Tacis

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

Phase 2, Detailed Design Report - Turkmenbashi March 1997

Volume I, Main Text

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PHASE 2, DETAILED DESIGN, TURKMENBASHI - REPORT, VOL 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 Turkmenbashi 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 Turkmenbashi has selected the Alt. 4 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. T.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 maximise 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
  . modifications to passenger terminal/passenger bridge
  . border crossing facilities
  . use of adjacent container handling facilities (in main port)
  . container handling equipment (through separate project)

  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 raising of complete railway access 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
  . new passenger terminal and administration building
  . new container yard
  . new trailer yard
  . raise of level of coastal protection
  . raise of remaining part of rail yard
  . additional 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 one area is outside the control of the port administration, namely the railway installations in the ferry terminal which are controlled by the railway authority. During the first 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 kNm, 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.	44°C
	Min.	-18°C
Extreme water temperatures	Max.	35°C
	Min.	~0°C
Average relative humidity		65%
Average yearly precipitation		116 mm

Wind loads

Wind pressure=0.60 kPa

Snow loads

Snow pressure=0.50 kPa

Ice loads

Considered of minor importance

Seismic loads

The coastal region of Turkmenbashi (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

Due to protected location of the Turkmenbashi port, the wave heights are very limited. The fetch is a few kilometers for the North winds and 20 km for the West winds. It is seldom to observe waves with heignts of more than 0,5 m in the bay

Soil Conditions

According to the report of geotechnical survey by KASPMORNIIPROEKT, ref. /5/, the Turkmenbashi Ferry Terminal region is formed by lithologic sands, big fragment rocks, by silts and loamy soils.

The ferry terminal area has been created by reclamation with sand, brought from Krasnovodsk spit.

The filled fine sand has the following characteristics:

- index of porosity	e=0.63
- carrying capacity	R=0.2 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 MPa
    Blinding layer.

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

  - Class 4 concrete; nominal compressive strength: 30 MPa
    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 MPa

.Type Y, high tension steel; yield strength : 550 MPa

-Structural steel.
.St. 36, yield strength : 235 MPa.
.St. 52, yield strength : 352 MPa.

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. T.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

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. This layout is based on using facilities in the main port for handling inter modal container and unaccompanied trailer traffic. To serve this traffic the existing internal road between the ferry terminal and the main port shall be upgraded (through separate project) and a dedicated container/administration additional road link 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 and administration building	(existing)
- Passenger bridge	(new)
- 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=22 cm
5.	Torpedo sand	h=10 cm

The thickness of the ballast is h=0,3 m (Ballast)

Lighting, power supply and electric installations

Two floodlighting masts, 18 m long each, with glow lamps in the floodlights, shall light the terminal area. Control after the flood lighting shall be carried out from the УОУ type control boxes, installed at the masts at the height of 1.8 m above sea level. Lighting of lanes, footpaths shall be arranged by fittings with ДРЛ type mercury vapour lamps, installed with a help of bracket on steel supports. Control after the outside lighting is carried out of the separately standing point of type ПР-41. Switching on of the lighting fixtures is with a phase being repeated in a continuous way. 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, coming from the constructing local boiler house POK-2, located at the ferry terminal fence. The HB-18 (2 pieces) type boilers shall be installed in the boiler house. The capacity of the each of the boilers is 0.3 Gcal/hr=0.34 MW.

Heat consumption for the ferry terminal :Q=0.3 Gcal/hr=0.34 MW.
Water temperature in the boiler house is : T1=95°C, T2=70°C

The heat net shall be laid in two ways:

The heating net is laid from the boiler house under ground. 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.

4.2 Marine works, berthing structure

Drawing T.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: T.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: T.02.18, T.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: T.02.14, T.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: T.02.01, T.02.10, T.02.11, T.02.12, T.02.13, T.02.16, T.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: T.02.10, T.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 Azobe 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

Two 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 access yard,

- Alt. Option 2, Phase I = Phase II: shore end of ramp raised, raising of complete railway access yard

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 reception yard at 1,5 m and go to the existing rail top of the marshalling yard at the distance of 555 m, the Designed Rail Road is 23.88m. The total length of the reception yard is l=555 m. The length of all the railways is 2,875 lm. The number of points is 12 pcs., rails are p-50 and p-50 (old ones). Sleepers are made of reinforced concrete, new ones. We remove the old ballast and throw it in the dump at the distance of 11km. We remove the asphalt with the thickness of 10 cm from the front area of the expanding bridge and throw it in the dump at the distance of 11 km. We bring the soil from the borrow pit at the distance of 11 km. The soil volume is 22350 m3.

We design non-guarded land base at the intersection of the railway with the car roads.

The ballast thickness is h=0,3m. Broken stone. Rails with the length of 25 m shall be welded by contact method at Kizil-Arvat base and assembled there. Then they shall be transported at the place of their installation at the distance of 250 km.

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 T.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.

[1] Building material

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.

Direct foundation is utilised constructed as strip monolithic beams of RC on strip slabs. Moisture preventive actions are foreseen. The floors of the ducts are pre-fabricated RC plates with the size of 60x80.

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.

Direct foundation is utilised constructed as strip monolithic beams of RC on strip slabs.

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 T.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 Modification of sea station in Turkmenbashi

Architectural layout

The following description has reference to drawing no. T.05.00. The existing sea station building in Turkmenbashi has recently undergone total repair. However, to arrange the necessary facilities for customs and police check of passengers after the new sky-walk has been introduced, a modification and extension of the building is proposed.

The existing yard is proposed to be covered with glass elements. On the ground floor of the covered yard, the following additional facilities will be constructed:

- ticketing office
- customs and police check area
- hall for arriving passengers
- offices for police and customs

On the first floor there will be connection to the sky-walk.

Window frames and doors of aluminium. Floors in halls and checking area will be of marble. In the offices, the floor will be parquet. Inside walls and columns in the halls will be covered by fire-proof materials and in the offices, walls will be covered by paint and wall-paper.

Structural part

For a convenient operation of the existing sea station, staircases and balconies, connected with a passenger bridge, shall be added.

Staircase elements are pre-fabricated RC steps and steel bridge-boards of U-profile.

The balconies are made of U-profile steel beams and a light floor.

The steel beams for the balconies are fastened to the existing columns (steel pipes) by welding.

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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

4.5.4 Ticketing terminal building

The following description corresponds to drawing T.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

Direct foundation is utilised constructed as strip monolithic beams of RC on strip slabs. 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.

Direct foundation is utilised constructed as strip monolithic beams of RC on strip slabs.

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 Turkmenistan

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 Turkmenistan, 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 Turkmenistan. Also the first private Turkmen construction companies has been founded. Most of these companies work on private financed projects and in the exploitation of natural resources. In a few cases the foreign companies work together with national Turkmen 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 only few public works are executed.

Just recently, at 12th of December, 1996, a decree "On construction of projects implemented by foreign firms and companies on the territory of Turkmenistan" has been adopted by the President of Turkmenistan. In compliance with this document, Ministries, organisations, khyakimliks (municipalities) of velayts (regions) and city of Ashgabat upon entering into the contracts with foreign companies to construct and reconstruct projects on the territory of Turkmenistan apart from sources of financing have to stipulate attraction of the contract organisations of Turkmenistan to execute works and services according to conditions of the contract in the amount not less than 30% from the total sum of the contract.

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 Turkmenistan 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 concerned with renovation works of traditional building works as well as new constructions in the town of Turkmenbashi.

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 Ashgabat together with local production of precast concrete elements

- high quality cement is locally produced, while all steel products are imported traditionally from Russia and Ukraine.

- 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 not available on the local market.

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 access yard

- Alt. Option 2, Phase I = Phase II: shore end of ramp raised, raising of complete railway access yard

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	3174	230
Marine Works	9018	190
Ramp Rehabilitation	3890	0
Railway Works	62	954
Terminal Building Works	639	220
Subtotal	16783	1594
Contingency for unforeseen ramp works	1500	
Total works	18283	
Additional activities:		
Site Surveys, Topographic, Bathymetric	30	
Soil Investigation	100	
Supervision of Works (20 months)	890	
Total additional services	1020	
Contingency, price variations (10%)	1930	
Grand Total, Budget	21233	

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 access yard)

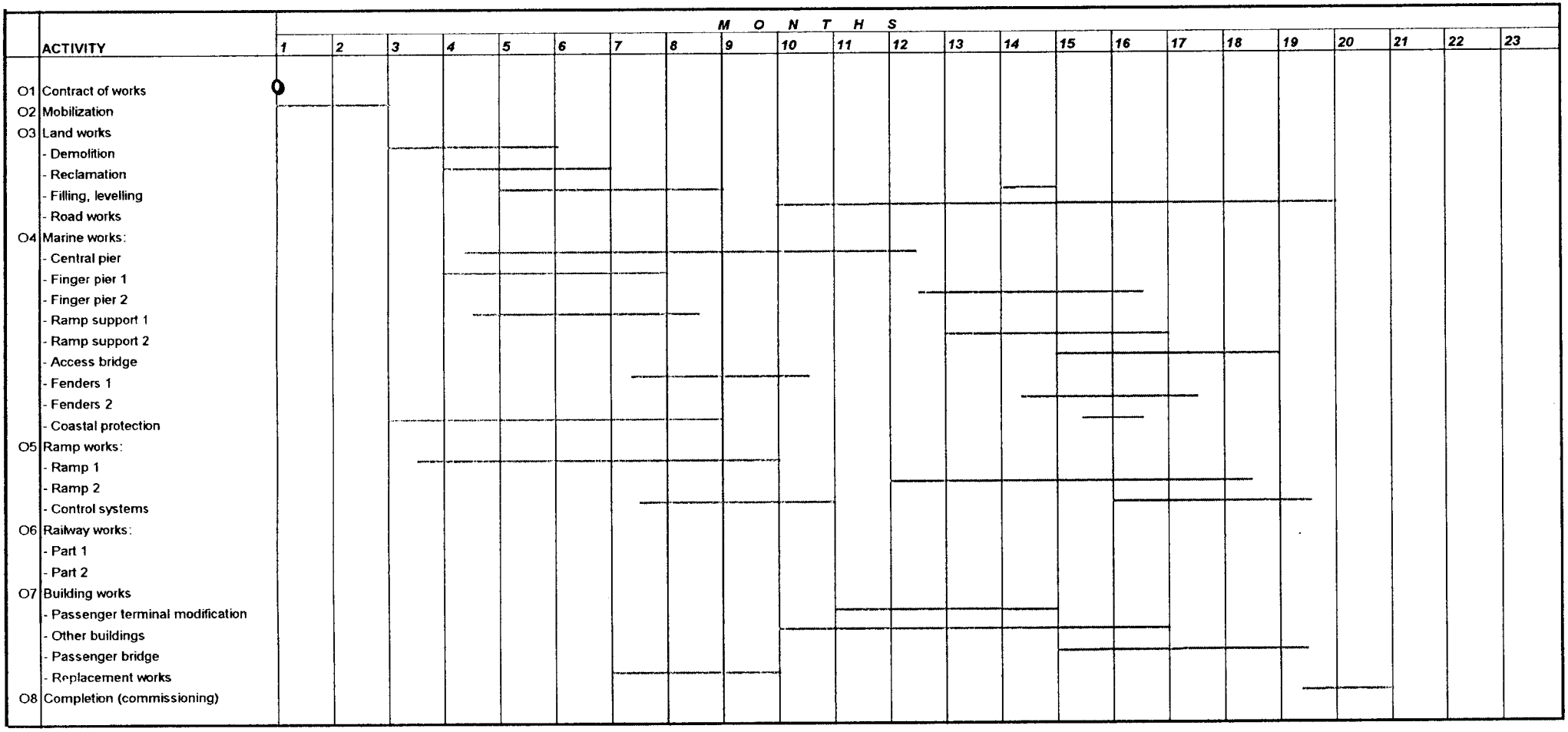
It follows from the planning that the total construction time, from start of mobilisation by the contractor to preliminary commissioning, is estimated to last 20 months. The construction period shall be followed by a one year guarantee period before the final commissioning will take place.

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 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 - Turkmenbashi
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/ Technical report on engineering researches, Part III, Engineering geological conditions, No 1173, Krasnovodsk sea port
KASPMORNIIPROEKT, Baku, 1979

Appendix 2

List of Drawings

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

j.BB960490.EJ	PROJ. NO.: 963324
European Commission / Tacis	DWG. NO.:
Port Network Plan and Improvement Programme	DRAWN. DATE: 1997-03-20
REV.DATO:	

DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
T.01.40	Terminal Area Water Supply and Severage, Plan	1997 0320					
T.01.41	Terminal Area Water and Severage, Longitudinal profile	1997 0320					
T.01.44	Terminal Area Heat system, Symbols	1997 0320					
T.01.45	Terminal Area Heat system, Layout of distribution nets	1997 0320					
T.01.46	Terminal Area Heat system, Layout of distribution nets	1997 0320					
T.01.47	Terminal Area Heat system, Profile of nets	1997 0320					

j.BB960490.EJ					PROJ. NO.: 963324			
European Commission / Tacis					DWG. NO.:			
Port Network Plan and Improvement Programme					DRAWN. DATE: 1997-03-20			
REV.DATO:								

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

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

DRAWING No.	TEKST	DATE	REVISION DATE				
			A	B	C	D	E
T.03.70	Control System, List of drawings	1997 0320					
T.03.71	Control System Electrical symbols	1997 0320					
T.03.72	Control System Lighting fixtures, Specifications	1997 0320					
T.03.76	Ramp Control Building and Lifting Tower Lighting and Power installations	1997 0320					
T.03.80	Control System, Ramp and pier Lighting and power installations	1997 0320					

Turkmenbashi Ferry Terminal					Job No.:	963324		
List of drawings, Electrical installations					Page No.:	1		
					Constr. date:	1997-03-25		
REV.DATE:								

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DRAWING No.	TEKST	DATE	REVISION DATE				
			A	B	C	D	E
T.03.84	Control System, Switchboard Outline diagram	1997 0320					
T.03.85	Control System, Ramp control building Main switchboard no. 1A	1997 0320					
T.03.86	Control System, Lifting Tower 1, right Switchboard 1A01	1997 0320					
T.03.87	Control System, Lifting Tower 2, right Switchboard no. 1A02						
T.03.88	Control System, Lifting Tower 3, right Switchboard no. 1A03						
T.03.89	Control System, Lifting Tower 4, right Switchboard no. 1A04						
T.03.90	Control System, Liftinf Tower 5, right Switchboard no. 1A05						
T.03.91	Control System, Lifting Tower 6, right Switchboard no. 1A06						
T.03.92	Control System, Lifting Tower 1, left Switchboard no. 1A07						
T.03.93	Control System, Lifting Tower 2, left Switchboard no. 1A08						
T.03.94	Control System, Lifting Tower 3, left Switchboard no. 1A09						
T.03.95	Control System, Lifting Tower 4, left Switchboard no. 1A10						
T.03.96	Control System, Lifting Tower 5, left Switchboard no. 1A11						
T.03.97	Control System, Lifting Tower 6, left Switchboard no. 1A12						
T.03.98	Control System, Control Board, right Switchboard no. 1A13						
T.03.99	Control System, Control Board, left Switchboard no. 1A14						

DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
T.05.01	Passenger Terminal, Plan, Sections and elevation	1997 0320					
T.05.45	Passenger Terminal, Heat system	1997 0320					
T.05.46	Passenger Terminal, Heat system	1997 0320					
T.05.47	Passenger Terminal, Heat system	1997 0320					

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Port Network Plan and Improvement Programme					DRAWN. DATE: 1997-03-20			
REV.DATO:								

DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
T.06.01	Border Control Terminal, Layout, Plan Doors and Windows details	1997 0320					
T.06.18	Border Control Terminal, Shed; Plan and Details	1997 0320					
B/T.06.30	Border Control Terminal, El Supply, Lighting, 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					
T.06.40	Border Control Terminal, Water Supply, Plan						
T.06.45	Border Control Terminal, Heat system, Ventilation	1997 0320					
T.06.46	Border Control Terminal, Heat system, Central Heating						

j.BB960490.EJ					PROJ. NO.: 963324			
European Commission / Tacis					DWG. NO.:			
Port Network Plan and Improvement Programme					DRAWN. DATE: 1997-03-20			
REV.DATO:								

DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
T.07.01	Ticketing Terminal, Lay-out, Plan Doors and Windows details	1997 0322					
T.07.10	Ticketing Terminal, Foundation, Plan and Details	1997 0322					
T.07.15	Ticketing Terminal , Slabs, Plan and Details	1997 0322					
T.07.18	Ticketing Terminal, Shed, Plan and details	1997 0322					
B/T.07.30	Ticketing Terminal, El Supply, Lighting, Plan	1997 0320					
B/T.07.31	Ticketing Terminal, El Supply, Diagram	1997 0320					
B/T.07.32	Ticketing Terminal, El , Telephone, Plan	1997 0320					
T.07.45	Public Service Bulding Heat system, Plan	1997 0322					

j.BB960490.EJ					PROJ. NO.: 963324			
European Commission / Tacis					DWG. NO.:			
Port Network Plan and Improvement Programme					DRAWN. DATE: 1997-03-20			
REV.DATO:								

DRAWING NO.	TEXT	DATE	REVISION DATE				
			A	B	C	D	E
T.08.01	Public Service Building, Lay-out, Plan Doors and Windows details	1997 0322					
T.08.10	Public Service Building, Foundation, Plan and Details	1997 0322					
T.08.15	Public Service Building, Slabs, Plan and Details	1997 0322					
B/T.08.30	Public Service Building, El Supply, Lighting, Plan	1997 0320					
B/T.08.31	Public Service Building, El Supply, Diagram	1997 0320					
B/T.08.32	Public Service Building, El , Telephone, Plan	1997 0320					
T.08.45	Public Service Bulding Heat system, Plan	1997 0322					

j.BB960490.EJ					PROJ. NO.: 963324		
European Commission / Tacis					DWG. NO.:		
Port Network Plan and Improvement Programme					DRAWN. DATE: 1997-03-20		
REV.DATO:							

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

						Job No.:	963324	
European Commission / Tacis						Page No.:	1	
Port Network Plan and Improvement Programme						Constr. date:	1997-03-20	
REV.DATE:								

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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

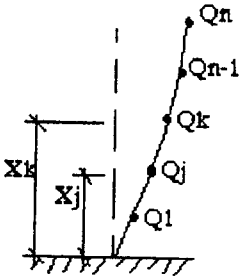


Figure 1

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
	The permanent			
1	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	30	1.1	33
	Total	182.6		252.23

b) Structures of reinforced concrete (RC)

No	Names	Normative loading, in kgs/m2	Coefficient γf	The estimated loading, kgs/m2
	The permanent			
1	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

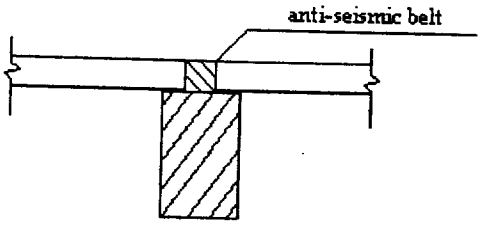


Figure 2

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.

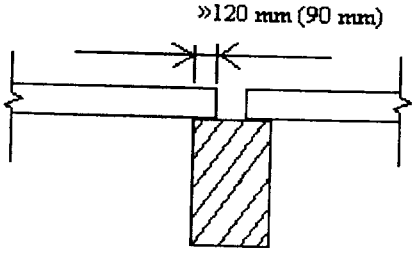


Figure 3

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 c/r*								

*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

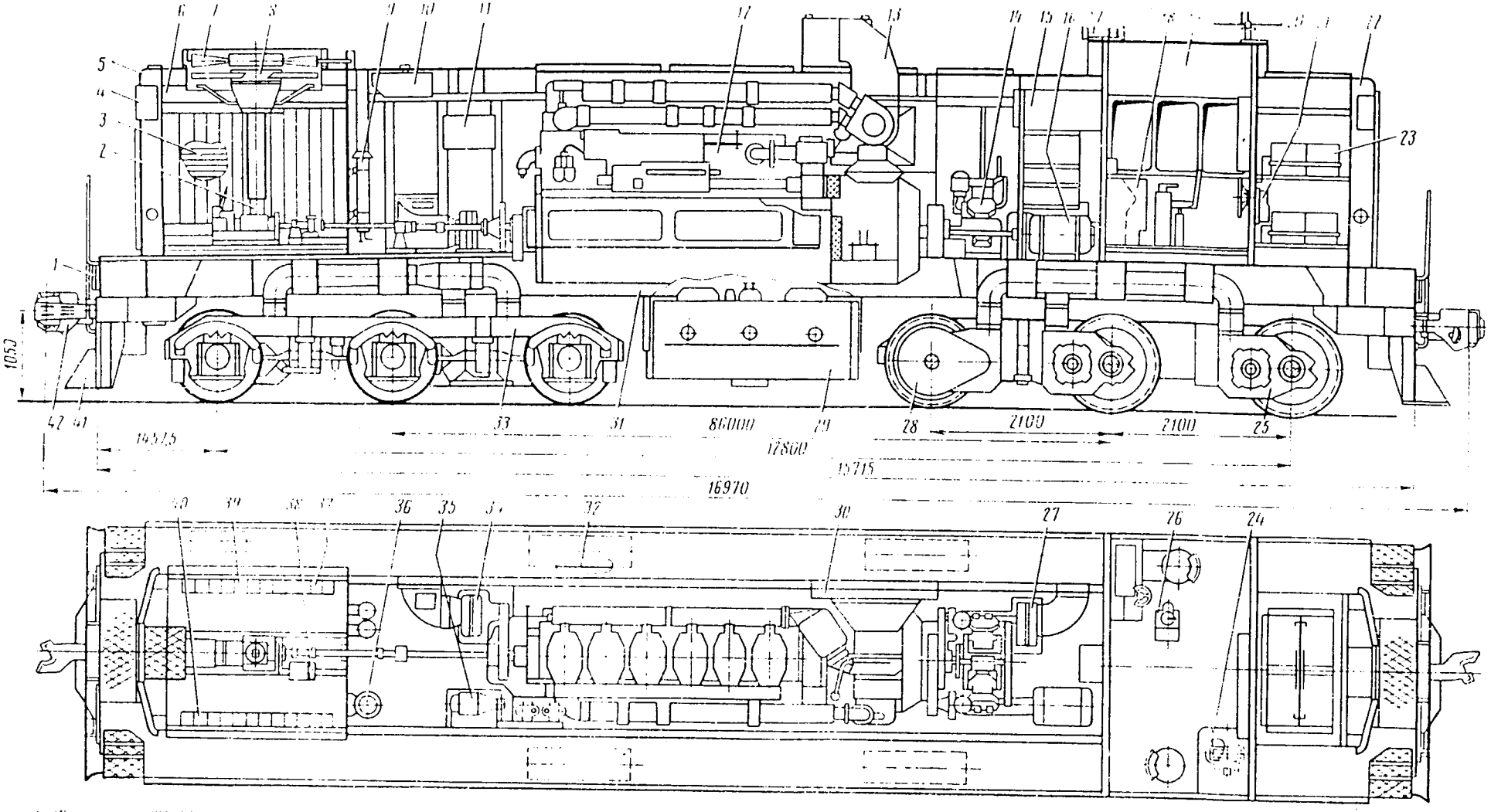


Рис. 2. Тепловоз ТЭМ2 Брянского машиностроительного завода:

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* — кран машиниста; *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 топливоподкачивающие насосы; *36* — топливоподогреватель; *37* — охлаждающие секции масла дизеля; *38* — водяной насос контура охлаждения наддувочного воздуха; *39* — водяные секции охлаждения наддувочного воздуха; *40* — водяные секции охлаждения воды дизеля; *41* — пылеочиститель; *42* — лесенка

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.

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 т
Нагрузка от колесной пары на рельсы, тс	20±3%	20.5 т
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 м
Колея, мм	1520	
Диаметр колес (новых) по кругу катания, мм	1520/1435	
Тип букс	1050	
	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 мм
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		599,7 ≈ ≈ 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 (горизонтировочный)	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

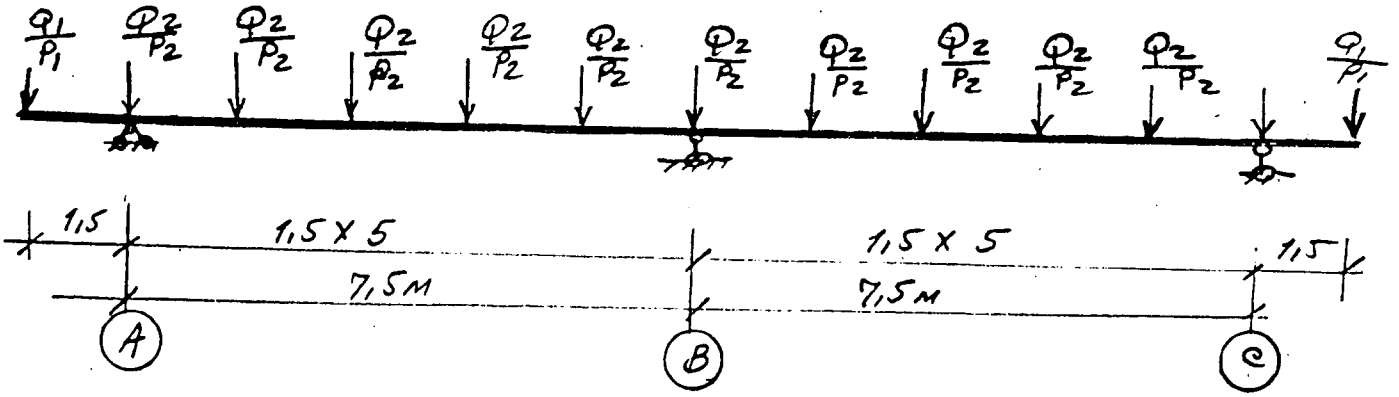
Снег:

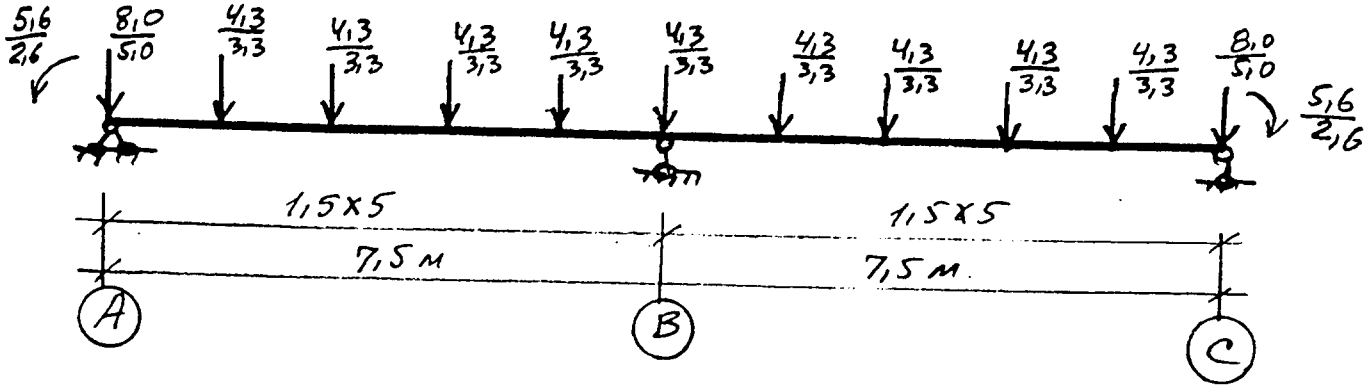
Нормативная нагрузка — 50кгс/м²

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 сосредоточена нагрузка (СН):

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

(покрития 1-2)

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

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

Временная СН

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

(покрития 1-3)

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

Опорные моменти (от конзола) и СН

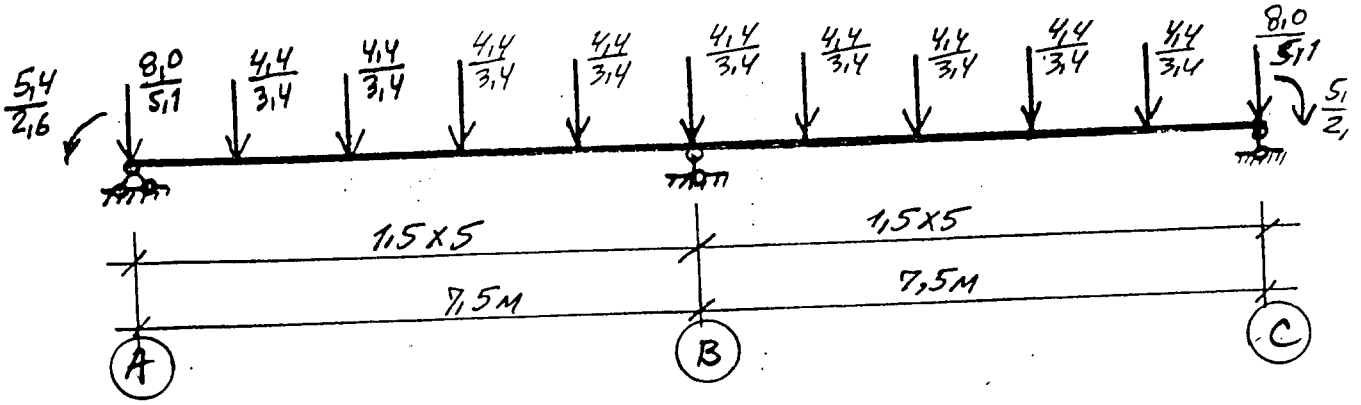
$$M_Q = Q_1 \cdot 1,5 = 3,7 \cdot 1,5 = 5,6 \text{ kN.m}$$

$$M_{P_1} = P_1 \cdot 1,5 = 1,7 \cdot 1,5 = 2,6 \text{ kN.m}$$

$$Q_3 = Q_1 + Q_2 = 8,0 \text{ kN}$$

$$P_3 = P_1 + P_2 = 1,7 + 3,3 = 5,0 \text{ kN}$$

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



Постоянная СН:

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

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

Временная СН.

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

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

Опорные моменты (от консола) и СН:

$M_Q = Q_1 \cdot 1{,}5 = 3{,}6 \cdot 1{,}5 = 5{,}4\text{ кН}\cdot\text{м}$
$M_P = P_1 \cdot 1{,}5 = 1{,}7 \cdot 1{,}5 = 2{,}6\text{ кН}\cdot\text{м}$.

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

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

2.3 Сбор ветровая нагрузка.

Расчетные ветровые нагрузки:

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

$W_0 = 60\text{кгс/м}^2$ нормативное значение ветрового давления (гор. баку V ветровой район);

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

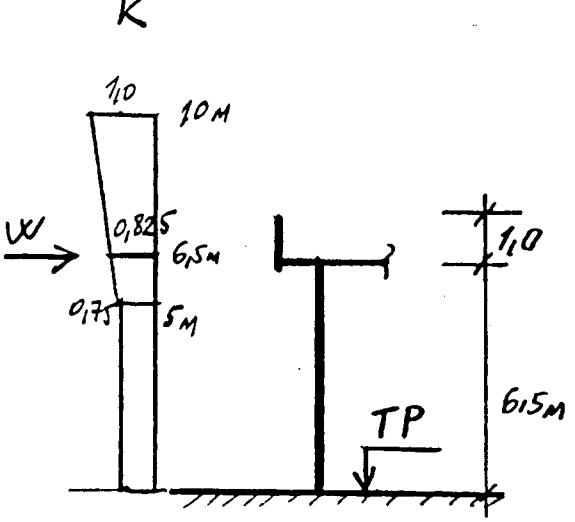
$\gamma_f = 1{,}2$ коэффициент надежности по нагрузке;

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;

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

по оси „А" и „С"

$$Q_1 = (8{,}0 \cdot 7 + 4{,}3 \cdot 4 + 4{,}4 \cdot 10) \cdot 0{,}9 + (5{,}0 \cdot 2 + 5{,}1 \cdot 5 + 3{,}3 \cdot 4 + 3{,}4 \cdot 10) \cdot 0{,}5 = 105{,}48 + 41{,}35 = 146{,}83 \text{ кН}$$

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

по оси „В"

$$Q_2 = (4{,}3 \cdot 10 + 4{,}4 \cdot 25) \cdot 0{,}9 + (3{,}3 \cdot 10 + 3{,}4 \cdot 3{,}0) \cdot 0{,}5 = 137{,}7 + 59 = 196{,}7 \text{ кН}.$$

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

по оси „1" и „4"

$$Q_3 = (8{,}0 \cdot 3 + 4{,}3 \cdot 9 + 4{,}4 \cdot 4{,}5) \cdot 0{,}9 + (5{,}0 + 5{,}1 + 3{,}3 \cdot 9 + 3{,}4 \cdot 4{,}5) \cdot 0{,}5 = 74{,}25 + 30{,}05 = 104{,}3 \text{ кН}$$

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

по оси „2" и „3"

$$Q_4 = (8{,}0 \cdot 4 + 4{,}4 \cdot 18) \cdot 0{,}9 + (5{,}1 \cdot 4 + 3{,}4 \cdot 18) \cdot 0{,}5 = 100{,}08 + 40{,}8 = 140{,}88 \text{ кН}$$

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

RAMBØLL

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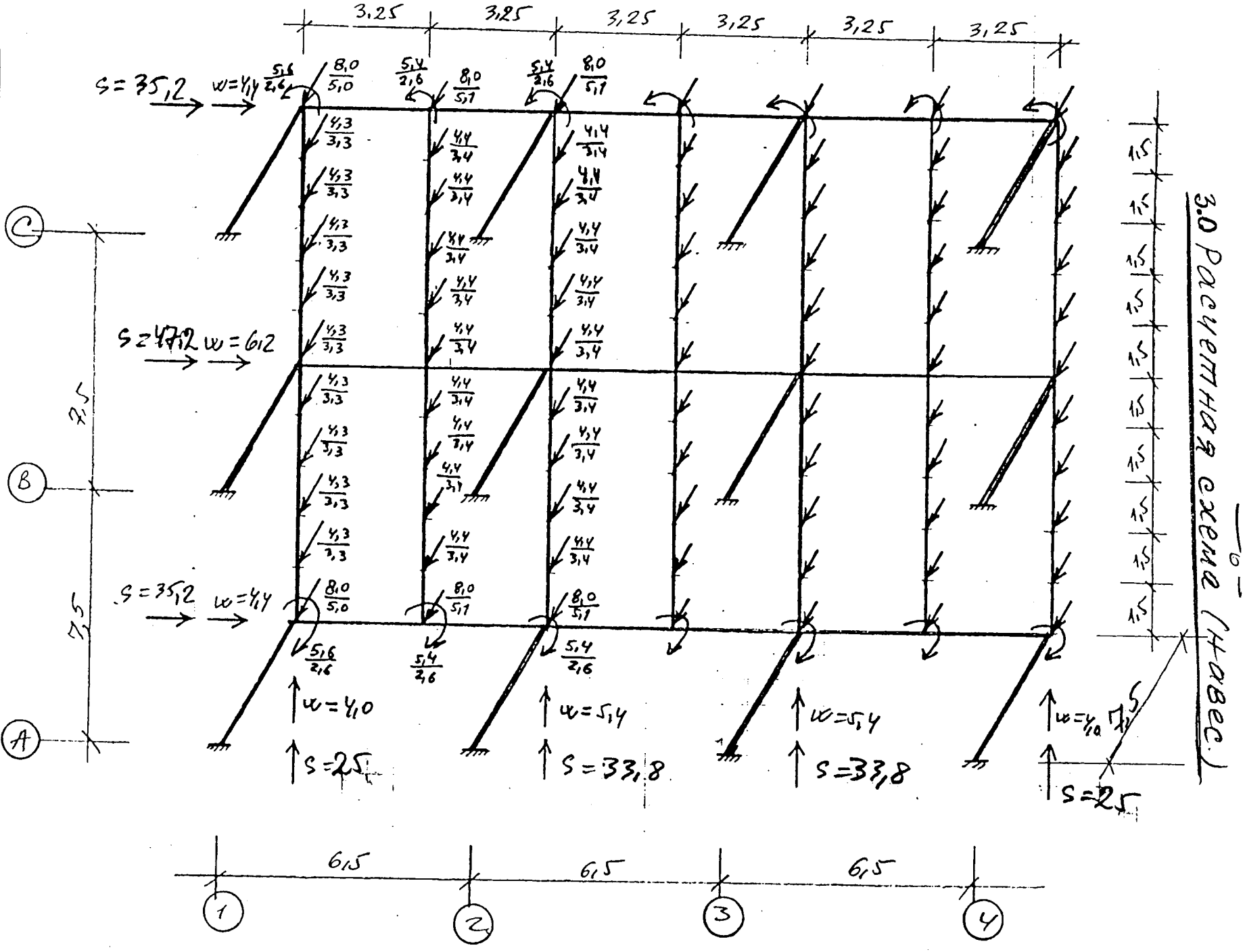
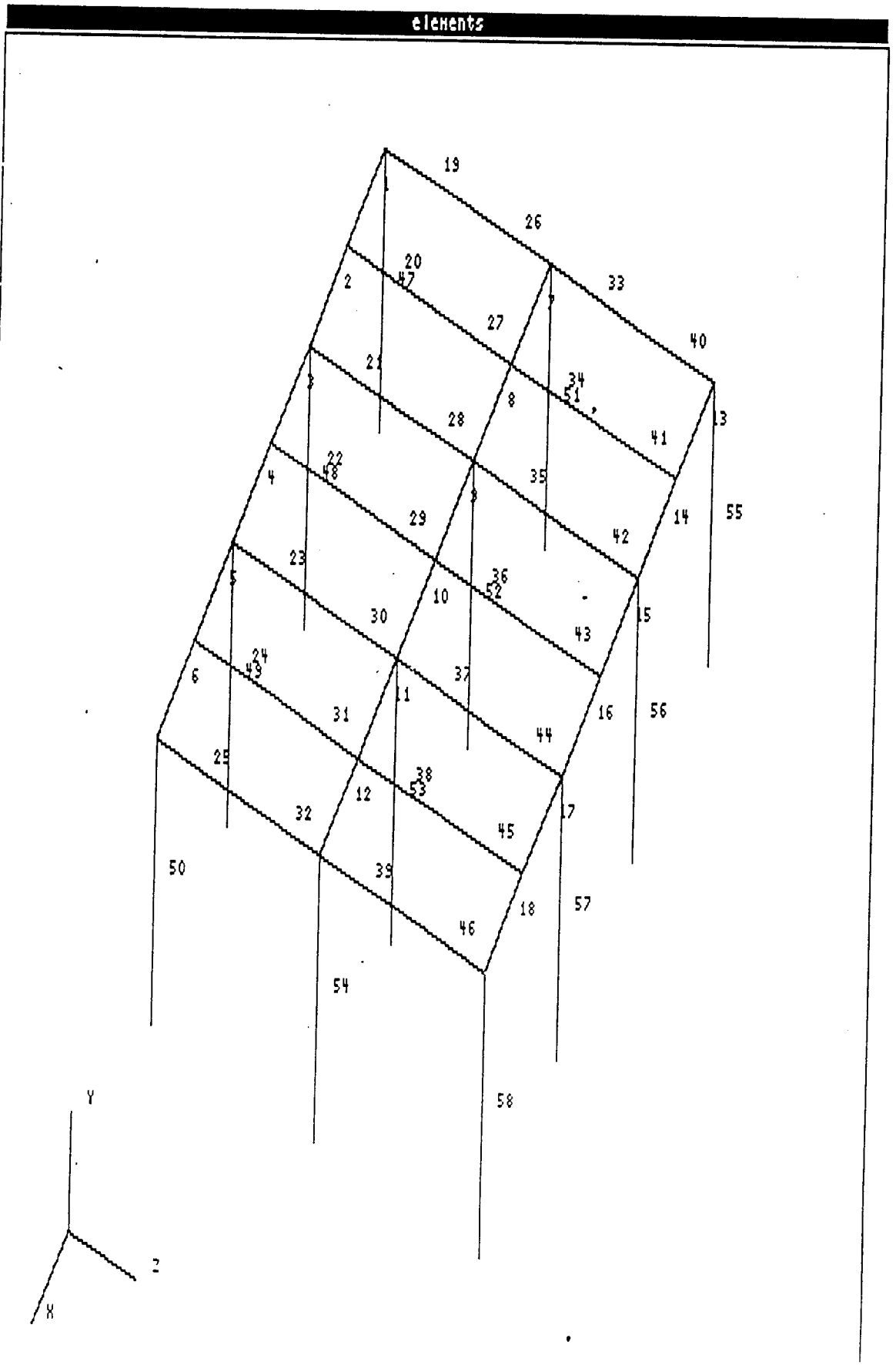


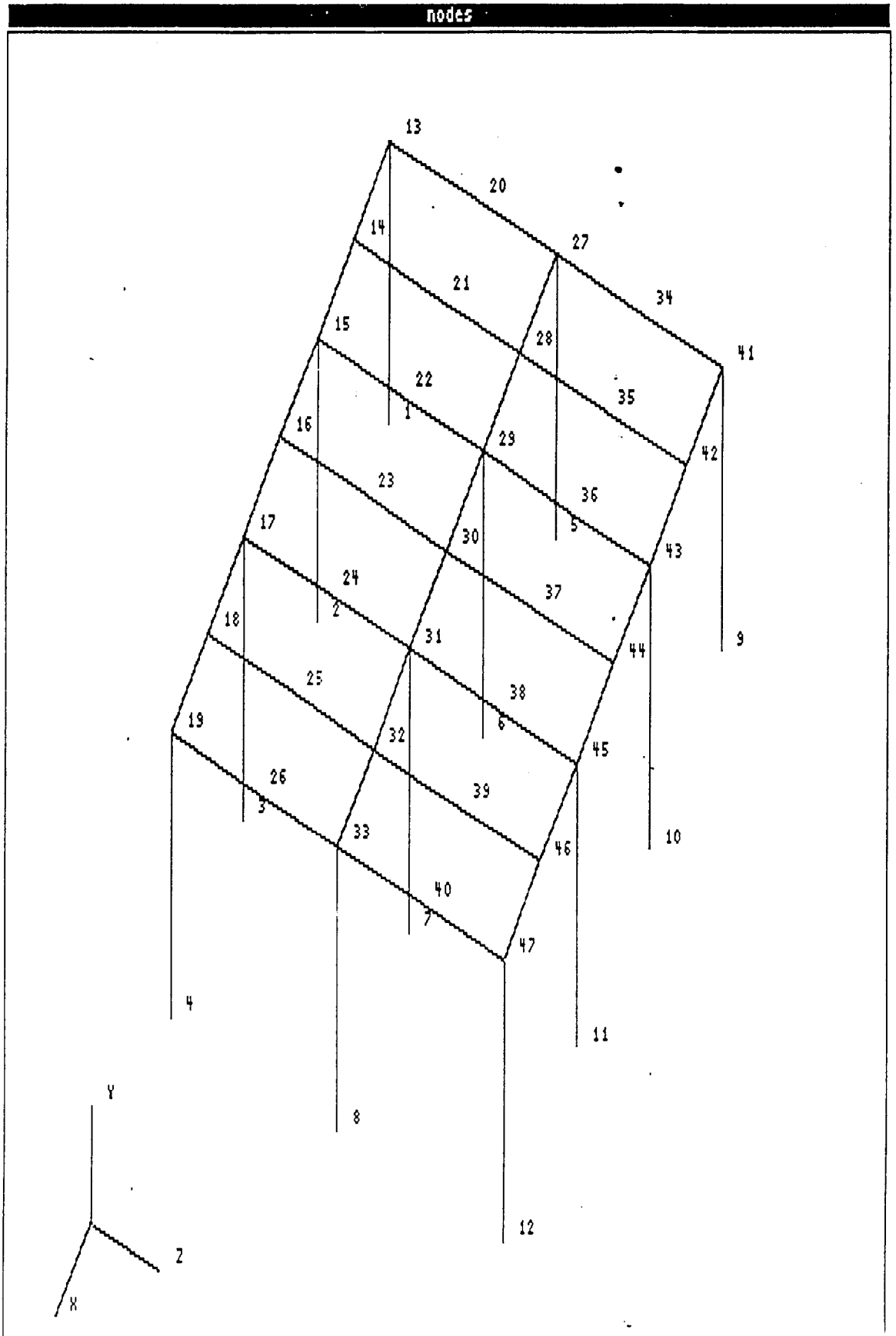
3.0 Расчетная схема (нагрев.)

— 6 —

CUSTOMS

4.0 Статической расчет (навес.)




nodes
13
20
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8
12
Y
Z
X

RAMBOLL
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	rotation x y z	End-nodepoint No.	degr.o.f. deflect. x y z	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	/---- Force (kN) -----/			/--- Moment (kNm) ab. ---/		
No.	X-dir.	Y-dir.	Z-dir.	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 $W_x = 2 \cdot 152 = 304 \text{ см}^3$ ([1])

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 ([1])

$W_x = 304$ 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 ([1])

$W_x = 304$ см3.

5.2 Расчет колонна

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

Требуемую площадь сечения определяем из формулы $Ad = \frac{N}{\varphi_e \cdot R_y \cdot \gamma_c}$ 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.

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

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.

$z = \frac{2r}{\pi} = 12,25$ 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

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

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 $\varphi_e = 0{,}129$

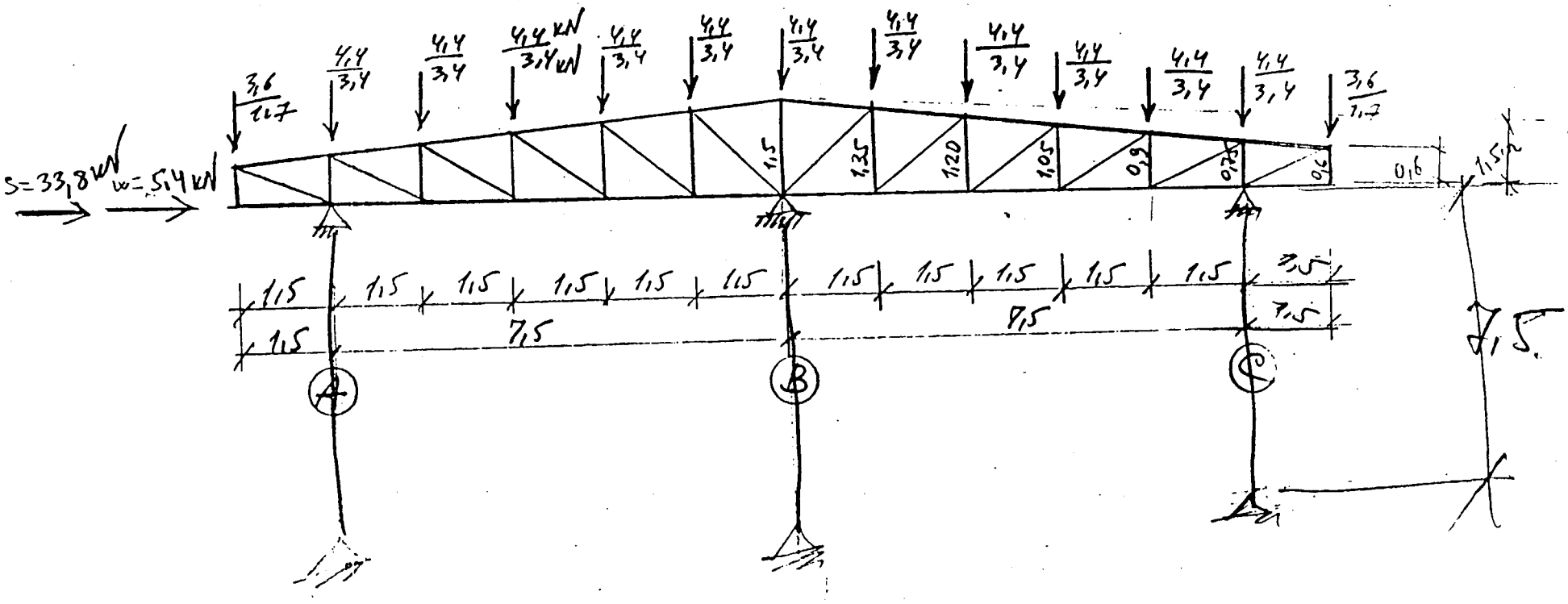
$$Ad = \frac{89\,600}{0{,}129\ 230(100)} = 30{,}2\ см^2 < 45\ см^2$$

Фактическое напряжение в сечении

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

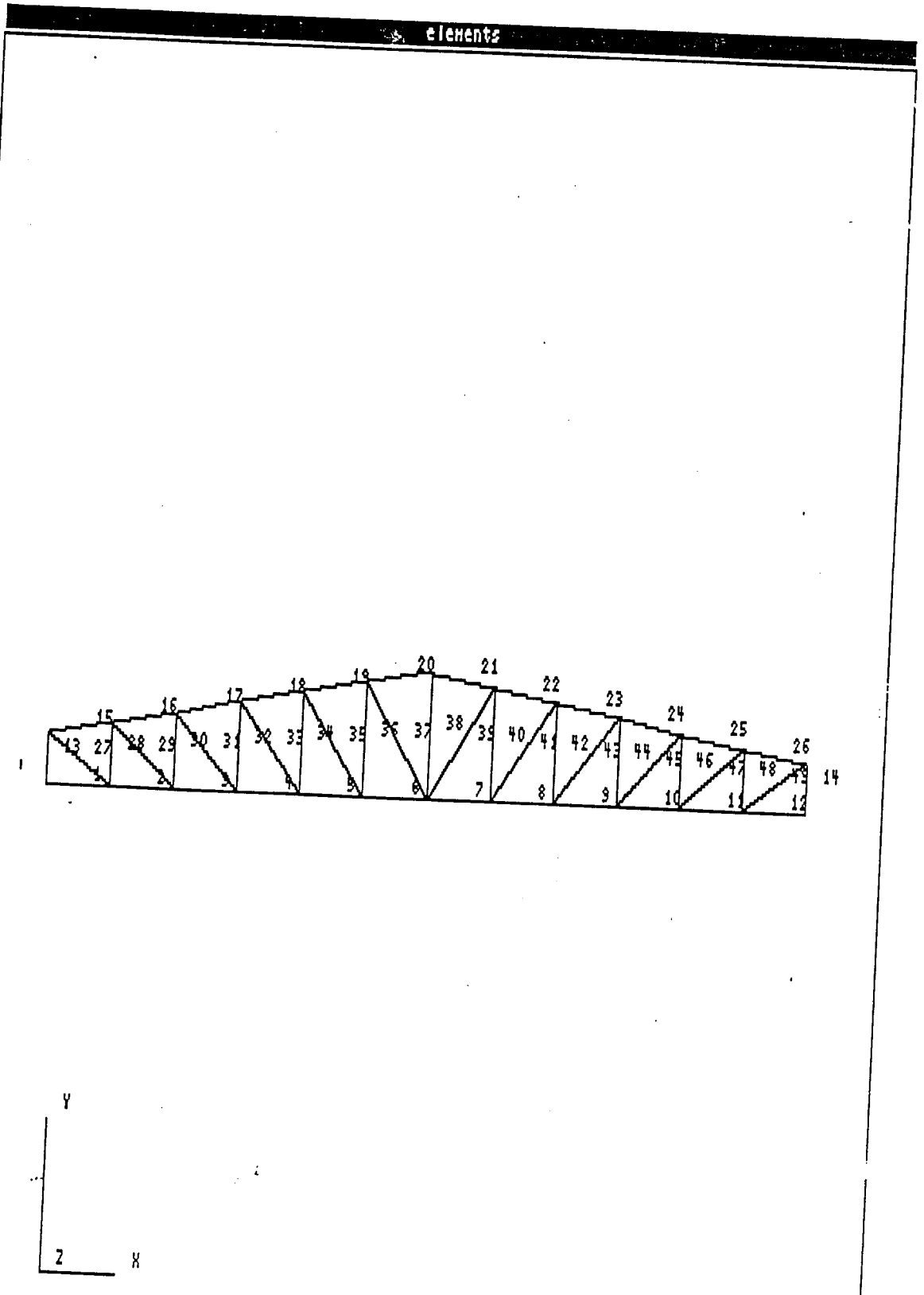
$$= 154{,}4\ МПа < R_y = 230\ МПа$$

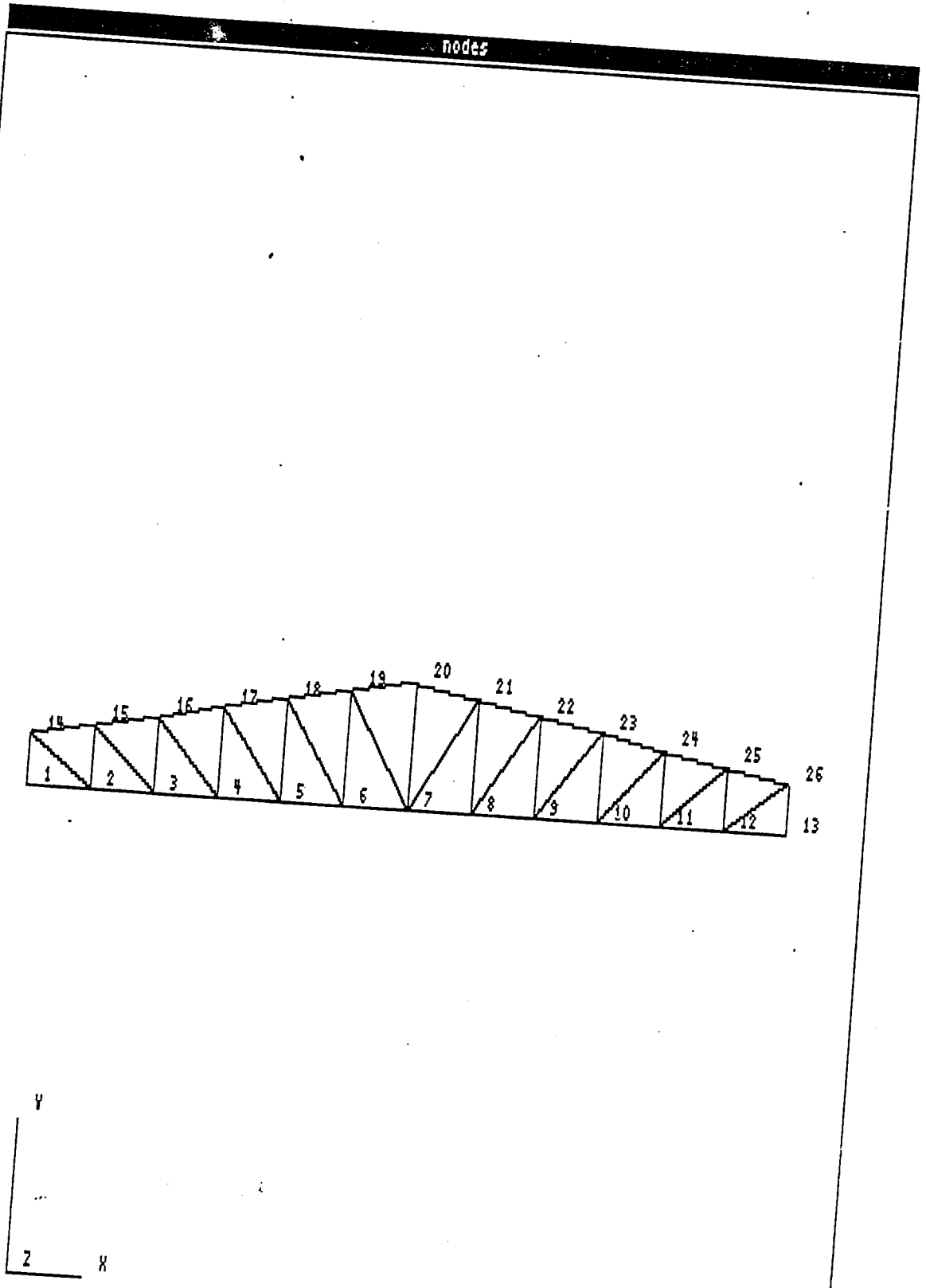
6.0. Расчетная схема фермы (II вариант)



Customs / Police - building

7.0 Статически расчет ферма.




nodes
14
15
16
17
18
19
20
21
22
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: combil

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 $\varphi \approx 0,7$ 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 ($A_s = 4,8 \text{ см}^2$)

$i_x = 1,53$ 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 ($A_s = 4,8 \text{ см}^2$)

$i_x = 1,53$ 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.

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

При $\varphi \approx 0,5$

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

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

$i_x = 1,53$ 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:

$$Ф_c^p = m\left(m_c \cdot m_{Rc} \cdot m_R \cdot R \cdot F + U \sum_{hp}^{e} m_{c_1} \cdot m_f \cdot f_i \cdot l_i\right)$$

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_1} 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 грунт. основания на боковой поверхностью свай, тс/м^2, определяемое по таб 2/2) (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 сваи

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

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

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

Длина верхнего участка свай вдоль которого сопротивление грунта на боковой поверхности

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

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

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

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

$m_c = m_{c2} = m_{c3} = 0{,}7$

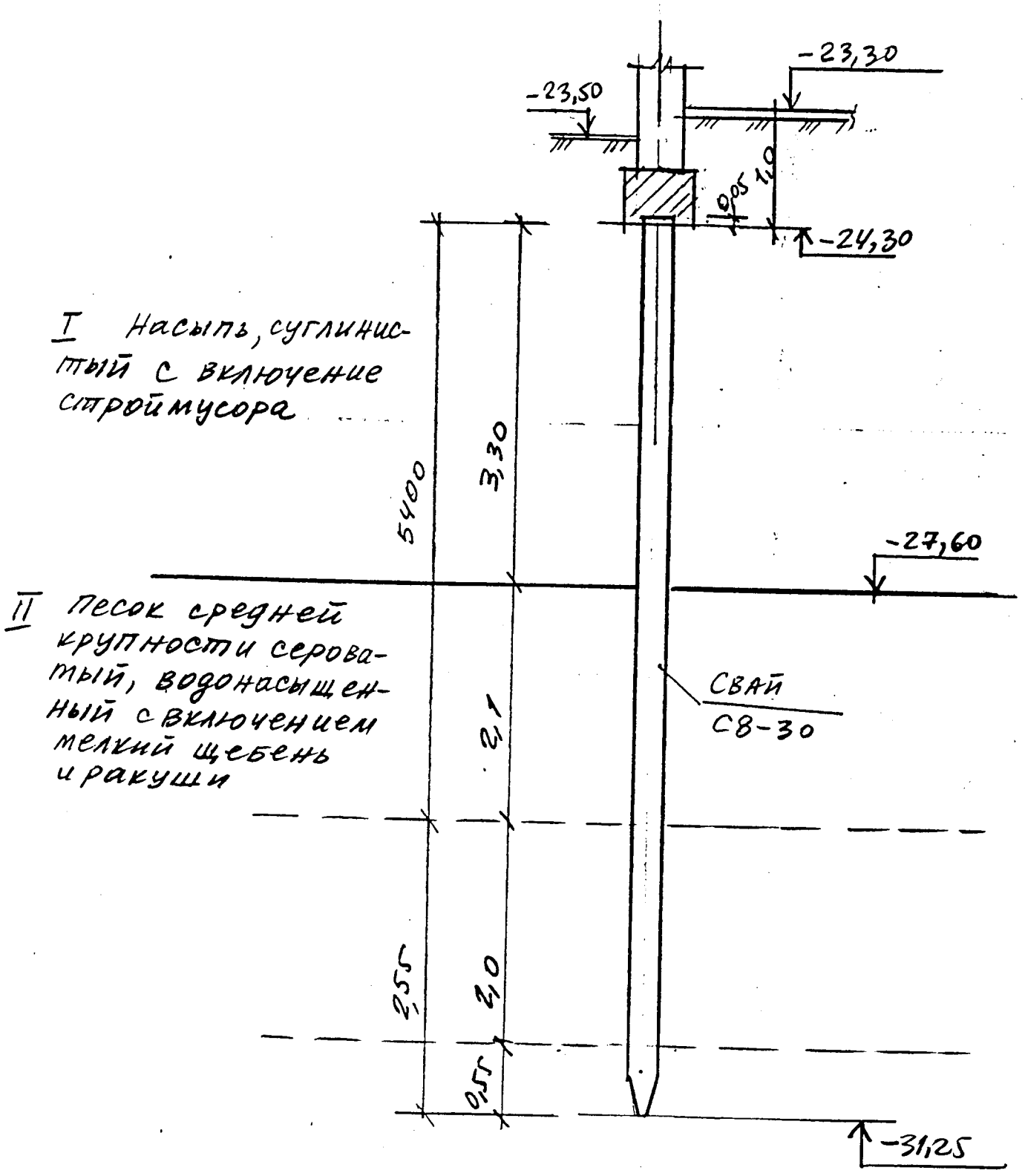
$m_R = m_f = m_{Rc} = 1{,}0$

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

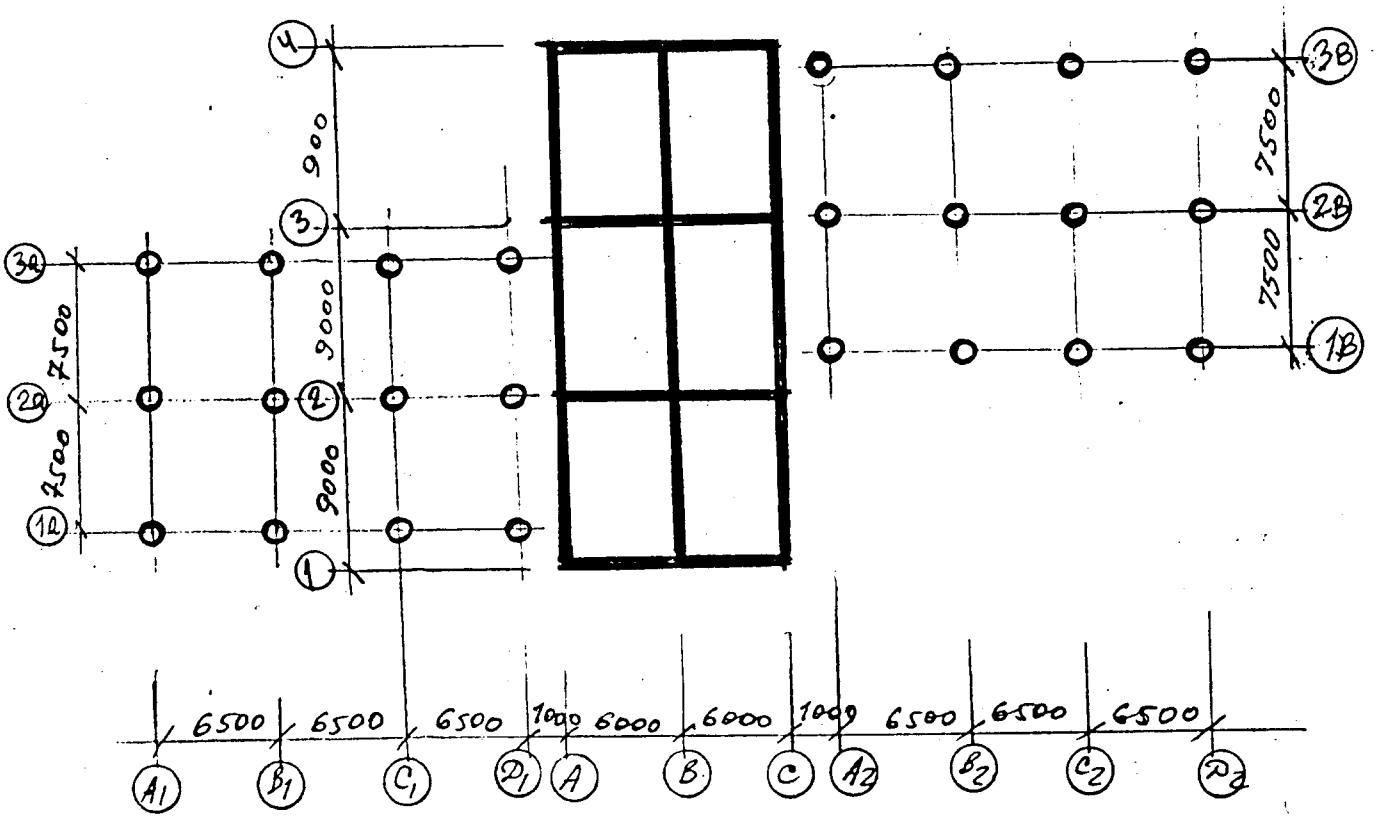
$+ 0{,}55 \cdot 6{,}26)) = 24{,}26 + 12{,}97 = 37{,}23$ т·с

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

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


-23,30
-23,50
1,0
0,05
-24,30
I Насыпь, суглинистый с включением строймусора
5,00
3,30
-27,60
II Песок средней крупности серовато-
ный, водонасыщенный с включением
мелкий щебень
и ракуши
2,1
Свай
С8-30
2,55
2,0
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 „$А_1$" и „$Д_1$" в осях „1а" и „3а" по оси „$А_2$" и „$Д_2$" 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)

$$N = 51{,}7 + \frac{120}{2} = 111{,}7 \text{ кН} = 11{,}17 \text{ тс}$$

Фундамент по оси „A_1" и „D_1" в осях „2а" по оси „A_2" и „D_2" 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 $\approx 15{,}02$ тс

Фундаменты по оси „B_1" и „C_1" в осях „2а" по оси „B_2" и „C_2" 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 „B_1" и „C_1" в осях „1а" и „3а" по оси „B_2" и „C_2" в осях „2а" и „4а".

Усилия от колонны

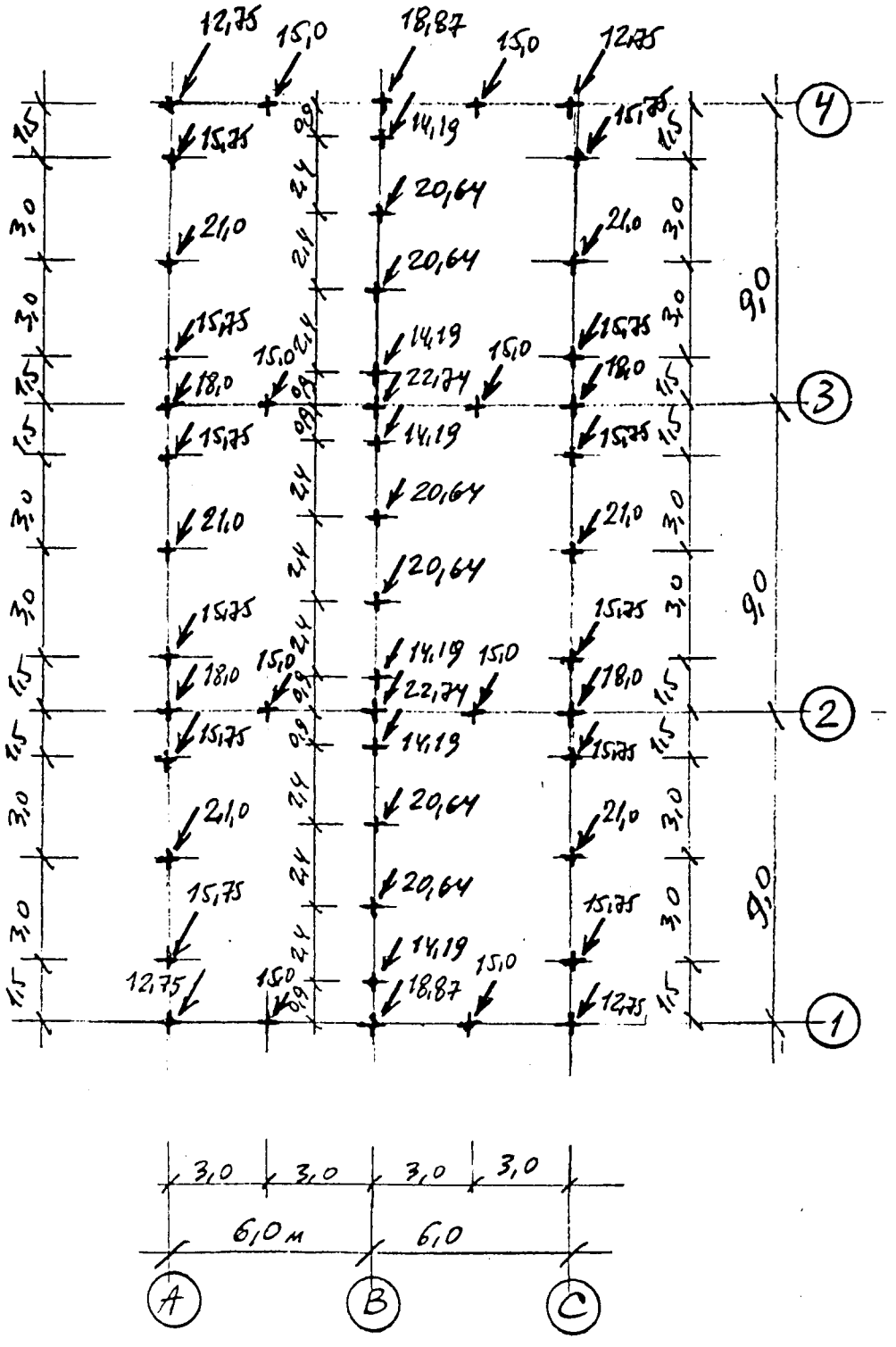
$N = 90{,}2$ кН ; $Q = -6{,}2$ кН ; $M = 17{,}8$ кН.м.

С учетом временная нагрузка (от транспорта.)

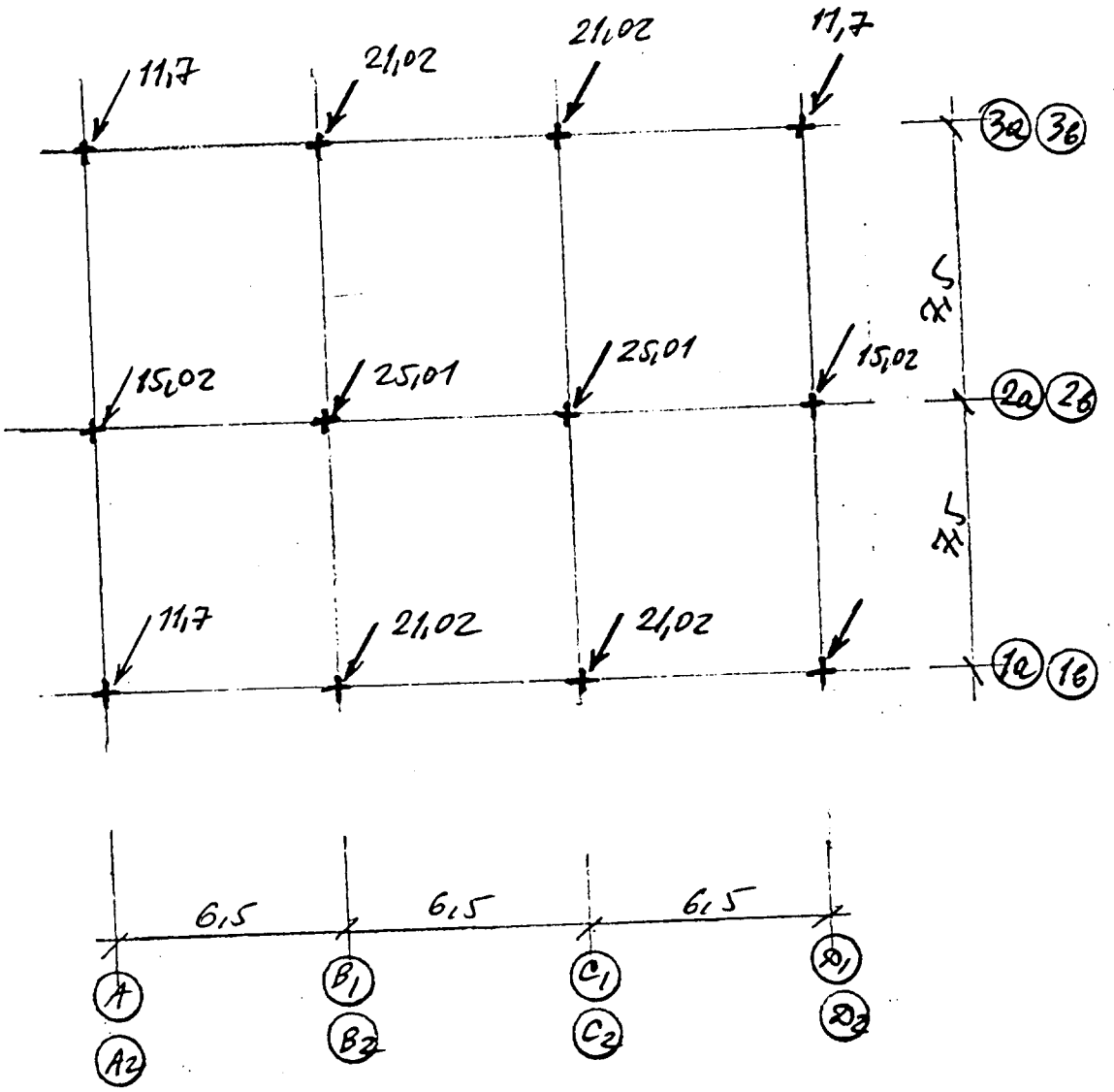
$N = 90{,}2 + 120 = 210{,}2$ кН $= 21{,}02$ т.с.

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 1пм 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

$$M_{пр} = \frac{p_0 \cdot a^2}{12} = \frac{3011 \cdot 0{,}659^2}{12} = 1{,}1\ т \cdot м.$$

Площадь арматура на опорах.

$$A_0 = \frac{M_{оп}}{b_р \cdot h_0^2 \cdot R_в} = \frac{8{,}3 \cdot 10^5}{60 \cdot 45^2 \cdot 86{,}7} = 0{,}08$$

Бетон кл. В15 ($R_в = 86{,}7$ кгс/см^2)

От таблицы $\eta = 0{,}968$

Требуемое площадь арматурные стержни

$$A_s = \frac{8{,}3 \cdot 10^5}{0{,}968\,45 \cdot 3750} = 5{,}1\ см^2$$

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

Площадь арматура на пролетах.

$$A_0 = \frac{M_{пр}}{b_р \cdot h_0^2 \cdot R_в} = \frac{1{,}1 \cdot 10^5}{60 \cdot 45^2 \cdot 86{,}7} = 0{,}01$$

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

$$A_s = \frac{1{,}1 \cdot 10^5}{0{,}995 \cdot 45 \cdot 3750} = 0{,}7\ см^2.$$

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

ELECTRICAL INSTALLATIONS

Проект по разделу "Энергия и электричество" терминала службы контроля (ОС) включает в себя следующие части и разделы (1)

- 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" и СНИП II-85-80 часть II глава 85 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 помещений уборных БК с лампами накаливания.~~
Для помещений вестибюля 150 лк и коридора 75 лк с люминисцентными лампами.
Для помещений уборных 20 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 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, ~~вестибюле коридоре~~ применяются светильники с люминисцентными лампами потолочные серии УСП5. В коридоре и вестибюле встраиваемые серии Л1046
В помещениях уборных светильники с лампами накаливания серии НПО01. ~~В вестибюле~~. 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

(2) ВОС-36

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

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

Все данные 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 ($Вт/м^2$)	$P_{общ, лам}$ (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	НПО01-40	1
Туалет (20 лк)	5,25	2,7	3,7	14,175	БК-220	40	1	НПО01-40	1
Коридор (75 лк)	39,9	2,7	5	199,5	ЛБ-40	40	5	ЛПО45-40	5
Вестибюль (150 лк)	26,44	2,7	10	264,40	-"-	-"-	7	ЛПО45-40	7
Кабины (200 лк)	6×3,75	2,2	12,2	45,8	-"-	-"-	1	УСП5-40	6×1
Территория под навесом (50 лк)	2×351	5,30	3,4	23,0	-"-	-"-	2×30	УСП5-2×40	2×15
Аварийные огни	—	0,5	—	100	БК-220	100	4	ППР-100	4

2 Электротехническая часть:

2.1. Величина напряжения — напряжение питающей сети 380/220В 50 Гц. 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 разомкнутой 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 пункта питания (ВРУ).

2.3. Размещение щитков – при размещении щитков с аппаратами защиты и руководствуясь указаниями ПУЭ и СН-543-82, СН 544-82 щитки устанавливать 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 – 800мм, 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 (станции жаркой консервации), 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 Ø 20 мм, горизонтальная часть проводки на участках, идущих к кабинам, шлагбаума и габаритным огням в винипластовой трубе Ø 25 уложенная в канале на глубине 20 см.

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

Вся групповая осветительная сеть и групповые сети от ГУО 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 устанавливаемые в щитах ВРУ и ГЩО-1; 2 и 3 имеют регулируемые уставки электромагнитных расцепителей.

Автоматические выключатели АЕ 2046 одно и трёхполюсные имеют регулируемые уставки электромагнитных расцепителей.

Токи уставок электромагнитных расцепителей установите по проектным критериям (3.2.5.5) и расчетным схемам щитов В(Т)6. 31 ÷ 33

СЛАБЫЕ ТОКИ

1 ПОЖАРНАЯ СИГНАЛИЗАЦИЯ

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

Автоматическая пожарная сигнализация предусматривается многошлейфная. В качестве приемно-контрольного прибора предусматривается станция пожарной сигнализации "ОТОЛ-10-С", который устанавливается в вестибюле. Питание станции осуществляется напряжением ~220 В через блок питания 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 лампой накаливания, устанавливаемыми на высоте 2.2 м от уровня пола на фасаде здания.

Тепловые максимальные 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 ~~с другими~~ служебы контроля включающая в себе выход через УАТС на ~~сеть~~ 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 настенным телефонным розеткам открытой скрытой проводкой.

Телефонная розетка марки РТМ устанавливается на высоте 1,0 м от уровня пола.

3.3. Радиофикация - здания предусматривает установку абонентского трансформатора марки ТАМУ-10 на 10 ВА ~~с установкой~~ с понижением напряжения до 30 В. Ввод в здание на щиток с трансформатором производится в стояке ~~выполненном~~ из оцинкованной трубы ⌀70 мм кабелем марки ПРППМ-2×1,2 мм ~~скрытая~~ Разветвления от трансформатора выполняются в коробках типа УК-2П установленных в коридоре проводом марки ППВ-2×1,2 мм прокладываемых 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 на стене.

От ограничительных коробок до радиорозеток проводку выполнить скрыто в пустотах плит перекрытий, в бороздах, с последующей заделкой штукатурным раствором проводом ППВ-2×0,6 открытой

Розетки типа РПВ-2 (11) для скрытой проводки устанавливаются в бетонных наружных стен на расстоянии не менее 1м от штепсельной розетки осветительной сети.

4 Сметная стоимость общей ~~суммы~~ работ, техническая спецификация прилагается к проекту.

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

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

K – коэффициент теплопередачи ограждения, ккал/м²ч.°С. 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.

поверхность ограждения – м².

$\Delta t = t_в - t_н$ – 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 рассчитываются 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 определенную температуру 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

$$L = \Sigma V \cdot Nср \ м^3/час.$$

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

$Nср$ – 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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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 (в %)	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	

RAMBOLL

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N пом.	Наименование помещений	t вх. °C	Наим. ориен.	K ккал/м².ч.°C.	Δt °C.	F м²	Qт ккал/ч.	%	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	
	KF=8		ок/с	1,25		1,2×1,8=2,2	61	1,25	76	
			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	
			об./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	
			об./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.	

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№ ном.	Наименов. помещений	$t_{вн}$ °C	Нацм. ориент.	K ккал/м²ч°C	Δt °C	F м²	$Q_т$ ккал/ч	β%	Q ккал/час.	Колв. секций-регистров
18	Коридор по длине	10	к.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 радиатори типа М140 АО.

Поверхность нагрева одной секции 0,35 экм.
Температура воды в системе отопления 95-70°C.
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.

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Расчетная поверхност нагрева прибора:

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

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.

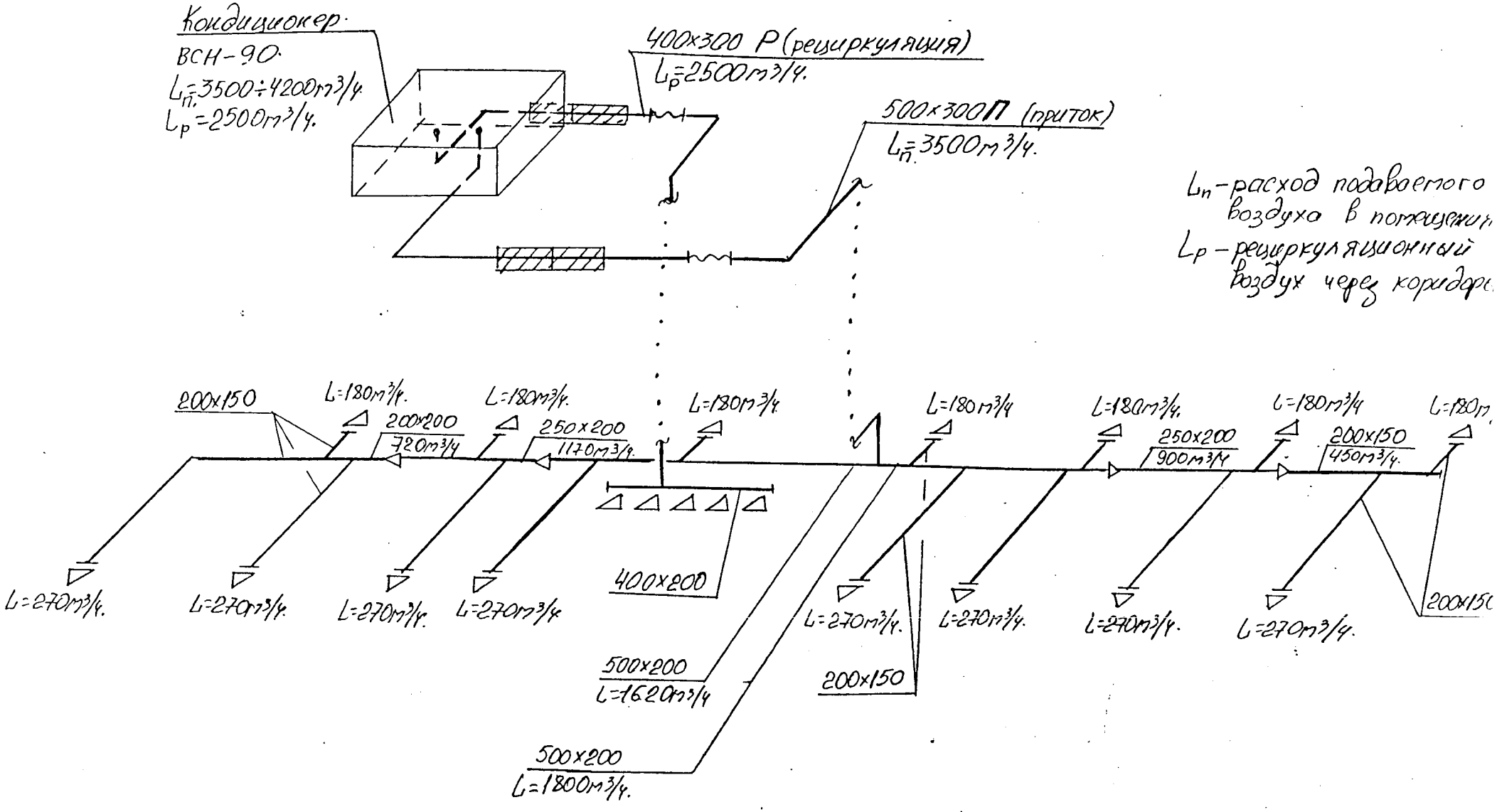
Δt – разность температур °С теплоносителя на входе и выхода из ветви (стояка)

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.

Схема для определения сечения воздуховодов.



L.S.R.

Representative Design Calculations,

Marine Works

RAMBØLL

sag nr.		udarb.:	to:	side:
963324	Baku and Turkmenbashi Ferry Terminals	JLI	3. 7. 98	:
		kontrol:	to:	

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:

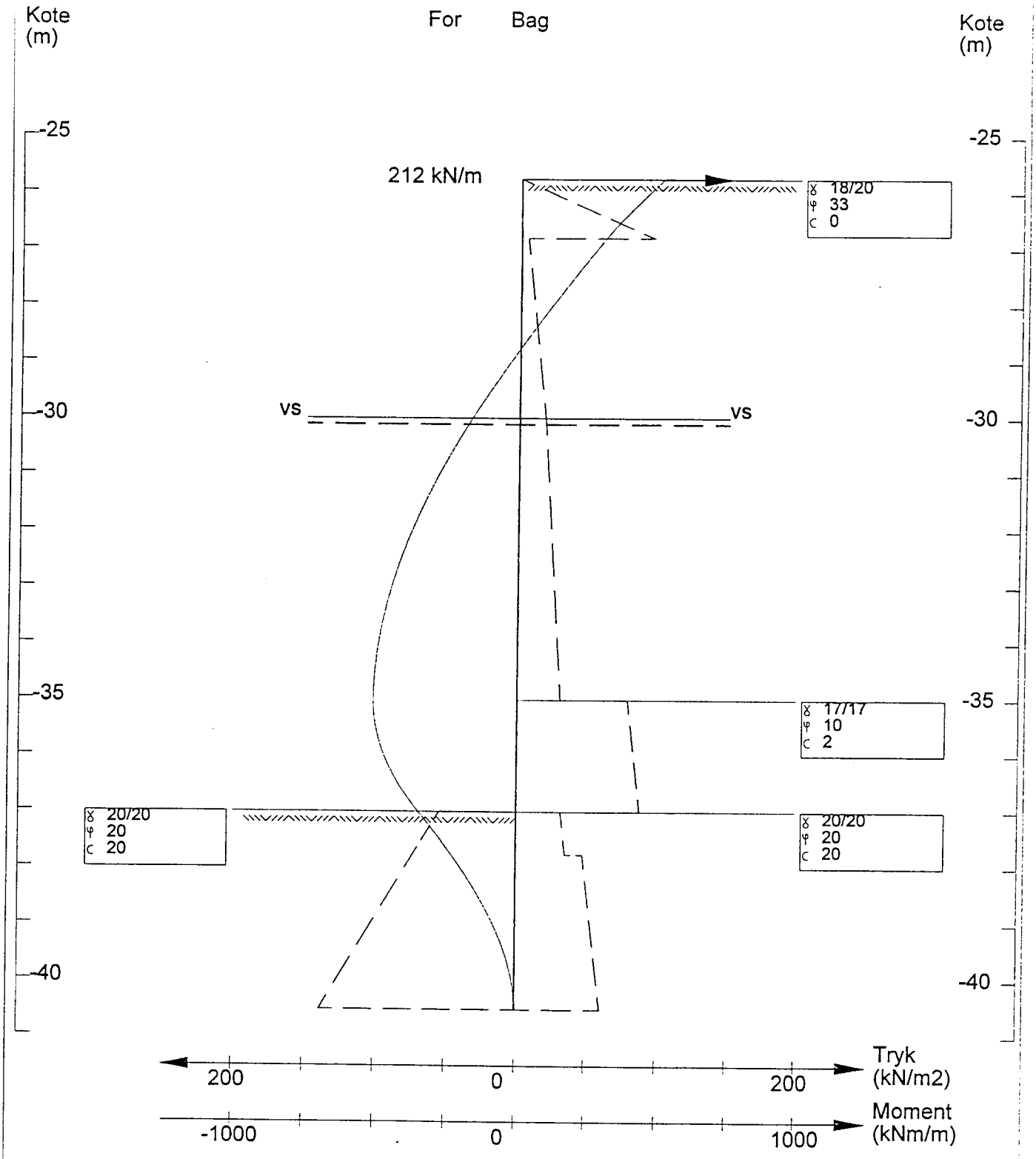
	Kote (m)	Jordtryk forside (kN/m2)	Jordtryk bagside (kN/m2)	Vandtryk bagside (kN/m2)
Jordoverflade	-25.75			
Top af væg	-25.75	0.00	0.00	0.00
Forankring/Afstivning	-25.75	0.00	0.00	0.00
Over tryk spring	-26.80	0.00	94.78	0.00
Under tryk spring	-26.80	0.00	4.61	0.00
Vandspejl	-30.00	0.00	18.67	0.00
Over 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 Dakar:

Calculating long term conditions

In front of sheet piles:

Bottom level -36.00 m

Bottom level in calculations -37.00 m

-37.00 to -38.00:

Density $\gamma / \gamma' = 17/7$ kN/m³

Angle of friction $\bar{\varphi} = 30°$

Below -38.00:

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

Behind sheet piles:

Level -25.75 to -35.00: sand fill:

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

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

Level -35.00 to -38.00

Density $\gamma / \gamma' = 17/7$ kN/m³

Angle of friction $\bar{\varphi} = 30°$

Cohesion $\bar{c} = 0$

Below level -38.0m

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

Cohesion $\bar{c} = 43$ kN/m³

Max cohesion for calculations: $\bar{c} = 20$ kN/m³

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:

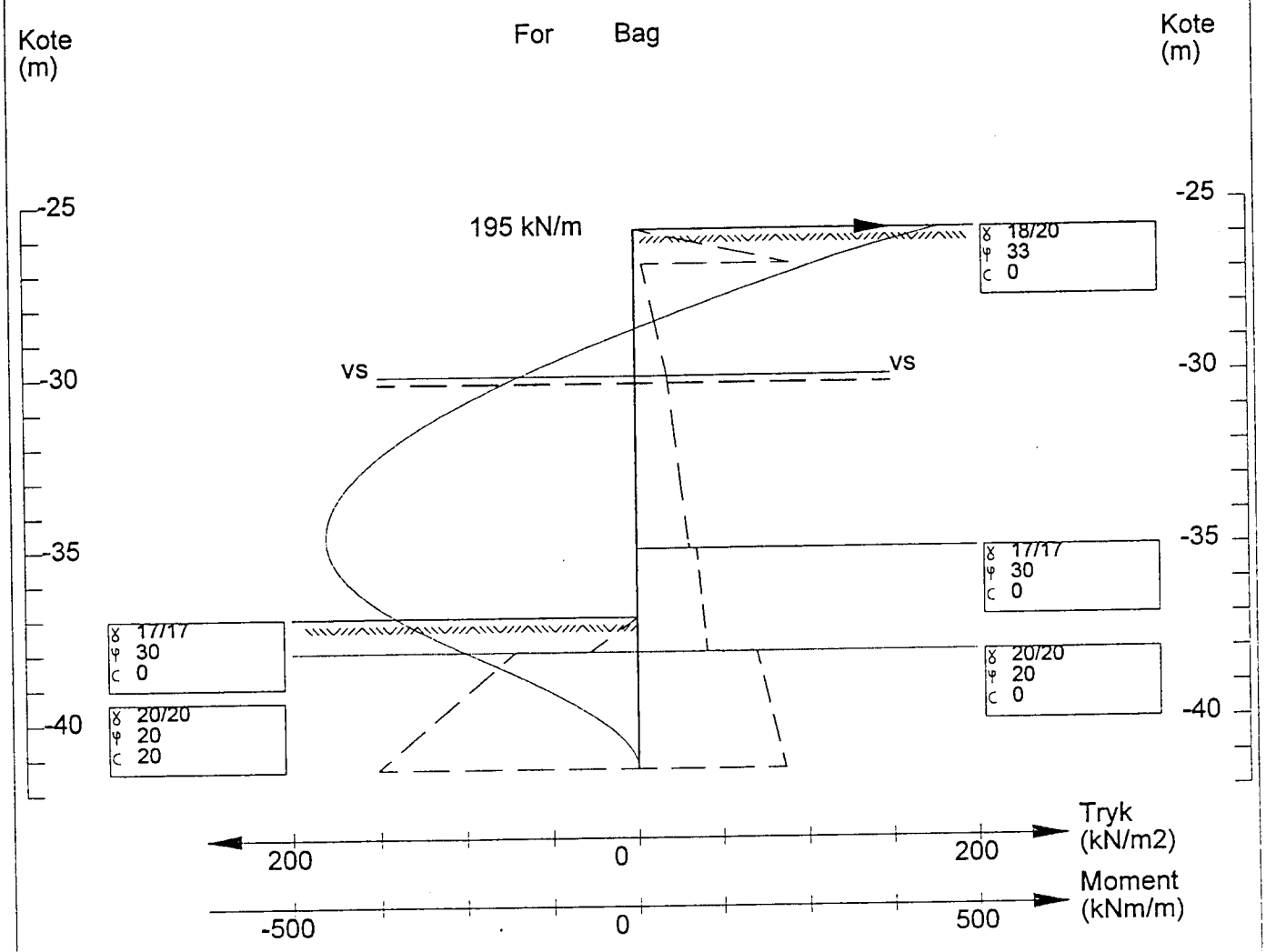
	Kote (m)	Jordtryk forside (kN/m2)	Jordtryk bagside (kN/m2)	Vandtryk bagside (kN/m2)
Jordoverflade	-25.75			
Top af væg	-25.75	0.00	0.00	0.00
Forankring/Afstivning	-25.75	0.00	0.00	0.00
Over trykspring	-26.76	0.00	90.77	0.00
Under trykspring	-26.76	0.00	4.42	0.00
Vandspejl	-30.00	0.00	18.67	0.00
Flydecharnier	-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 trykspring	-37.99	27.45	41.10	0.00
Under trykspring	-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:

sag nr.		udarb.:	dato:	side:
963324		JLI	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:

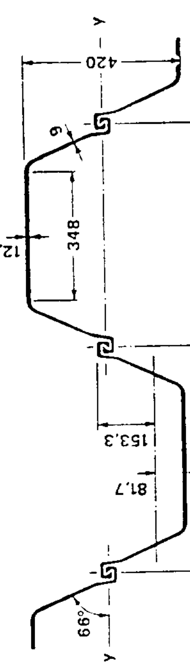
$$W \geq \frac{507.7 \times 10^6 \times 1.28}{355} = 1831 \times 10^3 \text{ mm}^3/\text{m}$$

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 $\sigma = 160$ MN/m²	kNm/m	-	-	-	323
	St Sp 45 $\sigma = 180$ MN/m²	kNm/m	-	-	-	364
	St Sp S ⊗ $\sigma = 240$ 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 Verriegelung 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

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

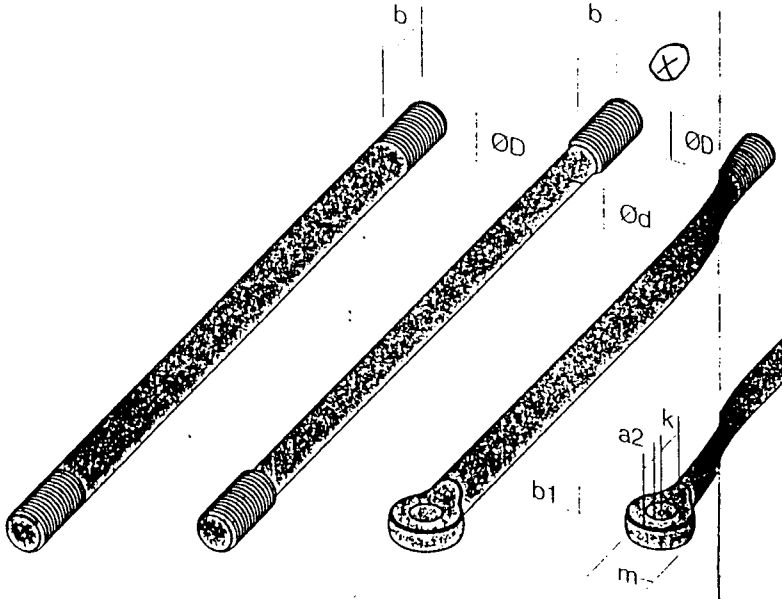
Tie rod ø50: $1963 \cdot \frac{335}{1.28} \times 10^{-3} = 514$ kN > 316.4 o.k.

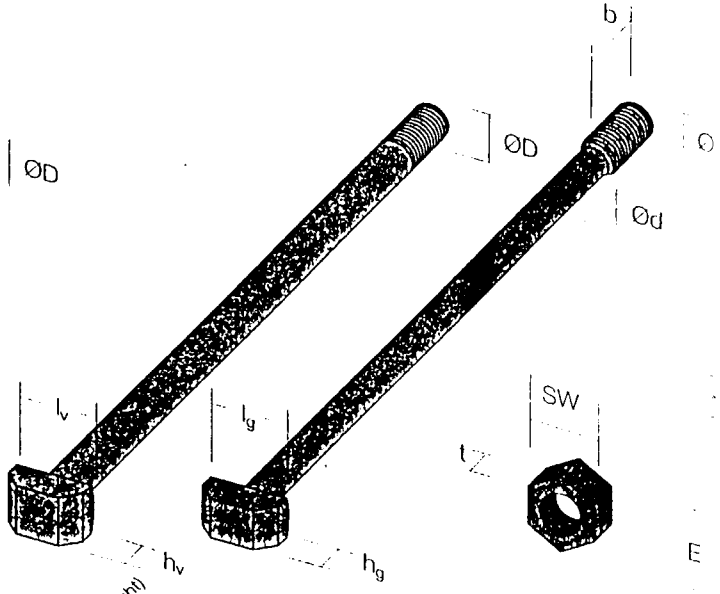
Thread 2½" WT:

$2565 \cdot \frac{335}{1.28 \times 1.4} \times 10^{-3} = 480$ kN > 316.4 o.k.

Anker
Tie Rods

ANKER SCHROEDER





Anker Nenngröße	Fzul. für S 235 JRG2/St 37-2	Fzul. für S 355 J0/St 52-3	Rundstahlanker (Vollschaft)		Rundstahlanker (gestaucht)		Augenanker (Vollschaft)			Augenanker (gestaucht)	
	kN	kN	OD	kg/m	od	kg/m	b	a_2	b_1	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	101,2	270	120	120	340	255

Anker Nenngröße	Hammerkopfanker (Vollschaft)			Hammerkopfanker (gestaucht)			Mutter			
	OD	l_v	h_v	ød	l_g	h_g	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

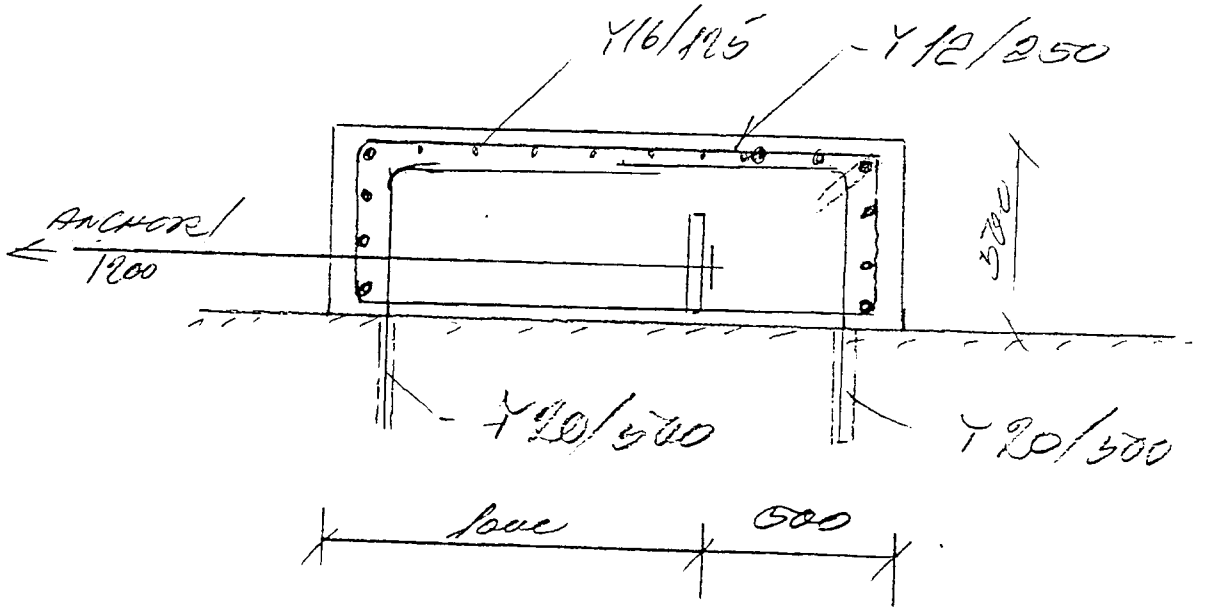
Reinforcement anchor to existing slab:

$$\Sigma = \frac{F}{A} \leq \frac{f_{yd}}{\sqrt{3}} \Rightarrow$$

$$\frac{263.7 \times 10^3}{A} \leq \frac{393}{\sqrt{3}} \Rightarrow$$

$$A \geq 1162 \text{ mm}^2/\text{m}$$

4 Y 20/m $A = 1260 \text{ mm}^2/\text{m}$



Appendix 4

Cost Estimates and Bill of Quantities

Cost Estimates

COST ESTIMATES, TURKMENBASHI 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 access yard

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	35	-	0	0	-	-
01.3	Reclamation	464	-	0	0	-	50
01.4	Land raising/levelling	434	10	0	0	-	50
01.5	Roads, internal, new	1604	150	1,5	24,06	26,31	25
01.6	Roads, internal, repair	122	-	0	0	-	-
01.7	Access road	206	0	1,5	3,09	3,09	25
01.8	Utilities (drain, water, power, telph)	150	20	2,5	3,75	4,25	25
01.9	Lighting, fencing, walls etc.	159	50	2,5	3,975	5,225	25
	Subtotal	3174	230				
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	19,76	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	-	28		-	-	-
04.2	Earthworks, 0/22350 m3	-	147		-	-	50
04.3	Centralised switches' and signals' control system, 0/12 sets	-	107	2,5	-	2,675	20
04.4	Paving works, 900/900 m2	32	32	1,5	0,48	0,96	25
	Railway works, final stage 2875 l m:						
04.5	Ballasting of the tracks, 0/4400 m3	-	53	0,75	-	0,3975	40
04.6	Laying of the railway tracks from new rails R-50 and RC sleepers, 0/1850 m	-	384	1,5	-	5,76	20
04.7	The same, from old rails R-50 and new RC sleepers, 0/1025 m	-	95	1,5	0 -	0 1,425	20
04.8	Installation of the switches and signals, 0/12 sets	-	108	2	-	2,16	20
04.9	Not guarded crossings, 3/0 sets	30	-	2	0,6	-	20
	Subtotal	62	954				
05	**Passenger terminal, modification**						
05.1	Structural works	126	-	1,5	1,89	-	30
05.2	Installation	28	-	2,5	0,7	-	25
	Subtotal	154	0				

06	**Border control terminal**						
06.1	Structural, building	93	-	1,5	1,395	-	30
06.2	Structural, sheds	56	0	2	1,12	1,12	30
06.3	Installation	36	0	2,5	0,9	0,9	25
	Subtotal	185	0				
07	**Ticketing terminal**						
07.1	Structural, building	49	-	1,5	0,735	-	30
07.2	Structural, sheds	18	-	2	0,36	-	30
07.3	Installation	6	-	2,5	0,15	-	25
	Subtotal	73	0				
08	**Public service building**						
08.1	Structural	65	0	1,5	0,975	0,975	30
08.2	Installation, incl. kitchen	22	0	2,5	0,55	0,55	25
	Subtotal	87	0				
09	**Passenger bridge**						
09.1	Structural works (70/110 m)	140	220	1,5	2,1	5,4	30
	Subtotal	140	220				
	Summary works						
	Terminal Area Arrangement	3174	230				
	Marine Works	9018	190				
	Ramp Rehabilitation	3890	0				
	Railway Works	62	954				
	Terminal Building Works	639	220				
	Subtotal	16783	1594				
	Contingency for unforeseen ramp works (if the ramps in general are suffering from fatique)	1500					
	Total works	18283					
	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%	1.930					
	GRAND TOTAL	21.233					

COST ESTIMATES, TURKMENBASHI FERRY TERMINAL

Alternative: Option 2
Phase 1=
Final Stage: Shore end of the ramp raised, raising of complete railway access yard

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	35	-	0	0	-	-
01.3	Reclamation	464	-	0	0	-	50
01.4	Land raising/levelling	444	0	0	0	-	50
01.5	Roads, internal, new	1750	0	1,5	26,25	26,25	25
01.6	Roads, internal, repair	122	-	0	0	-	-
01.7	Access road	206	0	1,5	3,09	3,09	25
01.8	Utilities (drain, water, power, telph)	170	0	2,5	4,25	4,25	25
01.9	Lighting, fencing, walls etc.	209	0	2,5	5,225	5,225	25
	Subtotal	3400	0				
02	**Marine works**						
02.1	Central pier	5059	0	1	50,59	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	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	28	0		0	0	-
04.2	Earthworks, 22350 m3	147	0		0	0	50
04.3	Centralised switches' and signals' control system, 12 sets	107	0	2,5	2,675	2,675	20
04.4	Paving works, 900 m2	32	0	1,5	0,48	0,48	25
	Railway works, final stage 2875 l m:						
04.5	Ballasting of the tracks, 4400 m3	53	0	0,75	0,3975	0,3975	40
04.6	Laying of the railway tracks from new rails R-50 and RC sleepers, 1850 m	384	0	1,5	5,76	5,76	20
04.7	The same, from old rails R-50 and new RC sleepers, 1025 m	95	0	1,5	0 1,425	0 1,425	20
04.8	Installation of the switches and signals, 12 sets	108	0	2	2,16	2,16	20
04.9	Not guarded crossings, 3 sets	30	0	2	0,6	0,6	20
	Subtotal	984	0				
05	**Passenger terminal, modification**						
05.1	Structural works	126	0	1,5	1,89	1,89	30
05.2	Installation	28	0	2,5	0,7	0,7	25
	Subtotal	154	0				

06	**Border control terminal**						
06.1	Structural, building	93	0	1,5	1,395	1,395	30
06.2	Structural, sheds	56	0	2	1,12	1,12	30
06.3	Installation	36	0	2,5	0,9	0,9	25
	Subtotal	185	0				
07	**Ticketing terminal**						
07.1	Structural, building	49	0	1,5	0,735	0,735	30
07.2	Structural, sheds	18	0	2	0,36	0,36	30
07.3	Installation	6	0	2,5	0,15	0,15	25
	Subtotal	73	0				
08	**Public service building**						
08.1	Structural	65	0	1,5	0,975	0,975	30
08.2	Installation, incl. kitchen	22	0	2,5	0,55	0,55	25
	Subtotal	87	0				
09	**Passenger bridge**						
09.1	Structural works (180 m)	360	0	1,5	5,4	5,4	30
	Subtotal	360	0				
	Summary works						
	Terminal Area Arrangement	3400	0				
	Marine Works	9070	0				
	Ramp Rehabilitation	3890	0				
	Railway Works	984	0				
	Terminal Building Works	859	0				
	Subtotal	18203	0				
	Contingency for unforeseen ramp works (if the ramps in general are suffering from fatique)	1500					
	Total works	19703					
	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%	2.072					
	GRAND TOTAL	22.795					

RAMBOLL

ПЕРЕЧЕНЬ No. 1

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
1	Цемент	Cement	tonne	38-40 USD		
2	Речной песок	River sand	m3			
3	Щебень	Rubble	m3	5 USD		
4	Бетон (М-100) В7,5	Concrete (M-100) B7,5	m3	172130 manat		
5	(М-200) В15	(M-200) B15	m3			
6	(М-250) В20	(M-250) B20	m3			
7	(М-300) В25	(M-300) B25	m3			
8	Растворы цементные	Cement mortars	m3			
9	Растворы сложные	Cement mortars (compound)	m3			
10	Камень "кубик" 40×20×20 cm	"Cubic" stone 40×20×20 cm	piece шт.			
11	Кирпич красный 25×12×6	Red brick 25×12×6	piece шт.	0,04 USD		
12	Кирпич огнеупорный 25×12×6	Fire- proof brick 25×12×6	piece шт.	0,08 USD		
13	Блоки керамические пустотелые	Ceramic hollow blocks	piece шт.			
14	Сб. ж/б сваи	Pre-fabricated reinforced concrete (RC) piles	linear m п/м			
15	Сб. ж/б плиты перекрытия	Pre-fabricated RC floor slabs	m2			
16	Сб. ж/б перемычки	pre-fabricated RC lintels	m3			
17	Сб. ж/б ступени	Pre-fabricated RC steps	linear m п/м			
18	Вент.блоки 40×20×20 см	Ventilation blocks	piece шт.			
19	Арматура	Reinforcement bars	tn	285-535 USD		
20	Металл. профиль	Steel profile	tn	500 USD		
21	Оцинкованный. профнастил	Galvanized metal floor decking	m2			
22	Лесоматериал	Timber	m3	160-180 USD		
23	Паркет	Parquet	m2			
24	Метлах	Clay tiles	m2	19200-35000 manat		

25	Мрамор	Marble	m2	20-22 USD		
26	Ковролит	Carpet covering	m2		14-18 USD (3 m wide)	
27	Витражи алюминевые	Aluminium stained-glasses	m2	100 USD		
28	Окна алюминевые	Aluminium windows	linear m		15-18 USD (250 USD per piece)	
29	Двери алюминевые	Aluminium doors	m2		280 USD	
30	Двери полированные	Burnished doors	m2			
31	Стекло 6 мм зеркальное	Plate glass 6 mm	m2			
32	Стекло 4мм, 5 мм	Glass 4 mm 5 mm	m2	4000 manat 4000 manat		
33	Стеклобмм 3,25×2,25	Glass 6 mm	m2		4,50 USD	
34	Стекло 8 мм 3,25×2,25	Glass 8 mm	m2			
35	Двери стеклянные из сталинита	Glass doors from stalinit ?	m2	150 USD		
36	Стеклорубероид - 10 м/р	Fibre-glass bitumenous felt	roll рулон	4,5 USD		
37	Битум	Bitumen	tn	300000 manat		
38	Камень "бут"	Quarry stone	m3			
39.0	Кафель	Encaustic tile	m2	95000 manat		
39.1	Кафель для пола	Encaustic tile (for floors)	m2	80000 manat (33x33 cm)		
40	Гранит	Granite	m2	97 USD		
41	ДСП-MDF-30 2,80×2,22	DSP-MDF-30 (chipboard) 2,8×2,22	sheet лист			
42	ДСП-MDF-18	DSP-MDF-18 (chipboard)	sheet лист			
43	ДСП-MDF-10	DSP-MDF-10 (chipboard)	sheet лист			
44	ДСП-MDF-8	DSP-MDF-8 (chipboard)	sheet лист			
45	ДСП-MDF-4	DSP-MDF-4 (chipboard)	sheet лист			
46	Подвесные потолки (Германия)	Suspended ceilings (Germany)	m2			16000 manat
47	Лампы "SPOT" для подвесного потолка	"SPOT" lamps for suspended ceiling	set к-т		32000 manat	
48	Травертин	Travertin	m2			
49	Краски масляные	Oil-paints	kg	12000 manat	40000 manat	
50	Краски водостойкие	Water proof paints	kg	2,8 USD		

51	Лаки	Varnishes	kg	18000 manat	402000 manat per 15 kg	
52	Растворитель	Solvent	kg	24000 kg		
53	Олифа	Boiled linseed oil	kg	5000	285000 per 17 kg	
54	Обои 5м2/р	Wall paper 5m2/r	roll рулон	3-3,6 USD	32000 manat	
55	Краски водо-эмульсионные	Water-emulsion paints	kg	1,7 USD	26000 manat	
56	Краски фасадные	Facade paints	25 kg	9000 manat	550000 manat	
57	Гравий	Gravel	m3			
58	Асфальт	Asphalt	tn			
59	Асфальто-бетон	Asphalt-concrete	tn			
60	Бордюры	Borders	linear m п/м			
61	Песок природный	Natural sand	m3			
62	Алебастр	Alabaster	kg	384 manat		
63	Известь	Lime	tn			
64	Маты стекловатные	Fibre glass batt insulation	m3	3 USD		
65	Оцинкованная кровельная сталь	Galvanised roofing steel	m2 tn			
66	Плиты облицовочные "Известняк" толщ. 4см	Loamy-stone tiles "Izvestniak" thickness 4cm	m2	10-18		
67	Рельсы металл. Р 65	Steel rails	linear m п/м			
68	Рельсы металлич. Р 50	Steel rails	linear m п/м			
69	Шпалы ж/б	RC sleepers	piece шт	26 USD		
70	Витражи Pemopen (без стекол)	Stained-glass panel Pemopen (without glasses)	m2			
71	Окна "Pemopen"	"Pemopen" windows	m2			
72	Двери "Pemopen"	"Pemopen" Doors	m2			
73	Перегородки раздвижные "Pimopen"	"Pemopen" expanding partitions	m2			
74	Стеклопакет 4×4	Insulating glass unit 4×4	m2			
75	Оргстекло 1,25×1,85	Organic glass	piece шт			
76	Пластик 1,22×2,44	Plastic material 1,22×2,44	piece шт			
77	Шпаклевка	Void filler	kg	700	80000 manat per 30 kg	
78	Штукатурка	Decorative plaster	kg	1,2-1,6 USD		

	декоративная					
79	Гипсолит 120×250см	Plaster blocks 120×250cm	piece шт			
80	Клей для кафеля	Glue for tile	kg		97000	
81	Нитрокраски	Nitro-paints	kg		32000 manat; 97000 manat per 4 kg	
82	Асбошифер	Asbestos slate	m2	2,1 USD		
83	Клей ПВА	PVA Glue	kg	12500 per 800 gr can	22000 manat; 71000 manat per 4 kg	
84	Мел	Chalk	kg	480 manat		
85	Клей столярный	Carpenter's glue	kg			
86.1	Двери деревянные глухие	Blind wooden doors	m2		350000 manat	
86.2	Двери деревянные глухие из хвойных пород	Blind wooden doors from firtrees	m2	100-150 USD		
87	Двери деревянные остекленные	Wooden glassed doors	m2	38 USD		
88	Окна спаренные деревянные	Coupled wood windows	m2			
89	Пластик волнистый 0,7×2,8м	Corrugated plastic 0,7×2,8m	piece шт			
90	ДСП- 4 мм	DSP (chipboard) - 4 mm	m2	4830 manat		
91	-10 мм	-10 mm	m2	130000 per plate 3,75x1,70 m		
92	-14 мм	-14 mm	m2	80000 per plate 2,44x1,84 m		
93	ДВП -4 мм	(DVP)- 4 mm (wood chipboard)	piece шт	10-15 USD		
94	-10 мм		m2	3681 manat		
95	-16 мм		m2			
96	Гвозди	Nails	kg	4233 manat		
97	Клей "бустилат"	"Bustilat" glue	kg	3 USD		
98.1	Фанера - 10мм	Plywood - 10 mm	m2	40000 per plate 1,5x1,5 m	77000 per plate 1,5x1,5 m	
98.1	Фанера - 8мм	Plywood - 8 mm	m2	40000 per plate 1,5x1,5 m	77000 per plate 1,5x1,5 m	
99	Сетка металлическая	Metallic net	m2	37,5 USD with size 10x1,5 m		
100	Щиты опалубки деревянные т. 25 мм	Wooden form shields 25 mm	m2			
101	Наличники	Jambs and lintel of	linear m	4000 manats		

		a door or window (architrave)	п/м			
102	Плинтуса	Plinths	linear m п/м	4000 manats		
103	Фольга алюминевая	Aluminium foil	m2	7,7 USD		
104	Стеклоблок 25×25×8 см	Glass block (brick) 25×25×8 cm	piece шт			
105	Болты, гайки	Screws, nuts	kg	3380		
106	Электроды	Electrodes	kg	25000		
107	Керамзит	Expanded clay	m3			
108	Линолиум	Linoleum	m2	3-7 USD	23000 manat	
109	Доски чистого пола	Floor planks	m3			
110	Шурупы	Screws	kg	13333		
111	Пакля	Oakum	kg			
112	Войлок т. 5мм	Felt - 5 mm	m2			
113	Смола	Resin	kg			
114	Стекло 3мм оконное (1,2×1,6)	Window glass (1,2×1,6)	m2	1,7-3 USD		
115	Подоконные доски	Window-sill boards	linear m п/м			
116	Краски сухие	Dry paints	kg	8000		
117	Щиты барьера полированные	Polish barrier shields	linear m			
118	Раскладки для щитов	Fillets for shields	linear m			
119	Витражи, двери, окна металлические	Steel doors, stained-glasses, windows	m2			
120	Закладные детали металлические	Steel fixed details	kg			

Additions made by PROBEL Consulting in Ashgabat

121	Лампы ЛП-40	Lamps ЛП-40	piece	4000		
122	Кафель (Исп.)	Encaustic tiles (Spain)	m2			74000
123	Кафель для пола (Исп.)	Encaustic tiles for floors (Spain)	m2			74000
124	Кафель (Иран)	Encaustic tiles (Iran)	m2	40000		
125	Кафель для пола (Иран)	Encaustic tiles for floors (Iran)	m2	45000		
126	Двери металлические, оборудованные	Steel doors, equipped	piece	700 USD		
127	Шпаклевка	Vold filler	kg	700 manat		
128	Растворитель	Soluvent		1.11 USD		
129	Олифа	Boiled linseed oil	kg	300-400 manat		
130	Лаки	Varnish	kg	4.85 USD		

131	Электроды	Electrodes	kg	1,2-1,6 USD		
132	Клей ТАНГИТ	TANGIT glue	kg	122000 manat		
133	Клей БАЛЛИ	BALLI glue	kg	56000 manat		
134	Крагис, размером 2,75мх1,70м	Paper veneer 2,75mx1,70m	sheet лист	35000 manat		
	Крагис, размером 2,75мх1,35м	Paper veneer 2,75mx1,35m	sheet лист	31000 manat		
	Крагис, размером 2,75мх1,160м	Paper veneer 2,75mx1,60m	sheet лист	20000 manat		
135	Шифер железный	Steel decking	лист			
136	Текстолит	Textolit	kg	2210 manat		
137	Линолеум	Linoleum	linear meter	80420 manat		

RAMBOLL

ПЕРЕЧЕНЬ No. 2

COST OF SANITARY-TECHNICAL MATERIALS

СТОИМОСТЬ САНИТАРНО-ТЕХНИЧЕСКИХ МАТЕРИАЛОВ

No.	Наименование материалов и изделий	Name of materials and articles	Unit of measuring Ед. измер.	Local местные	Turkey Турция	Europe Европа
1	Трубы стальные ∅ 15	Steel pipes ∅ 15	linear m п/м	2 USD		
2	∅ 20	∅ 20	linear m п/м			
3	∅ 25	∅ 25	linear m п/м			
4	∅ 32	∅ 32	linear m п/м			
5	∅ 40	∅ 40	linear m п/м	695 USD		
6	∅ 50	∅ 50	linear m п/м	695 USD		
7	∅ 70	∅ 70	linear m п/м			
8	∅ 89	∅ 89	linear m п/м			
9	∅ 100	∅ 100	linear m п/м	780 USD		
10	∅ 150	∅ 150	linear m п/м			
11	Трубы чугунные ∅ 50	Cast-iron pipes ∅ 50	linear m п/м			
12	∅ 100	∅ 100	linear m п/м			
13	∅ 150	∅ 150	linear m п/м			
14	∅ 200	∅ 200	linear m п/м			
15	Трубы керамические ∅ 100	Ceramic pipes ∅ 100	linear m п/м			
16	∅ 150	∅ 150	linear m п/м			
17	∅ 200	∅ 200	linear m п/м			
18	∅ 250	∅ 250	linear m п/м			
19	Трубы поливинилхлоридные ∅ 20	Plastic pipes ∅ 20	linear m п/м			

20	∅ 32	∅ 32	linear m п/м			
21	∅ 50	∅ 50	linear m п/м	11000 manat	3 m - 24000 manat	
22	∅ 70	∅ 70	linear m п/м	14800	3 m - 30500 manat	
23	∅ 100	∅ 100	linear m п/м	23000	3 m - 64500 manat	
24	∅ 150	∅ 150	linear m п/м	25750	3 m - 71700 manat	
25	Трубы асбесто-цементные ∅ 100	Asbestos-cement pipes ∅ 100	linear m п/м			
26	∅ 150	∅ 150	linear m п/м			
27	∅ 200	∅ 200	linear m п/м			
28	∅ 250	∅ 250	linear m п/м			
29	Задвижки стальные ∅ 50	Steel valves ∅ 50	piece шт.			
30	∅ 80	∅ 80	piece шт.			
40	∅ 100	∅ 100	piece шт.			
50	∅ 150	∅ 150	piece шт.			
60	∅ 200	∅ 200	piece шт.			
61	Вентиля ∅ 15	Globe valves ∅ 15	piece шт.			
62	∅ 20	∅ 20	piece шт.			
63	∅ 25	∅ 25	piece шт.			
64	∅ 32	∅ 32	piece шт.			
65	∅ 40	∅ 40	piece шт.			
66	Фланцы ∅ 50	Flanges ∅ 50	piece шт.			
67	∅ 100	∅ 100	piece шт.			
68	∅ 150	∅ 150	piece шт.			
69	∅ 200	∅ 200	piece шт.			
70	Пожарные гидранты	Fire hydrants	piece шт.			
71	Унитазы с бачком	Lavatory pans with a cistern	set компл.	93600	1040000	
72	Умывальники	Wash-stand, set	piece шт.		700000 1144100	

73	Смесители	Mixers, with shower	piece шт.	67200	300000 340000	
74	Мойки, сдвоенная	Sinks, coupled	piece шт.		257000 827000	
75	Чугунные ванны, 1,7 дл	Cast iron daths, 1,7 DLt	piece шт.		1340000	
76	Раковины	Sinks	piece шт.		700000	
77	Писсуары	Urinals	piece шт.			
78	Плиты газовые, 2 конфорки	Gas stoves, 2 flame	piece шт.	400000	460000	
79	Колонки газовые	Flow type callorifier	piece шт.		8880000	
80	Счетчики для воды	water flow meters	piece шт.			
82	Счетчики для газа	gas meters	piece шт.			
83	Котлы	Boilers	piece шт.			
84	Радиаторы	Radiant heaters	section секция piece шт.			
85	Вентиляторы	Ventilators (Fans)	piece шт.	350000		
86	Кондиционеры[1]	Air conditioners	piece шт.	467-1170 USD	1500 USD	
87	Калориферы	Air heater (callorrifiers)		680000		
88	Воздуховоды из оценкованной стали	Air pipeline from galvanised steel	m2			
89	Дефлекторы	Deflectors	piece шт.			
90	Баки для воды, 65 л	Water tanks, 65 lt			2165000	
92	Водо подогреватели	Convertor				
93	Манометр	Manometer	piece шт.			
94	Термометр	Thermometer	piece шт.			
95	Трапы	Floor gallies	piece шт.		82500 (steel) 15000 (plast)	
96	Фассоные части стальные	Shaped steel parts	kg			
96	Фасонные части чугунные	Shaped iron-cast parts	kg			
97	Краны	Taps	piece шт.			

[1] For 80 m2 area

98	Шумоглушители	Silencers	piece шт.			
99	Чаша клозетная с бачком	Asian type lavatory pan with a cistern	set компл.			
100	Радиаторы Н-570	Radiant heaters H-570	pieces /шт.			
	секции 4 0,8 м2	section 4 0,8 m2	pieces /шт.			
	секции 7 1,4 м2	section 7 1,4 m2	pieces /шт.	140000		
	секции 8 1,6 м2	section 8 1,6 m2	pieces /шт.	160000		
	секции 9 1,8 м2	section 9 1,8 m2	piece /шт.			
	секции 10 2,0 м2	section 10 2,0 m2	pieces /шт.			
	секции 11 2,2 м2	section 11 2,2 m2	pieces /шт.			
	секции 12 2,4 м2	section 12 2,4 m2	pieces /шт.			
	секции 13 2,6 м2	section 13 2,6 m2	pieces /шт.			
	секции 14 2,8 м2	section 14 2,8 m2	pieces /шт.			
	секции 15 3,0 м2	section 15 3,0 m2	pieces /шт.			
	секции 16 3,2 м2	section 16 3,2 m2	pieces /шт.			
101	Конвектор РККР Н-300мм L=920мм	Convector RKKR H-300mm L=920mm	pieces /шт.			
	L=1320мм	L=1320 mm	pieces /шт.			
	L=1560мм	L=1560 mm	pieces /шт.			
102	Вентиль ∅15 мм для радиаторов	Valve ∅15 mm for radiant heaters	pieces /шт.	4000	50000	
103	Кондиционер автономный ROOFTOP	Autonomous air conditioner ROOFTOP	pieces /шт.			
	BCH-60	BCH-60	pieces /шт.			
	BCH-90	BCH-90	pieces /шт.			
	BIN-240	BIN-240	pieces /шт.			
104	Вентиляторы	Ventilators	pieces /шт.			
	AXC-160	AXC-160	pieces /шт.	110000		
	AXC-200B	AXC-200B	pieces /шт.			

	АХС-315	АХС-315	pieces /шт.			
106	Решеткипотолочн. 250×250	Ceiling grilles 250×250	pieces /шт.			
	500×500	500×500	pieces /шт.			
	500×500	500×500	pieces /шт.			

Additions made by PROBEL Consulting, Turkmenistan

107	Муфта пластмассовая для канализации	Plastic sewage connectors	pieces /шт.	625		
108	Трубы пластмассовые для канализации (уголок)	Plastic sewage pipes	pieces /шт.	680		

RAMBOLL

Annex 5.3.3.
Приложение 5.3.3

COST OF ELECTRICAL MATERIALS TURKMENBASHI

СТОИМОСТЬ ЭЛЕКТРОМАТЕРИАЛОВ г. ТУРКМЕНБАШИ

No.	Наименование материалов и изделий	Name of materials and articles	Unit of measuring Ед. измер.	Local местные	Turkey Турция	Europe Европа
1	Пункт распределительный ПР 11-1048-2 АУЗ	Switchboard	piece шт.	83 USD		
2	Щиток групповой УОЩВ -12 АУХЛ4	Group meter board УОЩВ -12 АУХЛ4	piece шт.	5 USD		
3	Светильники с люминисцентными лампами и стартерами УСП 5 - 1×40	Lighting fittings with luminescent lamps and starters УСП 5 - 1×40	piece шт.			
	УСП 5 - 2×40	УСП 5 - 2×40	piece шт.			
	УСП 5 - 6×20	УСП 5 - 6×20	piece шт.			
	УСП 5 - 4×40	УСП 5 - 4×40	piece шт.			
	Л 104Б-40	Л 104Б-40	piece шт.			
	Л 104Б- 4×40	Л 104Б- 4×40	piece шт.			
	Л104Б - 6×20	Л104Б - 6×20	piece шт.			
4	Светильники с лампами накаливания НБ001-60	Lighting fittings with glow lapms НБ001-60	piece шт.	10-40 USD		
	НБ005-60	НБ005-60	piece шт.			
	НП001-100	НП001-100	piece шт.			
	МПР-100	МПР-100	piece шт.			
5	Люстры бытовые 1 ламповые	Consumer 's chandeliers 1 lamp	piece шт.	53000 manats		
	2-х ламповые	2 lamps	piece шт.			

6	Выключатели	Switches	piece шт.	2000 manats		
7	Розетки	Ontlets	piece шт.	2000 manats		
8	Трубы винипоастовые ∅ 20 мм	Vinilite pipes ∅ 20 mm	linear m п/м			
9	Кабель АВРГ сеч. 2×2,5 мм 2	Cable АВРГ sec. 2×2,5 mm 2	m	14000 manats		
	сеч. 2×4 мм 2	sec. 2×4 mm 2	km			
	сеч. 3×10+1×16 мм 2	sec.3×10+1×16mm2	km			
10	Провод АППВС сеч. 2×2,5мм	Wire АППВС with sec2×2,5mm	km	2500-5200 manats		
11	Коробки пластмассовые УПК- 4	Plastic branch boxes	piece шт.	1500 manats		
12	Фотореле с датчиком ФР-2	photorelay with transmitter ФР-2	piece шт.			
13	Станция пожарной сигнализации ТОЛ-10·С	Fire alam station ТОЛ-10·С	piece шт.			
14	Батарея аккумуляторная 10ЖН-60м	Accumulator battery 10ЖН-60m	piece шт.			
15	Звонок громкого боя М3-1	Long ringing bell М3-1	piece шт.	116000 manats		
	кнопки	buttons	piece шт.	4000 manats		
	трансформатор	transformer	piece шт.	80000 manats		
16	Извещатель конпочный ПКИЛ-9 м	Push button informant ПКИЛ-9 m	piece шт.			
17	Извещатель тепловой ИП105-2/1	Heat informant ИП105-2/1	piece шт.			
18	Провод ТРП сеч. 1×2×0,5 мм2	Wire ТРП with sec.1×2×0,5 mm2	km			
19	Блок питания станции БП-24/4	Power supply block БП-24/4 of the station	piece шт.			
20	Патрон настенный	Lamp socket	piece шт.			
21	Коробки телефонные КРТП	Phone cable distribution boxes КРТП	piece шт.			
22	Розетки телефонные	Phone autlets	piece шт.	12000-50000 manats		

23	Провод ТРП-2×0,4мм	Wire ТРП-2×0,4mm	km	6000 manats		
24	Абонентский трансформатор ТАМУ-10	Subscribers transformer ТАМУ-10	piece шт.			
25	Коробки раветвительные УК-2П	Branch boxes УК-2П	piece шт.			
26	Коробки ответвительные УК-2Р	Branch boxes УК-2П	piece шт.	1000 manats		
27	Радиорозетки	Radio outlets	piece шт.	33300 manats		
28	Провод ППВ-2×1,2	Wire ППВ-2×1,2	km	700-2000 manats		
	ППВ-2×1,2	ППВ-2×1,2	km			
	ППВ-2×0,6	ППВ-2×0,6	km			
29	Кабель АВРБ(АНРБ) -1кв сеч.3 ×25+ 1×16 мм2	Wire АВРБ(АНРБ)-1кв sec.3 ×25+116 mm2	km	13000 manats		
	сеч.3 ×50+ 1×35 мм2	sec.3 ×50+ 1×35mm2	km			
	сеч.3 ×70+ 1×50 мм2	sec.3 ×70+ 1×5mm2	km			
30	Муфты кабельные для сечения 3 ×50+ 1×35 мм2	Cable muffs for cables of section 3 ×50+ 1×35 mm 2	piece шт.			
	сеч.3 ×70+ 1×50 мм2	sec. 3 ×70+1×50 mm2	piece шт.			
31	Светильники наружного освещения с ртутными лампами РКУ -250	Lighting fittings for outside lighting with mercurial lamps	piece шт.	40 USD		

Representative Bill of Quantities

СЧЕТ No.: T06.x Терминал служб контроля

Пункт □	Описание	Ед. измер.	Кол-во	Цена за ед. в долл. США	Всего цена в долл. США
03	**Земляные работы**				
03.001	Разработка грунта II группы экскаватором с емкостью ковша 0,5 м3 в отвал	1000 м3	0.594		
03.002	Перемещение грунта бульдозером на расстояние 50 м в резерв	1000 м3	0.594		
03.003	То же, из резерва	1000 м3	0.572		
03.004	Зачистка котлована и траншеи вручную	100 м3	0.89		
03.005	Обратная засыпка грунта бульдозером за обрезы фундаментов	1000 м3	0.202		
03.006	То же, вручную	100 м3	0.40		
03.007	Подсыпка под полы грунтом с перекидкой экскаватором с емкостью ковша 0.5 м3	1000 м3	0.318		
03.008	Перекидка грунта вручную при подсыпке под полы	100 м3	0.96		
03.009	Планировка площади подсыпки вручную	100 м2	2.89		
03.010	Уплотнение грунта пневмотрамбовками	100 м3	5.79		
04	**Работы с камнем и щебнем**				
04.001	Щебеночная подготовка т. 10 см под ленточный фундамент	м3	39.5		
04.002	Уплотнение грунта щебнем под полы	100 м2	2.85		
06	**Бетонные работы**				
06.001	Бетонная подготовка т. 10 см под фундаменты из бетона В-7.5	м3	31.4		
06.002	Ж/б ленточные фундаменты из бетона В-15	м3	105.5		
06.003	Бетонный фундамент крыльца из бетона В-15	м3	0.3		
06.004	Монолитные ж/б стойки СКм-1 из бетона В-20	м3	1.4		
06.005	Монолитные железобетонный перемычки из бетона В-15	м3	5.27		
06.006	Монолитный железобетонный пояс из бетона В-15	м3	9.32		
06.007	Монолитные железобетонные участки перекрытий из бетона В-15	м3	1.8		
06.008	Установка сборных железобетонных пустотелых плит перекрытий 1ПК59.10-8Ат.С9 1ПК59.12-8Ат.С9	 шт. шт.	 30 17		
06.009	Бетонная подготовка т. 8 см из бетона В7.5 под полы	м3	22.8		
06.010	Бетонная подготовка под полы крыльца и ступени из бетона В7.5	м3	0.1		
06.011	То же, под каналы из бетона В-15	шт.	6.6		
06.012	Установка сборных ж/б плит каналов ПТ12.5-8.6	шт.	102		
07	**Работы с кирпичной кладкой**				
07.001	Стены фундаментные, входа в подвал и крыльца из камня кубик т. 39 см на р-ре М-50	м2	63.1		
07.002	Горизонтальная изоляция стен цементным				

	р-ром т. 20 мм	100 м2	0.51		
07.003	Боковая изоляция фундаменных стен и каналов цементным р-ром	100 м2	1.56		
07.004	То же, битумом за 2 раза	100 м2	1.56		
07.005	Стены наружные из камня кубик т. 39 см на р-ре М-50	м2	242.1		
07.006	То же, стены внутренние	м2	91.1		
07.007	Перегородки кирпичные т. 12 см	м2	219.3		
07.008	Ступеньки каналов из камня кубик т. 39 см	м2	3.4		
07.009	То же, т. 19 см	м2	35.1		
08	**Работы с металлом**				
08.001	Армирование монолитных железобетонных конструкций	т	9,292		
08.002	Установка металлических стоек навеса из труб д. 245х6 мм	т	5,841		
08.003	Установка металлических балок навеса из швеллера □ 20	т	5,226		
08.004	Установка прогонов навеса из швеллера □ 10	т	3,666		
08.005	Установка металлических ферм из уголка □ 50х50	т	6,428		
08.006	Покрытие навеса из оцинкованного профнастила	м2	810.0		
08.007	Обшивка парапета навеса профнастилом	м2	162.1		
08.008	Анкерные болты при установке стоек	т	0.48		
08.009	Кассовые будки 2.5х1.6х2.2 (Н) из ПЕМОПЕН с остеклением 6 мм стеклом	шт.	6		
08.010	Металлический каркас под кондиционер на крыше и в каналах	т	0.111		
08.011	Леса стальные для отделочных работ	100 м2	11.13		
09	**Плотницкие, кровельные работы**				
09.001	Гидроизоляция в один слой рубероида	100 м2	3.24		
09.002	Утеплитель из керамзита т. 8-14 см	м3	35.6		
09.003	Цементная стяжка т. 30 мм	100 м2	3.24		
09.004	Кровля из трех слоев стеклорубероида	100 м2	3.24		
09.005	Цементная стяжка т. 20 мм под полы (2 слоя)	100 м2	5.70		
09.006	Гидроизоляция в два слоя гидроизола под полы	100 м2	2.85		
09.007	Покрытие пола из метлахских плиток	м2	11.8		
09.008	Покрытие пола из мраморных плит	м2	100.4		
09.009	То же, из штучного паркета на дощатом настиле	100 м2	172.5		
09.010	Песчаная подготовка под полы крыльца	м3	0.2		
09.011	Покрытие площадок из метлахских плиток	м2	2.0		
10	**Столярные работы**				
10.001	Установка во внутренних стенах полирован. дверных блоков с замком ДГ21-9	шт.	8		
10.002	То же, в перегородках ДГ21-9	шт.	9		
10.003	Установка барьера в вестибюле из полированных щитов	п/м	10.0		
10.004	Установка дверных блоков из ПЕМОПЕН разм. 2.1х1.0 с остеклением 6 мм стеклом	шт.	2		
10.005	То же, оконных блоков с остеклением стеклопакетом 4х4 разм. разм. 1.2-1.5 1.2-0.6	шт. шт.	20 1		

10.006	Установка подоконников из мраморных плит	м2	9.5		
11	**Работы по отделке**				
11.001	Отделка потолков под окраску	100 м2	2.85		
11.002	Улучшенная штукатурка внутренних стен	100 м2	6.84		
11.003	Облицовка стен глазурованной плиткой-кафель	м2	79.2		
11.004	Улучшенная штукатурка внутренних оконных и дверных откосов	100 м2	0.32		
11.005	Устройство подвесного потолка PRONTO	м2	100.4		
11.006	Улучшенная водоэмульсионная окраска потолков	100 м2	2.85		
11.007	Улучшенная масляная окраска стен	100 м2	6.05		
11.008	Штукатурка стенок и днища каналов с железнением	100 м2	1.04		
11.009	Масляная окраска металлоконструкций	100 м2	7.15		
11.010	Облицовка наружных стен плитами известняка, цоколь	м2	31.9		
11.011	Высококачественная штукатурка стен фасада и входа в подвал	100 м2	2.48		
11.012	Перхлорвиниловая окраска стен фасада	100 м2	3.03		
11.013	Высококачественная штукатурка откосов на фасаде	100 м	1.12		
12	**Электроустройства/управление**				
	Электроснабжение				
12.001	Пункт распределительный ПРII-1048-2АУ3	шт.	1		
12.002	Щиток групповой осветительный УОЩВ-12АУХЛ4	шт.	4		
12.003	Фотореле с датчиком ФР-2	шт.	2		
12.004	Установка светильников с люминисцентными лампами до 2 шт.	шт.	30		
12.005	То же, до 6 шт.	шт.	30		
12.006	То же, до 2 шт. в подвесных потолках	шт.	18		
12.007	Установка светильников с лампами накаливания, потолочные	шт.	6		
12.008	Коробки осветительные пластмассовые УПК-4	шт.	68		
12.009	Розетки штепсельные скрытой проводки	100 шт.	0.32		
12.010	То же, открытой проводки	100 шт.	0.06		
12.011	Выключатели скрытой проводки	100 шт.	0.16		
12.012	То же, открытой проводки	100 шт.	0.06		
12.013	Ппрокладка винипластовых труб д. 20 мм	100 м	1.58		
12.014	Прокладка провода скрытой проводки, АППВС сеч. 2х2.5 мм2	100 м	5.40		
12.015	Прокладка кабеля АВРГ сеч. 2х2.5 мм2 по стенам на скобах	100 м	4.28		
12.016	То же, в винипластовой трубе	100 м	1.58		
12.017	Прокладка кабеля АВРГ сеч. 2х4 мм2 по стенам на скобах	100 м	0.25		
12.018	То же, сеч. 4х2.5 мм2	100 м			
12.019	То же, сеч. 3х10+1х16 мм2	100 м	0.05		
12.020	Прокладка провода АППВС сеч. 2х2.5 мм2 в пустотах плит	100 м	0.80		
12.021	Стоимость, светильники с люминисц. лампами УСП5-6х20 УСП5-4х40 УСП5-2х40 УСП5- 40 Л104Б-40	 шт. шт. шт. шт.	 14 16 30 6		

12.022	То же, лампы люминисцентные ЛБ-20 ЛБ-40	 шт. шт.	 84 142		
12.023	То же, стартеры	шт.	142		
12.024	То же, светильники потолочные НП-001	шт.	2		
12.025	То же, ППР-100	шт.	4		
12.026	То же, лампы накаливания	шт.	6		
	Пожарная сигнализация				
12.027	Установка станции пожарной сигнализации ТОЛ-10-С	шт.	1		
12.028	То же, батарея аккумуляторная 10ЖН-60М	шт.	1		
12.029	То же, звонок громкого боя М3-1	шт.	1		
12.030	Установка извещателя кнопочного ПКИЛ-9М	шт.	2		
12.031	Установка теплового датчика извещателя ИП105-2/1	шт.	38		
12.032	Прокладка провода ТРП сеч. 1х2х0.5 мм2	100 м	2.5		
12.033	Коробка ответвительная пластмассовая	шт.	19		
12.034	Установка патрона настенного с лампой	шт.	1		
12.035	Установка блока питания станции БП-24/4	шт.	1		
	Телефонизация				
12.036	Установка распределительной коробки КРТП-10	шт.	1		
12.037	То же, розетки РТШ	шт.	20		
12.038	Перекладка провода ТРП-2х0.4 мм2 по стенам	100 м	4.9		
	Радиофикация				
12.039	Абонентский трансформатор ТАМУ-10	шт.	1		
12.040	Установка разветвительных коробок УК-2П	шт.	1		
12.041	То же, УК-2Р	шт.	21		
12.042	Установка радиорозетки РПВ-2 для скрытой проводки	шт.	15		
12.043	То же, для открытой проводки	шт.	6		
12.044	Прокладка провода по стенам ППВ-2х1.2	100 м	0.5		
12.045	То же, ППВ-2х0.6	100 м	2.25		
13	**Водоснабжение/канализация/отопление**				
	Водопровод				
13.001	Установка оцинкованных труб д. 15 мм	п/м	5.0		
13.002	Установка оцинкованных труб д. 20 мм	п/м	10.0		
13.003	Испытание системы	100 м	0.15		
13.004	Стоимость вентиля 15 кч8р2, д. 15 мм	шт.	2		
13.005	Стоимость вентиля 15 кч8р2, д. 20 мм	шт.	1		
13.006	Масляная окраска труб за 2 раза	м2	3.0		
	Канализация				
13.007	Прокладка чугунных труб д. 50 мм	п/м	6.0		
13.008	Прокладка чугунных труб д. 100 мм	п/м	16.0		
13.009	Установка умывальника фаянсового типа "Утро" с краном	шт.	2		
13.010	Установка чаши клозетной чугунной с бачком	шт.	2		
	Отопление				
13.011	Установка радиаторов М-140АО чугунных	экм	42.0		
13.012	Прокладка стальных труб д. 15 мм	м	140.0		
13.013	То же, д. 20 мм	м	70.0		
13.014	Испытание системы	100 м	2.1		
13.015	Вентиль воздушный д. 15 мм инж. Маевского	шт.	2		
13.016	Стоимость вентиля д. 15 мм для радиаторов, двойной регулировки	шт.	18		
13.017	Стоимость вентиля 15кч18п2 д. 15 мм	шт.	4		
13.018	Масляная окраска труб и радиаторов				

	за 2 раза	100 м2	0.45		
13.019	Обмазка стальных труб изолом	м2	13.0		
13.020	Изоляция труб минватными плитами	м3	1.6		
13.021	Покровный лой из стеклопластика	м2	68.0		
13.022	**Вентиляция** Автоном. кондиционер крышный ROOFTOP (Турция) вес. 477 кг ВСН-90	шт.	1		
13.023	Канальный вентилятор осевой АХС-160 фирмы "Five Stars" (Турция)	шт.	1		
13.024	Решетки щелевые сеч. 600х200, Р200	шт.	5		
13.025	Воздуховоды из оцинкованной стали т 0.7 мм сеч. 600х300 мм	м2	18.0		
13.026	То же, сеч. 500х300 мм	м2	13.0		
13.027	То же, сеч. 500х200 мм	м2	18.0		
13.028	То же, т. 0.6 мм сеч. 400х200 мм	м2	12.0		
13.029	То же, сеч. 250х200 мм	м2	4.5		
13.030	То же, т. 0.5 мм сеч. 200х200 мм	м2	4.0		
13.031	То же, сеч. 150х150 мм	м2	12.0		
13.032	То же, д. 150 мм	м2	3.5		
13.033	Решетки воздухоприточные РР-1 сеч. 200х100 мм	шт.	15		
13.034	Решетки щелевые Р-150 сеч. 150х150	шт.	2		
13.035	Решетки щелевые Р200 сеч. 600х200	шт.	5		
13.036	Зонт для воздуховодов д. 150 мм	шт.	1		
13.037	Изоляция воздуховодов матами стекловатными (на крыше)	м3	2.5		
13.038	Покрывной слой воздуховодов фольгоизолом	100 м2	0.4		
13.039	Гибкие вставки 500х500 ВТН	шт.	2		
13.040	Шумоглушители ШТП-12	шт.	2		
13.041	То же, ШТП-10	шт.	2		

СЧЕТ No.: T07

Терминал билетных касс

Пункт □	Описание	Ед. измер.	Кол-во	Цена за ед. в долл. США	Всего цена в долл. США
03	**Земляные работы***				
03.001	Разработка грунта II группы экскаватором с емкостью ковша 0,5 м3 в отвал	1000 м3	0.159		
03.002	Перемещение грунта бульдозером на расстояние 50 м в резерв	1000 м3	0.159		
03.003	То же, из резерва	1000 м3	0.092		
03.004	Зачистка котлована и траншеи вручную	100 м3	0.26		
03.005	Обратная засыпка грунта бульдозером за обрезы фундаментов	1000 м3	0.092		
03.006	То же, вручную	100 м3	0.30		
03.007	Перекидка грунта вручную при подсыпке под полы	100 м3	0.09		
03.008	Планировка площади подсыпки вручную	100 м2	0.45		
03.009	Уплотнение грунта пневмотрамбовками	100 м3	0.92		
04	**Работы с камнем и щебнем**				
04.001	Щебеночная подготовка под фундаменты	м3	13.25		
04.002	Уплотнение грунта щебнем под полы	100 м2	0.45		
05	**Свайные работы**				
06	**Бетонные работы**				
06.001	Бетонная подготовка т. 10 см под фундаменты из бетона В-7.5	м3	10.6		
06.002	Монолитные ж/б ленточные фундаменты из бетона В-15	м3	32.8		
06.003	Монолитные железобетонный перемычки из бетона В-15	м3	0.92		
06.004	Монолитный железобетонный пояс из бетона В-15	м3	3.5		
06.005	Монолитные железобетонные участки перекрытий из бетона В-15	м3	1.7		
06.006	Установка сборных железобетонных пустотелых плит перекрытий 1ПК59.12-8Ат.С9	шт.	4		
06.007	То же, плит каналов ПТ12.5-8.6	шт.	12		
06.008	Бетонная подготовка т. 8 см из бетона В7.5 под полы	м3	3.95		
06.009	Бетонная подготовка под полы площадок и ступени из бетона	м3	1.0		
06.010	Бетонная подготовка т. 10 см из бетона В15 под каналы	м3	1.0		
07	**Работы с кирпичной кладкой**				
07.001	Стены фундаментные из камня кубик т. 39 см	м2	29.8		
07.002	Боковая изоляция стен и каналов цементным р-ром	100 м2	0.62		
07.003	То же, битумом за 2 раза	100 м2	0.62		
07.004	Горизонтальная изоляция стен цементным р-ром	100 м2	0.12		
07.005	Стены наружные из камня кубик т. 39 см на р-ре М-50	м2	95.6		

07.006	То же, стены внутренние	м2	11.4		
07.007	Стенки каналов из камня кубик толщиной 19 см	м2	17.0		
07.008	Стенки крыльца из камня кубик т. 19 см	м2	3.2		
07.009	Перегородки кирпичные т. 12 см	м2	33.0		
08	**Работы с металлом**				
08.001	Армирование монолитных железобетонных конструкций	т	3,634		
08.002	Армирование кладки стен	т	0.107		
08.003	Установка металлических стоек навеса из труб д. 245х6 мм	т	1,635		
08.004	Анкера для установки стоек	т	0.16		
08.005	Установка металлических балок навеса из швеллера □ 20	т	1,711		
08.006	Установка прогонов металлических из швеллера □ 10	т	1,142		
08.007	Установка металлических ферм из уголка □ 50х50	т	2,537		
08.008	Покрытие навеса из оцинкованного профнастила	м2	280.0		
08.009	Обшивка парапета навеса профнастилом	м2	78.0		
08.010	Леса стальные для отделочных работ	100 м2	3.17		
09	**Плотницкие, кровельные работы**				
09.001	Гидроизоляция в один слой рубероида	100 м2	0.58		
09.002	Утеплитель из керамзита т. 8-14 см	м3	6.4		
09.003	Цементная стяжка т. 30 мм	100 м2	0.58		
09.004	Кровля из трех слоев стеклорубероида	100 м2	0.58		
09.005	Цементная стяжка т. 20 мм под полы	100 м2	0.5		
09.006	Гидроизоляция в два слоя гидроизол под полы	100 м2	0.48		
09.007	Покрытие пола из метлахских плиток	м2	2.1		
09.008	Покрытие пола из штучного паркета на дощатом настиле	м2	45.9		
09.009	Крыльцо в одну ступень	м2	2.0		
10	**Столярные работы**				
10.001	Установка во внутрен. стенах дверных блоков с замком ДН21х9	шт.	2		
10.002	То же, в перегородках ДГ21-9 ДГ21-7	 шт. шт.	 8 1		
10.003	Установка дверных блоков из ПЕМОПЕН разм. 2.1х1.0 с остеклением 6 мм стеклом	шт.	1		
10.004	То же, с остеклением стеклопакетом 1.2-1.5 0.4-0.6	 шт. шт.	 4 1		
10.006	Установка подоконников из мраморных плит	м2	2.8		
11	**Работы по отделке**				
11.001	Отделка потолков под окраску	100 м2	0.45		
11.002	Улучшенная штукатурка внутренних стен	100 м2	1.52		
11.003	Облицовка стен глазурованной плиткой-кафель	м2	18.2		
11.004	Улучшенная штукатурка внутренних оконных и дверных откосов	100 м2	0.10		
11.005	Известковая окраска потолков и стен	100 м2	0.08		
11.006	Улучшенная водоэмульсионная окраска потолков	100 м2	0.43		
11.007	Улучшенная масляная окраска стен	100 м2	1.37		

11.008	Штукатурка внутренних стенок каналов с железнением	100 м2	17.0		
11.009	Облицовка наружных стен плитами известняка, цоколь	м2	13.2		
11.010	Высококачественная штукатурка стен фасада	100 м2	0.93		
11.011	Перхлорвиниловая окраска стен фасада	100 м2	0.93		
11.012	Высококачественная штукатурка откосов на фасаде	100 м	0.23		
12	**Электроустройства/управление**				
	Электроснабженме				
12.001	Щиток групповой осветительный УОЩВ-12АУХЛ4	шт.	1		
12.002	Фотореле с датчиком ФР-2	шт.	1		
12.003	Светильники с люминисцентными лампами	шт.	15		
12.004	Люстра бытовая	шт.	6		
12.005	Светильник настенный НБ001-60	шт.	1		
12.006	Светильник ППР-100	шт.	2		
12.007	Выключатель скрытой проводки	100 шт.	0.05		
12.008	Выключатель перекидной Т-1	100 шт.	0.03		
12.009	Розетка скрытой проводки	100 шт.	0.09		
12.010	То же, открытой проводки	100 шт.	0.03		
12.011	Коробки пластмассовый УПК-4	шт.	31		
12.012	Прокладка винипластовых труб д. 20 мм	100 м	0.48		
12.013	Прокладка кабеля АВРГ сеч. 2х2.5 мм2 по стене на скобах	100 м	1.88		
12.014	То же, в винипластовой трубе	100 м	0.48		
12.015	Прокладка провода АППВС сеч. 2х2.5 мм2 скрыто под штукатуркой	100 м	0.9		
12.016	То же, в пустотных плитах	100 м	0.2		
12.017	Стоимость светильника УСП5-2х40 УСП5-40	 шт. шт.	 12 3		
12.018	То же, люстра бытовая одноламповая	шт.	6		
12.019	То же, двухламповая	шт.	1		
12.020	Стоимость светильников НБ001-60	шт.	1		
12.021	Стоимость светильников ППР-100	шт.	2		
12.022	Стоимость ламп люминисцентных ЛБ-40 Вт	шт.	27		
12.023	Стоимость стартеров	шт.	27		
12.024	Стоимость ламп накаливания, разные	шт.	10		
	Пожарная сигнализация				
12.025	Установка станции пожарной сигнализации ТОЛ-10-С	шт.	1		
12.026	То же, батарея аккумуляторная 10ЖН-60М	шт.	1		
12.027	То же, звонок громкого боя М3-1	шт.	1		
12.028	Установка извещателя кнопочного ПКИЛ-9М	шт.	1		
12.029	Установка теплового датчика извещателя ИП105-2/1	шт.	8		
12.030	Прокладка провода ТРП сеч. 1х2х0.5 мм2	100 м	0.6		
12.031	Коробка ответвительная пластмассовая	шт.	2		
12.032	Установка патрона настенного с лампой	шт.	1		
12.033	Установка блока питания станции БП-24/4	шт.	1		
	Телефонизация				
12.034	Установка распределительной коробки КРТП-10	шт.	1		
12.035	То жеБ розетки РТШ	шт.	4		
12.036	Прокладка провода ТРП-2х0.4 мм2	100 м	0.90		
	Радиофикация				
12.037	Установка разветвительной коробки УК-2П	шт.	3		
12.038	То же, ответвительной коробки УК-2Р	шт.	7		

12.039	То же, радиорозетки РПВ-2 для скрытой проводки	шт.	4		
12.040	То же, для открытой проводки	шт.	3		
12.041	Прокладка провода ППВ-2х0.6 мм2	100 м	0.95		
13	**Водоснабжение/канализация/отопление**				
	Отопление				
13.001	Установка радиаторов М140АО	экм	14.0		
13.002	Прокладка стальных труб д. 15 мм	п/м	64.0		
13.003	Испытание системы отопления	100 м	0.64		
13.004	Вентиль чугунный 15кч18п2, д. 15 мм	шт.	4		
13.005	Кран двойной регулировки КРДШ д. 15 мм	шт.	5		
13.006	Установка воздушного крана инж. Маевского д. 15 мм	шт.	2		
13.007	Масляная окраска труб и радиаторов за 2 раза	100 м2	0.15		
13.008	Окраска труб изолом в канале	м2	0.4		
13.009	Изоляция труб минватными плитами	м3	0.01		
13.010	Покрытие изоляции пластиком РСТ	м2	2.4		
	Вентиляция				
13.011	Установка дефлектора ДВК-5 д. 500 мм	шт.	1		
13.012	Решетка щелевая регулирующая Р150 сеч. 150х150	шт.	1		
13.013	Воздуховод из оцинкованной стали т. 0.5 мм д. 200 мм	м2	1.0		
13.014	Автономный кондиционер ROOFTOP BTH-240 весом 1043 кг	к-т	1		
13.015	Воздуховод из оцинкованной кровельной стали т. 0.9 мм сеч. 1200х400 мм	м2	13.0		
13.016	То же, сеч. 1000х400 мм	м2	39.0		
13.017	То же, сеч. 900х400	м2	8.0		
13.018	То же, сеч. 800х400 мм	м2	79.0		
13.019	То же, сеч. 800х200 мм	м2	10.0		
13.020	То же, сеч. 500х400 мм	м2	121.0		
13.021	То же, сеч. 400х200 мм	м2	42.0		
13.022	Воздуховод круглый из оцинкованной стали т. 0.5 мм, д. 200 мм	м2	1.0		
13.023	Решетки потолочные 450х450 (Турция)	шт.	15		
13.024	Решетки щелевые Р150 сеч. 150х150	шт.	2		
13.025	Шумоглушители ШТП-12	шт.	12		
13.026	Гибкие вставки ВГН сеч. 500х500, F=1м2	шт.	3		
13.027	То же, 410х410 мм F=0.8 мм2	шт.	5		
13.028	Заслонки воздушные сеч. Р400х200Р	шт.	1		
13.029	То же, Р400х800Р	шт.	3		
13.030	То же, Р400х600Р	шт.	2		
13.031	Установка дефлектора ДВК-5 д. 500 мм	шт.	1		
13.032	Изоляция воздуховодов (на крыше) матами	м3	7.5		
13.033	Покрывной слой воздуховодов фольгоизолом	м2	120.0		
	Водоснабжение				
13.034	Прокладка водогазопроводных оцинкованных труб д.15 мм	п/м	3.0		
13.035	Прокладка водогазопроводных оцинкованных труб д.20 мм	п/м	10.0		
13.036	Испытание системы	100 м	0.13		
13.037	Стоимость вентиля 15кч8р2 д. 20 мм	шт.	1		
13.038	Масляная окраска труб за 2 раза	м2	3.0		
	Канализация				
13.039	Прокладка чугунных труб д. 50 мм	п/м	2.0		
13.040	Прокладка чугунных труб д. 100 мм	п/м	15.0		
13.041	Установка фаянсового умывальника "Утро"				

	с краном	к-т	1		
13.042	Установка чаши клозетной чугунной с бачком	к-т	1		

* - Засыпка за наружные стены фундаментов учтена в объеме вертикальной планировки

СЧЕТ No.: T08 Здание общественных услуг

Пункт □	Описание	Ед. измер.	Кол-во	Цена за ед. в долл. США	Всего цена в долл. США
03	**Земляные работы, дноуглубление***				
03.001	Разработка грунта II группы экскаватором с емкостью ковша 0,5 м3 в отвал	1000 м3	0.145		
03.002	Перемещение грунта бульдозером на расстояние 50 м в резерв	1000 м3	0.145		
03.003	То же, из резерва	1000 м3	0.124		
03.004	Зачистка котлована и траншеи вручную	100 м3	0.20		
03.005	Обратная засыпка грунта бульдозером за обрезы фундаментов	1000 м3	0.085		
03.006	То же, вручную	100 м3	0.17		
03.007	Подсыпка под полы грунтом с перекидкой экскаватором с емкостью ковша 0.5 м3	1000 м3	0.039		
03.008	Перекидка грунта вручную при подсыпке под полы	100 м3	0.29		
03.009	Планировка площади подсыпки вручную	100 м2	1.94		
03.010	Уплотнение грунта пневмотрамбовками	100 м3	1.14		
04	Работы с камнем и щебнем				
04.001	Щебеночная подготовка под фундаменты	м3	8.3		
04.002	Уплотнение грунта щебнем под полы	100 м2	1.95		
05	Свайные работы				
06	Бетонные работы				
06.001	Бетонная подготовка т. 10 см под фундаменты из бетона В-7.5	м3	7.0		
06.002	Монолитные ж/б ленточные фундаменты из бетона В-15	м3	22.5		
06.003	Монолитные ж/б стойки рам из бетона В-20	м3	2.64		
06.004	Монолитные ж/б ригели рам высотой до 500 мм на высоте до 6 м из бетона В-20	м3	4.0		
06.005	Монолитные железобетонный перемычки из бетона В-15	м3	0.88		
06.006	Монолитный железобетонный пояс из бетона В-15	м3	4.64		
06.007	Монолитные железобетонные участки перекрытий из бетона В-15	м3	4.12		
06.008	Установка сборных железобетонных пустотелых плит перекрытий 1ПК59.12-8Ат.С9 1ПК71.10-8Ат.С9 1ПК71.12-8Ат.С9 1ПК59.10-8Ат.С9 1ПК59.12-8Ат.С9	 шт. шт. шт. шт.	 4 5 8 2		
06.009	Бетонная подготовка т. 8 см из бетона В7.5 под полы	м3	10.9		
06.010	Бетонная подготовка под полы площадок и ступени из бетона В-7.5	м3	14.1		
06.011	Установка бетонных ступеней	п/м	70.8		
06.012	Бетонная подготовка т. 10 см из бетона В15 под каналы	м3	9.0		

06.013	Установка сборных ж/б плит каналов ПТ12.5-8.6	шт.	73		
07	Работы с кирпичной кладкой				
07.001	Стены фундаментные из камня кубик т. 39 см на р-ре М-50	м2	49.9		
07.002	Горизонтальная изоляция стен цементным р-ром т. 20 мм	100 м2	0.25		
07.003	Боковая изоляция фундаментных стен цементным р-ром	100 м2	0.87		
07.004	То же, битумом за 2 раза	100 м2	0.87		
07.005	Стены наружные из камня кубик т. 39 см на р-ре М-50	м2	156.2		
07.006	То же, стены внутренние	м2	29.5		
07.007	Перегородки кирпичные т. 12 см	м2	95.3		
07.008	Стенки крыльца из камня кубик т. 19 см	м2	3.2		
07.009	Стенки каналов из камня кубик толщ. 19 см	м2	35.8		
07.010	То же, т. 39 см	м2	1.8		
07.011	То же, из кирпича т. 12 см	м2	7.6		
07.012	Боковая изоляция стен каналов цементным раствором	100 м2	0.24		
07.013	То же, битумом за 2 раза	100 м2	0.24		
08	Работы с металлом				
08.001	Армирование монолитных железобетонных конструкций	т	2,862		
08.002	Установка металлических уголков □ 63 в углах каналов	т	0.038		
09	Плотницкие, кровельные работы				
09.001	Гидроизоляция в один слой рубероида	100 м2	1.59		
09.002	Утеплитель из керамзита т. 8-14 см	м3	17.5		
09.003	Цементная стяжка т. 30 мм	100 м2	1.59		
09.004	Кровля из трех слоев стеклорубероида	100 м2	1.59		
09.005	Цементная стяжка т. 20 мм под полы (2 слоя)	100 м2	3.02		
09.006	Гидроизоляция в два слоя гидроизола под полы	100 м2	1.51		
09.007	Покрытие пола из метлахских плиток	м2	78.0		
09.008	Покрытие пола из мраморных плит	м2	72.8		
09.009	Установка деревянного барьера	п/м	3.0		
09.010	Песчаная подготовка под полы крыльца	м3	14.5		
09.011	Покрытие площадок из метлахских плиток	м2	48.4		
10	Столярные работы				
10.001	Установка во внутрен. стенах дверных блоков с замком ДН21х10	шт.	2		
10.002	То же, во внутренних стенах ДГ21-9	шт.	2		
10.003	То же, в перегородках ДГ21-9 ДГ21-7 ДГ16-7	 шт. шт. шт.	 5 2 7		
10.004	Установка оконных блоков из ПЕМОПЕН с остеклением стеклопакетом раз. 1.4х1.8 м	шт.	1		
10.005	Установка витражей из ПЕМОПЕН с дверью 2.0х2.5	шт.	1		
10.006	То же, глухими переплетами 1.2х2.5	шт.	2		
10.007	Остекление витражей 6 мм полированным стеклом	м2	11.0		
10.008	Установка подоконников из мраморных плит	м2	2.6		

11	Работы по отделке				
11.001	Отделка потолков под окраску	100 м2	1.36		
11.002	Улучшенная штукатурка внутренних стен	100 м2	3.99		
11.003	Облицовка стен глазурованной плиткой-кафель	м2	175.1		
11.004	Улучшенная штукатурка внутренних оконных и дверных откосов	100 м2	0.09		
11.005	Известковая окраска потолков и стен	100 м2	1.9		
11.006	Улучшенная водоэмульсионная окраска потолков	100 м2	0.81		
11.007	Улучшенная масляная окраска стен	100 м2	1.00		
11.008	То же, откосов	100 м2	0.09		
11.009	Сплошное вырывнивание бетонных ригелей	100 м2	0.16		
11.010	Облицовка наружных стен плитами известняка, цоколь	м2	12.6		
11.011	Высококачественная штукатурка стен фасада	100 м2	1.89		
11.012	Перхлорвиниловая окраска стен фасада	100 м2	2.1		
11.013	Высококачественная штукатурка откосов на фасаде	100 м	0.28		
11.014	Штукатурка внутренних стенок каналов с железнением	100 м2	0.51		
12	**Электроустройства/управление**				
	Электроснабжение				
12.001	Щиток групповой осветительный УОЩВ-12АУХЛ4	шт.	1		
12.002	Фотореле с датчиком ФР-2	шт.	1		
12.003	Светильники с люминисцентными лампами до 6 шт.	шт.	14		
12.004	Светильники с лампами накаливания НП-001	шт.	8		
12.005	То же, настенные	шт.	3		
12.006	Выключатель перекидной Т-1 скрытой проводки	100 шт.	0.09		
12.007	Розетки штепсельные скрытой проводки	100 шт.	0.04		
12.008	То же, открытой установки	100 шт.	0.02		
12.009	Коробки пластмассовые УПК-4	шт.	2.5		
12.010	Прокладка провода АППВС сеч. 2х2.5 мм2 скрыто под штукатуркой	100 м	1.7		
12.011	То же, в пустотах плит	100 м	0.55		
12.012	Прокладка кабеля АВРГ сеч. 2х2.5 мм2 по стене на скобах	100 м	0.32		
12.013	То же, сеч. 4х2.5 мм2	100 м	0.2		
12.014	Стоимость светильников с люминисцентными лампами Л104Б-6х20	шт.	1		
12.015	То же, Л104Б-4х20	шт.	13		
12.016	То же, лампы люминисцентные ЛТБЦ-20	шт.	58		
12.017	То же, стартеры	шт.	58		
12.018	То же, светильник потолочный НП001	шт.	8		
12.019	То же, светильник настенный НБ005	шт.	3		
12.020	То же, лампы накаливания	шт.	11		
	Пожарная сигнализация				
12.021	Установка станции пожарной сигнализации ТОЛ-10-С	шт.	1		
12.022	То же, батарея аккумуляторная 10ЖН-60М	шт.	1		
12.023	То же, звонок громкого боя М3-1	шт.	1		
12.024	Установка извещателя кнопочного ПКИЛ-9М	шт.	1		
12.025	Установка теплового датчика извещателя ИП105-2/1	шт.	21		
12.026	Прокладка провода ТРП сеч. 1х2х0.5 мм2	100 м	1.2		

12.031	Коробка ответвительная пластмассовая	шт.	1		
12.032	Установка патрона настенного с лампой	шт.	1		
12.033	Установка блока питания станции БП-24/4	шт.	1		
	Телефонизация				
12.034	Установка распределительной коробки КРТП-10	шт.	1		
12.035	То же, розетки РТШ	шт.	4		
12.036	Прокладка провода ТРП-2х0.4 мм2	100 м	0.90		
	Радиофикация				
12.037	Установка разветвительной коробки УК-2П	шт.	1		
12.038	То же, ответвительной коробки УК-2Р	шт.	2		
12.039	То же, радиорозетки РПВ-2 для скрытой проводки	шт.	2		
12.040	Прокладка провода ППВ-2х0.6 мм2	100 м	0.2		
13	**Водоснабжение/канализация/отопление**				
	Отопление				
13.001	Установка радиаторов М140АО	экм	23.5		
13.002	Прокладка стальных труб д. 15 мм	п/м	102.0		
13.003	То же, д. 20 мм	п/м	6.0		
13.004	Испытание системы отопления	100 м	1.08		
13.005	Вентиль чугунный 15кч18п2, д. 15 мм	шт.	2		
13.006	То же, д. 20 мм	шт.	2		
13.007	Кран воздушный инженер. Маевского д.15мм	шт.	2		
13.008	Кран двойной регулировки КРДШ д. 15 мм	шт.	7		
13.009	Масляная окраска труб и радиаторов за 2 раза	100 м2	0.25		
13.010	Обмазка труб изолом	м2	3.0		
13.011	Изоляция труб минватными плитами	м3	0.5		
13.012	Покрывной слой из стеклопластика РСТ	м2	18.0		
	Вентиляция				
13.013	Установка бытового кондиционера БК-2500	шт.	1		
13.014	Канальный вентилятор АХС-315 (Турция) "Five Stars"	шт.	1		
13.015	То же, АХС-200А	шт.	2		
13.016	Воздуховод из оцинкованной стали т. 0.7 мм сеч. 500х250 мм	м2	1.5		
13.017	То же, д. 300 мм, т. 0.6 мм	м2	3.1		
13.018	То же, д. 200 мм	м2	6.3		
13.019	Решетки щелевые Р200 сеч. 400х200	шт.	6		
13.020	То же, Р150 сеч. 150х150	шт.	11		
13.021	Зонт для воздуховодов д. 200 мм	шт.	2		
13.022	То же, д. 300 мм	шт.	1		
	Водопровод				
13.023	Прокладка водогазопроводных оцинкованных труб д.15 мм	п/м	30.0		
13.024	Прокладка водогазопроводных оцинкованных труб д.20 мм	п/м	15.0		
13.025	Испытание системы	100 м	0.45		
13.026	Стоимость вентиля 15ч8р2 д. 15 мм	шт.	15		
13.027	Стоимость вентиля 15ч8р2 д. 20 мм	шт.	2		
	Канализация				
13.028	Прокладка чугунных труб д. 50 мм	п/м	12.0		
13.029	Прокладка чугунных труб д. 100 мм	п/м	15.0		
13.030	Прокладка чугунных труб д. 150 мм	п/м	32.0		
13.031	Установка умывальника эмалерованного с краном	шт.	7		
13.032	Установка трапа д. 100 мм	шт.	2		
13.033	Установка чаши клозетной чугунной с бачком	шт.	4		

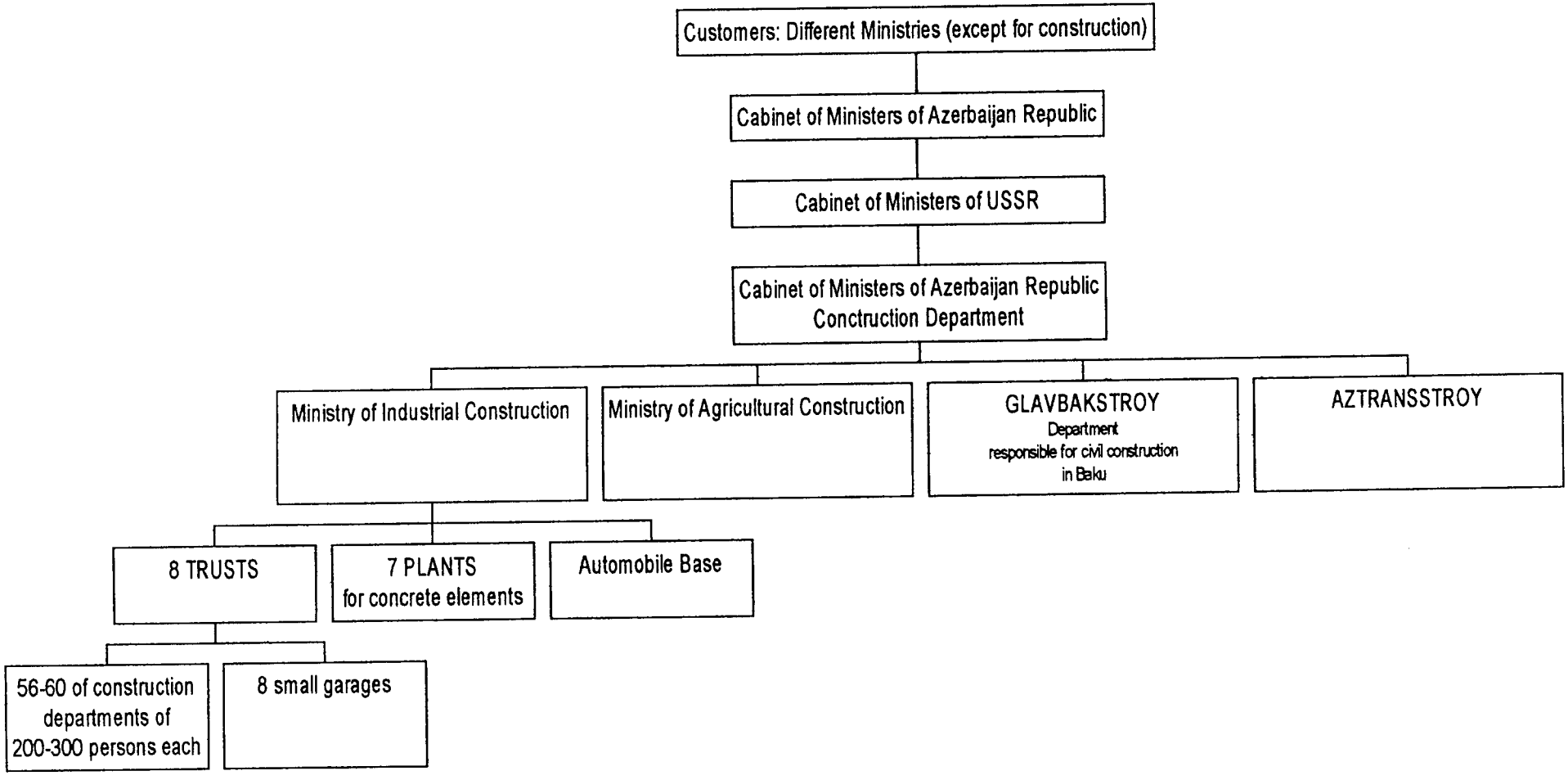
13.034	Установка мойки стальной с краном	шт.	2		
13.035	Установка писсуара фаянсового	шт.	4		

Appendix 5

Construction Sector Information

Approximate Layout of Organisation Diagramme of the Construction Sector in Azerbaijan during the Soviet Union

SITUATION IN TURKMENISTAN WAS SIMILAR TO THIS.



orgdiagr

CONSTRUCTION COMPANIES

No	*Company*	*Address*	*Profile*	*Telephone*	*Fax*	*Nationality*
1	Alarko					Turkish
2	Gama					Turkish
3	Norsel					Turkish
4	Summa					Turkish
5	Polimex					Turkish
6	Ucgen					Turkish
7	Agind Swissital Spa	Proezd Ajtakova,6 Ashgabad	industrial and building works			Italian
8	State Mobile Mechanized Group	Ashgabad	construction works, rural areas			Turkmen
9	State Construction Mounting Department	Ashgabad	consrtruction works city areas			Turkmen
10	Buygues		major construction works			French
11						
12						
13						
14						
15						

BUILDING MATERIALS
local and imported

1.Ceramic brick
Produced all over Turkmenistan territory. The biggest enterprises are located in Ashgabad, Mary, Chardjou. The main part of this material is used for low-storey individual construction. Dimension is 250×120×65. For the producing of ceramic bricks is used local raw material - clay.

2. Silicate brick

Produced in Ashgabad industrial complex "?"). Raw materials for its producing are clay and limes.

3. Stone "Gusha" - Saw stone, or is named - blocks from "Gusha stone" . Deposits are concentrated in Balkan and Chardjou regions. The main part is produced in Akdash building materials industrial complex. Is used for low-storey buildings (for walls and partitions).

4. Concrete - expanded clay blocks

The main components for its producing are cement and expanded clay. Actually produced all over the country territory in individual and state enterprises. Mainly is used in individual buildings for walls and others fencing constructions.

5. Non-metallic building materials, crussed stone, gravel, sand are extracted all over the Turkmenistan. Concentration plants or industrial complexes of non-metallic materials are situated mainly in Akhaltin and Balcan regions. Generally is used as aggregate for iron concrete items and also for road construction.

6. Cement industry in Turkmenistan is presented by ..? plant project capacity of the plant is 1,4 mln tonne.

Plant produces cement and blast furnace cement M300 and M400. The main part of cement is used for interstate needs. - - ..? is used for blast furnace cement producing.

The annual output of cement producing is 437.000 tonne.

7. Producing of building glass is carried out i n Ashgabad glass industrial complex. The capacity of enterprise for 1.01.96 is ?8.. mln?- - -

The row material mainly is local (Keljatin ?dolomites deposits). Alkali additions, sodium carbonate are imported mainly from CIS. Besides glass the enterprise produces glasses, bottles, cans.

8. Producing of wooden window and door blocks (joiner's items) is organised in small volumes in all state regions from imported wood.

In Ashgabad the is special enterprise Wooden decorate industrial complex - with annual output 247.000 m2 of joiner's items.

Besides, since 1996 Ashgabad factory of plastic, aluminium and joiner's items has been launched, volume 100.000 m2.

9. Producing of roof materials is presented by asbestos-cement boards or slates is organises in Bezmin on the base of imported raw material. The annual output of production is 46,4 mln. - - boards.

10. Ceramic veneers are produces by non-state sector. The main part of necessary quantity of tile for inner building decoration is imported from CIS and abroad.

11. The are lime deposits, granite deposits, ?"tuf"deposits for producing of face tiles from natural materials, producing of these materials is organised in every region.

12.? - -

13. Decorating materials: wall- paper, vanish paint, parquet are imported from CIS and abroad.

14. Alabaster or gypsum are produced in Ashgabad and Turkmenbashi. The row material is limes, Turkmenistan is rich in these deposits.

15. Porous aggregate (expanded clay) is produced in every region. Row material is ?argelit the recourses of which are located in the country. Expanded clay is used as light aggregate in iron concrete production.

16. Kaolin - is used for producing of ceramic lavatory items, crockery. Since 1996 has been produced in Bezmeins plant annual volume is 20.000 tonne . The row material is clay of Kyzyl- Kainsky deposits. This type of row material is world wide demanded.

Export materials

1. Black metals - Kasakhstan, Russia, UK, USA, Afghanistan

2. Wood - Russia, Boleros, Ukraine

3. Items from black metals - Germany, Cyprus, Kasakhstan, Russia Ukraine, Uzbekistan

4. Portland cement - Uzbekistan, Russia

5. Wooden materials - Russia, Ukraine

6. Paints, enamel - Ukraine, Russia, Armenia, Azerbaijan

7. Fire-proof items Ukraine, Uzbekistan Kasakhstan

8. Lavatory items - Russia, Uzbekistan, Ukraine, Germany, Czech
9. Wall-paper - Russia, Ukraine, Turkey

10. Electrical goods - Russia, Kirghizia, Boleros