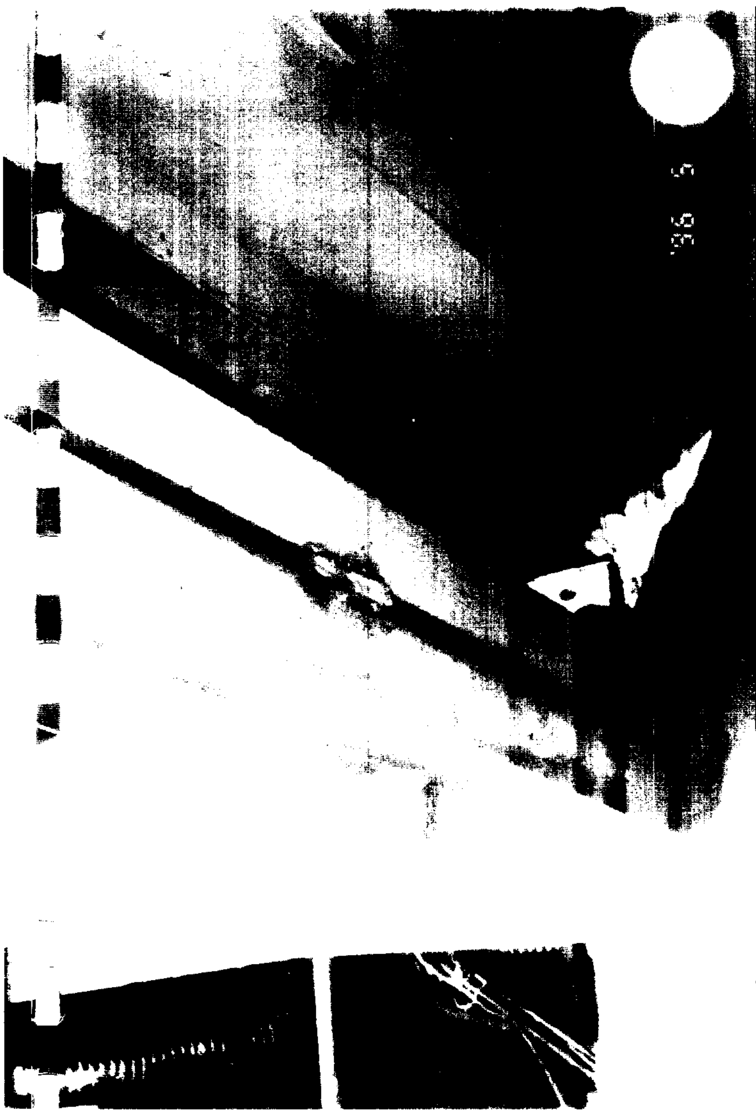
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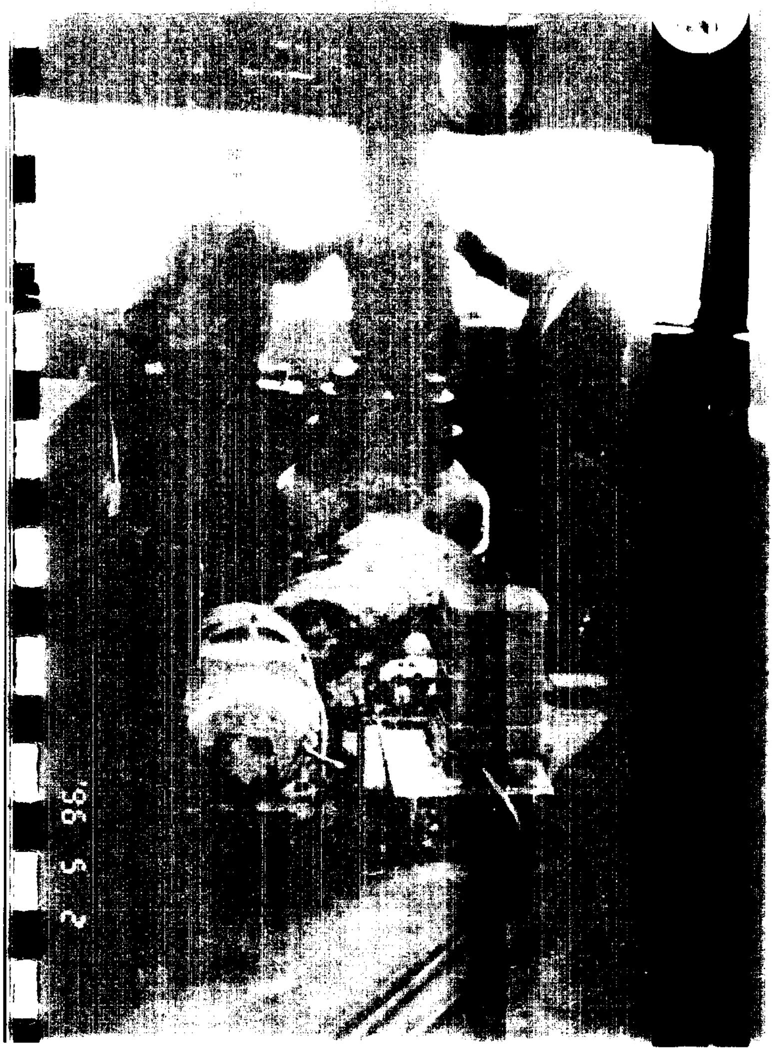
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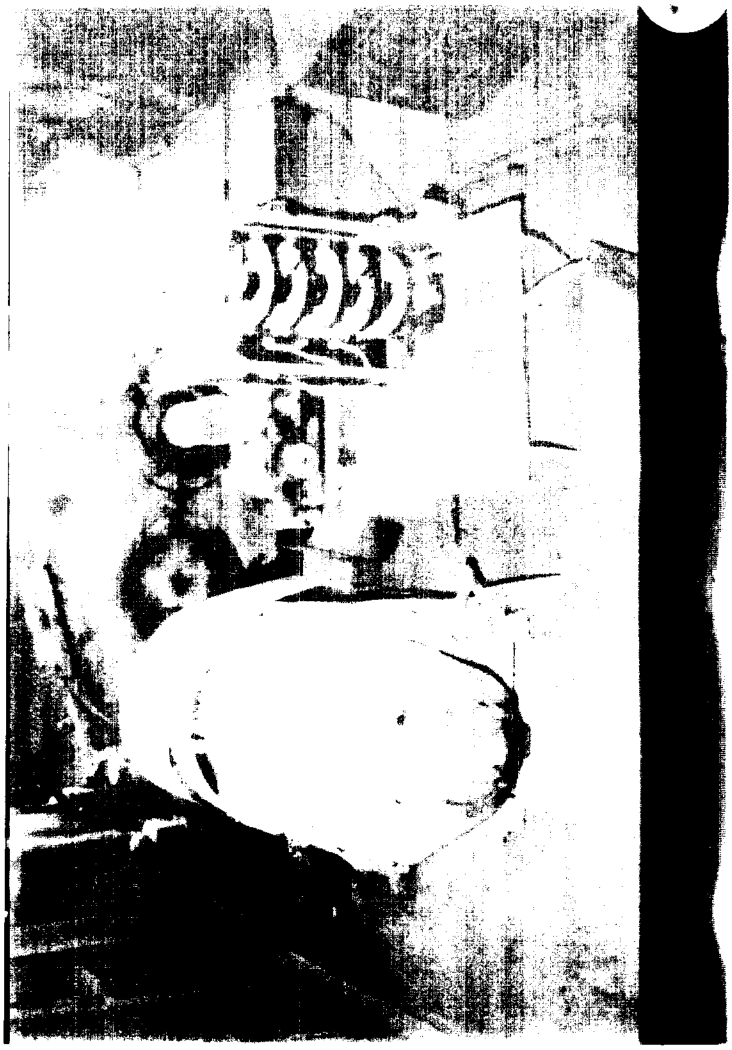

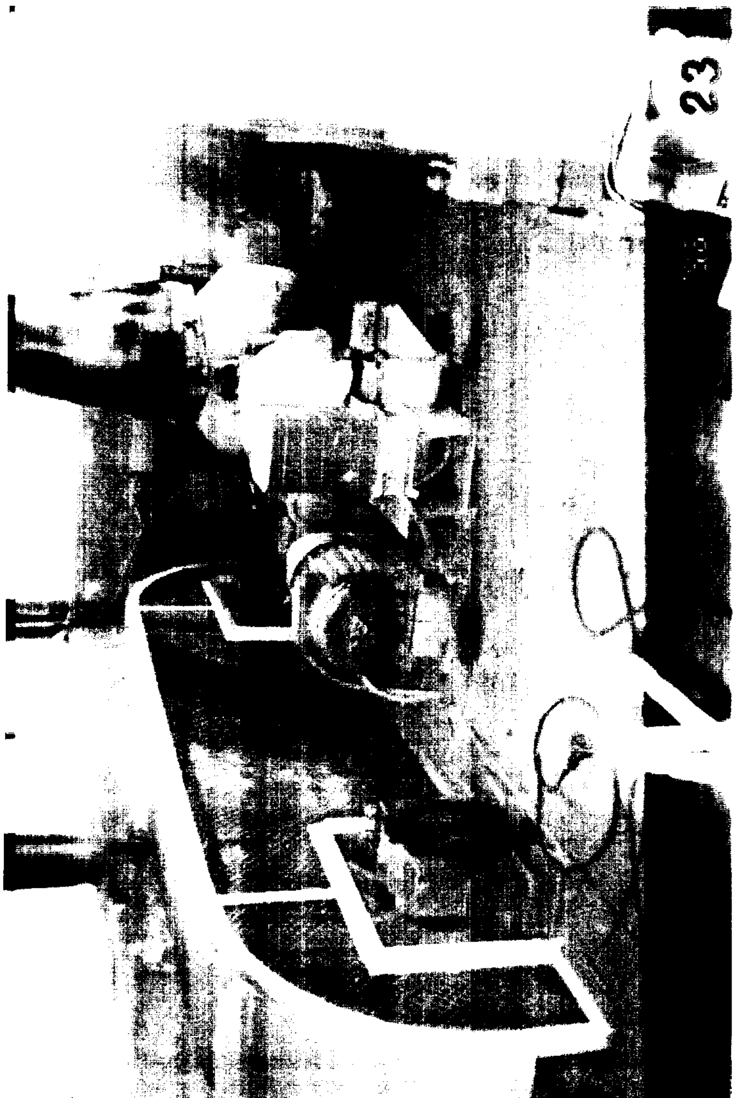
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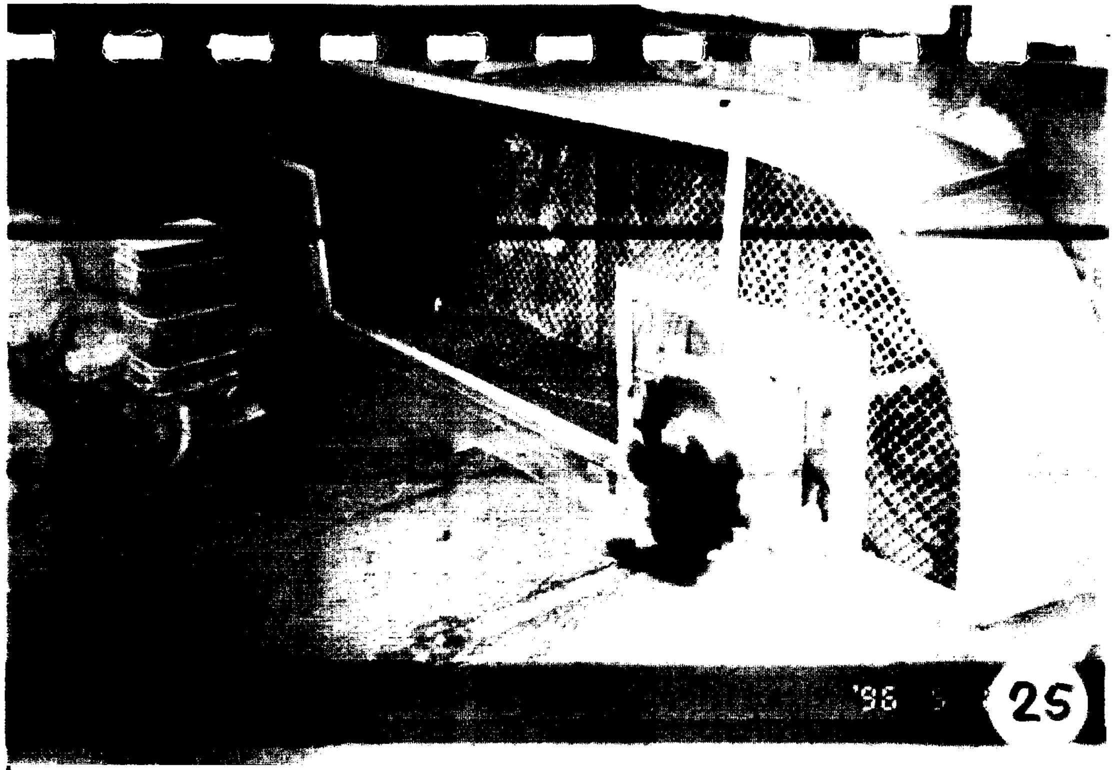
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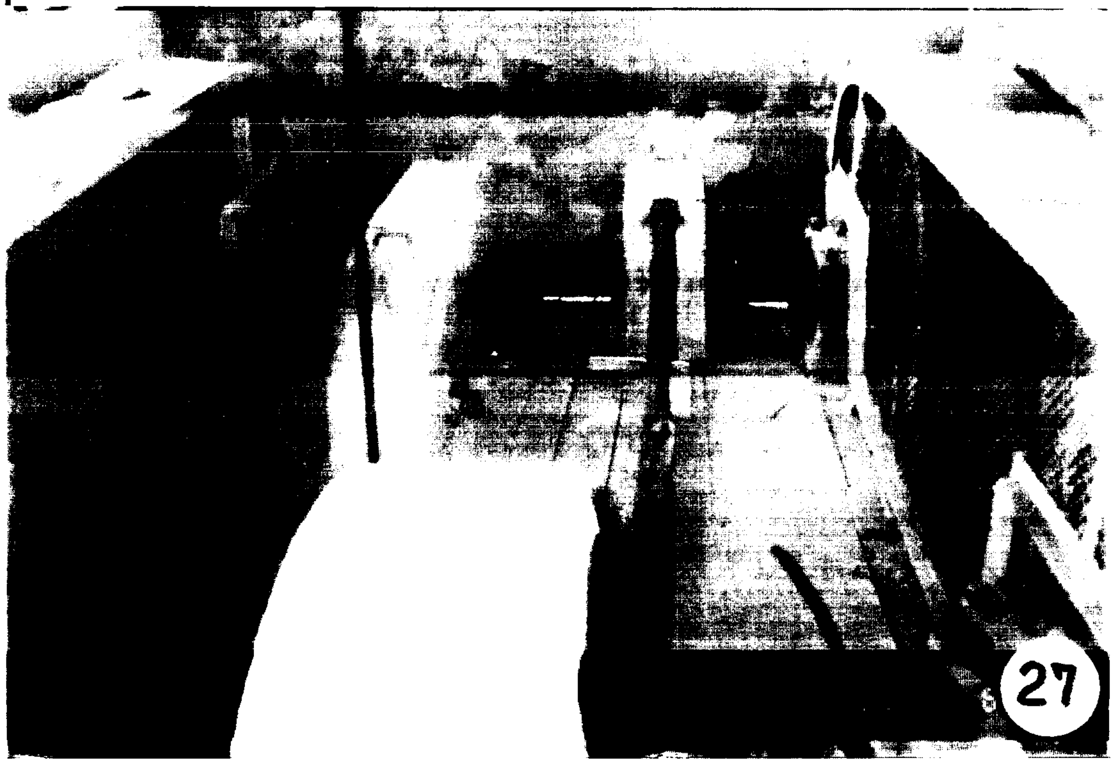
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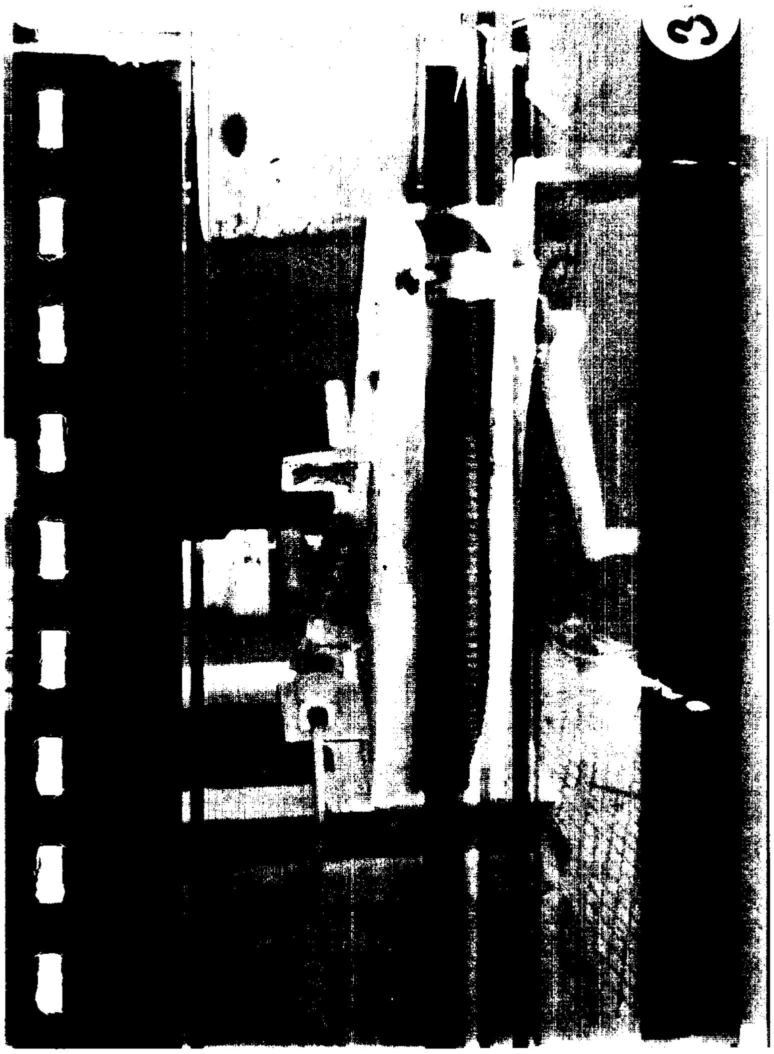


33

INSPECTION REPORT

BUILDINGS

ing in the port or at the railways. In the eastern part of the terminal a concrete factory is located.

Behind the port administration building, an old bunker is located.

A drawing showing the location of these buildings, is attached at the end of this report.

State of Repair

In the following table are summarized the results of the inspection of main buildings at the Baku ferry terminal.

Item	Dimensions (l x w x h)	Year of construction	Materials used	Remarks
Waiting hall (in city centre)		1963	Reinforced concrete beams and columns. Covered with marble tiles.	Generally in good condition. Some cracks are found in columns and especially in roof decks. Plastic chairs are present. Small café in the building, that also accommodates police office and shipping agents.
Customs' shed	5x5x3 m	1991	Concrete structure	Structure in bad condition, only temporary. Need replacement.
Port house	6x6x3m	1963	Brick structure with concrete covering layers. Roof of steel plates.	Generally in good condition.
Railway house	5x7x6 m	1963	Brick structure with concrete covering layers. Roof of steel plates.	Most covering layer missing. Bad state. Must be removed.
Customs and police house	5x8x6 m	1963	Brick structure with concrete covering layers. Roof of steel plates.	Most covering layer missing. Bad condition.
Waiting shed	6x12x4 m	1995	Brick structure with concrete covering layers. Roof of steel plates.	Relatively new. Can be reused.
Toilet building	6x12x3 m	1996	Brick structure with concrete covering layers.	Under construction
Cafés and small shops	Typically 3x6x3m	-	Various types of structures. Mostly concrete and steel.	Temporary structures. Must be removed.
Administration building	10x10x8m	1963	Concrete building.	Some covering layers are missing.
Hotel	13x18x6m	1963	Brick structure with concrete covering layers. Roof of steel	Some covering layers are missing.
Gate house	10x15x6m	1963	Brick structure with concrete covering layers. Roof of steel plates.	Some covering layers are missing.

Annex 3. Conditions of works, Baku - Buildings

During the data collection mission to Baku, from April 29 to May 12, 1996, an inspection was made of the existing buildings at the ferry terminal.

Buildings

The following main buildings are present at the ferry terminal in Baku:

- Waiting room (at city terminal)
- Custom's shed
- Port house
- Railway house
- Customs and police house
- Waiting shed for passengers
- Toilet building
- Administration building
- Hotel
- Cafés and small shops

The waiting hall for departing passengers is located in the building at the city terminal, which is located some 500 metres to the west of the ferry terminal. In the same building is located the ticket sales office along with other offices. There is no direct access from the city terminal to the ferry terminal. The passengers are brought by buses from the city terminal to the ferry terminal through the main entrance to the ferry terminal.

At the ferry terminal itself, a small waiting shed for relatives to arriving passengers is located.

The customs authorities have a small shed at the end of the access ramp, where customs check and passport control of passengers take place. In addition, the customs authorities have their offices in a house also located at the ferry terminal. In the same house, the office of the police is located. Police control of passengers is carried out in front of this customs and police house.

At the eastern part of the area and at the end of the ramp, a small house belonging to the port is located.

Between the rails leading to the two ramps, the railways authorities has a small house for welfare of the workers and control of railway operations.

A new toilet building is under construction at the ferry terminal.

The administration office of the ferry terminal department is located further back in the terminal area. In front of this office, a hotel is located.

Along the access road inside the terminal area, a number of small shops and cafés are located.

At the entrance to the ferry terminal area, a gate house is located.

In addition to the above-mentioned buildings, a number of temporary buildings have been constructed at the terminal area. These mostly consist of small welfare buildings for people work-

Degree of future re-utilization of buildings

Most of the buildings originate from the construction of the ferry terminal in 1963, and are therefore 33 years old. In principle, several of the existing buildings could be used for 20-30 years more, provided that they undergo a severe rehabilitation. However, as it will be advantageous to create some more space for the operations at the terminal, it is desirable to re-arrange the existing buildings. Some of the buildings have been made as temporary structures, in order to serve the demand for border crossing facilities, that arose in 1991, when the Soviet Union was dissolved into a number of independent republics.

The existing land area in the ferry terminal has the surface in level -25.4 m. The ferry terminal is located on reclaimed land. In the future it is anticipated that the surface will be located in a level that is 2-3 metres above the existing terrain. Therefore, the existing buildings can not be used at their existing level, and are anyway going to be demolished. Subsequently, the conclusion will be, that none of the existing buildings at the ferry terminal can be re-used.

Photos

In the following page two photos are attached ,showing some of the buildings at the Baku ferry terminal. Photo no. 1 shows the waiting shed and the customs/police house. To the right some of the small shops can be seen. Photo no. 2 shows the port house and the eastern most part of the ferry terminal, where some small temporary buildings have been constructed.

Photo no. 1: Baku Ferry Terminal - Waiting shed, customs/police house and small shops.

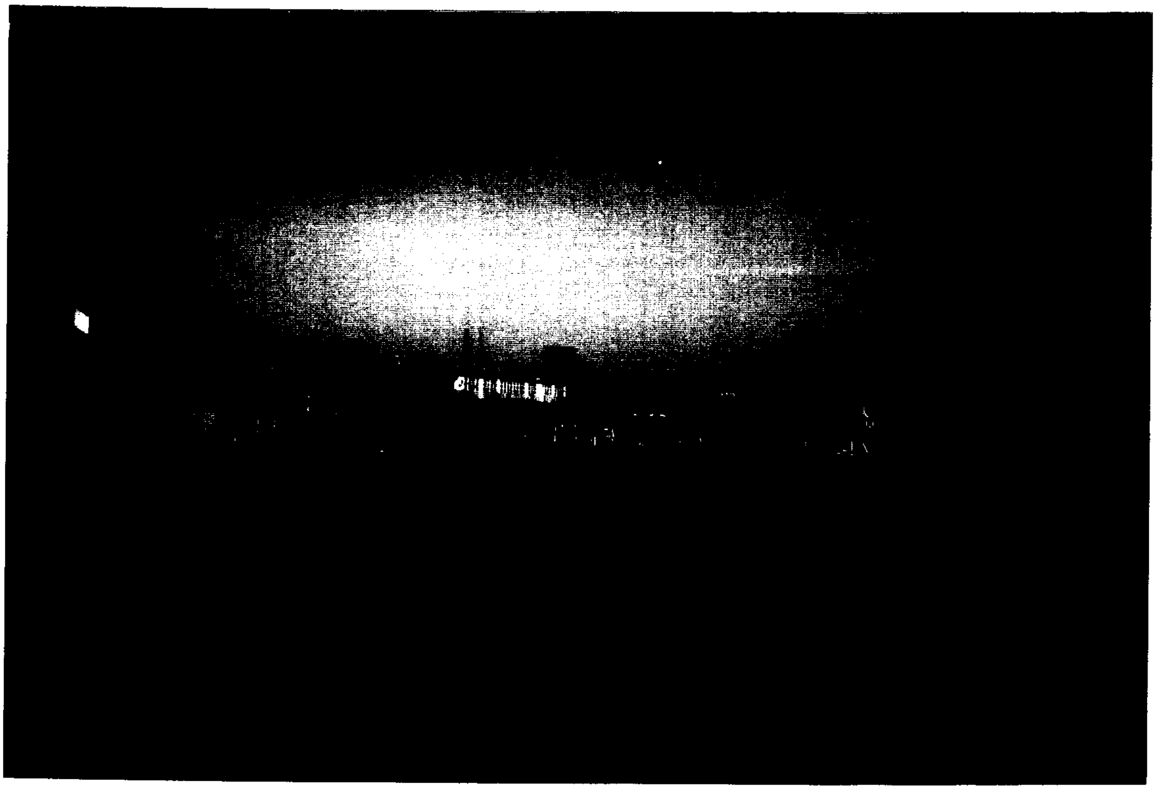


Photo no. 2: Baku Ferry Terminal - Port house and temporary houses at eastern part.

Table of Explanations for Layout

No. of Position on the Layout	Name of Position on the Layout	Structure of the Building, Dimensions	Remarks	Year of Construction	Belonging of the Building
1.	Bomb shelter	Underground structure elevated above the earth by 1-1.5 m; d. app. 28 x 24 m	filled with water due to the sea-level rise	1983	Port of Baku
2.	Department of the KOF of CSC	Shape of the building is irregular; d. app. 14 x 17 m; made of bricks with a roof of concrete slabs; 1-storey building	The KOF of the CSC is a division of the Caspian Shipping Co. (CSC) responsible for maintenance of the fleet (the Complex Maintenance of the Fleet - the KOF)	1987 or 1988	The CSC
3.	Restaurant	Made of bricks; 1-storey building, d. app. 10 x 6 m.	Territory has been fenced by a wall of bricks with height of app. 1.5-1.7 m	1994 or 1995	Was leased by a private company from the CSC
4.	Car wash	The slate roof with walls; 1-storey building; walls of bricks		between 1980 and 1983	Leased from the CSC
5.	Boiler house	Made of bricks; 1-storey building; roof of concrete slabs; d. app. 8 x 4	The building is the component part of building no. 6	Between 1980 and1 983	The CSC
6.	Divisions of the KOF of the CSC	Made of bricks; 1-storey; roof of concrete slabs; d. app. 28 x 10 m	The buildings of the divisions of the KOF of the CSC (No. 6), the boiler house (No. 5), and the car wash (No. 4) were constructed simultaneously as a single sanitary disenfectant point for people and cars in the case of war	between 1980 and 1983	The CSC
7.	Workshop of the KOF of the CSC	The hangar made of uncorroded steel; 1-storey; d. app. 6 x 20 m	It was constructed earlier but displaced in 1994	1994	The CSC

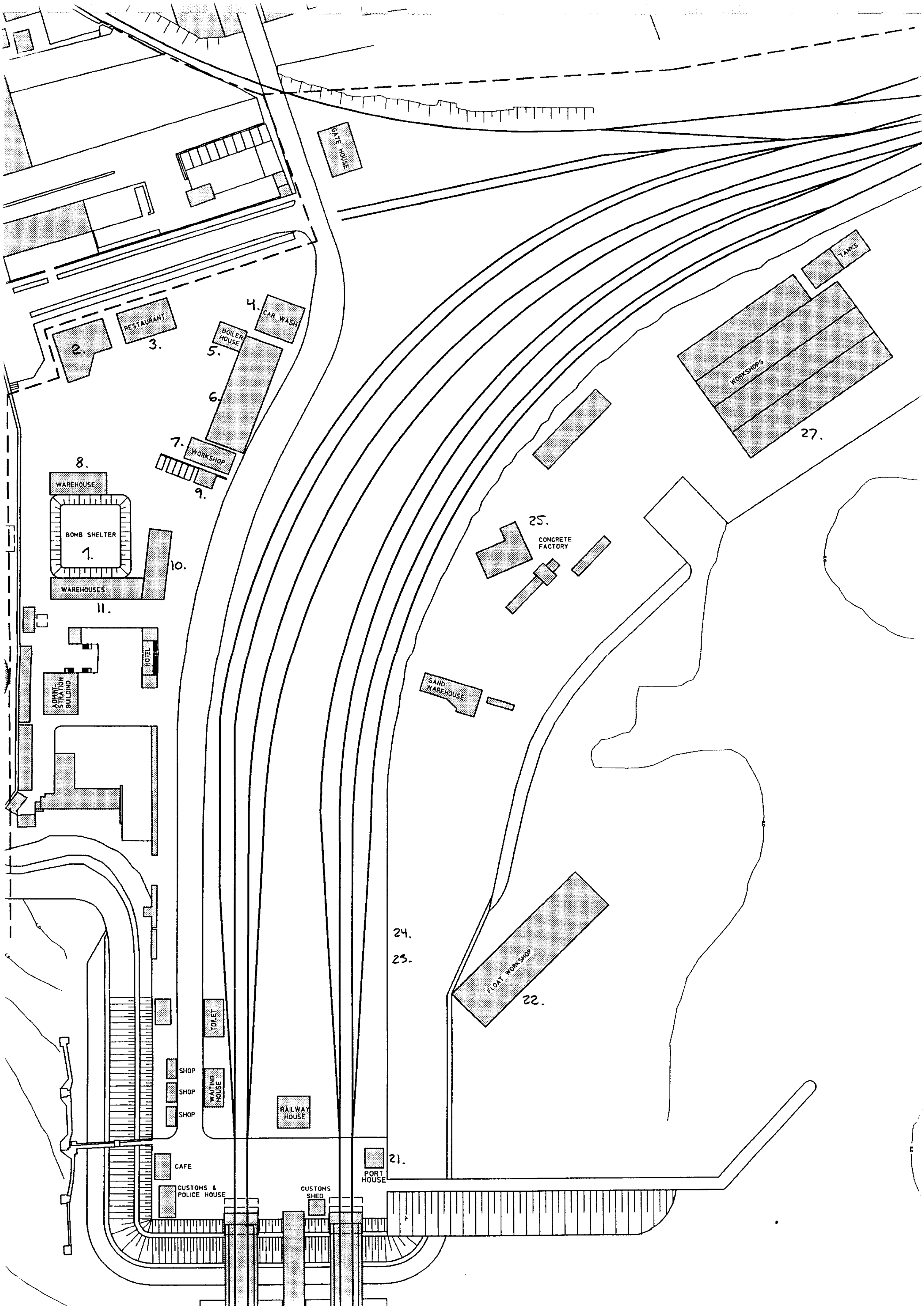
In addition to the above-mentioned main structures on the ferry terminal, a number of other buildings and structures are presented. Many of these are operated by other organizations than the port, such as the Caspian Shipping Co. and the concrete factory.

These buildings and structures are briefly summarized in the following:

Table of Explanations for Layout of Area C1

No. of Position on the Layout	Name of Position on the Layout	Structure of the Building, Dimensions and Occupation	Remarks	Year of Construction	Belonging of the Building
21.	Customs office and room of coastal sailors of the KOF	1-storey building of bricks, steel roof; d. app. 5.5 x 8.5 m; occupied by heads of the customs house and coastal sailors of the KOF		between 1965 and 1970	KOF of the port
22.	The float workshop of the KOF	2-storey building of steel; d. app. 60 x 15 m; occupied with acting equipment			The KOF of the port
23.	Control post for entrance to the territory of the KOF	1-storey building of bricks; the roof of concrete slab; d. app. 5.5 x 15 m		between 1985 and 1986	The KOF of the port
24.	Workshops of the KOF	1-storey building of bricks; the roof of concrete slabs; d. app. 28 x 2.5 m + 16 x 2.5 m; occupied by equipment for reparing of cars	The former warehouses	between 1985 and 1986	Were rented out
25.	Structure of the concrete factory	The structure with irregular shape; 2-storey; made of steel partly and concrete partly	The aim of the structure (the purpose) is to fill trucks with sand		Trust Aztransstroj
26.	The floating workshop/pier vessel	The vessel; d. app. 123 x 15 m; occupied by equipment			The KDF
27.	Workshops of the concrete factory	1-storey building of concrete slabs, roof of steel; occupied by equipment (e.g. cranes); d. app. 14 x 100 of each of sections; height is about 12-15 m			Trust "Aztransstroj"
28.		1-storey building of bricks; slate roof; d. app. 6 x 30 m			Trust "Aztransstsroj"

No. of Position on the Layout	Name of Position on the Layout	Structure of the Building, Dimensions	Remarks	Year of Construction	Belonging of the Building
8.	Warehouse of the KOF of the CSC	The building is under construction; 1-storey; walls of bricks; gates of steel; d. app. 7 x 17 m	The roof is absent	1996	The CSC
9.	Sewerage pump house	1-storey building of bricks; roof of concrete slabs; d. app. 5 x 6 m		1983	The port
10.	Department of the ferry terminal	1-storey building of bricks; roof of concrete slabs; d. app. 6 x 14 m		1990	The ferry terminal
11.	Warehouses of the CSC	1-storey building of bricks and roof of concrete slabs		1986	The CSC


GATE HOUSE
TANKS
4. CAR WASH
RESTAURANT
3.
2.
BOILER HOUSE
5.
6.
WORKSHOPS
27.
7. WORKSHOP
8.
9.
WAREHOUSE
BOMB SHELTER
1.
10.
WAREHOUSES
11.
25.
CONCRETE FACTORY
HOTEL
ADMINI-STRATION BUILDING
SAND WAREHOUSE
24.
23.
FLOAT WORKSHOP
22.
TOILET
SHOP
SHOP
SHOP
WAITING HOUSE
RAILWAY HOUSE
21.
PORT HOUSE
CAFE
CUSTOMS & POLICE HOUSE
CUSTOMS SHED

State of Repair

In the following table is given the results of the inspection of buildings at the Turkmenbashi ferry terminal.

Item	Dimensions (l x w x h)	Year of construction	Materials used	Remarks
Main building • Waiting hall • Restaurant/Police - Police office • Administration - Ticket office - Luggage room - Rest rooms - Offices - Visa office	18x30x8m+ 9x17x6m + 15x28x6m 18x30x8 m 9x17x6 m 15x28x6 m	1963	Reinforced concrete beams and columns. Painted in light blue. Large windows on steel frames. Floor of marble and concrete mix. Wooden floor. Concrete partition walls. Facade to south covered with marble tiles. Floor of marble and concrete, some places wooden floors.	Cracks are found in some columns. Paint is missing in some places. Some decks and beams are sloping. Could in principle be reused. 168 plastic chairs are present, space for double number. Restaurant in bad condition, is not used. Wooden floors need to be changed. Concrete structures need minor repairs. Wooden floors need replacement.
Customs' shed • Toilet	20x11x3 m +5x5x3 m 5x5x3 m	1991 1996	Structures of steel profiles. Walls and roof of steel plates with 75 mm foam. Concrete floors. Structure of bricks with concrete covering layer.	Damaged partition walls. Temporary building. Steel profiles can be reused. Under construction.
Railway house	5x7x6 m	1963	Brick structure with concrete covering layers. Roof of steel plates.	Most covering layer missing. Bad state. Must be removed.
Café "Volna"	30x6x3 m		Brick structure with concrete covering layers. Roof of steel plates.	Most covering layer missing. Bad state. Must be removed.
Substation and Workshop	10x4x6 m +15x4x3 m	1963	Brick structure with concrete covering layers. Roof of steel plates.	Most covering layer missing. Bad state. Must be renewed.

Annex 3. Conditions of works, Turkmenbashi - Buildings

During the data collection mission to Turkmenbashi, from April 21 to April 26, 1996, an inspection was made of the structures at the ferry terminal.

Buildings

The following main buildings are present at the ferry terminal in Turkmenbashi:

- Main building
  - Waiting hall
  - Restaurant and Police office
  - Administration building (ticket office, luggage room, rest rooms, offices, visa office)
- Customs shed
- Railway house
- Café
- Substation and workshop

The main ferry terminal building complex consists of three parts. The largest of these is the waiting hall, from where there is access to the restaurant located upstairs the police office, that forms the second part. The third part is the administration building, where f. inst. the offices of ferry terminal manager and operations manager are located. Also the ticket office is located in this part of the building.

A temporary customs shed was constructed in 1991 in order to comply with the demand for border crossing facilities. The building, which is used by passengers, includes the offices of customs officers as well as a separate toilet building.

South of the rails leading to the ramps, a railway house is located. The building which is owned by the railway authorities, is used as a welfare building for the railway workers and for control of railway operations.

Just outside the main terminal building, a café is located. Another café is located to the east of the terminal building.

North of the terminal building an electrical substation and a workshop are located.

On the southern most part of the ferry terminal area, the remainders of an old diesel oil tank is located.

A drawing showing the location of these buildings, is attached as dwg. no. 2.01.

Degree of future re-utilization of buildings

Most of the buildings originate from the construction of the ferry terminal in 1963, and are therefore 33 years old. In principle, parts of the existing buildings could be used for 20-30 years more, provided that they undergo a severe rehabilitation. However, as it will be advantageous to create some more space for the operations at the terminal, it is desirable to re-arrange the existing buildings. The customs building has been made as temporary structures, in order to serve the demand for border crossing facilities, that arose in 1991, when the Soviet Union was dissolved into a number of independent republics.

The existing land area in the ferry terminal has the surface in level -25.4 m. The ferry terminal is located on reclaimed land. In the future it is anticipated that the surface will be located in a level that is 2-3 metres above the existing terrain. Therefore, the existing buildings can not be used at their existing level, and are anyway going to be demolished. Subsequently, the conclusion will be, that none of the existing buildings at the ferry terminal can be re-used.

Photos

In the following page two photos are attached, showing some of the buildings at the Turkmenbashi ferry terminal. Photo no. 1 shows the entrance of the main terminal building. To the left the waiting hall building and on the first floor the restaurant. Photo no. 2 shows the port side of the main building complex with the administration building to the left and the waiting hall in the background.

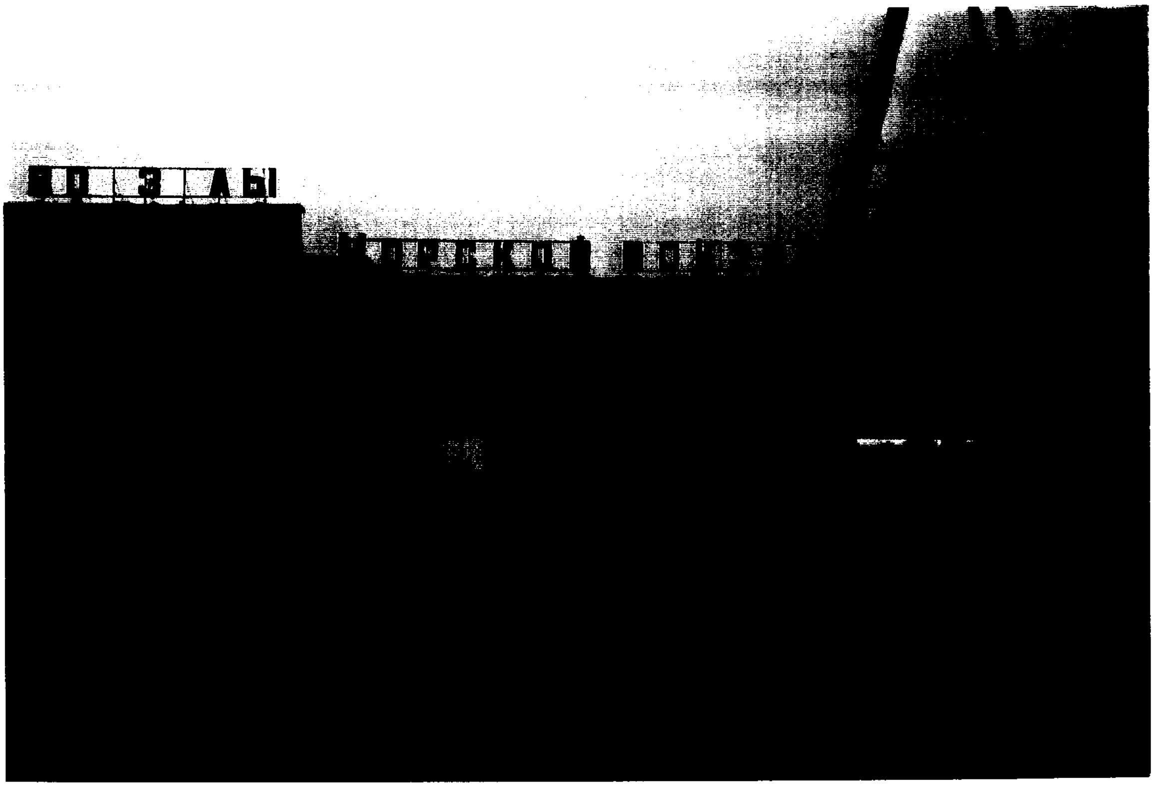


Photo no. 1: Turkmenbashi Ferry Terminal - Main entrance of main terminal complex with waiting hall to the left and restaurant on the first floor..

Photo no. 2: Turkmenbashi Ferry Terminal - Main complex seen from the port side with administration building to the left and waiting hall in the background.

Appendix 4

Sea Level Forecast

1 INTRODUCTION

After more than forty years of decreasing water level in the Caspian Sea the trend reversed in 1977 and the level has been rising rapidly ever since. Considerable coastal areas may be submerged within the next few years, threatening the continued operation of harbours, as the Baku and Turkmenbashi ferry terminals, as well as airports, railways, and heavy industry. The average annual increase in this period has been 14 cm, including a rise of 34 cm from 1990 to 1991.

The outflow from the Caspian sea into the Kara-Bogaz-Gul bay, from which all water eventually evaporated, was considerably reduced in 1980 with the construction of a dam. Free inflow was opened again in 1992, and the bay now receives and evaporates about 7% of the annual inflow to the sea.

A large number of studies have been carried out, mainly by scientist and engineers of the riparian countries, on the causes of the sea water level variations and its likely future development. Selected papers and reports are discussed below.

2 LITERATURE REVIEW

TER, 1992, is a major study of the level increase and its reasons and consequences, carried out by Russian scientists and engineers during 1991 and 1992. In table 1 below, the sea level variations since 1880 have been divided in periods of rising, falling, or nearly constant levels. For each period, values are given of the average annual inflow to the sea as well as the losses, comprising the outflow to the Kara-Bogaz-Gul bay and the *visible* evaporation, representing the sea evaporation minus the rainfall on the sea. The sea water level increments are seen to be positive in periods when the inflow to the sea exceeds the losses and visa versa. The period 1978 to 1990, for example, was characterised by a high inflow as well as an evaporation, which is lower than during all other periods given in the table.

The higher inflow is related to the more frequent and larger cyclones, that have occurred over the Volga catchment since 1976. When considering the increase in water use in the catchment area during the recent decades, the runoff generated in this period will have been higher than that of all other periods given in table 1. The reduction in runoff, caused by construction of reservoirs, irrigation and water supply combined with changes in land use in the catchment area, is estimated to have reached an annual level of 40 km^3 by now.

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Note on Design Water Levels for the Baku and Turkmenbashi Ferry Terminals

August 1996

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Project	Project No
Vandstandsvurdering - Det Kaspiske Hav	96-5048
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Revision	Description	By	Checked	App.	Date
0	Final Report	HCA	JCR	JCR	96.08.14

Key words	Classification
Caspian Sea, water level variations Design levels	☐ Open ☐ Internal x Proprietary

Although the report concludes that the level fluctuations are still "fairly mysterious", it comments favourably on predictions of a continued rise of 12 cm per year up to year 2010. Noting the typical shape of the rising level curve the report further predicts a sharp rise the next two years followed by three years of constant level, accumulating to 50 cm over the next five years.

However, no justifications are given, or can be given, for these predictions.

Golubtsov & Lee, 1995, presents an attempt to provide a basis for planning and construction design in the coastal zone of the Caspian sea up to year 2050. In a discussion of the climatic variations it is noted that the inflow to the sea was 12% above average during 1978-91 while the evaporation from the sea was 9 % below its norm, adding further to the level increase. In the period 1877 to 1934, with a rather constant sea level, the evaporation was usually high during periods of high inflow and visa versa, so that the combined effect of the variations in these components of the hydrological cycle was small.

A graph of the sea level variations during 1556 to 1991 has been constructed using historical and other sources for the period before measurements began in 1837, see figure 1. The effects of increasing water use in the catchment during the last half century is illustrated by a calculated water level variation corresponding to no water use ($C_x = 0$). It is seen that the water level would now have been 1.5 meters higher in that case, attaining a level similar to the observations during 1830-1930. The two lower lying curves similarly illustrate the water level variations, that correspond to a constant water use in the catchment of 40 and 50 km^3/year respectively, and open outflow to the Kara-Bogaz-Gol. Analyses have indicated that, under average climatic conditions and with the current water use in the catchment ($C_x = 40$), the average sea level would be -28.5 m and the return periods of the high levels of -26 and -25 m would be 100 and 1000 years.

The impact of potential climate changes due to the green-house effect is also considered. The paper assumes that the global warming will lead to a gradual increase in runoff and rainfall and decrease in evaporation. This leads to a calculation of probabilities for different sea levels up to year 2050. The most likely variation (50% probability curve) passes a minimum of -28 in 2015 and reaches a level of about -27 in 2050. At that time, probabilities are estimated at 10% for a level of -25 m and 1% for -24 m.

These calculations are, however, very uncertain. No reliable predictions of the global warming are available, and the impacts it will have on the hydrological cycle are not fully understood.

Ratkovich, 1986, includes in his article a discussion on future water consumption in the catchment area, estimating that the increasing demand for food production and the continued development of domestic water supply in the area will lead to a significant increase in the water demand. It is mentioned that unfavourable ecological conditions will arise at sea water levels below -29 m.

Table 1 *Water level changes and variations of the inflow, evaporation and runoff to the Kara-Bogaz-Gul bay. The flows are given in both km³ and in cm, representing the effect on the sea level. From /4/*

Periods	Increment of water level	Average water inflow and effect on the sea		Average runoff volume to Kara-Bogaz-Gul bay and effect on the sea		Average visible evaporation
	cm	km^3/year	cm/year	km^3/year	cm/year	cm
1880-1913	-92	306	75.5	24.7	6.7	71.5
1914-1932	16	321	80.4	9.7	4.9	74.7
1933-1940	-172	229	58.5	10.5	2.7	77.3
1941-1956	-61	292	77.5	11.6	3.1	78.2
1957-1970	-4	281	75.5	9.5	2.6	73.2
1971-1977	-61	236	65.2	6.9	1.9	72.0
1978-1990	166	305	81.9	1.8	0.5	68.4
full period	-206	293	75.3	16.6	4.2	73.5

The report refers to different forecasts of the future water level variations, mainly predicting a continuation of the rise until 2010, but it also clearly states that no reliable forecasts of the direction and amplitude of the level variations is - or can be - given at this time. This is mainly due to the large influence of the natural and unpredictable climatic variations.

Relative to the zero level of the Baltic sea, the Caspian sea level has varied between -29 and -25 meters since measurements began in 1837, see figure 1. The report states that in the long term levels may go as high as -20 m and as low as - 33 m, and it recommends that the strategy for social-economic development in the Caspian sea shore area should consider the possibility of such variations.

Sofremer et al, 1995, presents different estimates of the Caspian sea level variation over the last 100000 years. The estimated variation since 700 AD shows a cyclical character with a cycle duration of between 80 and 145 years. The highest level, reached around year 1800, is given here as -22.20 m, which compares well with estimates given in other reports, varying from -21 to -23 m. Seeing the recent variations in the context of this cyclic behaviour the report notes that it is fairly likely that the 1929 level will be reached. This does not, however, consider the effect of increased water use in the catchment.

Previous predictions made by Soviet scientists are described and compared to the actual variations to illustrate the difficulty of forecasting the behaviour of the sea. A forecast made in 1986, in which the water use in the catchment is expected to increase from 39 km³ at the time to 62 km³ in 2010, seems to be misunderstood by Sofremer, however, as these values have been taken as predictions of the inflow rather than the water use.

The variation in catchment rainfall and runoff, including the influence of reservoirs constructed during the 20th century, is discussed. The influence from dam filling and increased water use on the sea level are seen to be much less than that of the natural variations in the inflow from rivers.

Depressions	of the sea will be flooded and act as evaporation ponds if the level increases to between -26 and -25 m. The total capacity of these depressions is 24 km^3.
Reservoirs	Most of the reservoir construction in the catchment area took place during 1956 to 1969. It is estimated that the filling of the reservoirs reduced the Caspian sea level by 5 cm per year in this period. Many reservoirs are used for hydropower production and have therefore only a minor effect on the volumes of inflow to the sea, caused by the evaporation from the reservoir surfaces.
Water use	Water use for irrigation and water supply in the catchment has increased considerably in recent times. By 1991 the reduction of water inflow to the Caspian sea due to these activities is reported by several sources to be about 41 km^3 per year. It is not clear, however, whether this figure represent the diversions only or includes the reducing effects of irrigation return flows and drainage, by which part of the diverted water is reintroduced in natural rivers, draining to the sea.. Estimates of the effect of water use on the sea level variations are given in /1/, as mentioned above.
Tectonic movements of the sea bottom	The settlements created by these movements are estimated to effect the sea water level with no more than 1 mm per year.
The greenhouse effect	There is little doubt that the increase in the concentration of green-house gases in the atmosphere will eventually increase the global temperature. Local effects on the hydrological cycle are impossible to predict, however, with the present knowledge of the involved processes. There is no reason to believe that the current rise in the Caspian sea level is caused by other than natural variations, as seen previously in the history of the sea.

4 THE FUTURE SEA LEVEL VARIATIONS

Practically all papers and reports concerning the water level variations of the Caspian sea mention that no reliable predictions of the future can be given. The possibilities exists that, within the next 50 years, the level will rise to e.g. the height reached in 1800, i.e. -22 m, or reverse towards levels as low as -31 m, corresponding to the 1977 level adjusted for increased water use in the catchment.

The autocorrelation coefficient of the Caspian sea level is given as 0.98, indicating that levels in the near future are highly dependent on the present level. One-sided deviations from the mean level have thus persisted for decades in some cases.

The paper, which is from 1986, did not see any "substantial probability" of a further long rise of the level.

3 FACTORS INFLUENCING THE SEA LEVEL VARATIONS

Researcher agree that the sea level variations are mainly caused by natural climatic variations. The influencing factors are listed below.

Inflow	The Volga river contributed most of the inflow to the Caspian Sea, in average about 80 %. It is estimated that the increased runoff accounts for about 45 % of the level rise during the last two decades.
Sea evaporation and rainfall on the sea	The *visible* evaporation, i.e. the evaporation minus the rainfall on the sea, is about 700 mm per year, see table 1. The low evaporation during 1977 to 1993 has contributed an estimated 25% to the level increase, whereas the high rainfall, occurring at the same time, accounts for an estimated 16%.
Surface area	The sea level will fluctuate, on the long term, around a water level at which the surface area of the sea is sufficiently large to permit an evaporation, which is equal to the average inflow. Calculations have shown that a continuation of the climatic conditions prevailing since 1978 would result in an equilibrium water level of -24 m. The area of the Caspian Sea increased by 10.5 % from 1978 to 1992, and assuming an average evaporation rate, the annual water losses to the atmosphere will thus have increased by about 25 km^3. If the inflow is reduced to its long term average in the coming years, the present large surface area will thus ensure an excess evaporation and consequently a falling in water level.
The Kara-Bogaz-Gol bay	All water draining into this shallow bay is lost through evaporation. A dam was constructed in 1980, when the sea level was still low, to reduce water losses to less than 2 km^3 / year, and removed again in 1992, allowing presently an outflow of about 20 km^3/year.
Other	Several low lying depressions along the Eastern coast

For a constant water use of 40 km^3/year throughout the period shown in figure 1, the sea water level would have been below -30 m during 1940 to 1977, corresponding to 8.5% of the time. Considering the present high water level and the autocorrelation it is estimated that the probability of water levels below -30 within the next 55 years is also between 97 and 99%.

These recommendations have been made assuming that the impact of anthropogenic climate changes on the hydrological cycle at present and during most of the next half century are negligible. It is thus assumed that the high inflow and low evaporation prevailing these years are caused by natural variations and do not represent a permanent change in the climate.

It is estimated above that the probabilities of the water level crossing any of the suggested upper and lower limits are of the same order of magnitude. If the consequences of such an event are deemed more serious for one of the limits it may be considered to shift the design interval 0.5-1 meter in that direction. For a 1 meter change in limits, the probabilities of exceedence will become about 10 times smaller at the extended limit and about 10 times larger at the other.

Neither of these levels are, however, likely to occur, and for design purposes in the coastal zone it is often not possible to consider such an interval.

Based on the existing material and the above discussion on processes and factors influencing the sea level variation, recommendations are given below for an upper and lower design level.

Upper limit: -25 m

Different factors indicate that the level rise is unlikely to pass this limit:
The average annual water losses have increased by some 45 km^3 from 1980 to 1992 due to increased surface area and the opening of the Kara-Bogaz-Gol bay. These losses will increase further if the present level of inflow persists. If the inflow is reduced to a level closer to its long term average, the losses will still remain high until the sea level has fallen considerably.

If the Caspian sea reaches levels between -25 and -26 additional losses will start occurring through the flooding of other depressions along the eastern coast. This has been estimated to 11 km^3 per year initially, rising to 24 km^3 per year when all depressions are flooded.

A continued rise of the water level will make the situation increasingly difficult in many coastal areas, e.g. at the city of Atyrau in the North. This is likely to lead to an initiation of possible remedial measures including pumping of water to depressions, that are not directly linked to the sea. Previously abandoned plans for irrigation development in the Volga catchment may be taken up as well as the possibility of diverting water to the Azov and Aral seas.

For a long term constant water use of 40 km^3/year the probability of the sea level exceeding -25 meters has been given in /1/ as 0.1%. The present level is only 1.5 meters from this limit, however, and considering the high autocorrelation of the series the probability of levels above -25 m within the next 55 years will be higher than this.
Considering further an anthropogenic climate change which introduces higher annual inflows from the catchment and lower evaporation from the sea, the probability of the level exceeding -25 m is estimated in /1/ to gradually increase towards a value of 10% in year 2050. This calculation is, however, highly uncertain.

Taking these calculations and uncertainties into account, the probability of the water level staying below -25 m until year 2050 is estimated to be 97-99%.

Lower limit: -30 m

The concerns before the recent level rise of Ratkovich (ref /2/) and other researcher of a continued drop of the Caspian sea level were quite valid, considering the major developments of irrigated agriculture in the catchment. History has shown that the level can drop very rapidly due to natural climate variations, as it happened during the 1930s with a fall of almost 2 meters in only 8 years.
Considering further that the long term average water level corresponding to the present water use has been estimated at -28.5 m it seems prudent to design structures for the possible event of a drop in water level down to -30 m.

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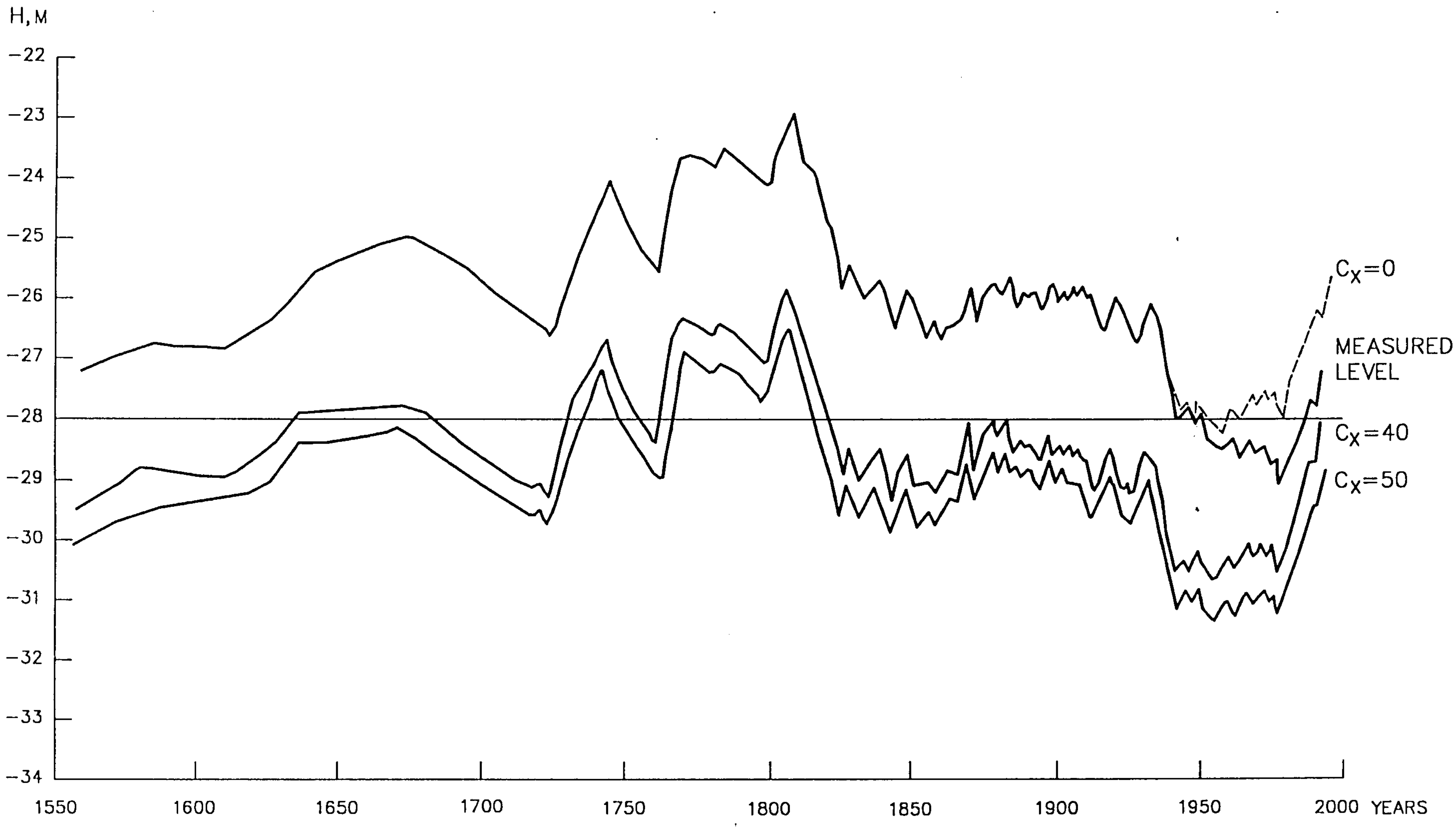
/4/ TER, 1992. The *Technical-Economic Report* on "Protection of the National Economic Objects and Populated Areas of the Caspian Sea Coastal Zone within Daghestan, Kalmuckia and Astrakhan Provinces." Prepared by the Moscow State University, the Russian Academy of Science, the Institute of Water Problems and several other organisations. The summary report was translated to English by Volga Ltd., 1992.



Estimated and observed water level variation of the Caspian sea during 1556-1992. From /1/ Calculated level variations corresponding to different cases of water use in the catchment of the sea are also shown: No water use (C_x = 0) and a constant use throughout the period of 40 and 50 km^3/year respectively.

Appendix 5

Wind and Wave Statistics

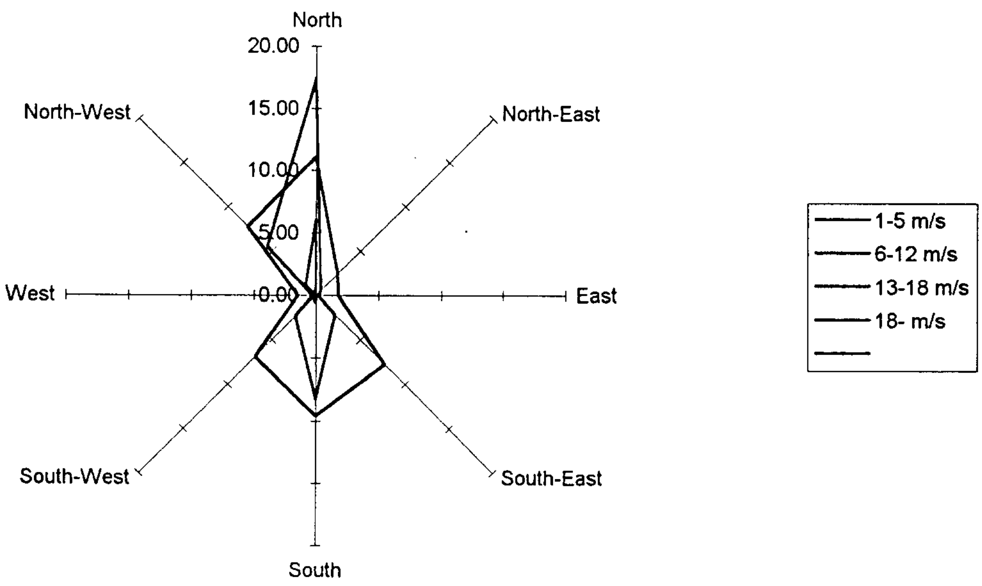
Wind speed distribution

	1-5 m/s	6-12 m/s	13-18 m/s	18- m/s	Total
North	11.10	17.39	6.00	1.15	35.64
North-East	2.44	0.58	0.01	0.00	3.03
East	1.79	0.22	0.00	0.00	2.01
South-East	7.76	2.15	0.03	0.01	9.95
South	9.60	8.25	0.54	0.03	18.42
South-West	6.88	2.31	0.29	0.00	9.48
West	1.44	0.25	0.02	0.00	1.71
North-West	7.82	5.50	1.17	0.09	14.58
Calm					8.17
	48.83	36.65	8.06	1.28	102.99

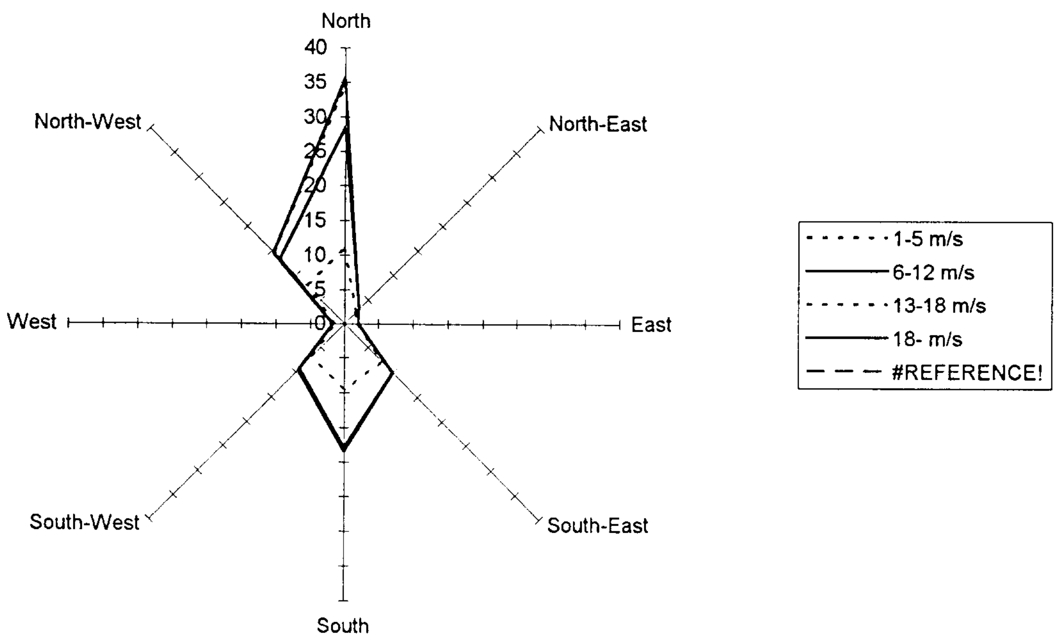
Accumulated wind speeds

	1-5 m/s	6-12 m/s	13-18 m/s	18- m/s
North	11.1	28.49	34.49	35.64
North-East	2.44	3.02	3.03	3.03
East	1.79	2.01	2.01	2.01
South-East	7.76	9.91	9.94	9.95
South	9.6	17.85	18.39	18.42
South-West	6.88	9.19	9.48	9.48
West	1.44	1.69	1.71	1.71
North-West	7.82	13.32	14.49	14.58
Calm				8.17
				102.99

Wind speed distribution in % - Baku



Accumulated wind speed distribution in % - Baku

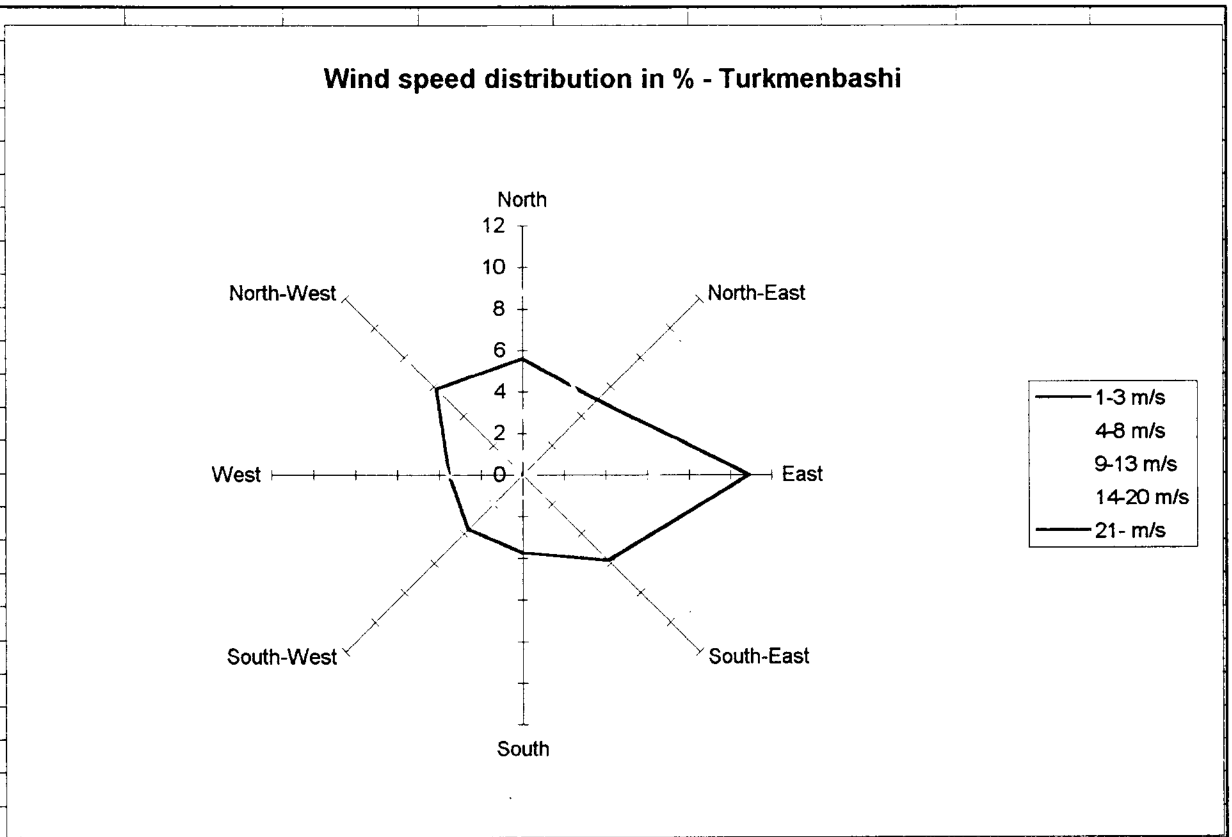


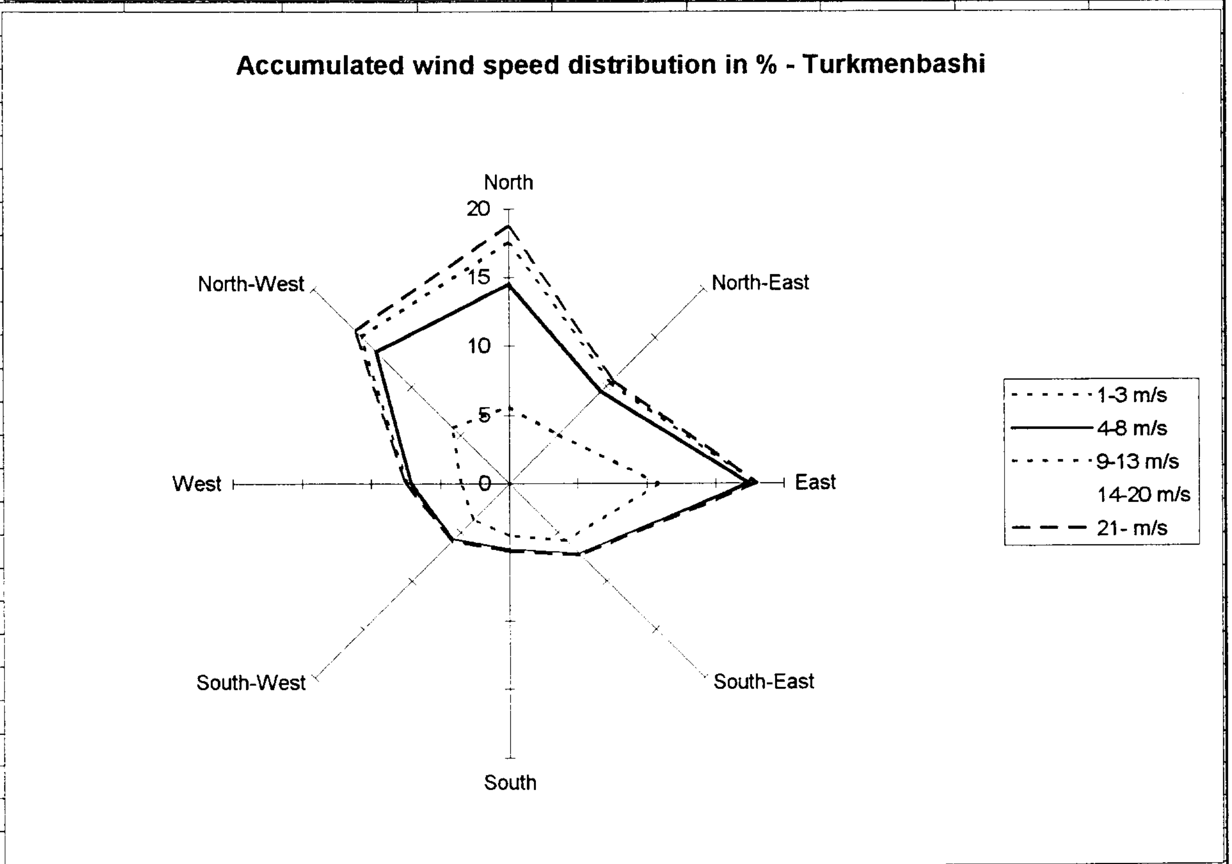
Wind speed distribution

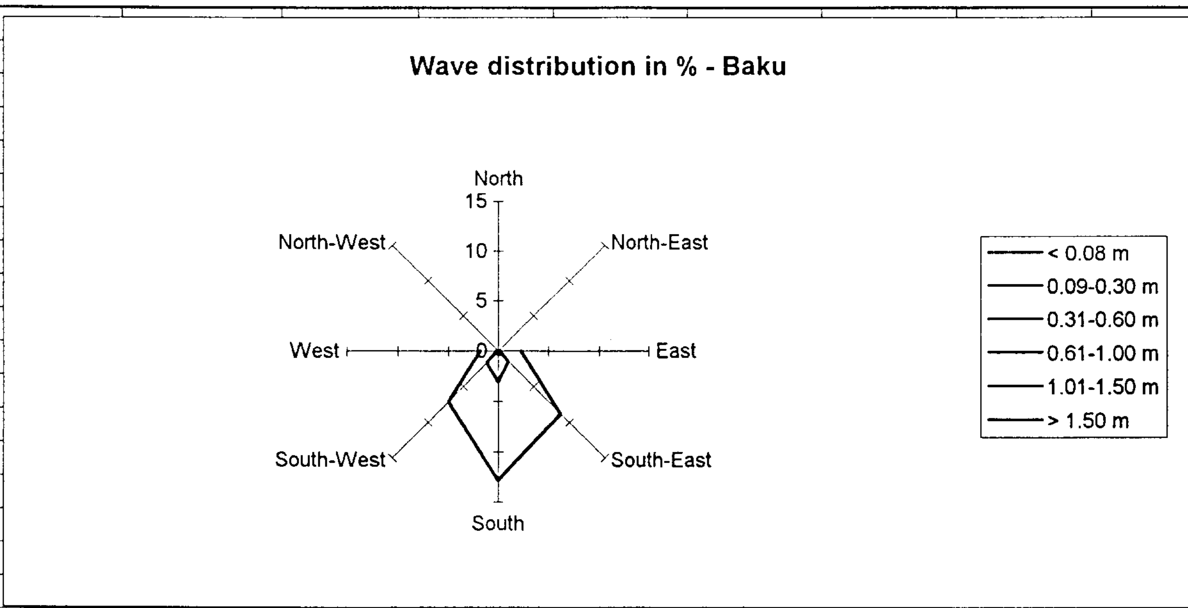
	1-3 m/s	4-8 m/s	9-13 m/s	14-20 m/s	21- m/s	Total
North	5,59	8,87	3,09	1,12	0,07	18,74
North-East	5,08	4,34	0,93	0,28	0,01	10,64
East	10,91	6,53	0,61	0,09	0,005	18,15
South-East	5,85	1,46	0,03	0,01		7,35
South	3,76	1,09	0,07	0,01		4,93
South-West	3,68	2,07	0,13	0,04		5,92
West	3,51	3,57	0,32	0,09		7,49
North-West	5,83	7,75	1,53	0,6	0,01	15,72
Calm						11,15
						100,09

Accumulated wind speeds

	1-3 m/s	4-8 m/s	9-13 m/s	14-20 m/s	21- m/s
North	5,59	14,46	17,55	18,67	18,74
North-East	5,08	9,42	10,35	10,63	10,64
East	10,91	17,44	18,05	18,14	18,145
South-East	5,85	7,31	7,34	7,35	7,35
South	3,76	4,85	4,92	4,93	4,93
South-West	3,68	5,75	5,88	5,92	5,92
West	3,51	7,08	7,4	7,49	7,49
North-West	5,83	13,58	15,11	15,71	15,72
Calm					11,15
					100,09


Wind speed distribution in % - Turkmenbashi
North
12
10
8
6
4
2
0
North-West
North-East
West
East
South-West
South-East
South
1-3 m/s
4-8 m/s
9-13 m/s
14-20 m/s
21- m/s


Accumulated wind speed distribution in % - Turkmenbashi
North
20
15
10
5
0
North-West
North-East
West
East
South-West
South-East
South
1-3 m/s
4-8 m/s
9-13 m/s
14-20 m/s
21- m/s



		< 0.08 m	0.09-0.30	0.31-0.60	0.61-1.00	1.01-1.50	> 1.50 m	Calm	Total
Waves	North								
	North-East								
	East	0	2.3	0.2	0.04	0	0		2.54
	South-East	0	8.8	1.4	0.5	0.02	0.01		10.73
	South	0	12.8	3.1	0.4	0.02	0		16.32
	South-West	0	7.1	1.6	0.2	0	0		8.9
	West	0	1.8	0.1	0.04	0	0		1.94
	North-West								53.77
								5.8	5.8
	Total	0	32.8	6.4	1.18	0.04	0.01		100

Appendix 6

Outline of Future Capacity Requirements of Sea Link and Terminals

Trucks (Semitrailer Type)

In Europe, road transport is assumed based on the following standard vehicle:

Length max.	:	18 m including tractor 13 m excluding tractor
Width max.	:	2.7 m (transport clearance width = 3.5 m)
Height max.	:	4.0 m
Weight max.	:	40 tons
Capacity	:	Max. load = 22-30 tons Assuming average nominal load = 20 tons

Containers

Based on ISO standard 20' containers.

Length	:	6.05 m
Width	:	2.44 m (transport clearance width ~ 3.3 m)
Capacity	:	Max. load = 20 tons Assuming average nominal load = 10 tons (normal type between 8-12 tons)

3. Sea Link Capacity Requirements

3.1 Required Number of Salings/Connections

Taking year 2015 as example (end economic planning period) for determining the number of sailings we have:

Modal split	Traffic Spread (1000 t)	Traffic Likely (1000 t)	Average Unit Load (t)	No. of Units	Ferry Capacity	Number of Sailings per Year
Rail	285-1400	557	30	18,566	28	663
Truck - incl. tractor	522-2,568	715	20	35,770	30	1,192
- excl. tractor		307	20	15,330	41	374
Int. container (TEU)	142-700	279	10	27,900	66	422
Total		1,858				2,651
Passengers ('000)	79-387	154			202	762

In the above table it has been assumed that 30% of the truck/trailer traffic is transferred without tractor. In many European shortsea routes almost all truck/trailer traffic is transferred without tractor even for much shorter sailing times.

From table 6.2 it is seen that the cargo flow is not evenly distributed in both directions but rather like Baku-Turkmenbashi/Turkmenbashi-Baku = 7/11.

APPENDIX 6
OUTLINE OF FUTURE CAPACITY REQUIREMENTS OF SEA LINK AND TERMINALS

1. Traffic Forecast

Noting the preliminary state of the traffic forecasts prepared in chapter 6.1 of the present report, a summary of the basic traffic forecast figures is given hereafter.

Service	1995			2000			2005			2010			2015		
	Low	Likely	High	Low	Likely	High	Low	Likely	High	Low	Likely	High	Low	Likely	High
Baku-Turkmenbashi	235.8	234.8	234.8	265.7	314.2	395.7	300.6	420.5	666.7	340.1	562.7	1123.4	384.7	753.0	1893.0
Turkmenbashi-Baku	344.4	344.4	344.4	389.7	460.9	580.3	440.9	616.8	977.9	498.8	825.4	1647.8	564.3	1104.5	2776.7
Ferry Total	579.2	579.2	479.2	655.3	775.1	976.0	741.4	1037.3	1644.6	838.9	1388.1	2771.2	949.1	1857.6	4669.7
Modal split															
Rail	330.1	340.1	330.1	262.1	310.0	390.4	222.4	311.2	493.4	251.7	416.4	831.4	284.7	557.3	1400.9
Truck	249.1	249.2	249.1	327.7	387.6	488.0	407.8	570.5	904.5	461.4	763.4	1524.2	522.0	1021.7	2568.3
Intermodal	0.0	0.0	0.0	65.5	77.5	97.6	111.2	155.6	246.7	125.8	208.2	415.7	142.4	278.6	700.5
Total	579.2	579.2	579.2	655.3	775.1	976.0	741.4	1037.3	1644.6	838.9	1388.1	2771.2	949.1	1857.6	4669.7
Passenger	48	48	48	54.3	64.2	80.9	61.4	86.0	136.3	69.5	115.0	229.7	78.7	153.9	387.0

The traffic forecast figures may be adjusted (refined) throughout the development of the present study if additional and more detailed information is obtained. In the light hereof, the findings of the analyses of the sea link and terminal requirements as presented in the subsequent part of this annex may undergo adjustments accordingly.

No information on the seasonal variation is given.

2. Traffic Instruments

The ferry link between Baku and Turkmenbashi is a typical short sea connection where the dominant traffic categories are:

- Truck/trailer transport.
- Rail wagon transport.
- Car transport.
- Passenger transport.
- Intermodal container transport (trailers).

The nominal dimensions and capacities of the various traffic instruments are assumed as follows:

Vessels (see also chapter 3.7.1)

Capacity main deck	:	Railway lnm = 416 m ~ 28 rail wagons.
or	:	Trucks lnm = 533 m ~ 30 trucks (semitrailer type)
		or ~ 41 semitrailers
		or ~ 66 containers (TEU)
Capacity hold deck	:	50 cars
Passengers	:	202

Rail Wagons

Length	:	14.4 m
Width	:	3.3 m (transport clearance width ~ 4.2 m)
Capacaity	:	Max. load = 40 tons
		Assumed average nominal load = 30 tons

8 ferries of the Dagestan type exist of which 2 presently operate outside the Caspian Sea. Assuming the above calculated effective production per ferry vessel the existing fleet of ferries will hve sufficient capacity to meet the requirements of even the high traffic forecast up to year 2008-2010. At that time, the ferries will be about 25 years old and it should be considered replacing them with new and bigger ones anyhow.

3.3 Berths Requirements

Compared to ordinary berths in a port the case of ferry berths destined for one sea link with pre-determined traffic time table is different and traditional calculation methods based on economic utilization and berth occupancy rates and cargo handling capacities cannot be used. The principal differences are:

- Departure and to some extent arrival times are in principle pre-determined and not randomly distributed.

- Allowable unloading/loading times are pre-determined and constant and not varying with different vessel size (constant).

Therefore, reasoning based on the situation described above will be used:

- With 6 departures every day the average time between departures will be 4 hours. This is higher than the aim of 2 hours service time that the terminal infrastructure and cargo harndling equipment will be designed for.

- **Assuming a Single Berth**

    - This will theoretically be sufficient as long as the time between departure is higher than 2 hours.

    - Delays are experienced on this sea link and they can more difficultly be absorbed without consequences for following arrivals if the time between departure narrows say 3 hours.

    - This will require that the terminal is open 24 hours per day, which is not the case in Turkmenbashi at present.

    - Therefore, berth occupation rate will be 50% which under normal conditions is considered too high for a single berth (not economic), ref. /6/.

    - In case of accidents/breakdowns and major maintenance works in the berth/ramp system the terminial will be non-operational and the sea link will be stopped.

- **Assuming two Berths**

    - Theoretical berth occupation rate will be as low as 25% which also is not most economic situation.

    - This will allow a more flexible and customer friendly time-table.

If the departure of vessels is determined due to a fixed schedule which is proposed for this service (see later) a correction has to be introduced for not every time filling the ferries completely before departure, here suggested to 80% utilization on average (already the fact that the cargo traffic is showing an asymmetric distribution is to some extent accounting for this).

This means that:

- Yearly number of sailings in each direction = $\frac{1}{0.8} x \frac{11}{7+11}$ x 2,651 = 2,025 departures/year/direction.

- If evenly distributed over the year, this corresponds to 2,025/360 = 5.6 departures/day.

- With the assumed model split the theoretical cargo transfer per return trip is 1,858,000/2,025 = 917 tons/return trip.

3.2 Required Number of Ferries

Besides the cargo flow and its distribution on direction and over the year the number of ferries required to keep up the service also depends on the kind of service to be provided. It is considered important that to attract cargo to the ferry link, the service should be characterized by:

- Regular service based on fixed time table for departures (and arrivals).

- That servicing time in the ports terminals is kept low (also to benefit of ferries). A turnaround time in terminal of max. 2 hours (unloading + loading) shall be aimed at. Port service time much lower are seen in European terminals for shorter sea links.

On this basis, the minimum trip turnaround time for the present "DAGESTAN" type of vessels is determined as follows:

- Sailing time (service speed 15.5 knots)	=	11 hours
- Service time in port	=	2 hours
- Minimum ferry trip turnaround time 2 x (11+2)	=	26 hours

Used on the case of year 2015 this means that:

- Fixed regular time schedule means that 5.6 departures turns to 6 departures/day (or 5 every day + one additional every second day).

- Time between departure on average 4 hours.

- Available trip turnaround time per ferry is then 24 hours + 4 hours = 28 hours on average (> 26 hours available for catching delays, increasing terminal service time, increasing sailing time).

A fixed time schedule with 6 daily departures and a minimum turnaround time of 26 hours requires a minimum of 7 ferries, corresponding to a yearly effective "production" by each ferry of 265,000 tons of cargo. The theoretical max. production is 24/29 x 230 x (28 x 40) x 2 = 627,000 tons, which means that the effective utilization of the ferries will be about 42% of their loading capacity.

Due to the relatively limited number of container throughput it is suggested that container handling is carried out as follows:

- Lifting from/to transport instrument is carried out by heavy forklifts (30 tons, toplift).
- Stacking/unstacking by heavy forklifts.
- Transfer between yard and vessel by terminal tractor and trailer (container mover).

Further, assuming that:

- Layout of container slots is three rows deep.
- Maximum stacking height is 3 containers.
- Average stacking height is 2 containers.
- Reserve area of 20% assumed for peaks/flexibility.

We arrive at a holding/storage capacity of 0.038 TEU/m^2 or 26 m^2/TEU which is in line with ordinary practice for this type of handling method. This includes stacking and operation alleys in the yard but excludes access road and railway for parking while loading/discharging containers.

Areas destined specially for empty containers may have a much higher holding capacity but in the present case no distinction is made between full and empty containers as they are suggested to be handled and stored as one group, the reasons being:

- No stripping of containers will take place in the terminal (transfer terminals).
- The terminal is a transfer point and should not be used as collecting point for empty containers which is the risk if a special area for empty containers is established.
- Special collecting yards for empty containers should be established elsewhere e.g. by the individual container operators.

Yard Area Requirements

The dwell time of containers in ordinary container terminals may typically be 5-7 days which ought to be shorter in a ferry terminal with daily departures. Assuming an average dwell time of containers of 4 days, this means that:

- Average number of containers to be stored: 4/365 ~ 1.1% of annual throughput (year 2015: 27,900 x 0.011 = 307 TEUs).
- Yard area required: 0.011 x 26 x C (C = annual TEU throughput) = 0.29 x C m^2 corresponding to 35 t/m^2 of annual cargo handling by container. (Year 2015: 27,900 x 0.29 = 8,100 m^2).
- Access to yard area is normally taken into account by adding 20-30% depending on the size of the area.

. It will provide safety with respect to keeping the sea-line operational at all times as a breakdown of both berth systems is unlikely.

. In this case as a minimum one terminal (port) has to allow operations at night.

- It follows from the above that before it becomes theoretical necessary to add a second ferry berth it will be needed due to other reasons depending on priorities.

  . Importance of operational safety.

  . Importance of custumer friendly service with precise departure times.

  . Operational flexibility (adjustments and changes in operations).

  . Planning flexibility (alternatives).

  . Costs of additional berths.

In the present case, it is recommended in all circumstances to prepare the design for a two-berth system (as requested according to TOR) and await with the final decision on implementation to the result of the economic evaluation, subject of phase 3 of the study, is known, as this is one of the project parameters that may be adjusted.

A 3 berth will not be required in a foreseeable future except if new sea links are being developed. Before a third berth for the existing sea link is required new bigger vessels will have been introduced together with a second shore ramp at existing berths.

4. Terminal Capacity and Area Requirements

4.1 Container Handling

The intermodal handling of containers takes place when containers are delivered to the terminal on one side of the sea by one transport instrument and carried away from the terminal on the other side of the sea by another transport instrument. This avoids crossing by the ferry of the transport instruments, being either rail wagons or trucks.

The handling of these containers requires a special area in the terminal where unloading/loading and intermediate storage of the containers waiting for crossing/delivery can take place.

Based on the traffic forecast the basic figures for determination of the space requirements in the socalled "area utilization" which may be stated in either t/m^2 or TEU/m^2. The area utilization is a function of area holding/storage capacity and average dwell time of containers in the terminal.

Holding/Storage Capacity

The storage capacity depends on the handling operation (container handling equipment) used and the consequent access requirements and the maximum/average stacking heights.

conditions and flexibility in the future with respect to changing departure timetable (two berths are available).

Assuming area requirements for trucks and cars to be 55 m^2 and 15 m^2 respectively, a ship load becomes: A (shipload) = 30 x 55 x 50 x 15 = 2,400 m^2 and providing a reserve area of 100%, the marshalling area becomes A = 2 x 2400 = 4,800 m^2.

Vehicle Disembarcation Area

This area shall hold a full ship load to empty the ferry immediately after arrival but awaiting border police and customs.

Area requirement is:

A = 1.2 x 2,400 = 2,900 m^2

including reserve area.

Arrival Area

This area is placed in front of ticketing, border control and possible customs control. The area shall serve as a buffer area avoiding backups on public roads caused by congestion at these controls. In the present case of expected heavy controls an area at least equivalent to one ship load should be provided split between ticket control and other controls.

Area requirement is A = 1.2 x 2,400 = 2,900 m^2 including reserve area.

Zone for Dangerous Cargoes

A separate area for parking of vehicles/trailers carrying hazardous cargoes is recommended. This will also facilitate that correct segregation, as requested by the IMO regulations, is achieved during loading operations.

The share of this type of cargo is normally relatively low and the parking area should reflect this, say 12 vehicles requiring an estimated area of 2000 m^2.

Areas for Ticketing, Customs and Police Operations

Whether these facilities will be combined in the same area or divided into two separate areas remain for the planning and design phase, but the total area requirement may be estimated to approximately 2,000 m^2.

Areas for Public Services

Whether these facilities will be combined with the passenger facilities depends on the area layout and will remain the design phase. Area requirement is assumed to be approximately 500 m^2.

Interface Area

Normally a separate interface area allowing for traffic movement between the ferries and the marshalling and disembarcation area will have to be established. The size of this area depends on

It shall be noted that for ordinary specialized container yards, an annual cargo handling of about 10 t/m^2 is realistic but for ferry terminals with daily departures this may be much higher.

4.2 Semitrailer Handling

As mentioned in chapter 3.1, part of the truck traffic is expected to be transferred as loose semi-trailers.

Depending on the annual throughput a special area for handling/parking of these semitrailers may be provided. The requirements may be determined parallel to the case of the containers on the ground of the following assumptions:

- Transfer between parking yard and ferry by terminal tractor (tugmaster).
- Layout of parking slots is two rows deep.
- Average dwell time of 2 days (no rail transport).
- Reserve area of 20% assumed for peaks/flexibility.

We arrive at:

- Capacity of parking area: 103 m^2/trailer including parking and operation/driving alleys.
- Average number of semitrailers to be parked: 0.6% (year 2015: 90 trailers).
- Parking yard area required: 0.62 x C m^2, where C is annual throughput of trailers corresponding to 32 t/m^2 of annual cargo handling by trailer (year 2015: 0.62 x 15,330 = 9,500 m^2).
- Access to parking area is normally taken into account by adding 20-30% depending on the size of the area.

4.3 Trucks and Car/Busses Handling

Space requirements for the remaining vehicle services will be estimated splitting the area into the different operational zones with due consideration to the PIANC recommendations for the design and operation of ferry ports, ref. /7/.

Vehicle Marshalling Area

This is the area after all clearances where vehicles are waiting ready for embarcation. Size of the area depends on vessel capacity, distance between departures and arrival distribution of vehicles. Assuming min. 4 hours between departures, normally only one ferry load should be necessary but often a reserve area for early arrivals is provided for. Access to this area can be regulated.

Under the present conditions of the ferry terminals it is observed that trucks are waiting several days. Instead of providing a special waiting area elsewhere it is considered more useful to add this area to the marshalling area as this will simultaneously provide for waiting under the present

the specific layout of the terminal and may vary considerably. It will be determined during the design phase but at this stage an area of say 3,000 m^2 shall be taken into account.

In general, space for access roads, service, security and emergency roads, non regularity of available areas and other unforeseen is taken into account by adding 20-30% depending on the size of the area.

4.4 Passenger Handling

To accommodate passengers, a terminal building is required offering space for customer services like ticketing, waiting hall, public utilities and services, restaurant, etc. Also customs and border police operations may be included. In front of this building an area for setting off/picking up passengers, short stay parking, taxis and busses, etc. shall be provided for.

The area set aside for these facilities is temporarily estimated at approximately 5,000 m^2.

4.5 Administration Facilities

To provide space for building facilities for terminal administration including parking and access an area of approximately 2000 m^2 will be set aside.

Appendix 7

Transportation Costs Estimates for Bulk Cargo Shipments from Turkmenistan to Selected Destinations

[illegible] Estimate[illegible] Cargo Shipments
[illegible] Destinat[illegible] (Continued)

Route	Origin	Destination	Distance Km	Transit Time	Rate Per Ton
[illegible]	[illegible]	[illegible]	2,[illegible]	1[illegible]	62.9
[illegible]	[illegible]	[illegible]	2,[illegible]	1[illegible]	76.6
[illegible]	[illegible]	[illegible]	1,[illegible]	[illegible]	40.5
[illegible]	[illegible]	[illegible]	2,55[illegible]	14	53.8
[illegible]	Ashgabad	[illegible]	1,23[illegible]	5	28.9
[illegible]	Ashgabad	[illegible]	1,250	4	33.8
[illegible]	Ashgabad	[illegible]	1,300	5	26.4
[illegible]					
[illegible] Rail Total	Ashgabad	[illegible]	2,300	9	64.4
[illegible] Rail	Ashgabad	[illegible]	3,100	15	62.9
[illegible] Samsun/Truck	Ashgabad	[illegible]	2,300	8	62.1
[illegible]/Mersin/Water Total	Ashgabad	[illegible]	2,600	13	72.4
[illegible] Turkey/Rail	Ashgabad	[illegible]	3,150	15	63.9
[illegible] Turkey/Truck	Ashgabad	[illegible]	2,650	9	71.6
To/From U.S.					
[illegible] Baltic/Water Total	Ashgabad	St. Petersburg	5,354	27	55.5
[illegible] Baltic/Rail	Ashgabad	St. Petersburg	4,551	15	71.9
[illegible] Baltic/Rail-Ferry-Rail Total	Ashgabad	St. Petersburg	3,635	13	59.0
[illegible] Pireaus/Water Total	Ashgabad	Pireaus	4,805	18	56.3
[illegible] Transcaucasian/Pireaus/Rail-Ferry-Rail-Water Total	Ashgabad	Pireaus	3,485	16	51.2
[illegible] Turkey/Rail	Ashgabad	Mercin	3,150	15	63.9
To Turkey/Truck	Ashgabad	Mercin	2,650	9	71.6

[illegible] 14 Summary: Transporta[illegible] C[illegible]sts Estimates for Bulk C[illegible]go S[illegible]ts from Turkmeni[illegible] to Selected Destinations

[illegible]	Origin	Via	[illegible]stination	Transportation Mode	Distance (km)	[illegible]	Rate [illegible]
1. To/From [illegible]lack Sea (Novorosyjsk, Poti, Odessa)							
1a. Nov[illegible]ro[illegible]ljsk/Water							
Total	*Asgabad*		[illegible]rosyjsk		3,299	1[illegible]	49.0
1b. Novorossijsk/Rail	Ashgabad		[illegible]rosljsk		3,579	[illegible]	56.5
1c. Odessa/Wat[illegible]r							
Total	*Ashgabad*		[illegible]sa		3,755	[illegible]	49.7
1d. Odessa/Rail	*Ashgabad*		[illegible]sa		4,456	[illegible]	70.4
1e. T[illegible]anscaucasian/Novorossljsk/Rail-Ferry-Rial							
Total	*Ashgabad*		[illegible]rosyjsk		2,165	8	35.8
1f. Transcaucasian/Potl/Rail-Ferry-Rail							
Total	*Ashgabad*		[illegible]		1,685	7	28.2
1g. Transcaucasian/Potl/Truck-Ferry-Truck							
Total	*Ashgabad*		[illegible]		1,685	[illegible]	43.9
1h. Transcaucasian/Odessa/Rail-Ferry-Rail							
Total	*Ashgabad*		*Odessa*		*2,685*	[illegible]	*43.2*
2. To/From Northern Europe/St. Petersburg							
2a. Baltic/Water							
Total	*Asgabad*		*St Petersburg*		*5,354*	*2[illegible]*	*55.5*
2b. Baltic/Rail	*Ashgabad*		*St Petersburg*		*4,551*	*15*	*71.9*
2c. Baltic/Rail-Ferry-Rail							
Total	*Ashgabad*		*St Petersburg*		*3,635*	*13*	*59.0*
3. To/From Western Europe/Frankfurt							
3a. North Adriatic/Water-Rail							
Total	*Ashgabad*		*Frankfurt*		*7,355*	*28*	*89.5*
3b. Rail							
Total	*Ashgabad*		*Frankfurt*		*6,700*	*19*	*109.3*
3c. Rail/Tchechnia							
Total	*Ashgabad*		*Frankfurt*		*4,985*	*18*	*83.4*
3d. Transcaucasian/Rail-Ferry-Poti/Vessel-North Adriatic/Rail-Frankfurt							
Total	*Ashgabad*		*Frankfurt*		*6,235*	*23*	*94.8*
3e. Transcaucasian/Truck-Ferry-Poti/Vessel-North Adriatic/Truck-Frankfurt							
Total	*Ashgabad*		*Frankfurt*		*6,235*	*22*	*121.3*
4. To/From Southern Europe							
a. North Adriatic/Water							
Total	*Ashgabad*		*North Adriatic*		*6,355*	*25*	*66.5*
4b. Venice/Rail							
Total	*Ashgabad*		*North Adriatic*		*6,145*	*17*	*99.3*

[illegible] Shipments

[illegible]				92.5
[illegible]				105.6
[illegible]				40.5
[illegible]				53.8
[illegible]				58.9
[illegible]				33.8
[illegible]				26.4

[illegible] Turkey

[illegible]nsun/Water Total — Ashgabad	[illegible]	[illegible]	9	94.4
[illegible]sun/Rail — Ashgabad	[illegible]	[illegible]	15	62.9
[illegible]rkey [illegible]nsun/Truck — Ashgabad	[illegible]	[illegible]	8	62.1
[illegible] Turkey/M[illegible]rcin/Water Total — Ashgabad	[illegible]	[illegible]	13	102.4
[illegible] — Ashgabad	[illegible]	[illegible]	15	63.9
[illegible] — Ashgabad	[illegible]	[illegible]	9	71.6

[illegible] To/From [illegible]S.

7a. [illegible]/Water Total — Ashgabad	[illegible]etersburg	5,354	27	70.5
7b. Baltic/Ra[illegible] — Ashgabad	Petersburg	4,551	15	71.9
7c. [illegible]ltic/Rail-Ferry-Rail Total — Ashgabad	Petersburg	3,635	13	59.0
7d. Pireaus/Water Total — Ashgabad	[illegible]reaus	4,805	18	71.3
7e. Transcaucasian/Pireaus/Rail-Ferry-Rail-Water Total — Ashgabad	[illegible]reaus	3,485	16	66.2
7f. Turkey/Rail — Ashgabad	Mercin	3,150	15	63.9
7g. Turkey/Truck — Ashgabad	Mercin	2,650	9	71.6

Table [illegible]1 Summary Transportation Costs Estimates for General Cargo Shipments from Turkmenistan to Selected Destinations

Route	Origin	Via	Destination	Transportation Mode	Distance (km)	Transit Time	Rate Per Ton
1. To/From Black Sea/Novorossiysk, Poti, Odessa							
[illegible] Novorossiysk/Water							
Total	Asgabad		Novorossiysk		3,29[illegible]	[illegible]	54.0
[illegible] Novorossiysk/Rail							
Total	Ashgabad		Novorossiysk		3,57[illegible]		56.5
[illegible] Odessa/Water							
Total	Ashgabad		Odessa		3,75[illegible]	16	64.7
[illegible] Odessa/Rail							
Total	Ashgabad		Odessa		4,45[illegible]	14	70.4
[illegible] Transcaucasian/Novorossijsk/Rail-Ferry-Rail							
Total	Ashgabad		Novorossiysk		2,16[illegible]	[illegible]	35.8
[illegible] Transcaucasian/Poti/Rail-Ferry-Rail							
Total	Ashgabad		Poti		1,68[illegible]	7	28.2
[illegible] Transcaucasian/Poti/Truck-Ferry-Truck							
Total	Ashgabad		Poti		1,68[illegible]	6	43.9
[illegible] Transcaucasian/Odessa/Rail-Ferry-Rail							
Total	Ashgabad		Odessa		2,68[illegible]	3	58.2
2. To/From Northern Europe/St. Petersburg							
2a. Baltic/Water							
Total	Asgabad		St. Petersburg		5,354	27	70.5
2b. Baltic/Rail							
Total	Ashgabad		St. Petersburg		4,551	15	71.9
2c. Baltic/Rail-Ferry-Rail							
Total	Ashgabad		St. Petersburg		3,635	13	59.0
3. To/From Western Europe/Frankfurt							
3a. North Adriatic/Water-Rail							
Total	Ashgabad		Frankfurt		7,355	28	119.5
3b. Rail							
Total	Ashgabad		Frankfurt		6,700	19	109.3
3c. Rail/Tchechnia							
Total	Ashgabad		Frankfurt		4,985	18	83.4
3d. Transcaucasian/Rail-Ferry-Poti/Vessel-North Adriatic/Rail-Frankfurt							
Total	Ashgabad		Frankfurt		6,235	23	124.8
3e. Transcaucasian/Truck-Ferry-Poti/Vessel-North Adriatic/Truck-Frankfurt							
Total	Ashgabad		Frankfurt		6,235	22	151.3
4. To/From Southern Europe							
4a. North Adriatic/Water							
Total	Ashgabad		North Adriatic		6,355	25	81.5
4b. Venice/Rail							
Total	Ashgabad		North Adriatic		6,145	17	99.3

Appendix 8

Major Commodity Trade Between Central Asian Countries

	[illegible]				
	[illegible]				
	[illegible]				
	[illegible]				
	[illegible]				
	[illegible]				
	[illegible]				
	Cotton fabric	[illegible]			
	Leather shoes				
	TV sets			[illegible]	[illegible]
	Buses				
	Cars			[illegible]	[illegible]
[illegible]	Bread grain	[illegible]			
	Vegetable oils	[illegible]			[illegible]
	Sugar	[illegible]			[illegible]
	Gasoline	[illegible]	[illegible]		[illegible]
	Diesel	[illegible]		[illegible]	76[illegible]
	Furnace oil	[illegible]	[illegible]	[illegible]	380.[illegible]
	Leather shoes	[illegible]		[illegible]	[illegible]
	Refrigerators		[illegible]	[illegible]	[illegible]
	TV sets	[illegible]		[illegible]	[illegible]
	Buses	[illegible]		[illegible]	[illegible]
	Cars	[illegible]	[illegible]	[illegible]	[illegible]
	Trucks		[illegible]	[illegible]	[illegible]
Kyrgyastan	Bread grain	Thousand tons			
	Vegetable oils	Thousand tons	[illegible]		[illegible]
	Sugar	Thousand tons	5.[illegible]		5.0
Tadzhikistan	Bread grain	Thousand tons		296.0	296.0
	Vegetable oils	Thousand tons	2.6		2.6
	Sugar	Thousand tons	0.[illegible]	8.4	8.5
Turkmenistan	Potatoes	Thousand tons	0.4		0.4
	Bread grain	Thousand tons		338.0	338.0
	Vegetable oils	Thousand tons	35.0	19.0	54.0
Uzbekistan	Potatoes	Thousand tons	9.7	71.0	80.7
	Bread grain	Thousand tons		1,478.0	1,478.0
	Sugar	Thousand tons	48.0	173.0	221.0
	Cotton fabric	Million meters	17.0	0.3	17.3
	Cars	Thousands	0.6	0.3	0.9
	Trucks	Thousands	0.4	0.1	0.5

Source: Compiled by LSU National Ports and Waterways Institute

	[illegible]				
	[illegible]				
	[illegible]				
	[illegible]				
	[illegible]				
	[illegible]				
	[illegible]				
	[illegible]				
	[illegible]				
	Raw zinc				
	[illegible]				
[illegible]	Mineral or chem[illegible]	[illegible]			[illegible]
	[illegible]tton fibre	[illegible]			[illegible]
	Refined coppe[illegible]	[illegible]			[illegible]
	Unrefined alum[illegible]	[illegible]			[illegible]
[illegible]	Cotton fibre	[illegible]		[illegible]	11.0
	Unrefined alumin[illegible]	[illegible]		[illegible]	[illegible]95.0
[illegible]enistan	Natural gas	[illegible] meter	[illegible]		25.0
	Mineral or chemica[illegible]	[illegible]	[illegible]		0.4
	Cotton fibre	[illegible] tons	[illegible]	[illegible]	255.0
Uzbekistan	Raw oil, condensation gas	[illegible]ousan[illegible] tons	[illegible]	28[illegible]	664.0
	Mineral or chemical fertilizer	[illegible]ousan[illegible] tons	[illegible]	288.0	508.0
	Cotton fibre	[illegible]ousand tons	[illegible]	56[illegible]	1,093.0

Source. Compiled by LSU National Ports and Wat[illegible] [illegible]nstitute

Appendix 9

List of Practical Codes and Local Standards for Design and Construction

21) SNiP 11.25.80 Wooden structures.

22) SNiP 11.26-76 Roofs.

23) SNiP 2.03.11-85 Protection of building structures from corrosion.

24) SNiP 2.03.13-88 Floors .

25)SNiP 2.05.02-85 Motor-car roads

26)SN 449-72 Instructions for design of earth railway and motor-car permanent ways (beds).

27) SNiP 2.0801-89 Houses.

28) SNiP 2.08.02-89 Public buildings and structures.

29) SNiP 2.09.04.87 Administrative and subsidiary buildings.

30)SNiP 3.01.01-85* Organization of building producing.

31) SNiP 3.01.04-87 Reception for exploitation of already constructed building sites. Basic thesises.

32) SNiP 111-4-80* Security in construction.

33) SNiP 111-10-75 Territory planning.

34) SNiP 3.03.01-87 Carrying and guarding structures.

35) SNiP 111-18-75 Metallic structures.

36) SNiP 3.04.03-87 Protection of building structures aganst corrosion.

37) SNiP 3.06.03-85 Motor-car roads.

38) SNiP 11-79-78 Hotels.

39) SNiP 11-80-75 Undertakings of public services.

40) SNiP 11-8 ?? Department buildings.

41) SNiP 11-85-80 Railway stations.

42) SNiP 11-L.8-71 Canteen feeding undertakings.

42) SNiP 2.07.01-89 Hydro-construction, planning and construction of towns and villages.

42) SnIP 2.05.07-85 Industrial traffic.

1. Practical codes and local standards for design and construction

The architectural and building item

1) SNiP 1. 02. 01-85 Instruction about contents, order of elaboration, agreement and approval of design and estimate documentation for construction of buildings, plants and structures.

2) SN460-74 Temporary instruction about contents and design of building working drawings of buildings and structures.

3) SN213-73 Instruction about the order of carrying out of examination of designs and estimates for construction (reconstruction) of buildings and structures.

4) SN387-78 Instruction for elaboration of General Layouts of groups of undertakings with common building sites (of industrial knots).

5) SN283-64 The temporary standarts for design duration.

6)Regulations about customer, executor and technical supervision.

7) SNiP1. 06-04-85 regulations about Chief Engineer (Chief Architector) of the design.

8) SNiP1. 06-05-85 Regulations about author's supervision of design institutes fo construction of undertakings, buildings, structures .

8a) SNiP 2.01.02.-85* Anti-fire standarts.

9) SNiP 11-4-79 Natural and man made lighting

10) SNiP 11-12-77 Protection from noise.

11) SNiP 2.01.07,85 Loading and influences.

12) SNiP 11-7-81* Construction in sesmic areas.

13) SNiP 2.01.14.83 Definition of calculated hydro-geological characteristics.

14) SNiP 2.02.01.83 Substructure of buildings and structures.

15) SNiP 2.02.02.85 Substructure of hydro-technical structures.

16) SNiP 2.02.03.85 Pile substructure.

17) SNiP 2.03.01.-84* Concrete and ferro-concrete structures.

18) SNiP 11.22.81 Stone and reinforced stone structures.

19) SNiP 11.23.81* Steel structures.

20) SNiP 2.03.06..85 Aluminium structures.

58) Technical rules for economical expenditure of basic building materials. Gosstroy of USSR. Moscow, 1983.

GOST

59) GOST 21.101.-79. Basic requirements for working drawings.

60) GOST 21.109-80. Estimates of requirements in materials.

61) GOST 2889-80. The hot bitumen roof-polish.

62) GOST 25246-82 Chemically firm concrete.

63) GOST 2551-75 Rolled roofing and hydro-isolation.

64)GOST 4.219-81 Facing materials of natural stone and blocks for their producing.

65) GOST 23499-79 Sound-absorbing and sound isolating building materials and wares.

66) GOST 12004-81 Steel for reinforcement bars.

67) GOST 6727-80 Wire of cold stretched steel with low content of carbon for reinforcing of ferro-concrete structures.

68) GOST 10178-76 Portland-cement and slag-cement.

69) GOST 15825-80 Colour portland-cement.

70) GOST 10140-80 Heat-isolated slabs of bitumen based mineral-wool.

71) GOST 1897-73 . Ferro-concrete piles for building.

72) GOST 21.503-80. Concrete and ferro-concrete precast structures and wares.

73) GOST 24992-81. Stone structures.

74) GOST 15.901-85. Building structures.

75) GOST 13015.0-83. Concrete and ferro-concrete precast structures and wares.

76) GOST 23166-78. Wooden windows and balcony doors.

77) GOST 12.1.046-85 Standards of lighting of building sites.

78) GOST Concrete and wares of ferro-concrete. Part 1;2.

Moscow (consist of 52 GOSTs).

79) GOST A steel wire . The official edition. Moscow. 1985. Total is 43.

Reference books

43) Design and calculation of wooden structures . The reference book. Kiev.

44) Calculation and design of guarding structures of buildings. The inquiry booklet to SNiP. Moscow, Strojizdat, 1990.

45) Precast ferro-concrete. The reference book. Leningrad.

46) The brief reference book of an architector. Kiev, "Budivelnik".

47) The inquiry booklet to SNiP. Design of structures for cleaning of sewage. Moscow. Strojizdat.

Textbooks

48) Textbook for design of houses, edition 3. Structures of houses (to SNiP 2.08.01-85). Moscow, Strojizdat, 1989.

49) Textbook for design of framework industrial buildings for their construction in seismic areas (to SNiP 11-7-81). Moscow, 1984.

50) Textbook for design of wooden structures (to SNiP 11-25-80). Moscow, 1986.

Recommendations

51) Recommendations for design of steel mortgage parts for ferro-concrete structures. Moscow, 1984.

52) Recommendations for design of structures. Moscow, 1984.

53) Recommendations for strengthening of stone strucres in buildins. "Gosstroy" of USSR. Moscow, 1984.

Textbooks of guidance

54) Textbook for design of slab substructures in framework tower-type buildings and structures. Moscow, 1984.

55) Textbook for selection of design decisions for substructures. Moscow, 198?

56) Textbook for selection of design of concrete and ferroconcrete structures made from heavy concrete (without preliminary stress). Moscow, 1978.

57) Textbook for exploitation of steel moulds during producing of ferro-concrete wares. Gosstroy of USSR. Moscow, 1972.

93) SNiP 2.01.01.-82. Building climatology and geophysics.

94) SNiP 11.3-79** Building heat devices.

95) SNiP 2.04.05-86. Heating, ventilation and conditioning.

96) SNiP 2.04.07-86. Heat networks.

97) ??

98) SNiP 2.04.08-87. Gas supply.

99) SNiP 2.04.14-88. Heat isolation of equipment and pipelines.

100) SNiP 11-35-76. Boiler equipment.

101) SNiP 2.05.06-85. Main pipelines.

102) SNiP 3.05.02.-88. Gas supply.

103) SNiP 3.05.03-85. Heat networks.

104) Series B3-71. Recommendations for choice of lock pipeline devices for inside sanitary-technical systems and industrial sewerage.

105) Series B3-75. Textbook for selection of lock pipeline devices for inside sanitary-technical systems.

106) Series B3-65. Recommendations for selection of lock pipeline devices for inside sanitary-technical devices.

107) T.S. 3.006 1-2.87. Assembled ferro-concrete channels and tunels of tray-type parts.

108) T.S. 903-4-11 type 1. Chambers of underground double-pipe water heat networks and layouts of knots of pipelines.

109) Series 4.903-10 issue 4. Immovable pipeline's supports.

110) Series 4.903-10 issue 5. Active supports of pipelines.

111) Series 7.900-9/3. Isolation of pipelines in underground channel laying of water heat networks.

112) T.P. 903-04213 Al.1. Automatic heat points (AHP) in buildings of civil and industrial importance.

113) Series 4.903-10. issue 8. Devices for mud.

114) Series 5.905-15. Parts 1 and 2. Equipment, knots and parts of outside gas pipelines.

115) Series 5.905.-8. Knots and parts of bindings in gas pipelines (working drawings).

116) Series 4.900-5/71. Flange joint for isolation.

Standarts of the republic

80) RSN 14-73. About design and construction of walls of limestones with right shape in Azerbaijan SSR, Baku, 1974.

81) RST Az. SSR 554-85. Masonry of sawed wall stones in conditions of Azerbaijan. Baku,1985.

82) RST Az. SSR 573-86. The emulsional bitumen-asbestos roof-polish. "BAEM" Baku, 1986.

83) RST Az. SSR 17-81. Instructions for use of facing slabs of limestone and travertin in Az. SSR, Baku, 1981.

84) RST Az. SSR 555-84 Installation of the roof-polish covering. Baku,1984.

85) RST Az. SSR 326-62. Solutional mixtures are made by industry. Baku,1982.

86) RST Az. SSR 572-76. Marchs and platforms of ferroconcrete stairways. Baku, 1976.

Catalogues

87) Territorial catalogue of model building structures and wares for civil consraction in Azerbaijanian SSR. Collection TK 38-2-88. GGPI "Azgospoekt" Baku,1988.

88) Model structures, wares and knots of buildings and strutures. series 2.140-5s Az. issue 1; Series 2. 130-6s Az. Issue 1; Series 2.260-3s. Az issue 1. GGPE "Azgosproekt " Baku, 1984.

89) Model structures, wares, knots of buildings and structures. Series A. 103. Ferro-concrete joints for outside and inside walls of stone buildings. Working drawings of GGPE "Azgosproekt" of Baku, 1986.

90) Model structures, wares and knots of buildings and structures. Series 1.134-3 Az. Issue 1;2;3. Ferro-concrete smoke ventilation blocks for dwelling and public houses. Working drawings. GGPE "Azgosproekt" Baku.

91) Design of industrial buildings and structures. By E. A. Shereshevsky. Leningrad, Stroyizdat, 1979.

92) Territorial catalogue of model precast ferro-concrete buildings and structures for industrial construction in Azerbaijan Republic, collection TK 38-1.87. GPE "Azgospromproekt". Baku, 1987.

B. Item. Heating, ventilation, air conditioning, heat supply, boiler devices, heat network, gas supply.

138) GOST 21.610-85 Gas supply. Outside gas pipelines. Working drawings.

139) GOST 21.609-83 Gas supply. Inside devices. Working drawings.

140) GOST 21.106.-78* Conventional signs of pipelines of sanitary-technic l systems.

141) GOST Heat network. Working drawings.

142) GOST 21.110-82 Specification of equipment.

143) GOST 21.102-79 General data by working drawings.

144) GOST 21.103-79 Basic inscriptions.

145) GOST 21.002-82 Standard control for design and estimate documentation.

146) GOST 21.00177 System of design documentation for construction. General indexes.

147) GOST 19903-74* Hot rolled sheet steel. Sorting.

148) GOST 19904-90 Cold rolled sheet steel.

149) SNiP 2.04.01-85 Inside water network and sewerage of buildings.

150) SNiP 2.04-02-84 Water supply. Outside networks and structures.

151) SNiP 2.04.03-85 Sewerage. Outside networks and structures.

152) SN 496-77 Temporary instructions for design of structures for cleaning of surface sewage.

153) SNiP 3.05.01-85 Inside sanitary-technical systems.

154) SNiP 3.05.04-85* Outside networks and structures of water supply and sewerage.

155) Series 4.900-10 Album of equipment of fashioned parts and devices for water pipelines and sewarage.

156) Series 5.901-1. Water measuring knots (rooms).

157) Series 3.900-1-12 Ferro-concrete wares for trays of sewerage.

158) Series 3.900-1-1E Ferro-concrete wares for round pits of VK.

159) Series 4.900-9 Issue 7. Knots and parts of pipelines of plastic pipes.

160) Series 4.900-3-10 Pipeline compensators. Seals.

161) Series 4.901-7 Stresses on outside water pipelines. water pipelines and sewerage.

162) T.P. 901-09-11.84 Pits of water pipelines.

117) Part 10. Item 1. Building catalogue. Centrifuge pumps with types K, KM, KE, CNEEPS, CVC.

118) MP "Pylygrym". Pumps (include 46 different types of pumps).

119) Item 86. Moscow. Engineering equipment of buildings and structures. Whirlwind pumps VK; VKK; VKO; CVK- types.

120) Catalogue of PPO "VNIIGYDROMASH" centrifugal console pumps with general purpose for water. Moscow, 1989.

121) A9-10 Recommendations for calculations of water heaters.

122) Textbook for selection of ventilators V-C4-70, V-C4-76, V-C14-46, V-C4-75.

123) A3-970. Textbook for selection of radial ventilators with common purpose VC4-75 type for sanitary-technical systems.

124) Part 10. Item 1. Ventilators.
Subitem 40

125) Item 80 Moscow, 1990. Drawings of model building structures, wares and knots of buildings. Heating, ventilation and conditioning (includes 38 model serieses).

126) Item 81 Moscow, 1985. Calorifiers, air-heaters, air-heat devices.

127) Item 81 Moscow, 1990. Bimetallic calorifiers.

128) Item 82 Moscow, 1987. Electrical water heaters.

129) Item 82 Moscow, 1987. Devices for removing of condencate.

130) Item 81 Moscow 1988. Filters for cleaning of incoming air.

131) Item 82 Moscow 1988. Heaters (Heat devices).

132) Item 82 Moscow 1985. Water heaters.

133) "TEPLOELEKTROPROEKT" Recommendations for selection and use of the lock devices and inverted valves for heat networks (2-nd edition).

134) Harkov 1991. Catalogue "Steel, cast-iron, ferro-concrete, plastic and asbestos pipes are produced by plants in USSR" (includes 41 types of pipes).

135) VNIPIENERGOProm Moscow 1987. Temporary instructions for design and construction of heat networks without channel method with isolation of bitumen-perlit, bitumen-ceramsit and bitumen-vermikulit.

136) Academy of Municipal Economy by Pamfilov. Instructions for electro-chemical protection of pipelines in heat networks against outside corrosion.

137) GOST 21.602-79* Heating, ventilation and conditioning of air. Working drawings.

186) T.p. 5. 407-142 Installation of switch boards ShRS1 and ShR11 types.

187) T.p. 5. 407-110 Installation of electro-magnetic starters PMA- series.

188) T.p. 5. 407-112 Installation of lighting screens.

189) T.p. 5. 407-83 Installation of switches and plugs.

190) T.p. 5. 407-11 Earthing and zeroing of electrical devices.

D. Item. Arrangment of communication

191) VSN60-89 Arrangement of communication, signalling and controllering of engineering equipment of dwelling and public buildings.

192) VSN 116-87 Instruction for design of line-cable structures of communication.

193) Minsvyaz of USSR Rules for design of line-cable structures of communication and broadcasting networks.

194) Minsvyaz of USSR Electrical standarts for design of broadcasting networks (with additions).

195) NP. 2. 008-6-82 Standards for phone capacity in towns and populated areas in country side for period up to 2000.

196) NTP-327 City phone network stations.

197) SN-342-65 Instructions for design of visual systems of industrial television.

198) Reference book Cable and wire productions etc.

E. Item. Automated mechanisms

199) SNiP 3.05.07-85 System of automation

200) SNiP 2.04.09-84 Fire automation of buildings and structures.

201) TP 87.88 Issue 3 Devices and means of automation are produced by industry.

202) Textbook for design of automation and controllation of systems for water supply (to SNiP 2.04.02-8 ? Gosstroy of USSR).

J. Item. Electrochemical protection of gas pipelines

203) Moscow. Stroyizdat, 1982. Instruction of city underground pipelines against electrochemical corrosion.

163) T.p. 902-09-22.84 Pits of sewerage.

164) T.p. 902-09-46-88 Chambers and pits of rain sewerage.

165) T.p. 901-4-70.83 Tanks for water with volume of 50m3.

166) T.p. 901-4-78984 Tanks for water with volume from 100 to 300m3.

167) T.p. 901-4-79s 84 Tanks for water with volume from 500 to 1000m3.

168) T.p. 091-9-15.1.87 Absorbtion filter for clean water tanks with volume from 50m3 to 300m3.

169) T.p. 0901-9-16.1.87 Absorbtion filters for clean water tanks with volume from 500m3 to 1400m3.

170) GOST 21.604-82 Water supply and sewerage. Outside networks. Working drawings.

171) GOST 21.601-79 Water pipelines and sewerage. Working drawings.
G. Item. Electrical supply, lighting.

172) SNiP 3.05.06-85 Electrotechnical devices.

173) SNiP 11-4-79 Standards of natural and man-made lighting.

174) PUE-85 Rules of installation for electrical devices.

175) VSN 59-88 Electrical equipment of dwelling and public buildings.

176) to VSN 59-88 Textbook for design of electrical equipment of dwelling and public buldings.

177) Reference book Electrical mounting devices and wares.

178) Reference book For design of electrical lighting.

179) Reference book Electrical networks of dwelling and public buildings.

180) T.P. 4. 407-251 Laying of the cable with voltage up to 35 kV in a trench.

181) T.p. 3.320. 3 Parts of outside light devices.

182) Series 3.407.1-143 10 kV ferro-concrete supports.

183) Series 3.407.1-136 0,38kV ferro-concrete supports.

184) Series 3.407-150 Earth conditions of supports in air lines of electrical transmission with voltage of 0,38; 6; 10; 20; 35kV.

185) T.p. 407-3-612. 91 Installation of complete set transformer substation with the voltage of 10/04kV and the capacity up to 160kV.

Remarks of the translator:

The word SNiP means The Building Standards and Rules;

The word GOST means The State Standard;

The letters RST mean The Standard of Republic;

Cities, publishing houses and years of edition are mentioned in the titles of books e. g. reference books, text-books etc.

204) T.p. 900-5/74 Knots and parts of elecrical protection.

205) T.p. 402-2/25 Installation of cathodic protection.

206) T.p. 4-02-438 Installation of protectors.

207) GOST 9.015-74* United system for protection against corrosion and aging. Underground structures. general technical requirements.

3. Item. Estimate documentation

208) SNiP IV-1-84 Building standards and rules.

209) SNiP IV-16-84* Part IV. Estimate standards and rules.

210) SNiP SNiP 4.02 -91 Collections for estimate standarts and collections for building works (consist of 48 collections).

Remarks: Items 1, 2, 3, 5, 6, 27, 28, 29, 38, 39, 40, 41, 42 belong to all parts which are participated in design.

Traditional building works in republic are as follows:

a) Stone (of sawed limestone
- stone "cubic"- type with the dimension of 190 X 190 X 390mm)
- up to 5 floors

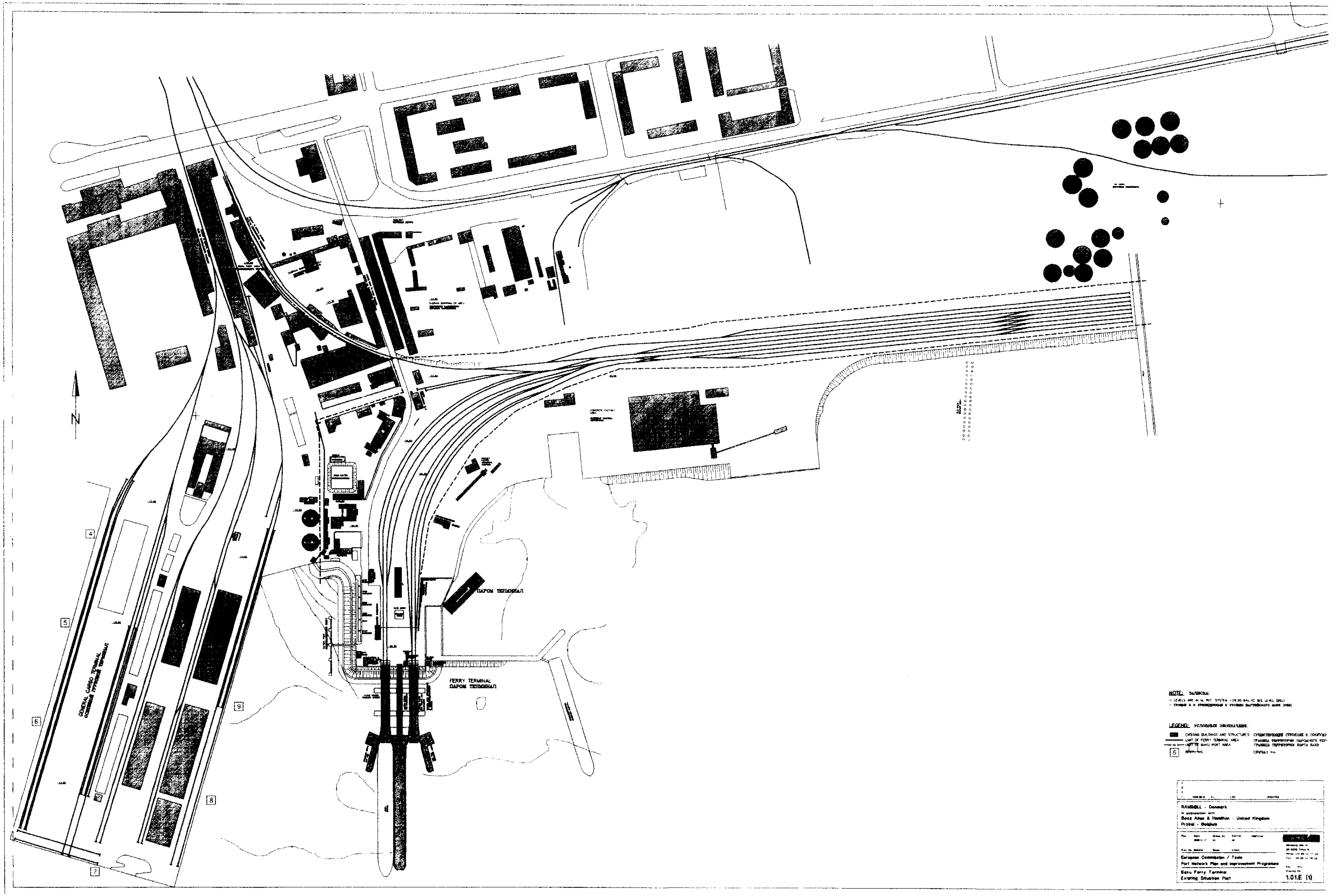
b) framework (framework consist of ferro-concrete and metal)

c) framework-stone

d) big panel (ready industrial wares) - up to 12 floors

e) monolithic (ferro-concrete and ceramsit-concrete wares).

DRAWINGS



NOTE:

- LEVELS ARE IN M, REF. SYSTEM -28.00 BALTIC SEE LEVEL (BSL)

LEGEND:

- EXISTING BUILDINGS AND STRUCTURES
- LIMIT OF FERRY TERMINAL AREA
- LIMIT OF BAKU PORT AREA
- 6 — BERTH NO.

RAMBØLL - Denmark
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European Commission / Tacis
Port Network Plan and Improvement Programme

Baku Ferry Terminal
Existing Situation Plan

1.01.E (1)

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Probel - Belgium

Rev.	Date	Drawn by	Control	Approved
	1996 07 17	lfa	lar/cs	hh

Proj. No. 963374 Scale 1:25000

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European Commission / Tacis
Port Network Plan and Improvement Programme

Baku Ferry Terminal
Sea Approch

File: 111E
Drawing No.: 1.11.E

ВМЕСТИМОСТЬ ЦИСТЕРН – CAPACITY OF TANKS

ОТДЕЛ	COMPARTMENT	ШПАЦИЯ FRAMES	ОБЪЕМ – VOLUME m³	ОБЪЕМ – VOLUME [illegible]	ВЕС T TONNES	ПЛЕЧО – C.G. (M) ОТ К.П. FROM A.P.	ПЛЕЧО – C.G. (M) ОТ ОСН. FROM B.L.
ВОДА – FRESH WATER					1.00 t/m³		
[illegible]	FRESH WATER TANK No 9 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	FRESH WATER TANK No 9 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	DRINKING WATER TANK No 11 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	DRINKING WATER TANK No 11 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	FEED WATER TANK No 24 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	M.E. FRESH W COOLING TK No 23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ВСЕГО	TOTAL		153.70 / 153.70	5427 / 5427	153.70 / 153.70		
ТЯЖЕЛОЕ ТОПЛИВО – FUEL OIL					0.93 t/m³		
[illegible]	FUEL OIL TANK No 14 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	FUEL OIL TANK No 14 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	FUEL OIL TANK No 11 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	FUEL OIL TANK No 11 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	FUEL OIL OVERFLOW TK No 12 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	FUEL OIL DAILY TANK No 17 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	FUEL OIL SETTLING TK No 16 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	FUEL OIL DRAIN TANK No 15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ВСЕГО	TOTAL		190.90 / 152.90	6742 / 5400	177.58 / 142.20		
ДИЗЕЛЬНОЕ ТОПЛИВО – DIESEL OIL					0.87 t/m³		
[illegible]	DIESEL OIL TANK No 3 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	DIESEL OIL TANK No 3 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	DIESEL OIL OVERFLOW TK No 13 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	DIESEL OIL DAILY TANK No 9 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	DIESEL OIL SETTLING TK No 18 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	A.E. DIESEL OIL DRAIN TK No 10 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ВСЕГО	TOTAL		83.04 / 60.82	2933 / 2148	72.25 / 52.92		
МАСЛО – LUBRICATING OIL					0.90 t/m³		
[illegible]	L.O. STORAGE TANK No 2 C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	DIRTY L.OIL TANK No 4 C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	L.O. CIRCULATING TANK No 5 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	L.O. CIRCULATING TANK No 5 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	A.E. L.OIL STORAGE TANK No 1 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	A.E. DIRTY LUB OIL TANK No 3 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	L.O. TK FOR STERN TUBE No 7 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	L.O. TK FOR STERN TUBE No 7 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	CPP DRAIN TANK No 6 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	CPP DRAIN TANK No 6 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	CYLINDER OIL TANK No 8 FC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	CYLINDER OIL TANK No 8 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ВСЕГО	TOTAL		[illegible] / 56.10	3145 / 1980	[illegible] / 50.51		
ВОДЯНОЙ БАЛЛАСТ – WATER BALLAST					1.009 t/m³		
[illegible]	FORE PEAK	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	D. BOTTOM TANK No 4 COOL W	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	D. BOTTOM TANK No 5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	D. BOTTOM TANK No 5 COOL W SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	D. BOTTOM TANK No 7 COOL W SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	SIDE TANK No 1 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	SIDE TANK No 2 P	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	SIDE TANK No 2 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	D. BOTTOM TANK No 8 SB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ВСЕГО	TOTAL		3988.07	141270	4035.07		
ОСТАЛЬНЫЕ ЦИСТЕРНЫ – COLLECTING TANKS							
[illegible]	WASTE WATER TANK No 20 P	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	WASTE WATER TANK No 20 SB	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	BILGE WATER TANK No 21 P	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
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[illegible]	D. BOTTOM TANK No 2 VOID SPACE	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	D. BOTTOM TANK No 3 CENTR. VOID SPACE	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
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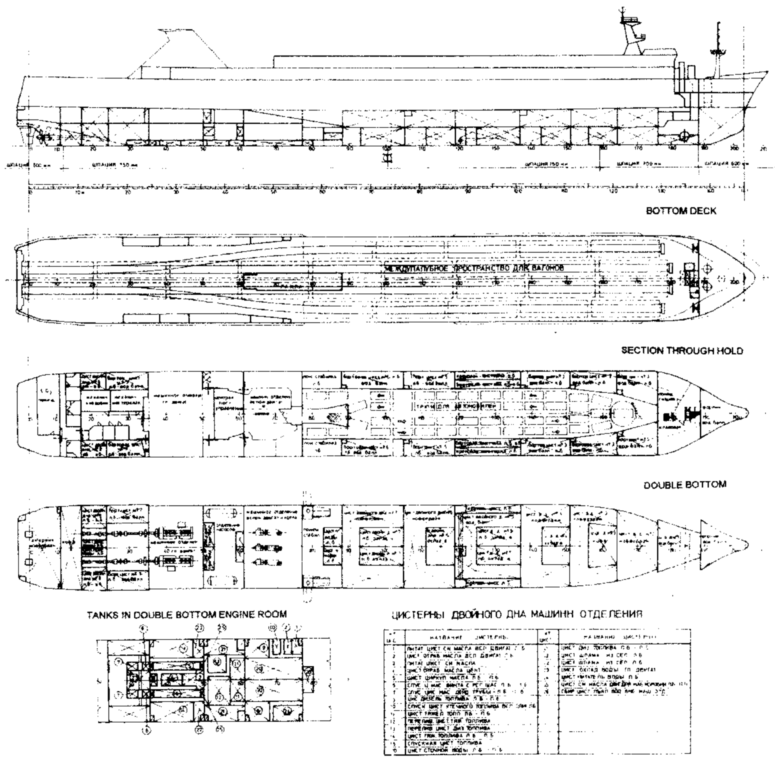
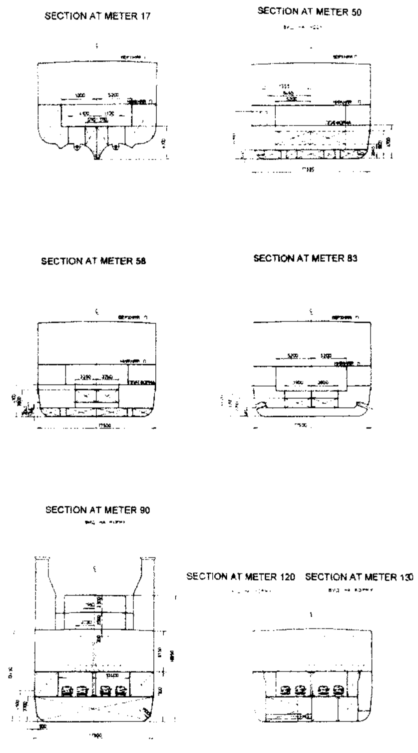
[illegible]	D. BOTTOM TANK No 7 VOID SPACE	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	VOID SPACE No 9	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	AFTER PEAK VOID	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	BILGE WATER COLLECT. TK [illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
ВСЕГО	TOTAL		2762.99	97576			

Примечание: суммарный объем цистерн тяжелого топлива, дизельного топлива и масла без цистерн обозначенных звездочками





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Probel - Belgium

Proj. No. 903324 Scale

European Commission / Tacis
Port Network Plan and Improvement Programme

Ferry Details

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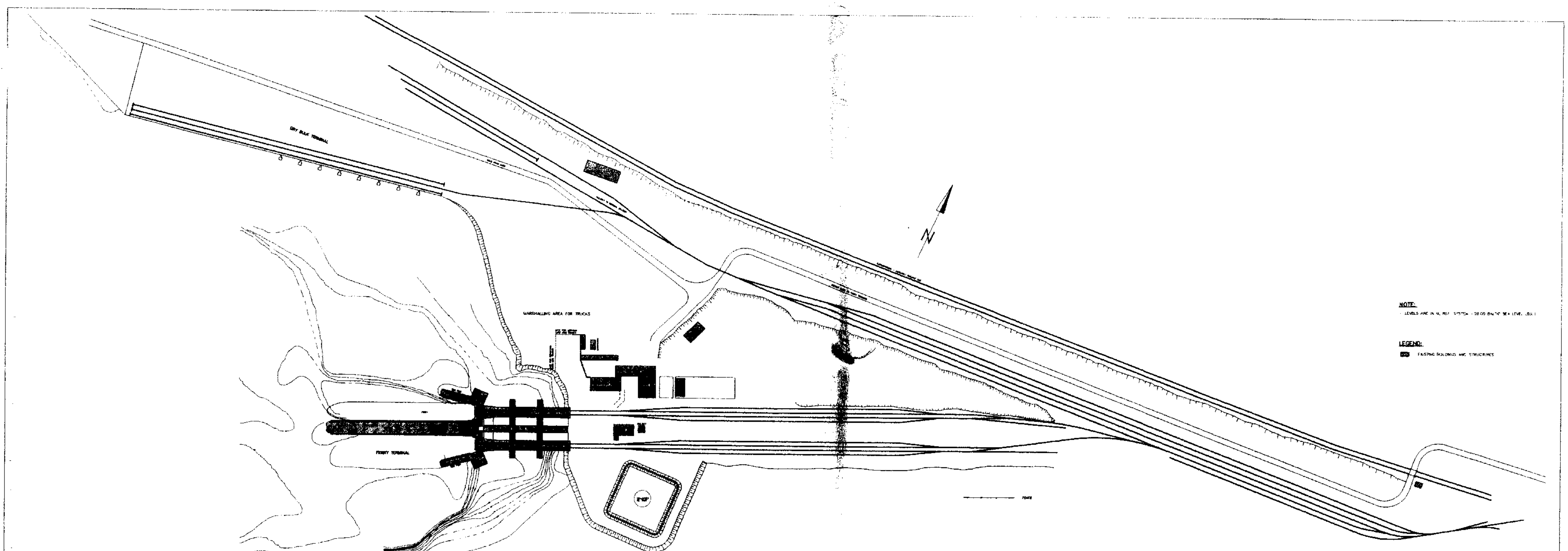
File 1918
Drawing No
1.91.E



NOTE:

- LEVELS ARE IN AL REF. SYSTEM - 28.00 BALTIC SEA LEVEL (BSL)

LEGEND:

EXISTING BUILDINGS AND STRUCTURES

UPDATED

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European Commission / Tacis
Port Network Plan and Improvement Programme

Turkmenbashi Ferry Terminal
Existing Situation Plan

2.01.E (1)

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Rev	Date	Drawn by	Control	Approved
	1996.07.17	lla	lar/cs	hh

Proj. No. 963324 Scale 1:50000

European Commission / Tacis
Port Network Plan and Improvement Programme

Turkmenbashi Ferry Terminal
Sea Approach

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File 211E
Drawing No.:
2.11.E