Tacis

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

Phase 2, Detailed Design
Report - Baku
March 1997

Volume I, Main Text

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1. INTRODUCTION

The present project, being part of the EC financed Tacis-Traceca programme for facilitation of trade on the Traceca corridor, is concerned with the rehabilitation of the ferry terminals in Baku and Turkmenbashi. The project is divided into four phases

Phase 1 - Determination of design basis

Phase 2 - Design of renovation works

Phase 3 - Economical and financial evaluation

Phase 4 - Tender documents preparation

After issue of the Inception Report in May 1996, a draft report covering the activities of Phase 1 of the project was prepared and issued in August 1996. Like all reports, this was submitted to the following organizations for commenting:

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

The Phase 1 Final Report, ref. /1/, was distributed in January 1997 having taken into account and incorporated where found appropriate the comments received from the above mentioned organizations.

Following submission of Phase 1 draft report last August, the second phase of the project concerned with the design of the rehabilitation measures was initiated. Of practical reasons this second phase has been divided into two parts, namely a conceptual design part and a detailed design part, with the clear intention in a structured way to obtain agreement on the development strategy and the general layouts of the different components of the project before the final detailed design would be carried out.

The conceptual design phase was concluded by the preparation of the Phase 2, Pre - Design and Feasibility Note, ref. /2/, which was issued in December 1996. Besides describing a development plan for the terminal and an outline of the first phase renovation measures, the note presents an assessment of the proposed measures with respect to technical, operational, environmental and financial implications. In addition the viability of the ferry service itself is discussed.

The present Phase 2, Detailed Design Report constitutes the reporting of the design activities and outcome following the second part of the design phase of the study. The report is divided into two volumes,

.VOL I - Main Text
.VOL II - Drawings

Separate reports have been prepared for Baku port and Turkmenbashi port. The present volume I concerns the development of the ferry terminal in Baku port.

Following this introduction, the present volume is divided into 6 sections as follows:

- With reference to the preceding phases of the project, chapter 2 gives an outline of the background of the detailed design. The terminal development plan selected and the proposed phasing of the works are presented.

- Chapter 3 presents the design criteria on the basis of which the detailed design has been carried out, indicating both the prevailing natural site conditions, physical conditions and loads and relevant norms and standards applied.

- With reference to the design drawings (Vol II) a description of the different components of the renovation works is presented in chapter 4. The description is divided according to the type of the works.

- As basis for planning and costing of the project the subject of chapter 5 is to outline the availability and costs of local support in terms of construction materials, manpower and equipment.

- Based on the detailed bill of quantities (BOQ) a costs estimate of the complete works is presented in chapter 6 and chapter 7 shows a tentative time schedule for the execution of the works.

About the general status of the project it may in brief be summarized

- that Phase 1 of the project has been completed and reported

- that all inspections (diver, facilities), surveys (topographic) and investigations (soil) intended during the study phases of the project have been completed and reported

- that by submission of the present report, Phase 2 of the project is completed. Due to late decision taking and agreement on general layouts and phasing of project components, the completion of this phase is (as announced already in the Phase 2, Pre-Design and Feasibility Note) considerably delayed, compared to the originally planning.

- that agreement with the railway authorities on the railway components has not been obtained yet.

- that simultaneously with the conclusion of the present phase 2, a separate report, presenting the economical and financial evaluation of the project, is under preparation as conclusion of Phase 3. The preparation of this report is linked to the completion of the present phase 2 through the use of costs estimates and planning of implementation of works.

- that initiation of Phase 4 awaits confirmation of EBRD requirements to procurement documents.

The overall planning aiming at finishing the services of the present assignment in April 1997 by preparation of the tender documents is still expected to apply. The

time required for final approvals by the public authorities and the bank afterwards is difficult to estimate.

An extension of the present assignment, comprising among other the tendering and contracting phases of the present project, has been awarded by Tacis to the consultant.

2. TERMINAL RENOVATION AND DEVELOPMENT PLAN

2.1 Objective of project

As pointed out in the Phase 1 report, ref. /1/, the ferry terminals in both Baku and Turkmenbashi ports today face various and serious problems that are of major constraint to a proper and smooth use of the terminals. If these problems are not addressed in a proper way in the near future they may even constitute a threat to the continuation of the ferry service on the sea route linking the two ports. This ferry service is a crucial element on the Traceca transport corridor linking Europe and the Caucasus region with the Central Asian countries.

The main issues of the present concern, when speaking of terminal infrastructure, are related to the following areas:

- poor state of repair of the terminal facilities
- inadequate terminal layout and insufficient facilities
- change of water level of the Caspian Sea

It is the direct objective of the present project to address these problems by preparing a terminal rehabilitation project ready for tendering and execution.

2.2 Terminal Development Plan

In order to ensure that the rehabilitation measures proposed for execution not only meet the immediate requirements but also are in accordance with the future needs of the terminal a plan for the terminal development has been prepared.

The surveys and analyses of the condition of the facilities is presented in ref./1/ where also the basic operational requirements are discussed using the elaborated traffic forecasts and taking into account international recommendations concerning design and operation of modern ferry terminals. The detailed analysis of the relevant development alternatives for the terminal is presented in the Phase 2 Pre-Design and Feasibility Note, ref. /2/, taking into consideration both technical, operational, environmental and economic aspects.

Following this analysis, the administration of the port of Baku has selected the Alt. 2A as basis for the future development of the ferry terminal. This development plan is basis of the detailed design as demonstrated by dwg's no. B.01.03/04.

2.3 Development Strategy - Phasing

Due to the present low level of traffic, the uncertainty in the momentum of the economic growth and traffic increase, the uncertainty in pace of changes in modal split, the present stop in water level increase, and the wish to maximize the financial feasibility it is proposed to implement the Terminal Development Plan in phases according to the pace of growth in terminal activities and possible reactivating of rise in Caspian Sea water level.

The following development phasing is proposed:

- Phase I Minimum investment plan with targeted immediately implementation, comprising

  . complete renovation of marine works
  . Partly raise of level of rail yard
  . establishment of complete truck/car facilities
  . preliminary passenger terminal (pavilion)/passenger bridge
  . border crossing facilities
  . use of adjacent container handling facilities (in main port)

  Due to absence of agreement with railway authorities on allowable railway track gradients, two options for the Phase I development have been considered.

  . Option 1: Shore end of ramp remains at existing level and consequently no raising of level of railway yard is required.

  . Option 2 Shore end of ramp will be raised and minimum raising of the berth end of railway yard will follow

- Phase II Additional investment plan with targeted implementation by or before the year 2010, depending on the pace of growth in terminal activities and possible raise in Caspian Sea water level, comprising

  . raise of level of administration area and road
  . new passenger terminal and administration building
  . new container yard (probably in main port)
  . new trailer yard (probably in main port)
  . raise of level of coastal protection
  . raise of remaining part of rail yard
  . container handling equipment

In chapter 4, the designs and descriptions of the different project components constituting the Phase I development plan, Option 1, are presented.

In connection with the approval of the development plan and the phasing of works it shall be mentioned that two areas are outside the control of the port administration, namely the railway installations in the ferry terminal which are controlled by the railway authority and the area of the auto-base owned by Caspian Shipping Company. Despite detailed discussions with the railway administration agreement on extend and phasing of rehabilitation measures of railway installations has not yet been reached.

3. DESIGN CRITERIA

3.1 Standards and Codes of Practice

Constructed during the period of the former Soviet Union, the existing terminal infrastructure in both Baku and Turkmenbashi ports have been designed and built according to Soviet standards and codes of practice

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 through relevant design institutions and/or from Russia (Moscow). Also they are not available in English translation.

The designs, as presented in this report, have been carried out applying what has been considered the most appropriate under the present circumstances. This means that with the exception of the marine works, the designs of other works have been carried out applying Soviet standards and codes of practice. The marine works have been designed according to relevant international norms, like Eurocodes, etc.

No matter what standard has been used proper account of specific local natural conditions and loads have been ensured.

3.2 Design Basis

Vessels

According to ref. /1/, the design will be based on the assumption of continued use of existing ferries of the 'Dagestan' type. The main features of this vessel type are:

- Deadweight, DWT : 3950 tons
- Length o.a. : 154.30 m
- Breadth, max : 18.30 m
- Draught, max : 4.50 m

- Capacity main deck : Railway lane-meters (lnm) = 416m ~ 28 rail wagons (14.4 m length)
  or alternatively: Truck lnm = 592m ~ 32 trucks (semitrailer type)
  or ~ 41 semitrailers
  or ~ 80 containers (TEU)
- Capacity hold deck : 50 cars
- Passengers : 202

Railways

- Category of the railway : III
- Speeds of rail traffic : up to 25 km/hr
- Railway stations along horizontal platform generally : 0‰
- Minimum vertical curve line : 5000 m
- Distance between tracks : 5.30 m

- Distance from a curb stone (of road) to axis of the railway : 3.75 m
- Distance in absence of the curb stone : 5.25 m
- Ballast : 0.30 m
- Rails : P-65, P-50 и P-50 (old)
- Norms of old rails' fatigue(P-50 old) : 17 mm
- Slopes of the ballast prism : 1:1.5
- Type of frog : M 1/9
- RC sleepers : C-56-1; C-56-2; C-56-3
- Wooden sleepers height : 15.5 cm
  length : 2.7 m

Lifetime

The general design lifetime of the new terminal infrastructure is 50 years as regards corrosion, fatigue of materials, statistics, etc. This do not apply to mobile equipment and likewise with normal economic lifetime much shorter.

3.3 Design Loads

Deadweight

- Reinforced concrete : 25 kN/m^3
- Construction steel : 78.5 kN/m^3
- Sawed loamy stones : 20.0 kN/m^3
- Clay bricks : 18 kN/m^3
- Masonry in hollow conc. Blocks : 14 kN/m^3
- Sea water : 10.25 kN/m^3

Live standardised loads

- Buildings: office : 2.0 kPa
  hall : 4.0 kPa reference is made to appendix 3
- Traffic areas road traffic : max axle load 12.0 tones
- Pier and access bridge : 10 kN/m2
- Passenger bridge : 4.0 kPa
- Ramp : 80 kN/m track or 40 kN/m rail see app. 3

Berthing loads

- Fender energy and forces : 540 kN/m, see app. 3 berthing speed 0.3 m/s
- Bollard forces : 750 kN

3.4 Natural design conditions

Temperature, Humidity, Precipitation

Extreme air temperatures	Max.	42°C
	Min.	-15°C
Extreme water temperatures	Max.	35°C
	Min.	~0°C
Average relative humidity		72%
Average yearly precipitation		219 mm

Wind loads

Wind pressure=0.60 kPa

Snow loads

Snow pressure=0.50 kPa

Ice loads

Considered without importance

Seismic loads

The coastal region of Baku (project area) is, according to SNiP II.7-81, belonging to seismic activity area of 9 degrees (9 degrees by Richter).

Water levels

Final stage of reconstruction works will be designed for water level variation between -25 m and -30 m (0 reference level is Baltic sea level).

Waves

Statistics of the waves for Baku bay is available. The bay is protected by Apsheron peninsula from the North side the maximum observed height of the waves is 1.5 m from the South side.

Soil Conditions

During the coarse of the present design a geological survey has been carried out in the region of Baku ferry terminal in January, 1997 (borings No 1; 2; 3; 4). The result of the survey was a report, ref. /5/, containing conclusion regarding geological condition of the soils.

In accordance with this document, soil conditions of the site are described as follows:

layer I from the ground surface, a capacity is 3.0-4.0 m	Filled, loamy, with inclusions of building rubbish
layer II, with a capacity of 6.5-7.5 m	Middle grained sand of grey colour, saturated, with inclusions of rubble and coquina shells Index of porosity e=0.54 Volumetric weight γ=1.73-1.96 g/cm3=17.3-19.6 кN/m3 Design shear strength R_o=3.5 kg/cm2=0.35 MPa Cohesion C_n=0.02 kgs/cm2=0.002 MPa Angle of inside friction φ_n=38° Modulus of deformation E=400 kgs/cm2=40 MPa
layer III, with a capacity of 1.0-1.5 m	Loam, with low plasticity
layer IV, with a capacity of 8.0-9.0 m	Clay of blue colour, half-solid, with layers of sand Index of porosity e=0.82-0.85 Plasticity I_p=0.20 Indices of yielding I_w=0.20-0.30 Volumetric weight γ=1.85-1.90 g/cm3=18.5-19.0 kN/m3 Design shear strength R_o=2.5 g/cm2=0.25 MPa Cohesion C_n=0.47 кгс/см2=0.047 MPa Angle of inside frictionния φ_n=18° Modulus of deformation E=180 g/cm2=18 MPa

3.5 Materials

Concrete

- Building works

  - Class B7.5 concrete; design compression strength: 4.5 MPa
    Blinding layer for foundations and floors.

  - Class B15 concrete; design compression strength: 8.5 MPa
    Building works, foundations, lintels, monolithic parts of floors, seismic belt.

  - Class B20 concrete; design compression strength: 11.5 MPa
    Building works, frame (columns and girders) of the public service building and columns of the passenger bridge.

  - Class B25 concrete; design compressive strength: 14.5 MPa
    Roofing works, frames (columns and girders, monolithic floors) of the passenger terminal

Otherwise reference is made to appendix 3

- Marine works

  - Class 1 concrete; nominal compression strength: 14 MN/m2
    Blinding layer.

  - Class 2/3 concrete; nominal compression strength: 27 MN/m2
    Building works, above ground.

  - Class 4 concrete; nominal compressive strength: 30 MN/m2
    Marine works

Reinforcement and structural steel

- Building works

  -Reinforcement steel.
  .Class AI, mild steel; yield strength : 225 MPa.
  .Class AIII, high tension steel; yield strength : 365 MPa.

  -Structural steel.
  .ВСт3кп2, yield strength : 225 MPa.

- Marine works

  -Reinforcement steel.
  .Type R, mild steel; yield strength : 220 MN/m2.
  .Type Y, high tension steel; yield strength : 550 MN/m2.

  -Structural steel.
  .St. 36, yield strength : 235 MN/m2.
  .St. 52, yield strength : 355 MN/m2

Other materials will be normally available standard materials.

3.6 Design Calculations

Due to the big volume of the design calculations, it was decided only to include representative examples in this report, as shown in Appendix 3.

4. GENERAL LAYOUT OF TERMINAL FACILITIES

4.1 Terminal area arrangement

Layout, arrangement

The chosen layout of the renovated terminal, following the initial investments according to Phase I, Option 1, development, is shown on Dwg. no. B.01.03/04. According to this layout the terminal will comprise the following new/renovated areas:

- Arrival and Ticketing area
- Holding area for dangerous cargo
- Border control area (customs, police)
- Marshalling area
- Interface traffic area in front of ferry berths
- Vehicle disembarkation area
- Passenger reception and parking area

All these area will be paved by asphalt on a gravel bed and supplied with drainage system and flood lighting. Traffic lanes will be separated by painted lines and low movable fences where found necessary. The customs area will be fenced off.

Access by road and rail will be through the existing infrastructure, but the widening of the access road will be necessary. This layout is based on using facilities in the main port for handling inter modal container and unaccompanied trailer traffic. To serve this traffic an internal road between the ferry terminal and the main port will be constructed.

The following new buildings/structures will be present on the terminal area:

-	Vehicle ticketing building	(new)
-	Border control building	(new)
-	Public service building	(new)
-	Passenger pavilion	(new)
-	Passenger bridge	(new)
-	Administration building	(existing)
-	Hotel,	(existing)
-	Railway control post	(existing)

These buildings are further described in section 4.5.

Road pavement works

The pavement at the areas, intersections and in front of the bridge will include:

1.	The upper layer-middle grained a-concrete	h=5 cm
2.	Lower layer-coarse grained	h=7 cm
3.	Broken stone	h=12 cm
4.	Gravel soil mixture	h=14 cm
5.	Torpedo sand	h=16 cm

Lighting, power supply and electric installations

Two floodlighting masts, 18 m long each, with glow lamps in the floodlights, shall light the terminal area. Lighting of lanes, footpaths shall be arranged by fittings with ДРЛ type mercury vapour lamps, installed with a help of bracket on steel supports. Outside lighting and power supply net of the buildings and structures is executed from cable conduits 0.7 m under ground. Telephone and radio net is also made of cables.

Drainage, water and sewerage

There shall be a drainage system to drain rain waters from the terminal area This will help to avoid a possible submersion of the lanes and the buildings, located at the low parts when there are heavy rains.

Rain waters, flowing from areas of lanes, go through water receivers into a closed water drainage system. The well, consisting of a removable grid, well rings and a bottom with a chute, is a drainage receiver.

From the drainage receiver, the rain waters come through a connecting branch with a diameter of 200-300 mm to a closed gutter. The gutter is installed at the bottom part of the drainage receiver. The drainage inlets shall be located in dependence on inclination of the lanes. In the layout, the drainage inlets have a round shape with a diameter of 0.8 m

The collected rain water shall not be pre-refined as there are no areas of industrial enterprises, polluted with oil and lubricants, on the terminal territory. Rain waters and precipitation are damped without refining into the sea by means of outlet installations.

On the terminal area, water pipelines are designed to provide the buildings and the structures with drinking water. There is also a water pipeline, designed for provision with watering of plantation and washing of pavements. The designed water pipeline is to be connected to the existing water pipeline.

Pipelines shall be executed from steel pipes with a diameter of 15-80 mm in accordance with GOST 3262-80. The pipes shall have a strong insulation. They shall be laid at a depth of 1.0-1.2 m under ground.

Sewage pipelines shall be on the ferry terminal territory to drain sewage.

From the designed buildings the sewage flows to the sewage nets to be designed from asbestos-cement pipes with a diameter of 200 mm according to GOST 539-80.

For inspection, washing and refining from littering, the inspection wells of RC pre-cast units with a diameter of 1000 mm according to GOST 8020-90 shall be installed on the yard net and manifolds.

The designed sewage manifold is to be connected to the existing sewage manifold according to the technical direction.

Heating installations

A heat source is hot water, prepared in the existing boiler house POK-2, located behind the ferry terminal fence. The water shall be supplied to the designed heat distribution point, located in the ticketing building basement.

Heat consumption for the ferry terminal	:Q=0.4 Gcal/hr=0.47 MW.
Water temperature in the system:	
Overheated water	: T11=130°C; T21=80°C (from POK-2)
Heating system	: T12=95°C; T22=70°C (from the exchange point)

The heat net shall be laid in two ways:

1. Laying above ground surface from POK-2 to the heat distribution point. Pipes of $2d_y$=100 are to be laid on RC bearings.
2. Underground laying from the heat distribution point to the buildings-consumers. The pipelines of from $2d_y$ 25 to $2d_y$ 100 are laid in a blind RC duct that corresponds to the КЛ type. Drainage of the ducts from ground waters shall be carried out in chambers.

The pipelines shall be mounted from steel welded pipes according to GOST 10704-76. All pipes are to be heat insulated.

Heat distribution point

The heat distribution point is located in the basement of the ticketing building. The POK-2 boiler house is operated as a heat source. The heat distribution point is designed for:

Heat consumption	: Q=0.4 KCal/hr=0.47 MW.
Heat bearer is an overheated water with the following parameters	: T11=130°C; T21=80°C.
The heat system parameters are	: T12=95°C; T22=70°C

The following devices shall be in the heat distribution point:

Device	Type
1. Heat exchanger with 3 sections - 1 piece	10-168-4000P
2. Heat system pump - 2 pieces	K20/30
3. Feed pumps - 2 pieces	K8/18

The pipelines are assembled from steel welded pipes by GOST 10704-76.

The automation scheme foresees temperature regulation in the heating pipelines. A control valve shall be installed on the pipeline for overheated water. There is also automation to control pressure in the pumps and a control-meter devices for the heat exchanger.

4.2 Marine works, berthing structure

Drawing B.02.01 is showing the layout of marine structures. Project components are summarised as follows:

. Land base for ferry ramps
. Access bridge
. Lifting towers (first row from land side)
. Lifting towers (second row from land side)
. 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
. Head of central pier

4.2.1 Land base for ferry ramps

Drawings: B.02.20

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.

To serve future needs of ramp motion with waterlevels varying between level -25 m and level - 30 m, the land base must be raised. Deck level at land base is chosen as the mean value of highest ship deck level at waterlevel - 25 m and lowest ship deck level at waterlevel - 30 m, which results in a ramp deck level at land base of - 23.88 m. Adjustment from land base level to future terminal ground level must take place in the terminal area behind the land base taking into account maximum inclination of 0.046 and maximum bend angle of 0.060.

Raising of land base shall be carried out in the following steps:
- Demolition parts of existing superstructure
- Sandblasting of surface
- Mounting of reinforcement anchors
- Concreting of new superstructure
- Install new bearings and buffers
- Raising of stone revetments at land base

If it is decided to maintain existing ramp deck level at land base in a first phase it will be necessary to rehabilitate bearings and buffers. Minor concrete repair works will also be needed.

4.2.2 Access Bridge

Drawings: B.02.22

Existing substructure consist of reinforced concrete piles 350 x 350 mm in lengths of 12 - 14 mr's. Existing superstructure is a reinforced concrete slab 6300 mm wide.

Existing access bridge shal be completely demolished.

A new steel access bridge shall be constructed. The bridge consists of 3 equal spans of 26 m U-shaped sections. Bridge supports are established as follows:

- Land base with steel sheet piles, concrete piles and a reinforced concrete superstructure
- 2 support reinforced concrete beams between bases of lifting towers
- Demolishing and concreting for a support in the rear side of pier base

Deck level varies in a straight line from pier level in - 23.07 m to planned terminal level in - 23.30 m. If it is decided to maintain existing ramp deck level at land base in a first phase, the first span and land base can be lowered at land level to the existing level in -25.39 m. The result will be an inclination in the first span of about 0.082, which is considered acceptable.

Free height will be limited to 3.5 m by the existing controll building on pier base exactly as it is limited today.

Future passenger access is considered executed as a steel bridge in a higher level above access bridge using the same supports and with the same free spans. When passing existing control building at the pier base it is planned to demolish parts of the top of this building to let the passenger access pass. For this purpose no installations should be plased in the mid section of existing control building.

4.2.3 Lifting towers

Drawings: B.02.18, B.02.19

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. Besides 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.

To serve future needs of ramp motion with waterlevels varying between level -25 m and level - 30 m, lifting towers must be raised. Ramp deck levels at land base, lifting points and ramp end will vary as follows:

	Highest position level	Lowest position level
Land base	- 23.88 m (-23.88 m)	- 23.88 m (-23.88 m)
First row of towers	- 22.83 m (-22.64 m)	- 24.91 m (-25.12 m)
Second row of towers	-21.78 m (-21.40 m)	-25.94 m (-26.36 m)
Third row of towers	-20.67 m (-20.08 m)	-27.03 m (-27.67 m)
Ramp end	-20.50 m (-19.88 m)	-27.20 m (-27.88 m)

Design levels are laid out for the maximum inclination of 0.046 giving levels in ( ) in the table.

Steel structures in existing towers will be rehabilitated and reused. Tower foundations are raised by concreting as shown in table below:

	Existing level	Future level
First row of towers	-25.39 m	-23.00 m
Second row of towers	-25.39 m	-22.00 m
Third row of towers	-24.19 m	-21.00 m

Pits are designed to give the necessary space for motion of counterweights. The pits shall be rehabilitated and made watertight as follows:

- Existing counterweights are taken up
- Pits are pumped dry, cleaned and sandblasted
- A steel tank lining are installed to secure watertightness
- The volume between existing pit surface and lining are concreted
- Raising of substructures by concreting to level shown i table

New circular counterweights are constructed, eventually reusing some of the heavy steel from existing counterweights. Lay out design of counterweights include a well (manhole) for maintenance access to pits. Existing steel sheet piles are protected by sacrificial anodes

4.2.4 Finger piers

Drawings: B.02.14, B.02.15

Existing substructure consist of reinforced concrete piles 350 x 350 mm with toe levels varying from - 15.0 to - 16.3 m. Existing superstructure is a reinforced concrete slab 6200 mm wide and about 28 mr's in length. 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 finger pier is equipped with wooden guiding fenders supported by driven wooden piles. On the pier a lighting tower is placed.

Existing finger piers shall be totally demolished from pier end to base at lifting towers.

New shorter fingerpiers are established consisting of:

- Steel pipe piles foundation protected by sacrificial anodes
- A reinforced concrete superstructure anchored to existing tower support substructure
- Fenders

4.2.5 Central Pier

Drawings: B.02.01, B.02.10, B.02.11, B.02.12, B.02.13, B.02.16, B.02.17

Existing substructure consist of reinforced concrete piles 400 x 400 mm with toe levels varying from - 16.5 to - 17.5 m. Existing superstructure is a reinforced concrete slab 12 m wide and 139.1 mr'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.

Demolition

Existing structures to be demolished are:

- All existing fenders and pile supports for fenders
- Front walls of precast concrete units
- Pavement
- All structures above concrete slab
- Taking up scrap material, broken piles etc. from the bottom

Existing slab and concrete piles support shall be a part of the rehabilitated structure to serve as relieving platform.

New Structures

The new pier structure is carried out as follows:

- Driving of a new steel sheet pile wall. The wall must be slightly inclined to avoid interference with existing concrete piles.
- Mutual anchoring of the walls on both sides the pier by anchors in every double pile.
- Sand are filled in between the walls up to slab level. It might be necessary to make interim holes in the slab to completely fill up the volume below the slab.
- Concreting of bollards- and fender supports.
- Filling in sand on top of slab.
- Installing of water outlets, water pipes, cables etc.
- Pavement

Quay Equipment

Fenders are designed to cover all levels of fender list belting of the ships ranging from the highest ship deck level at waterlevel - 25 m to lowest ship deck level at waterlevel - 30 m. New fenders are the pivot type to avoid fender panels to tilt into ships hull. Fenders are constructed with a closed box design for the panel minimizing the exposed surface area to be
protected from corrosion. Corrosion protection will be a combination of painted surface and sacrificial anodes. Steel panel facing is designed to be a 60 mm UHMWPE (ultrahigh molecular weight polyethylene) plate covering the total front from level -20.00 m to -27.50 m.

Pivot support is a driven steel pipe pile and top fastening and energy absorption is created by two rubber fender elements of types as "Trellex MV". Rubber fender elements can be installed in three different positions depending of actual waterlevel.

Additional equipment to be installed are:

- Bollards per 30 m
- Sacrificial anodes on sheet piles
- Safety ladders
- Light
- Water supply
- Water outlets

4.2.6 Head of Central Pier, Dolphin

Drawings: B.02.10, B.02.11

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

This existing pierhead shall be totally demolished.
The new dolphin forming the pierhead is positioned about 20 m far out than the original to create better berthing and mooring conditions for the ferries which are longer than existing pier.

A TT-shaped prestressed reinforced concrete beam makes the acces to the dolphin.

The dolphin consists of:

- A circular substructure of driven straight-web steel sheet piles filled up by sand
- A reinforced concrete superstructure as a sand filled box
- Fender supports
- Bollards
- Fenders

4.3 Ramp structures

It is the objective of the design to reuse as much as possible of the original design of the access ramps and the operating machinery, which for many years of service have proven records of reliable operation. Changes may be necessitated by deterioration, damages and accommodation to the future requirements for the operation of the terminals. Also, a proposed detailed inspection on land of the ramp structures at the beginning of construction works may reveal weak points in the structures.

4.3.1 Elevating of ferry access ramps

The existing ferry access ramps shall be relocated to elevation -23.88 m, which is the mean position between ferry light position at high water level and ferry loaded position at low water level.

The machinery shall be modified so as to allow for all three spans of the ramp to be positioned with a slope of maximum 4.6 % in upward as well as downward direction.

In the foreseeable future a maximum slope of 3.8% in both directions should be sufficient for the ferry terminal operation rendering a maximum allowable difference in ships position of 6.6 meters.

Using locomotives of say 120 ton to move wagons aboard the ferry would provide for a push/pull force of say 250-350 ton, compared to the required 250-300 ton for mowing 9 fully loaded (70 ton average) and 9 empty wagons (20 ton) up the elevated ramp at maximum slope of 3.8 to 4.6 %.

It is assumed, that when moving the wagon train aboard the ramps at a downward slope, the brake systems of the wagons will always be connected.

4.3.2 Structures of Ferry Access Ramps

The Wooden deck of the ramp spans shall be replaced with a deck of Ekki or Azobй timber.

The strength of the Azobe wood is such that the span between the supports of the timber may be maintained as it is on the existing structures, and yet the deck will be able to resist the design load from vehicles.

The steel structures of the ramp spans shall not be changed unless proven unable to resist the design loads agreed upon or unless they have been damaged or deteriorated.

It is suggested that since the rail switches on the seaward span of the ramps are not used (as the ferries have only two connecting rail tracks) the switches may be omitted and only two straight tracks be provided.

4.3.3 Machinery for the Ferry Access Ramps

Existing machinery

In principle the existing machinery may be used with the following modifications:

- The lifting towers are raised to an elevation corresponding to the new elevation of the ferry ramps.
- The spindles and the counterweight wires for machinery in rows 1 and 2 are replaced with longer ones allowing for the increased slope of the spans.
- Wires for the lifting machinery and counterweights at row 3 are replaced with longer ones for the added travel length of the span.
- Counterweight mass shall be increased in accordance with the increased mass of the wooden decks.

Other modifications are not foreseen unless the towers or machinery are proven unable to resist the design loads as agreed upon or unless they have been damaged or deteriorated.

Hydraulic machinery

It is possible to remove the lifting towers at rows 1 and 2 and replace the towers with steel columns for suspension of oil hydraulic cylinders for operation of the ramp spans no. 1 and 2.

Using hydraulic cylinders for the operation will make the use of counterweights unnecessary, and the counterweight pits may be filled with concrete.

In order to carry the live load, the spans shall be equipped with hydraulically operated sliding bolts or similar locking devices.

The machinery at row 3, however, can not in a simple way be operated by hydraulic machinery as the counterweights are necessary to reduce the weight of the third span at the ferry support and as the stroke length of the cylinders would be too long.

4.3.4 Electrical installations

The electrical installations on the ferry ramps and piers are of old construction and worn-out.

Generally, all the electrical installations (cable trays, cables, limit switches, motors, switchboards, control boards, lighting fixtures, etc.) shall be changed. The following chapters describe in outline the work to be done in the different areas.

It shall be emphasised that during the whole construction period shall the contractor organise the electrical work in a way making it possible to operate the left ramp system when right ramp system is renovated and vice versa.

Power Supply to the Ramp System

For the time being, the whole ramp system is supplied from 3 ≠ 3x150 + 1x70 Cu cables. These cables shall be used in the future for supply of the new installations. The cables are placed along the access pier and ending at the managing building.

The Ramp Control Building (Managing Building)

From this building the ferry ramps are controlled.
All the electrical installations in this building shall be changed. The contractor shall organise the work in the building in a way making it possible to operate one ramp side during the renovation.

Lifting Tower Buildings

All the existing electrical installations in these 6 buildings shall be totally replaced. After the building and the machinery has been repaired and renovated, the new electrical equipment can be installed.

Outdoor Lighting Installation

The outdoor installations on the piers and the buildings shall be total new installations.

New masts (3 nos.) shall be furnished, each 25 m high. The 3 masts shall be placed at the same spots as the existing ones.

Heating in the Managing Centre

After renovation, electrical heating in the managing centre shall be delivered and installed

4.3.5 Ramp control system

The existing control systems are described in the existing drawing. The way to move the ramps with electrical motors, gears and counterweights shall be retained but the total electrical installations and materials (motors, limit switches, control boards, cables, breaks, etc.) shall be changed to new materials and new technology. Further, the motor control shall be changed from slip ring AC motors to frequency controlled AC motors.

It shall be pointed out that the control system shown in the new drawings is a principle system and that the contractor shall carry out all necessary final design drawings and have the full responsibility for final design, final construction and running in of the total ramp control system. The necessary changes and adjustment to obtain a reliable and safe control system shall be carried out by the contractor during the running-in period.

Description of the New Control System

This description and the drawings describe the principal control system. Detailed design is to be carried out by the contractor.

1 Main Operation Methods

It shall be possible to operate the ramps in the following ways:

A. Land span (e.g. lifting towers 1 and 2)

- Remote control from the control panel in the managing building. Position indicators shall inform the operating personnel that the ramp movements are within tolerance of the spindle limits.

- Emergency operation (electrically) from each lifting tower. Co-ordination between the lifting towers manually or by walkie-talkie. Co-ordination marks e.g. on the bridge construction shall be established.

- Limit switches for protection of ramp movements shall function in all operation methods.

B. Intermediate span.

Same operation methods as for the land span.

C. Sea Span.

It shall be possible to operate the ramp in the following ways:

- Remote control from the control panel in the managing building. Position indicators shall inform the operating personnel that the ramp movements are within tolerances.

- Possibility to operate the ramp with only one motor running from the control panel in the managing building.

- Emergency operation (electrically) from each lifting tower (one motor mode).

- Possibility to operate the ramp with the manual handle as for the existing system.

2 Control System

The existing control system is based on relay systems.

The new control system shall be based on a PLC system and relay system as indicated in drawing no. ???

The PLC shall be make Siemens S5-115U, Omron or Telemecaniqe.

The control system shall not be based on a 2 wire loop system but hard wired from the lifting towers to the PLC placed in the main switchboard.

The emergency operation system (electrically) in each lifting tower shall be designed independently of the PLC system. These systems shall be hard wired and it shall be possible to run the systems locally with the PLC out of order, but in a safe way.

In each lifting tower and in each of the control panels emergency stop systems shall be designed according to EN 60 204.

The PLC shall be equipped with extra 20% input and 10% output more than the designed in- and output number (spare).

4.4 Railway works

Alternative options

Three alternative development strategies for the renovation of the terminal have been considered, as explained in the following:

- Alt. Option 1, Phase I: shore end of ramp maintained, no raising of railway yard
  Phase II: shore end of ramp raised, raising of complete railway yard, raising of existing road

- Alt. Option 2, Phase I: shore end of ramp raised, minimum raising of railway yard
  Phase II: shore end of ramp raised, raising of complete railway yard, raising of existing road

- Alt. Option 3, Phase I = Phase II: shore end of ramp raised, raising of complete railway yard, raising of existing road

Due to absence of agreement with railway authorities on allowable railway track gradients, Option I is proposed for Phase I implementation.

In the following, the possible railway works, concerned with each phase, are outlined, comparing to the final stage (Phase II) of development.

Final Stage of development.

We approximately raise the whole railway ferry yard at 1,5 m, in that case the rail heads will be equal to Designed Rail Head-23, 88m. The total length of the yard is equal to 1220 m. The length of all rail tracks in the ferry yard is 7800m. The number of the shifts is 43, rails are R-65 and R-50. The sleepers are made of reinforced concrete and wood. We remove the old ballast and throw it in the dump at the distance of 28 km. We bring soil (87100m3) from borrow pit for the construction of the land base. The thickness of the ballast is h=0,3 m (Ballast)

We design non-guarded crossings at the intersection of the railway and car roads. We design a pedestrian walkway.

The rails (R-65 and R-50) with the length of 25 m shall be welded by contact method at Salyan base. Then they shall be transported from Salyan base to Sangachal base and assembled there. Then they will be transported from Sangachal base to the place of their installation at the distance of 60 km.

Final Stage development (Reduced investment)

The same works shall be performed when using the second variant. Only 50% of the old ballast shall be removed, the rest of the ballast shall be used as a land base, that's why the quantity of the land base being used is 82000 m3. The quantity of the ballast being removed is 3760 m3. Sleepers will be made from reinforced concrete. Rails are R-65 (old ones), and R-50 (new ones), and R-50 (old ones), R-65 (old ones)-1.56 (ln), R-50-3.91 (ln), R-50 (old ones)-0.72 (ln).

We use rails with the length of p-65 (old ones-0,26 ln), p-50-1.20 (ln), p-50 (old ones-0.15 ln-12.5)

Phase I, Option 2 Development

We raise the railway a little, i.e. at the distance of 120m. In that case the total length of the rails will be 480 km. The number of points is 4 pcs. Other ferry rail tracks are left as they are. Sleepers are reinforced concrete, rails R-50.

Phase I, Option 1 Development

In this option no railway tracks are raised. Only the non-guarded crossings and the paved inspection walkway along tracks are executed.

Electrical Installations

Electrical installations of the railway terminal (flood lighting, electrical switches, communication and signalling, signal lights) shall be partly dismantled when the levelling works are being executed.

With a maximum utilisation of the existing equipment, it is possible to change quantity of the railway switches and lights, as well as the quantity of cable items during mounting.

4.5 Building works

4.5.1 One- storey united border control building.

Architectural layout.

Border control building is shown at the B.06.01 drawing. It is one-storey building which should be shared by the custom-house, water police and frontier-guards. The building dimensions are 12,4m x 27,4, the height is 3 m from the floor level up to the ceiling.

External doors are plastic aluminium (PEMOPEN[1]). There are veneered wood doors in the office rooms.

The floor of the office rooms is parquet. The floor of toilets is covered with ceramic tiles.
The floors in halls, corridors, rooms for customs examination are covered with marble plates.

The ceilings are suspended.

The walls in the office rooms are oil painted, walls of sanitary rooms are faced with tiles.

The facades are plastered with high-quality decorative plaster and painted.

Structural design.

The walls are made of bricks with the thickness of 40cm.The walls are plastered and painted from inside. The overhead covers are pre-fabricated RC hollow panels with the length of 5,86 m, supported by the longitudinal walls 1,2,3. The roof water insulation is 3 layer fibreglass felt for heat insulation, blinding, etc.

The foundations are pre-fabricated RC concrete piles with the cross section equal to 30x30 cm. The length is 8m. Beam type monolithic grids with the cross-section of 60x50 (h). The depth of laying is 1,0 m with the water-insulation. Moisture preventive actions are foreseen. The floors the ducts are pre-fabricated RC plates with the size of 60x80.

[1] Building material

Electric installation.

The lighting of the building are envisaged by the design:
natural- in day-time and artificial, presumably by fluorescent lamps, in evening.

Telephone and radio network and fire alarm system are envisaged in all the rooms.

Lighting over the shed are carried out by the fluorescent lamps built-in the suspended ceiling .All the wiring shall be laid over the metal pre-fabricated constructions. Fluorescent lamps, telephone and radio network are envisaged in the cabin that are under the penthouses. If any barriers are available they should be operated from the cabins installed under the shed. Overall lighting are envisaged along the lanes under the shed to provide safe driving of vehicles.

Water and sewerage.

Water-supply network for household needs are designed inside the building. According to total water consumption, water-supply network are designed to be made of galvanised steel pipes with d=15-50 mm in accordance with GOST 3262-80. The consumption of cold water are determined by different devices.

In accordance with the building designation and SNiP 2.04.01-85 i.15.1, sewage system for draining sewage from the lavatory, wash basins and w. c. pans are designed. In accordance with total consumption, the sewage network is designed to be made of sewage cast pipes with the d=50; 100 mm according to GOST 6942.3-80. Pipe connectors shall comply with the existing norms and GOST 6942.3-80 for sewage cast pipes, state standards and technical conditions.

It is envisaged to lay the sewage network by hiding them in the structures under the floor in ducts. The laying of drainage pipeline from sanitary equipment is envisaged above the floor with further providing of facing and water insulation.

Heating and ventilation.

There shall be water two pipe heating system with lower separation. The pipelines shall be laid in the floor ducts canal, heat insulated with a slope of i=0,003m to the side of the heat supply system inlet. M 140A0 radiant heater is accepted as a heater. The double-control cock is installed on the radiator delivery piping.

The ventilation is mechanical. Air conditioning is envisaged. "ROOFTOP Heat Pump" type conditioner is to be installed on the roof. Air is supplied to the rooms by means of air pipelines and grids.

Border control building rooms

Rooms	Square(m2)	Personnef for shift
Customs-house 1. Room of the Head 2. Duty officer room 3. Studies, 3 4. Examination room	 15,7 15,7 15,7, 10,98, 10,98	10
Borders service 1. Room of the Head 2. Reception,3 3. Duty officer room	 15,7 15,7 15,7	3
Police rooms 1. Room of the Head 2. Reception 3. Room of an officer on duty	 11,4 11,4 11,4	
Veterinary point	15,5	
W. C. for men and ladies		

Shed above the traffic lanes

Dimensions are 22.3x18 m, height is 5.5 m.

Foundations are made from precast RC piles with a section of 30x30 cm and with a length of 8 m. There are monolithic grids of a beam type with a section of beams of 40x50 (h) cm, the depth of installation is 1.2 m.

The bearing steel columns are executed from pipes with 245x6 mm diameter.

The floor of the shed is a steel pre-fabricated structure. It is welded roof structure, covered with steel galvanised plates.

Under the covering, there are high durable lighting fixtures (installed and painted) to provide lighting for customs.

4.5.2 Public Service Building

Architectural layout

The following description corresponds to drawing B.08.00. The public service building is one-storey, with dimensions of 10x12.4 m and with a height of 3.0 m. The building is to be located at the marshalling area for vehicles. The structure is divided into two parts:

- kiosks, telephones, buffet

- toilets for men and ladies

The buffet floors are of marble, in the toilets they are made from clay tiles-

Walls in the buffet shall be painted with oil paint, in the toilets walls are to be covered with encaustic tiles.

The outside walls and windows are individual, made from PEMOPEN. The inside walls are wooden, covered with veneer.

Outside facades of the building are plastered with high-quality decorative plaster and painted.

Structural part

Foundation is to be performed from RC piles with a section of 30x30 cm and with a length of 8 m. The foundations are pre-fabricated. Monolithic grids correspond to the beam type, their section is 60x50 cm, the installation depth is 1.0 m.

Outside walls shall be from "kubik" stone with a thickness of 40 cm.

The floors are RC, pre-fabricated hollow slabs. The length is 5.86 m and 7.06 m.

The floors of the ducts are from precast RC slabs with dimensions of 60x80 cm.

Electric installations.

Natural lighting shall be in day-time and artificial one in evenings. The lighting is carried out by luminescent lamps in the kiosk and in the cafeteria, and by glow lamps in the toilets.

Telephone and radio nets are also foreseen in all of the rooms. The fire alarm net is included.

Water, sewerage

Water-supply network for household needs are designed inside the building. According to total water consumption water-supply network are designed to be made of galvanised steel pipes with d=15-50 mm in accordance with GOST 3262-80. The consumption of cold water are determined by different devices.

In accordance with the building designation and SNiP 2.04.01-85 i.15.1 sewage system for draining sewage from the sanitary equipment, wash basins and w. c. pans, urinals are designed. In accordance with total consumption of sewage network is designed to be made of sewage cast pipes with the d=50; 100 mm; 150 mm according to 6942.3-80 GOST. Pipe connections I comply with the existing norms and 6942.3-80 GOST for sewage cast pipes, state standards and technical conditions.

It is envisaged to lay the sewage network by closing them in the structures of the floor ducts. The laying of drainage pipeline from sanitary equipment is envisaged above the floor with further provision of facing and water insulation.

Heating and ventilation

There it shall be water, two pipe heating system with low distribution pipe[2]. The pipes are laid on the surface, along the wall. M140A0 radiator is accepted as a heating appliance. Double control cock are installed on the delivery piping.

Ventilation is non-arranged. Mechanical extraction is envisaged for sanitary arrangements and wash basins.

Home air conditioner is to be installed in the hall.

4.5.3 Administration Building and Passenger Terminal/Pavilion

Architectural layout

Phase I Development, Pavilion

The following description corresponds to drawings B.05.00, B.05.01, B.05.02.

The design of the building takes into account possibility of future development in the 2nd phase of construction. This does not mean, that the existing structure shall be demolished. It is to be used completely.

The building is two-storey with dimensions of 12.4x26.10 m.

The height of the floors is accepted as 4.2 m (up to the bottom of the suspended ceiling).

The passenger terminal shall be connected with a ferry through a passenger bridge.

Floors in the lobby, the arrival and the departure halls, the rooms of customs' and border policemen' examination are of marble, in the toilets they are covered with clay tiles.

Ceilings shall be suspended.

Outside windows and stained glass windows are individual, made of plastic and aluminium (PEMOPEN). In the service rooms they are wooden and veneered.

Walls of facades should be performed from light structures as they can be easily dismounted and mounted again after development has been implemented. Coming from this, it has been decided to use glass and suspended light cladding panels for the facades. From outside the panels will be plastered with a high-quality plaster and painted.

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[2] the low distribution system means that main distribution pipeline is located at the bottom or in a basement of buildings, for the upper distribution system the pipeline must pass through roof

Composition of the rooms follows the below mentioned table.

Name of the rooms	Area (in m2)
Rooms of the ground floor	
1. Lobby	80.63
2. Ticketing offices	9.7
3. Examination halls of border and customs control	78.80
4. Rooms of customs	12.5
5. Rooms of policemen	12.5
6. Rooms of border policemen	13.8
7. Men' toilets	12.0
8. Ladies' toilets	11.0
Rooms of the 1st floor	
9. Departure hall	253.4
10. Buffet, service room, pantry	24.4
11. Kiosk	5.8

Phase II Development, Administration and terminal building

The following description corresponds to drawings B.05.05.

The building is two-storey, the dimensions are 42.4x18.40 m.

To the south part of the building (from the side of he sea), above the spindle staircase, there is a Service for Rail Traffic Control with a round field of view which gives a special perception from the building.

The composition of the rooms corresponds to the following table.

Name of the rooms	Area (in m2)
Rooms of the ground floor	
1. Room of Operational Manager of the Ferry Terminal	33.86
2. Room of Chief Controller and Controllers	42.5
3. Room of Electrician	15.6
4. Room of cashiers	34.2
5. Room of riggers	18.1
6. Lobby and operational and ticketing halls	234
7. Halls of border and passport control	92.9
8. Cloak rooms	25.0
9. Rooms for VIP	29.0
10. Room for division of communication	4.0
11. Public service enterprises (canteens, etc.)	88.0
12. Kiosks, information and exchanges	22.3
13. First aid room	
14. Toilets	43.0
15. Switchboard room	5.44
16. Heat distribution point	5.44
17. Staff toilets, for men and ladies	9.4
Rooms of the 2nd floor	
9. Departure hall	237.3
10. Arrival hall	180.3
11. Kiosk	5.8
12. Customs room	19.6
13. Border police room	10.8
14. Police room	12.5

Composition of the rooms for Service for Traffic Control (STC) is as follows:

1. Room of pilots-operators
2. Room of transmitting devices
3. Room of electronic engineers
4. Room of head of the STC
5. Room for inspection of the port supervision
6. Room for generator
7. Spare tools and devices warehouse
8. Auxiliary rooms and toilets
9. Antenna square

Windows and outside doors are individual, from plastic and aluminium (PEMOPEN). In the service rooms they are wooden and veneered.

Floors in the studies are parquet; the floors are of marble in the corridors and in the lobby and they are covered with clay tiles in the lavatories.

Inside walls of the rooms in the lobby, the passenger waiting hall, ticketing halls are faced with durable fire-proof materials (such as marble, gybsym tiles, etc.). In the working and service studies, in the corridors the inside walls are plastered with a high quality plaster and painted.

Structural part

The height of the building is 9.20 m from the plinth to the parapet top.

Foundation has to be performed from RC piles with a section of 30x30 cm. The 10 m piles shall be pre-fabricated. Monolithic grids, which have dimensions of 1.5x1.5 m, are connected by RC beams with a section of 40x50 (h) cm. The installation depth is 1.2 m.

Outside walls are from "kubik" stones with a thickness of 40 cm. Bearing columns with a section of 40x40 cm shall be installed according to structural net of 6.0x6.0 m.

Floors are pre-cast RC hollow slabs with a length of 5.86 m.

Floors of ducts are from pre-fabricated RC slabs with dimensions of 60x80 cm.

The main carrying structures (frame and floors) of the pavilion (1 phase) shall be also used for the passenger terminal without particular modifications. The new cell along the frame shall be installed along the length and the width of the building.

Electric installations.

Natural lighting shall be in day-time and artificial one in evenings. The lighting is carried out by luminescent lamps mounted in the suspended ceilings of the waiting hall, the lobby, the ticketing halls and by lamps mounted on ceilings in the remained rooms. In the subsidiary rooms, glow lamps shall be used.

There is also a emergency lighting, performed by wall decorative lighting fittings with glow lamp. There shall be an advertising lighting for indictor boards of entrances, exits and direction of passengers.

Radio nets are foreseen in administration rooms. The fire alarm and telephone nets are included.

Water and sewerage

Water-supply network for household needs are designed inside the buildings. According to total water consumption water-supply network are designed to be made of galvanised steel pipes with d=15-50 mm in accordance with 3262-80 GOST. The consumption of cold water are determined by different devices.

In accordance with the building designation and SNiP 2.04.01-85 i.15.1 sewage system for draining sewage from the sanitary equipment, wash basins and w c. pans, urinals are designed. Sewage system for draining sewage is designed. In accordance with total consumption of sewage network is designed to be made of sewage cast pipes with the d=50; 100 mm; 150 mm according to GOST 6942.3-80. Pipe connections I comply with the existing norms and GOST 6942.3-80 for sewage cast pipes, state standards and technical conditions.

It is envisaged to lay the sewage network by closing them in the constructions under the floor in canals. The laying of drainage pipeline from sanitary equipment is envisaged above the floor with further provision of facing and water insulation.

Heating and ventilation

Heating corresponds to water, two pipe heating system with low distribution system. The pipes are laid in the floor ducts (ground floor) and in the constructed floor (the first floor), heat-insulated with a slope of i=0,003 to the heat supply system. Heating appliances are accepted as follows: M140A radiators and converters. Thermostatic control valve is installed on the delivery piping.

Ventilation is mechanical. Centralised air-conditioning is envisaged. ROOF TOP Heat pump air conditioner is installed on the roof. Air consumption is L=13600 m3 per hour. The installation of one air conditioner is envisaged for the first construction phase. The installation of the second air-conditioner is envisaged for the second construction phase.

Air is supplied in the rooms by air pipelines and grids. Extraction from the sanitary arrangements is envisaged.

4.5.4 Ticketing terminal building

The following description corresponds to drawing B.07.00.

Architectural layout

The dimensions are 6.4x10.0 m. The building is one-storey, with a basement. The basement contains the heat distribution point. The rooms have a height of 2.70 m. The height is 2.5 m from the floor to the ceiling. The height of the basement is 2.5 m. The building shall also contain rooms for work, rest, kitchen and toilet.

Floors in the rooms and in the corridors are from parquet. In the toilets they are covered with clay tiles and with linoleum in the kitchen.

Ceilings are painted with water-emulsion paint.

Outside windows and doors are individual (from PEMOPEN), the inside doors are wooden and veneered.

Walls shall be painted with oil paint. In the toilets walls are to be covered with encaustic tiles.

Facades are plastered with high-quality decorative plaster and painted.

Structural part

Foundation is to be performed from RC piles with a section of 30x30 cm and with a length of 8 m. The foundations are pre-fabricated. Monolithic grids correspond to the beam type, their section is 60x50 cm. The measures, protecting against moisture, are foreseen.

Outside walls, plastered from inside and painted, shall be from "kubik" stone with a thickness of 40 cm.

The floors are RC, pre-fabricated hollow slabs. The length is 5.86 m, supported by longitudinal walls 1, 2, 3. Water insulation of the floors has to be performed from 3 layers of fibre glass felt on heat insulation, blinding, etc.

Electric installations.

Natural lighting shall be in day-time and artificial one in evenings. The lighting is carried out by decorative home chandeliers, and by glow lamps in the rest rooms. Lighting under the shed is performed with lighting fittings, installed in the pre-fabricated steel structure of the shed roof.

Lighting of the ticketing cabins shall be executed by luminescent fittings.

If there are barriers, the control after them should be implemented from the cabins. The lanes under the shed shall have identification lights to provide safe driving for vehicles.

Telephone and radio nets are also foreseen in all of the cabins. One of the rest rooms shall have telephone communication. The fire alarm net is included.

The shed above the traffic lanes

Dimensions are 22.5x12 m, h=5.5 m.

Foundation is to be performed from RC piles with a section of 30x30 cm and with a length of 8 m. The foundations are pre-fabricated. Monolithic grids are connected with 40x50 (h) cm beams with an installation depth of 1.2 m.

Carrying steel columns are made from steel pipes with a diameter of 245x6 mm.

The shed roof is a pre-cast steel beam structure, welded and covered with steel galvanised plates.

Under the shed, there are super durable lighting fittings, installed and painted, to provide customs officers with light.

Water and sewerage

Water-supply network for household needs are designed inside the building. According to total water consumption water-supply network are designed to be made of galvanised steel pipes with d=15-50 mm in accordance with GOST 3262-80. The consumption of cold water are determined by different devices.

In accordance with the building designation and SNiP 2.04.01-85 i.15.1 sewage system for drainage of sewage from the sanitary devices, wash basins and w. c. pans are designed. In accordance with total consumption of sewage network is designed to be made of sewage cast pipes with the d=50; 100, 150 mm according to GOST 6942.3-80. Pipe connectors shall comply with the existing norms and GOST 6942.3-80 for sewage cast pipes, state standards and technical conditions.

It is envisaged to lay the sewage network by closing them in the constructions under the floor in ducts. The laying of drainage pipeline from sanitary equipment is envisaged above the floor with further providing of facing and water insulation.

Heating and ventilation.

Water two pipe heating system with low distribution system is envisaged. The pipelines shall be laid on the surface, along the wall. M140A0 radiant heater is accepted as a heating appliance. Double control cock is installed on the delivery piping.

Ventilation is natural.

4.6 Passenger bridge

Structural design

The basic carrying structures are space steel frames and monolithic RC posts.

Decking of the bridge is from steel galvanised plates.

Floor of the bridge is to be made from steel plates covered with asphalt.

Foundations are pre-cast RC piles with a section of 30x30 cm. The monolithic grids correspond to a column type.

Side fence of the structure shall be implemented from steel nets with small cells.

Lighting, electric installations

Natural lighting shall be in day-time and artificial one in evenings. The lighting is carried out by lighting fittings with glow lamps, installed on the ceiling every other 10 m along the whole passenger bridge.

5. CONSTRUCTION MATERIALS, MANPOWER AND EQUIPMENT

5.1 Construction Sector in Azerbaijan

During the period of the former Soviet Union the implementation of a construction project, like the present, was pre-determined in all phases. Design would be carried out by a state design institute and construction works by another state construction organisation, both of national origin. Construction materials, equipment and plant were distributed in a centralised way annually by order of Cabinet of Ministers of the USSR and of Government of Azerbaijan, always at the same and fixed prices. This meant that both the design institute and the constructing organisation were known at the start of the project. It also meant that both the implementation time and the implementation costs were pre-determined according to fixed norms. The consequence of this was among other that the design institute would be designing in accordance with the capacities and equipment available at the specific construction organisation and that the design project would have to be submitted to the construction company for approval. Another feature of the construction sector was that the construction companies were few but relatively powerful/well equipped. As everything was pre-determined no competition on quality and costs were taken place.

After the break-up of the Soviet Union, the situation has changed and like in most other sectors of the economy also the construction sector is in a transition period. Today the construction sector is in principal liberated and several foreign construction companies are now operating in Azerbaijan. Also the first private Azerbaijanian construction companies has been founded. Most of these companies work on private financed projects and in the oil sector for the different oil consortiums. In a few cases the foreign companies work together with national Azerbaijan companies and in all cases the bulk of the labour force is local working under foreign management. At the same time the national construction companies have been struck by the dramatic decline in the economy which means that virtually no public works are executed.

This transition of the construction sector may leave questions with respect to the availability of proper construction equipment, qualified manpower, procurement of construction materials and not least the present level of construction costs. Under these circumstances it was decided to undertake a survey/investigation of the present situation of the local construction sector with regard to the availability of construction companies, manpower and equipment, construction materials and the costing hereof.

5.2 Construction Companies

A preliminary survey has revealed that a number of foreign construction companies now are operating in Azerbaijan side by side with a few private owned local companies. Also the old state owned companies are still operating but at reduced activity. Without claiming to be complete a listing of these companies is enclosed in Appendix 5. The activities of several of the companies are limited to renovation works of traditional building works which is blooming in Baku right now.

5.3 Construction Materials

As concerns building materials an investigation into this market was carried out in late 1996. The result of this investigation is presented in Appendix 5. The general results of this investigation are that

- low cost building materials for traditional building and construction works like sand, rock stone, building blocs and bitumen are locally produced and of acceptable quality

- ready mix concrete plants exist in Baku together with local production of precast concrete elements

- high quality cement and all steel products are imported traditionally from Russia (and Ukraine for steel and Turkmenistan/Uzbekistan for cement)

- outfitting products of good quality to the building works are all imported traditionally from Russia but now increasingly from Western Europe and Turkey.

The survey of the construction materials also comprised a cost survey the result of which is shown in Appendix 4.

5.4 Manpower

The construction sector is depending mainly on local building workers while the foremen and specialised workers in many cases are foreigners, often from Turkey. As may be seen from Appendix 4 the costs of labour varies much depending whether it is a local worker or not and whether he works for a local company or a foreign company.

5.5 Construction Equipment

Besides traditional construction equipment the execution of the present project will require more specialised equipment for heavy lifts at sea, for pile works at sea and possibly laying of complete sections of rail tracks. Such equipment is available on the local market both through the old state construction companies and the private companies working for the oil industry. As an example a list of major plant of one of the state construction companies is shown in Appendix 5.

6. COSTS ESTIMATE

6.1 Implementation costs

In connection with the survey of the local construction sector described in Chapter 5, also a detailed survey of the construction costs like costs of labour and materials, etc. was carried out. Lists of representative local costs are shown in Appendix 4.

Following the detailed design and based on the design drawings preliminary lists of works (BOQ's) have been prepared as presented in Appendix 4. Based on these lists of work, estimates of the costs for the implementation of the renovation project have been prepared. To obtain an overview of the costs that may be envisaged for the different phases of the project and in order to provide the basis for an evaluation of the sensitivity of the phasing of the investments in several and different stages the estimates have been prepared for three alternative development strategies, as follows

- Alt. Option 1, Phase I: shore end of ramp maintained, no raising of railway yard
  Phase II: shore end of ramp raised, raising of complete railway yard, raising of existing road

- Alt. Option 2, Phase I: shore end of ramp raised, minimum raising of railway yard
  Phase II: shore end of ramp raised, raising of complete railway yard, raising of existing road

- Alt. Option 3, Phase I = Phase II: shore end of ramp raised, raising of complete railway yard, raising of existing road

The detailed costs estimates for each of these alternatives are shown in Appendix 4 and for the development strategy proposed, a summary of the implementation budget is given hereafter:

Summary implementation budget: Option 1.

Description of work	Implementation costs	
	Phase I (1000 USD)	Additional Final stage (1000 USD)
Summary Works:		
Terminal Area Arrangement	4357	717
Marine Works	9018	190
Ramp Rehabilitation	3890	0
Railway Works	62	3211
Terminal Building Works	980	1356
Subtotal	18307	5474
Contingency for unforeseen ramp works	1500	
Total works	19807	
Additional activities:		
Site Surveys, Topographic, Bathymetric	30	
Soil Investigation	100	
Supervision of Works (20 months)	890	
Total additional services	1020	
Contingency, price variations (10%)	2083	
Grand Total, Budget	22910	

In connection with preparation of the cost estimates the following comments shall be made:

a) The estimate is based on the assumption that although the works are intended to be comprised in a single contract to be signed with an international experienced non-local contractor, the works shall be executed by maximum use of local sub-contractors carrying out e. g. traditional building works on land.

Accordingly, costs estimates for traditional building works have been estimated using the result of the local costs survey and applying the calculation methods traditionally used by local contractors. An outline of the method is shown in Appendix 4. Otherwise, costs have been estimated using international price levels, including transportation but excluding any import taxes or customs on items that have to be imported.

Due to the uncertainty of extend of local involvement an analysis has been carried out showing the impact that change of source of manpower may have on the construction cost. The example presented concerns the Public Service Building (see Appendix 4) and it is shown that change from use of local labour to use of labour from other Asian countries the direct costs may increase with 25 %, while substitution with other European labour will increase the direct costs with 170 %. This will not be directly reflected in the fianl costs as overheads and

profits may be ajusted but it shows that some caution has to be taken in preparing the budget. This is part of the reason for the contingency position of 10 % in the budget estimate above.

b) the estimate excludes costs of other replacement building/construction works than those which have been directly mentioned in the list of works in chapter 4.1 of this report. Examples of possible works that has not been included in the present design, but has to be replaced, are water tanks and associated installations.

c) It is anticipated that investments in container handling facilities and equipment is covered through the budget for the rehabilitation of the main port as these facilities are envisaged in the master plans presently under preparation for this part of the port

d) No costs associated with possible acquisition of additional land has been included

e) The costs estimate has been prepared using the present price level assuming only minor increases within the execution period, anticipated to be concluded by beginning of year 2000. Due to the present transition period of the economy, important variations in local labour cost, etc. can not be ruled out. It is expected, however, that the present use of foreign labour from other Asian countries will reduce the effects of such variations.

6.2 Maintenance costs

The state of the present facilities have demonstrated very clearly the need for and importance of carrying out regular, thorough and correct maintenance inspection and maintenance repair of the renovated terminal facilities. For the purpose of performing a correct financial analysis, subject of the Phase 3 Report, and in order to provide an overview of the resources it will be necessary to make available for this purpose, a rough estimate of the overall maintenance costs has been carried out (see Appendix 4).

In the absence of port information on maintenance costs, the estimate is based on generally accepted standard data for maintenance costs for works and facilities as indicated e.g. by UNTAD, see ref. /3/

Annual average maintenance costs during the economic lifetime are assumed as indicated in the table below

Assumed Maintenance Costs and Economic lifetime of Renovated Facilities

Class of work / equipment		Maintenance (%)	Economic lifetime (years)
Reclamation		0.0	50
Coastal embankment		0.75	50
Roads, pavement:	- asphalt	1.5	25
	- concrete	1.0	40
Quay works:	- steel	1.0	25
	- concrete	1.0	40
	- fendering	3.0	10
Railway works:	- ballasting	0.75	40
	- rails, sleepers	1.5	20
	- signalling	2.0	20
Building works:	- concrete, masonry	1.5	30
	- steel structures	2.0	30
	- installations	2.5	25
Equipment:	- mobile	5.0	8
	- machinery	3.0	20
	- control systems	2.5	20

In the table above, further the economic lifetime of the various types of works and equipment is shown. To ensure these optimum economic lifetimes for the different works and equipment of the terminal it is a pre-condition that regular and proper maintenance according to well planned schedules and procedures is carried out. Otherwise, the economic lifetime may be reduced considerably due to the deteoriation of the facilities with important capital losses as one result and lowering of the service level (eventually disruption of services) as another.

6.3 Operational costs

As background for the financial analysis operational costs of the terminal will have to be determined. These operational costs depend on the staffing of the terminal, energy consumption and cost of energy, etc and they are indicated in the Phase 3 Report, ref./4/, together with the economic and financial analysis.

7. IMPLEMENTATION SCHEDULE

7.1 Planning of works

Following the detailed design presented in the preceding chapters of this report, this chapter presents an outline of the planning of the construction works related to the renovation of the ferry terminal. A schematic presentation of the planning is shown on the following page.

The planning shown concerns the Phase I development, according to the development strategy proposed, which is,

- Alt. Option 1, Phase I : shore end of ramp maintained, no raising of railway yard
  (Phase II: shore end of ramp raised, raising of complete railway yard, raising of existing road)

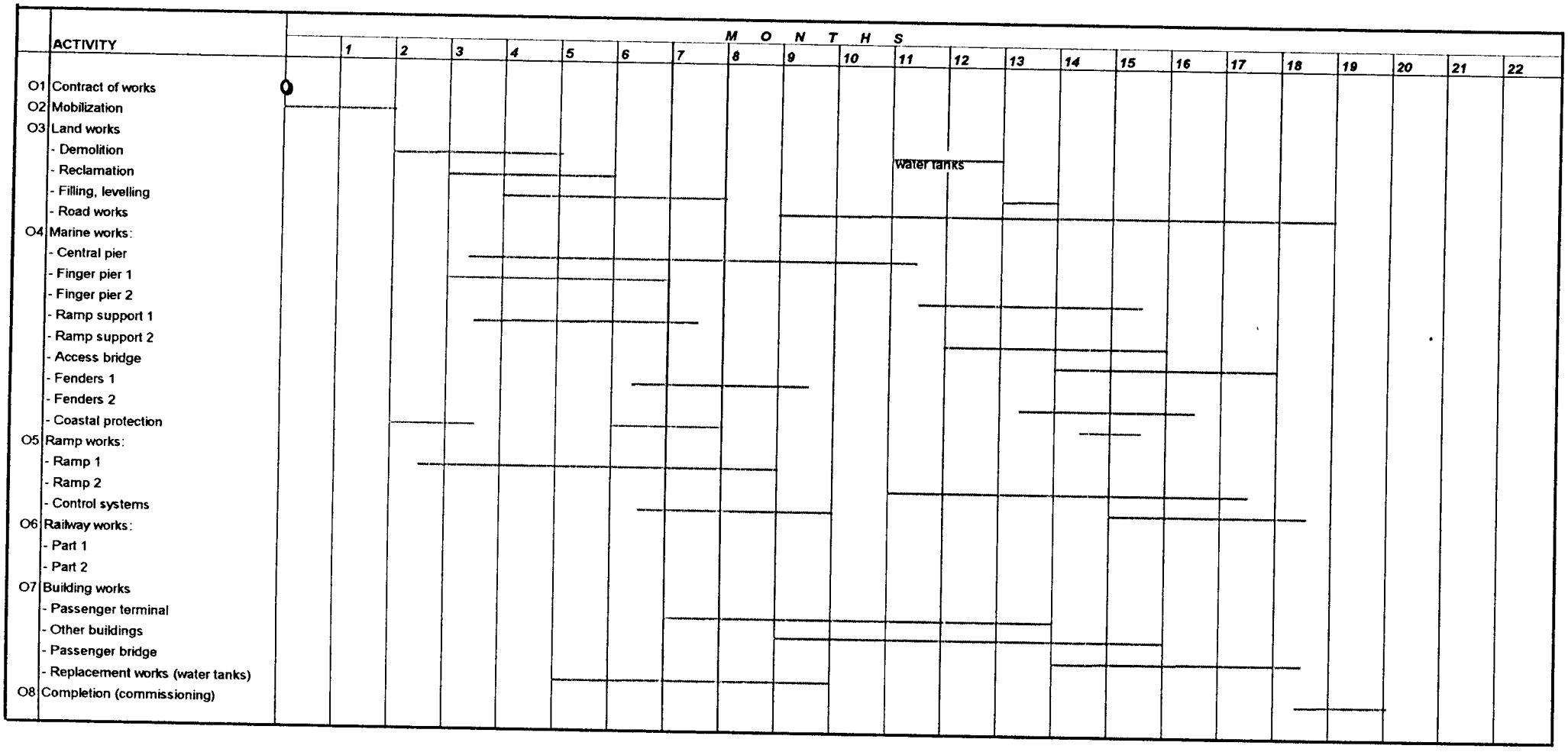
It follows from the planning that the total construction time, from start of mobilisation by the contractor to preliminary commissioning, is estimated to last 20 months. The construction period shall be followed by a one year guarantee period before the final commissioning will take place.

The planning presented takes into account that the ferry terminal in principle shall be kept operational during the whole of the construction period. This is obtained by phasing the works, renovating only one berth and ramp at the time. The critical paths of this planning are assumed to be the finishing of substitution works for works to be demolished (e.g. water tanks, etc.) and the completion of the renovation of the first ramp before the work on the second one can be started. Also the road traffic through the construction site and border control operations during the period of construction will have to be planned in detail by the contractor before the different phases of the construction works can begin.

Before construction works can start the contractor has to be selected. A procedure starting with pre-qualification of interested international contractors, followed by invited international tendering leading to conclusion of contract, is envisaged. The pre-qualification is expected to take 4 - 5 months and the tendering including contracting may take another 5 - 6 months.

According to the plans of the EBRD, who most probably will be financing the works, the tendering has to wait until the loan agreement is in place. At present time (March 1997), it is expected that the loans financing the works may be finally agreed around the end of 1997. Accordingly the contract ready for starting the works may be expected signed earliest Mid - 1998 resulting in a completion of works early in year 2000.

Renovation of Ferry Terminal - Baku
Planning of Works - Option 1, Phase 1



Appendix 1

List of References

Appendix 1 - List of Project References

/1/ Renovation of the Ferry Terminals of Baku and Turkmenbashi
Phase 1 Final Report, Design Basis
Ramboll, January 1997

/2/ Renovation of the Ferry Terminals of Baku and Turkmenbashi
Phase 2 Pre-Design and Feasibility Note
Ramboll, December 1996

/3/ Port Development,
UNCTAD, 1988

/4/ Renovation of the Ferry Terminals of Baku and Turkmenbashi
Phase 3 Economic and Financial Evaluation Report
Ramboll, March 1997

/5/ Renovation of the Ferry Terminals of Baku and Turkmenbashi
Report on Engineering Geological Works, Baku Sea Port
Azgosagropromproekt, January 1997

Appendix 2

List of Drawings

DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
B.01.00	Baku Ferry Terminal 1:2000 Location Plan	1997 0320					
B.01.01	Existing Facilities 1:1000 Site and Demolishing Plan, West	1997 0320					
B.01.02	Existing Facilities 1:1000 Site and Demolishing Plan, East	1997 0320					
B.01.03	New /Renovated Facilities 1:1000 General Plan, West	1997 0320					
B.01.10	Terminal Area 1:500 Pavements, Plan	1997 0320					
B.01.11	Terminal Area Pavements, Sections and Details	1997 0320					
B.01.13	Terminal Area Drainage system, Plan	1997 0320					
B.01.14	Terminal Area Drainage, Sections and Details	1997 0320					
B.01.30	Terminal Area Electrical Power Supply and Ligtning, Plan	1997 0320					

j.BB960490.EJ					PROJ. NO.: 963324		
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DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
B.01.40	Terminal Area Water Supply and Severage, Plan	1997 0320					
B.01.41	Terminal Area Water and Severage, Longitudinal profile	1997 0320					
B.01.44	Terminal Area Heat system, Symbols	1997 0320					
B.01.45	Terminal Area Heat system, Layout of distribution nets	1997 0320					
B.01.46	Terminal Area Heat system, Layout of distribution nets	1997 0320					
B.01.47	Terminal Area Heat system, Profile of nets	1997 0320					
B.01.48	Terminal Area Heat system, Pipe details	1997 0320					
B.01.49	Terminal Area Heat system, Pipe details						

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DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
B.02.01	MARINE WORKS LAYOUT PLAN	03 20 1997					
B.02.02	MARINE WORKS COASTAL PROTECTION						
B.02.10	MARINE WORKS PIERHEAD . DOLPHIN	03 20 1997					
B.02.12	MARINE WORKS PIER	03 20 1997					
B.02.13	MARINE WORKS PIER	03 20 1997					
B.02.14	MARINE WORKS PIER BASE AND FINGER PIER	03 20 1997					
B.02.15	MARINE WORKS PIER BASE AND FINGER PIER	03 20 1997					
B.02.16	MARINE WORKS FENDER	03 20 1997					
B.02.17	MARINE WORKS FENDER	03 20 1997					
B.02.18	MARINE WORKS LIFTING TOWER BASES	03 20 1997					
B.02.19	MARINE WORKS LIFTING TOWER BASES	03 20 1997					
B.02.20	MARINE WORKS LAND BASE FOR RAMPS	03 20 1997					
B.02.22	MARINE WORKS PASSENGER ACCESS	03 20 1997					
B.02.24	MARINE WORKS QUAY EQUIPMENT						

European Commission / Tacis Port Network Plan and Improvement Programme					JOB NO.: 963324				
BAKU FERRY TERMINAL List of drawings					DRAW. NO.:				
					DATE: 1997-03-20				
REV.DA TE:									

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DRAWING No.	TEKST	DATE	REVISION DATE				
			A	B	C	D	E
B.03.70	List of drawings	1997 0225					
B.03.71	Electrical symbols	1997 0225					
B.03.72	Lighting fixtures Specifications	1997 0225					
B.03.76	Ramp Control Building and Lifting Tower Lighting and Power installations	1997 0225					
B.03.80	Ramp and pier Lighting and power installations	1997 0225					

Baku Ferry Terminal					Job No.:	963324		
List of drawings, Electrical installations					Page No.:	1		
					Constr. date:	1997-02-25		
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DRAWING No.	TEKST	DATE	REVISION DATE				
			A	B	C	D	E
B.03.84	Switchboard Outline diagram	1997 0225					
B.03.85	Ramp control building Main switchboard no. 1A	1997 0225					
B.03.86	Lifting Tower 1, right Switchboard 1A01	1997 0225					
B.03.87	Lifting Tower 2, right Switchboard no. 1A02						
B.03.88	Lifting Tower 3, right Switchboard no. 1A03						
B.03.89	Lifting Tower 4, right Switchboard no. 1A04						
B.03.90	Liftinf Tower 5, right Switchboard no. 1A05						
B.03.91	Lifting Tower 6, right Switchboard no. 1A06						
B.03.92	Lifting Tower 1, left Switchboard no. 1A07						
B.03.93	Lifting Tower 2, left Switchboard no. 1A08						
B.03.94	Lifting Tower 3, left Switchboard no. 1A09						
B.03.95	Lifting Tower 4, left Switchboard no. 1A10						
B.03.96	Lifting Tower 5, left Switchboard no. 1A11						
B.03.97	Lifting Tower 6, left Switchboard no. 1A12						
B.03.98	Control Board, right Switchboard no. 1A13						
B.03.99	Control Board, left Switchboard no. 1A14						

DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
B.05.01	Passenger Terminal, Plan, Sections and elevation	1997 0320					
B.05.02	Passenger Terminal Elevations	1997 0320					
B.05.10	Passenger Terminal, Foundation, Plan	1997 0320					
B.05.11	Passenger Terminal, Cannels, Plan and Details	1997 0320					
B.05.12	Passenger Terminal, Floor Slabs, Plan and Details	1997 0320					
B.05.13	Passenger Terminal, Roof slabs, Plan and Details	1997 0320					
B.05.14	Passenger Terminal, Colums and Beams, Elevation and details	1997 0320					
B.05.15	Passenger Terminal, Colums and Beams, Elevation	1997 0320					
B.05.16	Passenger Terminal, Colums and Beams, Elevation and details	1997 0320					
B.05.17	Passenger Terminal, Colums and Beams, Elevation and details	1997 0320					
B.05.30	Passenger Terminal El supply, Lightning, Plan	1997 0320					
B.05.31	Passenger Terminal El supply, Diagram	1997 0320					
B.05.32	Passenger Terminal Telephon, Plan	1997 0320					

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DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
B.05.40	Passenger Terminal, Water Supply, Plan and diagram	1997 0320					
B.05.44	Passenger Terminal, Heat system, Ventilation, Plan 1. floor	1997 0320					
B.05.45	Passenger Terminal, Heat system, Ventilation, Plan 2. floor	1997 0320					
B.05.46	Passenger Terminal, Heat system, Details	1997 0320					
B.05.47	Passenger Terminal, Heat system, Central heating, Plan	1997 0320					
B.05.48	Passenger Terminal, Heat system, Central heating, Diagram	1997 0320					
B.05.49	Passenger Terminal, Heat system, Central heating, Control system	1997 0320					

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Port Network Plan and Improvement Programme					DRAWN. DATE: 1997-03-20			
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DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
B.06.01	Border Control Terminal, Lay-out, Plan, Doors and windows details	1997 0320					
B.06.18	Border Control Terminal, Shed, Plan and Details	1997 0320					
B/T.06.30	Border Control Terminal, El Supply, Lihhting, Plan	1997 0320					
B/T.06.31	Border Control Terminal, El Supply, Diagram	1997 0320					
B/T.06.32	Border Control Terminal, El Telephone, Plan	1997 0320					
B.06.40	Border Control Terminal, Water Supply	1997 0320					
B.06.45	Border Control Terminal, Heat System, Ventilation	1997 0320					
B.06.46	Border Control Terminal, Heat System, Central Heating	1997 0320					

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DRAWING NO.	TEXT	DATE	REVISION DATE A	B	C	D	E
B.07.01	Ticketing Terminal Lay-out, Plan Doors and Windows details	1997 0320					
B.07.10	Ticketing Terminal Foundations, Plan and detais	1997 0320					
B.07.15	Ticketing Terminal Slabs, Plan and details	1997 0320					
		1997 0320					
B.07.18	Ticketing Terminal Shed, Plan and details	1997 0320					
		1997 0320					
B/T.07.30	Ticketing Terminal El, Plan	1997 0320					
B.07.31	Ticketing Terminal El, diagram	1997 0320					
B/T.07.32	Ticketing Terminal EL, Telefon, Plan and details	1997 0320					
B.07.40	Ticketing Terminal Water Supply, Plan and details	1997 0320					

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DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
B.07.43	Ticketing Terminal Heat system, Ventilaion, Plan	1997 0320					
B.07.44	Ticketing Terminal Heat system, Boiler Room, Diagram	1997 0320					
B.07.45	Ticketing Terminal Heat system, Boiler Room, Layout and Secti.	1997 0320					
B.07.46	Ticketing Terminal Heat system, Boiler Room, Heat exchanger	1997 0320					
B.07.47	Ticketing Terminal Heat system, Automation, Layout	1997 0320					
B.07.48	Ticketing Terminal Heat system, Ventilation	1997 0320					
B.07.49	Ticketing Terminal Heat system, Central Heating	1997 0320					

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DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
B.08.01	Public Service Building, Lay-out, Plan Doors and Windows details	1997 0322					
B.08.10	Public Service Building, Foundation, Plan and Details	1997 0322					
B.08.15	Public Service Building, Slabs, Plan and Details	1997 0322					
B/T.08.30	Public Service Bulding El supply, Lightning, Plan	1997 0322					
B.08.31	Public Service Bulding El supply, Diagram	1997 0322					
B/T.08.32	Public Service Bulding El supply, Telefon, Plan	1997 0322					
B.08.40	Public Service Bulding Water supply, Plan	1997 0322					
B.08.45	Public Service Bulding Heat system, Plan	1997 0322					

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DRAWING No.	TEKST	DATE	REVISION DATE				
			A	B	C	D	E
B.09.10	Passenger Bridge Layout	1997 0320					
B/T.09.11	Passenger Bridge Elevation, Details	1997 0320					

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Appendix 3

Design Calculations

Design Criteria

DESIGN CRITERIA - GENERAL

Wind load

(According to SNiP[1] 2.01.07-85 for map 3 of the obligatory annexe)

The city of Baku belongs to category V of wind regions

The normative value of the average mean of the wind load Wm on the height of z above the land surface is:

$$Wm=Wo*K*C$$

where Wo=60 kgs/m2 is the normative value of wind pressure;
K- the coefficient, which takes into account changes of wind pressure in dependence of heights (for area A; the open cost-line of the sea).

Heights, z, in m	« 5	10	20	40	60
Coefficient K (for area A)	0.75	1.0	1.25	1.50	1.70

C is the aerodynamic coefficient
for windward side C=+0.8
for leeward side C=-0.6 (Annex 4, obligatory, layout 1)
The estimated wind loads should be calculated according to formula:

$$W=Wm*\gamma f$$

where γf=1.2 is the coefficient of reliability for loads.

Snow load

(According to SNiP 2.01.07-85 for map 1 of the obligatory Annexe 5)

The city of Baku belongs to the 1 category of snow regions.

The full normative value of the snow load on to horizontal surface of a covering is

$$S=So\mu=50*1=50 \text{ kgs/m2}$$

where So=50 kgs/m2 is the normative value of the snow layer weight for 1 m2 of horizontal surface.

μ=1.0 (according to Obligatory Annexe 3; layout 1) is the coefficient for transition from the snow layer weight upon the land to the snow layer upon the covering.

The load coefficient of reliability for snow load γf=1.4.

The calculated loads should be defined according to the formula:

$$S* \gamma f=50*1.4=70 \text{ kgs/m2}.$$

Seismic loads (SNiP II.7-81*)

Seismic activity of the project area is 9 degrees.
The estimated seismic loads should be calculated according to the formula:

$$Sik=K1*K2*Soik$$

[1] SNiP- the Soviet Building Standards and Rules

where K1 is the coefficient taking into account permitted damages of the buildings and the structures, K1=0.25;
K2 is the coefficient taking into account constructive solutions of the buildings and the structures, K2=1.0;
Soik is the seismic load value for tone i which takes into consideration oscillations of the building or the structure by itself; these oscillations are defined according to assumption that the structure is elastically deformed:

$$Soik=Qk*A*\beta i*K\psi*\eta ik$$

where Qk is weight of the building or the structure set to the point and determined with the account of rated loads on to the structure;
A=0.4 (for the seismic activity of 9 degrees) is the coefficient taking into account values of acceleration amplitudes of soils in shares of acceleration of the force of gravity g;
βi is the dynamic coefficient corresponding to tone i of oscillation of buildings and structures βi=2.0 (for the soils of category III);
Kψ is the coefficient taking into consideration dissipating features of the structures.

a) the framework buildings with piles of reinforced concrete
hc:b»25 Kψ=1.5 hc:b«15 Kψ=1.0

b) the framework buildings with piles of steel
ho:z»80 Kψ=1.5
ho:z«40 Kψ=1.0

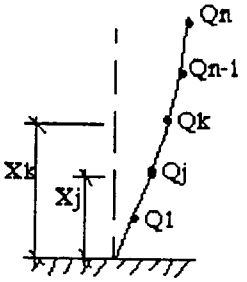


Figure 1

c) the buildings of stone Kψ=1.0

ηik is the coefficient depending on the form of building's or structure's deformation while they are oscillating for tone i and depending on the place of loading concentration

$$\eta k=(Xk*\Sigma Qj*Xj):(\Sigma\ Qj*Xj)$$

(n: j=1; 2: j=1)

Xk and Xj are the distances from points k and j to the top of the edge (Figure 1)

The live equally distributed loads (edl) for floors

No	Names	Normative loading, in kgs/m2	Coefficient γf	The estimated loa-ding, kgs/m2
1	Service rooms, studies, subsidiary rooms	200	1.2	240
2	Waiting hall, pavements on areas with possible accumulation of people		1.2	480
3	Lobby, corridors, staircases adjusted to rooms mentioned in items a) item 1 b) item 2	 300 400	 1.2 1.2	 360 480

The permanent edl for 1m2 of pavements

a) for light structures

No	Names	Normative loading, in kgs/m2	Coefficient γf	The estimated loading, kgs/m2
1	The permanent Protective layer of gravel on polish made of bitumen - 20mm	40	1.3	52
2	Water insulation layer of four layers of tarred felt[2] on the polish of bitumen	16	1.2	19.2
3	Heaters: slabs of mineral wool with high durability according to GOST 22950-78 c=250 kg/m3	24.5	1.2	29.4
4	Steam insulation of one tarred felt layer	4	1.2	4.8
5	Profiled covering	15.6	1.05	16.38
6	Spans of the rolled beams (preliminarily l=6)	12	1.05	12.6
7	Beam frames with fastenings (approximately)	25	1.05	26.25
8	Technological suspended ceiling Total	30 182.6	1.1	33 252.23

b) Structures of reinforced concrete (RC)

No	Names	Normative loading, in kgs/m2	Coefficient γf	The estimated loading, kgs/m2
1	The permanent Protective layer of gravel on polish made of bitumen - 20mm	40	1.3	52
2	Water insulation layer of four layers of tarred felt on the polish of bitumen	16	1.2	19.2
3	Layer of solution of cement and sand δ=2.5 cm	50	1.3	65
4	Heaters: insulation gravel h=8-14cm; γ=900 kg/ m3 0.11*900	99	1.3	128.7
5	Steam insulation of one tarred felt layer	4	1.2	4.8

[2] the rolled material, which is made of fibre-glass basis soaked by bitumen

No	Names	Normative loading, in kgs/m2	Coefficient γf	The estimated loading, kgs/m2
6	RC floor slab	300	1.1	330
	Total	509		599.7

Permanent edl for 1m2 of the floors

a) parquet floor

No	Names	Normative loading, in kgs/m2	Coefficient γf	The estimated loading, kgs/m2
	The permanent			
1	Parquet floor δ=2cm 0.02*900	18	1.2	21.6
2	Layer of solution of cement and sand δ=1.5 cm 0.015*2000	30	1.3	39
3	Two layers of steam insulation	8	1.2	9.6
4	Concrete of insulation gravel δ=4.5 cm 0.045*1400	63	1.3	81.9
5	Bulkheads	100	1.1	110
6	RC floor slab	300	1.1	330
	Total	519		592.1

b) ceramic floor

No	Names	Normative loading, in kgs/m2	Coefficient γf	The estimated loa-ding, kgs/m2
	The permanent			
1	Floor of ceramic tiles on the layer of solution of sand-cement, δ=2.5 cm 0.025*2000	50	1.3	65
2	Two layers of water insulation	8	1.2	9.6
3	Concrete of insulation gravel h=4.5 cm 0.045*1400	63	1.3	81.9
4	Bulkheads	100	1.1	110
6	RC floor slab	300	1.1	330
	Total	521		596.5

Concrete (SNiP 2.03.01-84)

Type of resistance		Class (type) of the concrete				
		B7.5 (M100)	B12.5 (M150)	B15 (M200)	B20 (M250)	B25 (M300)
Normative resistance of the concrete	Axis pressure (prism durability) Rbn and Rb; Rb,ser; kgs/sm2	56.1	96.9	112	153	189
	Axis stretching Rbtn and Rbt,ser	7.14	10.2	11.7	14.3	16.3
Calculated resistance of the concrete	Axis pressure (prism durability) Rbn and Rb; Rb,ser; kgs/sm2	45.9	76.5	86.7	117	148
	Axis stretching Rbtn and Rbt,ser	4.89	6.73	7.65	9.18	10.7
The initial modulus of elasticity, Eb, kgs/cm2		1.63*10^5	2.14*10^5	2.35*10^5	2.75*10^5	3.06*10^5
		163000	214000	235000	275000	306000

Reinforcement bars

Type of resistance		The reinforcement bars of types						
		A-I	A-II	A-III D[3]6-8mm	A-III D10-40mm	Bp-I D3mm	Bp-I D-4mm	Bp-I D-5 mm
The calculated resistance of a steel bar for extreme limits of the I group	For stretching of longitudinal R3	2300	2850	3600	3750	3850	3750	3700
	For stretching of longitudinal Rsw	1800	2300	2900	3000	2750	2700	2650
	For pressure of Rsc	2300	2850	3600	3750	3850	3750	3700
Normative resistance against stretching Rsn and calculated resistance against stretching for extreme limits of the II group Rs,ser, kgs/cm2		2400	3000	4000		4200	4150	4050
Elasticity modulus		2.10*10^6		2.0*10^6		1.70*10^6		
		2100000		2000000		1700000		

2.3 Assortment of the steel span rolled profiles

a) I-girders according to GOST 8239-89[4]
b) Beams according to GOST 8240-89
c) Angles with equal sides according to GOST 8509-86
d) Angles with different sides according to GOST 8510-86

[3] diameter
[4] Soviet State Standard

The stone wall (SNiP II-7-81*)

Masonry of the carrying and self carrying walls or filling of the framework should be implemented by utilisation of the lime stone bricks of type 50. The solution is M50 (category II of the masonry).

The normal cohesion Rpb (for temporary resistance against the axis stretching) for the masonry of the II category is 1.8 kgs/cm2‹Rpb»1.2 kgs/cm2.

The reinforcement nets should be installed in to conjunctions of piles. The reinforcement net bars should have a section with total area of the longitudinal bars not less than 1 cm2; the length of the bars is 1.5 m; they should be installed every 500 mm along the height (when the seismic activity is 9 degrees).

Partitions (SNiP II-7-81*)

The partitions are made of bricks M75 on the solution M50.

To avoid fall of the partitions, they should be connected by flex fastenings with walls and three points; if the length is more than 3 m, the bulkheads should be also connected with floors.

The partitions made of bricks should be reinforced along the whole length; the reinforcement should be arranged not more than every 700 mm along the height of the wall. The steel bars of the total section area not less than 0,02 cm2 should be put on the solution, which joints bricks (2FUVR-I).

Anti-seismic joints (SNiP II-7-81*)

The anti-seismic joints should divide buildings and structures along the whole height. The width of the anti-seismic joint is defined either by calculation or by appointment in dependence on height of the building. If the height of building or structure is up to 5 m, the width should not be less than 30 mm with further rising by 20 mm per each 5 m of the height.

The anti-seismic joints should be executed by construction of pair walls or frames, and also by composition of the frame and the wall.

Anti-seismic belts (SNiP II-7-81*)

The anti-seismic belt (with a bearing part of the floor), see Figure 2, should be, as a rule, installed over the whole width of a wall; the belt's width should not exceed 100-150 mm if the width of the belt is less than width of the wall. The height of the belt should not be less than 150 mm, class (type) of concrete is not less than V12.5 (M150).

Anti-seismic belts should have longitudinal reinforcement bars 4Diameter12AI with the designed seismic activity of 9 degrees.

The upper storey belt should be connected with below laid masonry by 658 mm long anchors, which are made of reinforcement bars Diameter6A-I. The anchors go

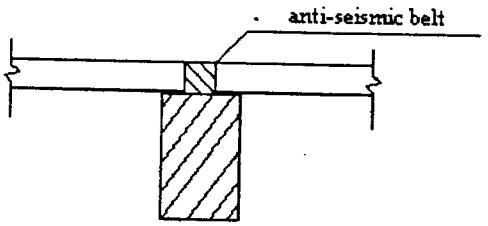


Figure 2

inside the masonry by 300 mm. They are installed on blind parts of the walls and bulkheads in chess order every 600 mm.

Joints (SNiP II-7-81*)

As a rule, the joints should be installed along the thickness of the wall. The depth of installation of the joints in to masonry should be not less than 350 mm. It is accepted to build in the joints to the depth of 250 mm if the width of the embrasure is up to 1.5 m.

Balcony (SNiP II-7-81*)

The structure of balconies and their fastenings with the floors should be calculated as console beams and slabs.

Projection of the balconies should not be more than 1.5 m in the stone wall buildings.

Floor panel (panel of covering)

The pre-fabricated floor panels correspond to series 1.141.1.-40s.

In the stone buildings the length of parts of the floor (covering) panels supported by the carrying walls, which are made manually, should not be less than 120 mm. This length should not be less than 90 mm for RC elements. See Figure 3.

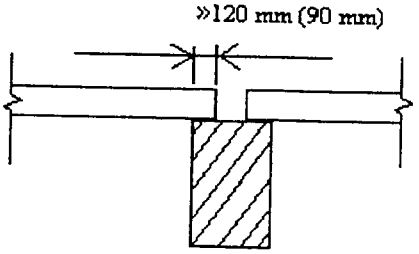


Figure 3

Design Criteria - Railway Works

In some cases, requirements to location of separated points in a plan and in a profile are dependent on category of a railway.

The designed railway (the Ferry Terminal station) belongs to the III category. Therefore, speeds of trains (speed of provision) are up to 25 km/hr; the net cargo turnover is 3 million tones/year. In accordance with SNiP 2.05.07-85 and "Reference book of a rail station designer", the slope equals 0‰ (a horizontal platform). A minimum vertical curve line is 5000 m. Tracks for arriving and departing wagons are located (plan) along the curves, the conditions are hard (renovation) - Rmin=160 м.

A distance between axles of the adjusted station tracks on the straight sections is equal to 5.30 m (SNiP 2.05.07-85 п. 2.39).

A distance between curb stones (of a road) and axis of the railways shall be 3.75 m. When there are no curb stones, it is 5.25 m.

A width of the permanent way at curved parts shall be increased from outside of the curve by:

R=1800-1200 m : 0.1 m
R=1000-700 m : 0.2 m
R<700 m : 0.3 m

On the upper structure of the railways, the quntity of sleepers per 1 km shall be accepted according to table 13 of СНиП 2.05.07-85: hб=0.30 м, rails P-65, P-50.

The width of the ballast prism at the top is 3.1 m on straight one-track spots. The railway ballast prism at curved spots with a radius of <600 m shall be widened by 0.1 m from outside. Slope inclination of the ballast prism shall be accepted as 1:1.5 independently on type of the ballast.

Rails

Type of rails	Weight of 1 l/m of the rails in kg	Dimensions of the rails in mm						GOST
		Width of the head	Width of the shoe	Height of			Rail height	
				the shoe	the web	the heel		
P-65	64.91	76	150	45	105	30	180	8161-63
P-50	50.504	70	132	42	83	27	152	7174-65
P-50 с/г*								

*P-50 c/r - the old rails with a tolerant fatigue. The norms of rail fatigue on station tracks are 17 mm.

Standardised length of the rails

Rails, identified by the length	Standardised length, in m	
Normal	12.5	25.0
Shortened, for laying along curved spots	12.46, 12.42, 12.38	24.36, 24.32, 24.24

Rail switches shall be accepted in accordance with table 14 of SNiP 2.05.07-85.
Type of the frog is M1/9.
Type of the switch rails shall correspond to the rail base of the adjusted track sections
Limit posts are to be installed at the spots, where the distance between axles of meeting tracks is not less than 4100 mm.

Sleepers

Type of the sleepers	Width (height), in cm	Width of the upper bed in cm	Width of the lower bed in cm	Length, in m	Average volume of the sleepers, in m3	Weight, kg
Wooden Trimming						
IA	17.5	16.0	25.0	2.70	0.1160	86
IIA	15.5	15.0	25.0	2.70	0.1018	75
IIIA	14.5	15.0	25.0	2.70	0.0925	68
IVA	14.5	15.0	23.0	2.70	0.0852	63
VA	13.5	13.0	21.5	2.70	0.0670	50
Reinforced concrete fastening						
C-56-1 (K2- separated, terminal-pipe)	21.9	17.3	30.0	2.70	0.075	250
C-56-1 (K2- separated, terminal-bolt)	21.9	17.4	30.0	2.70	0.075	250
C-56-1 (K2- separated, terminal-bolt with spring terminals without lining)	21.9	17.4	30.0	2.70	0.075	250

Fastening of the tracks against displacement shall be carried out by spring type of stop devices or spike type ones. Railway blind ends on the stations shall be equipped with supports, protecting freight trains against coming off the rails.

Basic indices of vehicles, taken into account in standardised loads N-30 и N-10, are as follows.

Description of the indices		N-30	N-10 vehicles	
			with increased weight	normal
Weight of a loaded vehicle , t		30	13	10
Axle pressure, t	a) in back	2x12	9.5	1
	b) in front	6	3.5	3
Width of a wheel base, m	a) back	0.6	0.4	0.3
	b) front	0.3	0.2	0.15
Base of the vehicle, m		6+1.6	4.0	4.0
Width of a body, m		2.9	2.7	2.7
Width of a gauge, m		1.9	1.7	1.7

from Railway C. 96.12.03

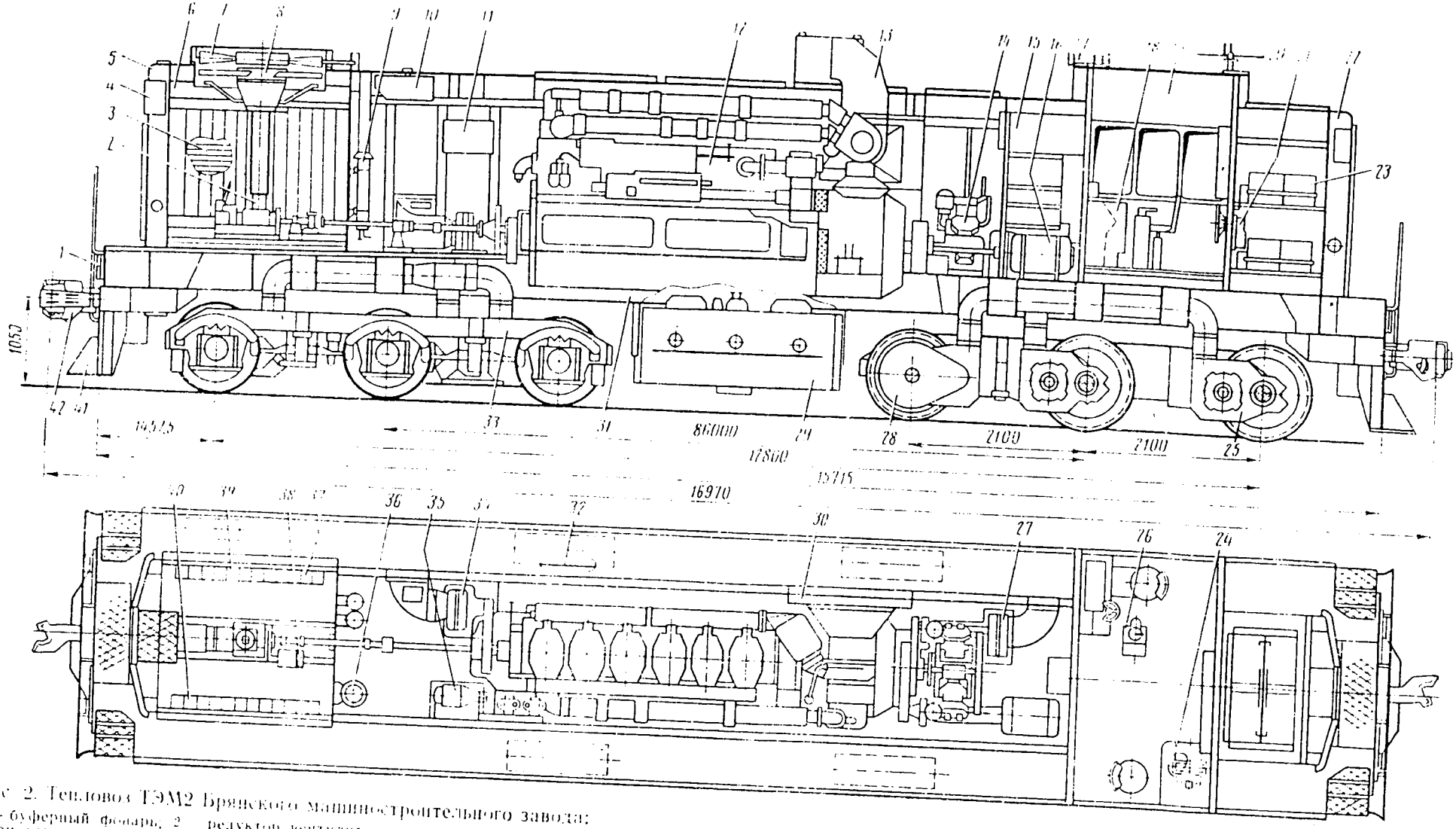


Рис. 2. Тепловоз ТЭМ2 Брянского машиностроительного завода:

1 — буферный фонарь; *2* — редуктор вентилятора холодильной камеры; *3* — жалюзи боковые; *4* — прожектор; *5* — песочницы передние; *6* — холодильная камера; *7* — жалюзи верхние; *8* — вентилятор холодильника; *9* — масляные фильтры; *10* — бак для воды; *11* — бак для масла; *12* — дизель-генератор; *13* — искрогаситель; *14* — компрессор; *15* — аппаратная камера; *16* — двухмашинный агрегат; *17* — тифон; *18* — пульт управления; *19* — кабина машиниста; *20* — антенна; *21* — ручной тормоз; *22* — песочницы задние; *23* — аккумуляторная батарея; *24* — калорифер (нагревательная секция); *25* — тяговый электродвигатель; *26* — воздухоочиститель (воздушный фильтр) дизеля; *27* — вентилятор охлаждения тяговых электродвигателей задней тележки; *28* — кожух редуктора; *29* — топливный бак; *30* — воздухоочиститель (воздушный фильтр) дизеля; *31* — главная рама тепловоза; *32* — главный резервуар; *33* — тележка; *34* — вентилятор охлаждения тяговых электродвигателей передней тележки; *35* — масло- и топливоподогреватель; *36* — топливоподогреватель; *37* — аккумуляторное отделение; *38* — водяной насос контура охлаждения масла дизеля; *39* — водяной насос контура охлаждения наддувочного воздуха; *40* — водяные секции охлаждения воды дизеля; *41* — пылеочиститель; *42* — рессора; *43* — ботинные секции охлаждения наддувочного воздуха.

тушителя, еще два огнетушителя есть в дизельном помещении. Для отопления кабины в зимнее время установлены калорифер и батарея обогрева ног машиниста. У кабины три двери: две для входа в кабину с площадок тепловоза, одна—для входа в аппаратную камеру. В дверь, соединяющую кабину машиниста и аппаратную камеру, вмонтирован шкаф для хранения одежды. Торцовые и боковые окна обеспечивают хорошую освещенность кабины и вполне достаточную видимость вперед, назад и по сторонам. Средние секции боковых окон могут отодвигаться, обеспечивая машинисту при необходимости возможность обзора вперед и назад через открытые окна. Открывающаяся часть окна ограждена специальными защитными щитками из стекла.

Под главной рамой тепловоза находится топливный бак и бачок для хранения запаса смазки. Здесь же укреплены четыре главных тормозных резервуара. Все электропровода заключены в специальные трубопроводы, расположенные в раме и частично в кузове тепловоза. Песок хранится в четырех бункерах, расположенных попарно спереди и сзади тепловоза и выполненных заодно с кузовом.

Тепловозы оборудованы радиостанцией. Приемопередатчик радиостанции и пульт управления радиостанцией размещены в кабине машиниста.

Отсек под переходной площадкой спереди тепловоза и четыре небольших ниши в раме над лестницами предназначены для хранения крупных и редко применяемых принадлежностей тепловоза.

Basic technical characteristics of Loco's

Основные технические характеристики тепловозов

	ТЭМ1, ТЭМ2	ТЭМ3
Род службы	маневровый	
Тип передачи	электрическая	
Осевая характеристика	$3_0—3_0$	
Число ведущих осей	6	
Число секций	1	
Масса тепловоза (при 2/3 запаса топлива и песка), т	120±3%	123 ton
Нагрузка от колесной пары на рельсы, тс	20±3%	20.5 ton
Конструкционная скорость, км/ч	100	
Сила тяги длительная (для тепловоза ТЭМ1 при 9 км/ч, для ТЭМ2 при 11,1 км/ч), кгс	20 000/20 200*	
Минимальный радиус проходимых кривых (при скорости 3 км/ч), м	80	80 m
Колея, мм	1520 / 1520/1435	
Диаметр колес (новых) по кругу катания, мм	1050	
Тип букс	на роликовых подшипниках	
Тип автосцепки	СА3	
Количество воды в системе, л	~950/1050	
Количество масла в системе, кг (при плотности $\gamma=0{,}86$ т/м³)	430	
Запас топлива, кг (при плотности $\gamma=0{,}85$ т/м³)	5440	
Запас песка, кг (при плотности $\gamma=1{,}7$ т/м³)	2000	
Габаритные размеры, мм:		
Наибольшая высота от головок рельсов	4 900/5 010	
Наибольшая ширина	3 080	
Расстояние между осями автосцепок	16 970	17220 mm
База тележки	4 200	
Расстояние между шкворнями	8 600	
База тепловоза	12 800	
Расстояние (при новых колесах) от уровня головок рельсов до:		
кожуха тягового редуктора	125_{-3}	
тягового электродвигателя	155	
козырька под вентиляционным каналом тягового электродвигателя	115	

* Здесь и далее в числителе — для тепловоза ТЭМ1, в знаменателе — для ТЭМ2.

Laying of the branch pipelines from the equipment is foreseen under the floors with installation of facing and water insulation.

DESIGN CALCULATIONS
B.06.40-49

Customs/police building

A. Water supply

The hydraulic calculation of the inner pipelines of cold water should be implemented according to maximum water consumption in correspondence with SNiP 2.04.01-85
Annexes 1 and 2. Cold water consumption is created by certain equipment:

1. The wash basin with a water tap - 2 pieces q=2×0,1Lt/sec =0,2 Lt/sec.

2. The lavatory pan (a closet pan with a cistern) - 2 pieces q=2 ×0,1 Lt/sec =0,2Lt/sec.

Therefore, the total cold water consumption is q_{tot} = 0,4 Lt/sec.

According to the total consumption of the cold water, the water supply networks are designed from galvanised steel pipes with the diameter of ∅15; 20; 50 mm according to GOST 3262-75.

B. Sewerage

According to purpose of the building, in correspondence with SNiP 2.04.01-95 item 15.1, the inside water system should be designed to drain sewage from the lavatory equipment, the wash basin and the lavatory pan. The system for sewage drainage is to be designed in the building.

Sewage consumption is created by the equipment:

1. The wash basin, the hand wash with a tap - 2 pieces; q=2×0,15Lt/sec =0,3Lt/sec.

2. The lavatory pan (a WC pan with a cistern) - 2 pieces; q=2×1,6Lt/sec = 3,2 Lt/sec.

Therefore the total sewage consumption of the equipment is q_{tot} = 3,5 Lt/sec.

According to the total sewage consumption, the sewage networks are designed from sewage cast-iron pipes with the diameter of ∅50; 100 mm according to GOST 6942.3-80. Connecting parts of the pipelines are accepted according to the valid norms and GOST 6942.3-80 of the cast-iron sewage pipes, state standards and technical terms.

Laying of the inside sewage pipelines is foreseen closed with blocking up into construction structures under floors in a canal (a trench).

Laying of the branch pipelines from the equipment is foreseen above floors with installation of facing and water insulation.

Representative Design Calculations,

Building Works

Design Example

Border Control Terminal

Структурный проект.

ЗДАНИЯ СЛУЖБА КОНТРОЛЯ.

1.0. Равномерно-распределенные нагрузки (РРН) на 1м² покрытия:

1.1. Постоянная РРН на 1м² покрытия (на зданиях)

№	Наименование	Нормативная нагрузка кгс/м²	Коэф. надеж. γ_f	Расчетная нагрузка кгс/м²
1.	Защитный слой гравия по битумной мастике — 20мм	40	1,3	52
2	Водоизоляционный ковер из четырех слоев рубероида по битумной мастике	16	1,2	19,2
3.	Стяжка из цементно-песчанного раствора — 25мм	50	1,3	65
4	Утеплитель, керамзитовый гравий $h = 80 \div 140$мм, $\gamma = 900$кг/м³ — 0,11·900	99	1,3	128,7
5.	Пароизоляция из одного слоя рубероида	4	1,2	4,8
6.	Ж/б панель перекрытия	300	1,1	330
	Итого	509		5997 ≈ ≈ 600

1.2. Постоянная РРН на 1м² покрытия (на навесах)

№	Наименование	Нормативная нагрузка кгс/м²	Коэф. γ_f	Расчетная нагрузка кгс/м²
1	Профилированный настил	15,6	1,05	16,38
2.	Прогоны-прокатных швеллеров	12	1,05	12,6
3.	Структурный конструкции (ориентировочно)	25	1,05	26,25
4.	Подвестный технологические оборудование (освещение)	30	1,2	36
	Итого	82,6		91,23 ≈ ≈ 91 кгс/м²

1.3. Временная РРН на 1м² покрытия

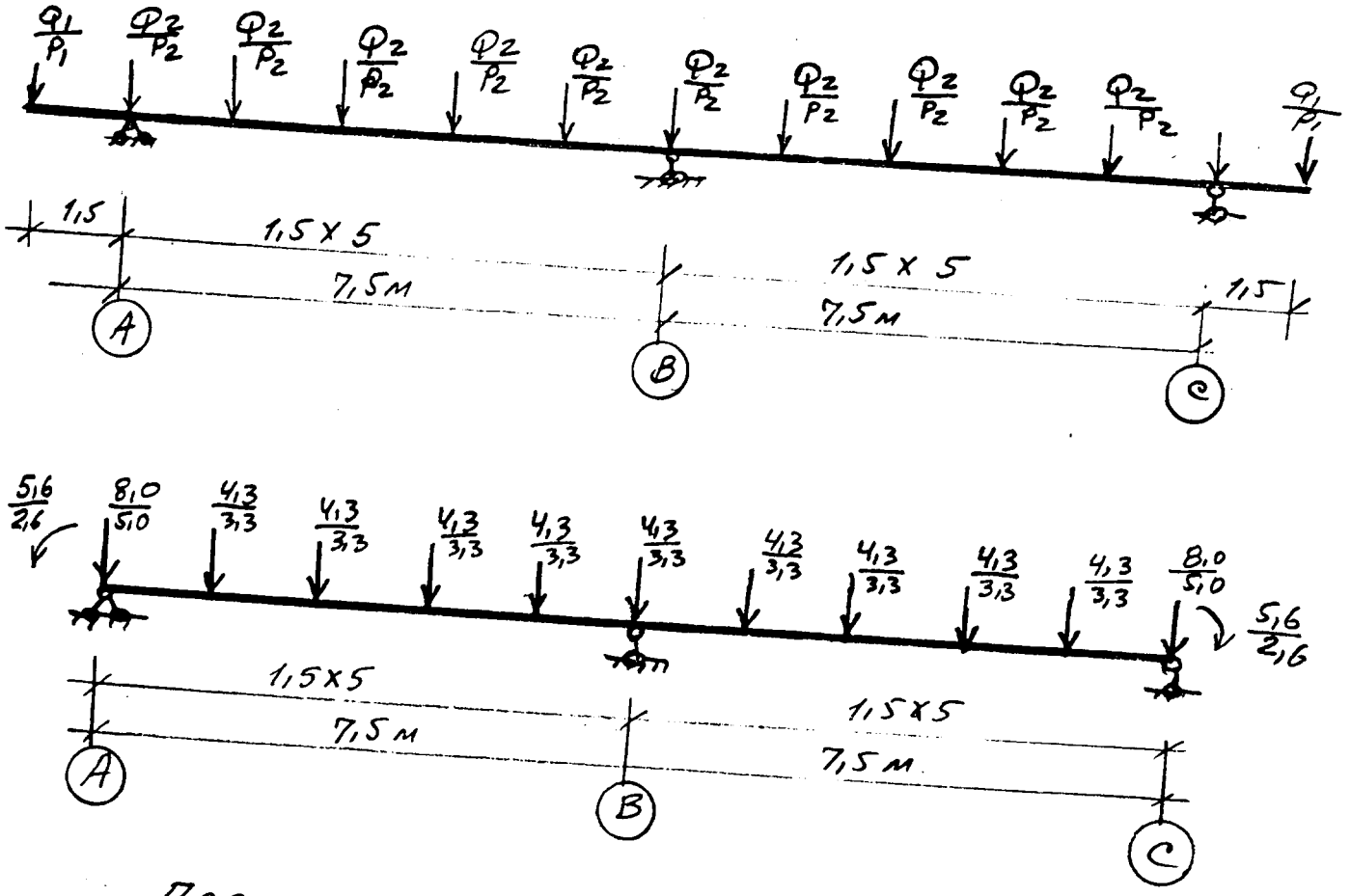
Снег

Нормативная нагрузка — 50 кгс/м²

Расчетная нагрузка $50 \cdot 1,4 = 70$ кгс/м²

2.0. Сбор нагрузок на навеса (на структура)

2.1 Сбор нагрузок по оси „1" и „4"



Постоянная сосредоточная нагрузка (СН):

$$Q_1 = 91 \cdot \left(\frac{3,25}{2} + 1,5\right) \cdot \frac{1,5}{2} + (12,6 \cdot 2 + 15,6) \cdot 1,0 \left(1,5 + \frac{1,5}{2} + \frac{3,25}{2}\right) =$$

(покрытие 1-2)

$$= 213 + 158 = 371 \text{ кг} \approx 3,7 \text{ кН}$$

$$Q_2 = 91 \left(\frac{3,25}{2} + 1,5\right) \cdot 1,5 = 426 \text{ кг} \approx 4,3 \text{ кН}$$

Временная СН

$$P_1 = 70 \left(\frac{3,25}{2} + 1,5\right) \cdot \frac{1,5}{2} = 164 \text{ кг} \approx 1,7 \text{ кН}$$

(покрытие 1-3)

$$P_2 = 70 \left(\frac{3,25}{2} + 1,5\right) \cdot 1,5 = 328 \text{ кг} \approx 3,3 \text{ кН}.$$

Опорные моменты (от консоля.) и СН.

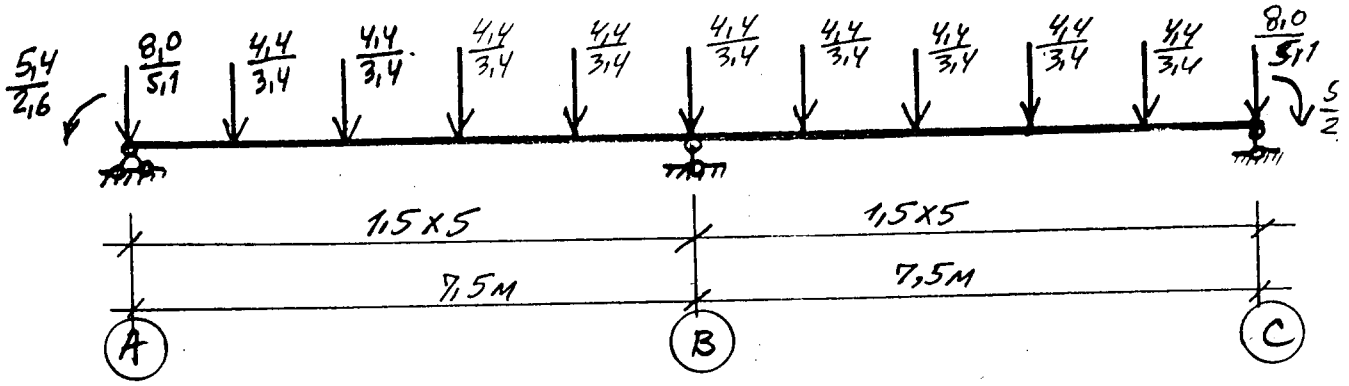
$M_{Q_1} = Q_1 \cdot 1,5 = 3,7 \cdot 1,5 = 5,6$ кН.м.

$M_{P_1} = P_1 \cdot 1,5 = 1,7 \cdot 1,5 = 2,6$ кН.м.

$Q_3 = Q_1 + Q_2 = 8,0$ кН.

$P_3 = P_1 + P_2 = 1,7 + 3,3 = 5,0$ кН.

2.2. Сбор нагрузок по оси 2", 3", 1/2", 2/3" и 3/4"



Постоянная СН:

$Q_1 = 91 \cdot 3{,}25 \cdot \frac{1{,}5}{2} + (12{,}6 \cdot 2 + 15{,}6) \cdot 1{,}0 \cdot 3{,}25 = 222 + 133 = 355$ кг ≈ 3,6 кН

$Q_2 = 91 \cdot 3{,}25 \cdot 1{,}5 = 443$ кг ≈ 4,4 кН

Временная СН.

$P_1 = 70 \cdot 3{,}25 \cdot \frac{1{,}5}{2} = 171$ кг ≈ 1,7 кН

$P_2 = 70 \cdot 3{,}25 \cdot 1{,}5 = 341$ кг ≈ 3,4 кН

Опорные моменты (от консола) и СН:

$M_Q = Q_1 \cdot 1{,}5 = 3{,}6 \cdot 1{,}5 = 5{,}4$ кН·м

$M_P = P_1 \cdot 1{,}5 = 1{,}7 \cdot 1{,}5 = 2{,}6$ кН·м

$Q_3 = Q_1 + Q_2 = 3{,}6 + 4{,}4 = 8{,}0$ кН

$P_3 = P_1 + P_2 = 1{,}7 + 3{,}4 = 5{,}1$ кН

2.3 Сбор ветровая нагрузка.

Расчетные ветровые нагрузки:

$W = W_0 \cdot K \cdot C \cdot \gamma_f \cdot A$

$W_0 = 60$ кгс/м² нормативное значение ветрового давления (гор. Баку V ветровой район);

$C = 1{,}4$ аэродинамический коэффициент;

$\gamma_f = 1{,}2$ коэффициент надежности по нагрузке;

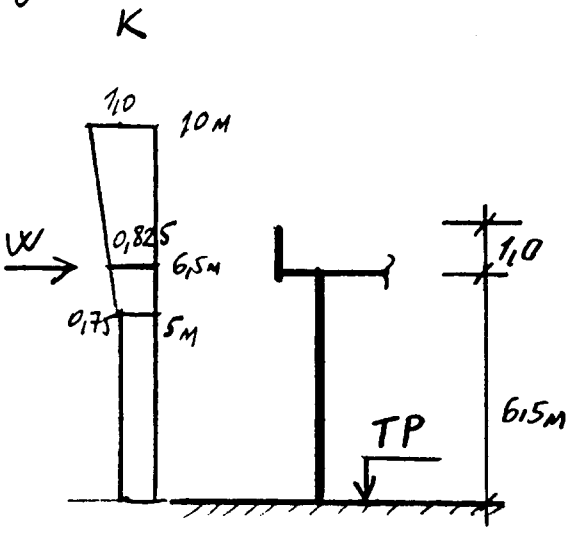
K — коэффициент, учыты вающий изменение ветрого давления по высоте (по местности А, открытые побережья море.

Высота $z \leq 5м$, $K = 0,75$

Высота $z = 10м$, $K = 1,0$.

А — площадь присмотренные участки.

По оси „А" и „С"



$$W_1 = 60 \cdot 0,825 \cdot 1,4 \cdot 1,2 \cdot 1,0 \left(\frac{7,5}{2} + 1,5\right) =$$
$$= 437кг \approx 4,4кН.$$

По оси „В"

$$W_2 = 60 \cdot 0,825 \cdot 1,4 \cdot 1,2 \cdot 1,0 \cdot 7,5 =$$
$$= 624кг \approx 6,2кН.$$

По оси „1" и „4"

$$W_3 = 60 \cdot 0,825 \cdot 1,4 \cdot 1,2 \cdot 1,0 \cdot \left(\frac{6,5}{2} + 1,5\right) = 395кг \approx 4,0кН.$$

$$W_4 = 60 \cdot 0,825 \cdot 1,4 \cdot 1,2 \cdot 1,0 \cdot 6,5 = 540,5кг \approx 5,4кН.$$

2.4. Сбор сейсмическая нагрузка

Расчетные сейсмические нагрузки: (СНиП II-7-81*)

$$S_{ik} = K_1 \cdot K_2 \cdot \Phi_k \cdot A \cdot \beta_i \cdot K_\psi \cdot \eta_{ik} \cdot 1,2$$

1,2 — дополнительный коэффициент по сейсмику

$K_1 = 0,25$ коэффициент, учыты вающий допускаемые повреждения зданий и сооружений;

$K_2 = 1,0$ коэффициент, учыты вающий конетруктивные решения зданий и сооружений;

$A = 0,4$ (для сейсмичность 9 баллов) — коэффициент учыты вающий значение амплитуд ускорений грунт в долях ускорения силы тяжести g;

β_i — коэффициент динамичности, соответствующий i-му тону собственных колебаний зданий и сооружений $\beta_i = 2,0$ (для грунт III категорий)

$K_\psi = 1{,}0$ — коэффициент, учитывающий диссипативные свойства конструкций;

$\gamma_{ik} = 1{,}0$ — коэффициент, зависящий от формы деформации здания или сооружения при его собственных колебаниях по i-му тону и от места расположения нагрузки;

Φ_k — вес здания или сооружения отнесенный к точке к определяемый с учетом расчетных нагрузок на конструкции.

<u>По оси „А" и „С"</u>

$$\Phi_1 = (8{,}0 \cdot 7 + 4{,}3 \cdot 4 + 4{,}4 \cdot 10) \cdot 0{,}9 + (5{,}0 \cdot 2 + 5{,}1 \cdot 5 + 3{,}3 \cdot 4 + 3{,}4 \cdot 10) \cdot 0{,}5 = 105{,}48 + 41{,}35 = 146{,}83 \text{ кН}$$

$$S_1 = 0{,}25 \cdot 1{,}0 \cdot 146{,}83 \cdot 0{,}4 \cdot 2{,}0 \cdot 1{,}0 \cdot 1{,}0 \cdot 1{,}2 = 35{,}2 \text{ кН}.$$

<u>По оси „В"</u>

$$\Phi_2 = (4{,}3 \cdot 10 + 4{,}4 \cdot 25) \cdot 0{,}9 + (3{,}3 \cdot 10 + 3{,}4 \cdot 3{,}0) \cdot 0{,}5 = 137{,}7 + 59 = 196{,}7 \text{ кН}$$

$$S_2 = 0{,}25 \cdot 1{,}0 \cdot 196{,}7 \cdot 0{,}4 \cdot 2 \cdot 1{,}0 \cdot 1{,}0 \cdot 1{,}2 = 47{,}2 \text{ кН}.$$

<u>По оси „1" и „4"</u>

$$\Phi_3 = (8{,}0 \cdot 3 + 4{,}3 \cdot 9 + 4{,}4 \cdot 4{,}5) \cdot 0{,}9 + (5{,}0 + 5{,}1 + 3{,}3 \cdot 9 + 3{,}4 \cdot 4{,}5) \cdot 0{,}5 = 74{,}25 + 30{,}05 = 104{,}3 \text{ кН}$$

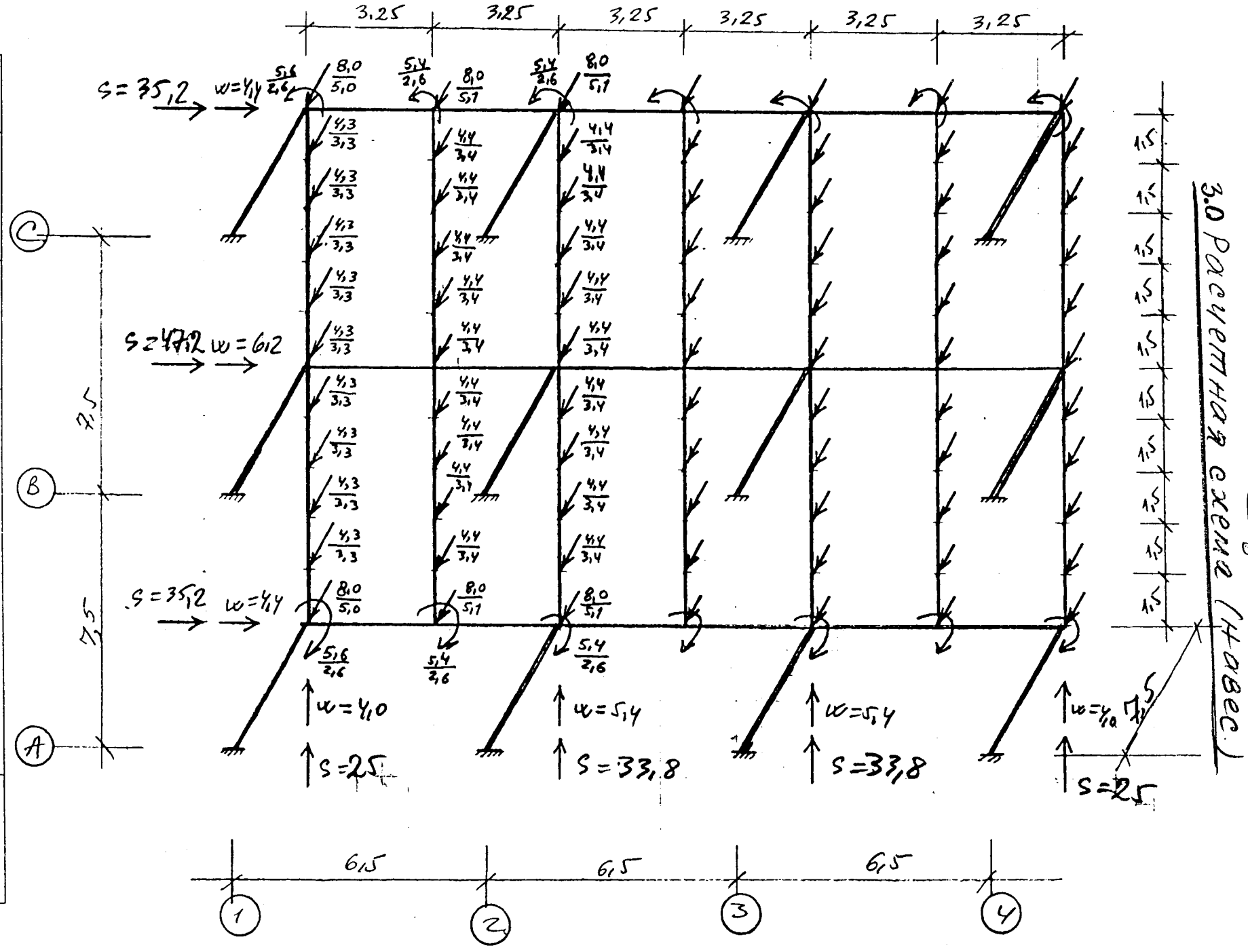
$$S_3 = 0{,}25 \cdot 1{,}0 \cdot 104{,}3 \cdot 0{,}4 \cdot 2{,}0 \cdot 1{,}0 \cdot 1{,}0 \cdot 1{,}2 = 25{,}0 \text{ кН}.$$

<u>По оси „2" и „3"</u>

$$\Phi_4 = (8{,}0 \cdot 4 + 4{,}4 \cdot 18) \cdot 0{,}9 + (5{,}1 \cdot 4 + 3{,}4 \cdot 18) \cdot 0{,}5 = 100{,}08 + 40{,}8 = 140{,}88 \text{ кН}$$

$$S_4 = 0{,}25 \cdot 1{,}0 \cdot 140{,}88 \cdot 0{,}4 \cdot 2{,}0 \cdot 1{,}0 \cdot 1{,}0 \cdot 1{,}2 = 33{,}8 \text{ кН}$$

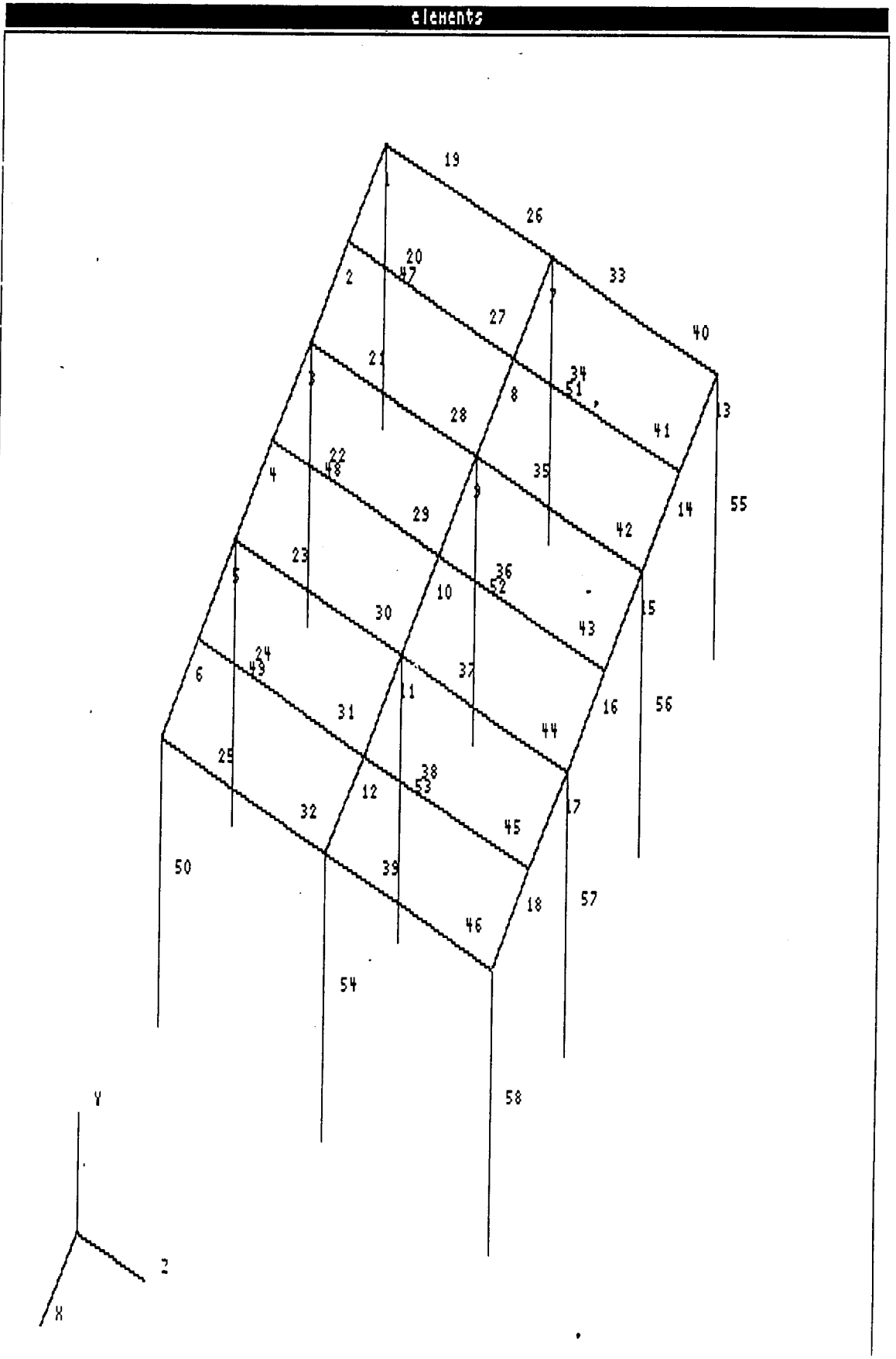
3.0 Расчетная схема (Навес)

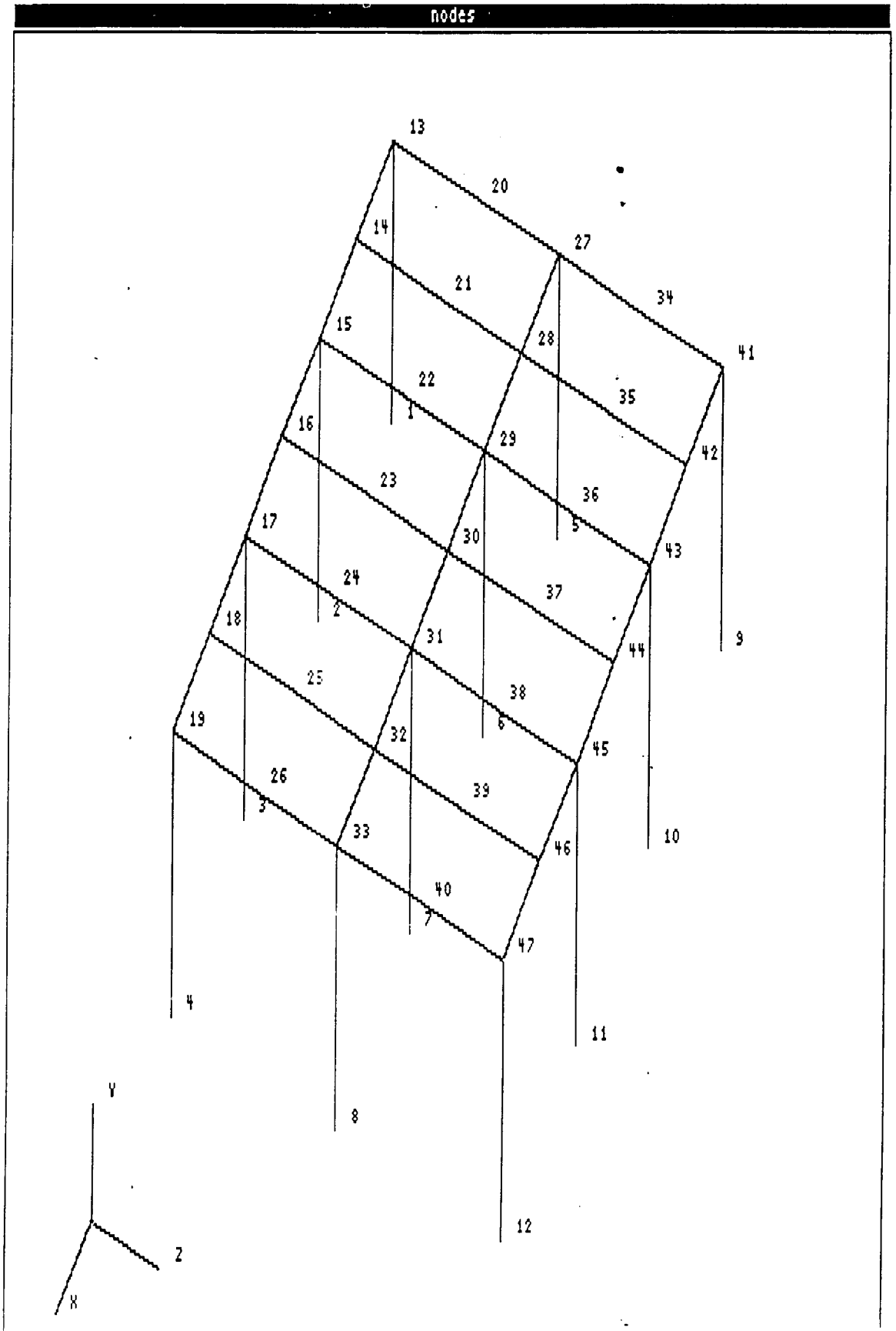


RAMBØLL

side:	
dato:	dato:
udarb.:	kontrol:
sag nr.	

4.0 Статической расчет (навес.)




nodes
13
20
14
27
21
34
15
28
41
22
35
1
16
29
42
23
36
5
17
30
43
24
37
2
18
31
44
9
25
38
6
19
32
45
26
39
3
33
46
10
40
7
47
4
11
8
12
Y
Z
X

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Baku

Type of structure SPACE STRUCTURE

Data file: CUSCOV
Uddatafil: cusco

SPACE FRAME

C O O R D I N A T E S for 47 node points

Nodepoint No.	X-coord.	Y-coord.	Z-coord.	Fixed against deflection in			rotation about		
	m	m	m	X-d.	Y-d.	Z-d.	X-a.	Y-a.	Z-a.
1	0.000	0.000	0.000	Y	Y	Y	Y	Y	Y
2	6.500	0.000	0.000	Y	Y	Y	Y	Y	Y
3	13.000	0.000	0.000	Y	Y	Y	Y	Y	Y
4	19.500	0.000	0.000	Y	Y	Y	Y	Y	Y
5	0.000	0.000	7.500	Y	Y	Y	Y	Y	Y
6	6.500	0.000	7.500	Y	Y	Y	Y	Y	Y
7	13.000	0.000	7.500	Y	Y	Y	Y	Y	Y
8	19.500	0.000	7.500	Y	Y	Y	Y	Y	Y
9	0.000	0.000	15.000	Y	Y	Y	Y	Y	Y
10	6.500	0.000	15.000	Y	Y	Y	Y	Y	Y
11	13.000	0.000	15.000	Y	Y	Y	Y	Y	Y
12	19.500	0.000	15.000	Y	Y	Y	Y	Y	Y
13	0.000	7.500	0.000						
14	3.250	7.500	0.000						
15	6.500	7.500	0.000						
16	9.750	7.500	0.000						
17	13.000	7.500	0.000						
18	16.250	7.500	0.000						
19	19.500	7.500	0.000						
20	0.000	7.500	3.750						
21	3.250	7.500	3.750						
22	6.500	7.500	3.750						
23	9.750	7.500	3.750						
24	13.000	7.500	3.750						
25	16.250	7.500	3.750						
26	19.500	7.500	3.750						
27	0.000	7.500	7.500						
28	3.250	7.500	7.500						
29	6.500	7.500	7.500						
30	9.750	7.500	7.500						
31	13.000	7.500	7.500						
32	16.250	7.500	7.500						
33	19.500	7.500	7.500						
34	0.000	7.500	11.250						
35	3.250	7.500	11.250						
36	6.500	7.500	11.250						
37	9.750	7.500	11.250						
38	13.000	7.500	11.250						
39	16.250	7.500	11.250						

40	19.500	7.500	11.250
41	0.000	7.500	15.000
42	3.250	7.500	15.000
43	6.500	7.500	15.000
44	9.750	7.500	15.000
45	13.000	7.500	15.000
46	16.250	7.500	15.000
47	19.500	7.500	15.000

E L E M E N T D A T A for 58 elements

Elem. No.	Start-nodepoint No.	degr.o.f. deflect. x y z	degr.o.f. rotation x y z	End-nodepoint No.	degr.o.f. deflect. x y z	degr.o.f. rotation x y z	Angle beta	L m
1	13			14			0.0	3.250
2	14			15			0.0	3.250
3	15			16			0.0	3.250
4	16			17			0.0	3.250
5	17			18			0.0	3.250
6	18			19			0.0	3.250
7	27			28			0.0	3.250
8	28			29			0.0	3.250
9	29			30			0.0	3.250
10	30			31			0.0	3.250
11	31			32			0.0	3.250
12	32			33			0.0	3.250
13	41			42			0.0	3.250
14	42			43			0.0	3.250
15	43			44			0.0	3.250
16	44			45			0.0	3.250
17	45			46			0.0	3.250
18	46			47			0.0	3.250
19	13			20			0.0	3.750
20	14			21			0.0	3.750
21	15			22			0.0	3.750
22	16			23			0.0	3.750
23	17			24			0.0	3.750
24	18			25			0.0	3.750
25	19			26			0.0	3.750
26	20			27			0.0	3.750
27	21			28			0.0	3.750
28	22			29			0.0	3.750
29	23			30			0.0	3.750
30	24			31			0.0	3.750
31	25			32			0.0	3.750
32	26			33			0.0	3.750
33	27			34			0.0	3.750
34	28			35			0.0	3.750
35	29			36			0.0	3.750
36	30			37			0.0	3.750
37	31			38			0.0	3.750
38	32			39			0.0	3.750
39	33			40			0.0	3.750
40	34			41			0.0	3.750
41	35			42			0.0	3.750
42	36			43			0.0	3.750
43	37			44			0.0	3.750
44	38			45			0.0	3.750
45	39			46			0.0	3.750

46	40	47	0.0	3.750
47	1	13	0.0	7.500
48	2	15	0.0	7.500
49	3	17	0.0	7.500
50	4	19	0.0	7.500
51	5	27	0.0	7.500
52	6	29	0.0	7.500
53	7	31	0.0	7.500
54	8	33	0.0	7.500
55	9	41	0.0	7.500
56	10	43	0.0	7.500
57	11	45	0.0	7.500
58	12	47	0.0	7.500

M A T E R I A L S A N D S E C T I O N A L P R O P E R T I E S

Elem. No.	Elast.-modulus N/mm2	Shear modulus N/mm2	Sec.prop-name
1	210000.	80000.	IPE500
2	210000.	80000.	IPE500
3	210000.	80000.	IPE500
4	210000.	80000.	IPE500
5	210000.	80000.	IPE500
6	210000.	80000.	IPE500
7	210000.	80000.	IPE500
8	210000.	80000.	IPE500
9	210000.	80000.	IPE500
10	210000.	80000.	IPE500
11	210000.	80000.	IPE500
12	210000.	80000.	IPE500
13	210000.	80000.	IPE500
14	210000.	80000.	IPE500
15	210000.	80000.	IPE500
16	210000.	80000.	IPE500
17	210000.	80000.	IPE500
18	210000.	80000.	IPE500
19	210000.	80000.	IPE500
20	210000.	80000.	IPE500
21	210000.	80000.	IPE500
22	210000.	80000.	IPE500
23	210000.	80000.	IPE500
24	210000.	80000.	IPE500
25	210000.	80000.	IPE500
26	210000.	80000.	IPE500
27	210000.	80000.	IPE500
28	210000.	80000.	IPE500
29	210000.	80000.	IPE500
30	210000.	80000.	IPE500
31	210000.	80000.	IPE500
32	210000.	80000.	IPE500
33	210000.	80000.	IPE500
34	210000.	80000.	IPE500
35	210000.	80000.	IPE500
36	210000.	80000.	IPE500
37	210000.	80000.	IPE500
38	210000.	80000.	IPE500

39	210000.	80000.	IPE500
40	210000.	80000.	IPE500
41	210000.	80000.	IPE500
42	210000.	80000.	IPE500
43	210000.	80000.	IPE500
44	210000.	80000.	IPE500
45	210000.	80000.	IPE500
46	210000.	80000.	IPE500
47	210000.	80000.	IPE500
48	210000.	80000.	IPE500
49	210000.	80000.	IPE500
50	210000.	80000.	IPE500
51	210000.	80000.	IPE500
52	210000.	80000.	IPE500
53	210000.	80000.	IPE500
54	210000.	80000.	IPE500
55	210000.	80000.	IPE500
56	210000.	80000.	IPE500
57	210000.	80000.	IPE500
58	210000.	80000.	IPE500

S E C T I O N A L P R O P E R T Y D A T A

Sec.prop-name	Area	Tors. moment of inertia	Bending mom. of inertia ab. y-axis	ab. z-axis
	m2	m4	m4	m4
IPE500	0.011600	0.0000008970	0.0000214000	0.0004820000

L O A D C A S E No. 1 deadegen

Dead load, specific density: 78.50 kN/m3
Direction: -Y

L O A D C A S E No. 2 deadload

NODEPOINT LOADS

Nodepoint No.	Load type	Direct.	Intensity (kN,kNm,mm,rad/1000)
13	Point load	Y	-8.00
14	Point load	Y	-8.00
15	Point load	Y	-8.00
16	Point load	Y	-8.00
17	Point load	Y	-8.00
18	Point load	Y	-8.00
19	Point load	Y	-8.00
41	Point load	Y	-8.00
42	Point load	Y	-8.00
43	Point load	Y	-8.00
44	Point load	Y	-8.00
45	Point load	Y	-8.00
46	Point load	Y	-8.00
47	Point load	Y	-8.00
27	Point load	Y	-4.40
28	Point load	Y	-4.40
29	Point load	Y	-4.40
30	Point load	Y	-4.40
31	Point load	Y	-4.40
32	Point load	Y	-4.40
33	Point load	Y	-4.40
13	Moment	Z	5.60
14	Moment	Z	5.60
15	Moment	Z	5.60
16	Moment	Z	5.60
17	Moment	Z	5.60
18	Moment	Z	5.60
19	Moment	Z	5.60
41	Moment	Z	-5.60
42	Moment	Z	-5.60
43	Moment	Z	-5.60
44	Moment	Z	-5.60
45	Moment	Z	-5.60
46	Moment	Z	-5.60
47	Moment	Z	-5.60

ELEMENT LOADS

Elem. No.	Load type	Direct.	Distance (Term.c.) m (/10**5)	Length (Height) m (m)	Intens. (kN,kNm,deg. C)	Intens.
19	Point load	Y Glo	1.500	0.000	-4.40	0.00

20	Point load	Y Glo	1.500	0.000	-4.40	0.00
21	Point load	Y Glo	1.500	0.000	-4.40	0.00
22	Point load	Y Glo	1.500	0.000	-4.40	0.00
23	Point load	Y Glo	1.500	0.000	-4.40	0.00
24	Point load	Y Glo	1.500	0.000	-4.40	0.00
25	Point load	Y Glo	1.500	0.000	-4.40	0.00
33	Point load	Y Glo	1.500	0.000	-4.40	0.00
34	Point load	Y Glo	1.500	0.000	-4.40	0.00
35	Point load	Y Glo	1.500	0.000	-4.40	0.00
36	Point load	Y Glo	1.500	0.000	-4.40	0.00
37	Point load	Y Glo	1.500	0.000	-4.40	0.00
38	Point load	Y Glo	1.500	0.000	-4.40	0.00
39	Point load	Y Glo	1.500	0.000	-4.40	0.00
19	Point load	Y Glo	3.000	0.000	-4.40	0.00
20	Point load	Y Glo	3.000	0.000	-4.40	0.00
21	Point load	Y Glo	3.000	0.000	-4.40	0.00
22	Point load	Y Glo	3.000	0.000	-4.40	0.00
23	Point load	Y Glo	3.000	0.000	-4.40	0.00
24	Point load	Y Glo	3.000	0.000	-4.40	0.00
25	Point load	Y Glo	3.000	0.000	-4.40	0.00
33	Point load	Y Glo	3.000	0.000	-4.40	0.00
34	Point load	Y Glo	3.000	0.000	-4.40	0.00
35	Point load	Y Glo	3.000	0.000	-4.40	0.00
36	Point load	Y Glo	3.000	0.000	-4.40	0.00
37	Point load	Y Glo	3.000	0.000	-4.40	0.00
38	Point load	Y Glo	3.000	0.000	-4.40	0.00
39	Point load	Y Glo	3.000	0.000	-4.40	0.00
26	Point load	Y Glo	0.750	0.000	-4.40	0.00
27	Point load	Y Glo	0.750	0.000	-4.40	0.00
28	Point load	Y Glo	0.750	0.000	-4.40	0.00
29	Point load	Y Glo	0.750	0.000	-4.40	0.00
30	Point load	Y Glo	0.750	0.000	-4.40	0.00
31	Point load	Y Glo	0.750	0.000	-4.40	0.00
32	Point load	Y Glo	0.750	0.000	-4.40	0.00
40	Point load	Y Glo	0.750	0.000	-4.40	0.00
41	Point load	Y Glo	0.750	0.000	-4.40	0.00
42	Point load	Y Glo	0.750	0.000	-4.40	0.00
43	Point load	Y Glo	0.750	0.000	-4.40	0.00
44	Point load	Y Glo	0.750	0.000	-4.40	0.00
45	Point load	Y Glo	0.750	0.000	-4.40	0.00
46	Point load	Y Glo	0.750	0.000	-4.40	0.00
26	Point load	Y Glo	2.250	0.000	-4.40	0.00
27	Point load	Y Glo	2.250	0.000	-4.40	0.00
28	Point load	Y Glo	2.250	0.000	-4.40	0.00
29	Point load	Y Glo	2.250	0.000	-4.40	0.00
30	Point load	Y Glo	2.250	0.000	-4.40	0.00
31	Point load	Y Glo	2.250	0.000	-4.40	0.00
32	Point load	Y Glo	2.250	0.000	-4.40	0.00
40	Point load	Y Glo	2.250	0.000	-4.40	0.00
41	Point load	Y Glo	2.250	0.000	-4.40	0.00
42	Point load	Y Glo	2.250	0.000	-4.40	0.00
43	Point load	Y Glo	2.250	0.000	-4.40	0.00
44	Point load	Y Glo	2.250	0.000	-4.40	0.00
45	Point load	Y Glo	2.250	0.000	-4.40	0.00
46	Point load	Y Glo	2.250	0.000	-4.40	0.00

L O A D C A S E No. 3 variable

NODEPOINT LOADS

Nodepoint No.	Load type	Direct.	Intensity (kN,kNm,mm,rad/1000)
13	Point load	Y	-5.10
14	Point load	Y	-5.10
15	Point load	Y	-5.10
16	Point load	Y	-5.10
17	Point load	Y	-5.10
18	Point load	Y	-5.10
19	Point load	Y	-5.10
41	Point load	Y	-5.10
42	Point load	Y	-5.10
43	Point load	Y	-5.10
44	Point load	Y	-5.10
45	Point load	Y	-5.10
46	Point load	Y	-5.10
47	Point load	Y	-5.10
13	Moment	Z	2.60
14	Moment	Z	2.60
15	Moment	Z	2.60
16	Moment	Z	2.60
17	Moment	Z	2.60
18	Moment	Z	2.60
19	Moment	Z	2.60
41	Moment	Z	-2.60
42	Moment	Z	-2.60
43	Moment	Z	-2.60
45	Moment	Z	-2.60
47	Moment	Z	-2.60
27	Point load	Y	-3.40
28	Point load	Y	-3.40
29	Point load	Y	-3.40
30	Point load	Y	-3.40
31	Point load	Y	-3.40
32	Point load	Y	-3.40
33	Point load	Y	-3.40
44	Moment	Z	-2.60
46	Moment	Z	-2.60

ELEMENT LOADS

Elem. No.	Load type	Direct.	Distance (Term.c.) m (/10**5)	Length (Height) m (m)	Intens. (kN,kNm,deg. C)	Intens.
19	Point load	Y Glo	1.500	0.000	-3.40	0.00
20	Point load	Y Glo	1.500	0.000	-3.40	0.00
21	Point load	Y Glo	1.500	0.000	-3.40	0.00
22	Point load	Y Glo	1.500	0.000	-3.40	0.00
23	Point load	Y Glo	1.500	0.000	-3.40	0.00
24	Point load	Y Glo	1.500	0.000	-3.40	0.00
25	Point load	Y Glo	1.500	0.000	-3.40	0.00
33	Point load	Y Glo	1.500	0.000	-3.40	0.00
34	Point load	Y Glo	1.500	0.000	-3.40	0.00
35	Point load	Y Glo	1.500	0.000	-3.40	0.00
36	Point load	Y Glo	1.500	0.000	-3.40	0.00
37	Point load	Y Glo	1.500	0.000	-3.40	0.00
38	Point load	Y Glo	1.500	0.000	-3.40	0.00
39	Point load	Y Glo	1.500	0.000	-3.40	0.00

19	Point load	Y Glo	3.000	0.000	-3.40	0.00
20	Point load	Y Glo	3.000	0.000	-3.40	0.00
21	Point load	Y Glo	3.000	0.000	-3.40	0.00
22	Point load	Y Glo	3.000	0.000	-3.40	0.00
23	Point load	Y Glo	3.000	0.000	-3.40	0.00
24	Point load	Y Glo	3.000	0.000	-3.40	0.00
25	Point load	Y Glo	3.000	0.000	-3.40	0.00
33	Point load	Y Glo	3.000	0.000	-3.40	0.00
34	Point load	Y Glo	3.000	0.000	-3.40	0.00
35	Point load	Y Glo	3.000	0.000	-3.40	0.00
36	Point load	Y Glo	3.000	0.000	-3.40	0.00
37	Point load	Y Glo	3.000	0.000	-3.40	0.00
38	Point load	Y Glo	3.000	0.000	-3.40	0.00
39	Point load	Y Glo	3.000	0.000	-3.40	0.00
26	Point load	Y Glo	0.750	0.000	-3.40	0.00
27	Point load	Y Glo	0.750	0.000	-3.40	0.00
28	Point load	Y Glo	0.750	0.000	-3.40	0.00
29	Point load	Y Glo	0.750	0.000	-3.40	0.00
30	Point load	Y Glo	0.750	0.000	-3.40	0.00
31	Point load	Y Glo	0.750	0.000	-3.40	0.00
32	Point load	Y Glo	0.750	0.000	-3.40	0.00
40	Point load	Y Glo	0.750	0.000	-3.40	0.00
41	Point load	Y Glo	0.750	0.000	-3.40	0.00
42	Point load	Y Glo	0.750	0.000	-3.40	0.00
43	Point load	Y Glo	0.750	0.000	-3.40	0.00
44	Point load	Y Glo	0.750	0.000	-3.40	0.00
45	Point load	Y Glo	0.750	0.000	-3.40	0.00
46	Point load	Y Glo	0.750	0.000	-3.40	0.00
26	Point load	Y Glo	2.250	0.000	-3.40	0.00
27	Point load	Y Glo	2.250	0.000	-3.40	0.00
28	Point load	Y Glo	2.250	0.000	-3.40	0.00
29	Point load	Y Glo	2.250	0.000	-3.40	0.00
30	Point load	Y Glo	2.250	0.000	-3.40	0.00
31	Point load	Y Glo	2.250	0.000	-3.40	0.00
32	Point load	Y Glo	2.250	0.000	-3.40	0.00
40	Point load	Y Glo	2.250	0.000	-3.40	0.00
41	Point load	Y Glo	2.250	0.000	-3.40	0.00
42	Point load	Y Glo	2.250	0.000	-3.40	0.00
43	Point load	Y Glo	2.250	0.000	-3.40	0.00
44	Point load	Y Glo	2.250	0.000	-3.40	0.00
45	Point load	Y Glo	2.250	0.000	-3.40	0.00
46	Point load	Y Glo	2.250	0.000	-3.40	0.00

L O A D C A S E No. 4 earthx

NODEPOINT LOADS

Nodepoint No.	Load type	Direct.	Intensity (kN,kNm,mm,rad/1000)
13	Point load	X	35.20
41	Point load	X	35.20
27	Point load	X	47.20

L O A D C A S E No. 5 windx

NODEPOINT LOADS

Nodepoint No.	Load type	Direct.	Intensity (kN,kNm,mm,rad/1000)
13	Point load	X	4.40
41	Point load	X	4.40
27	Point load	X	6.20

L O A D C A S E No. 6 earthz

NODEPOINT LOADS

Nodepoint No.	Load type	Direct.	Intensity (kN,kNm,mm,rad/1000)
13	Point load	Z	25.00
19	Point load	Z	25.00
15	Point load	Z	33.80
17	Point load	Z	33.80

L O A D C A S E No. 7 windz

NODEPOINT LOADS

Nodepoint No.	Load type	Direct.	Intensity (kN,kNm,mm,rad/1000)
13	Point load	Z	4.00
19	Point load	Z	4.00
15	Point load	Z	5.40
17	Point load	Z	5.40

L O A D C A S E No. 8 combi1

Loadcase		Load factor
1	deadegen	1.00
2	deadload	1.00
4	earthx	1.00

L O A D C A S E No. 9 combi2

Loadcase Load factor

1	deadegen	1.00
2	deadload	1.00
3	variable	1.00
5	windx	1.00

L O A D C A S E No. 10 combi3

Loadcase		Load factor
1	deadegen	1.00
2	deadload	1.00
6	earthz	1.00

L O A D C A S E No. 11 combi4

Loadcase		Load factor
1	deadegen	1.00
2	deadload	1.00
3	variable	1.00
7	windz	1.00

R E S U L T S for loadcase No. 8: combi1

S E C T I O N A L F O R C E S

SIGN CONVENTION: Local x-axis is oriented from start node towards end node. Local y-axis forms angle beta with the plane containing local x-axis and global Y-axis. Local z-axis is defined by the righthand-rule. Positive axial force creates tension. Positive shear force is oriented as local y- and z-axes respectively in the start joint and opposite in the end joint. Positive torsion acts in positive x direct. in the start node, opposite in the end node. Positive moment creates tension in the underside, i.e. at negative local y resp. z direction.

Elem No.	Joint No.	Forces (kN) Px	Py	Pz	Moments (kNm) Mx	My	Mz
1	13	-28.7	4.7	-0.2	0.0	0.4	13.1
	14	-28.7	1.8	-0.2	0.0	-0.3	23.7
2	14	-28.8	-15.3	-0.1	0.0	0.2	18.1
	15	-28.8	-18.3	-0.1	0.0	-0.2	-36.5
3	15	-18.7	8.5	-0.1	0.0	0.2	-5.4
	16	-18.7	5.5	-0.1	0.0	-0.2	17.3
4	16	-18.9	-11.5	-0.1	0.0	0.2	11.7
	17	-18.9	-14.4	-0.1	0.0	-0.2	-30.4
5	17	-9.6	8.3	-0.1	0.0	0.2	-3.1
	18	-9.6	5.3	-0.1	0.0	-0.2	19.0
6	18	-9.7	-11.7	-0.2	0.0	0.3	13.4
	19	-9.7	-14.7	-0.2	0.0	-0.4	-29.5
7	27	-39.8	8.3	0.0	0.0	0.0	17.0
	28	-39.8	5.4	0.0	0.0	0.0	39.2
8	28	-39.5	-29.7	0.0	0.0	0.0	39.2
	29	-39.5	-32.7	0.0	0.0	0.0	-62.1
9	29	-26.1	14.8	0.0	0.0	0.0	-14.5
	30	-26.1	11.8	0.0	0.0	0.0	28.7
10	30	-25.8	-23.5	0.0	0.0	0.0	28.7
	31	-25.8	-26.5	0.0	0.0	0.0	-52.6
11	31	-13.7	14.9	0.0	0.0	0.0	-11.5
	32	-13.7	12.0	0.0	0.0	0.0	32.2
12	32	-13.4	-23.2	0.0	0.0	0.0	32.2
	33	-13.4	-26.1	0.0	0.0	0.0	-47.9
13	41	-29.0	0.6	0.2	0.0	-0.4	21.8
	42	-29.0	-2.3	0.2	0.0	0.3	19.1
14	42	-29.1	-19.4	0.1	0.0	-0.2	24.7
	43	-29.1	-22.4	0.1	0.0	0.2	-43.3
15	43	-18.7	5.1	0.1	0.0	-0.2	-0.2
	44	-18.7	2.2	0.1	0.0	0.2	11.7
16	44	-18.9	-14.8	0.1	0.0	-0.2	17.3
	45	-18.9	-17.7	0.1	0.0	0.2	-35.6
17	45	-9.3	4.2	0.1	0.0	-0.2	3.7
	46	-9.3	1.2	0.1	0.0	0.2	12.4
18	46	-9.4	-15.8	0.2	0.0	-0.3	18.0
	47	-9.4	-18.8	0.2	0.0	0.4	-38.3
19	13	-0.4	8.9	0.1	0.0	-0.4	-0.7
	20	-0.4	-3.3	0.1	0.0	0.0	13.1
20	14	0.1	9.1	0.1	0.0	-0.5	0.0
	21	0.1	-3.1	0.1	0.0	0.0	14.5
21	15	-0.2	9.0	0.1	0.0	-0.5	-0.8

	22	-0.2	-3.3	0.1	0.0	0.0	13.2
22	16	0.0	9.0	0.1	0.0	-0.5	0.0
	23	0.0	-3.2	0.1	0.0	0.0	14.0
23	17	-0.1	9.0	0.1	0.0	-0.5	-0.8
	24	-0.1	-3.3	0.1	0.0	0.0	13.2
24	18	-0.1	9.0	0.1	0.0	-0.5	0.0
	25	-0.1	-3.2	0.1	0.0	0.0	14.3
25	19	0.0	8.9	0.1	0.0	-0.4	-0.8
	26	0.0	-3.3	0.1	0.0	0.0	13.1
26	20	-0.4	-3.3	0.1	0.0	0.0	13.1
	27	-0.4	-15.5	0.1	0.0	0.5	-25.4
27	21	0.1	-3.1	0.1	0.0	0.0	14.5
	28	0.1	-15.3	0.1	0.0	0.5	-23.4
28	22	-0.2	-3.3	0.1	0.0	0.0	13.2
	29	-0.2	-15.5	0.1	0.0	0.5	-25.2
29	23	0.0	-3.2	0.1	0.0	0.0	14.0
	30	0.0	-15.5	0.1	0.0	0.5	-24.4
30	24	-0.1	-3.3	0.1	0.0	0.0	13.2
	31	-0.1	-15.5	0.1	0.0	0.5	-25.2
31	25	-0.1	-3.2	0.1	0.0	0.0	14.3
	32	-0.1	-15.4	0.1	0.0	0.5	-23.8
32	26	0.0	-3.3	0.1	0.0	0.0	13.1
	33	0.0	-15.5	0.1	0.0	0.4	-25.3
33	27	-0.4	15.5	-0.1	0.0	0.4	-25.4
	34	-0.4	3.3	-0.1	0.0	0.0	13.1
34	28	0.1	15.3	-0.1	0.0	0.5	-23.4
	35	0.1	3.1	-0.1	0.0	0.0	14.5
35	29	-0.2	15.5	-0.1	0.0	0.5	-25.2
	36	-0.2	3.2	-0.1	0.0	0.0	13.2
36	30	0.0	15.5	-0.1	0.0	0.5	-24.4
	37	0.0	3.2	-0.1	0.0	0.0	14.0
37	31	-0.1	15.5	-0.1	0.0	0.5	-25.2
	38	-0.1	3.3	-0.1	0.0	0.0	13.2
38	32	-0.1	15.4	-0.1	0.0	0.5	-23.8
	39	-0.1	3.2	-0.1	0.0	0.0	14.3
39	33	0.0	15.5	-0.1	0.0	0.4	-25.4
	40	0.0	3.3	-0.1	0.0	0.0	13.1
40	34	-0.4	3.3	-0.1	0.0	0.0	13.1
	41	-0.4	-8.9	-0.1	0.0	-0.4	-0.8
41	35	0.1	3.1	-0.1	0.0	0.0	14.5
	42	0.1	-9.1	-0.1	0.0	-0.5	0.0
42	36	-0.2	3.2	-0.1	0.0	0.0	13.2
	43	-0.2	-9.0	-0.1	0.0	-0.4	-0.8
43	37	0.0	3.2	-0.1	0.0	0.0	14.0
	44	0.0	-9.0	-0.1	0.0	-0.4	0.0
44	38	-0.1	3.3	-0.1	0.0	0.0	13.2
	45	-0.1	-9.0	-0.1	0.0	-0.4	-0.8
45	39	-0.1	3.2	-0.1	0.0	0.0	14.3
	46	-0.1	-9.0	-0.1	0.0	-0.4	0.0
46	40	0.0	3.3	-0.1	0.0	0.0	13.1
	47	0.0	-8.9	-0.1	0.0	-0.4	-0.8
47	1	-28.5	6.7	0.1	0.0	-0.4	-31.2
	13	-21.7	6.7	0.1	0.0	0.7	18.7
48	2	-50.5	10.2	0.2	0.0	-0.4	-39.8
	15	-43.7	10.2	0.2	0.0	0.8	36.6
49	3	-46.5	9.4	0.2	0.0	-0.4	-37.6
	17	-39.7	9.4	0.2	0.0	0.8	32.9
50	4	-38.5	9.8	0.2	0.0	-0.4	-38.6
	19	-31.6	9.8	0.2	0.0	0.8	35.1
51	5	-50.5	7.2	0.0	0.0	0.0	-36.9
	27	-43.7	7.2	0.0	0.0	0.0	17.0

52	6	-89.6	13.2	0.0	0.0	0.0	-51.6
	29	-82.8	13.2	0.0	0.0	0.0	47.6
53	7	-83.6	11.9	0.0	0.0	0.0	-48.0
	31	-76.8	11.9	0.0	0.0	0.0	41.1
54	8	-68.4	13.2	0.0	0.0	0.0	-51.2
	33	-61.5	13.2	0.0	0.0	0.0	47.9
55	9	-24.4	6.3	-0.2	0.0	0.4	-31.1
	41	-17.6	6.3	-0.2	0.0	-0.8	16.2
56	10	-51.3	10.5	-0.2	0.0	0.4	-41.3
	43	-44.5	10.5	-0.2	0.0	-0.8	37.5
57	11	-45.7	9.7	-0.2	0.0	0.4	-39.1
	45	-38.9	9.7	-0.2	0.0	-0.8	33.7
58	12	-42.6	9.5	-0.1	0.0	0.4	-38.5
	47	-35.7	9.5	-0.1	0.0	-0.8	32.7

R E A C T I O N S

Node No.	/---- Force (kN) X-dir.	Y-dir.	-----/ Z-dir.	/--- Moment (kNm) ab. X-axis	Y-axis	---/ Z-axis
1	-6.7	28.5	0.1	0.4	0.0	31.2
2	-10.2	50.5	0.2	0.4	0.0	39.8
3	-9.4	46.5	0.2	0.4	0.0	37.6
4	-9.8	38.5	0.2	0.4	0.0	38.6
5	-7.2	50.5	0.0	0.0	0.0	36.9
6	-13.2	89.6	0.0	0.0	0.0	51.6
7	-11.9	83.6	0.0	0.0	0.0	48.0
8	-13.2	68.4	0.0	0.0	0.0	51.2
9	-6.3	24.4	-0.2	-0.4	0.0	31.1
10	-10.5	51.3	-0.2	-0.4	0.0	41.3
11	-9.7	45.7	-0.2	-0.4	0.0	39.1
12	-9.5	42.6	-0.1	-0.4	0.0	38.5

R E S U L T S for loadcase No. 9: combi2

S E C T I O N A L F O R C E S

SIGN CONVENTION: Local x-axis is oriented from start node towards end node. Local y-axis forms angle beta with the plane containing local x-axis and global Y-axis. Local z-axis is defined by the righthand-rule. Positive axial force creates tension. Positive shear force is oriented as local y- and z-axes respectively in the start joint and opposite in the end joint. Positive torsion acts in positive x direct. in the start node, opposite in the end node. Positive moment creates tension in the underside, i.e. at negative local y resp. z direction.

Elem No.	Joint No.	/---- Forces (kN) Px	Py	-------/ Pz	/---- Moments (kNm) Mx	My	---/ Mz
1	13	-5.7	16.2	0.0	0.0	0.1	-15.9
	14	-5.7	13.2	0.0	0.0	-0.1	31.8
2	14	-5.7	-13.9	0.0	0.0	0.0	23.6
	15	-5.7	-16.9	0.0	0.0	0.0	-26.5
3	15	-4.2	18.3	0.0	0.0	0.1	-28.4
	16	-4.2	15.3	0.0	0.0	0.0	26.2
4	16	-4.2	-11.6	0.0	0.0	0.1	18.0
	17	-4.2	-14.6	0.0	0.0	-0.1	-24.6

5	17	-3.8	21.2	0.0	0.0	0.0	-31.4
	18	-3.8	18.2	0.0	0.0	0.0	32.5
6	18	-3.8	-8.9	0.0	0.0	0.1	24.3
	19	-3.8	-11.9	0.0	0.0	-0.1	-9.5
7	27	-9.7	24.8	0.0	0.0	0.0	-20.1
	28	-9.7	21.9	0.0	0.0	0.0	55.8
8	28	-9.6	-33.9	0.0	0.0	0.0	55.8
	29	-9.6	-36.9	0.0	0.0	0.0	-59.2
9	29	-7.1	30.3	0.0	0.0	0.0	-48.9
	30	-7.1	27.3	0.0	0.0	0.0	44.6
10	30	-7.0	-28.8	0.0	0.0	0.0	44.6
	31	-7.0	-31.8	0.0	0.0	0.0	-53.8
11	31	-6.3	34.5	0.0	0.0	0.0	-52.6
	32	-6.3	31.6	0.0	0.0	0.0	54.9
12	32	-6.2	-24.2	0.0	0.0	0.0	54.9
	33	-6.2	-27.2	0.0	0.0	0.0	-28.6
13	41	-6.2	10.1	0.0	0.0	0.0	-3.1
	42	-6.2	7.2	0.0	0.0	0.0	25.0
14	42	-6.2	-20.0	0.0	0.0	0.0	33.2
	43	-6.2	-22.9	0.0	0.0	0.0	-36.5
15	43	-4.2	13.4	0.0	0.0	0.0	-20.8
	44	-4.2	10.5	0.0	0.0	0.0	18.0
16	44	-4.2	-16.5	0.0	0.0	0.0	26.2
	45	-4.2	-19.5	0.0	0.0	0.0	-32.2
17	45	-3.3	15.1	0.0	0.0	0.0	-21.4
	46	-3.3	12.2	0.0	0.0	0.0	22.9
18	46	-3.3	-15.0	0.0	0.0	0.0	31.1
	47	-3.3	-17.9	0.0	0.0	0.0	-22.3
19	13	-0.3	13.8	0.0	0.0	-0.1	-1.2
	20	-0.3	-5.2	0.0	0.0	0.0	20.8
20	14	0.0	14.0	0.0	0.0	-0.1	0.0
	21	0.0	-5.0	0.0	0.0	0.0	22.8
21	15	-0.3	13.9	0.0	0.0	-0.1	-1.2
	22	-0.3	-5.2	0.0	0.0	0.0	20.9
22	16	0.0	13.9	0.0	0.0	-0.1	0.0
	23	0.0	-5.1	0.0	0.0	0.0	22.2
23	17	-0.2	13.9	0.0	0.0	-0.1	-1.3
	24	-0.2	-5.1	0.0	0.0	0.0	20.9
24	18	0.0	14.0	0.0	0.0	-0.1	0.0
	25	0.0	-5.0	0.0	0.0	0.0	22.8
25	19	-0.2	13.8	0.0	0.0	-0.1	-1.3
	26	-0.2	-5.2	0.0	0.0	0.0	20.8
26	20	-0.3	-5.2	0.0	0.0	0.0	20.8
	27	-0.3	-24.2	0.0	0.0	0.1	-40.2
27	21	0.0	-5.0	0.0	0.0	0.0	22.8
	28	0.0	-24.0	0.0	0.0	0.1	-37.3
28	22	-0.3	-5.2	0.0	0.0	0.0	20.9
	29	-0.3	-24.2	0.0	0.0	0.1	-39.9
29	23	0.0	-5.1	0.0	0.0	0.0	22.2
	30	0.0	-24.2	0.0	0.0	0.1	-38.6
30	24	-0.2	-5.1	0.0	0.0	0.0	20.9
	31	-0.2	-24.2	0.0	0.0	0.1	-39.9
31	25	0.0	-5.0	0.0	0.0	0.0	22.8
	32	0.0	-24.0	0.0	0.0	0.1	-37.4
32	26	-0.2	-5.2	0.0	0.0	0.0	20.8
	33	-0.2	-24.2	0.0	0.0	0.1	-40.2
33	27	-0.3	24.2	0.0	0.0	0.1	-40.2
	34	-0.3	5.2	0.0	0.0	0.0	20.8
34	28	0.0	24.0	0.0	0.0	0.1	-37.3
	35	0.0	5.0	0.0	0.0	0.0	22.8
35	29	-0.3	24.2	0.0	0.0	0.0	-39.9

	36	-0.3	5.1	0.0	0.0	0.0	20.9
36	30	0.0	24.2	0.0	0.0	0.0	-38.6
	37	0.0	5.1	0.0	0.0	0.0	22.2
37	31	-0.2	24.2	0.0	0.0	0.0	-39.9
	38	-0.2	5.2	0.0	0.0	0.0	20.9
38	32	0.0	24.0	0.0	0.0	0.0	-37.4
	39	0.0	5.0	0.0	0.0	0.0	22.8
39	33	-0.2	24.2	0.0	0.0	0.0	-40.2
	40	-0.2	5.2	0.0	0.0	0.0	20.8
40	34	-0.3	5.2	0.0	0.0	0.0	20.8
	41	-0.3	-13.8	0.0	0.0	0.0	-1.3
41	35	0.0	5.0	0.0	0.0	0.0	22.8
	42	0.0	-14.0	0.0	0.0	0.0	0.0
42	36	-0.3	5.1	0.0	0.0	0.0	20.9
	43	-0.3	-13.9	0.0	0.0	0.0	-1.3
43	37	0.0	5.1	0.0	0.0	0.0	22.2
	44	0.0	-13.9	0.0	0.0	0.0	0.0
44	38	-0.2	5.2	0.0	0.0	0.0	20.9
	45	-0.2	-13.9	0.0	0.0	0.0	-1.2
45	39	0.0	5.0	0.0	0.0	0.0	22.8
	46	0.0	-14.0	0.0	0.0	0.0	0.0
46	40	-0.2	5.2	0.0	0.0	0.0	20.8
	47	-0.2	-13.8	0.0	0.0	0.0	-1.2
47	1	-49.9	-1.3	0.2	0.0	-0.6	1.8
	13	-43.1	-1.3	0.2	0.0	1.2	-7.7
48	2	-69.0	1.5	0.2	0.0	-0.6	-5.1
	15	-62.2	1.5	0.2	0.0	1.3	6.3
49	3	-69.5	0.5	0.3	0.0	-0.6	-2.6
	17	-62.7	0.5	0.3	0.0	1.3	1.3
50	4	-45.7	3.8	0.3	0.0	-0.7	-10.7
	19	-38.8	3.8	0.3	0.0	1.3	17.7
51	5	-87.9	-3.5	0.0	0.0	0.0	6.3
	27	-81.1	-3.5	0.0	0.0	0.0	-20.1
52	6	-130.1	2.6	0.0	0.0	0.0	-8.8
	29	-123.2	2.6	0.0	0.0	0.0	10.3
53	7	-129.3	0.7	0.0	0.0	0.0	-4.2
	31	-122.5	0.7	0.0	0.0	0.0	1.3
54	8	-90.2	6.2	0.0	0.0	0.0	-17.8
	33	-83.4	6.2	0.0	0.0	0.0	28.6
55	9	-43.9	-1.8	-0.3	0.0	0.7	2.0
	41	-37.1	-1.8	-0.3	0.0	-1.3	-11.3
56	10	-70.2	2.0	-0.3	0.0	0.6	-7.3
	43	-63.3	2.0	-0.3	0.0	-1.3	7.5
57	11	-68.4	1.0	-0.2	0.0	0.6	-4.8
	45	-61.6	1.0	-0.2	0.0	-1.3	2.6
58	12	-51.7	3.3	-0.2	0.0	0.6	-10.5
	47	-44.8	3.3	-0.2	0.0	-1.2	14.1

R E A C T I O N S

Node No.	/---- Force (kN) X-dir.	Y-dir.	-----/ Z-dir.	/--- Moment (kNm) ab. X-axis	Y-axis	---/ Z-axis
1	1.3	49.9	0.2	0.6	0.0	-1.8
2	-1.5	69.0	0.2	0.6	0.0	5.1
3	-0.5	69.5	0.3	0.6	0.0	2.6
4	-3.8	45.7	0.3	0.7	0.0	10.7
5	3.5	87.9	0.0	0.0	0.0	-6.3
6	-2.6	130.1	0.0	0.0	0.0	8.8
7	-0.7	129.3	0.0	0.0	0.0	4.2

8	-6.2	90.2	0.0	0.0	0.0	17.8
9	1.8	43.9	-0.3	-0.7	0.0	-2.0
10	-2.0	70.2	-0.3	-0.6	0.0	7.3
11	-1.0	68.4	-0.2	-0.6	0.0	4.8
12	-3.3	51.7	-0.2	-0.6	0.0	10.5

R E S U L T S for loadcase No. 10: combi3

S E C T I O N A L F O R C E S

SIGN CONVENTION: Local x-axis is oriented from start node towards end node. Local y-axis forms angle beta with the plane containing local x-axis and global Y-axis. Local z-axis is defined by the righthand-rule. Positive axial force creates tension. Positive shear force is oriented as local y- and z-axes respectively in the start joint and opposite in the end joint. Positive torsion acts in positive x direct. in the start node, opposite in the end node. Positive moment creates tension in the underside, i.e. at negative local y resp. z direction.

Elem No.	Joint No.	Forces (kN) Px	Py	Pz	Moments (kNm) Mx	My	Mz
1	13	-2.0	11.9	-0.9	0.0	1.7	-13.0
	14	-2.0	8.9	-0.9	0.0	-1.1	20.8
2	14	-2.6	-8.2	-1.1	0.0	1.3	15.2
	15	-2.6	-11.1	-1.1	0.0	-2.2	-16.2
3	15	-2.8	13.1	0.1	0.0	-0.8	-20.5
	16	-2.8	10.1	0.1	0.0	-0.3	17.2
4	16	-2.8	-6.8	-0.2	0.0	-0.3	11.6
	17	-2.8	-9.8	-0.2	0.0	-0.8	-15.3
5	17	-2.9	15.2	1.1	0.0	-2.1	-23.0
	18	-2.9	12.3	1.1	0.0	1.3	21.7
6	18	-2.3	-4.8	0.9	0.0	-1.1	16.1
	19	-2.3	-7.7	0.9	0.0	1.7	-4.2
7	27	-3.2	17.4	-1.7	0.0	3.0	-16.0
	28	-3.2	14.4	-1.7	0.0	-2.4	35.6
8	28	-3.2	-20.7	-1.5	0.0	2.1	35.6
	29	-3.2	-23.7	-1.5	0.0	-2.8	-36.5
9	29	-2.6	20.6	-0.2	0.0	-0.2	-33.6
	30	-2.6	17.7	-0.2	0.0	-0.7	28.6
10	30	-2.6	-17.7	0.1	0.0	-0.7	28.6
	31	-2.6	-20.6	0.1	0.0	-0.2	-33.6
11	31	-3.2	23.7	1.5	0.0	-2.7	-36.5
	32	-3.2	20.7	1.5	0.0	2.0	35.6
12	32	-3.2	-14.4	1.7	0.0	-2.4	35.6
	33	-3.2	-17.4	1.7	0.0	3.0	-16.0
13	41	-1.5	7.8	-0.9	0.0	1.8	-4.3
	42	-1.5	4.8	-0.9	0.0	-1.3	16.1
14	42	-0.8	-12.3	-0.9	0.0	1.1	21.7
	43	-0.8	-15.2	-0.9	0.0	-1.9	-23.0
15	43	0.0	9.8	0.0	0.0	-0.5	-15.3
	44	0.0	6.8	0.0	0.0	-0.6	11.7
16	44	0.0	-10.1	0.0	0.0	-0.6	17.3
	45	0.0	-13.1	0.0	0.0	-0.6	-20.5
17	45	-0.5	11.1	0.9	0.0	-1.9	-16.1
	46	-0.5	8.2	0.9	0.0	1.1	15.2
18	46	-1.1	-8.9	0.9	0.0	-1.3	20.8
	47	-1.1	-11.9	0.9	0.0	1.7	-13.0

19	13	-16.6	1.9	0.4	0.0	-1.7	34.1
	20	-16.6	-10.4	0.4	0.0	-0.1	21.5
20	14	-0.2	9.1	0.6	0.0	-2.4	0.0
	21	-0.2	-3.1	0.6	0.0	-0.1	14.4
21	15	-22.7	1.4	0.4	0.0	-1.4	36.3
	22	-22.7	-10.8	0.4	0.0	0.0	22.1
22	16	-0.3	9.0	0.0	0.0	0.0	0.0
	23	-0.3	-3.3	0.0	0.0	0.0	14.0
23	17	-22.7	1.4	-0.3	0.0	1.3	36.3
	24	-22.7	-10.8	-0.3	0.0	0.0	22.1
24	18	-0.2	9.1	-0.6	0.0	2.4	0.0
	25	-0.2	-3.1	-0.6	0.0	0.1	14.4
25	19	-16.6	1.9	-0.4	0.0	1.7	34.0
	26	-16.6	-10.3	-0.4	0.0	0.1	21.5
26	20	-16.6	-10.4	0.4	0.0	-0.1	21.5
	27	-16.6	-22.6	0.4	0.0	1.5	-43.6
27	21	-0.2	-3.1	0.6	0.0	-0.1	14.4
	28	-0.2	-15.4	0.6	0.0	2.3	-23.6
28	22	-22.7	-10.8	0.4	0.0	0.0	22.1
	29	-22.7	-23.0	0.4	0.0	1.3	-44.5
29	23	-0.3	-3.3	0.0	0.0	0.0	14.0
	30	-0.3	-15.5	0.0	0.0	0.0	-24.4
30	24	-22.7	-10.8	-0.3	0.0	0.0	22.1
	31	-22.7	-23.0	-0.3	0.0	-1.2	-44.5
31	25	-0.2	-3.1	-0.6	0.0	0.1	14.4
	32	-0.2	-15.4	-0.6	0.0	-2.2	-23.6
32	26	-16.6	-10.3	-0.4	0.0	0.1	21.5
	33	-16.6	-22.6	-0.4	0.0	-1.5	-43.5
33	27	-8.6	8.4	0.4	0.0	-1.5	-7.2
	34	-8.6	-3.8	0.4	0.0	0.1	4.8
34	28	0.0	15.4	0.6	0.0	-2.2	-23.6
	35	0.0	3.1	0.6	0.0	0.1	14.4
35	29	-11.1	7.9	0.4	0.0	-1.3	-5.8
	36	-11.1	-4.3	0.4	0.0	0.0	4.3
36	30	0.0	15.5	0.0	0.0	0.0	-24.4
	37	0.0	3.2	0.0	0.0	0.0	14.0
37	31	-11.1	7.9	-0.3	0.0	1.2	-5.8
	38	-11.1	-4.3	-0.3	0.0	0.0	4.4
38	32	0.0	15.4	-0.6	0.0	2.2	-23.6
	39	0.0	3.1	-0.6	0.0	-0.1	14.4
39	33	-8.6	8.4	-0.4	0.0	1.5	-7.3
	40	-8.6	-3.8	-0.4	0.0	-0.1	4.8
40	34	-8.6	-3.8	0.4	0.0	0.1	4.8
	41	-8.6	-16.0	0.4	0.0	1.7	-35.6
41	35	0.0	3.1	0.6	0.0	0.1	14.4
	42	0.0	-9.1	0.6	0.0	2.4	0.0
42	36	-11.1	-4.3	0.4	0.0	0.0	4.3
	43	-11.1	-16.5	0.4	0.0	1.4	-37.9
43	37	0.0	3.2	0.0	0.0	0.0	14.0
	44	0.0	-9.0	0.0	0.0	0.0	0.0
44	38	-11.1	-4.3	-0.3	0.0	0.0	4.4
	45	-11.1	-16.5	-0.3	0.0	-1.3	-37.9
45	39	0.0	3.1	-0.6	0.0	-0.1	14.4
	46	0.0	-9.1	-0.6	0.0	-2.4	0.0
46	40	-8.6	-3.8	-0.4	0.0	-0.1	4.8
	47	-8.6	-16.0	-0.4	0.0	-1.7	-35.5
47	1	-28.6	-1.5	-9.2	0.0	35.2	4.2
	13	-21.7	-1.5	-9.2	0.0	-34.1	-7.4
48	2	-40.5	0.2	-9.9	0.0	37.6	-0.1
	15	-33.7	0.2	-9.9	0.0	-36.4	1.2
49	3	-41.3	-0.5	-9.9	0.0	37.6	1.6

	17	-34.5	-0.5	-9.9	0.0	-36.3	-2.1
50	4	-24.4	1.9	-9.2	0.0	35.2	-4.3
	19	-17.6	1.9	-9.2	0.0	-34.0	9.8
51	5	-59.6	-3.2	-9.7	0.0	36.4	7.9
	27	-52.8	-3.2	-9.7	0.0	-36.3	-16.0
52	6	-86.5	0.6	-10.3	0.0	38.7	-1.5
	29	-79.6	0.6	-10.3	0.0	-38.7	2.9
53	7	-86.5	-0.6	-10.3	0.0	38.7	1.5
	31	-79.6	-0.6	-10.3	0.0	-38.7	-2.9
54	8	-59.6	3.2	-9.7	0.0	36.3	-7.9
	33	-52.8	3.2	-9.7	0.0	-36.3	16.0
55	9	-38.6	-1.9	-9.5	0.0	36.0	4.4
	41	-31.8	-1.9	-9.5	0.0	-35.6	-9.9
56	10	-56.3	0.5	-10.2	0.0	38.3	-1.6
	43	-49.5	0.5	-10.2	0.0	-37.9	2.0
57	11	-55.5	-0.2	-10.2	0.0	38.3	0.1
	45	-48.7	-0.2	-10.2	0.0	-37.9	-1.2
58	12	-42.7	1.6	-9.5	0.0	35.9	-4.2
	47	-35.9	1.6	-9.5	0.0	-35.6	7.4

R E A C T I O N S

Node No.	/---- Force (kN) X-dir.	Y-dir.	-----/ Z-dir.	/--- Moment (kNm) ab. X-axis	Y-axis	---/ Z-axis
1	1.5	28.6	-9.2	-35.2	0.0	-4.2
2	-0.2	40.5	-9.9	-37.6	0.0	0.1
3	0.5	41.3	-9.9	-37.6	0.0	-1.6
4	-1.9	24.4	-9.2	-35.2	0.0	4.3
5	3.2	59.6	-9.7	-36.4	0.0	-7.9
6	-0.6	86.5	-10.3	-38.7	0.0	1.5
7	0.6	86.5	-10.3	-38.7	0.0	-1.5
8	-3.2	59.6	-9.7	-36.3	0.0	7.9
9	1.9	38.6	-9.5	-36.0	0.0	-4.4
10	-0.5	56.3	-10.2	-38.3	0.0	1.6
11	0.2	55.5	-10.2	-38.3	0.0	-0.1
12	-1.6	42.7	-9.5	-35.9	0.0	4.2

R E S U L T S for loadcase No. 11: combi4

S E C T I O N A L F O R C E S

SIGN CONVENTION: Local x-axis is oriented from start node towards end node. Local y-axis forms angle beta with the plane containing local x-axis and global Y-axis. Local z-axis is defined by the righthand-rule. Positive axial force creates tension. Positive shear force is oriented as local y- and z-axes respectively in the start joint and opposite in the end joint. Positive torsion acts in positive x direct. in the start node, opposite in the end node. Positive moment creates tension in the underside, i.e. at negative local y resp. z direction.

Elem No.	Joint No.	/---- Forces (kN) Px	Py	-------/ Pz	/---- Moments (kNm) ---/ Mx	My	Mz
1	13	-2.4	17.0	-0.1	0.0	0.3	-19.1
	14	-2.4	14.1	-0.1	0.0	-0.2	31.5
2	14	-2.5	-13.0	-0.2	0.0	0.2	23.3

	15	-2.5	-16.0	-0.2	0.0	-0.4	-23.9
3	15	-2.3	18.9	0.0	0.0	-0.1	-30.3
	16	-2.3	15.9	0.0	0.0	-0.1	26.2
4	16	-2.3	-11.0	0.0	0.0	0.0	18.0
	17	-2.3	-14.0	0.0	0.0	-0.1	-22.7
5	17	-3.0	22.0	0.2	0.0	-0.3	-33.9
	18	-3.0	19.1	0.2	0.0	0.2	32.9
6	18	-2.9	-8.1	0.1	0.0	-0.2	24.7
	19	-2.9	-11.0	0.1	0.0	0.2	-6.4
7	27	-4.9	26.0	-0.3	0.0	0.5	-24.4
	28	-4.9	23.1	-0.3	0.0	-0.4	55.3
8	28	-4.9	-32.7	-0.3	0.0	0.4	55.3
	29	-4.9	-35.7	-0.3	0.0	-0.5	-55.8
9	29	-4.0	31.0	0.0	0.0	0.0	-51.4
	30	-4.0	28.1	0.0	0.0	-0.1	44.6
10	30	-4.0	-28.1	0.0	0.0	-0.1	44.6
	31	-4.0	-31.0	0.0	0.0	-0.1	-51.4
11	31	-4.9	35.7	0.2	0.0	-0.4	-55.8
	32	-4.9	32.7	0.2	0.0	0.3	55.3
12	32	-4.9	-23.1	0.2	0.0	-0.4	55.3
	33	-4.9	-26.0	0.2	0.0	0.4	-24.4
13	41	-2.7	11.0	-0.2	0.0	0.3	-6.4
	42	-2.7	8.1	-0.2	0.0	-0.2	24.7
14	42	-2.6	-19.1	-0.2	0.0	0.2	32.9
	43	-2.6	-22.0	-0.2	0.0	-0.3	-33.9
15	43	-1.8	14.0	0.0	0.0	-0.1	-22.7
	44	-1.8	11.1	0.0	0.0	-0.1	18.0
16	44	-1.8	-15.9	0.0	0.0	-0.1	26.2
	45	-1.8	-18.9	0.0	0.0	-0.1	-30.3
17	45	-2.1	16.0	0.1	0.0	-0.3	-23.9
	46	-2.1	13.0	0.1	0.0	0.2	23.3
18	46	-2.2	-14.1	0.1	0.0	-0.2	31.5
	47	-2.2	-17.1	0.1	0.0	0.3	-19.2
19	13	-2.9	12.7	0.1	0.0	-0.3	4.4
	20	-2.9	-6.3	0.1	0.0	0.0	22.1
20	14	0.0	14.0	0.1	0.0	-0.4	0.0
	21	0.0	-5.0	0.1	0.0	0.0	22.8
21	15	-3.9	12.7	0.1	0.0	-0.2	4.7
	22	-3.9	-6.4	0.1	0.0	0.0	22.4
22	16	0.0	13.9	0.0	0.0	0.0	0.0
	23	0.0	-5.1	0.0	0.0	0.0	22.2
23	17	-3.9	12.7	0.0	0.0	0.2	4.7
	24	-3.9	-6.4	0.0	0.0	0.0	22.4
24	18	0.0	14.0	-0.1	0.0	0.4	0.0
	25	0.0	-5.0	-0.1	0.0	0.0	22.8
25	19	-2.9	12.7	-0.1	0.0	0.2	4.3
	26	-2.9	-6.3	-0.1	0.0	0.0	22.1
26	20	-2.9	-6.3	0.1	0.0	0.0	22.1
	27	-2.9	-25.3	0.1	0.0	0.3	-43.1
27	21	0.0	-5.0	0.1	0.0	0.0	22.8
	28	0.0	-24.0	0.1	0.0	0.4	-37.3
28	22	-3.9	-6.4	0.1	0.0	0.0	22.4
	29	-3.9	-25.4	0.1	0.0	0.2	-43.0
29	23	-0.1	-5.1	0.0	0.0	0.0	22.2
	30	-0.1	-24.2	0.0	0.0	0.0	-38.6
30	24	-3.9	-6.4	0.0	0.0	0.0	22.4
	31	-3.9	-25.4	0.0	0.0	-0.2	-43.0
31	25	0.0	-5.0	-0.1	0.0	0.0	22.8
	32	0.0	-24.0	-0.1	0.0	-0.3	-37.3
32	26	-2.9	-6.3	-0.1	0.0	0.0	22.1
	33	-2.9	-25.3	-0.1	0.0	-0.2	-43.1

33	27	-1.6	23.1	0.1	0.0	-0.3	-37.3
	34	-1.6	4.1	0.1	0.0	0.0	19.4
34	28	0.0	24.0	0.1	0.0	-0.4	-37.3
	35	0.0	5.0	0.1	0.0	0.0	22.8
35	29	-2.0	23.0	0.1	0.0	-0.2	-36.8
	36	-2.0	3.9	0.1	0.0	0.0	19.5
36	30	0.0	24.2	0.0	0.0	0.0	-38.6
	37	0.0	5.1	0.0	0.0	0.0	22.2
37	31	-2.0	23.0	0.0	0.0	0.2	-36.8
	38	-2.0	3.9	0.0	0.0	0.0	19.5
38	32	0.0	24.0	-0.1	0.0	0.3	-37.3
	39	0.0	5.0	-0.1	0.0	0.0	22.8
39	33	-1.6	23.1	-0.1	0.0	0.2	-37.3
	40	-1.6	4.1	-0.1	0.0	0.0	19.5
40	34	-1.6	4.1	0.1	0.0	0.0	19.4
	41	-1.6	-15.0	0.1	0.0	0.3	-6.8
41	35	0.0	5.0	0.1	0.0	0.0	22.8
	42	0.0	-14.0	0.1	0.0	0.4	0.0
42	36	-2.0	3.9	0.1	0.0	0.0	19.5
	43	-2.0	-15.1	0.1	0.0	0.2	-7.2
43	37	0.0	5.1	0.0	0.0	0.0	22.2
	44	0.0	-13.9	0.0	0.0	0.0	0.0
44	38	-2.0	3.9	0.0	0.0	0.0	19.5
	45	-2.0	-15.1	0.0	0.0	-0.2	-7.2
45	39	0.0	5.0	-0.1	0.0	0.0	22.8
	46	0.0	-14.0	-0.1	0.0	-0.3	0.0
46	40	-1.6	4.1	-0.1	0.0	0.0	19.5
	47	-1.6	-14.9	-0.1	0.0	-0.3	-6.7
47	1	-49.7	-2.3	-1.3	0.0	5.1	6.2
	13	-42.8	-2.3	-1.3	0.0	-4.4	-10.9
48	2	-67.5	0.3	-1.4	0.0	5.4	-0.1
	15	-60.6	0.3	-1.4	0.0	-4.7	1.8
49	3	-68.6	-0.7	-1.3	0.0	5.4	2.3
	17	-61.8	-0.7	-1.3	0.0	-4.7	-3.1
50	4	-43.6	2.8	-1.2	0.0	5.0	-6.4
	19	-36.8	2.8	-1.2	0.0	-4.3	14.6
51	5	-89.1	-4.9	-1.6	0.0	5.9	12.1
	27	-82.2	-4.9	-1.6	0.0	-5.8	-24.4
52	6	-129.7	0.9	-1.7	0.0	6.2	-2.3
	29	-122.8	0.9	-1.7	0.0	-6.2	4.5
53	7	-129.7	-0.9	-1.6	0.0	6.2	2.3
	31	-122.8	-0.9	-1.6	0.0	-6.2	-4.5
54	8	-89.1	4.9	-1.5	0.0	5.8	-12.1
	33	-82.2	4.9	-1.5	0.0	-5.8	24.4
55	9	-45.9	-2.8	-1.8	0.0	6.3	6.4
	41	-39.1	-2.8	-1.8	0.0	-6.8	-14.6
56	10	-71.0	0.7	-1.9	0.0	6.7	-2.3
	43	-64.2	0.7	-1.9	0.0	-7.2	3.0
57	11	-69.9	-0.3	-1.8	0.0	6.7	0.1
	45	-63.0	-0.3	-1.8	0.0	-7.2	-1.8
58	12	-51.9	2.3	-1.7	0.0	6.3	-6.2
	47	-45.1	2.3	-1.7	0.0	-6.8	11.0

R E A C T I O N S

Node No.	/---- Force (kN) X-dir.	Y-dir.	Z-dir. -----/	/--- Moment (kNm) ab. X-axis	Y-axis	Z-axis ---/
1	2.3	49.7	-1.3	-5.1	0.0	-6.2
2	-0.3	67.5	-1.4	-5.4	0.0	0.1

3	0.7	68.6	-1.3	-5.4	0.0	-2.3
4	-2.8	43.6	-1.2	-5.0	0.0	6.4
5	4.9	89.1	-1.6	-5.9	0.0	-12.1
6	-0.9	129.7	-1.7	-6.2	0.0	2.3
7	0.9	129.7	-1.6	-6.2	0.0	-2.3
8	-4.9	89.1	-1.5	-5.8	0.0	12.1
9	2.8	45.9	-1.8	-6.3	0.0	-6.4
10	-0.7	71.0	-1.9	-6.7	0.0	2.3
11	0.3	69.9	-1.8	-6.7	0.0	-0.1
12	-2.3	51.9	-1.7	-6.3	0.0	6.2

5.0. Подбор сечения элементов навес.

5.1 Расчет балки

Для балки по оси „В" $M_{max} = -62,1$ кН.м

Требуемый момент сопротивления сечения балки по формуле (из стали марки ВСт3кп2)

$$W = \frac{M_{max}}{c_1 \cdot R_y \cdot \gamma_c} = \frac{6210\,000}{1,0 \cdot 230(100) \cdot 1,0} = 270 \text{ см}^3$$

$c_1 = 1,0$; $R_y = 230$ МПа; $\gamma_c = 1,0$

По сортаменту принимаем 2 штук швеллер №20, имеющий $W_x = 2 \cdot 152 = 304 \text{ см}^3$ ([3])

Для балки по оси „А" и „С" $M_{max} = -43,4$ кН.м

$$W = \frac{M_{max}}{c_1 \cdot R_y \cdot \gamma_c} = \frac{43\,400}{1,0 \cdot 230(100) \cdot 1,0} = 188,7 \text{ см}^3$$

Принимаем 2 штук швеллер №20 ([3])

$W_x = 304$ см3.

Для балки по оси „1", „2", „3", „4", „1/2", „2/3", „3/4"

$M_{max} = -44,5$ кН.м

$$W = \frac{44\,500}{1,0 \cdot 230(100) \cdot 1,0} = 193,5 \text{ см}^3$$

Принимаем 2 штук швеллер №20 ([3])

$W_x = 304$ см3.

5.2 Расчет колонна

Для колонна $M_{max} = -89,6$ кН ; $M = 51,6$ кН·м.

Требуемую площадь сечения определяем из формулы $A_d = \frac{N}{\varphi_e \cdot R_y \cdot \gamma_c}$ расчета внецентренно сжатых элементов на устойчивость в плоскости действия момента:

$\gamma_c = 1,0$; $R_y = 230$ МПа

Для нахождения коэффициента φ_e предварительно находим значения.

$$e = \frac{M}{N} = \frac{51,6}{89,6} = 0,576м = 57,6см.$$

предварительно сечения колонны принимаем.

Труба Ф245х6 , $A = 45 см^2$, $i = 8,46$ см.

$l = 6,5$ м (фактическая).

$$l_x = \mu \cdot l = 0,7 \cdot 6,5 = 4,55 м.$$

$$\lambda_x = \frac{l_x}{i_x} = \frac{455}{8,45} = 53,8$$

$$\rho = \frac{i_x^2}{z} = \frac{8,45^2}{12,25} = 5,83 см.$$

$$z = \frac{24,5}{2} = 12,25 см$$

Условная гибкость стержня

$$\bar{\lambda}_{ef} = \lambda_x \cdot \sqrt{\frac{R_y}{E}} = 53,8 \cdot \sqrt{\frac{230}{2,06 \cdot 10^5}} = 53,8 \cdot 0,0334 =$$

$$= 1,8 < 5$$

$E = 2,06 \cdot 10^5$ МПа

относительный эксцентриситет

$$m = \frac{e}{\rho} = \frac{57,6}{5,83} = 9,9 < 20 \qquad \frac{57,6}{5,83} = 9,9$$

Из таблицы находим. $\eta = 1,1$

Приведенный относительный эксцентриситет:

$$m_{ef} = \eta \cdot m = 1{,}1 \cdot 9{,}9 = 10{,}9$$

$\bar{\lambda}_{ef} = 1{,}8$ $\quad m_{ef} = 10{,}9$ из таблицы $\varphi_e = 0{,}129$

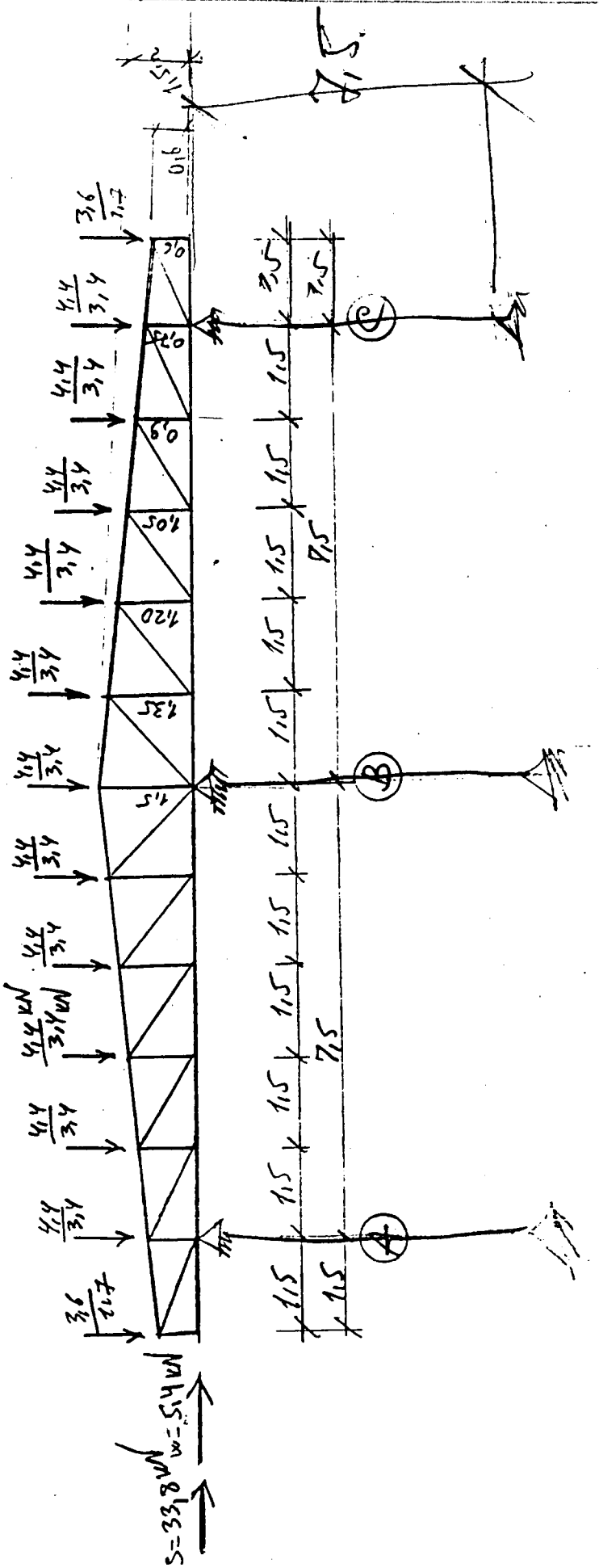
$$Ad = \frac{89\,600}{0{,}129\,230(100)} = 30{,}2\ см^2 < 45\ см^2$$

Фактическое напряжение в сечении

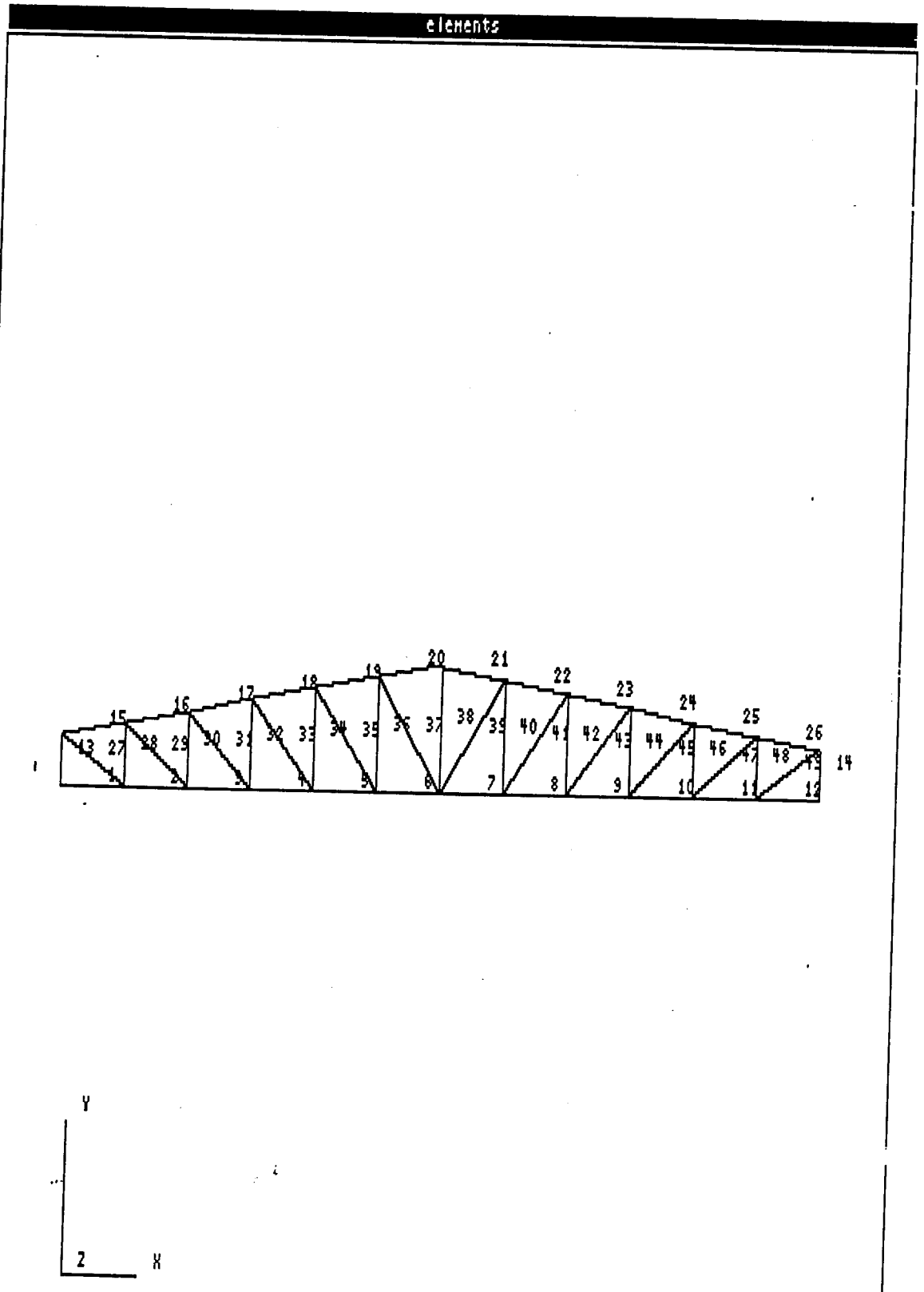
$$\sigma = \frac{N}{\varphi_e \cdot A} = \frac{89\,600}{0{,}129 \cdot 45} = 15435\ Н/см^2 =$$

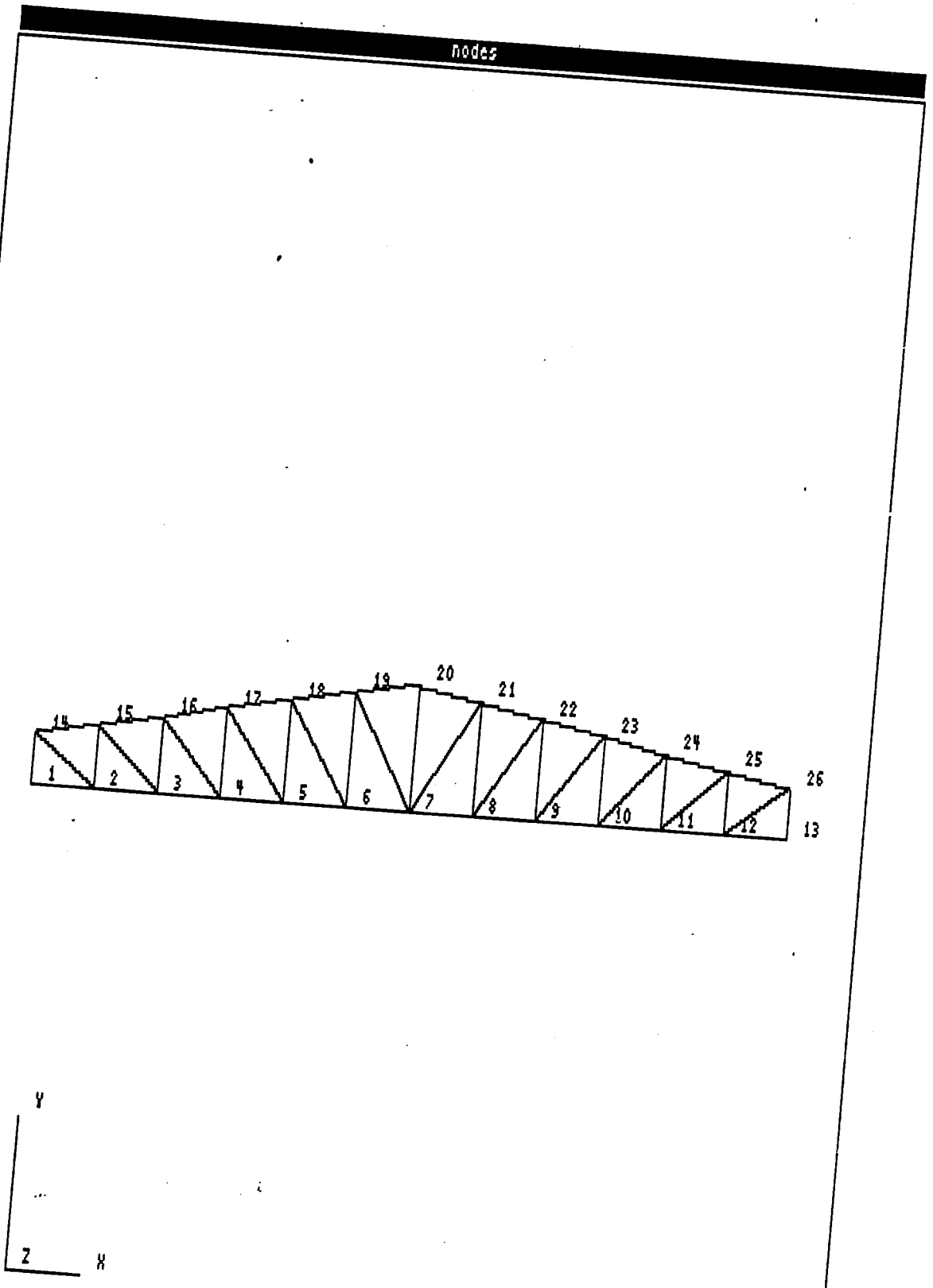
$$= 154{,}4\ МПа < R_y = 230\ МПа$$

6.0. Расчетная схема ферма (II вариант.)



7.0 Статический расчет ферма.




nodes
14
15
16
17
18
19
20
21
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23
24
25
26
1
2
3
4
5
6
7
8
9
10
11
12
13
Y
Z
X

RAMBOLL
Baku

Type of structure PLANE STRUCTURE

Data file: CUSGIT
Uddatafil: cusgi

LATTICE

C O O R D I N A T E S for 26 node points

No.point No.	X-coordinate m	Y-coordinate m	Fixed against deflect. in: X-dir.	Y-dir.
1	0.000	0.000		
2	1.500	0.000	Y	Y
3	3.000	0.000		
4	4.500	0.000		
5	6.000	0.000		
6	7.500	0.000		
7	9.000	0.000	Y	Y
8	10.500	0.000		
9	12.000	0.000		
10	13.500	0.000		
11	15.000	0.000		
12	16.500	0.000	Y	Y
13	18.000	0.000		
14	0.000	0.600		
15	1.500	0.750		
16	3.000	0.900		
17	4.500	1.050		
18	6.000	1.200		
19	7.500	1.350		
20	9.000	1.500		
21	10.500	1.350		
22	12.000	1.200		
23	13.500	1.050		
24	15.000	0.900		
25	16.500	0.750		
26	18.000	0.600		

E L E M E N T D A T A for 49 elements

Elem. No.	From node	To node	Elast. modulus N/mm2	Area m2
1	1	2	210000.	0.003000
2	2	3	210000.	0.003000
3	3	4	210000.	0.003000
4	4	5	210000.	0.003000
5	5	6	210000.	0.003000
6	6	7	210000.	0.003000
7	7	8	210000.	0.003000
8	8	9	210000.	0.003000

9	9	10	210000.	0.003000
10	10	11	210000.	0.003000
11	11	12	210000.	0.003000
12	12	13	210000.	0.003000
13	1	14	210000.	0.003000
14	13	26	210000.	0.003000
15	14	15	210000.	0.003000
16	15	16	210000.	0.003000
17	16	17	210000.	0.003000
18	17	18	210000.	0.003000
19	18	19	210000.	0.003000
20	19	20	210000.	0.003000
21	20	21	210000.	0.003000
22	21	22	210000.	0.003000
23	22	23	210000.	0.003000
24	23	24	210000.	0.003000
25	24	25	210000.	0.003000
26	25	26	210000.	0.003000
27	2	14	210000.	0.003000
28	2	15	210000.	0.003000
29	3	15	210000.	0.003000
30	3	16	210000.	0.003000
31	4	16	210000.	0.003000
32	4	17	210000.	0.003000
33	5	17	210000.	0.003000
34	5	18	210000.	0.003000
35	6	18	210000.	0.003000
36	6	19	210000.	0.003000
37	7	19	210000.	0.003000
38	7	20	210000.	0.003000
39	7	21	210000.	0.003000
40	8	21	210000.	0.003000
41	8	22	210000.	0.003000
42	9	22	210000.	0.003000
43	9	23	210000.	0.003000
44	10	23	210000.	0.003000
45	10	24	210000.	0.003000
46	11	24	210000.	0.003000
47	11	25	210000.	0.003000
48	12	25	210000.	0.003000
49	12	26	210000.	0.003000

L O A D C A S E No. 1 deadegen

Dead load, specific density: 78.50 kN/m3
Direction: -Y

L O A D C A S E No. 2 deadload

NODEPOINT LOADS

Nodepoint No.	Load type	Direct.	Intensity (kN,kNm,mm,rad/1000)
14	Point load	Y	-3.60
26	Point load	Y	-3.60
15	Point load	Y	-4.40
16	Point load	Y	-4.40
17	Point load	Y	-4.40
18	Point load	Y	-4.40
19	Point load	Y	-4.40
20	Point load	Y	-4.40
21	Point load	Y	-4.40
22	Point load	Y	-4.40
23	Point load	Y	-4.40
24	Point load	Y	-4.40
25	Point load	Y	-4.40

L O A D C A S E No. 3 variable

NODEPOINT LOADS

Nodepoint No.	Load type	Direct.	Intensity (kN,kNm,mm,rad/1000)
14	Point load	Y	-1.70
26	Point load	Y	-1.70
25	Point load	Y	-3.40
15	Point load	Y	-3.40
16	Point load	Y	-3.40
17	Point load	Y	-3.40
18	Point load	Y	-3.40
19	Point load	Y	-3.40
20	Point load	Y	-3.40
21	Point load	Y	-3.40
22	Point load	Y	-3.40
23	Point load	Y	-3.40
24	Point load	Y	-3.40

L O A D C A S E No. 4 earth

NODEPOINT LOADS

Nodepoint No.	Load type	Direct.	Intensity (kN,kNm,mm,rad/1000)
1	Point load	X	33.80

L O A D C A S E No. 5 wind

NODEPOINT LOADS

Nodepoint No.	Load type	Direct.	Intensity (kN,kNm,mm,rad/1000)
1	Point load	X	5.40

L O A D C A S E No. 6 combi1

Loadcase		Load factor
1	deadegen	1.00
2	deadload	1.00
4	earth	1.00

L O A D C A S E No. 7 combi2

Loadcase		Load factor
1	deadegen	1.00
2	deadload	1.00
3	variable	1.00
5	wind	1.00

R E S U L T S for loadcase No. 6: combi1

S E C T I O N A L F O R C E S

SIGN CONVENTION: Local x-axis is oriented from start node towards end node. Local z-axis is oriented in same direction as the global Z-axis. Positive axial force creates tension. Positive shear force is oriented as the local y-axis in the start joint and opposite in the end joint.

Elem. No.	Node No.	Axial force kN	Shear force kN
1	1	-33.800	0.177
	2	-33.800	-0.177
2	2	-11.505	0.177
	3	-11.505	-0.177
3	3	4.958	0.177
	4	4.958	-0.177
4	4	8.541	0.177
	5	8.541	-0.177
5	5	4.007	0.177
	6	4.007	-0.177
6	6	-6.001	0.177
	7	-6.001	-0.177
7	7	-6.001	0.177
	8	-6.001	-0.177
8	8	4.007	0.177
	9	4.007	-0.177
9	9	8.541	0.177
	10	8.541	-0.177
10	10	4.958	0.177
	11	4.958	-0.177
11	11	-11.505	0.177
	12	-11.505	-0.177
12	12	0.000	0.177
	13	0.000	-0.177
13	1	0.177	0.000
	14	0.318	0.000
14	13	0.177	0.000
	26	0.318	0.000
15	14	8.596	0.177
	15	8.632	-0.177
16	15	-7.949	0.177
	16	-7.914	-0.177
17	16	-11.550	0.177
	17	-11.514	-0.177
18	17	-6.993	0.177
	18	-6.957	-0.177
19	18	3.065	0.177
	19	3.100	-0.177
20	19	17.030	0.177
	20	17.065	-0.177
21	20	17.065	0.177
	21	17.030	-0.177
22	21	3.100	0.177
	22	3.065	-0.177
23	22	-6.957	0.177

	23	-6.993	-0.177
24	23	-11.514	0.177
	24	-11.550	-0.177
25	24	-7.914	0.177
	25	-7.949	-0.177
26	25	8.632	0.177
	26	8.596	-0.177
27	2	-9.302	-0.177
	14	-9.161	0.177
28	2	-15.007	0.000
	15	-14.830	0.000
29	3	18.318	-0.177
	15	18.495	0.177
30	3	-7.681	0.000
	16	-7.469	0.000
31	4	4.072	-0.177
	16	4.284	0.177
32	4	-1.590	0.000
	17	-1.343	0.000
33	5	-5.658	-0.177
	17	-5.411	0.177
34	5	3.743	0.000
	18	4.025	0.000
35	6	-12.957	-0.177
	18	-12.674	0.177
36	6	8.585	0.000
	19	8.903	0.000
37	7	-18.854	-0.177
	19	-18.536	0.177
38	7	-8.501	0.000
	20	-8.148	0.000
39	7	-18.854	0.177
	21	-18.536	-0.177
40	8	8.585	0.000
	21	8.903	0.000
41	8	-12.957	0.177
	22	-12.674	-0.177
42	9	3.743	0.000
	22	4.025	0.000
43	9	-5.658	0.177
	23	-5.411	-0.177
44	10	-1.590	0.000
	23	-1.343	0.000
45	10	4.072	0.177
	24	4.284	-0.177
46	11	-7.681	0.000
	24	-7.469	0.000
47	11	18.318	0.177
	25	18.495	-0.177
48	12	-15.007	0.000
	25	-14.830	0.000
49	12	-9.302	0.177
	26	-9.161	-0.177

R E A C T I O N S

Node No.	/--- Force (kN) ----/ X-dir.	Y-dir.
2	-30.866	18.979

7	0.000	34.342
12	-2.934	18.979

R E S U L T S for loadcase No. 7: combi2

S E C T I O N A L F O R C E S

SIGN CONVENTION: Local x-axis is oriented from start node towards end node. Local z-axis is oriented in same direction as the global Z-axis. Positive axial force creates tension. Positive shear force is oriented as the local y-axis in the start joint and opposite in the end joint.

Elem. No.	Node No.	Axial force kN	Shear force kN
1	1	-5.400	0.177
	2	-5.400	-0.177
2	2	-17.446	0.177
	3	-17.446	-0.177
3	3	8.188	0.177
	4	8.188	-0.177
4	4	13.464	0.177
	5	13.464	-0.177
5	5	5.949	0.177
	6	5.949	-0.177
6	6	-10.154	0.177
	7	-10.154	-0.177
7	7	-10.154	0.177
	8	-10.154	-0.177
8	8	5.949	0.177
	9	5.949	-0.177
9	9	13.464	0.177
	10	13.464	-0.177
10	10	8.188	0.177
	11	8.188	-0.177
11	11	-17.446	0.177
	12	-17.446	-0.177
12	12	0.000	0.177
	13	0.000	-0.177
13	1	0.177	0.000
	14	0.318	0.000
14	13	0.177	0.000
	26	0.318	0.000
15	14	12.013	0.177
	15	12.049	-0.177
16	15	-13.748	0.177
	16	-13.713	-0.177
17	16	-19.051	0.177
	17	-19.015	-0.177
18	17	-11.499	0.177
	18	-11.463	-0.177
19	18	4.685	0.177
	19	4.720	-0.177
20	19	26.968	0.177
	20	27.003	-0.177
21	20	27.003	0.177
	21	26.968	-0.177
22	21	4.720	0.177

	22	4.685	-0.177
23	22	-11.463	0.177
	23	-11.499	-0.177
24	23	-19.015	0.177
	24	-19.051	-0.177
25	24	-13.713	0.177
	25	-13.748	-0.177
26	25	12.049	0.177
	26	12.013	-0.177
27	2	-12.964	-0.177
	14	-12.823	0.177
28	2	-23.909	0.000
	15	-23.733	0.000
29	3	28.571	-0.177
	15	28.748	0.177
30	3	-12.266	0.000
	16	-12.054	0.000
31	4	6.047	-0.177
	16	6.259	0.177
32	4	-2.606	0.000
	17	-2.359	0.000
33	5	-9.296	-0.177
	17	-9.049	0.177
34	5	5.829	0.000
	18	6.112	0.000
35	6	-20.763	-0.177
	18	-20.481	0.177
36	6	13.462	0.000
	19	13.780	0.000
37	7	-29.989	-0.177
	19	-29.671	0.177
38	7	-13.879	0.000
	20	-13.525	0.000
39	7	-29.989	0.177
	21	-29.671	-0.177
40	8	13.462	0.000
	21	13.780	0.000
41	8	-20.763	0.177
	22	-20.481	-0.177
42	9	5.829	0.000
	22	6.112	0.000
43	9	-9.296	0.177
	23	-9.049	-0.177
44	10	-2.606	0.000
	23	-2.359	0.000
45	10	6.047	0.177
	24	6.259	-0.177
46	11	-12.266	0.000
	24	-12.054	0.000
47	11	28.571	0.177
	25	28.748	-0.177
48	12	-23.909	0.000
	25	-23.733	0.000
49	12	-12.964	0.177
	26	-12.823	-0.177

R E A C T I O N S

Node No.	/--- Force (kN) ----/ X-dir.	Y-dir.

2	0.075	29.241
7	0.000	54.617
12	-5.475	29.241

8.0 Подбор сечений элементов ферм.

Сечения подбираем по формулам центрального сжатия или растяжения.

8.1 Для нижнего пояса $N_{max} = -33,8$ кН

Требуемая площадь сечения уголков при $\varphi = 0,7$ и $\gamma_c = 1,0$ составит

$$A_d = \frac{N_{max}}{\varphi \cdot R \cdot \gamma_c} = \frac{33800}{0,7 \cdot 230(100)} = 2,1 \text{ см}^2$$

Конструктивные принимаем ∠50×5 ($A_s = 4,8$ см^2)

$i_x = 1,53$ см

Гибкость:

$$\lambda_x = \frac{l_x}{i_x} = \frac{151,0}{1,53} = 98,7 < \lambda_{lim} = 120$$

8.2 Для верхнего пояса $N_{max} = 27,0$ кН.

Требуемая площадь:

$$A_n = \frac{N}{R_y \gamma_c} = \frac{27000}{230(100) \cdot 1,0} = 1,2 \text{ см}^2$$

Конструктивные принимаем ∠50×5 ($A_s = 4,8$ см^2)

$i_x = 1,53$ см

Гибкость:

$$\lambda_x = \frac{l_x}{i_x} = \frac{150}{1,53} = 98 < \lambda_{lim} = 400$$

8.3 Для раскосы и стойки $N_{max} = -30,0$ кН.

$$l_x = 0,8l = 0,8 \cdot 168 = 134 \text{ см}.$$

Пр. $\varphi = 0,5$

$$A_d = \frac{N}{\varphi R_y \cdot \gamma_c} = \frac{30\,000}{0,5 \cdot 230(100) \cdot 0,8} = 3,3 \text{ см}^2$$

Принимаем конструктивный ∠50×5 ($A_s = 4,8$ см^2)

$i_x = 1,53$ см

Гибкость

$$\lambda_x = \frac{l_x}{i_x} = \frac{134}{1,53} = 87,6 < \lambda_{lim} = 150.$$

9.0. Расчет свайным фундаментам.

9.1. Несущая способность свая.

Несущая способность $Ф_c^p$, тс, работающей на осевую сжимающую нагрузку с учетом сейсмических воздействий определяются по формулу:

$$Ф_c^p = m\left(m_c \cdot m_{Rc} \cdot m_R \cdot R \cdot F + U \sum_{hp}^{e} m_{c_i} \cdot m_f \cdot f_i \cdot l_i\right)$$

Расчетный глубине погружения нижнего конца свай от поверхности грунта

$$l_к + l_c = 7{,}95 + 0{,}75 = 8{,}70 м.$$

По таблица $1(1)^{СНиП}$ для этой глубины находим расчетное сопротивление грунта в плоскости нижнего конца свай $R = 385$ тс/м^2

Площадь поперечные сечения свай:

$F = 0{,}3 \cdot 0{,}3 = 0{,}09$ м^2 и периметр поперечный сечения $U = 4 \times 0{,}3 = 1{,}2$ м.

$m = 1{,}0$ коэффициент условий работы свай в грунте;

m_c и m_{c_i}, коэффициент условий работ, учитывающие влияние сейсмических колебаний на напряжения состоянии грунта под нижнего и боков поверхности (таб. 41(17)),

f_i — расчетное сопротивление i-го слоя грунта основания на боковой поверхностью свай, тс/м^2, определяемое по таб г/г) (СНиП.)

l_i — толщина i-го слоя грунта, соприкасающегося с боковой поверхности;

m_{Rc} — коэффициент работы нижнего конца свай при сейсмические воздействия.

m_R и m_f — коэффициенты условий работы грунта соответственно под нижним концом и на боковой поверхности свай, учитывающие влияние способа погружения определяемые по табл 3(3) и принимаемые независимо друг от друга

Коэффициент деформации:

$$\alpha_g = \sqrt[5]{\frac{K \cdot b_c}{E_б \cdot I}}$$

$K = 500$

$b_c = 1{,}5d + 0{,}5 = 1{,}5 \cdot 0{,}3 + 0{,}5 = 0{,}95$

материал свая
бетон кл. В25 (М300) $E_б = 3{,}05 \cdot 10^6$ тс/м²

$$I = \frac{b^4}{12} = \frac{0{,}3^4}{12} = 6{,}75 \cdot 10^{-4}\ м^4$$

$$\alpha_g = \sqrt[5]{\frac{500 \cdot 0{,}95}{3{,}05 \cdot 6{,}75 \cdot 10^2}} = \sqrt[5]{23072 \cdot 10^{-5}} = 0{,}746\ м^{-1}$$

Длина верхнего участка свай вдоль которого сопротивление грунта на боковой поверхности

$$h_р = \frac{4}{\alpha_g} = \frac{4}{0{,}746} = 5{,}4\ м$$

$\bar{e}_1 = 0{,}75 + 5{,}4 = 6{,}15\ м$, $f_1 = 0$

$\bar{e}_2 = 0{,}75 + 5{,}4 + \frac{2}{2} = 7{,}15\ м$, $f = 6{,}0$ тс/м²

$\bar{e}_3 = 0{,}75 + 5{,}4 + 2{,}0 + \frac{0{,}55}{2} \simeq 8{,}4\ м$, $f = 6{,}26$ тс/м²

$m_c = m_{c_2} = m_{c_3} = 0{,}7$

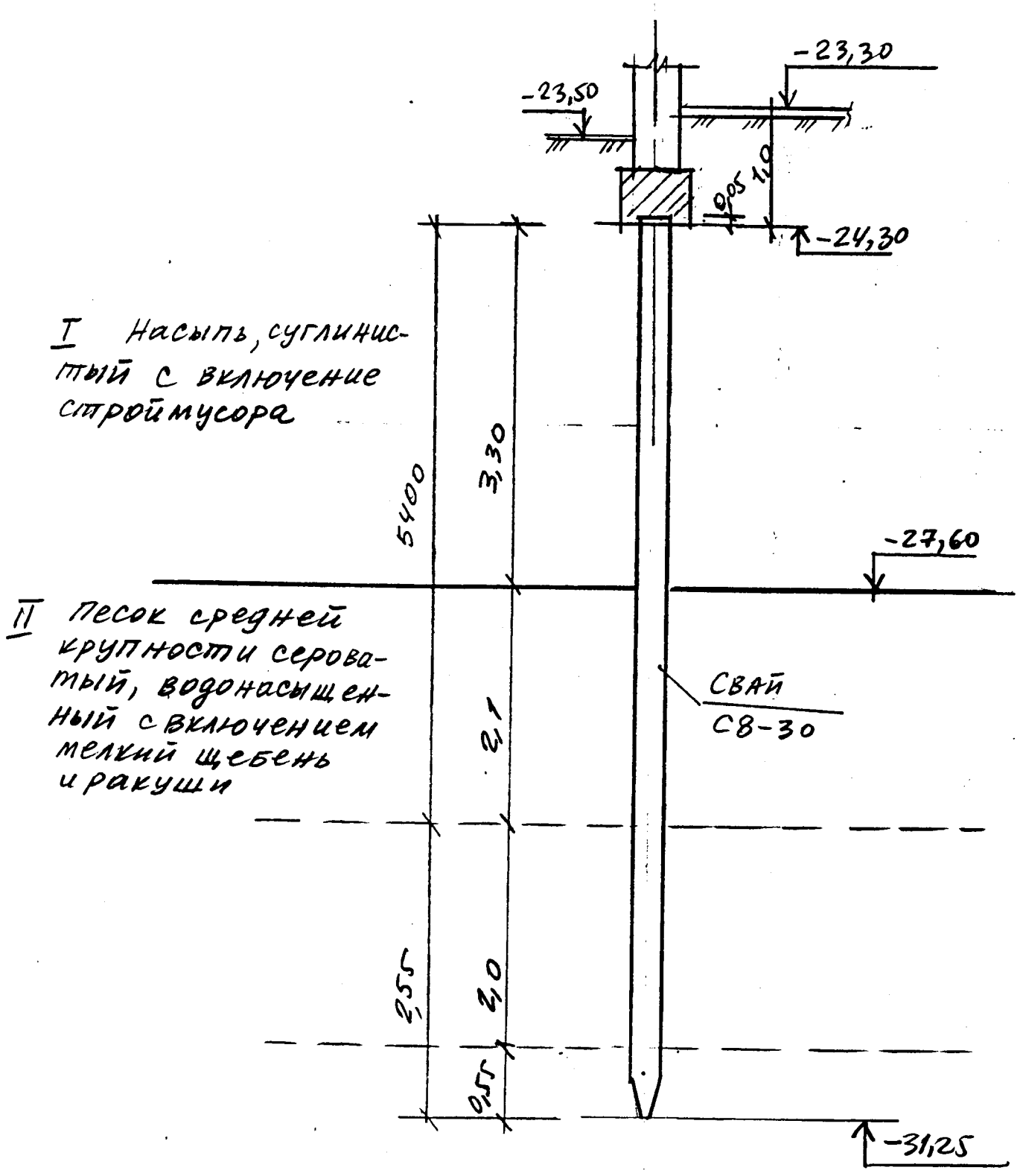
$m_R = m_f = m_{R_c} = 1{,}0$

$\Phi_c^{\,p} = 1{,}0\,(0{,}7 \cdot 1{,}0 \cdot 1{,}0 \cdot 385 \cdot 0{,}09 + 1{,}2 \cdot 0{,}7 \cdot 1{,}0\,(2{,}0 \cdot 6{,}0 +$

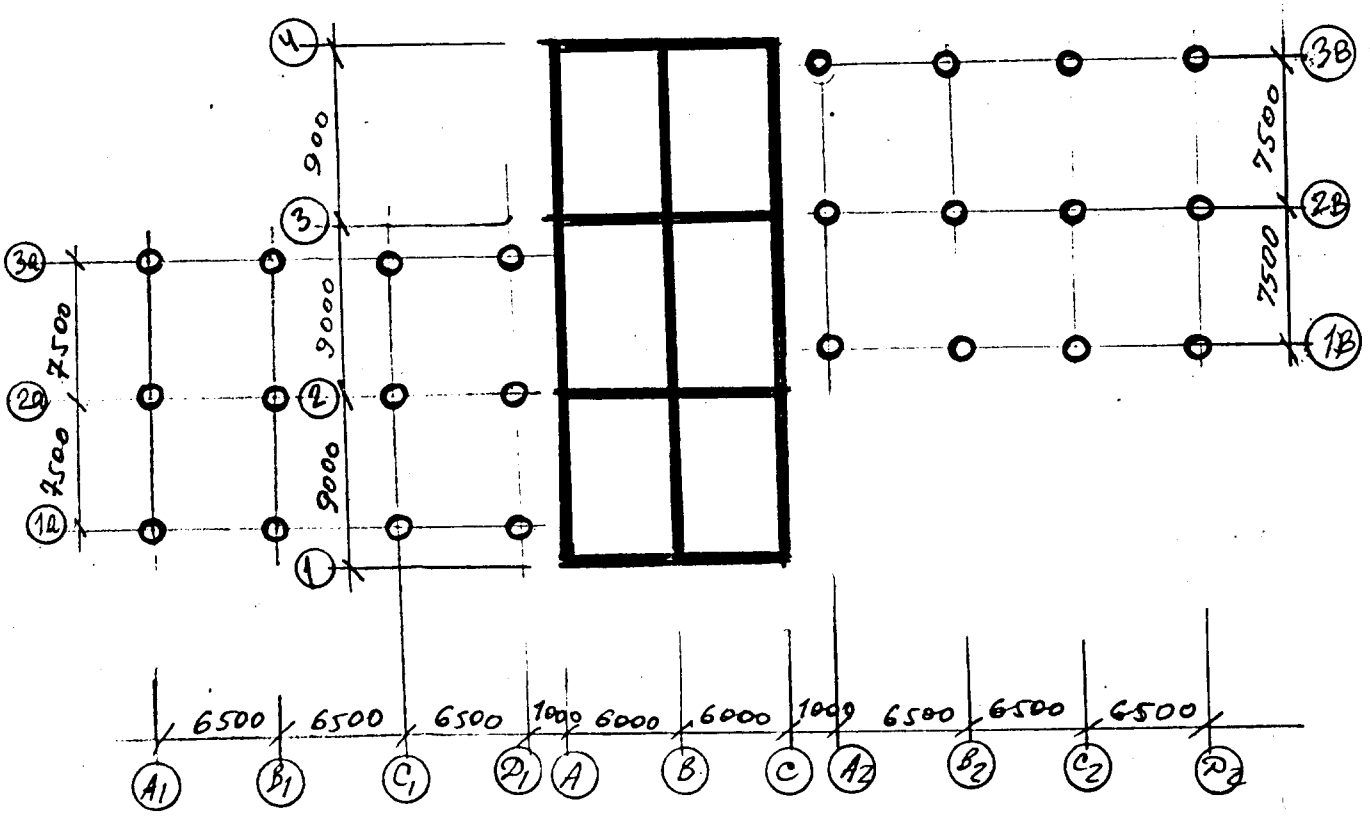
$+ 0{,}55 \cdot 6{,}26)) = 24{,}26 + 12{,}97 = 37{,}23$ т·с

Расчетная нагрузка допускаемая на сваю, в соответствии с формулой 1(1):

$$P = \frac{37{,}23}{1{,}4} = 26{,}6\ тс$$


-23,30
-23,50
0,05
1,0
-24,30
I Насыпь, суглинистый с включением строймусора
5400
3,30
-27,60
II Песок средней крупности серовато-водонасыщенный с включением мелкий щебень и ракуши
Свай С8-30
2,1
2,55
3,0
0,55
-31,25

9.2 Сбор нагрузок фундаментов на ▽ -1,00.



Фундаменты по оси „А" и „С"

от покрытия:

постоянная: 599,7 · 3,0 = 1799 кг/м

временная: 70 · 3,0 = 210 кг/м.

от собственный веса стены

0,45 · 2000 · 1,1 · 3,7 = 3663 кг/м.

от веса ростверка с учетом стен и грунт.

0,6 · 1,0 · 2000 · 1,1 = 1320 кг/м

Итого — 6992 кг/м ≈ 7,0 т с/м.

Фундамент по оси „В"

от покрытия:

постоянная: 599,7 · 6,0 = 3598 кг/м

временная: 70 · 6,0 = 420 кг/м

от собственный веса стены

0,45 · 2000 · 1,1 · 3,7 = 3663 кг/м.

от веса ростверка с учетом стен и грунт

0,6 · 1,0 · 2000 · 1,1 = 1320 кг/м.

Итого — 8605 кг/м ≈ 8,6 т с/м.

Фундаменты по оси „1", „2", „3" и „4."

от собственный веса стены — 3663 кг/м.

от. веса ростверка с учетом стен и грунт:

1320 кг/м

Итого — 4983 кг/м = 5 т с/м.

Фундаменты по оси „А₁" и „Д₁" в осях „1а" и „3а" по оси „А₂" и „Д₂" в осях „1б" и „3б"

Усилия от колонны

N = 51,7 кН ; Q = 3,3 кН ; M = 10,5 кН·м.

С учетом временная нагрузка (от транспорта)

$$N = 51,7 + \frac{120}{2} = 117,7 \text{ кН} = 11,17 \text{ тс}$$

Фундамент по оси „А₁" и „Д₁" в осях „2а" по оси „А₂" и „Д₂" в осях „2".

Усилия от колонны

$N_1 = 90,2$ кН ; $Q = -6,2$ кН ; $M = 17,8$ кН·м

С учетом временная нагрузка (от транспорта)

$N = 90,2 + \frac{120}{2} = 150,2$ кН $\simeq 15,02$ тс

Фундаменты по оси „В₁" и „С₁" в осях „2а" по оси „В₂" и „С₂" в осях „2б"

Усилия от колонны.

$N_1 = 130,1$ кН ; $Q = -2,6$ кН ; $M = 8,8$ кН·м.

С учетом временная нагрузка (от транспорта)

$N = 130,1 + 120 = 250,1$ кН $= 25,01$ тс.

Фундаменты по оси „В₁" и „С₁" в осях „1а" и „3а" по оси „В₂" и „С₂" в осях „2а" и „4а".

Усилия от колонны

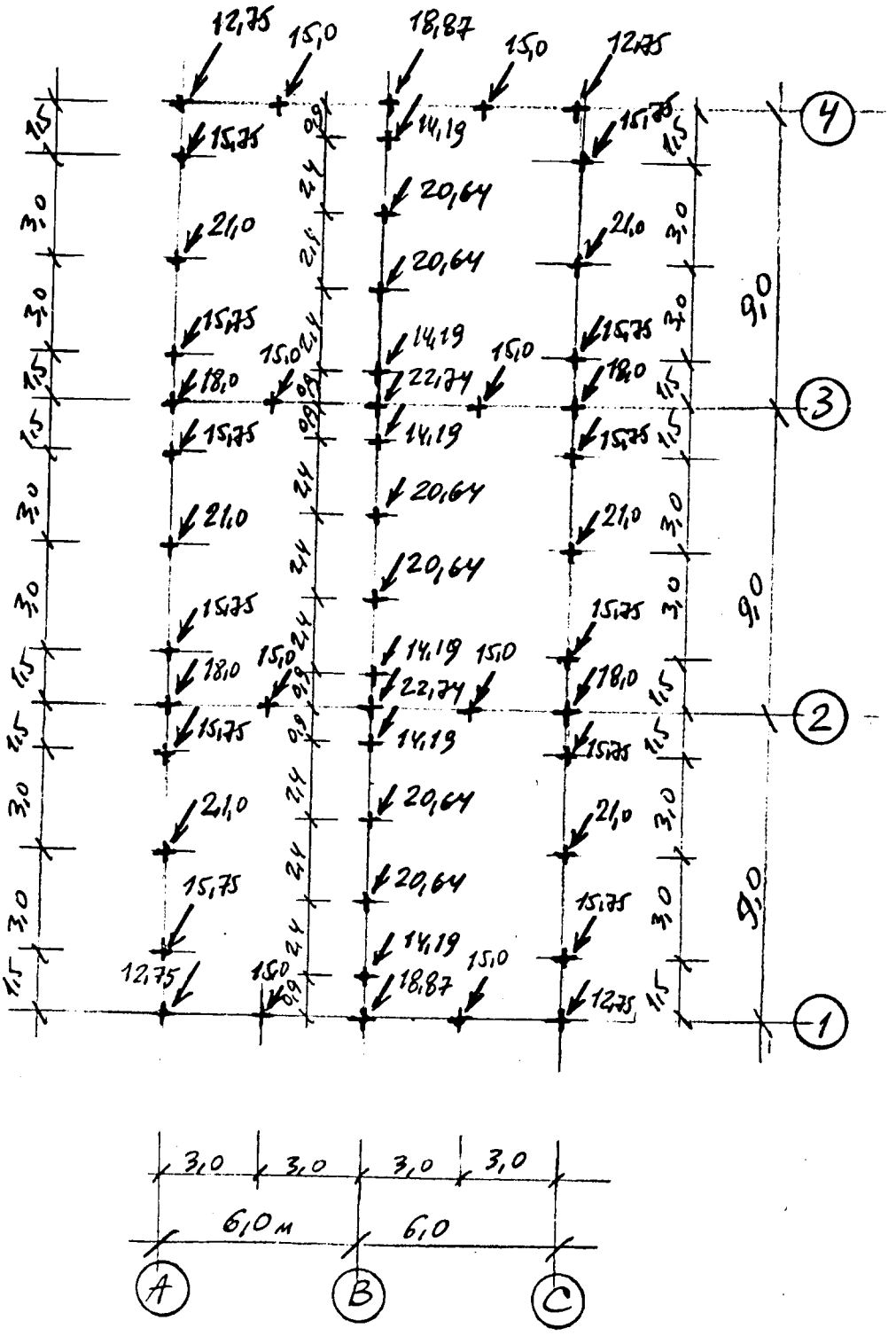
$N = 90,2$ кН ; $Q = -6,2$ кН ; $M = 17,8$ кН·м.

С учетом временная нагрузка (от транспорта.)

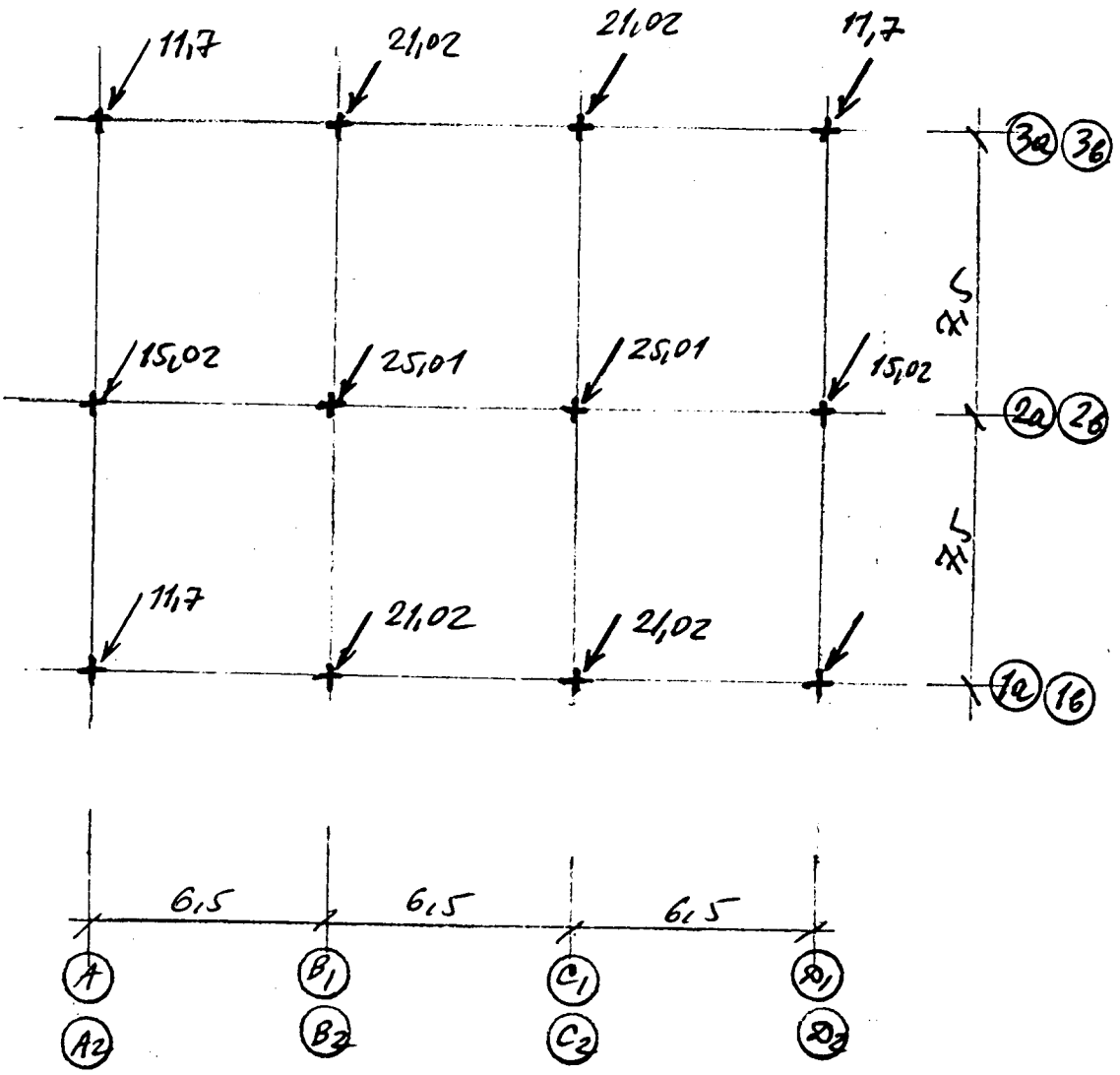
$N = 90,2 + 120 = 210,2$ кН $= 21,02$ т.с.

9.3 Нагрузок на 1 свай от здания и навеса (ТС)

Здания



Навес. —



$N_{max} = 22,74$ тс $< P = 26,6$ тс.

что удовлетворяет требованиям расчета.

9.4 Расчет железобетонных ленточных ростверков.

Нагрузка на 1 пм ростверков.

$$P = \frac{q_0 \cdot L}{a}$$

$L = 3{,}0$ м расстояния между сваями;

$q_0 = 7{,}0$ тс/м нагрузок от зданий.

$$a = 3{,}14 \cdot \sqrt[3]{\frac{E_p \cdot I_p}{E_к \cdot b_к}}$$

бетон кл. В15

$E_p = 2{,}35 \cdot 10^5$ кгс/см² (расчетное сопротивления бетона.)

Расчетные сопротивления кладки

$E_к = 0{,}37 \cdot 10^6$ тс/м² $= 3{,}7 \cdot 10^5$ кгс/см²

$b_к = 40$ см ширина стены.

Момент инерция ростверков

$$I_p = \frac{60 \cdot 50^3}{12} = 6{,}25 \cdot 10^5 \text{ см}^4.$$

$$a = 3{,}14 \cdot \sqrt[3]{\frac{2{,}35 \cdot 10^5 \cdot 6{,}25 \cdot 10^5}{3{,}7 \cdot 10^5 \cdot 40}} =$$

$$= 3{,}14 \cdot \sqrt[3]{9924} = 3{,}14 \cdot 20{,}972 = 65{,}9 \text{ см}$$

$$P = \frac{7{,}0 \cdot 3{,}0}{0{,}659} = 32 \text{ тс/м}.$$

Над гранн свая

$$P_0 = \frac{q_0 \cdot L_p}{a} = \frac{7{,}0 \cdot 2{,}84}{0{,}659} = 30{,}1 \text{ тс/м}$$

$L_p = 1{,}05\, L_{св} = 1{,}05 \cdot 2{,}7 = 2{,}84$ м

$a = 9659$ м $< \frac{L_{св}}{2} = \frac{2{,}84}{2} = 1{,}42$ м

Опорные моменты:

$$M_{оп} = \frac{-P_0 \cdot a\,(2 \cdot L_р - a)}{12} = \frac{-30{,}1 \cdot 0{,}659\,(2 \cdot 2{,}84 - 0{,}659)}{12} =$$

$$= -8{,}3\ т \cdot м$$

Пролетные моменты

$$M_{пр} = \frac{P_0 \cdot a^2}{12} = \frac{30{,}11 \cdot 0{,}659^2}{12} = 1{,}1\ т \cdot м.$$

Площадь арматура на опорах.

$$A_0 = \frac{M_{оп}}{b_р \cdot h_0^2 \cdot R_в} = \frac{8{,}3 \cdot 105}{60 \cdot 45^2 \cdot 86{,}7} = 0{,}08$$

Бетон кл. В15 ($R_в = 86{,}7$ кгс/см²)

От таблица $\eta = 0{,}968$

Требуемое площадь арматурные стержни.

$$A_s = \frac{8{,}3 \cdot 105}{0{,}968\,45 \cdot 3750} = 5{,}1\ см^2$$

Принимаем 4Ф16 А-III ($A_s = 8{,}04\ см^2$)

Площадь арматура на пролетах.

$$A_0 = \frac{M_{пр}}{b_р \cdot h_0^2 \cdot R_в} = \frac{1{,}1 \cdot 105}{60 \cdot 45^2 \cdot 86{,}7} = 0{,}01$$

$$\eta = 0{,}995$$

$$A_s = \frac{1{,}1 \cdot 105}{0{,}995 \cdot 45 \cdot 3750} = 0{,}7\ см^2.$$

Принимаем 4Ф16 А-III ($A_s = 8{,}04\ см^2$)

ELECTRICAL INSTALLATIONS

Проект по разделу "Энергия и электричество" терминала служебы контроля (06) включает в себя следующие части и разделы

- светотехническая
- электротехническая
- слабые токи
- сметная стоимость, объем работ, технические спецификации

1 Светотехническая часть

1.1. Источники света - во всех помещениях здания источниками света являются люминисцентные лампы серии ЛБ, в помещениях уборной - лампы накаливания серии БК-220.

В освещении кассовых кабин и территории под навесом использованы люминисцентные лампы серии ЛБ габаритные огни проходов выполнены лампами накаливания серии БК-220.

1.2. Освещенность * помещений - принята согласно СНИП-II-4-79 „Естественное и искусственное освещение" для всех помещений и СНИП II-85-80 Часть II Глава 35 Вокзалы, нормы проектирования, Раздел 6.

Для всех служебных помещений норма освещенности на горизонтальной плоскости на высоте 0,8 м от пола принята равной 300 лк при использовании люминисцентных ламп. ~~Для всех помещений уборных бак с лампами накаливания~~.

Для помещений вестибюля 150 лк и коридора 75 лк с ~~лампами~~ люминисцентными лампами.

Для помещений уборных 30 лк с лампами накаливания. Для кассовых кабин и территории под навесом норма освещенности принята равной 200 и 50 лк соответственно.

1.3. Система освещения - для всех помещений принято общее равномерное освещение.

В служебных помещениях предусмотрены штепсельные розетки для подключения местного освещения (настольных ~~ламп~~ светильников)

Согласно СНИП II-85-80 Часть II Раздел 6 проектом предусмотрено аварийное освещение

1.4. Типы светильников и их размещение -

- следующие во всех служебных помещениях, ~~во всех помещениях~~ применяются светильники с люминисцентными лампами потолочные серии УСП5 в коридоре и вестибюле встраиваемые серии ЛПО45

В помещениях уборных светильники с лампами накаливания серии НПО01.

~~В кассовых~~. В кассовых кабинах и под навесом светильники УСП5 потолочные с люминисцентными лампами. Для габаритных огней проходов для машин использовать светильники промышленные с лампой накаливания пыленепроницаемые серии ППР

Количество и мощность ламп в светильниках корректируется после расчета установленной мощности ламп для каждого помещения

1.5. Расчет установленной мощности ламп - производится по методу удельной мощности, где исходными данными для расчета являются:

- освещенность E(лк)
- освещаемая площадь S($м^2$)
- высота подвеса светильников (м)
- типы светильников

Мощность ламп $P_{общ, ламп}$ (Вт) определяется для каждого помещения по формуле $P_{общ, ламп} = \rho(Вт/м^2) \cdot S(м^2)$

где $\rho(Вт/м^2)$ - удельная мощность имеющая устойчивое значение под воздействием исходных данных

Все данные для расчета и результаты расчета, а именно мощность ламп, их число в светильнике и количество светильников приведены в таблице.

Таблица 1.5.1

Наименование помещений	Площадь помещения ($м^2$)	Высота подвеса светильников (м)	ρ (Вт/$м^2$)	$P_{общ, ламп}$ (Вт)	Тип лампы	Мощность одной лампы (Вт)	Общее число ламп (шт)	Тип светильников	Кол-во светильников (шт)
Таможня (E=300 лк)	10,98	2,7	20	219,6	ЛБ-20	20	12	УСП5-6×20	2
Таможня	11,14	2,7	20	222,8	-"-	-"-	12	-"-	2
Таможня	15,46	2,7	20	309,2	ЛБ-40	40	8	УСП5-4×40	2
Таможня	15,68	2,7	20	313,6	-"-	-"-	8	-"-	2
Таможня	16,35	2,7	20	327,0	-"-	-"-	8	-"-	2
Комната досмотра	15,68	2,7	20	313,6	-"-	-"-	8	-"-	2
Транспортная полиция	11,14	2,7	20	222,8	ЛБ-20	20	12	УСП5-6×20	2
Транспортная полиция	11,14	2,7	20	222,8	-"-	-"-	12	-"-	2
Полиция	11,14	2,7	20	222,8	-"-	-"-	12	-"-	2
Полиция	11,14	2,7	20	222,8	-"-	-"-	12	-"-	2
Полиция	11,14	2,7	20	222,8	-"-	-"-	12	-"-	2
Пограничники	16,35	2,7	20	327,0	ЛБ-40	40	8	УСП5-4×40	2
Пограничники	15,68	2,7	20	313,6	-"-	-"-	8	-"-	2
Пограничники	15,68	2,7	20	313,6	-"-	-"-	8	-"-	2
Ветеринарный пункт	15,46	2,7	20	309,2	-"-	-"-	8	-"-	2
Туалет (20 лк)	5,25	2,7	3,7	14,175	БК-220	40	1	НП001-40	1
Туалет (20 лк)	5,25	2,7	3,7	14,175	БК-220	40	1	НП001-40	1
Коридор (75 лк)	39,9	2,7	5	199,5	ЛБ-40	40	5	НП045-40	5
Вестибюль (150 лк)	26,44	2,7	10	264,40	-"-	-"-	7	НП045-40	7
Кассы (200 лк) Кабины	6×3,75	2,2	12,2	45,8	-"-	-"-	1	УСП5-40	6×1
Территория (50 лк) под навесом	2×351	5,30	3,4	1193,0	-"-	-"-	2×30	УСП5-2×40	2×15
Габаритные огни	—	0,5	—	400	БК-220	100	4	ППР-100	4

2 Электротехническая часть:

2.1. Величина напряжения — напряжение питающей сети 380/220В 50Гц. Напряжение силовой сети (кондиционер) – 380В 50Гц, групповой осветительной сети – 220В 50Гц.

2.2. Схема питания – силовое вводно-распределительное устройство (ВРУ) получает питание от трансформаторной подстанции №275(6) 6/0,4кВ кабельного терминала двумя кабельными линиями проложенными в траншее (земле) по разомкнуто радиальной схеме. Один из кабелей подключен к низкой стороне 0,4кв работающего трансформатора второй к низкой стороне второго трансформатора является резервным вводом.
Групповые осветительные щитки ГЩО-1 ГЩО-2 и 3 а также кондиционер получает питание от ВРУ по разомкнуто-радиальной схеме.
Все щиты расположены в центре нагрузок с некоторым смещением в сторону щита питания (ВРУ).

2.3. Размещение щитков – при размещении щитков с аппаратами защиты и руководствуясь указаниями ПУЭ и СН-543-82, СН 544-82 щитки устанавливаем в местах доступных для обслуживания персоналом.
Все щиты утопленного исполнения и устанавливаются в нишах. Щиты ВРУ и ГЩО-1 монтируются внутри, ГЩО-2 и ГЩО-3 вне здания.
Размеры ниш для щитов следующие
ВРУ – (глубина – 250мм; высота – 1000мм, ширина – 650мм)
ГЩО-1 (глубина – 140мм; высота – 900мм, ширина – 800мм)
ГЩО-2и3 (глубина – 140мм; высота – 500мм ширина – 400мм)
Высота установки щитов от уровня пола до верхнего уровня щитов – 1.8м.
Ввод кабелей в щит (ВРУ) произвести снизу

отходящие кабельные линии снизу и сверху.
Вводы кабелей в щитки ГУО-1, ГУО-2 и ГУО-3 предусмотрены сверху, отходящие линии – сверху посредством снятия съемных крышек этих щитков.

Для соблюдения интерьера помещения вестибюля щиты ВРУ и ГУО-1 можно укрыть под декоративным съемным несгораемым материалом.

2.4. Проводка и способ прокладки – питающие линии к групповым щитам ГУО-1, ГУО-2, ГУО-3 (к станции пожарной сигнализации), а также к кондиционеру выполнены кабелем марки АВРГ с алюминиевыми жилами с резиновой изоляцией в поливинилхлоридной оболочке и проложены по стене на скобах. Внутри здания горизонтальная часть проводки проходит над подвесным потолком, вертикальная скрыто под декоративным лотком из алюминиевого профиля, вне здания открыто по стене на скобах.

Вся групповая сеть под навесом от щитов ГУО-2 и ГУО-3 выполнена кабелем марки АВРГ с алюминиевыми жилами. Вертикальная часть проводки выполнена в винипластовой трубе Ø20 мм, горизонтальная часть проводки на участках, идущих к кабинам, Шлагбауму и габаритным огням в винипластовой трубе Ø20 уложенная в канале на глубине 20 см.

Горизонтальная проводка под навесом выполнена открыто на скобах. В кабинах открыто на скобах.

Вся групповая осветительная сеть и групповые сети от щитов питающие штепсельные розетки, выделенные в отдельные группы, выполнена внутри здания скрытой проводкой проводом плоским с алюминиевыми жилами марки АППВС в бороздах с последующей заделкой штукатурным раствором. При прокладке проводов использовать также пустоты плит перекрытий.

Горизонтальная проводка выполняется параллельно линии потолка на расстоянии 200 мм от линии потолка. Вертикальная проводка к выключателям и розеткам прокладывается параллельно линиям проёмов окон и дверей на расстоянии не менее 100 мм.

2.5 Расчет сети - включает в себя расчет осветительной и силовой нагрузки, расчет сечений проводов и кабелей, расчет и выбор аппаратуры защиты и управления.
Расчетная мощность групповой осветительной и силовой нагрузки определяется по формулам (3.2.5.1) и (3.2.5.4) указанных в проектных критериях при Кс - коэффициент спроса равный 1.
Расчетная мощность суммарной осветительной и силовой нагрузки для каждого щита определяется по формулам (3.2.5.3) и (3.2.5.4).
Расчетные мощности вводов в щиты групповые и вводные определяются по формуле (3.2.5.5) указанной в проектных критериях.
Выбор сечений проводов и кабелей производится по допустимому нагреву проводника по формуле (3.2.5.6) и проверяется на потерю напряжения по формуле (3.2.5.10)
Расчетные токи нагрузок определяются по формулам (3.2.5.7) и (3.2.5.9)
Выбор аппаратов защиты и управления производится по таблице (3.2.5.5.)
Все результаты расчетов сведены в расчетные схемы щитов ВРУ, ГЩО-1 и ГЩО-2(3) (см. листы В(Т)6. 31÷33).
Автоматические однополюсные выключатели серии АЕ2020 и АЕ61 установленные в щитах ВРУ и ГЩО-1; 2 и 3 имеют регулируемые установки электромагнитных расцепителей.
Автоматические выключатели АЕ2046 одно и трёхполюсные имеют регулируемые установки электромагнитных расцепителей.
Токи установок электромагнитных расцепителей устанавливают

3. СЛАБЫЕ ТОКИ

3.1 ПОЖАРНАЯ СИГНАЛИЗАЦИЯ

Система автоматической пожарной сигнализации предусматривается автономная на тепловых легкоплавких датчиках типа ИП-105-2/1, которые соединяются в шлейф последовательно и срабатывают на размыкание при повышении температуры воздуха в помещении больше 70°С ± 10°С. Автоматическими датчиками оборудуются все помещения службы контроля кроме коридора.

Автоматическая пожарная сигнализация предусматривается многошлейфная. В качестве приемно-контрольного прибора предусматривается станция пожарной сигнализации "ТОЛ-10-С", который устанавливается в вестибюле. Питание станции осуществляется напряжением ~220 В через блок питания от ВРУ здания. В качестве резервного питания предусматривается установка аккумуляторной батареи 10-НН в непосредственной близости от станции.

Сигнал о пожаре дублируется электрозвонком громкого боя МЗ-1 и кнопкой включения, устанавливаемые на высоте 2.2 м от уровня пола на фасаде здания.

Тепловые легкоплавкие датчики устанавливаются на потолках на расстоянии не менее 0,5 м от светильников. В коридоре предусматривается установка двух кнопочных пожарных извещателей серии ПКИЛ-9М на высоте 1.5 м от уровня пола для подачи сигнала о пожаре ручным способом.

Вся проводка пожарной сигнализации выполняется проводом марки ТРП-1×2×0,5 открыто на стене.

3.2 Телефонизация - предусматривается комплексная телефонная сеть для служебной связи контроля включающая в себя выход через УАТС на городскую телефонную сеть (ГТС), административно-хозяйственную связь, оперативную диспетчерскую и громкоговорящую связь.

Ввод телефонного кабеля ТПВ-50×0,4 мм от УАТС в здание производится в стояке ⌀50 мм выполненной из оцинкованной трубы ⌀50 мм. Телефонный кабель ТПВ-50×0,4 мм до распределительной коробки КРТП-10 прокладывается по стене на высоте 3,30 м параллельно линии потолка к коробке. От коробки КРТП-10 абонентские линии выполненные проводом марки ТРП-2×0,4 мм прокладываются по коридору под подвесным потолком с заходом в каждое помещение сверху вниз до нулевой отметки и по плинтусам идут к штепсельным телефонным розеткам открытой скрытой проводкой.

Телефонная розетка марки РТШ устанавливается на высоте 1.0 м от уровня пола.

3,3. Радиофикация - здания предусматривает установку абонентского трансформатора марки ТАМУ-10 на 10 ВА с понижением напряжения до 30 В. Ввод в здание на щиток с трансформатором производится в стояке выполненном из оцинкованной трубы ⌀20 мм кабелем марки ПРППМ-2×1,2 мм. Разветвления от трансформатора выполняются в коробках типа УК-2П установленных в коридоре проводом марки ППВ-2×1,2 мм проложенных по стене под подвесным потолком открыто. От разветвительных коробок до

ограничительных коробок УК-Р установленных
в каждом помещении проводка выполняется
проводом марки ППВ-2×0,6 мм открыто под
подвесным потолком ~~[illegible]~~ по стене.
От ограничительных коробок до радиорозеток
проводку выполнить скрыто в пустотах
плит перекрытий, в бороздах, с последующей
заделкой штукатурным раствором проводом ППВ-2×0,
Розетки типа РПВ-2 (1) для скрытой открытой проводки
устанавливаются ~~в~~ не менее 1м от штепсельной розетки
на расстоянии в ~~[illegible]~~ наружных стен
осветительной сети.

4 ~~Сметная стоимость, общие [illegible] работ,~~
Техническая спецификация прилагается
к проекту.

Отопление и вентиляция. / HEATING AND VENTILATION.

I Расчет системы отопления.

Потери тепла для каждого помещения состоят из основных и добавочных.

$$Q = Q_т + q \text{ ккал/ч.}$$

$Q_т$ – основные теплопотери поступающие в помещения через наружные ограждения.

q – добавочные теплопотери вычисляют в процентах к основным по таблице:

Ограждения	Добавочные теплопотери в %
Наружные стены, двери, окна, обращенные на север, восток, северо-восток, северо-запад	10
То же, на юго-восток и запад	5
Наружные ограждения с расчетной зимней скоростью ветра до 5 м/сек включительно: защищенные от ветра не защищенные от ветра в зданиях расположенной у моря	5 10
Для угловых помещений	5

$Q_т = K \cdot F \cdot \Delta t$ ккал/час.

K – коэффициент теплопередачи ограждения, ккал/м²ч.°C. определяется по расчетам или по таблицам из Справочника

Наименование ограждений	K.
Наружная стена из камня „Кубик" толщиной 40 см.	1,25
Наружная одинарная дверь	4,0
Наружная двойная дверь	2,0
Внутренние двери одинарные	2,5
Одинарное остекление – фрамуга	5,0
Двойное остекление	2,5
Витрина	4,0
Перекрытия	1,1.
Пол на грунтах ~~по~~	по таблице.

F – поверхность ограждения – $м^2$.

$\Delta t = t_в - t_н$ – расчетные температуры внутри помещений и наружного воздуха, принимаемые по таблицам.

$t_н$ – наружный воздух. Для Баку $t_н = -4°C$.

Для Туркменбаши $t_н = -8°C$.

Для удобства проверки, теплопотери рассчитывают по отдельным помещениям на специальной таблице. Условные обозначения для этой таблицы.

Обозначения	Наименование.
Н.С.	Наружная стена
В.С.	Внутренняя стена
Дв.	Дверь.
Ок.	Окно.
фр.	Фрамуга
П.Л.	Пол.
ПТ	Перекрытия
С	Север.
Ю	Юг
З	Запад
В	Восток.

На листе №4÷7 дано „Расчет системы отопления" для „Терминал Службы контроля".

II. Расчет системы вентиляции.

Вентиляция для Паромного терминала принято – кондиционирование воздуха.

Производительность кондиционеров определяется:

1. Расчеты теплопоступлений в помещения через наружные ограждения,
2. По кратностям воздухообмена в час.

Так как в здание Службы контроля не имеется особо технологическое оборудование, которое требует определенные температура в помещения и с целью экономия холода принято расчет кондиционирования – по кратностям.

Расчет кондиционирования для „Терминала Службы контроля" см. лист № 3

Расчет кондиционирования воздуха для „Терминал Службы контроля".

Производительность кондиционера по формуле

$$L = \Sigma V \cdot n_{ср} \ м^3/час.$$

ΣV – суммарный внутренний объем кондиционируемых помещений $м^3$

$n_{ср}$ – средняя кратность воздухообмена в час, равная для общественных зданий 5÷8.

$$V_{здания} = 24_м \times 10,8 м \times 3 м (H) = 780 м^3.$$

$n = 5$ – принимаем.

$$L = 780 \cdot 5 = 3900 \ м^3/час;$$

Принимаем крышный кондиционер ВСН-90.

Производительность кондиционера:

Приток $L = 4250 \ м^3/час$.

Рециркуляция $L = 2840 \ м^3/час$.

Сечение воздуховодов определяется по формуле:

$$F = \frac{L}{3600 \cdot в} \ м^2.$$

L – часовой расход воздуха $м^3/час$.

$в$ – скорость воздуха в воздуховоде м/сек – по таблице принимаем $в = 6 м/сек$.

Например: $F = \frac{4250 м3}{3600 \cdot 6} = 0,4 м^2$ (приток).

сечение воздуховода — 1000×400 (H) мм.

$F = \frac{2840}{3600 \cdot 6} = 0,26 м^2$ (рециркуляция)

сечение воздуховода – 800×300 (H) мм.

Расчеты сечения воздуховодов. см. лист 18.

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		controlled by:	date:	

Расчет теплопотери для „Терминал Службы контроля" в Баку.
$t_н = -4°C$. Высота здания – 3м. Остекление – двойное.

N помещения	Наименование помещений	t внут. °C	Наим. ориент.	K ккал/м²·ч·°C	$\Delta t = t_в - t_н$	F м²	$Q_т$ ккал/ч.	Коэфф. для учета надбавок (q %)	Q ккал/ч.	Кол-во секций радиаторов
1.	Таможня	18	н.с./ю	1,25	18+4= 22°C	4×3(н)=12	330	1,15	380	
			ок./ю	2,5-1,25= =1,25		1,2×1,8=2,2	61	1,15	70	
			н.с./в	1,25		2,8×3=8,4	231	1,25	290	
	По таблицам KF=6 →		ПЛ			4×2,8=11	132	—	132	8 секций
			ПТ	1,1		4×2,8=11	266	—	266	
									Σ 1138	
2, 3, 4, 6, 7	Таможня Транспортная полиция KF=3,6 →	18	н.с./в	1,25	22	2,8×3=8,4	231	1,2	277	
			ок/в	1,25		1,2×1,8=2,2	61	1,2	73	
			ПЛ			4×2,8=11	79	—	79	6
			ПТ	1,1		4×2,8=11	266	—	266	
									Σ 695×5= =3475 (5 – кол-во помещений).	
8	Сан. узел	15	н.с./в	1,25	19	3×3=9	214	1,25	268	
			фр./в	5-1,25= =3,75		0,8×0,5=0,4	29	1,25	36	
			н.с./с	1,25		4×3=12	330	1,25	413	
			ок./с	1,25		1,2×1,8=2,2	52	1,25	65	
	KF=6		ПЛ			4×3=12	114	—	114	8
			ПТ	1,1		4×3=12	250	—	250	
									Σ 1146	
5	Полиция	18	н.с./в	1,25	22	3×3=9	248	1,2	303	
			ок/в	1,25		1,2×1,8=2,2	61	1,2	73	
	KF=3,6		ПЛ			4×3=12	79	—	79	8
			ПТ	1,1		4×3=12	290	—	290	
									Σ 745	

Job no.		worked out by:	date:	page:
		controlled by:	date:	

N пом.	Наименование помещений	t вх. °C	Наим. ориен.	K ккал/м².ч.°C.	Δt °C.	F м²	$Q_т$ ккал/ч.	β%	Q ккал/ч.	Кол-во секций радиаторов
9.	Таможня	18	н.с/ю	1,25	18+4=22	5,6×3=17	468	1,15	538	
			ок/ю	1,25		1,2×1,8=2,2	61	1,15	70	
			н.с./з	1,25		2,8×3=8,4	231	1,2	277	7
	KF=8		ПЛ			5,6×2,8=16	176	—	176	8
			ПТ	1,1		16	387	—	387	
									Σ 1448	
10,	Таможня	18	н.с./з	1,25	22	2,8×3=8,4	231	1,15	266	
11,	Комната досмотра		ок/з	1,25		1,2×1,8=2,2	61	1,15	70	
14,15	Пограничники	KF=4,2	ПЛ			5,6×2,8=16	93	—	93	7
			ПТ	1,1		16	387	—	387	
									Σ 816×4= =3264.	
12,	Таможня	18	н.с./з	1,25	22	2,6×3=7,8	215	1,15	247	
13	Пограничники		ок/з	1,25		1,2×1,8=2,2	61	1,15	70	
	KF=4,2		ПЛ			5,6×2,6=15	93	—	93	
			ПТ	1,1		15	363	—	363	7
									Σ 773×2= =1546	
16	Ветеринар. пункт.	18	н.с./з	1,25	22	2,6×3=7,8	215	1,2	258	
			н.с./с	1,25		5,6×3=17	468	1,25	585	
			ок/с	1,25		1,2×1,8=2,2	61	1,25	76	
	KF=8		ПЛ			5,6×2,6=15	176	—	176	6
			ПТ	1,1		15	363	—	363	
									Σ 1458	
17	Коридор по ширине	10	н.с./в	1,25	14	2,6×3=7,8	137	1,2	164	
			дв./в	4·1,25=2,75		2,2×2,4=5,3	204	1,2	245	
			н.с./з	1,25		2,9×3=8,7	152	1,15	175	
			дв/з	2,75		5,3	204	1,15	235	8
	KF=14		ПЛ			12×3=36	196	—	196	
			ПТ	1,1		36	555	—	555	
									Σ 1570.	

Job no.		worked out by:	date:	page:
		controlled by:	date:	

№ пом.	Наименов. помещений	t вн. °C	Наим. ориент.	K ккал/м²·ч·°C	Δt °C	F м²	$Q_т$ ккал/ч	β%	Q ккал/час.	Кол-во секций радиаторов
18	Коридор по длине	10	н.с./ю	1,25	14	1,6×3=4,8	84	1,1	92	
			ок/ю	1,25		1,2×1,8=2,2	39	1,1	43	
			н.с./с	1,25		1,6×3=4,8	84	1,2	101	
			ок/с	1,25		2,2	39	1,2	47	8.
	Кf=21,6		пл			27×1,6=43	303	—	303	
			пт	1,1		=43	665	—	665	
									Σ1250.	

Σ Q по коридорам = 1570+1250 = 2820 ккал/час.

По всему зданию Q = 17040 ккал/ч.

Расчет отопительных приборов.

В здании устанавливается радиатор типа М140 АО.

Поверхность нагрева одной секции 0,35 экм.
Температура воды в системе отопления 95-70°С.
Определим число секций радиаторов в помещении №1.
Q = 1138 ккал/час.

Находим теплоотдачу 1 экм радиаторов:

$$\Delta t_т = \frac{t_{вх}+t_{вых}}{2} - t_в = \frac{95+70}{2} - 18 = 64,5°C.$$

По таблице находим $q_э$ = 435 ккал/ч.

Требуемая поверхность нагрева прибора:

$$F_{треб} = \frac{Q_{пр}}{q_э} \beta_1 \beta_2 \text{ экм}.$$

$$F_{треб} = \frac{1138}{435} \cdot 1 \cdot 1,05 = 2,8 \text{ экм}.$$

$Q_{пр}$ - расчетная тепловая нагрузка прибора $Q_{пр}$ = 1138 ккал/ч.
β_1, β_2 – по таблицам.

По таблицам находим $F_{тр}$ = 0,12 экм – поверхность нагрева открыто проложенных труб.

RAMBØLL

Job no.		worked out by:	date:	page:
		controlled by:	date:	

Расчетная поверхност нагрева прибора:

$$F_р = F_{треб} - F_{тр} = 2,8 - 0,12 = 2,68 \text{ кв.м.}$$

Количество секций нагревательных приборов для помещений № 1.

$$N_р = \frac{2,68}{0,35} = \underline{8 \text{ шт.}}$$

Таким образом проводится расчеты для других помещений.

Расчет трубопроводов

Расход теплоносителя системы отопления определяется

$$G = \frac{\Sigma Q}{\Delta t \cdot c} \text{ кг/ч.}$$

Q – суммарные потери тепла помещений ккал/ч.

Δt – разность температур °С теплоносителя на входе и выхода из ветви (стояка)

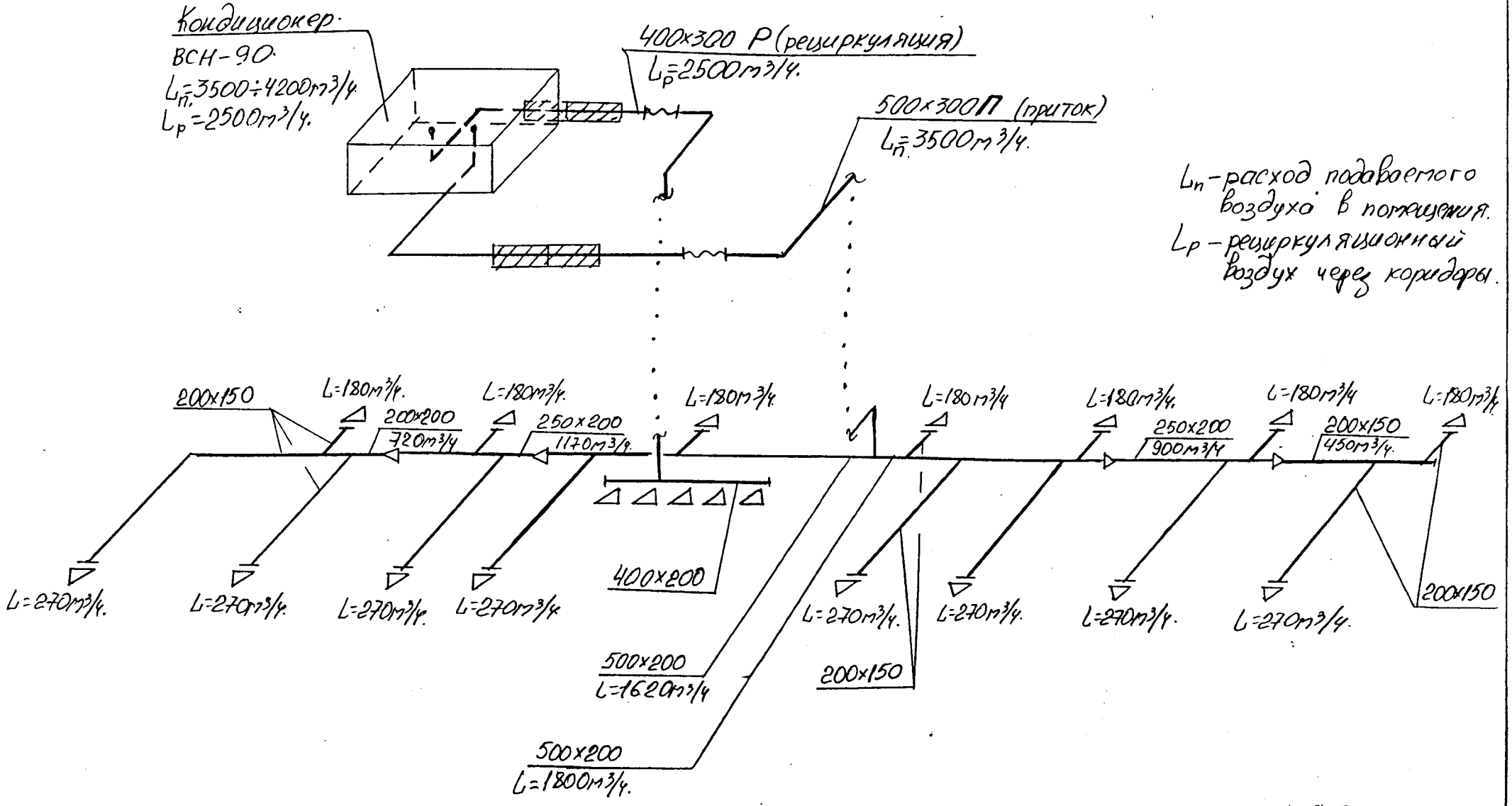
c – удельная теплоемкость воды $c = 1$ ккал/кг °С.

Зная G кг/час по таблице находим диаметр труб.

Скорость воды для водяного отопления $v = 0,2 \div 0,8$ м/сек.

Сістма СКС1 Е11 П-1 (прит.-рециркуляция)

Схема для определение сечения воздуховодов.



L.S.R.

Representative Design Calculations,

Marine Works

RAMBØLL

sag nr.		udarb.:	dato:	side:
963324	Baku and Turkmenbashi Ferry Terminals	JLI	1997.01.28	.1
		kontrol:	dato:	

Central pier:

Sheet piles and anchors:

Soil in Turkmenbashi:

Calculating long term conditions

In front of sheet piles:

Bottom level -36.00 m

Bottom level in calculations -37.00 m

Density $\gamma/\gamma' = 20/10$ kN/m³

Angle of friction $\bar{\varphi} = 20°$

Cohesion $\bar{c} = 43$ kN/m²

Max cohesion for calculations $\bar{c} = 20$ kN/m²

Behind sheet piles:

Level -25.75 to -35.00 sandfill:

Density $\gamma/\gamma' = 18/10$ kN/m³

Angle of friction $\bar{\varphi} = 33°$

Level -35.00 to -37.00

Density $\gamma/\gamma' = 17/7$ kN/m³

Angle of friction $\bar{\varphi} = 10°$

Cohesion $\bar{c} = 2$ kN/m²

Below level -37.00

Density $\gamma/\gamma' = 20/10$ kN/m³

Angle of friction $\bar{\varphi} = 20°$

Cohesion $\bar{c} = 43$ kN/m²

Max cohesion for calculations: $\bar{c} = 20$ kN/m²

RAMBØLL

sag nr.		udarb.:	dato:	side: .2
		kontrol:	dato:	

Sheet piles are calculated with relieving platform (existing concrete slab on piles)
Full moment of sheet piles in anchor level.
See sheet pile calculation enclosed.

FIRMA: RAMBØLL
SAG: 963324 Færgelejer i Baku og Turkmenbashi
EMNE: Turkmenbashi. Central pier, long term condition

INDDATA FRA FIL: C:\PCSPUNS\turkm1.IND

VÆGTYPE: Spunsvæg

VÆGGENS BRUDMÅDE:

Indspænding i ankerpunkt	ja
Indspænding i bund	nej
Flydecharnier på midterste del	ja

VÆGGENS GEOMETRI:

Top af væg, kote	-25.75 m
Forankring, kote	-25.75 m
Aflastningsgrænse, kote	-25.75 m

JORDOVERFLADER OG VANDSPEJL:

Overfladehældning, forside	0.00 grader
Overfladehældning, bagside	0.00 grader
Vandspejlskote, forside	-30.00 m
Vandspejlskote, bagside	-30.00 m

JORDLAG PÅ FORSIDE:

Overside kote (m)	Rumvægt o.vandsp. (kN/m3)	Rumvægt u.vandsp. (kN/m3)	Gradient	Karakter. frikt.vk. (grad)	Karakter. kohæsion (kN/m2)	Relativ ruhed
-37.00	20.00	20.00	0.000	20.0	20.0	1.00

JORDLAG PÅ BAGSIDE:

Overside kote (m)	Rumvægt o.vandsp. (kN/m3)	Rumvægt u.vandsp. (kN/m3)	Gradient	Karakter. frikt.vk. (grad)	Karakter. kohæsion (kN/m2)	Relativ ruhed
-25.75	18.00	20.00	0.000	33.0	0.0	1.00
-35.00	17.00	17.00	0.000	10.0	2.0	1.00
-37.00	20.00	20.00	0.000	20.0	20.0	1.00

BELASTNING OG SIKKERHED:

Sikkerhedsklasse	normal
Funderingsklasse	normal
Overfladelast, forside	0.0 kN/m2
Overfladelast, bagside	0.0 kN/m2

FIRMA: RAMBØLL
SAG: 963324 Færgelejer i Baku og Turkmenbashi
EMNE: Turkmenbashi. Central pier, long term condition

TRYKFORDELING:

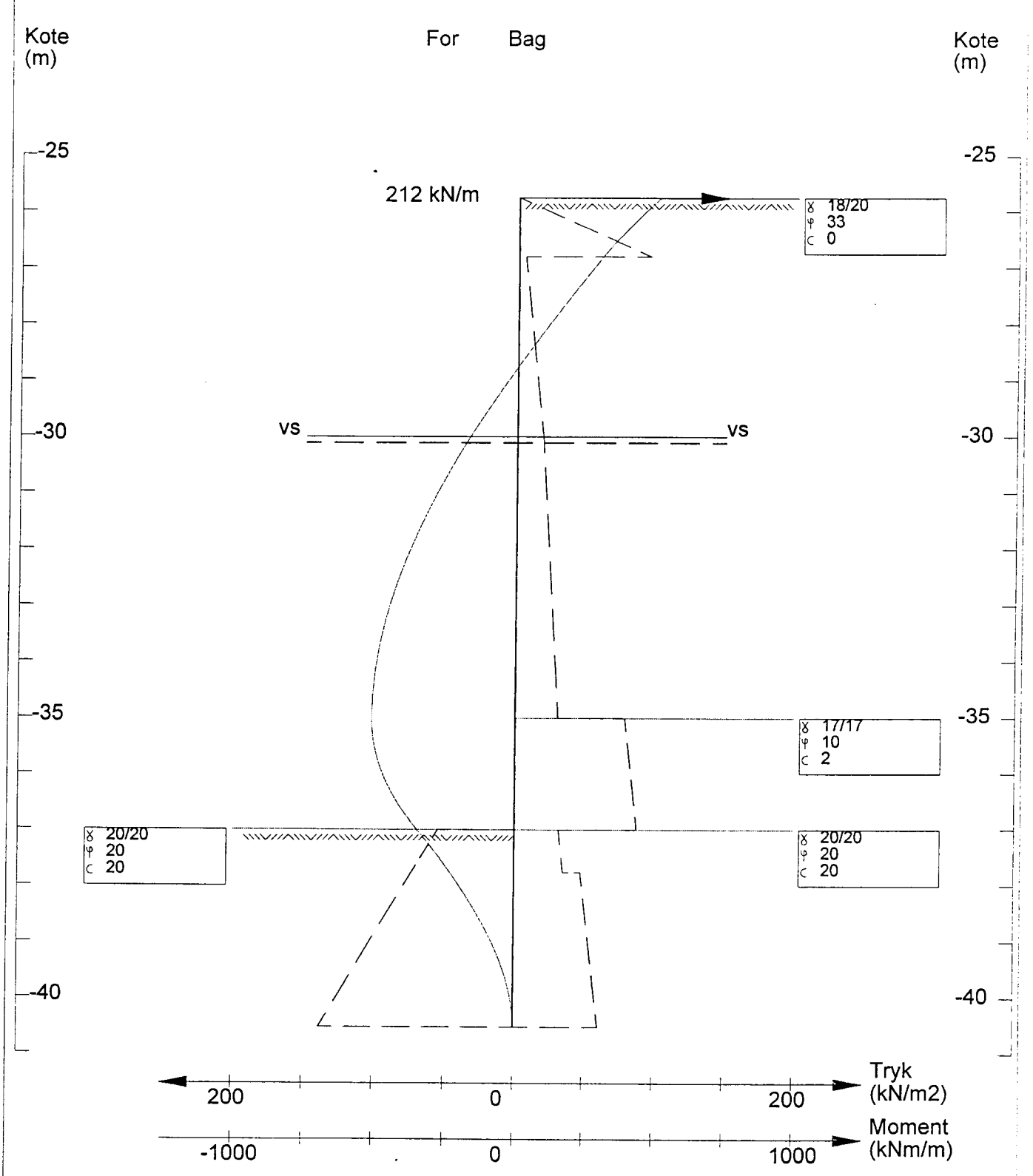
	Kote (m)	Jordtryk forside (kN/m2)	Jordtryk bagside (kN/m2)	Vandtryk bagside (kN/m2)
Jordoverflade	-25.75			
Top af væg	-25.75	0.00	0.00	0.00
Forankring/Afstivning	-25.75	0.00	0.00	0.00
Over tryk spring	-26.80	0.00	94.78	0.00
Under tryk spring	-26.80	0.00	4.61	0.00
Vandspejl	-30.00	0.00	18.67	0.00
Over laggrænse	-35.00	0.00	30.87	0.00
Under laggrænse	-35.00	0.00	78.53	0.00
Flydecharnier	-35.01	0.00	78.58	0.00
Jordoverflade	-37.00	54.94	87.63	0.00
Over laggrænse	-37.00	54.94	87.63	0.00
Under laggrænse	-37.00	54.94	31.89	0.00
Over tryk spring	-37.76	73.09	35.15	0.00
Under tryk spring	-37.76	73.09	47.66	0.00
Spids af væg	-40.52	138.44	60.75	0.00

DIMENSIONSGIVENDE RESULTATER:

Ankerkraft	211.8 kN/m
Moment under forankring	507.7 kNm/m
Flydemoment i kote-35.01	507.7 kNm/m
Spids af væg, kote	-40.52 m

MOMENTMAKS OG -MIN I VÆGGEN:

Kote (m)	Moment (kNm/m)
-25.75	507.7
-35.01	-507.7



——— Moment
– — — – Jordtryk
— · — · — Vandtryk

γ Rumvægt over/under vandspejl i kN/m3
φ Friktionsvinkel i grader
c Kohæsion i kN/m2

RAMBØLL
963324 Færgelejer i Baku og Turkmenbashi
Turkmenbashi. Central pier, long term condition

Filnavn: turkm1

Init:	Kontrol:	Godkendt:	Dato: 25 Mar 1997 Sag:

Rambøll,Hannemann & Højlund A/S

Bilag:

RAMBØLL

sag nr.		udarb.:	dato:	side: 6
		kontrol:	dato:	

Soil in Bakke:

Calculating long term conditions

In front of sheet piles:

Bottom level -36.00m

Bottom level in calculations -37.00 m

-37.00 to -38.00:

Density γ/γ' = 17/7 kN/m³

Angle of friction $\bar{\varphi}$ = 30°

Below -38.00:

Density γ/γ' = 20/10 kN/m³

Angle of friction $\bar{\varphi}$ = 20°

Cohesion $\bar{c}$ = 43 kN/m²

Max cohesion for calculations $\bar{c}$ = 20 kN/m²

Behind sheet piles:

Level -25.75 to -35.00: sand LL:

Density γ/γ' = 18/10 kN/m³

Angle of friction $\bar{\varphi}$ = 33°

Level -35.00 to -38.00

Density γ/γ' = 17/7 kN/m³

Angle of friction $\bar{\varphi}$ = 30°

Cohesion $\bar{c}$ = 0

Below level -38.0m

Density γ/γ' = 20/10 kN/m³

Cohesion $\bar{c}$ = 43 kN/m³

Max cohesion for calculations: $\bar{c}$ = 20 kN/m²

FIRMA: RAMBØLL
SAG: 963324 Færgelejer i Baku og Turkmenbashi
EMNE: Baku. Central pier ,long term condition

INDDATA FRA FIL: C:\PCSPUNS\baku.IND

VÆGTYPE: Spunsvæg

VÆGGENS BRUDMÅDE:

Indspænding i ankerpunkt	ja
Indspænding i bund	nej
Flydecharnier på midterste del	ja

VÆGGENS GEOMETRI:

Top af væg, kote	-25.75 m
Forankring, kote	-25.75 m
Aflastningsgrænse, kote	-25.75 m

JORDOVERFLADER OG VANDSPEJL:

Overfladehældning, forside	0.00 grader
Overfladehældning, bagside	0.00 grader
Vandspejlskote, forside	-30.00 m
Vandspejlskote, bagside	-30.00 m

JORDLAG PÅ FORSIDE:

Overside kote (m)	Rumvægt o.vandsp. (kN/m3)	Rumvægt u.vandsp. (kN/m3)	Gradient	Karakter. frikt.vk. (grad)	Karakter. kohæsion (kN/m2)	Relativ ruhed
-37.00	17.00	17.00	0.000	30.0	0.0	1.00
-38.00	20.00	20.00	0.000	20.0	20.0	1.00

JORDLAG PÅ BAGSIDE:

Overside kote (m)	Rumvægt o.vandsp. (kN/m3)	Rumvægt u.vandsp. (kN/m3)	Gradient	Karakter. frikt.vk. (grad)	Karakter. kohæsion (kN/m2)	Relativ ruhed
-25.75	18.00	20.00	0.000	33.0	0.0	1.00
-35.00	17.00	17.00	0.000	30.0	0.0	1.00
-38.00	20.00	20.00	0.000	20.0	0.0	1.00

FIRMA: RAMBØLL
SAG: 963324 Færgelejer i Baku og Turkmenbashi
EMNE: Baku. Central pier ,long term condition

BELASTNING OG SIKKERHED:

Sikkerhedsklasse	normal
Funderingsklasse	normal
Overfladelast, forside	0.0 kN/m2
Overfladelast, bagside	0.0 kN/m2

FIRMA: RAMBØLL
SAG: 963324 Færgelejer i Baku og Turkmenbashi
EMNE: Baku. Central pier ,long term condition

TRYKFORDELING:

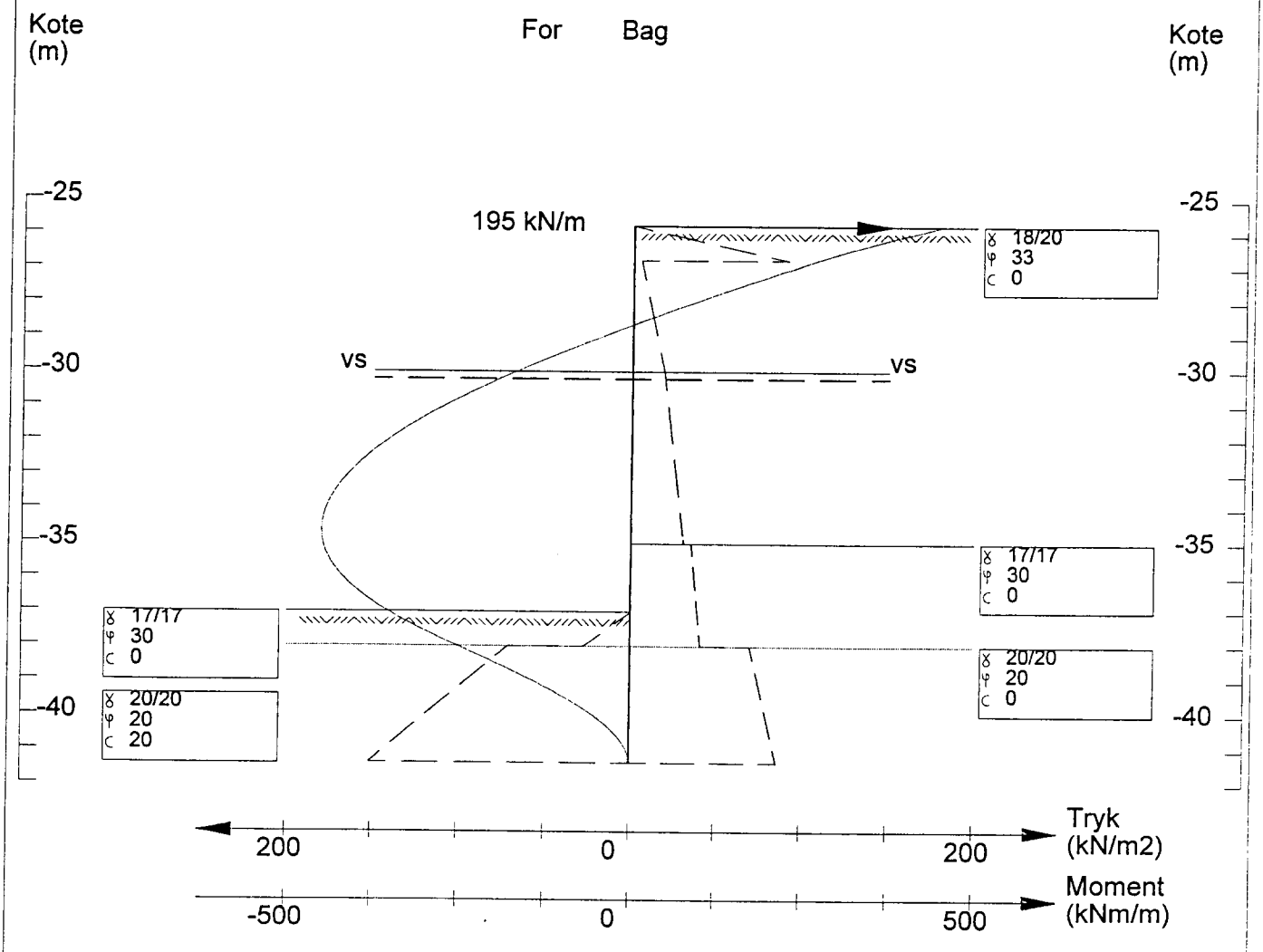
	Kote (m)	Jordtryk forside (kN/m2)	Jordtryk bagside (kN/m2)	Vandtryk bagside (kN/m2)
Jordoverflade	-25.75			
Top af væg	-25.75	0.00	0.00	0.00
Forankring/Afstivning	-25.75	0.00	0.00	0.00
Over tryk spring	-26.76	0.00	90.77	0.00
Under tryk spring	-26.76	0.00	4.42	0.00
Vandspejl	-30.00	0.00	18.67	0.00
Flydecharnier	-34.62	0.00	29.94	0.00
Over laggrænse	-35.00	0.00	30.87	0.00
Under laggrænse	-35.00	0.00	35.26	0.00
Jordoverflade	-37.00	0.00	39.16	0.00
Over tryk spring	-37.99	27.45	41.10	0.00
Under tryk spring	-37.99	27.45	47.66	0.00
Over laggrænse	-38.00	27.65	47.68	0.00
Under laggrænse	-38.00	71.56	70.13	0.00
Spids af væg	-41.37	151.46	86.13	0.00

DIMENSIONSGIVENDE RESULTATER:

Ankerkraft	195.4 kN/m
Moment under forankring	449.1 kNm/m
Flydemoment i kote-34.62	449.1 kNm/m
Spids af væg, kote	-41.37 m

MOMENTMAKS OG -MIN I VÆGGEN:

Kote (m)	Moment (kNm/m)
-25.75	449.1
-34.62	-449.1



——— Moment
– — — – Jordtryk
— - — - — Vandtryk

γ Rumvægt over/under vandspejl i kN/m3
φ Friktionsvinkel i grader
c Kohæsion i kN/m2

RAMBØLL
963324 Færgelejer i Baku og Turkmenbashi
Baku. Central pier ,long term condition

Filnavn: baku

Init:	Kontrol:	Godkendt:	Dato: 25 Mar 1997 Sag:
Rambøll,Hannemann & Højlund A/S			Bilag:

RAMBØLL

sag nr.		udarb.:	dato:	side:
963824		JLoI	1997.01.28	- 11
		kontrol:	dato:	

Sheet pile profile: Baku + Turkmenbashi

Max moment: $M = 507.7$ kNm/m

Steel (DIN 17100) St. 52

Yield strength $f_y = 355$ N/mm²

Section modulus:

$$W \geq \frac{507.7 \times 10^6 \times 1.28}{355} = 1831 \times 10^3 \text{ mm}^3/\text{m}$$

Profile Larssen 605 $W = 2020 \times 10^3$ mm³/m >

1831×10^3 — " —

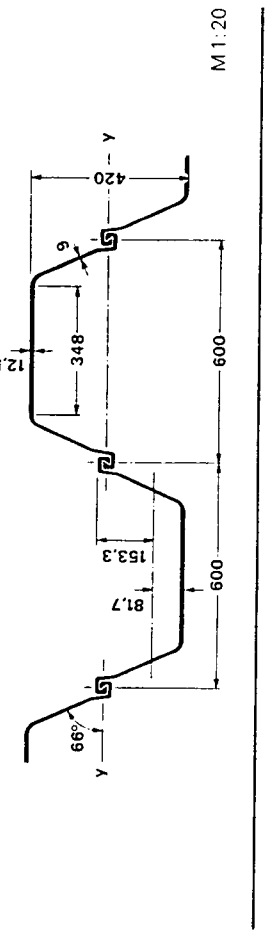
3.1.1 Profil Larssen 605

		Einheit	Einzelbohle E	Doppelbohle D	Dreifachbohle Dr	je m Wand
Eigenlast		kg/m	83.5	167	250	139 ⊗
Fläche		cm²	106	213	319	177
Umfang[1]		cm	200	374	548	290
Widerstandsmoment	W_y[2]	cm³	520	2420	2790	2020 ⊗
	W_z	cm³	1420	–	–	–
Statisches Moment	S_y	cm³	–	–	–	1130
Flächenmoment 2. Grades	J_y	cm⁴	7910	50840	70420	42370
	J_z	cm⁴	45350	–	–	–
Trägheitsradius	i_y	cm	8.62	15.5	14.9	15.5
Zul. Biegemomente[3] für Lastfall 1	St Sp 37 σ = 160 MN/m²	kNm/m	–	–	–	323
	St Sp 45 σ = 180 MN/m²	kNm/m	–	–	–	364
	St Sp S ⊗ σ = 240 MN/m²	kNm/m	–	–	–	485

1) Bei E, D u. Dr einschließlich Schloßinneres der freien Schlösser.

2) Widerstandsmomente bezogen: E u. Dr auf – die Schwerachse des jeweiligen Elements:
D u. je m Wand auf – die Wandachse y-y.
Die Widerstandsmomente der D, Dr u. je m Wand bedingen eine Vermegelung der Schlösser zur Aufnahme der Schubkräfte.

3) Bei Druck und Biegedruck für den Stabilitätsnachweis gelten verminderte zulässige Spannungen (siehe E 20 der EAU 1985)



M 1:20

Profiltafeln für Hoesch Stahlspundwände
Nachtrag 2, Stand 04/89

RAMBØLL

sag nr.		udarb.:	dato:	side: .12
		kontrol:	dato:	

Anchors Batu + Turkmenbashi

From sheet pile calculation

$A_{max} = 211.8$ kN/m

From soil pressure and surface load above anchor level:

Surface load $p_k = 10$ kN/m²

$p_{dl} = 1.3 \times 10 = 13$ kN/m²

Level -23.00 : $13 \times 0.5 = 6.5$ kN/m²

" -23.75 : $18 \times 2.75 \times 0.5 + 6.5 = 31.25$ kN/m²

$A = 211.8 + \frac{1}{2}(6.5 + 31.25) \times 2.75 = 263.7$ kN/m

Anchor in each double pile:

$A = 263.7 \times 1.2 = 316.4$ kN/anchor

Steel (DIN 17.100) St. 52

Yield strength $f_y = 355$ N/mm²

Anchors like 2½" WT / ø50

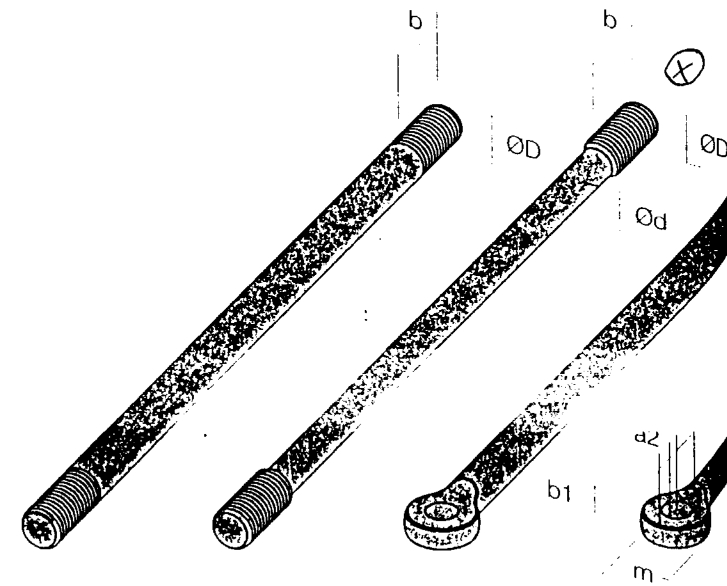
Tie rod ø50: $1963 \times \frac{335}{1.28} \times 10^{-3} = 514$ kN > 316.4 o.k.

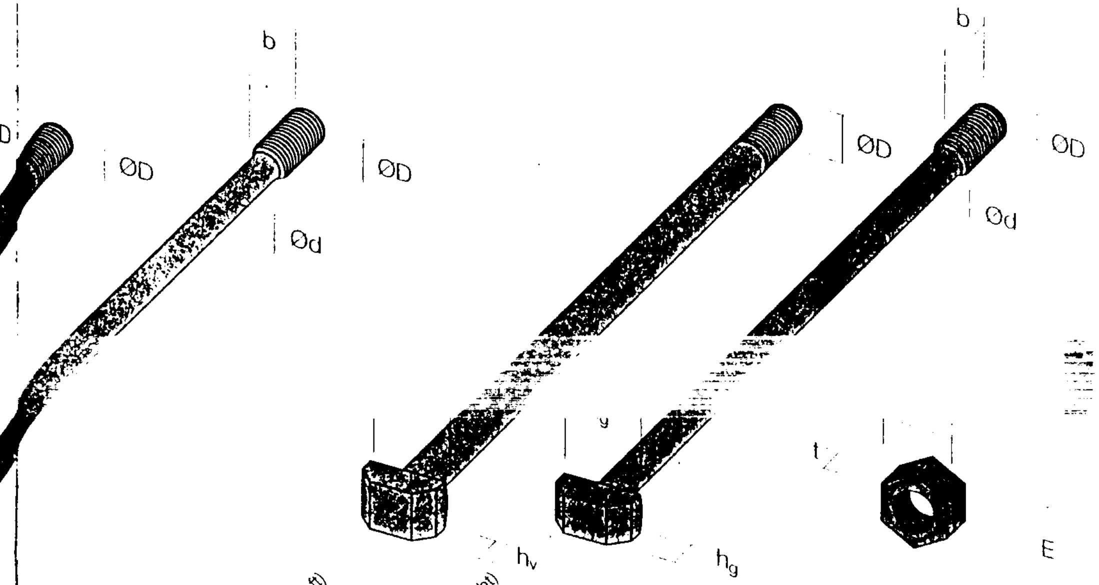
Thread 2½" WT:

$2565 \times \frac{335}{1.28 \times 1.4} \times 10^{-3} = 480$ kN > 316.4 O.K.

Anker
Tie Rods

ANKER SCHROEDER





Anker Nenngröße OD	S 235JRG2/St 37-2 kN	S 355J0/St 52-3 kN	Rundstahlanker (Vollschaft) OD	kg/m	Rundstahlanker (gestaucht) ød	kg/m	b	Augenanker (Vollschaft) a_2	b_1	Augenanker (gestaucht) m	k
1 1/2"	94	126	38	8,9	38	8,9	190	24	25	72	50
1 3/4"	127	170	45	12,5	45	12,5	190	27	30	85	60
2"	159	224	50	15,4	38	8,9	220	33	33	105	70
2 1/4"	212	283	57	20,0	45	12,5	220	35	39	110	75
2 1/2"	270	361	63	24,5	50	15,4	250	41	42	125	85
2 3/4"	297	432	70	30,2	52	16,7	250	44	47	135	90
3"	357	527	75	34,7	57	20,0	270	50	50	155	105
3 1/4"	436	620	82	41,5	63	24,5	270	54	55	165	110
3 1/2"	539	733	90	49,9	70	30,2	270	60	60	180	120
3 3/4"	619	839	95	55,6	75	34,7	270	64	63	190	130
4"	704	971	100	61,6	80	39,5	270	70	66	210	135
4 1/4"	739	1100	110	74,6	82	41,5	270	75	72	230	165
4 1/2"	891	1250	115	81,5	90	49,9	270	80	75	240	170
4 3/4"	992	1395	120	88,8	95	55,6	270	85	80	255	180
5"	1100	1563	125	96,3	100	61,6	270	90	85	270	190
5 1/4"	1212	1725	130	1042	105	68,0	270	95	90	275	195
5 1/2"	1331	1909	140	120,8	110	74,6	270	95	95	290	205
5 3/4"	1454	2085	145	129,6	115	81,5	270	100	100	300	205
6"	1583	2289	150	138,7	120	88,8	270	105	105	310	230
6 1/4"	1718	2502	160	157,8	125	96,3	270	115	115	330	245
6 1/2"	1858	2725	165	167,9	130	104,2	270	120	120	340	255

⊗

Anker Nenngröße OD	Hammerkopfanker (Vollschaft) ØD	l_v	h_v	Hammerkopfanker (gestaucht) ød	l_g	h_g	Mutter SW	E	t	kg
1 1/2"	38	85	35	38	85	35	60	69	30	0,5
1 3/4"	45	95	40	45	95	40	70	81	35	0,7
2"	50	110	45	38	100	45	80	92	40	1,1
2 1/4"	57	125	55	45	100	50	85	98	45	1,4
2 1/2"	63	135	60	50	110	55	95	110	50	1,9
2 3/4"	70	145	65	52	115	55	105	121	55	2,4
3"	75	160	70	57	125	65	110	127	60	2,9
3 1/4"	82	180	75	63	135	70	120	139	65	3,8
3 1/2"	90	190	85	70	145	75	130	139	65	3,8
3 3/4"	95	205	90	75	160	80	135	159	75	5,2
4"	100	220	95	80	180	90	145	167	80	6,4
4 1/4"	110	235	105	82	185	95	155	179	85	7,6
4 1/2"	115	245	110	90	190	100	165	191	90	9,1
4 3/4"	120	260	115	95	205	105	175	202	95	10,9
5"	125	290	120	100	220	110	180	208	100	11,8
5 1/4"	130	290	120	105	235	115	190	219	105	13,9
5 1/2"	140	300	135	110	235	120	200	231	110	16,1
5 3/4"	145	300	140	115	245	130	210	242	115	18,8
6"	150	320	145	120	260	135	220	254	120	21,5
6 1/4"	160	340	145	125	270	145	235	271	125	25,4
6 1/2"	165	350	145	130	280	155	245	283	130	29,6

⊗

Grundlage der Tabellenwerte für zulässige Belastungen F_{zul} sind Streckgrenzwerte von 235 N/mm² bei S 235 JRG2/RST 37 und 355 N/mm² bei S 355 J0/ St 52-3.
Bei größeren Durchmessern sind die Streckgrenzwerte bei der Angabe der zulässigen Belastung nicht abgemindert.

These values of safe working loads for round steel tie rods are based on yield strength values of 235 N/mm² at S 235 JRG2/RST 37 and 355 N/mm² at S 355J0/ St 52-3.
At larger diameters the safe working loads are specified without any reduction.

RAMBØLL

sag nr.		udarb.:	dato:	side:
963324	ANCHORING	JLS	1997-01-31	14
		kontrol:	dato:	

Fixing and anchoring to existing concrete slab:

Anchor force 263.7 kN/m

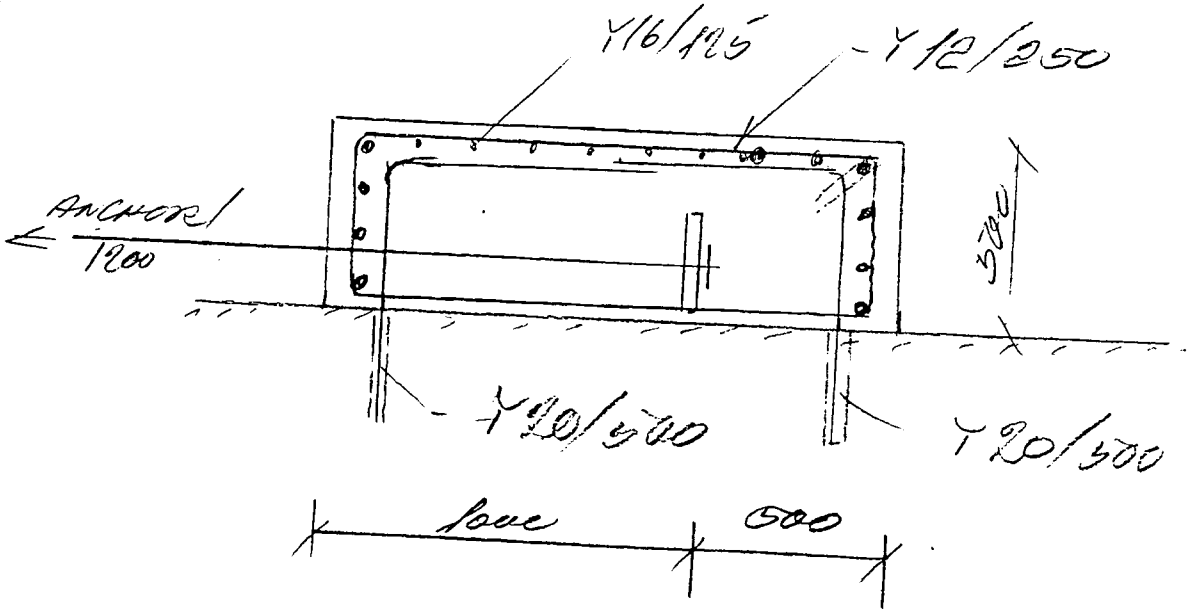
Reinforcement anchor to existing slab:

$$\Sigma = \frac{F}{A} \leq \frac{f_{yd}}{\gamma_3} \Rightarrow$$

$$\frac{263.7 \times 10^3}{A} \leq \frac{393}{\gamma_3} \Rightarrow$$

$$A \geq 1162 \text{ mm}^2/\text{m}$$

4 Y 20/m $A = 1260 \text{ mm}^2/\text{m}$



Appendix 4

Cost Estimates and Bill of Quantities

Cost Estimates

COST ESTIMATES, BAKU FERRY TERMINAL

Alternative: Option 1
Phase 1: Shore end of the ramp maintained, no raising of railway yard
Final Stage: Shore end of the ramp raised, raising of complete railway yard, raising of existing road

Pos. No	Description of works	Implementation costs		Annual maintenance, costs			Average economic lifetime, years
		Phase 1 (in 1000 USD)	Additional Final Stage (in 1000 USD)	%	Phase 1 (in 1000 USD)	Final stage (in 1000 USD)	
01.	**Terminal area arrangement**						
01.1	Land purchase	0	-	0			-
01.2	Demolition	479	50	0	0	0	-
01.3	Reclamation	396	-	0	0	-	50
01.4	Land raising/levelling	540	192	0	0	-	50
01.5	Roads, internal, new	2096	385	1,5	31,44	37,215	25
01.6	Roads, internal, repair	182	-	0	0	-	-
01.7	Access road	351	-	1,5	5,265	-	25
01.8	Utilities (drain, water, power, telph)	202	40	2,5	5,05	6,05	25
01.9	Lighting, fencing, walls etc.	111	50	2,5	2,775	4,025	25
	Subtotal	4357	717				
02	**Marine works**						
02.1	Central pier	5059	-	1	50,59	-	40
02.2	Finger pier	1044		1	10,44	10,44	40
02.3	Access bridge	641	100	1	6,41	7,41	25
02.4	Ramp/ tower supports	1936	40	1	19,36	-	40
02.5	Coastal embankment	338	50	0,75	2,535	2,91	50
	Subtotal	9018	190	1,75	157,815	161,14	
03	**Ramps rehabilitation**						
03.1	Link spans	2395	-	2	47,9	-	30
03.2	Machinery	500	-	3	15	-	20
03.3	Control system	620	-	2,5	15,5	-	20
03.4	Tower superstructure	375	-	2	7,5	-	30
	Subtotal	3890					
04	**Railway works**						
04.1	Dismantling works	-	81		-	-	-
04.2	Earthworks, 0/87100 m3	-	773		-	-	50
04.3	Centralised switches' and signals' control system, 0/43 sets	-	376	2,5	-	9,4	20
04.4	Paving works, 900/900 m2	32	32	1,5	0,48	0,96	25
	Railway works, final stage 7900 l m:						
04.5	Ballasting of the tracks, 0/14235 m3	-	285	0,75	-	2,1375	40
04.6	Laying of the railway tracks from new rails R-50 and RC sleepers, 0/5520 m	-	1168	1,5	-	17,52	20
04.7	The same, from old rails R-50 and new RC sleepers, 0/2380 m	-	257	1,5	0 -	0 3,855	20
04.8	Installation of the switches and signals, 0/43 sets	-	239	2	0	0 4,78	20
04.9	Not guarded crossings, 3/0 sets	30	-	2	0,6	-	20
	Subtotal	62	3211				
05	**Passenger terminal**						
05.1	Structural works	295	908	1,5	4,425	18,045	30
05.2	Installation	87	228	2,5	2,175	7,875	25
	Subtotal	382	1136				

06	**Border control terminal**						
06.1	Structural, building	112	-	1,5	1,68	-	30
06.2	Structural, sheds	76	0	2	1,52	1,52	30
06.3	Installation	35	0	2,5	0,875	0,875	25
	Subtotal	223	0				
07	**Ticketing terminal**						
07.1	Structural, building	54	-	1,5	0,81	-	30
07.2	Structural, sheds	26	-	2	0,52	-	30
07.3	Installation excl. heat exch. instal.	6	-	2,5	0,15	-	25
07.4	Heat exchanger installation	11	-	2,5	0,275	-	25
	Subtotal	97	0				
08	**Public service building**						
08.1	Structural	76	0	1,5	1,14	1,14	30
08.2	Installation, incl. kitchen	22	0	2,5	0,55	0,55	25
	Subtotal	98	0				
09	**Passenger bridge**						
09.1	Structural works (90/110 m)	180	220	1,5	2,7	6	30
	Subtotal	180	220				
	Summary works						
	Terminal Area Arrangement	4357	717				
	Marine Works	9018	190				
	Ramp Rehabilitation	3890	0				
	Railway Works	62	3211				
	Terminal Building Works	980	1356				
	Subtotal	18307	5474				
	Contingency for unforeseen ramp works (if the ramps in general are suffering from fatique)	1500					
	Total works	19807					
	Additional Activities						
	Site surveys, topo, bathy	30					
	Site surveys, soil	100					
	Supervision of works (20 months)	890					
	Total, additional services	1020					
	Contingency, price variation 10%	2.083					
	GRAND TOTAL	22.910					

COST ESTIMATES, BAKU FERRY TERMINAL

Alternative: Option 2
Phase 1: Shore end of the ramp raised, minimum raising of railway yard
Final Stage: Shore end of the ramp raised, raising of complete railway yard, raising of existing road

Pos. No	Description of works	Implementation costs		Annual maintenance, costs			Average economic lifetime, years
		Phase 1 (in 1000 USD)	Additional Final Stage (in 1000 USD)	%	Phase 1 (in 1000 USD)	Final stage (in 1000 USD)	
01.	**Terminal area arrangement**						
01.1	Land purchase	0	-	0			-
01.2	Demolition	479	50	0	0	0	-
01.3	Reclamation	396	-	0	0	-	50
01.4	Land raising/levelling	550	182	0	0	-	50
01.5	Roads, internal, new	2246	365	1,5	33,69	39,165	25
01.6	Roads, internal, repair	182	-	0	0	-	-
01.7	Access road	351	-	1,5	5,265	-	25
01.8	Utilities (drain, water, power, telph)	202	40	2,5	5,05	6,05	25
01.9	Lighting, fencing, walls etc.	111	50	2,5	2,775	4,025	25
	Subtotal	4517	687				
02	**Marine works**						
02.1	Central pier	5059	-	1	50,59	-	40
02.2	Finger pier	1044		1	10,44	10,44	40
02.3	Access bridge	641	0	1	6,41	6,41	25
02.4	Ramp/ tower supports	1946	0	1	19,46	-	40
02.5	Coastal embankment	380	0	0,75	2,85	2,85	50
	Subtotal	9070	0	1,75	158,725	158,725	
03	**Ramps rehabilitation**						
03.1	Link spans	2395	-	2	47,9	-	30
03.2	Machinery	500	-	3	15	-	20
03.3	Control system	620	-	2,5	15,5	-	20
03.4	Tower superstructure	375	-	2	7,5	-	30
	Subtotal	3890					
04	**Railway works**						
04.1	Dismantling works	7	81		-	-	-
04.2	Earthworks, 4700/83400 m3	37	736		-	-	50
04.3	Centralised switches' and signals' control system, 4/39 sets	35	341	2,5	-	8,525	20
04.4	Paving works, 900/900 m2	32	32	1,5	0,48	0,96	25
	Railway works, 480/7900 l m:						
04.5	Ballasting of the tracks, 930/13800 m	19	275	0,75	-	2,0625	40
04.6	Laying of the railway tracks from new rails R-50 and RC sleepers, 480/5040 m	101	1067	1,5	1,515	16,005	20
04.7	The same, from old rails R-50 and new RC sleepers, 0/2380 m	-	257	1,5	0 -	0 3,855	20
04.8	Installation of the switches and signals, 4/39 sets	36	203	2	0 0,72	0 4,78	20
04.9	Not guarded crossings, 3/0 sets	30	-	2	0,6	-	20
	Subtotal	297	2992				
05	**Passenger terminal**						
05.1	Structural works	295	908	1,5	4,425	18,045	30
05.2	Installation	87	228	2,5	2,175	7,875	25
	Subtotal	382	1136				

06	**Border control terminal**						
06.1	Structural, building	112	-	1,5	1,68	-	30
06.2	Structural, sheds	76	0	2	1,52	1,52	30
06.3	Installation	35	0	2,5	0,875	0,875	25
	Subtotal	223	0				
07	**Ticketing terminal**						
07.1	Structural, building	54	-	1,5	0,81	-	30
07.2	Structural, sheds	26	-	2	0,52	-	30
07.3	Installation excl. heat exch. instal.	6	-	2,5	0,15	-	25
07.4	Heat exchanger installation	11	-	2,5	0,275	-	25
	Subtotal	97	0				
08	**Public service building**						
08.1	Structural	76	0	1,5	1,14	1,14	30
08.2	Installation, incl. kitchen	22	0	2,5	0,55	0,55	25
	Subtotal	98	0				
09	**Passenger bridge**						
09.1	Structural works (90/110 m)	180	220	1,5	2,7	6	30
	Subtotal	180	220				
	Summary works						
	Terminal Area Arrangement	4517	687				
	Marine Works	9070	0				
	Ramp Rehabilitation	3890	0				
	Railway Works	297	2992				
	Terminal Building Works	980	1356				
	Subtotal	18754	5035				
	Contingency for unforeseen ramp works (if the ramps in general are suffering from fatique)	1500					
	Total works	20254					
	Additional Activities						
	Site surveys, topo, bathy	30					
	Site surveys, soil	100					
	Supervision of works (20 months)	890					
	Total, additional services	1020					
	Contingency, price variation 10%	2.127					
	GRAND TOTAL	23.401					

COST ESTIMATES, BAKU FERRY TERMINAL

Alternative: Option 3
Phase 1=
Final Stage: Shore end of the ramp raised, raising of complete railway yard, raising of existing road

Pos. No	Description of works	Implementation costs		Annual maintenance, costs			Average economic lifetime, years
		Phase 1 (in 1000 USD)	Additional Final Stage (in 1000 USD)	%	Phase 1 (in 1000 USD)	Final stage (in 1000 USD)	
01.	**Terminal area arrangement**						
01.1	Land purchase	0	0	0			-
01.2	Demolition	549	0	0	0	0	-
01.3	Reclamation	396	0	0	0	0	50
01.4	Land raising/levelling	732	0	0	0	0	50
01.5	Roads, internal, new	2611	0	1,5	39,165	39,165	25
01.6	Roads, internal, repair	182	0	0	0	0	-
01.7	Access road	351	0	1,5	5,265	5,265	25
01.8	Utilities (drain, water, power, telph)	262	0	2,5	6,55	6,55	25
01.9	Lighting, fencing, walls etc.	161	0	2,5	4,025	4,025	25
	Subtotal	5244	0				
02	**Marine works**						
02.1	Central pier	5059	0	1	50,59	50,59	40
02.2	Finger pier	1044	0	1	10,44	10,44	40
02.3	Access bridge	641	0	1	6,41	6,41	25
02.4	Ramp/ tower supports	1946	0	1	19,46	19,46	40
02.5	Coastal embankment	380	0	0,75	2,85	2,85	50
	Subtotal	9070	0	1,75	158,725	158,725	
03	**Ramps rehabilitation**						
03.1	Link spans	2395	0	2	47,9	47,9	30
03.2	Machinery	500	0	3	15	15	20
03.3	Control system	620	0	2,5	15,5	15,5	20
03.4	Tower superstructure	375	0	2	7,5	7,5	30
	Subtotal	3890					
04	**Railway works**						
04.1	Dismantling works	88	0		0	0	-
04.2	Earthworks, 87100 m3	773	0		0	0	50
04.3	Centralised switches' and signals' control system, 43 sets	376	0	2,5	9,4	9,4	20
04.4	Paving works, 900 m2	32	0	1,5	0,48	0,48	25
	Railway works, final stage 7900 l m:						
04.5	Ballasting of the tracks, 14235 m3	285	0	0,75	2,1375	2,1375	40
04.6	Laying of the railway tracks from new rails R-50 and RC sleepers, 5520 m	1168	0	1,5	17,52	17,52	20
04.7	The same, from old rails R-50 and new RC sleepers, 2380 m	257	0	1,5	0 3,855	0 3,855	20
04.8	Installation of the switches and signals, 43 sets	239	0	2	0 4,78	0 4,78	20
04.9	Not guarded crossings, 3 sets	30	0	2	0,6	0,6	20
	Subtotal	3248	0				
05	**Passenger terminal**						
05.1	Structural works	1203	0	1,5	18,045	18,045	30
05.2	Installation	315	0	2,5	7,875	7,875	25
	Subtotal	1518	0				

06	**Border control terminal**						
06.1	Structural, building	112	0	1,5	1,68	1,68	30
06.2	Structural, sheds	76	0	2	1,52	1,52	30
06.3	Installation	35	0	2,5	0,875	0,875	25
	Subtotal	223	0				
07	**Ticketing terminal**						
07.1	Structural, building	54	0	1,5	0,81	0,81	30
07.2	Structural, sheds	26	0	2	0,52	0,52	30
07.3	Installation excl. heat exch. instal.	6	0	2,5	0,15	0,15	25
07.4	Heat exchanger installation	11	0	2,5	0,275	0,275	25
	Subtotal	97	0				
08	**Public service building**						
08.1	Structural	76	0	1,5	1,14	1,14	30
08.2	Installation, incl. kitchen	22	0	2,5	0,55	0,55	25
	Subtotal	98	0				
09	**Passenger bridge**						
09.1	Structural works (200 m)	400	0	1,5	6	6	30
	Subtotal	400	0				
	Summary works						
	Terminal Area Arrangement	5244	0				
	Marine Works	9070	0				
	Ramp Rehabilitation	3890	0				
	Railway Works	3248	0				
	Terminal Building Works	2336	0				
	Subtotal	23788	0				
	Contingency for unforeseen ramp works (if the ramps in general are suffering from fatique)	1500					
	Total works	25288					
	Additional Activities						
	Site surveys, topo, bathy	30					
	Site surveys, soil	100					
	Supervision of works (23 months)	1022					
	Total, additional services	1152					
	Contingency, price variation 10%	2.644					
	GRAND TOTAL	29.084					

EXAMPLE OF THE COST ESTIMATE VARIATION
DEPENDING ON UTILISATION OF LABOUR POWER
FROM DIFFERENT COUNTRIES

B.08 Public Service Building
General construction costs - 76450 USD, including direct costs 76450 USD:1,5 USD=50967 USD
K=1,5 includes other costs and profits of the Contractor from the direct costs

Pos. No	Direct costs	including			% of wages from direct costs	Increase of the costs
		Materials and Equip.	Wages	Labour		
1	**50964**	46377	4587	The local labour resourses when their monthly wage is equal to 250 USD	9	-
2	**64725**	46377	18348	The labour resourses from Asian countries (Turkey, India, China) when the costs are equal to 1000 USD per month for 1 employee (incl. salary, travels, life)	28,3	K=1,25
3	**138117**	46377	91740	The European labour resourses when the costs are equal to 5000 USD per month for 1 employee	66,4	K=2,7

The costs of a local contractor taken into account when the local labour is utilised

Pos. No	Names of the costs	Justification	% to the direct costs
1	New construction when an active enterprise is being renovated	GOSSTROY no 43/62 10.04.1986	5
2	Overhead expenses (adminstrative-economic, expenses for arrangement of works; expenses for service of the workers	GOSSTROY no 8A-6484-4 15.12.1983	18
3	Planned stocks (normative profit-payments to the budget and pension fund, increase of the own working capital, payments for bank loan)	GOSSTROY no 4-225 28.02.1983	8
4	Temporary buildings and facilities for sea ports and port structures	SNiP 4.09.91	5,4
5	Wind zone in Baku and Turkmenbashi	GOSSTROY no 47-OCH-4 24.04.1979	1,1
6	Awarding of prises for introduction the unit into operation	GOSSTROY no 1336 ВКП-Д 10.10.1991	1,85
7	"Payment by the job" system of paid labour	GOSSTROY no 44-Д 30.11.1988	2,2
8	Costs for rewards for long work	GOSSTROY no 44-Д 30.11.1988	1
9	Costs for covering of expenses related with additional holidays	GOSSTROY no 44-Д 30.11.1988	0,4
	Coming from the above, coefficient to the direct costs for covering of the expenses and the profit of the Contractor will be: 1,05*1,18*1,08*1,054*1,011*1,0185* *1,022*1,01*1,004=	1,5	
	Besides, it is necessary to include into the costs the following:		
	a) contingency	SNiP1.02.01-85	7
	b) technical supervision	GOSSTROY no 79 25.03.1983	0,7
	c) author's supervision	GOSSTROY no 49 24.04.1986	0,2

2. PROJECT CRITERIA

2.1 Construction cost estimate

According to SNiP IV - 16 -84 the jastification for determination of the cost estimation of construction is:

a) Working documentation of detailed design, including drawings, lists of volume of construction and installation works, specifications and list of equipment;

b)Main decisions of organisation and phased development of construction, accepted in the project of construction organisation;

c) Explanatory notes for project materials;

d) Valid estimate norms developed on the base of part IV of Construction Norms and Rules(SNiP) "Estimate Norms and Rules";

e) Separate decisions of local State Authority concerning the corresponding construction.

2.2 Forms of estimate documentation

Forms of estimate documentation accept to compile it in a certain order by gradual transition from small to bigger construction elements:

a) local estimates
b) unit (building site) estimates
c) summary estimate calculation

2.3 Local estimates

Are the initial document and are compiled for separate types of works for buildings and structures or for general site works (form No 4 SNiP-1.02.01-85 p. 82).

Local estimates for separate types of works are compiled on the basis of the following data:

a) parameters of building, structures, their parts and constructive elements accepted from the working drawings;

b) volume of works accepted from the lists of volumes of construction and installation works and defined by working drawings;

c) Nomenclatures and number of equipment, furniture and inventory, taken from the specifications made to order;

d) Valid norms for types of works, construction elements showing the expenses on works and operational costs for construction machines and mechanisms

(SNiP - 2-82) and expenses for building materials per unit of works.

e) cost of labour (salary) for builders and drivers is defined from average salary:

- for local specialists - 100-120 $ per month
- for Turkish specialists - 1100-1300 $ per month
- for specialists from Europe - 6000-8000 $ per month

д) cost of building materials has been accepted from the market prices in Baku on 1.12.96.

2.4 Direct expenses

Cost defined by local estimates includes *direct expenses*. All costs of the contractor

2.5 Estimates by types of works

Local building estimates are compiled for the following types of work:

a) general construction works
b) water-supply
c) sewerage
d) heating
e) ventilation
f) gas-supply
g) electric lighting and electric equipment
h) low currents (telephone, signalling and etc.)
i) technological equipment
j) furniture and inventory

2.6 Construction norms and rules

Local estimates are compiled according to the following construction norms and rules:

1. General construction works - united regions and unitary valuation (URUV)(EPEP$_{russian}$) collections IV 1÷15, 22÷34,45,46,47,48 - Snip IV-5-82

2. Sanitary works - URUV (EPEP$_{russian}$) collections No16 : 20 SNiP IV - 5-82

3. Works for hydrotechnical structures- URUV collections No36÷41 SNiP IV-5-82

4. Coast protection works - URUV collections No 42 SNiP-IV-5-82

5. Under-water construction works - URUV collections No44 SNiP-IV-5-82

6. Electric-installation works VIE (valuation for installation equipment) (PMO$_{russian}$)

- No8 SniP-IV-6-82

7. Low currents (telephone, radio, signalling, control communication) VIE No10.1 SNiP IV- 6-82

8. Automatic and signalling devices - VIE No 11 SNiP - IV - 6-82

9. Technological pipelines - VIE No 12 IV - 6-82

10. Technological equipment - VIE No 1÷7 SNiP - IV -6-82

11. Collections of element estimate norms for construction structures and works 1÷volume 9 SNiP IV-2-82

12. Collections of operational costs for construction machines SNiP - IV - 3-82

13. Collections of average estimate prices of regions for materials, wares and structures section I, II, III, IV, V. SNiP - IV - 4 -82

14. Collections of estimate norms of expenses for equipment and inventory SNiP - IV - 13 - 84

15. Expenses norms for materials on railway. air, sea, motor-car transport units - SNiP 5.01.17-85

2.7. Building site estimate

Local estimate data are summarized in the building site estimate with the grouping by works and expenses on "construction works", "installation works", "equipment, furniture and inventory" (form No 3 SNiP - 1.02, 01-85 p.81).

2.8 Summary estimate calculation

Building site estimate and local estimate data for separate types of works are summarised in the summary estimate calculation (form 1 SNiP - 1.02, 01-85)

2.3 Chapters of summary estimate calculations

In summary estimate calculations cost of construction is divided into the following chapters:

1. Preparation of territory for construction
2. Main construction units (building sites)
3. Subsidiary units (building sites)
4. Power supply units (building sites)
5. Units (building sites) for transport and communication

6. External nets and installations
7. Improvement and planting of the territory
8. Temporary buildings and structures
9. Other works and expenses
10. Maintenance of the management of the enterprise constructed
11. Preparation of operational personnel
12. Design and survey works

According to SNiP1.02.01.-85, unforeseen works and expenses are included into the total of summary estimate calculation:

a) on individual design	5% from total cost of these units (building sites)
b) on standard and using repeatedly designs	2% from total cost of these units (building sites)
c) on engineering nets and improvement	3% from total cost of these units (building sites)

2.10 Coefficients of norms of work expenses, salary and norms of machine operation

SNiP- IV- 2-82 volume 1 "General instructions for collections"

No	Specific conditions of work execution	Coefficient
6.1	during construction works in operated buildings and structures, free of equipment and other things preventing to execute the works normally	1,2
6.2	during construction works in operated buildings and structures if in zone of work execution there are technological equipment (machines, installations, cranes)or blocking things (laboratory equipment, furniture, etc.) or transport operation along inner workshop ways	1,3
	a) the same, when working places are very cramped	1,35
	b) the same, with the unhealthy labour conditions, where the enterprise fixed the working day of 36 hours, and for builders it fixed the 42 hours working day.	1,5
6.3	during construction works in open and half-open production sites if in the execution zone there are functioning technological equipment or technological transport	1,1
	a) the same, when working places are very cramped	1,15
6.4	during construction works near units (building sites) under high voltage	1,2
6.5	during construction works in closed structures, located 3 m lower from ground surface	1,1
6.6	during construction of new units on area of active enterprises, having a branched net of transport and engineering communications and cramped conditions for material storage	1,1
	a) the same, by very cramped conditions	1,15

COST OF BUILDING MATERIALS

СТОИМОСТЬ СТРОИТЕЛЬНЫХ МАТЕРИАЛОВ

No.	Наименование материалов и изделий	Name of materials and articles	Unit of measuring Ед. измер.	Local местные		Turkey Турция	Europe Европа
				available налич.	Transfferig перечисл.		
1	Цемент	Cement	tonn	75,00	100,00		
2	Речной песок	River sand	m3	12.00	18.00		
3	Щебень	Crushed stone	m3	15.00	21.00		
4	Бетон М-100	Concrete M-100	m3	70.0	85.00		
5	М-200	М-200	m3	80.0	95.00		
6	М-250	М-250	m3	90.0	110.00		
7	М-300	М-300	m3	100.0	120.00		
8	Растворы цементные	Grout s (cement)	m3	70	85		
9	Растворы сложные	Grouts (compound)	m3	65	80		
10	Камень "кубик" 40×20×20 cm	"Cubik" stone 40×20×20 cm	pice шт.	0,15	0,25		
11	Кирпич красный 25×12×6	Red brick 25×12×6	pice шт.	0,15	0,25		
12	Кирпич огнеупорный 25×12×6	Fire-brick 25×12×6	pice шт.				
13	Блоки керамические пустотелые	Ceramic hollow blocks					
14	Сб. ж/б сваи	Reinforced concrete (R/C) assembling piles	lenear m п/м				
15	Сб. ж/б плиты перекрытия	Reinfofoced	m2				
16	Сб. ж/б перемычки	R/C assembling crosspices	m3				
17	Сб. ж/б ступни	R/C concrete assembling foots	lenear m п/м				
18	Вент.блоки 40×20×20 см	Ventilation blocks	pice шт.				
19	Арматура	Rainforcement steel	tn	400.00			
20	Металл. профиль	Metallic profile	tn	400.00			
21	Алюмин. профнастил	Aluminium profile planking	m3				
22	Лесоматериал	Timber	m3	200.00			
23	Паркет	Parquet	m2	20.0			
24	Метлах	Ceramic tiles	m2	15.0			22.0
25	Мрамор	Marble	m2	50.0			65.0
26	Ковролит	Carpet covering	m2				17.0
27	Витражи алюминевые	Aluminium stained-glasses	m2				

No.	Наименование материалов и изделий	Name of materials and articles	Unit of measuring Ед. измер.	Local местные		Turkey Турция	Europe Европа
				available налич.	Transfferig перечисл.		
28	Окна алюминевые	Aluminium windows	m2				
29	Двери алюминевые	Aluminium doors	m2				
30	Двери полированные	Polish doors	m2				
31	Стекло 6мм зеркальное	Plate glass 6 mm	m2		60.0		
32	Стекло 4мм	Glass 4 mm	m2		18.0		
33	Стекло 6мм	Glass 6 mm	m2		30		
34	Стекло 8 мм	Glass 8 mm	m2		60.0		
35	Двери стеклянные из сталинита	Glass doors from stalinit ?	m2				
36	Стеклорубероид - 10 м/р	Roofing/tarred felt	roll рулон				
37	Битум	Bitumen	tn				
38	Камень "бут"	"But" stone	m3				
39	Кафель	Duch tile	m2				
40	Гранит	Granite	m2		150.00		14
41	ДСП-MDF-30 2,8×2.22	DSP-MDF-30 (pressed sawdust) 2,8×2.22	sheet лист		125.00		
42	ДСП-MDF-18	DSP-MDF-18 (pressed sawdust)	sheet лист		115		
43	ДСП-MDF-1	DSP-MDF-1 (pressed sawdust)	sheet лист		80.00		
44	ДСП-MDF-8	DSP-MDF-8 (pressed sawdust)	sheet лист		60.00		
45	ДСП-MDF-4	DSP-MDF-4 (pressed sawdust)	sheet лист				
46	Повесные потолки	Hanging sills	m2				22.0
47	Лампы "SPOT" для подвесного потолка	"SPOT" lamps for hanging sills	к-т				
48	Травертин	Travertitin	m2				
49	Краски масляные	Oil-colours	kg		3.50		
50	Краски водостойкие	Water proof colours	kg		3.00		
51	Лаки	Varnishes	kg		4.00		7.00
52	Растворитель	Solvent	kg		2.0		
53	Олифа	Drying oil	kg				
54	Обои 5м2/р	Wall paper 5m2/r	roll рулон				15.0
55	Краски водо-эмульстонные	Water-emulsion colours	kg				
56	Краски фасадные	Facade colours	kg				
57	Гравий	Gravel	m3				

No.	Наименование материалов и изделий	Name of materials and articles	Unit of measuring Ед. измер.	Local местные		Turkey Турция	Europe Европа
				available налич.	Transfferig перечисл.		
58	Асфальт	Asphalt	tn				
59	Асфальто-бетон	Asphalt-concrete	tn				
60	Бордюры	Bordes	linear m п/м				
61	Песок природный	Natural sand	m3				
62	Алебастр	Alabaster	kg				
63	Известь	Lime	tn				
64	Покрытие металлических структур панелями "Севиндж"	Covering of metallic structures by "Sevindj" panels	m3				
65	Маты стекловатные	Silicate cotton mats	m3				75.0
66	Оцинкованная кровельная сталь	Galvanized roffing steel	tn				
67	Плиты облицовочные "Известняк" толщ. 4см	Facing tiles "Izvestniak" thickness 4cm	m2				
68	Рельсы ж/б	R/C rails	linear m п/м				
69	Шпалы ж/б	R/C sleepers	pice шт				
70	Витражи Pimopen (без стекол)	Stained-glass panel Pimopen (without glasses)	m2	80			
71	Окна "Pimopen"	"Pimopen" windows	m2	220			
72	Двери "Pimopen"	"Pimopen" Doors	m2	260			
73	Перегородки раздвижные "Pimopen"	"Pimopen" expanding partitions	m2	120			
74	Стекло "Севинч" 4×4	"Sevindj" glass 4×4	m2		52		
75	Оргстекло 1,25×1,85	Organic glass	piece шт				50.0
76	Пластик 1,22×2,44	Plastic material 1,22×2,44	pice шт				165
78	Шпаклевка	Patty	kg		1,0		1,20
79	Штукатурка декоративная	Decorative plaster	kg		6.0		
80	Гипсолит 120×250см	Plaster blocks 120×250cm	pice шт		16.0		
81	Клей для кафеля	Glue for Duch tile	kg				
					0.75		
82	Нитрокраски	Nitro-colours	kg		6.0		
83	Асбошифер	Asbestos slate	sheet лист				

Representative Bill of Quantities

BILL No.: B05.1 Passenger Terminal

Item No.	Description	Unit	Quantity	Unit price in USD	Total price in USD
03	**Earthworks, dredging**				
03.001	Levelling of the pile area	100 m2	11.25		
03.002	Mining of the II group soil in cuts by excavator with a scoop volume of 0,65 m3 with loading upon trucks	1000 m3	0.565		
03.003	Soil transportation to the site at dist. of 28 km	t	989.0		
03.004	Filling of the soil under floors with relocation by 0.65 m3 excavator	1000 m3	0.565		
03.005	Manual soil relocation when it is being filled under the floors	100 m3	1.41		
03.006	Manual levelling of the filling area	100 m2	3.14		
03.007	Soil compaction by air tampers	100 m3	5.65		
04	**Stone and rubble works**				
04.001	Rubble base with a thickness of 10 cm under a strip foundation	m3	19.8		
04.002	Soil compaction by rubble under floors	100 m2	2.74		
05	**Pile works**				
05.001	Driving of 10 m long RC piles with sec. of 30x30 cm by diesel hammer on excavator, II group soils- 84 pieces	m3 of piles	75.6		
05.002	Felling of concrete out of reinforcement frame of RC piles	piles	84		
06	**Concrete works**				
06.001	Concrete blinding with thickness of 10 cm under foundations of concrete B-7.5	m3	15.8		
06.002	RC strip foundations of concrete B-25	m3	52		
06.003	Monolithic RC posts of concrete B25	m3	24.5		
06.004	Monolithic RC girders of concrete B25	m3	65.0		
06.005	Monolithic RC reinforcement of parapet from concrete B-15	m3	10.2		
06.006	Monolithic RC belt of concrete B-15	m3	4.8		
06.007	Monolithic RC parts of floors from concrete B-15	m3	2.8		
06.008	Installation of precast RC hollow slabs of floors 1ПК59.10-8Ат.С9 1ПК59.12-8Ат.С9	 piece piece	 37 40		
06.009	8 cm thick concrete blinding of concrete B7.5 under floors	m3	21.92		
06.010	Concrete blinding under ducts, squares and steps from concrete B7.5	m3	16.0		
06.011	Installation of concrete steps for staircases and stair platforms	linear m	60.8		
06.012	Monolithic RC floors of concrete B15	m3	0.4		
06.013	The same, of concrete B25	m3	10.5		
06.014	Installation of precast RC slabs for ducts, type ПТ12.5-8.6	piece	114		
07	**Masonry works**				

07.001	Foundation walls of "kubik" stones, 39 cm thick on mortar M-50	m2	109.5		
07.002	Horizontal wall insulation by cement mortar, 20 mm thick	100 m2	0.63		
07.003	Side insulation of foundation walls with cement mortar	100 m2	2.19		
07.004	The same, with bitumen in 2 times	100 m2	2.19		
07.005	Outside walls of "kubik" stones, 39 cm thick, on mortar M-50	m2	191.5		
07.006	Filling of frame walls with hollow bricks, 12 cm thick	m2	40.8		
07.007	Partitions of bricks, 12 cm thick	m2	273.4		
07.008	Porch walls of "kubik" stones, 19 cm thick	m2	12.8		
07.009	Duct walls of "kubik" stones, 19 cm thick	m2	86.8		
07.010	Side insulation of the ducts with cement mortar	100 m2	0.35		
07.011	The same, with bitumen in 2 times	100 m2	0.35		
08	**Steel works**				
08.001	Reinforcing of monolithic RC structures	t	23,574		
08.002	Installation of steel angles □63 in duct corners	t	0.063		
08.003	Steel frame from angles No 63 for piers	t	1.0		
08.004	Steel frame from U-profile No 16 for air conditioner on the roof	t	0.284		
08.005	Steel bridgeboards from U-profile □20	t	0.515		
08.006	Steel stair grids with railings	linear m	6.0		
08.007	Pipe scaffolding for finishing works	100 m2	6.97		
09	**Carpentry, roofing works**				
09.001	Water insulation of one bitumenous felt layer	100 m2	3.0		
09.002	Heater of expanded clay, 8-14 cm thick	m3	33.0		
09.003	Cement blinding, 30 mm thick	100 m2	3.0		
09.004	Roofing of 3 layers of fibre glass bitumenous felt	100 m2	3.0		
09.005	Cement blinding of 20 mm under floors	100 m2	7.95		
09.006	Water insulation from two layers of mastic compound under floors	100 m2	2.74		
09.007	Blinding of expanded clay concrete, 40 mm thick	100 m2	2.97		
09.008	Floor covering of clay tiles	m2	37.1		
09.009	Floor covering from parquet about plank deck	m2	48.5		
09.010	Covering of floors and squares with marble tiles	m2	568.7		
09.011	Sand bedding under porch floors	m3	28.5		
09.012	Covering of steps with marble plates	m2	37.2		
10	**Joinery works**				
10.001	Installation of stained glass windows from PEMOPEN, glazed with 6mm glass and dimensions 5.6x3.3 m (1.4x3.3+4.2x2.8) m 5.6x2.8 m 2.8x2.8 m	piece piece piece piece	5 2 1 2		
10.002	Installation of stained glass windows from PEMOPEN, glazed with 6 mm glass and door block of 15 mm tempered glass, dimensions 5.6x3.3 m (door 1.6x2.2) 4.2x3.3 m (door 2.2x2.2x2)	шт. шт.	2 1		
10.003	Installation of stained glass windows from PEMOPEN, glazed with insulated glass unit				

	4x4 mm, dimensions				
	1.4x0.9	piece	8		
	1.4x0.5	piece	8		
	3.3x0.7	piece	8		
	3.3x1.4	piece	4		
	1.5x0.7	piece	8		
	1.5x1.4	piece	4		
10.004	Installation of blind partition from PEMOPEN, glazed with 6 mm glass, dimensions 11.6x3.3	piece	1		
10.005	The same, with window of dimensions				
	5.6x3.3	piece	1		
	1.0x3.3	piece	1		
10.006	Installation of burnished door blocks with				
	lock ДГ21-9=8 шт	m2	15.2		
	lock ДГ21-8=2 шт	m2	3.6		
10.007	Installation of plastic door blocks in lavatory cabins, 1.6x0.8=6 pieces	m2	7.7		
10.008	Partitions in the lavatory cabins	m2	21.6		
10.009	Installation of barrier in ticketing cabin with doors and folding board	linear m	10.4		
11	**Finishing works**				
11.001	Finishing of ceilings for painting	100 m2	0.43		
11.002	Improved plastering of inside walls	100 m2	4.57		
11.003	Facing of walls with encaustic tiles	m2	129.9		
11.004	Improved plastering of inside window and door and door reveals	100 m2	0.43		
11.005	Installation of suspended ceiling PRONTO	m2	503.9		
11.006	The same, from coloured glass in lavatories	m2	23.0		
11.007	Improved water-emulsion painting of ceilings about concrete and of the suspended ceiling	100 м2	5.47		
11.008	Improved oil painting of the walls	100 m2	3.27		
11.009	Facing of walls with marble tiles	m2	314.2		
11.010	The same, of columns	m2	78.6		
11.011	Improved oil painting of staircase grids	m2	6		
11.012	The same, of wooden plinths	m2	5		
11.013	Plastering of walls and bottoms of ducts with cementation	100 m2	1.12		
11.014	Oil painting of metallic structures	100 m2	0.25		
11.015	Plastering of outside walls with loamy-stone tiles, plinth	m2	38.7		
11.016	High quality plastering of facade walls and entrance to the basement	100 m2	4.21		
11.017	Perchlorumvynil painting of facade walls	100 m2	6.97		
11.018	High quality plastering of facade slopes	100 m	1.84		
11.019	Plastering of bridge boards along net	m2	14.0		
12	**Electrical installations/controls**				
	Power supply				
12.001	Distribution box ПР II-3048-21У3	pieces	1		
12.002	Consumer's meter-board ЩКИ-8504-УХЛ	pieces	1		
12.003	Group meter-board for lighting ОЩВ-12АУХЛУ	pieces	2		
12.004	Photo-relay with transmitter ФР-2	pieces	3		
12.005	Installation of ceiling lamps with 4 luminescent lamps	pieces	6		
12.006	Installation of wall lighting fittings with 4 luminiscent lamps	pieces	1		
12.007	Installation of wall lighting fittings with 4				

	luminiscent lamps in suspended ceilings	pieces	49		
12.008	Installation of the ceiling lighting fittings with glow lamps	pieces	14		
12.009	Installation of wall lighting fittings with glow lamps	pieces	1		
12.010	Installation of the ceiling lighting fittings with glow lamps, suspended ceiling	pieces	2		
12.011	Installation of lighting fittings with glow lamps, sconce type	pieces	13		
12.012	Installation of lighting fittings with glow lamps, for outside lighting	pieces	6		
12.013	Lighting plastic boxes УПК-4	pieces	80		
12.014	Outlets for hidden electric wires	100 pieces	0.12		
12.015	Outlets for hidden wires with earthing contact	100 pieces	0.02		
12.016	Switches for hidden wires	100 pieces	0.06		
12.017	Installation of steel supports "Torsher" type from pipes with d=50 mm	pieces	6		
12.018	Laying of viniplastic pipes with d=20 mm along the wall	100 m	0.63		
12.019	The same, in pipes of 50 mm	100 m	0.06		
12.020	Open laying of АПВ-type wire with the sec. of 2.5 mm2 above suspended ceiling	100 m	13.94		
12.021	The same, in hollows of slabs	100 m			
12.022	Tie of АПВ-type wire with sec. 2.5 мм2 in a pipe	100 m	0.33		
12.023	Laying of АППВ-type wire with sec.2x2.5 mm2 under plaster	100 m	0.5		
12.024	Laying of АВРГ-type wire with sec. 2x2.5 mm2 on buckles	100 m	1.49		
12.025	The same, sec. 4x2.5 mm2	100 m	0.22		
12.026	Laying of АВРГ-type wire with sec. 4x2.5 mm2 in pipes	100 m	0.13		
12.027	The same, sec. 4x4 mm2	100 m	0.03		
12.028	The same, sec. 3x10+1x6 mm2	100 m	0.15		
12.029	The same, sec. 3x16+1x10 mm2	100 m	0.1		
12.030	Ceiling lighting fitting with luminiscent lamps УСПБ-4x40	pieces	6		
12.031	The same, wall typeЛП003-4x40	pieces	1		
12.032	The same, for suspended ceiling Л104Б-4x20 Л104Б-4x40	 pieces pieces	 41 8		
12.033	Luminiscent lamps ЛБ-20 ЛБ-40	 pieces pieces	 164 60		
12.034	Starters	pieces	224		
12.035	Ceiling lighting fittings with glow lamps НП001-40 НП001-60	 pieces pieces	 5 1		
12.036	The same, for walls НБ-005-40	pieces	1		
12.037	The same, for ceilings СПО-60	pieces	8		
12.038	The same, suspended ППР-40	pieces	2		
12.039	The same, for outside lighting НТУ01-100	pieces	6		
12.040	Sconces	pieces	13		
12.041	Glow lamps	pieces	36		
	Fire alarm system				
12.042	Installation of fire alarm station ТОЛ-10-С	pieces	1		
12.043	The same, for battery 10ЖН-60М	pieces	1		
12.044	The same, for alarm bell М3-1	pieces	1		
12.045	The same, for push-button informant ПКИЛ-9М	pieces	2		

12.046	The same, for heat transmitter of the informant ИП105-2/1	pieces	63		
12.047	Laying of ТРП type wire with sec. 1x2x0.5 mm2	100 m	3.1		
12.048	Laying of viniplastic pipes with d=20 mm along walls	100 m	0.06		
12.049	Plastic branch box	pieces	6		
12.050	Installation of wall lamp socket with lamp	pieces	1		
12.051	Installation of power supply block БП-24/4 of the station	pieces	1		
13	**Water supply/sewerage/heating**				
	Water supply				
13001	Laying of galvanized pipes, diameter 15 mm	linear m	25.0		
13002	Laying of galvanized pipes, diameter 25 mm	linear m	25.0		
13003	Test of the system	100 m	0.37		
13004	Costs for globe valves, 15кч8р diameter 15 mm	pieces	6		
13005	Costs for globe valves, 15кч8р diameter 25 mm	pieces	2		
13.006	Oil painting in 2 times	m2	7.0		
	Sewerage				
13007	Laying of cast-iron pipes, diameter 50 mm	linear m	12.0		
13008	Laying of cast-iron pipes, diameter 100 мм	linear m	65.0		
13009	Installation of the "Utro"-type faience wash-basin with a tap	set	4		
13010	WC pan installation with a cistern	pieces	6		
13011	Floor gully installation, diameter 100 mm	pieces	2		
13012	A cast-iron enamelled sink with a tap	pieces	1		
	Heating				
13.013	Installation of cast-iron radiant heaters with 15 sections, H=570 mm (Turkey)	pieces	15		
13.014	The same, 12-section	pieces	2		
13.015	The same, 10-section	pieces	1		
13.016	The same, 8-section	pieces	4		
13.017	Installation of convector РККР (Turkey), H=300 mm, l=1.32 mm	pieces	25		
13.018	Laying of steel pipes with d=15 mm	linear m	200.0		
13.019	The same, d=20 mm	linear m	116.0		
13.020	The same, d=25 mm	linear m	54.0		
13.021	The same, d=40 mm	linear m	2.0		
13.022	Test of the system	100 m	3.72		
13.023	Installation of Engineer Maevsky's air valve	pieces	2		
13.024	Cost of valve 15кч18п2, d=15 mm	pieces	4		
13.025	The same, d=20 mm	pieces	8		
13.026	The same, d=25 mm	pieces	4		
13.027	Cost of radiant heater valve, d=15 mm (Trukey)	pieces	48		
	Heat distribution point				
13.028	Laying of steel pipes with d=40 mm	linear m	6.0		
13.029	Drain pocket, d=40 mm	pieces	2		
13.030	Water flow meter ВТГ-50	pieces	1		
13.031	Control valve УРРДМ-50	pieces	1		
13.032	Thermometer	pieces	1		
13.033	Manometer	pieces	1		
13.034	Cast iron globe valve d=40 mm	pieces	4		
13.035	Oil painting of pipes	100 m2	0.06		
13.036	Painting of steel pipes with mastic compound	m2	25.0		
13.037	Pipe insulation with mineral wool boards	m3	2.7		
13.038	Covering layer of glass fibre reinforced lastics РСТ	m2	118.0		
	Ventilation				

13.039	Installation of autonomous air conditioner BIH-240 ROOFTOP (Turkey) weghing 1043 kg	pieces	1		
13.040	Installation of axial flow fan of "Five Stars" Co (Turkey), AXC-200, weghing 5 kg	pieces	1		
13.041	Ceiling grilles, sec. 500x500 (Turkey)	pieces	9		
13.042	The same, sec. 250x250	pieces	3		
13.043	Air discharge grilles PP-1, sec. 200x100	pieces	3		
13.044	Exhaust control grille P-150 sec. 450x150	pieces	6		
13.045	The same, sec. 150x150	pieces	8		
13.046	Laying of air pipelines from galvanised roof steel 0.9 mm thick, with sec. 1250x400 mm	m2	43.0		
13.047	The same, from steel 0.7 mm thick, sec. 1000x400 mm	m2	3.0		
13.048	The same, sec. 1000x250 mm	m2	13.0		
13.049	The same, sec. 900x300 mm	m2	22.0		
13.050	The same, sec. 800x400 mm	m2	7.0		
13.051	The same, sec. 800x250 mm	m2	23.0		
13.052	The same, sec. 600x250 mm	m2	80.0		
13.053	The same, sec. 500x500 mm	m2	44.0		
13.054	The same, sec. 500x200 mm	m2	79.0		
13.055	The same, sec. 500x150 mm	m2	20.0		
13.056	The same, steel 0.5 mm thick, sec. 250x250 mm	m2	2.0		
13.057	The same, sec. 200x150 mm	m2	8.0		
13.058	The same, sec. 150x150 mm	m2	1.0		
13.059	The same, round with d=200 mm	m2	10.0		
13.060	Silencers ШТП-13	pieces	4		
13.061	The same, ШТП-11	pieces	2		
13.062	Insulation of outside air pipelines with fibre glass glass batt insulation	m3	9.0		
13.063	Covering layer of foil-mastic felt	100 m2	1.47		
13.064	Cowl for the air pipeline with d=200 mm	pieces	1		
13.065	Silencer ШТП-10	pieces	4		
13.066	Flexible connectors ВГВ, d=300 mm	pieces	13		

BILL No.: 05.2 Passenger Terminal

Item No.	Description	Unit	Quantity	Unit price in USD	Total price in USD
00	General aspects				
00.001	.....				
00.002	.....				
00.003	.....				
01	Surveys, geotechnical investigations				
01.001	.....				
01.002	.....				
01.003	.....				
02	Demolition works				
02.001	.....				
02.002	.....				
02.003	.....				
03	Earthworks, dredging				
03.001	.....				
03.002	.....				
03.003	.....				
04	Stone and rubble works				
04.001	.....				
04.002	.....				
04.003	.....				
05	Pile works				
05.001	.....				
05.002	.....				
05.003	.....				
06	Concrete works				
06.001	.....				
06.002	.....				
06.003	.....				
07	Masonry works				
07.001	.....				
07.002	.....				
07.003	.....				
08	Steel works				
08.001	.....				
08.002	.....				
08.003	.....				
09	Carpentry, roofing works				
09.001	.....				
09.002	.....				
09.003	.....				
10	Joinery works				

10.001	.....				
10.002	.....				
10.003	.....				
11	Finishing works				
11.001	.....				
11.002	.....				
11.003	.....				
12	**Electrical installations/controls**				
12.001	Installation of fire alarm station ТОЛ-10-С	pieces	2		
12.002	Accumulator battery 10ЖН-60М	pieces	2		
12.003	Installation of loud ringing bell М3-1	pieces	2		
12.004	Installation of push-button informant ПКИЛ-9М	pieces	4		
12.005	Installation of heat transmitter ИП105-2/1 of the informant	pieces	200		
12.006	Laying of wire ТРП, sec. 1x2x0.5 mm2	100 m	11.0		
12.007	Laying of vinyl-plastic pipes, d=20 mm along the walls	100 m	0.25		
12.008	Plastic branch box	pieces	30		
12.009	Installation of a wall lamp socket with a lamp	pieces	2		
12.010	Installation of power supply block БП-24/4	pieces	2		
13	**Water supply/sewerage/heating**				
	Water supply				
13.001	Laying of water-gas galvanised pipes, d=15 mm	linear m	60.0		
13.002	The same, d=20 mm	linear m	28.0		
13.003	The same, d=50 mm	linear m	24.0		
13.004	Test of the system	100 m	1.12		
13.005	Water tap, d=15 mm	pieces	15		
13.006	Globe valve, d=15 mm	pieces	25		
13.007	The same, d=20 mm	pieces	8		
13.008	Installation of valve 30ч6бр, d=50 mm	pieces	4		
13.009	Oil painting in 2 times	100 m2	0.18		
	Sewerage				
13.010	Installation of an "Утро" type wash basin of faience	pieces	16		
13.011	Cast-iron WC pan, Asian type	pieces	16		
13.012	Laying of cast iron pipes, d=50 mm	linear m	48.0		
13.013	The same, d=100 mm	linear m	85.0		
13.014	The same, d=150 mm	linear m	35.0		
13.015	Wall urinals	pieces	8		
	Heating				
13.016	Installation of convectors РККР (Turkey) H=300 l=1560 мм	pieces	25		
13.017	The same, l=1320 mm	pieces	19		
13.018	The same, l=1200 mm	pieces	6		
13.019	The same, l=1080 mm	pieces	4		
13.020	The same, l=960 mm	pieces	13		
13.021	The same, l=840 mm	pieces	3		
13.022	The same, l=720 mm	pieces	2		
13.023	The same, l=480 mm	pieces	7		
13.024	Laying of steel pipes, d=15 mm	linear m	495.0		
13.025	The same, d=20 mm	linear m	634.0		
13.026	The same, d=25 mm	linear m	94.0		
13.027	The same, d=50 mm	linear m	16.0		
13.028	Test of the system	100 m2	12.39		
13.029	Valve 15кч18п2 d=20 mm	pieces	20		

13.030	The same, d=25 mm	pieces	2		
13.031	Valve for radiant heaters d=15 mm	pieces	79		
13.032	Air valve d=15 mm	pieces	6		
13.033	Installation of valves 3КЛ2-40, d=50 mm	pieces	4		
13.034	Drain pocket installation, d=50 mm	pieces	2		
13.035	Installation of water flow meter ВТГ-50, d=50 mm	pieces	1		
13.036	Installation of control valve УРРДМ-50	pieces	1		
13.037	Installation of a thermometer	pieces	2		
13.038	Manometer installation	set	2		
13.039	Laying of steel pipes, d. 57x3 мм	linear m	8.0		
13.040	Painting of uninsulated pipes with oil paint	100 м2	0.08		
13.041	Painting of the steel pipes with mastic compound	m2	107.0		
13.042	Pipe insulation by mineral wool boards	m3	12.0		
13.043	Covering layer of glass fiber reinforced plastics PCT	m2	525.0		
	Ventilation				
13.044	Autonomous air conditioners "ROOFTOP" BIH-240, weighing 1043 kg	pieces	2		
13.045	The same, BCH-60 weighing 282 kg	pieces	1		
13.046	Axial flow fan AXC200B	pieces	1		
13.047	The same, AXC-160	pieces	1		
13.048	The same, AXC-200A	pieces	2		
13.049	The same, AXC-300	pieces	1		
13.050	Air pipeline of galvanised steel with thick. of 0.9 mm, sec. 1200x500 mm	m2	47.6		
13.051	The same, 07 mm thick, sec. of 1000x400 mm	m2	28.0		
13.052	The same, sec. 900x400 mm	m2	70.2		
13.053	The same, sec. 800x300 mm	m2	37.4		
13.054	The same, sec. 800x250 mm	m2	21.0		
13.055	The same, sec. 600x300 mm	m2	68.4		
13.056	The same, sec. 600x250 mm	m2	44.2		
13.057	The same, sec. 500x400 mm	m2	59.4		
13.058	The same, sec. 500x300 mm	m2	51.2		
13.059	The same, sec. 500x250 mm	m2	82.5		
13.060	The same, sec. 500x200 mm	m2	17.0		
13.061	The same, 06 mm thick, sec. 400x400 mm	m2	54.4		
13.062	The same, sec. 400x300 mm	m2	14.0		
13.063	The same, sec. 400x200 mm	m2	50.4		
13.064	The same, sec. 300x200 mm	m2	54.0		
13.065	The same, sec. 200x250 mm	m2	79.2		
13.066	The same, 0.5 mm thick, sec. 200x200 mm	m2	57.6		
13.067	The same, sec. 200x150 mm	m2	38.5		
13.068	The same, sec. 150x150 mm	m2	12.0		
13.069	Air pipeline of galvanised steel with a thick. of 0.5 mm, d=200 mm	m2	18.0		
13.070	The same, d=150 mm	m2	9.6		
13.071	Ceiling grilles (Turkey), sec. 450x450 mm	pieces	25		
13.072	The same, 300x300 mm	pieces	6		
13.073	Air discharge grilles PP-1 sec. 200x100 mm	pieces	27		
13.074	Linear air terminal devices P-150 sec. 150x150	pieces	26		
13.075	Pipe silencer ШТП-12 with a sec. of 500x400 mm	pieces	12		
13.076	The same, ШТП-10, sec. 400x400 mm	pieces	14		
13.077	The same, ШТП-5 sec. 200x200 mm	pieces	8		
13.078	The same, ШТП-4 sec. 200x150 mm	pieces	2		
13.079	The same, ШТП-3 sec. 150x150 mm	pieces	2		
13.080	A cowl for air outflow d=200 mm	pieces	3		
13.081	The same, d=150 mm	pieces	1		
13.082	The same, d=300 mm	pieces	1		

13.083	Flexible connector ВГН-500x500, 1 m2	pieces	6		
13.084	The same, ВГН-441x441, 0.8 m2	pieces	5		
13.085	The same, ВГН-350x350, 0.6 m2	pieces	15		
13.086	The same, ВГН-210x210, 0.34 m2	pieces	8		
13.087	Blast gate P200x200P	pieces	9		
13.088	The same, P200x250P	pieces	3		
13.089	The same, P200x400P	pieces	2		
13.090	The same, P250x500P	pieces	4		
13.091	The same, P400x500P	pieces	2		
13.092	The same, P400x600P	pieces	2		
13.093	The same, P400x800P	pieces	2		
13.094	Air pipeline insulation on the roof and air conditioners by fiber glass batts	m3	23.0		
13.095	Covering layer of air pipelines and air conditioners from foil-mastic felt	m2	396.0		

BILL No.: 06. Customs/police Terminal

Item No.	Description	Unit	Quantity	Unit price in USD	Total price in USD
03	**Earthworks**				
03.001	Area levelling for the pile region	100 m2	28.0		
03.002	Mining of II group soil in cuts by excavator with the 0,65 м3 scoop capacity with loading upon trucks	1000 m3	0.37		
03.003	Soil transportation to the distance of 28 km	t	648		
03.004	Reclamation under floors with soil relocation by excavators with the scoop of 0.65 m3	1000 m3	0.37		
03.005	Manual soil relocation during reclamation under floors	100 m3	0.74		
03.006	Manual levelling of the reclamation area	100 m2	2.85		
03.007	Soil compaction by air tampers	100 m3	3.7		
04	**Stone and rubble works**				
04.001	10 cm thick rubble base for strip foundation	m3	31.5		
04.002	Soil compaction by rubble under floors	100 м2	2.85		
05	**Pile works**				
05.001	Driving of 8 m long RC piles with sec. of 30x30 cm by diesel hammer on excavator, II group soils- 75 pieces	m3 of piles	54.0		
05.002	Felling of concrete out of reinforcement frame of RC piles	piles	75		
06	**Concrete works**				
06.001	Concrete blinding with thickness of 10 cm under foundations of concrete B-7.5	m3	25.2		
06.002	RC strip foundations of concrete B-15	m3	91.0		
06.003	Concrete porch foundation of concrete B-15	m3	0.3		
06.004	Molithic RC posts СКм-1 of concrete B-20	m3	1.4		
06.005	Monolithic RC lintel of concrete B-15	m3	5.27		
06.006	Monolithic RC belt of concrete B-15	m3	9.32		
06.007	Monolithic RC parts of floors from concrete B-15	m3	1.8		
06.008	Installation of pre-fabricated RC hollow slabs of floors 1ПК59.10-8Ат.С9 1ПК59.12-8Ат.С9	 pieces pieces	 30 17		
06.009	8 cm thick concrete blinding of concrete B7.5 under floors	m3	22.8		
06.010	Concrete blinding under floors of the porch and steps of concrete B7.5	m3	0.1		
06.011	The same, under ducts of concrete B-15	pieces	6.6		
06.012	Installation of pre-fabricated RC slabs ПТ12.5-8.6 of ducts	pieces	102		
07	**Masonry works**				
07.001	Walls of foundation, basement entrance and porch of "kubik" stones, 39 cm thick, on mortar M-50	m2	63.1		
07.002	Horisontal wall insulation with cement mortar with the thickness of 20 mm	100 m2	0.51		

07.003	Side insulation of foundation walls and ducts with cement mortar	100 m2	1.56		
07.004	The same, with bitumen in 2 times	100 m2	1.56		
07.005	Outside walls of "kubik" stones, 39 cm thick on mortar M-50	m2	242.1		
07.006	The same, inside walls	m2	91.1		
07.007	Partitions of bricks, 12 cm thick	m2	219.3		
07.008	Duct steps of "kubik" stones, t. 39 cm	m2	3.4		
07.009	The same, t. 19 cm	m2	35.1		
08	**Steel works**				
08.001	Reinforcement of monolithic RC structures	t	9,292		
08.002	Installation of steel shed posts of pipes with d=245x6 mm	t	5,841		
08.003	Installation of steel shed beams from U-profile No. 20	t	5,226		
08.004	Installation of shed purlins of U-profile No. 10	t	3,666		
08.005	Installation of steel frames from angle No. 50x50	t	6,428		
08.006	Shed roofing of galvanised steel floor decking	m2	810.0		
08.007	Lining of shed parapet with metal floor decking	m2	162.1		
08.008	Anchor bolts for posts installation	t	0.48		
08.009	Ticketing kiosks 2.5x1.6x2.2 (H) from PEMOPEN with 6 mm glass glazing	pieces	6		
08.010	Steel framework for air-conditioner on roof and in ducts	t	0.111		
08.011	Steel scaffolding for finishing works	100 m2	11.13		
09	**Carpentry, roofing works**				
09.001	Water insulation in a layer of bitumenous felt	100 m2	3.24		
09.002	Heater of expanded clay with thickn. of 8-14 cm	m3	35.6		
09.003	Cement blinding, thick. 30 mm	100 m2	3.24		
09.004	Rouf of 3 layers of fibre glass felt	100 m2	3.24		
09.005	Cement blinding with t. of 20 mm under floors (2 layers)	100 m2	5.70		
09.006	Water insulation of 2 mastic compound layers under floors	100 m2	2.85		
09.007	Covering of the floors with clay tiles	m2	11.8		
09.008	Covering of the floors from marble tiles	m2	100.4		
09.009	The same, from parquet on a deck from planks	100 m2	172.5		
09.010	Sand bedding under porch floors	m3	0.2		
09.011	Covering of squares from clay tiles	m2	2.0		
10	**Joinery works**				
10.001	Installation of burnished door blocks ДГ21-9 with a lock in inside walls	pieces	8		
10.002	The same, in partitions ДГ21-9	pieces	9		
10.003	Installation of a barrier from burnished shields in the lobby	linear m	10.0		
10.004	Installation of door blocks of PEMOPEN with dim. 2.1x1.0 with glazing by 6 mm glass	pieces	2		
10.005	The same, of window blocks with glazing by insulating glass unit 4x4, dim. 1.2-1.5 1.2-0.6	pieces pieces	20 1		
10.006	Installation of window boards from marble tiles	m2	9.5		
11	**Finishing works**				
11.001	Finishing of ceilings for painting	100 m2	2.85		
11.002	Improved plastering of inside walls	100 m2	6.84		

11.003	Facing of walls with encaustic tiles	m2	79.2		
11.004	Improved plastering of inside window and door and door reveals	100 m2	0.32		
11.005	Installation of suspended ceiling PRONTO	m2	100.4		
11.006	Improved water-emulsion painting of ceilings	100 m2	2.85		
11.007	Improved oil painting of the walls	100 m2	6.05		
11.008	Plastering of walls and bottoms of ducts with cementation	100 m2	1.04		
11.009	Oil painting of metallic structures	100 m2	7.15		
11.010	Plastering of outside walls with loamy-stone tiles, plinth	m2	31.9		
11.011	High quality plastering of facade walls and entrance to the basement	100 m2	2.48		
11.012	Perchlorumvynil painting of facade walls	100 m2	3.03		
11.013	High quality plastering of facade slopes	100 m	1.12		
11.014	Steel scaffolding for finishing works	100 m2	11.13		
12	**Electrical installations/controls**				
	Electrical supply				
12.001	Distribution box ПРІІ-1048-2АУ3	pieces	1		
12.002	Group lighting meter-board УОЩВ-12АУХЛ4	pieces	4		
12.003	Photo-relay with transmitter ФР-2	pieces	2		
12.004	Installation of lighting fittings with luminescent lamps, up to 2 pieces	pieces	30		
12.005	The same, up to 6 pieces	pieces	30		
12.006	The same, up to 2 pieces in suspended ceilings	pieces	18		
12.007	Installation of lighting fittings with glow lamps, for ceilings	pieces	6		
12.008	Lighting plastic boxes УПК-4	pieces	68		
12.009	Outlets for hidden wiring	100 ps	0.32		
12.010	The same, for open wiring	100 ps	0.06		
12.011	Switches of hidden wiring	100 ps	0.16		
12.012	The same, for open wiring	100 ps	0.06		
12.013	Laying of viniplastic pipes with d=20 mm	100 m	1.58		
12.014	Laying of wires for АППВС-type hidden wiring section 2x2.5 mm2	100 m	5.40		
12.015	Laying of АВРГ-type cable with sec. 2x2.5 mm2 along walls on buckles	100 m	4.28		
12.016	The same, in viniplastic pipe	100 m	1.58		
12.017	Laying of АВРГ-type with sec. of 2x4 mm2 along walls on buckles	100 m	0.25		
12.018	The same, sec. of 4x2.5 mm2	100 m	0.10		
12.019	The same, sec. of 3x10+1x16 mm2	100 m	0.05		
12.020	Laying of АППВС-type wire, sec. 2x2.5 mm2 in slab hollows	100 m	0.80		
12.021	Lighting fittings with luminiscent lamps				
	УСП5-6х20	pieces	14		
	УСП5-4х40	pieces	16		
	УСП5-2х40	pieces	30		
	УСП5- 40 Л104Б-40	pieces	6		
12.022	Luminiscent lamps				
	ЛБ-20	pieces	84		
	ЛБ-40	pieces	142		
12.023	Starters	pieces	142		
12.024	Lighting fittings for ceilings НП-001	pieces	2		
12.025	The same, ППР-100	pieces	4		
12.026	Glow lamps	pieces	6		

	Fire Alarm System				
12.027	Installation of fire alarm station ТОЛ-10-С	pieces	1		
12.028	The same, for battery 10ЖН-60М	pieces	1		
12.029	The same, for alarm bell М3-1	pieces	1		
12.030	The same, for push-button informant ПКИЛ-9М	pieces	2		
12.031	The same, for heat transmitter of the informant ИП105-2/1	pieces	38		
12.032	Laying of ТРП type wire with sec. 1x2x0.5 mm2	100 m	2.5		
12.033	Plastic branch box	pieces	19		
12.034	Installation of wall lamp socket with lamp	pieces	1		
12.035	Installation of power supply block БП-24/4 of the station	pieces	1		
	Phone Communication				
12.036	Installation of distributor box КРТП-10	pieces	1		
12.037	The same, outlets РТШ	шт.	20		
12.038	Laying of wire ТРП-2x0.4 mm2 along walls	100 m	4.9		
	Radio				
12.039	Subscriber's transformer ТАМУ-10	pieces	1		
12.040	Installation of branch boxes УК-2П	pieces	1		
12.041	The same, УК-2Р	pieces	21		
12.042	Installation of radio outlets РПВ-2 for hidden wiring	pieces	15		
12.043	То же, для открытой проводки	pieces	6		
12.044	Прокладка провода по стенам ППВ-2х1.2	100 m	0.5		
12.045	The same, ППВ-2х0.6	100 m	2.25		
13	**Water supply/sewerage/heating**				
	Water Supply				
13.001	Installation of galvanised pipes with d=15 mm	linear m	5.0		
13.002	Installation of galvanised pipes with d=20 mm	linear m	10.0		
13.003	Test of the system	100 m	0.15		
13.004	Cost for globe valve 15 кч8р2, d=15 mm	pieces	2		
13.005	Cost for globe valve 15 кч8р2, d=20 mm	pieces	1		
13.006	Oil painting of pipes in 2 times	m2	3.0		
	Sewerage				
13.007	Laying of cast-iron pipes, d=50 mm	linear m	6.0		
13.008	Laying of cast-iron pipes, d=100 mm	linear m	16.0		
13.009	Installation of faience wash basin "Utro" with a tap	pieces	2		
13.010	Installation of WC cast-iron pan with a cistern	pieces	2		
	Heating				
13.011	Installation of cast-ironradiant heaters М-140АО	esm*	42.0		
13.012	Laying of steel pipes with d=15 mm	m	140.0		
13.013	The same, d=20 mm	m	70.0		
13.014	Test of the system	100 m	2.1		
13.015	Air valve of engineer Maevsky with d=15 mm	pieces	2		
13.016	Cost of a double regulated valve with d=15 mm for radiant heaters	pieces	18		
13.017	Cost of valve 15кч18п2 with d=15 mm	pieces	4		
13.018	Oil painting of pipes and radiant heaters in 2 times	100 m2	0.45		
13.019	Lubrication of steel pipes with mastic compound	m2	13.0		
13.020	Pipe insulation with board type wool insulants	m3	1.6		
13.021	Covering layer of glass fiber reinforced plastics	m2	68.0		
	Ventilation				
13.022	Autonomous roof conditioner ROOFTOP (Turkey), weighing 477 kg of ВСН-90-type	pieces	1		
13.023	Axial flow fan АХС-160 of company "Five Stars"				

	(TurKey)	pieces	1		
13.024	Linear air terminal device with sec. 600x200, of P200-type	pieces	5		
13.025	Air pipelines of galvanised steel 0.7 mm thick with sec. 600x300 mm	m2	18.0		
13.026	The same, sec. 500x300 mm	m2	13.0		
13.027	The same, sec.500x200 mm	m2	18.0		
13.028	The same, 0.6 mm thick, sec. 400x200 mm	m2	12.0		
13.029	The same, sec. 250x200 mm	m2	4.5		
13.030	The same, 0.5 mm thick, sec. 200x200 mm	m2	4.0		
13.031	The same, sec. 150x150 mm	m2	12.0		
13.032	The same, d=150 mm	m2	3.5		
13.033	Air disharge grille PP-1 type, sec.200x100 mm	pieces	15		
13.034	Linear air terminal device P-150 sec. 150x150	pieces	2		
13.035	Linear air terminal device P200 sec. 600x200	pieces	5		
13.036	A cowl for air pipelines, d=150 mm	pieces	1		
13.037	Air pipeline insulation of fiber glass flexible insulation (on the roof)	m3	2.5		
13.038	Covering layer of air pipelines from foil-mastic felt	100 m2	0.4		
13.039	Flexible connector 500x500 BTH	pieces	2		
13.040	Silencers ШТП-12	pieces	2		
13.041	The same, ШТП-10	pieces	2		

*- equivalent square meter

BILL No.: B07.x Ticketing Terminal

Item No.	Description	Unit	Quantity	Unit price in USD	Total price in USD
03	**Earthworks, dredging**				
03.001	Area levelling of the pile region	100 m2	9.6		
03.002	Mining of II group soil in cuts by excavator with the scoop volume of 0,65 m3, with loading upon trucks	1000 m3	0.067		
03.003	Transportation of soil to spot at a distance of 28 km	t	117.0		
03.004	Reclamation of soil under floors with moving by excavator 0.65 m3	1000 m3	0.067		
03.005	Manual moving of soil during reclamation under floors	100 m3	0.14		
03.006	Manual planning of the reclaimed area	100 m2	0.45		
03.007	Compaction of the soil by air tampers	100 m3	0.67		
04	**Stone and rubble works**				
04.001	Gravel layer under strip foundations, 10 cm thick	m3	11.9		
04.002	Compaction of the soil under floors	100 m2	0.45		
05	**Pile works**				
05.001	Driving of RC piles with sec. 30x30 cm and 8 m long by diesel hammer on excavator in II group soil, 23 piles	m3 piles	25.92		
05.002	Felling of concrete out of reinforcement frame of RC piles	piles	36		
06	**Concrete works**				
06.001	Concrete blinding of B-7.5 type concrete, 10 cm thick, under foundations	m3	9.5		
06.002	RC strip foundations of concrete B-15	m3	34.0		
06.003	Concrete porch foundation of concrete B-15	m3	1.5		
06.004	Concrete side of concrete B-15	m3	0.6		
06.005	Monolithic RC lintel of concrete B-15	m3	1.66		
06.006	Monolithic RC belt of concrete B-15	m3	7.0		
06.007	Monolithic RC floor parts of concrete B-15	м3	3.4		
06.008	Installation of pre-fabricated RC hollow slabs for floors 1ПК59.12-8Ат.С9	pieces	14		
06.009	Concrete blinding, 8 cm thick, from concrete B-7.5 under floors	m3	3.95		
06.010	Concrete blinding under floors of squares and steps from concrete B-7.5	m3	1.6		
06.011	Installation of concrete steps	linear m	21.6		
06.012	Installation of concrete B-15 foundations under equipment	m3	1		
07	**Masonry works**				
07.001	Walls for foundations, entrance to the basement and of the porch from "kubik" stones, 39 cm thick on mortar M-50	m2	128.8		
07.002	Horisontal insulation of walls by cement mortar with the thickness of 20 mm	100 m2	0.15		

07.003	Side insulation of foundation walls by cement mortar	100 m2	0.83		
07.004	The same, by bitumen for 2 times	100 m2	0.83		
07.005	Outside walls of "kubik" stones with the thickness of 39 cm on mortar M-50	m2	95.6		
07.006	The same, for internal walls	m2	11.40		
07.007	Partitions of bricks, 12 cm thick	m2	33.0		
08	**Steel works**				
08.001	Armouring of monolithic RC structures	t	3,813		
08.002	Installation of steel shed posts of pipes with diameter 245x6 mm	t	1,935		
08.003	Installation of steel shed beams of U-profile No 20	t	1,711		
08.004	Installation of steel shed purlins of U-beams No 10	t	1,142		
08.005	Installation of steel frames of angle No 50x50	t	2,537		
08.006	Roofing of the shed from galvanised metal decking	m2	280.0		
08.007	Lining of the shed parapetum by galvanised metal decking	m2	78.0		
08.008	Anchor bolts during installation of the posts	t	0.16		
08.009	Ticketing kiosks of PEMOPEN with glazing of 6 mm glass, dim. 2.5x1.6x2.2 (H)	pieces	3		
08.010	Steel scaffolding for finishing works	100 m2	3.17		
09	**Carpentry, roofing works**				
09.001	Water insulation in one layer of bituminous felt	100 m2	0.58		
09.002	Heater of expanded clay, thickness of 8-14 cm	m3	6.4		
09.003	Cement blinding, thickness 25 mm	100 m2	0.58		
09.004	Roof of three layers of fibre glass felt	100 m2	0.58		
09.005	Cement blinding, 20 mm thick under floors	100 m2	0.90		
09.006	Water insulation in two layers of mastic compound under floors	100 m2	0.52		
09.007	Covering of floors with clay tiles	m2	51.4		
09.008	Covering of floors with parquet upon a deck of planks	m2	45.9		
09.009	Blinding of expanded clay concrete, 40 cm thick	100 m2	0.02		
09.010	Sand bedding under floors of the porch and entrance to the basement	m3	4.5		
09.011	Covering of squares with clay tiles	m2	5.2		
09.012	Installation of ceiling insulation of acoustical boards in the basement	m2	45		
10	**Joinery works**				
10.001	Installation of doors ДН21x10 with a lock in outside walls	pieces	1		
10.002	The same, polished in internal walls, ДГ21-9	pieces	2		
10.003	The same, in partitions				
	ДГ21-9	pieces	2		
	ДГ21-7	pieces	1		
	ДГ16-7	pieces			
10.004	Installation of doors from PEMOPEN with dim. 2.1x1.0 with glazing by 6 mm glass	pieces	1		
10.005	The same, windows with glazing by insulating glass unit of 4x4 dim.				
	12-15	pieces	4		
	04-06	pieces	1		

	12-06	pieces	4			
10.006	Installation window boards of marble tiles	m2	2.8			
11	**Finishing works**					
11.001	Finishing of ceilings for painting	100 m2	0.90			
11.002	Improved plastering of internal walls	100 m2	2.52			
11.003	Facing of walls with glazed encaustic tiles	m2	18.2			
11.004	Improved plastering of internal window and door reveals	100 m2	0.15			
11.005	Whitewash painting of ceilings and walls	100 m2	1.98			
11.006	Improved water emulsion painting of ceilings	100 m2	0.48			
11.007	Improved oil painting of walls	100 m2	1.37			
11.008	Oil painting of the steel structures	100 m2	2.88			
11.009	Facing of outside walls with limestone tiles, basement	m2	25.2			
11.010	High quality plastering of facade walls and entrance to the basement	100 m2	0.93			
11.011	Perchlorvinil painting of facade walls	100 m2	0.93			
11.012	High quality plastering of slopes on the facade	100 m2	0.38			
12	**Electrical installations/controls**					
	Electric lighting					
12.001	Group lighting meter-board ПРІІ-1062	pieces	1			
12.002	Photo relay with transmitter ФР-2	pieces	1			
12.003	Lighting fittings with luminiscent lamps	pieces	15			
12.004	Consumer's chandelier	pieces	6			
12.005	Wall lighting fitting НБ001-60	pieces	1			
12.006	Wall lighting fitting ППР-100	pieces	5			
12.007	Switch for hidden wiring	100 ps	0.03			
12.008	Switch Т-1	100 ps	0.06			
12.009	Outlets for hidden wiring	100 ps	0.09			
12.010	The same, for open wiring	100 ps	0.03			
12.011	Plastic boxes УПК-4	pieces	33			
12.012	Laying of viniplastic pipes with a d. of 20 mm	100 m	0.51			
12.013	Laying of viniplastic pipes with a d. of 50 mm	100 m	0.03			
12.014	Magnetic starter ПМЛ-121002	pieces	6			
12.015	Control button ПКЕ212-2У3	pieces	4			
12.016	Laying of control cable АКВВГб with a size of 4x2.5 mm2	100 m	0.04			
12.017	Laying of cable АВРГ with sec. 2x2.5 mm2 along walls on buckles	100 m	1.99			
12.018	Laying of cable АВВГ, size 3x4+1x2.5 mm2 along walls on buckles	100 m	0.6			
12.019	The same, in viniplastic pipes	100 m	0.54			
12.020	Laying of АППВС type wire with sec. of 2x2.5 mm2 with blocking under plaster	100 m	1.0			
12.021	The same, in the slab hollows	100 m	0.3			
12.022	Lighting fitting УСП5-2x40 УСП5-40	pieces pieces	12 3			
12.023	Consumer's chandelier with one lamp	pieces	5			
12.024	The same, with two lamps	pieces	1			
12.025	Lighting fitting НБ001-60	pieces	1			
12.026	Lighting fitting ППР-100	pieces	5			
12.027	Luminiscent lamps ЛБ-40 Вт	pieces	27			
12.028	Starters	pieces	27			
12.029	Glow lamps, various	pieces	13			
	Fire alarm system					

12.030	Installation of fire alarm station ТОЛ-10-С	pieces	1		
12.031	The same, for battery 10ЖН-60М	pieces	1		
12.032	The same, for loud ringing bell М3-1	pieces	1		
12.033	The same, for push-button informant ПКИЛ-9М	pieces	2		
12.034	The same, for heat transmitter of the informant ИП105-2/1	pieces	16		
12.035	Laying of ТРП type wire with sec. 1x2x0.5 mm2	100 m	0.95		
12.036	Plastic branch box	pieces	3		
12.037	Installation of wall lamp socket with lamp	pieces	1		
12.038	Installation of power supply block БП-24/4 of the station	pieces	1		
	Automation of the heat distribution point				
12.039	Installation of temperature regulator Т48-М1	pieces	1		
12.040	The same, resistance thermometer ТСМ-0879 on pipeline	pieces	2		
12.041	The same, ТСМ-6114 on wall	pieces	1		
12.042	Installation of mercurial thermometer on pipeline	pieces	3		
12.043	Installation of manometer МП-4У on pipeline	pieces	10		
12.047	Installation of 1/2" manometer connection pipe 16-225У on the pipeline	pieces	10		
12.048	Installation of junction box КС-10	pieces	1		
12.049	Laying of cable КВВГЭ sec. 4x1.00 mm2	linear m	20.0		
12.050	Latying of metal-lined hose Р3-Ц-Х-Ш-18	linear m	10.0		
12.051	Laying of protective pipes d=20 mm	linear m	10.0		
12.052	Tightening of the first wire in pipes ПВ3 1x1.0 mm2	100 l/m	0.15		
12.053	The same, АПВ 1x2.5 mm2	100 l/m	0.05		
12.054	Tightening of each subsequent wire ПВ3 sec. 1x1.0 mm2	100 m	0.20		
12.055	The same, АПВ 1x2.5 mm2	100 m	0.10		
12.056	Laying of chute ЛП-85	pieces	6		
12.057	Steel structures	kg	20.0		
	Phone Communication				
12.058	Installation of distributor box КРТП-10	pieces	1		
12.059	The same, outlets РТШ	шт.	4		
12.060	Laying of wire ТРП-2x0.4 mm2 along walls	100 m	0.90		
	Radio				
12.061	Installation of branch boxes УК-2П	pieces	3		
12.062	The same, УК-2Р	pieces	7		
12.063	Installation of radio outlets РПВ-2 for hidden wiring	pieces	4		
12.064	То же, для открытой проводки	pieces	3		
12.065	The same, ППВ-2x0.6	100 m	0.95		
13	**Water supply/sewerage/heating**				
	Water supply				
13.001	Laying of water-gas galvanised pipes, d=15 mm	linear m	3.0		
13.002	Laying of water-gas galvanised pipes, d=20 mm	linear m	10.0		
13.003	Test of the system	100 m	0.13		
13.004	Cost of globe valve 15кч8р2 d=20 mm	pieces	2		
13.005	Oil painting of pipes in 2 times	m2	3.0		
	Sewerage				
13.006	Laying of cast iron pipes with the d=50 mm	linear m	2.0		
13.007	Laying of cast iron pipes with the d=100 mm	linear m	15.0		
13.008	Installation of faience wash basins "Utro" with a tap	set	1		
13.009	Cast iron WC with a cistern	set	1		

13.010	Installation of steel sink with a tap	set	1		
	Heating				
13.011	Installation of cast-iron radiant heaters М-140-АО	esm*	12.6		
13.012	Laying of steel pipes, d=15 mm	m	60.0		
13.013	Test of the system	100 м	0.6		
13.014	Installation of the Eng. Maevsky's air valve	pieces	2		
13.015	Cost of globe valve 15кч18р2 d=15 mm	pieces	4		
13.016	Cost of a double control valve for radiant heaters d=15 mm	pieces	5		
13.017	Lubrication of steel pipes with mastic compound	pieces	0.4		
13.018	Insulation of pipes with mineral wool	m3	0.01		
13.019	Covering layer from glass fiber reinforced plastic PCT	m2	2.4		
	Ventilation				
13.020	Installation of abat-vents ДВК-5, d=200 mm	pieces	1		
13.021	Air pipeline of galvanised steel, t=0.5 mm, d=200 mm	m2	1.0		
13.022	Linear air terminal device Р150 sec. 150x150 mm	pieces	1		
	Heat Distribution Point				
13.023	3 section speedy boiler, 10-168-4000 p, weighing 633 kg	set	1		
13.024	Centrifugal pump К20/30 with electric motor 4Л-10052	pieces	2		
13.025	The same, К8/18 with electric motor 4А80А2	pieces	2		
13.026	Drain pocket, d=100 mm	pieces	2		
13.027	Manual pump БК-8-2	pieces	1		
13.028	Water flow meter ВТГ-50	pieces	1		
13.029	Steel valve 30с41нж, d=100 mm	pieces	4		
13.030	Cast iron valve 30ч6бр, d=100 mm	pieces	8		
13.031	Steel globe valve 15с27нж1, d=25 mm	pieces	5		
13.032	Back valve 19ч21бр, d=100 mm	pieces	2		
13.033	The same, 16ч3бр, d=25 mm	pieces	2		
13.034	Control valve 25ч931нж, d=50 mm	pieces	1		
13.035	Steel pipe laying, d=108x3.5 mm	linear m	48.0		
13.036	The same, d=32x2.0 mm	linear m	21.0		
13.037	Supports under the boiler from steel plates	100 kg	2.12		
13.038	Vibration isolators ДО45 under pumps	pieces	16		
13.039	Hoses, connectors, d=100 mm	linear m	2.8		
13.040	The same, d=50 mm	linear m	2.8		
13.041	Pre-fabricated RC slab 1.2x0.8x0.2, 2 pieces	m3	0.40		
13.042	Painting of pipelines and the boiler with mastic compound	m2	28.0		
13.043	Insulation of the pipeline and equipment with mineral wool half-cylinders	m3	1.6		
13.044	Covering layer of glass fiber reinforced plastic PCT, rolled	m2	56.0		

*- equivalent square meter

BILL No.: B.08. Public Services Building

Item No.	Description	Unit	Quantity	Unit price in USD	Total price in USD
03	**Earthworks, dredging**				
03.001	Area planning of the pile region	100 m2	9.0		
03.002	Elaboration of II group soil in cuts by excavator with the scoop volume of 0,65 m3, with loading upon trucks	1000 m3	0.146		
03.003	Transportation of soil to spot at a distance of 28 km	t	256		
03.004	Reclamation of soil under floors with moving by excavator 0.65 m3	1000 m3	0.146		
03.005	Manual moving of soil during reclamation under floors	100 m3	0.44		
03.006	Manual planning of the reclaimed area	100 m2	1.46		
03.007	Compaction of the soil by air tampers	100 m3	1.46		
04	**Stone and rubble works**				
04.001	Rubble layer under strip foundations, thick. is 10 cm	m3	6.8		
04.002	Compaction of the soil with rubble under floors	m2	1.36		
05	**Pile works**				
05.001	Driving of RC piles with sec. 30x30 cm and 8 m long by diesel hammer on excavator into II group soil, 23 piles	m3 of piles	16.56		
05.002	Felling of concrete from reinforcement frame of RC piles	piles	23		
06	**Concrete works**				
06.001	Concrete blinding of B-7.5 type concrete, 10 cm thick, under foundations	m3	5.4		
06.002	RC strip foundations of concrete B-15	m3	21.0		
06.003	Monolithic RC columns of concrete B-20 for frames	m3	2.64		
06.004	Monolithic RC girders of frames with a length of up to 500 mm on the height of up to 6 m of concrete B-20	m3	4.0		
06.005	Monolithic RC lintel of concrete B-15	m3	0.88		
06.006	Monolithic RC belt of concrete B-15	m3	4.64		
06.007	Monolithic RC floor parts of concrete B-15	м3	4.12		
06.008	Installation of pre-fabricated RC hollow slabs for floors				
	1ПК71.10-8Ат.С9	pieces	4		
	1ПК71.12-8Ат.С9	pieces	5		
	1ПК59.10-8Ат.С9	pieces	8		
	1ПК59.12-8Ат.С9	pieces	2		
06.009	Concrete blinding 8 cm thick from concrete B-7.5 under floors	m3	10.9		
06.010	Concrete blinding under floors of squares and steps from concrete B-7.5	m3	14.1		
06.011	Installation of concrete steps	linear m	70.8		
06.012	Concrete blinding 10 cm thick from concrete B-15 for canals	m3	9.0		

06.013	Installation of pre-fabricated RC slabs ПТ12.5-8.6 for canals	pieces	73		
07	**Masonry works**				
07.001	Foundation walls from "kubik" stones, 39 cm thick on mortar M-50	m2	32		
07.002	Horisontal insulation of walls by cement mortar with the thickness of 20 mm	100 m2	0.25		
07.003	Side insulation of foundation walls by cement mortar	100 m2	0.62		
07.004	The same, by bitumen for 2 times	100 m2	0.62		
07.005	Outside walls of "kubik" stones with the thickness of 39 cm on mortar M-50	m2	156.2		
07.006	The same, for internal walls	m2	29.5		
07.007	Partitions of bricks, 12 cm thick	m2	95.3		
07.008	Porch walls of "kubik" stones, 19 cm thick	m2	3.2		
07.009	Canal walls of stones "kubik", 19 cm thick	m2	35.8		
07.010	The same, 39 cm thick	m2	1.8		
07.011	The same, from bricks 12 cm	m2	7.6		
07.012	Side insulation of wall canals by cement mortar	100 m2	0.24		
07.013	The same, by bitumen in 2 times	100 m2	0.24		
08	**Steel works**				
08.001	Armouring of monolithic RC structures	t	3.634		
08.002	Installation of steels angles №63 in canal corners	t	0.038		
09	**Carpentry, roofing works**				
09.001	Water insulation in one layer of bituminous felt	100 m2	1.59		
09.002	Heater of expanded clay, thickness of 8-14 cm	m3	17.5		
09.003	Cement blinding, thickness 25 mm	100 m2	1.59		
09.004	Roof of three layers of fibre glass felt	100 m2	1.59		
09.005	Cement blinding, 20 mm thick under floors, 2 layers	100 m2	3.02		
09.006	Water insulation in two layers of mastic compound	100 m2	1.51		
09.007	Covering of floors with clay tiles	m2	78.0		
09.008	Covering of floors with marble tiles	m2	72.8		
09.009	Installation of the wooden barrier	linear m	3		
09.010	Sand bedding under porch floors	m3	14.5		
09.011	Covering of squares with clay tiles	m2	48.4		
10	**Joinery works**				
10.001	Installation of polished doors with a lock ДН21x10 in outside walls	pieces	2		
10.002	The same, in internal walls, type ДГ21-9	pieces	2		
10.003	The same, in partitions ДГ21-9 ДГ21-7 ДГ16-7	 pieces pieces pieces	 5 2 7		
10.004	Installation of window blocks of "PEMOPEN" with glazing with iinsulating glass unit 4x4 раз. 1.4x1.8 м	pieces	1		
10.005	The same, blind transoms 1.2x2.5	pieces	2		
10.006	Installation of stained-glass windows from PEMOPER with door, 2.0x2.5	pieces	1		
10.007	Glazing of stained-glass windows with 6 mm polished glass	m2	11.0		

10.008	Installation of marble window boards	м2	2.6		
11	**Finishing works**				
11.001	Finishing of ceilings for painting	100 m2	1.36		
11.002	Improved plastering of internal walls	100 m2	3.99		
11.003	Facing of walls with glazed encaustic tiles	m2	175.1		
11.004	Improved plastering of internal window and door reveals	100 m2	0.09		
11.005	Whitewash painting of ceilings and walls	100 m2	1.9		
11.006	Improved water emulsion painting of ceilings	100 m2	0.81		
11.007	Improved oil painting of walls	100 m2	1.00		
11.008	Complete aligning of concrete girders	100 m2	0.16		
11.009	Facing of outside walls with limestone tiles, basement	m2	25.2		
11.010	High quality plastering of facade walls	100 m2	1.89		
11.011	Perchlorvinil painting of facade walls	100 m2	2.1		
11.012	High quality plastering of slopes on the facade	100 m2	0.28		
11.013	Plastering of internal canal walls with dry cementation	100 m2	0.51		
12	**Electrical installations/controls**				
12.001	Group lighting meter-board УОЩВ-12АУХЛ4	pieces	1		
12.002	Photo relay with transmitter ФР-2	pieces	1		
12.003	Lighting fittings with luminiscent lamps up to 6 pieces	pieces	14		
12.004	Lighting fitting with glow lamps НП-001	pieces	8		
12.005	The same, for walls	pieces	3		
12.006	Switch Т-1 for hidden wiring	100 ps	0.09		
12.007	Outlets for hidden wiring	100 ps	0.04		
12.008	The same, for open wiring	100 ps	0.02		
12.009	Plastic boxes УПК-4	pieces	2.5		
12.010	Laying of wires АППВС with sec. 2x2.5 mm2 under plaster	100 m	1.7		
12.011	The same, in slab hollows	100 m	0.55		
12.012	Laying of cable АВРГ with sec. 2x2.5 mm2 along walls on buckles	100 m	0.32		
12.013	The same, sec. 4x2.5 mm2	100 м	0.2		
12.014	Cost for lighting fitting with luminiscent lamps Л104Б-6х20	pieces	1		
12.015	The same, Л104Б-4х20	pieces	13		
12.016	The same, for luminiscent lamps ЛТБЦ-20	pieces	58		
12.017	The same, for starters	pieces	58		
12.018	The same, for ceiling lighting fitting НП001	pieces	8		
12.019	The same, for wall lighting fittings НБ005	pieces	3		
12.020	The same, for glow lamps	pieces	11	4	
	Fire Alarm System				
12.021	Installation of the fire alarm station ТОЛ-10-С	pieces	1		
12.022	The same, accumulator battery 10ЖН-60М	pieces	1		
12.023	The same, loud ringing bell М3-1	pieces	1		
12.024	Installation of push-button informant ПКИЛ-9М	pieces	1		
12.025	Installation of heat transmitter ИП105-2/1 of the informant	pieces	21		
12.026	Laying of wire ТРП, sec. 1x2x0.5 mm2	100 m	1.2		
12.031	Plastic branch box	pieces	1		
12.032	Installation of lamp socket with a lamp	pieces	1		
12.033	Installation of power supply block БП-24/4 for the station	pieces	1		
	Phone Communication				

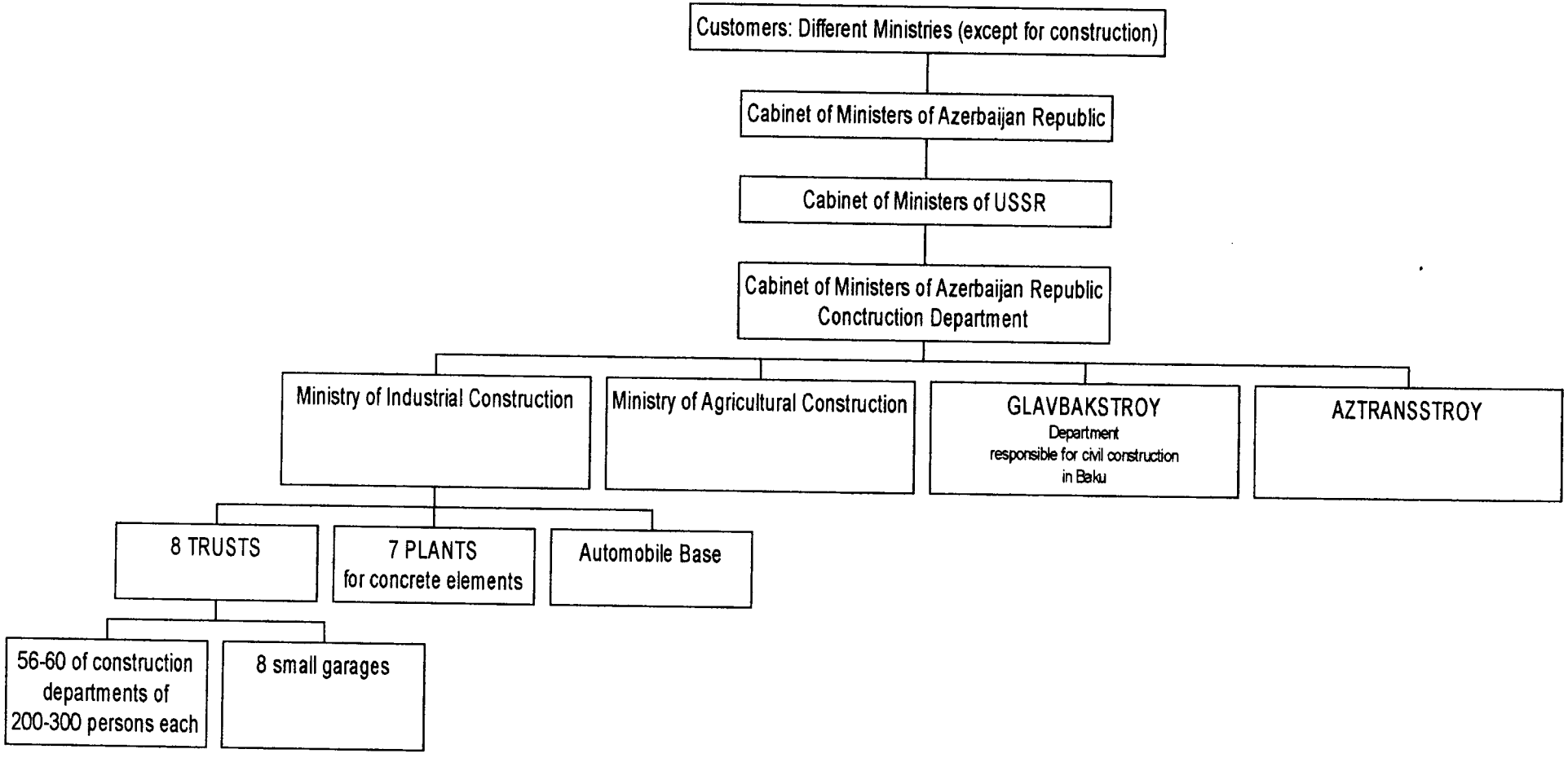
12.034	Installation of the КРТП-10 distribution box	pieces	1		
12.035	The same, the РТШ outlet	pieces	4		
12.036	Laying of wire ТРП-2х0.4 mm2	100 m	0.90		
	Radio				
12.037	Installation of branch box УК-2П	pieces	1		
12.038	The same, branch box УК-2Р	pieces	2		
12.039	The same, radio outlet РПВ-2 for hidden wiring	pieces	2		
12.040	Laying of the ППВ-2х0.6 mm2 wire	100 m	0.2		
13	**Water supply/sewerage/heating**				
	Water supply				
13.001	Laying of water-gas galvanised pipes with d=15 mm	linear m	30.0		
13.002	Laying of water-gas galvanised pipes with d=20 mm	linear m	15.0		
13.003	Test of the system	100 m	0.45		
13.004	Cost of globe valve 15ч8р2 d=15 mm	pieces	15		
13.005	Cost of globe valve15ч8р2 d=20 mm	pieces	2		
13.006	Масляная окраска труб за 2 раза	м2	8.0		
	Sewerage				
13.007	Laying of cast-iron pipes with d=50 mm	linear m	12.0		
13.008	Laying of cast-iron pipes with d=100 mm	linear m	15.0		
13.009	Laying of cast-iron pipes with d=150 mm	linear m	32.0		
13.010	Installation of enamelled wash basin with a tap	pieces	7		
13.011	Floor gully installation, d=100 mm	pieces	2		
13.012	Installation of cast-iron WC pan with a cistern	pieces	4		
13.013	Installation of steel sink with a tap	pieces	2		
13.014	Installation of faience urinals	pieces	4		
	Heating				
13.015	Installation of radiant heaters М-140-А	esm**	21.0		
13.016	The same, of air valve	pieces	2		
13.017	Laying of steel pipes, d=15 mm	linear m	110.0		
13.018	Test of the heating system	100 m	1.1		
13.019	Cost of valve 15кч18п2 d=15 mm	pieces	4		
13.020	Cost of double control valve КРДШ	pieces	6		
13.021	Oil painting for steel non-insulated pipes and radiant heaters	100 m2	0.23		
13.022	Lubrication of steel pipes with mastic compound	m2	3.0		
13.023	Insulation of steel pipes from mineral wool boards	m3	0.5		
13.024	Covering layer of glass fiber reinforced plastics РСТ	m2	18.0		
	Ventilation				
13.025	Installation of consumer's air conditioner	pieces	1		
13.026	Installation an axial flow fan of "Five Stars" (Turkey), AXC-315 weghing 8 kg	pieces	1		
13.027	The same, AXC-200A, weighing 5 kg	pieces	2		
13.028	Air pipelines of galvanised steel, 0.6 mm thick d=300 mm	m2	3.0		
13.029	The same, of steel, 0.5 mm thick, d=200 mm	m2	8.0		
13.030	Control linear air terminal device, Р150, sec. 150x150 mm	pieces	11		
13.031	The same, Р200, sec. 200x400 mm	pieces	6		
13.032	A cowl for air pipelines, d=200 mm	pieces	2		
13.033	The same, d=300 mm	pieces	1		

* - Reclamation over outside foundaion walls has been taken into account in the volume of vertical levelling
** - equivalent square meter

Appendix 5

Construction Sector Information

Approximate Layout of Organisation Diagramme of the Construction Sector in Azerbaijan during the Soviet Union



orgdiagr

CONSTRUCTION COMPANIES

No	*Company*	*Address*	*Profile*	*Telephone*	*Fax*	*Notes*
1	Azerbtransdorstroy	4, Nobel St	roads,bridges, ports, airports, railway	66-00-82 66-74-29	93-18-31	 +
2	Azerpromstroy	85, S. Askerova St	plants, factories	94-89-04 94-63-87	95-74-12	
3	AzGur	80, Zardobi St	assembling and special works	92-79-51 92-67-35	92-94-25	
4	"Bay Inshaat (Turkey)	14, s. Vurgun St	dwelling houses and public buildings	98-13-48	93-57-13	+
5	Donek Co. ltd	98, Sh. Badelbeily St Opera studio, 3-rd floor, conservatory	big objects	98-91-60	98-91-58	
6	DHT (Turkey)	Ganly Gel Jasamal,	big objects	98-15-14		
		117, Nizamy		98-15-03		
7	Kazer Engineering Ltd	86, M. Guseyna St,app. 28	different objects	92-62-22		
8	Morisson Construction (UK)	3, Sh. Shamil St.		92-78--50	98-09-66	+
9	Petrofak International Ltd	17, Caspiyskaya St		67-84-84 68-94-63	93-29-85	
10	Pivani Enterprises Ltd	9, Sardarova St	decorating works, building materials	92-78-36 92-38-43	9358-30	+
11	Ramko-Baku	1, Bakihanova St		38-55-10 98-03-25	98-08-26	
12	Spezmontajteatr (Azerb)	30, Mardanov gardash (Gorkogo), Vidadi corner	electrical assembling works, communication and signalling	94-05-08 94-05-18		+
13	Hazar		Icheri Shahar, Beuk Gala	92-05-91 92-05-36	98-06-81	+
14	Elko KASKO International Ltd (UK)	27/10 Istiglalijat St		92-97-64 92-24-54	98-06-81	+
15	Ferko (Turkey)	1025-127, 1030 Tbilisi prospekt, near the Sport Palace		98-09-30 92-64-31 98-08-18	98-09-31	

No	*Company*	*Address*	*Profile*	*Telephone*	*Fax*	*Notes*
16	Lukovo	3, Sabira St, Icheri Shaher		92-32-35	98-18-16	
				98-18-16		
17	Gabek (Germany)	29, Azerbaijan Prospect, the 3-rd floor, app.125, near Sahil metro station		93-42-59		Johen Shtopper

Annex 5

Building materials

As a result of investigations of building material market on November-December, 1996 in Baku, it was exposed that building materials are provided both by local enterprises and by firms of SIC, Europe and Turkey.

A) Local materials:

1. " Kubic"-type stone (kubic stone) is a compact limestone-coquina sawed by machines from natural limestone massif. The dimensions are 39×19×19 cm, the weight is 26 kg. Quarry situated at Karadag settlement (30 km from Baku). Used in erection of walls and bulkheads (partitions). 1 m3 of walls made of these stones is cheaper than walls of bricks by 2 times. 90 % of construction in Baku is implemented using the kubic stones.

2. Solid clay bricks are produced by factories in Baku. The dimensions are 25×12×6 cm, weight is 3,7 kg. Used for partitions, balcony fences.

3. Ceramic hollow stone for ventilation channels is produced by Baku factories. The dimensions are 39×19×19 cm, the weight is 13,3 kg. Used for masonry of ventilation channels.

4. River sand (for concrete) is used for preparation of high solid concrete. Quarry located at Mingechaur city (250 km from Baku).

5. Natural sand (fine sand) is used for grout preparation and strewing under floors Quarries located in suburbs of Baku

6. Ballast is used for concrete preparation and strewing under floors and roads. There are the Dashkesan-Gjanjia quarry (250 km from Baku) and Hachmaz quarry (150 km from Baku).

7. Cement M300 is produced by the factory in Karadag settlement (30 km from Baku). Due to the old equipment, the factory produces cement of a low quality.

8. Haydite (light) ballast is used for haydite (light) concrete instead of ballast and for heat insulation of floors. There is a factory in Baku.

9. Window glass is produced by the factory in Sumgait (30 km from Baku). Quality of the glass is low because of the old equipment.

10. Joiner's wares (windows, doors) are produced by the factory in Aljaty settlement (70 km from Baku). Quality is low because of the old technology.

11. Bitumen is produced by the factory in Baku. This is a water insulating material. Hot bitumen is used for insulation of foundation walls, floors, roofing works.

12. Roofing/tarred felt is produced by workshops in Baku. The length of the rolls is 10 m, the width is 1 m. It is used for insulation of foundation walls, floors, roofing works.

13. Glazed ceramic tiles are produced by workshops in Baku. The size is 15×15 cm (there are also other dimensions). Used for facing of walls in lavatories and other wet rooms.

14. Ceramic tiles (metlah) are produced by workshops in Baku. There are dimensions of 10×10 cm and other. Should be used for floor covering in lavatories, balconies and in other wet rooms.

15. Marble tiles are produced by the factory in Baku. There are different sizes. (Quarries of Azerbaijan). Used for facing of walls and floors inside public buildings.

16. "But" stone is used as a filler of foundations under light structures (e. g. porches, landings, etc.). The size is not less than 150 mm and not more than 500 mm.

17. Cobble-stone (or river stone) is used for motor-road (highway) foundation, coast protection works. The size is 160-300 mm. There are quarries in Azerbaijan.

18. Timber - planks, bars, parquet, etc. There are workshops in Hurdalan (10 km from Baku). Used for floor covering, installation of concrete moulds, etc.

19. Wall paper is produced by a workshop in Baku. The roll is 10 m's long, the width is 1 m. The quality is low because of the old technology.

20. Asphalt concrete is used for covering of pedestrian footpaths, motor-roads. There are factories in Baku

21. Alabaster (plaster)-lime is used for inner decorative works.. There is a factory in Karadag settlement (30 km from Baku).

22. Asbestos-cement corrugated sheets (slate) are used for covering of inclined roofs on wooden beams. The size is 1.5x1 m.

23. Asbestos-cement pipes are used for construction of external water pipelines and telephone nets. The diameter is from 100 to 300 mm. There is a factory Baku.

24. Glass-blocks (bricks of glass) are used for filling of apertures and erection of partitions. The dimensions are 25×25×8 cm. There is a factory in Sumgait (30 km from Baku).

25. Materials for varnishing and painting. There are workshops in Baku. The quality is low because of the old technology.

26. Big state construction companies have their own reinforced concrete (RC) factories where they can produce any pre-fabricated elements:

1. Piles
2. Foundation slabs
3. RC beams
4. Foundation shoes under columns
5. Columns
6. Cross-beams
7. Beams
8. Frame girders
9. Cross pieces (tie plates)
10. Floor plates, hollow
11. Ceiling plates, ribbed
12. Balcony slabs

B) Materials from CIS

1.	Metal (reinforcement bars for RC, U-profiles, I-profiles, rails)	Russia, Ukraine
2.	Cement M-400÷500	Russia, Turkmenistan, Uzbekistan
3.	Steel pipes, cast-iron pipes, plastic pipes	Russia, Ukraine
4.	Fire-proof bricks	Russia
5.	Window glasses, shop-window (glassed) glasses	Russia
6.	Fittings for pipelines	Russia, Ukraine
7.	Glazed tiles	Russia, Belorussia
8.	Ceramic tile (metlah)	Russia, Belorussia
9.	Wall papers	Russia, Belorussia
10.	Varnish-paint materials	Russia
11.	Electrical materials (wires, cables, lamps, switches, etc.)	Russia
12.	Electrical equipment (lighting boxes, distributor boxes, transformers)	Russia
13.	Lavatory equipment (bathes, pans, wash-stand, sinks, etc.)	Russia, Belorussia

C) Materials from Europe

The branch of British company "PIVANI ENTERPRISES LIMITED" offers building materials from USA, Germany, Belgium, Netherlands, Italy, Finland Canada, Austria, Japan (Annex on 12 sheets)

1. Lavatory equipment

2. Air-conditioners

3. Suspension ceilings

4. Varnish-paint materials

5. Ceramic glazed tiles

6. Ceramic tiles (for floor) (metlah)

7. Roofing/tarred felt

8. Tiles (for roof)

9. Mineral wool

10. Wall paper

11. Carpet covering

12. Organic glass

13. Plastic

14. Marine paints "TRANSOCEAN"

D) Materials from Turkey

Branch of Turkish firm "TURK SIEMENS" offers cables, electrical appliances and apparatuses of European quality and standards
(Appendix No. [2 on 21 sheets)

Azeri-Turkish joint ventures "Gunaj - IMS" and "AZERPEN" in Baku produce windows, doors, partitions (bulkheads) made of aluminium and foam rubber of Turkish profile according to European technology.

Turkish shops "Istanbul", "Antalia", "Selsen" "Marshall" offer wide range of the following Turkish and European building materials:

1. Varnish-paint materials

2. Suspended ceilings

3. Lavatory equipment

4. Wall paper

5. Tiles (for wall)

6. Ceramic tiles (for floor) (metlah)

7. MDF - plates of sawdust

8. Decorative plaster mortars

9. Parquet

Annex 5

Labour

1. Average wages of local workers (builders), working in local building companies are 100-120$.

2. Average wages of local workers (builders), working in Turkish building companies are 200-250 $.

3. Expenses for a Turkish worker (builder) working in Turkish building company including salary, transport, lease of a hostel are 1100-1300 $ per month.

4. Expenses for a European specialist-builder working in European building company including salary, transport, lease of a hotel are 6000-8000 $ per month.

Annex 5

Equipment

One of the leading State Construction Company "Azerbaijantransdorstroy" offers the list of available motor transport, construction machines and technical fleet.

No.	Name	Model	Unit of mesuring	Power	Motor cars' park
1	Dump truck	(MMZ)-ММЗ-554,555	tonne	5,25	27
2	Dump truck	ММЗ-4502,45021	tonne	5,8	35
3	Dump truck	(MAZ)-МАЗ-5549,5551	tonne	8-8,5	30
4	Dump truck	(KamAZ)-КамАЗ-5511	tonne	10	14
5	Dump truck	КамАЗ-55111	tonne	13	29
6	Dump truck	(KrAZ)-КрАЗ	tonne	12	27
7	Dump truck	(TATRA)-ТАТРА-815;815С1; 815-2С1А	tonne	15,3; 16,3;17,2	19
8	Board motor car	(GAZ)-ГАЗ-52;53	tonne	2,5;4	4+3
9	Board motor car	(ZIL)-ЗИЛ-130;431410	tonne	5;6	4115
10	Board motor car	ЗИЛ-133ГЯ	tonne	10	3
11	Board motor car	(MAZ)-МАЗ-5335	tonne	8	2
12	Board motor car	(KamAZ)-КамАЗ-5320	tonne	8	9
13	Board motor car	КамАЗ-53212	tonne	10	2
14	Board motor car	(KrAZ)-КрАЗ-257	tonne	12	1
15	Board motor car	КрАз-255	tonne	7,5	1
16	Board motor car	(MAZ)-МАЗ-7310	tonne	21	1
17	Board motor car	(TATRA)-ТАТРА-813	tonne	60	1
18	Cement truck	(ZIL) ЗИЛ-130В	tonne	7	3
19	Cement truck	(KamAZ)-КамАЗ-5410	tonne	14	4
20	Bitumen truck	(ZIL)-ЗИЛ-130	tonne	7	2
21	Bitumen truck	(KamAZ)-КамАЗ-53213	tonne	10	4

22	Auto-cargo launch	(DS)- ДС-39А	tonne	7	1
23	Truck tractors	(ZIL)- ЗИЛ-130В	tonne	7	4
24	Truck tractors	(KamAZ)- КамАЗ-5410	tonne	14,5	6
25	Truck tractors	(KrAZ)- КрАЗ-258	tonne	15	1
26	Truck tractors	(MAZ)- МАЗ-5430	tonne	14,5	1
27	Truck tractors	МАЗ-5432	tonne	20	2
28	Water carrier	(АВС)- (АСТР) АВЦ-1,7;АЦТП-5	tonne	1,7;5	1+2
29	Watering-wash carrier	(РМ)- ПМ-130	tonne	5	14
30	Petrol truck and fuel service truck		tonne	4÷7,5	16
31	Concrete mix truck on chassis	(KrAz)- КрАз-250	m 3	6,1/3,5	9
32	Assemble-hinged boom	(MSHTS)- МШТС-2А	кw	110,4	1
33	Repair truck	(GAZ)- (ZIL)- ГАЗ-52;ЗИЛ-130	кw	55,2;110,4	10
34	Drilling installation	ГАЗ-66;ЗИЛ-131	кw	84,6;110,4	3
35	Buses	(KAVZ) (PAZ) КАВЗ, ПАЗ	m/hr	21;23	30
36	Cars	(GAZ)- ГАЗ-24;31	kw	70;77	17
37	Cars	(Jiguli) Жигули			3
38	Cars	(Pride) Прайд			2
39	Cars	(МС) МЦ12	kw	55	1
40	Autocrane	(KS)- КС-3575	tonne	10	3
41	Autocrane	КС-3562;71;77	tonne	10;10;12;5	17
42	Autocrane	КС-4561;4562	tonne	16;20	7
43	Autocrane	(SMK)- СМК-10	tonne	10	1
44	Autocrane	(KS)- КС-2561	tonne	6,3	3
45	Special crane on chassis	КС-5473	tonne	25	5
46	Special crane on chassis	КС-6471	tonne	40	5
47	Special crane on chassis “КАТО”	(IK) - (MS) ИК-500МС	tonne	50	1

48	Special crane on chassis "КАТО"	(IK)- ИК-750	tonne	75	1
49	Pneumocrane	(KS)- КС-4361	tonne	16	4
50	Pneumocrane	КС- 4362	tonne	16	2
51	Pneumocrane	КС- 5363	tonne	25	3
52	Pneumocrane	(МКТ6)- МКТ6-45	tonne	40	1
53	Crawler crane	(DEK) ДЭК-25-1	tonne	25	4
54	Crawler crane	(RDK)- РДК-25-1	tonne	25	4
55	Crane pile-driver "Hitachi"		tonne	90	1
56	Tower crane		tonne	8;10	8
57	Tower crane		tonne	12,5;25	3
58	Excavator	(EO)- ЭО-2621	m3	0,25	8
59	Excavator	ЭО-3322,3323	m3	0,5;0,65	8+1
60	Excavator	К--606-1	m3	0,6	4
61	Excavator	(UDS)- УДС-114А	m3	0,65	1
62	Excavator	(EO)- ЭО-4121;4124	m3	0,65;1	7
63	Excavator	К-612	m3	0,6	1
64	Excavator	(EO)- ЭО-4321	m3	0,65	2
65	Excavator	(E) Э10011	m3	1,0	2
66	Excavator	(EO)- (B) ЭО-5111Б	m3	1,0	1
67	Excavator	(UB)- УБ-1233-1	m3	1,25	2
68	Excavator	(EO)- (AHL) ЭО-5123,5122АХЛ	m3	1,25	4
69	Excavator	ЭО-5124,5122А	m3		
70	Earth scoopers	(MoAZ)- МоАЗ-6014	m3	10	4
71	Bulldozer	(DZ)- ДЗ-110;27;109	m3	10	17
72	Bulldozer	ДЗ-171	m3	10	4
73	Bulldozer	ДЗ-129	m3	25	1
74	Bulldozer	Д355 А-3	m3	25	2
75	Bulldozer	ДЗ-42	m3	4	9
76	Motor grader	ДЗ-99	kw	66,2	1

77	Motor grader	Д3-122	kw	95,7	7
78	Motor grader	Д3-143	kw	95,7	2
79	Motor grader	Д3-98	kw	202,2	2
80	Tractors	К-701	kw	221	5
81	One-scoop loader	ТО-18,25	m3	1,5	4
82	One-scoop loader	ТО-30	kw	1,1	2
83	Static rollers	(DU)- ДУ-47;48;49	tonne	8;12;18	14
84	Combined rollers	ДУ-62	tonne	14	4
85	Combined rollers	(SD)- СД-801	tonne	20	1
86	Combined roolers on rubber-tired scraper	(DU)- ДУ-16	tonne	25	3
87	Asphalt layers	(DS)- ДС-126			2
88	Asphalt layers	ДС-143			1
89	Asphalt layers	(S)- С-600			1
90	Asphalt layers	С-750			1
91	Asphalt mixers	(D) Д508-2А	tn/hr	25	1
92	Asphalt mixers	(DS)- ДС-117-2Е	tn/hr	25	2
93	Asphalt mixers	ДС-117-2К	tn/hr	35	1
94	Asphalt mixers			50	1
95	Compressors	(PKSD)- (D) ПКСД-5,25Д	m3/min	5,25	11
96	Compressors	?(PK)- ?ПК-10	m3/min	10	6
97	Marine tug boat	(MB)- МБ-7026	hp	930	11
98	Marine tug boat	МБ-7026	hp	484	1
99	Tug motor ship	МБ-5		490	1
100	Motor boat	(MZ "Gilavar") МЗ "Гилавар"	hp	340	1
101	Roadstead tug, motor ship	(RBT)- РБТ-101	hp	300	1
102	Marine tug boat	(BMK)- БМК-130М	hp	120	4
103	Floating pile-driver	(PK)- ПК-315	hp tn	1600 45	1

104	Floating crane	(PK "Drava") ПК "Драва"	hp tn	640 90	1
105	Floating crane	PK "Astrachan" ПК "Астрахань"	hp tn	720 60	
106	Floating crane	(PK "Braihert") ПК "Брейхерт"	hp tn	550 50	1
107	Floating barge	(MSB "Omega") МСБ "Омега	tonne	1000	1
108	Floating barge	(MSB)- МСБ-3	tonne	250	1
109	Pontoon		tonne	450	1
110	Pontoon		tonne	400	1
111	Pontoon	(KS)- КС-63	tonne	63	21

Vice- President
Chief Engineer of State Company
"Aztransdorstroy"

N. H. Adygezalov