MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN

Satbayev University
Institute of Architecture and Civil Engineering named after T. Basenova
Department of Civil Engineering and Building Materials

Salehuddin Frotan

On the theme of “Administrative building using renewable energy sources”

EXPLANATORT NOTE
To the diploma project

Specialty 5B072900 – Civil Engineering

Almaty 2021

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
Satbayev University

Institute of Architecture and Civil Engineering named after T. Basenova
Department of “Civil Engineering and Building Materials”

ALLOWED TO PROTECT

Head of Department
_____N.V. Kozyukova
Master of technical science, lecturer
«_26_»__01__2021 y.

EXPLANATORY NOTE

to the diploma project

On the theme of “Administrative building using renewable energy sources”

5B072900 - "Civil Engeneering"

Prepared by _____Salehuddin Frotan

Scientific adviser _____ Kyzylbayev N.K

«_30_»__05__2021 y.

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Specialty 5B072900 – Civil Engineering

APPROVE
Head of Department
_____ N.V. Kozyukova
Master of technical science, lecturer
«30» 05 2021 y.

ASSIGNMENT
Complete a diploma project

Student: Salehuddin Frotan
Topic « Administrative building using renewable energy sources »
Approved by the Order of the Rector of the University No. 2131-b dated November 24, 2020.
The deadline for the completed work is May 10, 2020.
Initial data for the diploma project: Almaty
Structural schemes of the building – column with beam, structures are made of monolithic reinforced concrete, architectural solution.
List of questions to be developed:
a) Architectural and analytical part: basic initial data, space-planning solutions, heat engineering calculation of enclosing structures (outer wall), lighting calculation, calculation of the foundation option and depth of laying, justification of energy efficiency measures;
b) Calculation and design part: calculation and design of column and beam;
c) Organizational and technological part: development of technological maps, construction schedule and construction plan;
d) Economic part: local estimate, object estimate, summary estimate;
List of graphic material (with exact indication of required drawings):
1. I, standard floor plans, parts 1-1 and 2-2 – 4 sheets.
2. KZh columns, specifications – 1 sheet.
3. Technical maps of earthworks and formwork, calendar plan, construction site plan 4 sheets.
11 slides of work presentation are provided.
Recommended main literature: SP RK 2.04-01-2017 “Construction climatology”, SN RK 2.04-04-2013 “Construction heat engineering”, SN RK 2.03-30-2017 “Construction in seismic zones”

SCHEDULE

preparation of thesis (project)

№	Part	30%	60%	90%	100%	Note
1	Architectural and analytical	11.01.2021г.-14.02.2021г.				
2	Calculation and design		15.02.2021г. 23.03.2021г.			
3	Organizational and technological			24.03.2021г. 01.05.2021г.		
4	Economic				01.05.2021г. 09.05.2021г.	
5	Pre-defense	10.05.2021г.-14.05.2021г.				
6	Anti-plagiarism, norm control	17.05.2021г.-31.05.2021г				
7	Quality control	26.05.2021г.-31.05.2021г.				
8	Defense	01.06.2021г.-11.06.2021г.				

Signatures

consultants and the normative controller for the completed diploma work (project) with an indication of the parts of work (project) related to them

Name parts	Consultants, I.O.F. (academic degree, rank)	the date signing	Signature
Architectural and analytical	Kyzylbayev N.K Senior-lecturer		
Calculation and design	Zhambakina Z.M Assistant professor		
Organizational and technological	Kyzylbayev N.K Senior-lecturer		
Economic	Kyzylbayev N.K Senior-lecturer		
Norm controller	Bek A.A Assistan		
Quality control	Kozyukova N.V M.Eng.lecturer		

Scientific adviser _____ Kyzylbayev N.K

The task was accepted for execution student _____Salehuddin Frotan

Date "_30_" ____05____ 2021 y.

АҢДАТПА

Дипломдық жұмыстың тақырыбы – «Алматы қаласының гелиожүйесі бар Әкімшілік ғимараты». Жұмыс келесі бөлімдерден тұрады: сәулет-құрылыс, есептік-конструктивтік, құрылыс өндірісінің технологиясы мен ұйымдастырылуы, экономикалық, тіршілік қауіпсіздігі және еңбекті қорғау.

Осы жұмысты құру кезінде бағдарламалық кешендердің келесі тізімі пайдаланылды:

1 AutoCAD 2019;
2 Revit 2019;
3 ETABS V18
4 Microsoft Project 2016.

АННОТАЦИЯ

Тема данной дипломной работы – «Административное здание с гелиосистемой отопления городе Алматы». Работа состоит из следующих разделов: архитектурно-строительный, расчетно конструктивный, технология и организация строительного производства, экономический, безопасность жизнедеятельности и охрана труда.

При создании данной работы был использован следующий перечень программных комплексов:

1 AutoCAD 2019;
2 Revit 2019;
3 ETABS V18
4 Microsoft Project 2016.

ANNOTATION

The topic of this final thesis is “Administrative building with solar heating system in Almaty”. The work consists of the following sections: architectural and construction, design and construction, technology and organization of construction production, economic, life safety and labor protection.

For creation of the building, the following software programs are used:

1 AutoCAD 2019;
2 Revit 2018
3 ETABS V18
4 Microsoft Project 2016.

CONTENT

Introduction	7
1. Architectural and analytical part	8
1.1 Basic information about the construction site	8
1.2 Natural-climatic and engineering-geological conditions	8
1.3 General plan. Improvement of the territory	10
1.4 Space-planning solution	10
1.5 Constructive solutions of the object	11
1.6 Thermal calculation of the outer wall	11
2 Calculation and design part	12
2.1 Collection of loads	12
2.2 Collecting Lateral Ground Pressure	12
2.3 Live loads according to EN 1991	13
2.4 Calculating snow load	13
2.5 Calculation of wind load	13
2.6 Anti-seismic measures	17
2.7 Calculation of seismic loads	18
2.7 Analysis	19
2.8 Combinations of action for permanent design situation	20
2.9 Ultimate strains and bases	22
2.10 Deflection of the slab and girder	22
2.11 Maximum horizontal displacement from the wind	23
2.12 Checking the regularity of buildings in the plan	23
2.13 Selection of reinforcement Beams	24
2.14 Calculation of transverse reinforcement	25
2.15 Selection of column reinforcement	28
3 Organizational and technological part	30
3.1 Determination of work volume	30
3.2 The construction of temporary fencing	31
3.3 Removal of top soil	31
3.4 Soil excavation in the pit and trench access to the pit	32
3.5 Concrete preparation for foundations	32
3.6 Reinforcement installation	32
3.7 Formwork installation	33
3.8 Concreting of foundations	33
3.9 Backfilling	34
3.10 Soil compaction	34
3.11 Final land planning	34
3.12 Selection of machines	35

3.13 Selection Formwork 36
3.14 Reinforcing the structure 36
3.15 Install safety layer concrete retainers for vertical rebar 40
3.16 Health and safety, environmental and fire safety requirements 41
3.17 Need for logistical resources 42
3.18 Building general plan 42
3.19 Calculation of electrical supply 43
3.20 Calculating the site's need for temporary buildings and storage sites 43
3.21 Occupational health and safety in construction 39
3.21 Organization of production areas, work areas and workplaces 45
4 Economic part 47
4.1 Calculation of the estimated cost of construction 47
4.2 Calculation of investment costs for construction 48
4.3 Technical and economic indicators of the project 48
Conclusion 49
The list of references 50
Appendix A 52
Appendix B 63
Appendix C 68

INTRODUCTION

Construction refers to engineering transactions for the construction of buildings and structures such as residential buildings. A simple building can be defined as a walled space with a roof, food, fabric, and basic human needs. In ancient times, people lived in caves, in trees or under trees to protect themselves from wild animals, rain, sun, etc. Over time, people began to live in huts made of wooden branches. The orphanages of those old ones turned into beautiful houses. Rich people live in sophisticated homes. a building is an important indicator of a country's social progress. Each person has a desire to have comfortable houses on average, as a rule, each person spends his two-thirds of his life in houses. A civil sense of responsibility is safe. These are several reasons a person does their best and spend their hard-earned savings in their own homes. Today, house building is the main work of the country's social progress.

New technologies are developed every day to build homes, cost-effectively, quickly, and with the needs of the engineering and architectural community involved in the design, planning and planning of buildings. The designer is responsible for the drafting of the building, as well as for the direction of the engineers and architects. The designer must know his job and be able to follow the instructions of the engineer and be able to draw the required building drawing, site plans, layout plans, etc. In accordance with the requirements.

The main type of urban development is multi-storey residential buildings. The operation of such houses allows us to rationally use the territory, reduce urban transport facilities, the length of engineering networks, and streets.

In the world housing construction, a large share is occupied by multi-storey residential buildings.

The use of multi-storey residential buildings primarily provides the goal of saving urban areas, since during the construction of multi-storey residential buildings we can significantly increase the population density. The growth of cities is "wide" and exacerbates the transport problem and increases the length of engineering networks. For the selection of types of multi-storey residential buildings in large cities, the urban planning situation is considered, as well as the conditions for the reconstruction of the central regions.

1. Architectural and analytical part

1.1 Basic information about the construction site

The diploma project was developed for "Construction of an administrative building located at the address: Almaty city, Al-Farabi-Dostiq".

Characteristics of the building:

The project was developed for the following construction conditions:

Humidity zone - normal;

Climatic region - II: temperate continental climate;

Snow region - VII, the standard value of the weight of the snow cover is 1.2 kPa;

Wind region - II, standard value of wind pressure - 0.23 kPa;

Climatic parameters of the cold season: air temperature of the coldest day: mines 30 Celsius ; air temperature of the coldest five-day period: -23˚ Celsius;

The construction area is earthquake-prone, the magnitude is 8-9 points;

The construction site is located in the zone of residential and administrative buildings; the relief of the site is calm.

The average elevation of 650m is taken as the mark of the existing land.

1.2 Natural-climatic and engineering-geological conditions

The characteristic features of the climate of this territory are: an abundance of sunlight and warmth, continentally, hot long summers, relatively cold winters with alternating thaws and cold snaps, large annual and daily amplitudes of air temperature fluctuations, dry air and changes in climatic characteristics with terrain altitude.

Table 1 - Air temperature

Weather station	months												per year
	1	2	3	4	5	6	7	8	9	10	11	12	
Average monthly and average annual air temperature, ˚C													
Almaty	-6,8	-5,2	1,9	10,8	16,2	20,7	23,4	22,3	16,9	9,7	0,8	-4,8	8,8
Average maximum air temperature,˚C													
Almaty	-1,3	0,2	7,1	16,5	21,7	26,5	29,7	28,8	23,4	15,9	6,2	0,4	14,6
Absolute maximum air temperature, ˚C													
Almaty	17	19	26	33	35	39	43	40	36	31	25	19	43
Average minimum air temperature, ˚C													
Almaty	-11,1	-9,5	-2,4	5,6	10,9	15,2	17,6	16,3	11,0	4,6	-3,3	-8,8	3,8
Absolute minimum air temperature, ˚C													
Almaty	-40	-45	-25	-11	-7	2	7	5	-3	-11	-34	-32	-45

The coldest month - January is characterized by negative temperatures minus 6.6-16.5-16 Celsius (for plains and foothills). The hottest month is August. The average temperature for the plains is plus24 - plus 26˚ Celsius. The absolute maximum temperature reaches plus 36.7 Celsius _ plus 41.5 Celsius in the same zone. The main data on the snow cover are given in Table 2.

Table 2 – Snow cover

Weather station	months									Highest values for the winter		
	9	10	11	12	1	2	3	4	5	Average.	Max.	Min.
Average monthly snow height, см												
Almaty		2	9	24	30	25	13	1		21	66	9

With distance from the mountains, the wind regime changes. The average annual wind speed is 1.3 m / s. The wind breakthrough reaches 28 m / s. The lowest average monthly wind speeds throughout the entire territory are observed in winter (December, January), and the highest - in summer.

Table 3 – Wind velocity

Wind Weather Station	months												Per year
	1	2	3	4	5	6	7	8	9	10	11	12	
Average wind speed by months and per year, м/с													
Almaty	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.6	0.6	0.6	1.3
Maximum wind speed and wind vane breakthrough, м/с													
Almaty	9	11	18	18	18	18	17	14	9	11	10	9	18

Table 4 – Periodicity of different wind direction, Percentage

Weather station	Direction								Calm
	N	NE	E	SE	S	SW	W	NW	
Almaty	20	9	9	17	20	9	9	7	26

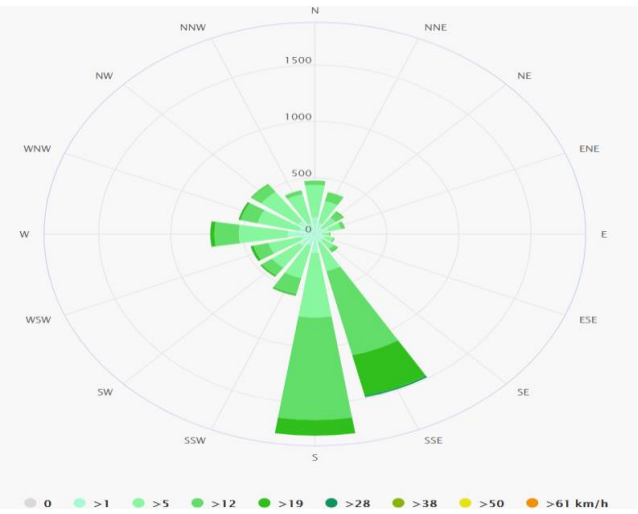


Figure 1 - Wind rose according to the weather station in Almaty

1.3 General plan. Improvement of the territory

The master plan has been developed for the entire territory of the construction land plot. The plot with a total area of 2 hectares, allocated for construction, located in the city of Almaty, has a rectangular shape. The plot allocated for construction is free of buildings. An 8.0-meter wide driveway is provided for the territory of the facility; the pavement is made of asphalt concrete on a crushed stone base. Improvement and gardening of the site provided for by the project reduces the overall dust content and eliminates local sources of dust

Table 5 - Technical and economic indicators for the general plan

Name	Indicator
Land area	1.5*a*
Built-up area	2430$м^2$
Building factor	0,104
Landscaping area	4451,4$м^2$
Landscaping factor	0.297
Hard surface area	8992,1$м^2$
Territory utilization rate	0,745

The area around the building is landscaped, other administrative and residential buildings. The building has hard surfaced access roads.

1.4 Space-planning solution

The building of the administrative building consists of one buildings of fourteen floors (including the ground floor).The height of the building from the zero mark is 45.5 m. The height of the first floor is 3.5, the basement one is 3.6 m. The main staircase, elevators of the engineering equipment shaft are located in the concrete core of stiffness in the middle of the front side of the building. At the ends of the building there are spare staircases between the separate floors.

As a rule, various premises of the building are grouped according to functional characteristics, which allow organizing clear technological interconnections between them, meeting sanitary-hygienic and fire safety requirements, contributing to the convenience of operating the hotel, as well as increasing the comfort of living in it.

Since the administrative and public parts are located in the same building, the public premises are located on the lower floors, and the administrative ones are above them.

1.5 Constructive solutions of the object

The structural scheme of the building is a frame, while at the level of the basement, reinforced concrete columns and walls are load-bearing (that is, it is a frame-link system). Spatial immutability is ensured by external and internal heating blocks, reinforced concrete columns and girders, and a hard floor plate made of precast reinforced concrete slabs.

Foundations – is made of monolithic pile with diameter of 500mm. the cap of pile is has thickness of 1000mm which is made as raft foundation. Make horizontal waterproofing of foundations from 2 layers of roofing material on bitumen mastic. Vertical waterproofing of foundations in contact with the ground should be coated with hot bitumen (BN 70/30) 2 times.

Walls - the outer walls of the basement are monolithic reinforced concrete walls with a thickness of 300 mm. For exterior wall of the superstructure of the building I have used tempered glass.

Partitions – The interior partition of the building has done by gypsum board with the thickness of 150mm.

Covering slabs - Monolithic reinforced concrete floor slabs with a thickness of 200mm.

Beams - reinforced concrete with a section of 600x450;

Column- reinforced concrete with section of 700x700, 600x600, 50x450;

Windows - installation of PVC windows in accordance the eurocode standards;

Doors - installation of internal wooden doors in accordance with eurocode of metal external doors in accordance with eurocode.

External finishing – for the external finishing I have used galss and if necessry some decorative layer.

1.6 Thermal calculation of the outer wall

I have used glazing system for the outer wall of the structure. The insulated glasses are used in outer walls, for this reason the thermal calculation for the outer wall is not need to calculate.

2 Calculation and design section

For the determination of the stiffness of the building we follow a specific formula, which is, that determine the size of the part of the structure and after that we select the size of the building. All the stiffness are calculated and put it in the following table1[1].

Table 6- Accepted stiffnesses

Name	Parameters (section- (cm) stiffness- (T/m^2) spread weight- (T/m^3))
column 70 X 70	Ro=2.5 , E=2.75e+006, GF = 0,B = 70, H = 70
column 60 X 60	Ro=2.5 , E=2.75e+006, GF = 0,B = 60, H =60
column 45 X 45	Ro=2.5 , E=2.75e+006, GF = 0,B = 45, H =45
Beam 45 X 60	Ro=2.5 , E=2.75e+006, GF = 0,B = 45, H =60
slab H20	E=2.75e+006, V = 0.2, H = 20, Ro = 2.5
Plate H 20 (staircase)	E=2.75e+006, V = 0.2, H = 20, Ro = 2.5
Plate H 30(Walls)	E=2.75e+006, V = 0.2, H = 30, Ro = 2.5
Plate H 30 (Walls (elevator shaft))	E=2.75e+006, V = 0.2, H = 30, Ro = 2.5
Plate H 100 (base plate)	E = 3.16e + 006, V = 0.2, H = 100, Ro = 2.5

2.1 Collection of loads

For the calculation of the load on the structure, we consider dead and live load, which are acting on the structure. We choose the loads according building code EN1991 including dead and live load, and calculated loads are filled in the Appendix A, Table A.1.

2.2 Collecting Lateral Ground Pressure

Type of soil for foundations - coarse sandy soil

$$\gamma = 1.8\ т/м3$$
$$\varphi = 36°$$
$$c = 0$$
$$h = 2.6\ m$$
$$q = 0.52\ T/м2$$

Active pressure:

The intensity of the horizontal active soil pressure from its own weight γ, at a depth of h = y = 2.6 m should be determined by the formula:

$$P_\gamma = \left[\gamma \cdot h \cdot \lambda_г - c \cdot 2\sqrt{\lambda_г}\right]y/h \quad (1)$$

$$P_\gamma = \left[1.8 \cdot 2.6 \cdot 0.39 - 0 \cdot 2\sqrt{0.39}\right] 2.6/2.6 = 1.7 \text{ т/м2}$$

where

$$\lambda_\text{г} = tg^2\left(45 - \frac{\varphi}{2}\right) = tg^2\left(45 - \frac{36}{2}\right) = 0.32$$

Passive pressure:

$$\lambda\ for\ \varphi = 36°$$
$$\lambda_\text{г} = 0.39$$
$$Pq = q \cdot \lambda \text{ т/м2}$$
$$\text{Pq} = 0.52 \cdot 0.39 = 0.2 \text{ т/м2}$$
$$P = 1.7 + 0.2 = 1.9 \text{ т/м2}$$

2.3 Live loads according to EN 1991

For term of temporary load we find according the type of building which kind of building we have my one administrative building Building category –C3 (Administrative building)

-Slabs – 5 кN/м^2

-Stairs – 5 кN/м^2

2.4 Calculating snow load

We choose the snow load according the region that the building going to be build, according my city (Almaty) the snow load will calculate according the following expressions.

$$\mu_1 = 0.8$$
$$\mu_2 = 0.8$$
$$C_e = 1$$
$$C_t = 1$$
$$s_k = 3.2$$
$$s = \mu_i \cdot C_e \cdot C_t \cdot s_k = (0.8 + 0.8) \cdot 1 \cdot 1 \cdot 3.2 = 5.12 \text{ кПа}$$

2.5 Calculation of wind load

The wind loads also be calculated according the region and the dimension of the building according the building code.

Dimensions of the building 54 x 45 x 45.5, Almaty – II wind region.

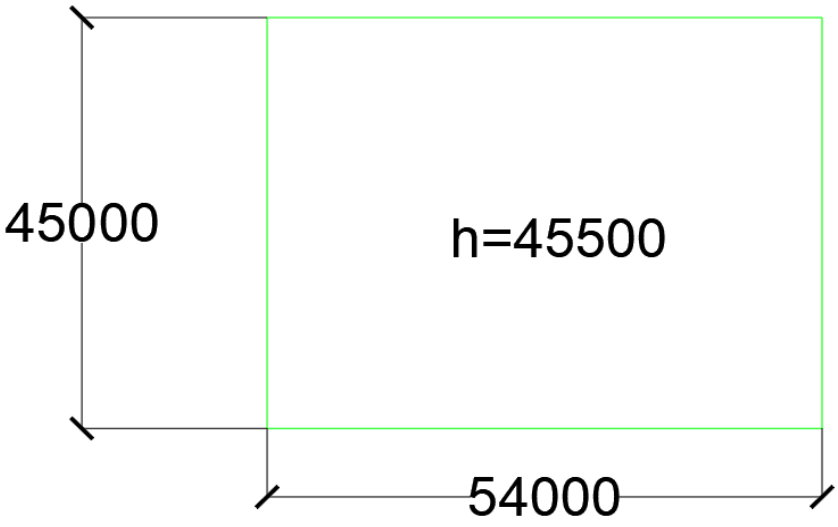


Figure 2 - Plan of the building

Calculation of wind load by OX:

We divide the building in height into zones corresponding to the base height for external pressure z_e according to the method with b = 55; h = 45.5<b = 55:

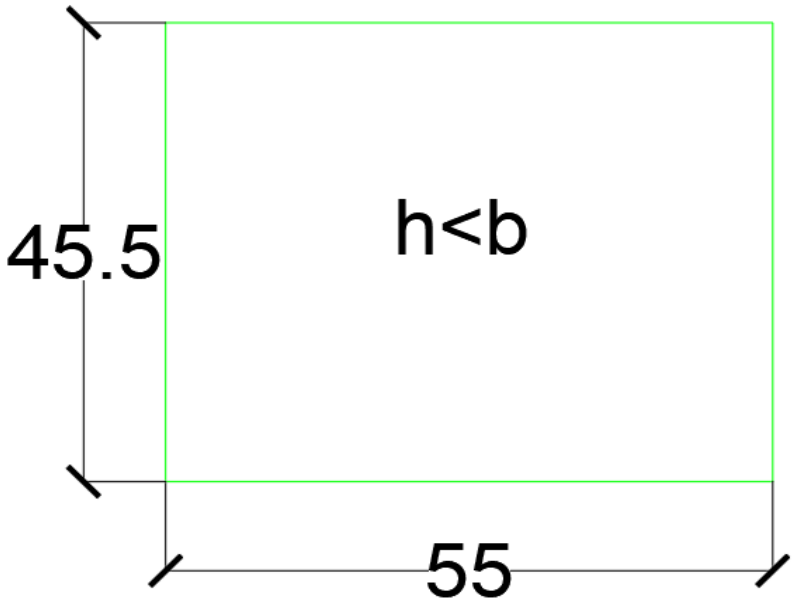


Figure 3- Base height z_e depending on h and b and the profile of the velocity head

Basic velocity wind head for wind region II $q_b = 0.52$ кПа

Wind pressure w_e is:

When

$z_e = 45.5$ м

$$c_e(45.5) = 2.1$$
$$w_e = 2.1 \cdot 520 \cdot 1$$
$$w_e = 874\ pa$$

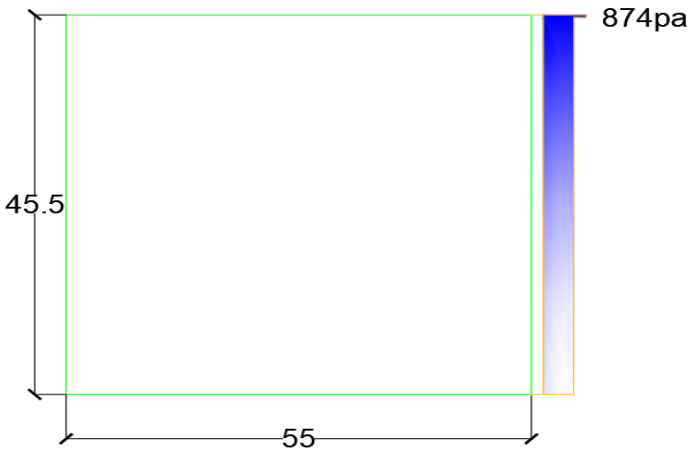


Figure 4 - Diagram of wind pressure

Wind pressure c_e is equal to:

Table 7 - Values of wind pressure

A	$c_{pe} = -1.2$	$c_e(45.5) = 2.1$	$w_e = 2.1 \cdot 520 \cdot (-1.2) = -1311$Па $= -159$ кг/м^2
B	$c_{pe} = -1.4$	$c_e(45.5) = 2.1$	$w_e = 2.1 \cdot 520 \cdot (-1.4) = -1412$ Па $= -106$ кг/м^2
E	$c_{pe} = -0.5$	$c_e(45.5) = 2.1$	$w_e = 2.1 \cdot 520 \cdot (-0.5) = -546$ Па

Windward side (D):

At the level of the 1st floor: take into account half of the floor (1750mm) plus foundation above ground level (1000mm). Estimated strip on the 1st floor - 2750 mm.

Typical floors design strip - 3500 mm.

At the roof level - 1750 mm.

For the windward side, two zones in the first zone from 0 to 45.5 m include floors 1-6 floors; in the second from 7-14 + roof.

Table 8 - Pressure on the floors of the building

	1 floor
D	$111.92 \cdot 2.75 = 257.4$ кг/м
A	$-131.1 \cdot 2.75 = -342$ кг/м
B	$-141.2 \cdot 2.75 = -232$ кг/м
E	$-54.6 \cdot 2.75 = -143$ кг/м
	Typical floor 2-7
D	$118.92 \cdot 3.6 = 428.1$ кг/м

Continuation of table 8 - Pressure on the floors of the building

	1 floor
A	$-131.1 \cdot 3.5 = -572.4$ кг/м
B	$-141.2 \cdot 3.5 = -381.6$ кг/м
E	$-54.6 \cdot 3.5 = -238.3$ кг/м
	Typical floor 7-14
D	$111.92 \cdot 3.5 = 428.1$ кг/м
A	$-131.1 \cdot 3.5 = -572.4$ кг/м
B	$-141.2 \cdot 3.5 = -381.6$ кг/м
E	$-54.6 \cdot 3.5 = -238.3$ кг/м
	Roof
D	$118.92 \cdot 1.8 = 128.7$ кг/м
A	$-131.2 \cdot 1.8 = -182.5$ кг/м
B	$-141.2 \cdot 1.8 = -121.5$ кг/м
E	$-54.6 \cdot 1.8 = -76.1$ кг/м

Wind load calculation according to OY:

We divide the building in height into zones corresponding to the base height for external pressure z_e according to the method 7.2.2 (1) at $b = 45 < h = 45.5 \approx b = 45$

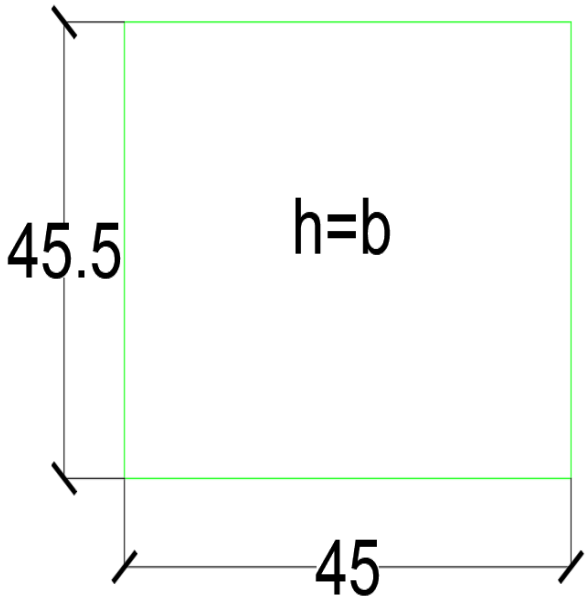


Figure 5 - Base height z_e depending on h and b and the profile of the velocity head

Basic velocity wind pressure for wind region II q_b = 0.52 kPa

Wind pressure w_e is equal to:

When z_e = 45.5 м; $c_e(45.5) = 2.1$:

$$w_e = 2.1 \cdot 520 \cdot 0.8 = 856\ pa$$

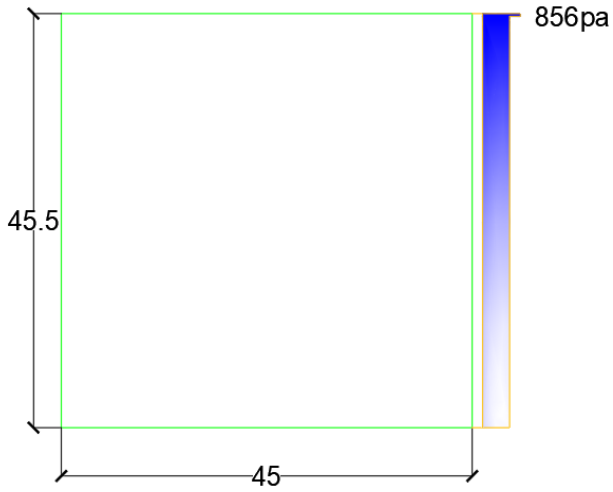


Figure 6 - Diagram of wind pressure

2.6 Anti-seismic measures

Seismic hazard - the threat of seismic impacts on the territory under consideration. Seismic hazard is determined in space, in time (frequency or probability over a certain period of time) and in intensity (in points or in kinematic parameters of ground movements).

The seismic hazard of construction zones should be determined using a map of seismic generating zones of the territory of Kazakhstan, a set of maps of general seismic zoning of the territory of the Republic of Kazakhstan or a list of settlements located in seismic zones.

List of settlements located in the seismic zones of the Republic

The residential building designed in the thesis is located in a seismic zone, therefore, anti-seismic measures are required. Seismicity of the work area according to SP 2.03-30-2017 is 9 points.

The category of soils for seismic properties is II (second). The revised seismicity value should be taken equal to 9 (nine) points.

The residential building has a length of 60 meters, since our frame is reinforced concrete, the length should not exceed 48 meters, therefore we make a sedimentary (expansion) seam.

Anti-seismic joints should be performed by erecting paired walls, paired frames, or a frame and wallThe width of the antiseismic seam between buildings or compartments should be taken not less than the total value of their calculated horizontal displacements at the corresponding level, calculated using expression With a building height of up to 5 m, the width of the antiseismic joint, regardless of the calculation results, must be at least

30 mm. The width of the anti-seismic joint for buildings of greater height should be increased by 20 mm for every 5 m in height.

Anti-seismic joints separating the foundations (except for pile foundations) are allowed to be 10 mm wide.

The structures of anti-seismic joints and their filling should not impede the mutual movement of adjacent compartments during earthquakes.

In buildings located on construction sites with seismicity of 8 points or more, it is not allowed to provide the possibility of mutual displacement of adjacent compartments due to the movement of the span structures that are freely lying on the structures of adjacent compartments.

2.7 Calculation of seismic loads

Sand and gravel soil - class II

According to the soil conditions $a_g = 0.528\ g > 0.08g$ therefore, the calculation for the determination of seismic loads along the X and Y axes is necessary.

Where $a_g > 0{,}4g$; $a_{gv}/a_g = 0.9$.

$$a_{vg} = a_g * 0.9 = 0.528g * 0.9 = 0.47g > 0.25g \Rightarrow$$

Taking into account the vertical seismic load along the Z-axis is necessary.

Calculation according to horizontal:

$$a_g = 0.528g, q = 3.3$$

$$T_B = 0.20\ \text{c}, T_c = 0.72\ \text{c}$$

With a value of the coefficient of behavior q = 3:

At $0 \le T \le 0.25$:

$$S_d\ (T) = \max\left\{\begin{array}{c} a_g\ \left[\frac{2}{3} + \frac{T}{T_B}\left(\frac{2.5}{\text{q}} - \frac{2}{3}\right)\right] = 0.528\left[\frac{2}{3.3} + \frac{T}{0.20}\left(\frac{2.5}{3} - \frac{2}{3}\right)\right] \\ = 0.528\ (0.66 + 0.83T) \\ \\ ,but\ not\ less\ \ a_g\ \cdot \frac{2.5}{\text{q}} = 0.528 \cdot \frac{2.5}{3} = 0.44 \end{array}\right\}$$

At $0{,}25 \le T < 0{,}96$:

$$S_d\ (T) = \ a_g\ \ \frac{2.5}{\text{q}} = 0.528\ \frac{2.5}{3.3} = 0.46$$

At $0.96 \le T$:

$$S_d\ (T) = \max\left\{\begin{array}{c} a_g\ \ \left[\frac{2.5}{\text{q}}\left(\frac{T_c}{\text{T}}\right)\right] = 0.258 \cdot \frac{2.5}{5}\left(\frac{0.96}{\text{T}}\right) = 0.124 \\ ,but\ not\ less\ \beta\ \ a_g\ \ = 0.2\ a_g\ \ = 0.2 \cdot 0.258 = 0.052 \end{array}\right\}$$

$$= \max\left\{\begin{matrix}\frac{0.124}{T}\\ 0.052\end{matrix}\right\}$$

The quantitative values of the ordinates of the spectra of the calculated reactions, calculated for some periods T at q = 3.3, are given in tables 1.

Table 9 - Values of ordinates of the spectrum of calculated reactions at q = 5

T, c	0	0.25	0.50	0.96	1.20	1.50	2.0	2.50	3.0
Se(T), в долях g	0.028	0.129	0.129	0.129	0.103	0.083	0.062	0.052	0.052

Calculation of the acceleration S_d (T) by the formulas (4.15); (4.16); (4.17) NTP RK 08-01.1-2017 «Design of earthquake-resistant buildings and structures "and the construction of the schedule is carried out in the Excel 2020 program.

2.7 Analysis

The 7 load cases are defined in my structure and according these load case the structure is analyzed, the load cases are illustrated in following figures.

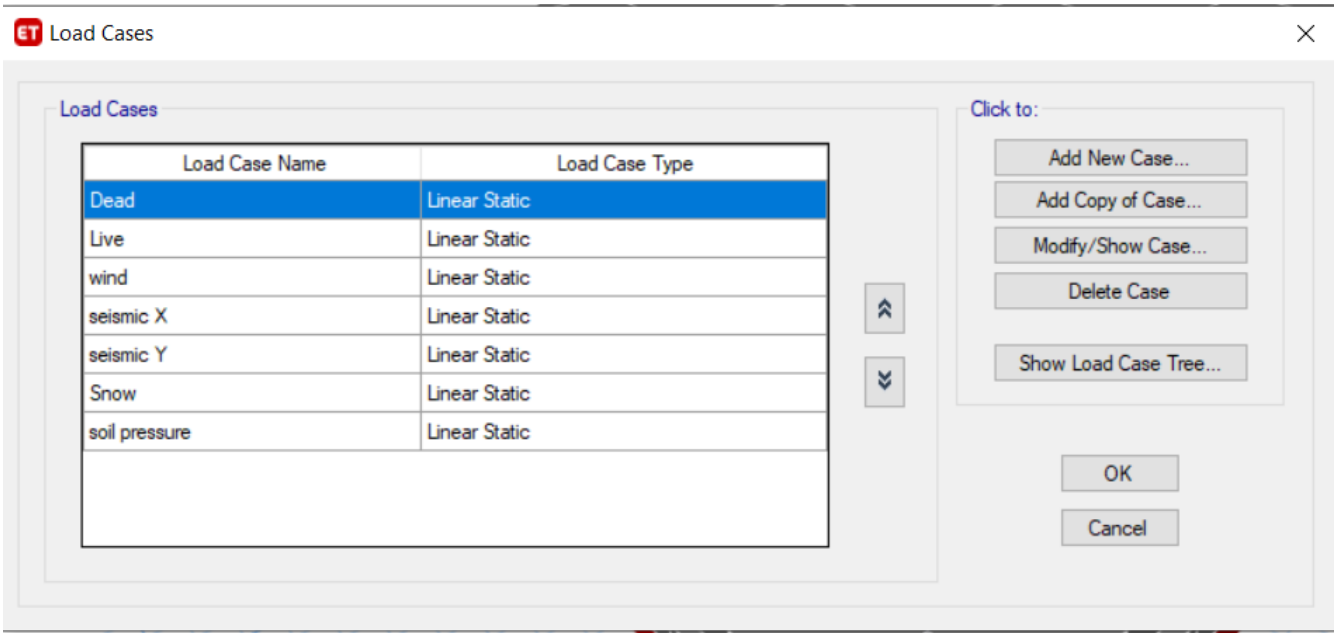


Figure 7 - Editing load cases

Then we proceed to the loading of our building itself that are shown in Figure A.1, Figure A.2 and Figure A.3 in Appendix A.

2.8 Combinations of action for permanent design situation (basic combination)

All coefficient and formulas are taken from СП РК EN 1990 bases for designing loading structure. We can calculate manually by the following formulas.

$$\sum_{j\geq 1} \gamma_G \cdot G_K + \gamma_p \cdot \mathrm{p} + \gamma_Q \cdot Q_K + \sum_{i>1} \gamma_Q \cdot \Psi_{0.1} \cdot Q_k \quad (2)$$

$$\sum_{j\geq 1} \gamma_G \cdot G_K + \gamma_p \cdot \mathrm{p} + \gamma_Q \cdot \Psi_{0.1} \cdot Q_K + \sum_{i>1} \gamma_Q \cdot \Psi_{0.i} \cdot Q_k \quad (3)$$

$$\sum_{j\geq 1} \gamma_G \cdot G_K + \gamma_p \cdot \mathrm{p} + \gamma_Q \cdot Q_K + \sum_{i>1} \gamma_Q \cdot \Psi_{0.i} \cdot Q_k \quad (4)$$

where $\gamma_G = 1.35$ −for permanent loads;
G_K − sum of permanent loads;;
$\gamma_Q = 1.5$ − for temporary loads ;
Q_K − sum of temporary loads;
Ψ_0, Ψ_1, Ψ_2 − in table НП.А1.1.
Combinations of actions for seismic design situations

$$\sum_{j\geq 1} G_{kj} + \mathrm{p} + A_{Ed} + \sum_{i>1} Q_{k.i} \cdot \Psi_{2.i} \quad (5)$$

Table 10 - The values of ψ

Воздействия	ψ_0	ψ_1	ψ_2
Приложенные нагрузки в зданиях, категории (см. EN 1991-1-1):			
Категория A: бытовые, жилые зоны	0,7	0,5	0,3
Категория B: офисные площади	0,7	0,5	0,3
Категория C: зоны для собраний	0,7	0,7	0,6
Категория D: торговые площади	0,7	0,7	0,6
Категория E: складские площади	1,0	0,9	0,8
Категория F: зоны дорожного движения для транспортных средств весом ≤ 30 кН	0,7	0,7	0,6
Категория G: зоны дорожного движения для транспортных средств весом от 30 кН до 160 кН	0,7	0,5	0,3
Категория H: покрытия (крыши)[a)]	0,7	0	0
Снеговые нагрузки на здания (см. EN 1991-1-3)*:			
Для районов, находящихся на высоте H > 1000 м над уровнем моря	0,7	0,5	0,2
Для районов, находящихся на высоте H ≤ 1000 м над уровнем моря	0,5	0,2	0
Ветровые нагрузки на здания (см. EN 1991-1-4)	0,6	0,2	0
Температурные воздействия (исключая пожары) на здания (см. EN 1991-1-5)	0,6	0,5	0
а) См. также 3.3.2(1) EN 1991-1-1.			

Then the combinations of design load combinations will look in accordance with Figures 8.

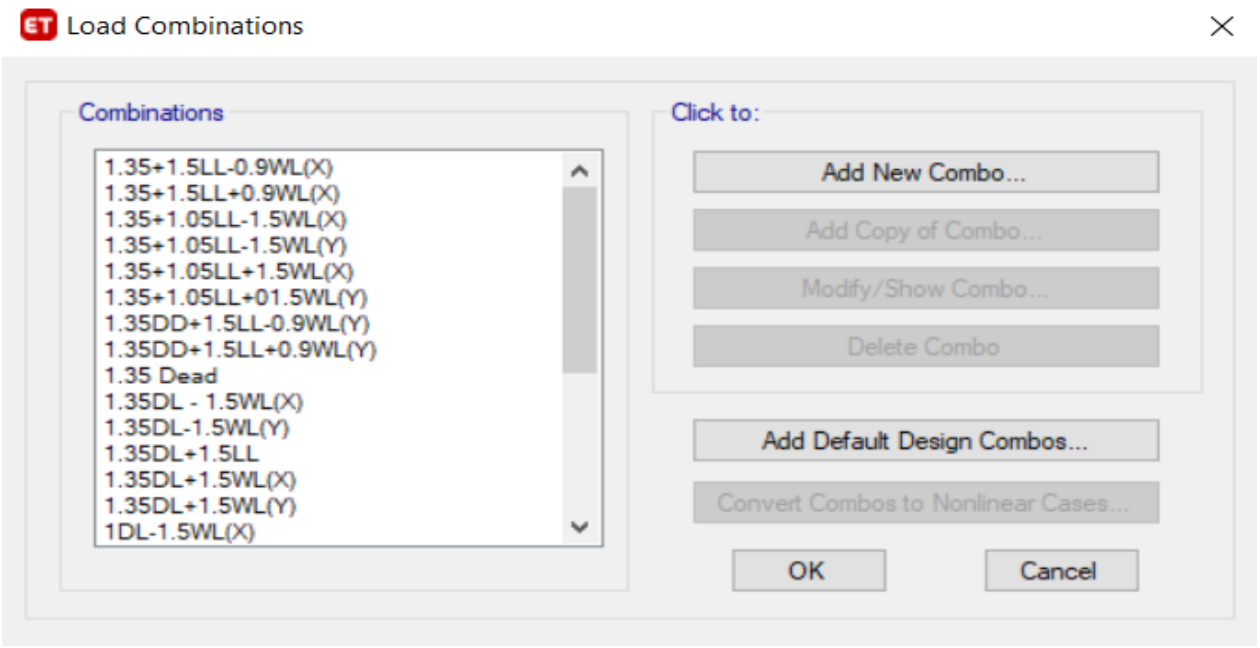


Figure 8 - Combination of actions

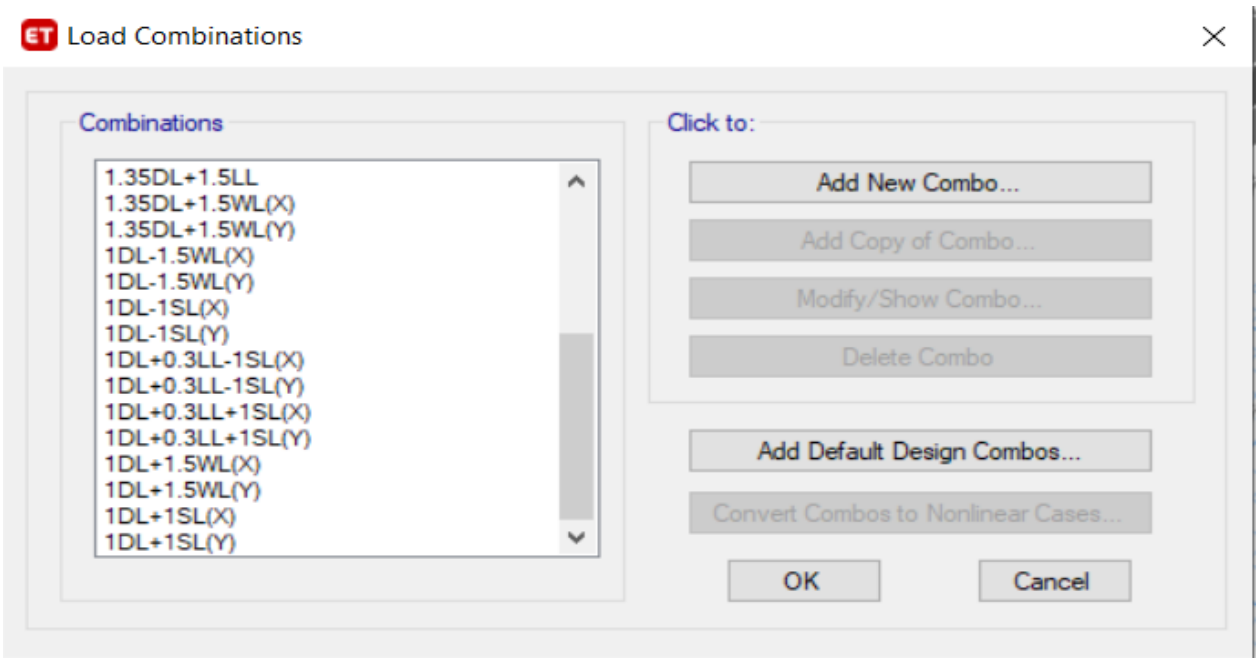


Figure 9 – Combination of actions

2.9 Ultimate strains and bases

Industrial and civil one-story and multi-storey buildings with a full frame: the same, with the device of reinforced concrete belts or monolithic floors, as well as buildings with a monolithic structure, Average s_ (max, μ) = 10 cm., Respectively, according to the standard (SP RK 5.01-102- 2013-Base, According to [1], the maximum settlement of the base is s_ (max, μ) = 10 cm)

For our design scheme, the maximum drift is 18 mm, which satisfies the condition which is shown in Figure A.4 in Appendix A,.

$$s \leq s_{max,\mu}$$

$$18 \text{ мм} \leq 100 \text{ мм}$$

The relative difference in sediment is:

$$\text{RS} = (\frac{\Delta s}{L})_u,$$

where L is the distance between the axes of the foundation blocks in the direction of horizontal loads, and in guyed supports - the distance between the axes of the compressed foundation.

According to Appendix B [1], the relative draft should not exceed 0.002.

Then, according to FigureA.5 in Appendix A, we get that the relative draft is:

$$\frac{11}{20000} = 0.00055 < 0.002$$

Conidian is met

2.10 Deflection of the slab and girder

The appearance and overall serviceability of the supporting structure may be compromised if the calculated deflection of a beam, slab or cantilever beam, near a constant combination of actions, exceeds L / 250 span. According to the standard (sn pk en 1992-1-1 + np <Design of reinforced concrete structures for buildings>, according to sub-clause 7.4 Control of deflections).

a) For plat

The deflection of the floor slab is determined according to Figure A.5 in Appendix A

The deflection is 18mm

According to subparagraph the deflection of the slab should not exceed a value equal to:

$$\frac{l}{250} = \frac{9000}{250} = 36 \text{ мм}$$

2.11 Maximum horizontal displacement from the wind

According to paragraph EN1991 10.14 of Table 22 [3], the maximum horizontal displacements from the wind are calculated by the formula:

$$\text{Maximum horizontal displacements from the wind} = \frac{h}{500}$$

where h - is the height of multi-storey buildings, equal to the distance from the top of the foundation to the axis of the roof girder.

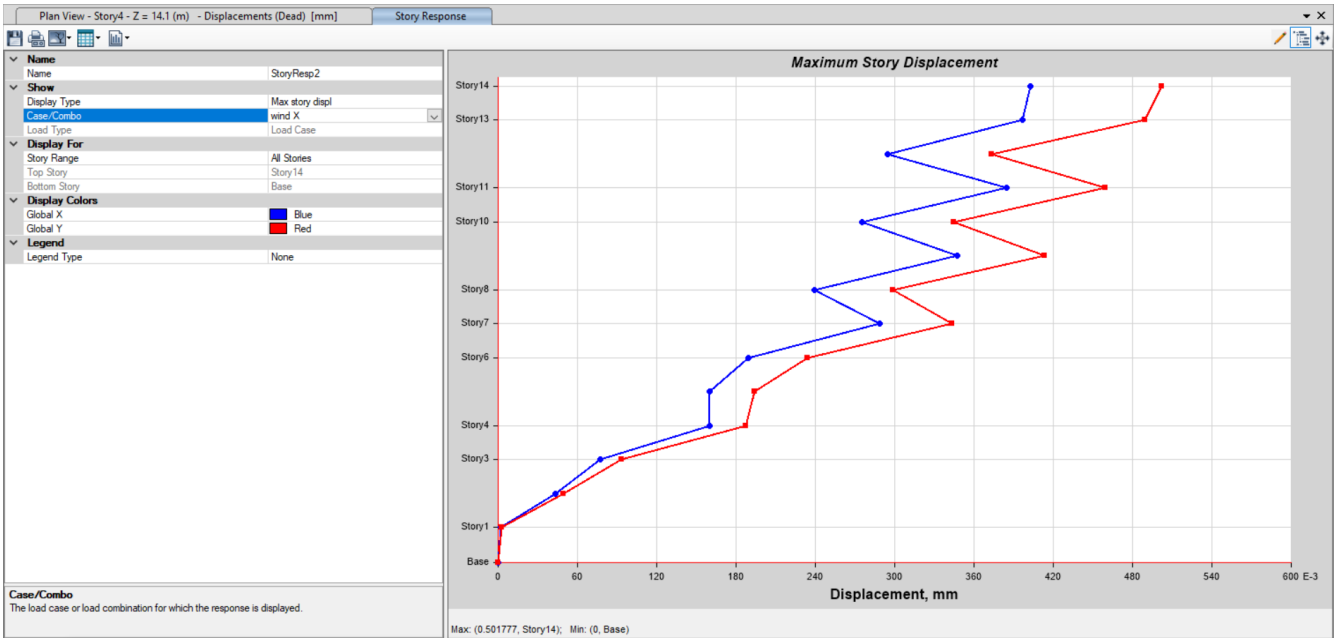


Figure 10 – Movements from the wind along the X axis

The maximum movement along the X axis is 0.5 mm.

$$0.5 \text{ мм} < \frac{45000}{500} = 90 \text{ мм}$$

The condition is met.

The maximum displacement along the Y-axis is 1.03 мм according Figure A.6 in Appendix A.

$$1.03 < \frac{45000}{500} = 90 \text{ мм}$$

The condition is met.

2.12 Checking the regularity of buildings in the plan

To begin with, let's check the building for regularity in terms of X. To do this, we use the formula according the Figure A.7 in Appendix A.

$$100 - \frac{\delta_{max}+\delta_{min}}{2\cdot\delta_{max}} \cdot 100$$

$$100 - \frac{0.279+0.019}{2\cdot 0.247} \cdot 100 = 48.3\ percent$$

According the Figure A.8 in Appendix A.

$$100 - \frac{\delta_{max} + \delta_{min}}{2 \cdot \delta_{max}} \cdot 100$$

$$100 - \frac{28.4 + 22}{2 \cdot 28.4} \cdot 100 = 11.2\ \%$$

According the Figure A.9 in Appendix A.

$$100 - \frac{\delta_{max}+\delta_{min}}{2\cdot\delta_{max}} \cdot 100$$

$$100 - \frac{114.8+105.6}{2\cdot 114.8} \cdot 100 = 4 percent$$

According the Figure A.10 in Appendix A.

$$100 - \frac{\delta_{max}+\delta_{min}}{2\cdot\delta_{max}} \cdot 100$$

$$100 - \frac{0.53+0.01}{2\cdot 0.53} \cdot 100 = 49.09 ercent$$

According the Figure A.11 in Appendix A.

$$100 - \frac{\delta_{max}+\delta_{min}}{2\cdot\delta_{max}} \cdot 100$$

$$100 - \frac{50.2+38.9}{2\cdot 50.2} \cdot 100 = 11.2 ercent$$

According the Figure A.12 in Appendix A.

$$100 - \frac{\delta_{max}+\delta_{min}}{2\cdot\delta_{max}} \cdot 100$$

$$100 - \frac{193.5+178.1}{2\cdot 193.5} \cdot 100 = 3.9 ercent$$

Since not all values exceed 25%, our building is irregular in plan along the OX and OY axes.

We take all the displacement values from the ETABS software package (story response)

2.13 Selection of reinforcement Beams

Longitudinal reinforcement calculation:
Rectangular beam (600x450mm)
Normal concrete class C30 / 35

$$f_{ck} = 30, \Upsilon c = 1.5,$$

$$f_{cd} = acc \cdot \frac{fck}{\Upsilon c} = 0.85 \cdot \frac{30}{1.5} = 17\ mPa$$

Reinforcement class S450

$$f_{yk} = 450\ MPa$$

$$f_v = f_{yk} / \Upsilon_s = 450 / 1.15 = 435\ MPa$$

$$M_{ED} = 390.2\ \text{кN} \cdot \text{м}$$

The values are taken from the ETABS program

$$d = h - c_1 - t$$

$$d = 600 - 30 - 10 = 560mm$$

$$\alpha_{E\,d\,s} = \frac{Meds}{fcd \cdot b \cdot d^2} = \frac{390.2}{17 \cdot 10^3 \cdot 0.45 \cdot 0.56^2} = 0.37$$

Since $\alpha_{E\,d\,s} = 0.373 > \alpha_{Eds,lim} = 0.371$ for the given section dimensions and concrete class, compressed reinforcement is required. Taking.

Assuming C2 = 40 mm, $\alpha_{Eds,lim} = 0.371$

$$k_d = \frac{d[cm]}{\sqrt{M_{ED}[KN \cdot M / b[M]}} \tag{6}$$

$$k_d = \frac{56}{\sqrt{390.2\ /0.45}} = 1.391$$

Since $k_d = 1.39$ then $k_{s1} = 2.83$ and $k_{s2} = 0.1$ [Table B.4].

$$M_{EDs} = M_{ED} - N_{ED} \cdot z_{s1} \tag{7}$$

$$M_{EDs} = 390.2 - 0 \cdot 132.5 = 390.2KN \cdot m$$

$$A_{s1}[cm^2] = \rho_1 \cdot k_{s1} \cdot \frac{M_{ED}[KN \cdot M}{d[cm]} + \frac{N_{ED}[KN]}{43.5} \tag{8}$$

$$A_{s1}[cm^2] = 1 \cdot 2.83 \cdot \frac{390.2}{56} = 19.35cm^2$$

We accept seven rebar with diameter of twenty (4Ø25 S500 ($A_{s1} = 19.64cm^2$)

$$A_{s2}[cm^2] = \rho_2 \cdot k_{s2} \cdot \frac{M_{ED}[KN \cdot M}{d[cm]} \tag{9}$$

$$A_{s2}[cm^2] = 1.02 \cdot 0.1 \cdot \frac{390.2}{56} = 13.97cm^2$$

We accept 3Ø25 S500 ($A_{s1} = 14.73cm^2$)

2.14 Calculation of transverse reinforcement

Rectangular beam (600x450mm)

Normal concrete class C30 / 35

$$f_{ck} = 30, \Upsilon c = 1.5,$$

$$f_{cd} = acc \cdot \frac{fck}{\Upsilon c} = 0.85 \cdot \frac{30}{1.5} = 17\ mPa$$

Reinforcement class S275

$$f_{yk} = 275\,MPa$$

$$f_v = f_{yk} / \Upsilon_s = 275 / 1.15 = 240\,MPa$$

Bending moment acts on the beam$M_{ED} = 390.2KN \cdot M$

The shear force$V_{Ed} = 241.8KN.$

The bending moment and shear force are taken from ETABS calculation result.

The length of the section on which the transverse reinforcement must be installed according to the calculation is determined from the diagram of the shear forces. To do this, we determine the lateral force that concrete can perceive by the formula:

$$V_{Rd;c} = \left[\frac{0.18}{\gamma_c} \cdot K \cdot \left(100 p_l \cdot f_{ck}\right)^{\frac{1}{3}}\right] \cdot b_w \cdot d \qquad (10)$$

where

$$k = 1 + \sqrt{\frac{200}{d}} = 1 + \sqrt{\frac{200}{560}} = 1.59 \leq 2$$

$$d = h - c2 = 600 - 40 = 560mm$$

$$p_l = \frac{A_{s1}}{b_w \cdot d} = \frac{1976\ mm^2}{450mm \cdot 560mm} = 0.007 < 0.02$$

$$V_{Rd;c,max} = \left[\frac{0.18}{1.5} \cdot 1.59 \cdot \left(100 \cdot 0.007 \cdot 30\right)^{\frac{1}{3}}\right] \cdot 450 \cdot 560 = 336.5KN$$

But not less $V_{Rd;c,min}$ according to the formula:

$$V_{Rd;c,min} = \left[0.035 \cdot k^{3/2} \cdot {f_{ck}}^{1/2}\right] b_w \cdot d$$

$$V_{Rd;c,min} = \left[0.035 \cdot 1.59^{\frac{3}{2}} \cdot 30^{\frac{1}{2}}\right] 450 \cdot 560 = 98.8KN$$

So far as

$$V_{Rd;c,min} < V_{Ed;max} < V_{Rd;c}, max;\ 98.8\ кN < 275.6kN < 336.5кN$$

We install transverse reinforcement based on design considerations.

$$V_{Ed;max} = V_{Ed;} \cdot L = 241.8 \cdot 1.14 = 275.6\ кN/м$$

The step of the transverse reinforcement is determined by the formula:

$$s \leq 0.75d$$

$$s \leq 0.75 \cdot 560 = 420\,mm$$

We accept the step of the transverse reinforcement

$$s = 275mm$$

$$A_{sw} = \frac{V_{Ed;max} \cdot s}{d_z\, f_{sw} \cos \Upsilon} \qquad (11)$$

$$A_{sw} = \frac{275.6 \cdot 10^3 \cdot 275}{560 \cdot 275 \cos 21.8^\circ} = 530\,mm^2 = 5.3cm^2$$

where ($d_z = 530\ mm$) The first design section is assigned at a distance.

We set the angle of inclination of the cracks to the horizontal

$$\Upsilon = 21.8°$$

We accept (10∅ 275mm) , $A_{sw} = 6.28$ см^2 , s=275 mm.

In this case, the following conditions must be met:

$$\frac{A_{sw} \cdot f_{sw}}{b_w \cdot s} \leq 0.5 \cdot v \cdot f_{cd} \quad (12)$$

$$\frac{628 \cdot 275}{450 \cdot 275} \leq 0.5 \cdot 0.528 \cdot 17$$

$$1.39\ Mpa < 4.48\ Mpa$$

where v-is the coefficient that takes into account the reduction in the strength of concrete under compression and tensile conditions and is equal for heavy concrete:

$$V = 0.6\left(1 - \frac{f_{ck(Мпа)}}{250}\right) = 0.6\left(1 - \frac{30}{250}\right) = 0.528 \geq 0.5$$

$$V_{Ed;max} < V_{Rd;c}, max = \frac{v \cdot f_{cd} \cdot b_w \cdot d_z}{\cot 40 + \tan 40}$$

$$V_{Rd;c}, max = \frac{0.528 \cdot 17 \cdot 450 \cdot 560}{\cot 21.8 + \tan 21.8} = 782.9kN$$

$$V_{Ed;max} = 275.6 < V_{Rd;c}, max = 782.9kN$$

The condition is met. Other sections are calculated in the same way.

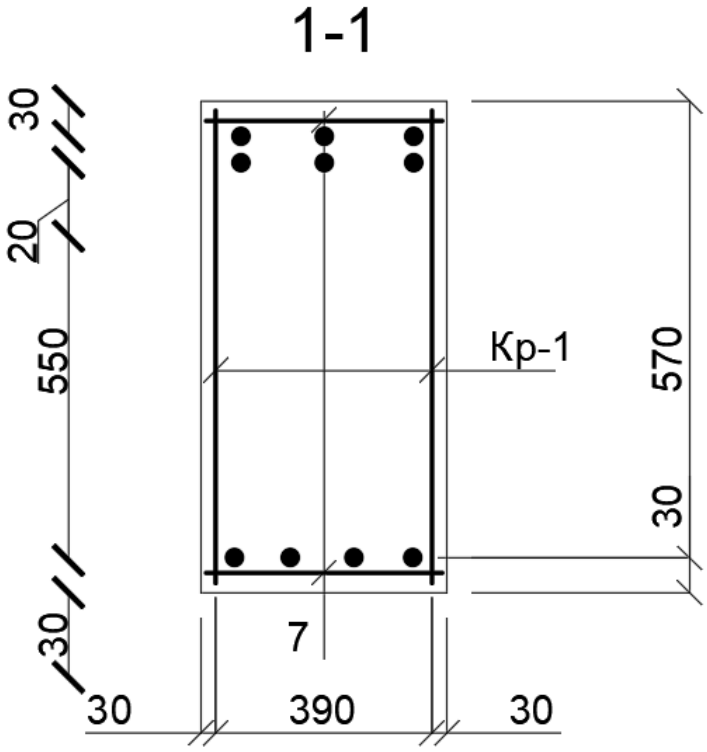


Figure 11- Section of the beam

2.15 Selection of column reinforcement

Longitudinal reinforcement calculation:
Rectangular column(700x700mm)
Normal concrete class C30 / 35

$$f_{ck} = 30, \Upsilon c = 1.5,$$
$$f_{cd} = acc \cdot \frac{fck}{\Upsilon c} = 0.85 \cdot \frac{30}{1.5} = 17\ mPa$$

Reinforcement class S450

$$f_{yk} = 450\ MPa$$
$$f_v = f_{yk} / \Upsilon_s = 450 / 1.15 = 435\ MPa$$
$$M_{ED} = 390.2\ кN \cdot м$$

The values are taken from the ETABS program

$$\frac{c_1}{700} = \frac{c_2}{h} = \frac{40}{700} = 0.05$$
$$N_{ed} = 13993.321KN$$
$$M_{ED} = 326.5kN \cdot m$$

(Efforts from RSN1 in column C8, 513) The values are taken from the ETABS software

$$\alpha_{Eds} = \frac{N_{ed}}{b \cdot h \cdot f_{cd}} \quad (13)$$

$$\alpha_{Eds} = \frac{13993.3 \cdot 10^3}{750 \cdot 750 \cdot 17} = 0.14 \rightarrow \omega_{tot} = 0.63$$

$$A_{s,tot} = \omega_{tot} bh/(\frac{f_{yd}}{f_{cd}}) \quad (14)$$

$$= As_{,tot} = \frac{0.63 \cdot 700 \cdot 700}{(\frac{435}{17})} = 8056мм2 = 80.56\ см2$$

A_{s1}= 80.56 accept 8Ø 36 S500 (A_s = 81.43 см^2).

We accept transverse reinforcement constructively proceeding from the following condition that the diameter should be:

-not less then 6 мм
-not more then 1/4d_{max}

$$1/4d_{max}=1/4 \cdot 660=165mm$$
$$d_{max}=h\text{-}c=700\text{-}40=660\ mm$$

=> accept ø10 S275

The step is taken based on the conditions:
- not more then 400 мм;
- no more than the minimum side of the section;

- not more 20d_{min}.
We take the step equal 150 мм.

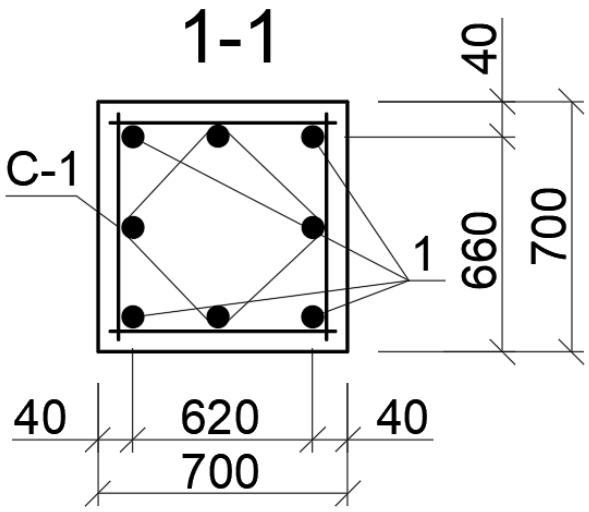


Figure 12 – Columns reinforcement

3 Organizational and technological part

When determining the technical and economic indicators the particular attention is paid to the determination of shift work of earth digging and earth– moving machines sets, as well as the cost of 1 m3 of soil excavation of one kind of process or another. In the Course Project such processes may include: soil excavation in the excavation pit by excavator with loading in vehicles and haulage by dump trucks to the embankment or dumping area; soil excavation in the borrow–pit by excavator with loading in vehicles and haulage by dump trucks to the embankment with missing soil, its leveling and compaction; backfilling of cavities by bulldozer with soil compaction by air rammer; piling of soil by bulldozer, excavation by excavator with loading in vehicles and haulage by dump trucks from the construction site to the dumping area; implementation of the whole quantity of planning works at the construction site.

Student determines the technical and economic indicators of one type of work and one construction process.

Calculation for the type of work is carried out as follows: to be determined equipment shift work in any type of work (or process) with dividing of the total quantity of excavated soil by the duration of the work (process) in shifts as per the schedule data, to be determined the cost of 1 m3 of soil excavation with dividing of the cost of equipment–shift by the equipment shift work.

For a complex process, which involves several construction machines, to be determined the cost of operation of each machine by multiplying of the cost of equipment–shift by corresponding duration of work in shifts (from the schedule); determine the operating cost of the entire machines set by accumulation of the cost of operation of each machine; to be calculated the cost of 1 m3 of soil excavation with dividing of the cost of the machines set operation by the total soil quantity, excavated by this set (from the schedule)[3].

3.1 Determination of work volume

Construction of industrial structure foundations with the preparation of temporary excavations includes works listed in table 2.

Table 11 – Foundations with the preparation of temporary excavations

Name of processes	Unit of measure)	Volume of work	
		on one base	in total
The construction of temporary fencing	m		278
Removal of top soil)	m3		*940.2*
Soil excavation in the pit (trench) and trench access to the pit	m3		*7890.6*
Excavation of soil underrun	m3		562.9
Concrete preparation for foundations	(m		243
Reinforcement installation, incl			171.7
a) grids installation	pieces/t		12.197
b) frames installation	pieces/t		5.15
Formwork installation)	m2		1394.48
Concreting of foundations	(m3		71.2
Formwork removal	m2		578
Foundation waterproofing	m2		2430
Backfilling	m3		1510.5
Soil compaction	m2		5035.1
Final land planning	(m		5227.8
Removal of temporary fencing	m		278

3.2 The construction of temporary fencing

Prior to the construction work necessary to perform the construction temporary fencing, fencing perimeter, m, determined by the formula (for the pit and the trench)[3]:

$$P_{fen} = (20 + l_1) \cdot 2 + (20 + l_2) \cdot 2 \quad (15)$$

where l_1, l_2– length and width of the structure in plan, respectively (per the task);
Distance from the axis of the building in each direction is 20 m.

$$P_{fen} = (20 + 54) \cdot 2 + (20 + 45) \cdot 2 = 278\text{m}$$

3.3 Removal of top soil

During pit excavation removal of top soil to be implemented at the area (only for the pit):[6]

$$S_1 = (10 + l_{1s.t} + 10) \cdot (10 + l_{2s.t} + 10), (m^2) \quad (16)$$

$$S_1 = (10 + 63.8 + 10) \cdot (10 + 54.8 + 10) = 6268.2\, m^2$$

$$V_{s.r} = S_{1(a)} x 0{,}15m$$

$$V_{s.r}=6268.2x0,15= 940.2m^3$$

3.4 Soil excavation in the pit and trench access to the pit

Pit volume determination.

$$V_p=h/6\cdot[(2l_{1s.b}+l_{2s.t})l_{2s.b.}+(2l_{1s.t.}+l_{1s.b})\cdot l_{2s.t}], (m^3) \quad (17)$$

where h– depth of pit.
So for area of 54x45 of the building:

$$V_p = 3.6\ /6 \cdot [(2 \cdot 26.6 + 34.5)26.6_{.} +(2 \cdot 34.5 + 26.6) \cdot 34.5] = 7890.6\ \text{m3}$$

3.5 Concrete preparation for foundations

In soft soils for monolithic foundations is arranged concrete preparation from lean concrete.

The quantity of concrete preparation for one foundation is *(for strip foundation):*

$$W_p = F_p \cdot h_p, m^3 \quad (18)$$

$$Fp = 45 \cdot 54 = 2430\, m2$$

So,

$$W_p = 2430 \cdot 0.1 = 243m^3$$

3.6 Reinforcement installation

Reinforcement consumption for the mat foundation**:**

$$G_1 = g \cdot V_{s/f}, t \quad (19)$$

where g – reinforcement frame consumption for $1m^3$ of concrete, kg/m^3 (100–150 kg/m^3).

$$G_1 =100 \cdot 171.7 =17170 =17.17\text{t} \quad (20)$$

$$V_{s/f}=(h_f\,(s) \cdot 0,3 \cdot P_{base.}) + (h_f\,(b) \cdot 0,8 \cdot P_{base}), m^3 \quad (21)$$

where $V_{s/f}$ – volume of strip foundation, m^3;

$h_{f\ (b)}$– the height of the foundation base, ref. monolithic strip foundation;

$h_{f\ (s)}$– the height of the structure basement, ref. monolithic strip foundation section;

P_{base} – total foundation length per the scheme.

$$V_{s/f}=(1 \cdot 0{,}3 \cdot 54) + (3.6 \cdot 0{,}8 \cdot 54) = 171.7 m^3$$

$$G = g \frac{V_s}{f}$$

$$G = 100 \cdot 171.7 = 17171\ kg$$

Reinforcement weight distribution between grid and frame conditionally

Accepted as: for the grid–0,7G_1; for the frame – 0,3G_1.

$$Grid = 0.7 \cdot 17171 = 12019.7\ kg$$

$$Frame = 0.3 \cdot 17171 = 5151.3\ kg$$

3.7 Formwork installation

The quantity of formworks is equal to the area of the surfaces form. It is necessary to count the area of rectangular side faces of the foundation and trapezoidal inner glass surfaces. The scheme of foundations reinforcement, type of reinforcement structures and reinforcing bars consumption in real conditions is included in the working drawings of the foundations. In the Course Project the amount of reinforcement work is defined as follows. Accepted the foundation reinforcement in the form of a horizontal grid at the bottom and vertical spatial frame at the entire height of the concrete preparation to the top of column footing [2].

3.8 Concreting of foundations

Concrete quantity in the foundations is determined by geometry formulas with the use of plan and foundation section drawn earlier

For the strip foundation:

$$V_{s/f}=(h_{f\ (s)} \cdot 0{,}3 \cdot P_{base.}) + (h_{f\ (b)} \cdot 0{,}8 \cdot P_f),\ m^3 \qquad (22)$$

where $V_{s/f}$– volume of strip foundation, m^3;

$h_{f\ (b)}$– the height of the foundation base, ref. monolithic strip foundation section;

$h_{f\ (s)}$– the height of the structure basement, ref. monolithic strip foundation section;

P_f – total foundation length per the scheme.

$$V_{S/f} = (3.6 \cdot 0{,}3 \cdot 54.) + (0.3 \cdot 0{,}8 \cdot 54) = 71.2 m^3$$

3.9 Backfilling

The volume of soil to be backfilled in the pit gaps, in structures with basements is calculated by the formula

(for pit*):*

$$v_{b.f} = \frac{v_{p\_}v_{s/f\_}v_{cellular}}{1+K_{rl}} = \frac{4634.57\text{-}154.3\text{-}259.2}{1+1.03} = 2079.3$$

3.10 Soil compaction

Compaction volume is measured mainly by the area of compaction that can be found, given by the average value of the compacted layer thickness (for the pit):

$$v_{com} = \frac{v_{bf}}{h_c} \text{ m}^2 \qquad (23)$$

where V_{bf} – backfilling **v**olume, m^3;

h_c– compacted layer thickness, 0,2÷0,4 m.

$$v_{com} = \frac{2079.3}{0.3} = 6931 \text{ m}^2$$

3.11 Final land planning

The final planning is made after the completion of all excavations and communication devices (for the pit):

$$S_{planning} = S_{1(a)} - S_{building}, m^2$$

where $S_{1(a)}$– cutting area of the vegetation layer of the pit (trench);

$S_{building}$– area of the building.

$$S_{planning} = 5947.8 - 720 = 5227.8 \ m^2$$

$$S_{building} = l_1 \cdot l_2, m^2$$

where l_1, l_2– length and width of the structure in plan, respectively (per the task),

$$S_{building} = (36 \cdot 24) - (4 \cdot 36) = 720 m^2$$

3.12 Selection of machines

During the comprehensive mechanization, the processes are performed by machine sets, complementing each other and linked to each other on the basic parameters and the location in the processing chain.

Table 12 – Distance properties

The average distance of soil haulage	Up to 50	50…70	70…150
Recommended equipment	Bulldozer on the tractor basis with the power, kW (l.s.)		
Equipment features	Up to 59	Equipment features	Up to 59

We choose bulldozer on the tractor basis with the power 50-70 k_W .Because of 2 km soil transportation II choose tractor (T-74) and bulldozer (DZ-42).

-Selection of excavator depends on the soil volume in the pit To determine the cost of $1m^3$ of soil in the pit (trench) for each excavator type:

Soil volume in pit 6000-11000

Capacity of excavator 0.8 so type of excavator (E - 801)

-As an initial data in cranes selection serves the dimensions of pit for foundations and the basement of the structure, dimensions and weight of mounted structures.

In the cranes selection for installation of column foundations need to be used self–propelled jib cranes. When mounting the structure monolithic strip foundations with basement to be used column– tower crane.

Cranes selected by the technical parameters: load capacity, hook-lifting height, working radius and the largest load moment. Tower BH-1

-The number of machines and vehicles included in the set must provide the required intensity of the concrete work.

If neither the intensity nor the duration of the concrete works are not set, then, as the intensity of the concrete should be accepted a performance of leading concrete paver Basic car: KAMAZ 53212.

In the cranes selection for installation of column foundations need to be used self–propelled jib cranes. When mounting the structure monolithic strip foundations with basement to be used column– tower crane.

Cranes selected by the technical parameters: load capacity, hook-lifting height, working radius and the largest load moment

3.13 Selection Formwork

The selected forms are listed in table 9.

Table 13 – Selected forms

Name of a board	Designation	Sizes, mm	Quantity of boards in a set		Area of the 1 shield
			For 1 basement	All	
Linear board	(LB–1)	1200mm	5	75	1200x3300mm^2
(Linear board	(LB–2)	800mm	28	364	800x3300mm^2
Linear board	(LB–3)	1200mm	25	250	1200x300mm^2
Angular board	(AB–1)	300mm	1	8	300x3300mm^2
Angular board	(AB–2)	600mm	1	4	600x3300mm^2
Angular board	(AB–3)	400mm	4	48	400x3300mm^2
Angular board	(AB–4)	600mm	4	44	600x300mm^2

3.14 Reinforcing the structure

The technological map examines the installation of nets and flat and spatial reinforcement frames in mat foundations, arranged in pits.

All rebar products are delivered to the site of their installation in the design position by a tracked crane of the type RDK-25 with an arrow of 17.50 m within the corresponding capacity. If you use a lift mechanism of another brand, the card must be tied to local conditions by a specialized organization.

Linking the technological map to specific facilities and production conditions is to clarify the volume of work, the need for labor and logistical resources and adjust the production schedule, and is used as part of the PPR according to the NNIP 12-01-2004.

The form of use of the technological map involves its application in the field of information technology with the inclusion in the database on technology and the organization of construction production of an automated workplace construction manufacturing technologist contractor and customer.

The following work must be done before the work on reinforcement of the mat foundations can be carried out:

- perform lighting: the entire site at least 2 lk; Place of reception and supply of rebar products - 10 lk; Place installation of rebar - 25 lk; Place of work of electrical welding machines - 50 lk;

- to break, fix and adopt the building and rappers under the act of the axis of the building and rappers in accordance with the SNIP 3.01.03-84 "Geodesic works in construction";

- to perform the formwork of ribbon foundations;

To carry out measures to ensure the safety of the work.

Fixtures larger than 1.5 metres in body length are transported in semi-trailer vehicles.

The same type of mesh with a diameter of up to 14 mm, flat frames of the same brands and separate reinforcement rods of one diameter should arrive on the construction site in packages or bundles of mass, corresponding to the cargo characteristics of cranes available to the construction organization at the site.

When transporting fixtures should be taken measures to protect it from deformation: the use of wooden linings, the rigid fixation of the fixture to the design of the car.

All deformed fixtures must be corrected before they are installed in the design position.

The reediting, cutting and cleaning of the fixtures is done on the drive machines located at the facility. At low volumes of work, manual processing of the rebar is allowed.

The fixture is delivered to the facility in accordance with the approved schedule in the form of finished fittings.

The armature should be equipped with labels with the designation of the brand and stored on the racks under the canopy, taking into account the order of delivery of it to the workplace. When storing, you should pay attention to the safety of metal tags and free access to them.

The axis of the crane's movement is set depending on the natural angle of the collapse of the ground and the steepness of the escarpment, but not less than 1 m from the caterpillar to the escarpment.

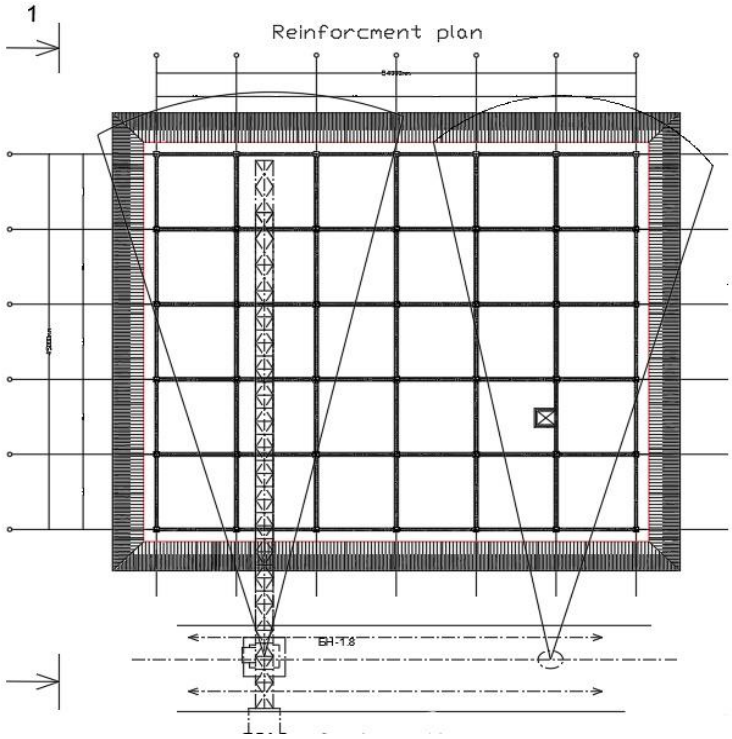


Figure 13 - Scheme of installation of reinforcement frames

The installation of nets and frames weighing up to 100 kg is done by hand, and nets, frames and blocks weighing more than 100 kg are installed in the design position of the crane, chosen depending on the mass of the fixtures adopted in the project.

Installation of reinforced products should be carried out in accordance with the requirements of the working drawings of the for the reinforcement of mat foundations and in compliance with the rules of production and acceptance of works according to the

The device of mat foundations of grids and flat frames.

The rebar is imported according to the approved schedule, linked to the general schedule of the construction of mat monolithic foundations. To the place of installation, the nets are served by crane with packages using a spatial traverse according to Figure 5, stacked in a design position on one grid or another way, ensuring the design immutability of the reinforcements according to following figure.

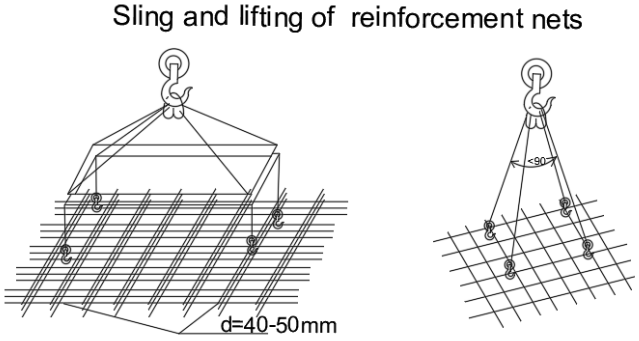


Figure 14 - Sling and lifting of reinforcement nets

3.15 Install safety layer concrete retainers for vertical rebar

From the package of reinforcements served by the crane, workers at one grid unhook from the slings and stacked in the workplace so as not to cause unnecessary movements when they are installed in the design position manually. Then a specialized link of welders rebar stacks flat nets and frames on fixing linings after the installation of formwork.

The design position between the rebar rows in the cross-section of the reinforced concrete element when reinforced with flat nets and frames should be provided by the capture between them of reinforcement rods at a distance of 0.8 - 1 m along the length of the element.

The zero-cycle designs are recommended to be reinforced with unified welding nets or frames according to the approved project, as well as enlarged.

The reinforced system is designed to provide general technological and technical requirements for the design and construction of reinforced concrete structures.

This system is based on:

A single form-size module of 300 mm;

A single grade of welded unified nets;

- unified (universal) principles of reinforcement of reinforced concrete structures by variety grids;

Specially designed welding and flexible equipment for making variety nets;

The possibility of centralized production of heavy nets.

The variety of welded nets, designed for reinforcement of reinforced concrete structures, provides two types of unified mesh:

- with a working fixture with a diameter of 10 to 32 mm in one longitudinal direction (basic type) (type 1);

- with a working fixture with a diameter of 10 to 20 mm in two directions (type 2).

The sizes of the nets with working rods in one (longitudinal) direction (type 1) are taken:

- in width - from 850 mm to 2850 mm through 200 mm;

- length - from 1450 mm to 8950 mm through 300 mm.

The width of the grids is taken at the edges of the mounting rods, the length - at the edges of the working rods.

The step of longitudinal (working) rods - 200 mm, transverse (mounting) - 600 mm.

The output of the working mesh rods is 125 mm for structures that are 300 mm long and 275 mm long for structures that are 600 mm long.

The sizes of nets with working rods in two directions (type 2) are:

- in width - from 1150 mm to 2950 mm through 300 mm;

- by length - from 1150 mm to 4150 mm through 300 mm.

The step of rods in longitudinal and cross directions is taken 200 mm.

Grid rods are 25 mm long or wide for multiples of 300 mm and 75 mm for structures that are 600 mm long or wide.

The reinforcement of the structures is based on three principles:

- supersting the mesh on the grid,

Pairing grids by length,

- laying the nets in tiers.

The principle of mesh overlay ensures the distribution of the area of the work fixture in the section of the structure in accordance with the calculation data. It provides for the mesh to be superstured at the site of the greatest calculations, with a distance between the working rods of 100 mm. And the upper grid should usually have a larger diameter of working rods and a smaller width (minimum 200 mm) and a length compared to the bottom grid.

The principle of pairing the grids ensures the distribution of the area of the work fixture of the grids along the structure, taking into account the change of the episode of the moments.

The principle of mesh laying on tiers ensures the distribution of the area of the work fixture in the structure, taking into account the change in load, for example, changing the side pressure of the ground or water by the height of the wall of reinforced concrete construction. According to this principle, the grid layout is laid in tiers with the arrangement of the working fixture in a horizontal direction (the height of the tier is equal to the width of the grid) along the size of the structure, which changes the attached load (e.g., the height of the structure).

The principles considered in comparison with the existing ones provide a reduction in steel consumption from 6 to 20 percent.

3.16 Health and safety, environmental and fire safety requirements

In the production of rebar works it is necessary:

- to protect places designed for unwinding bays and straightening of the fixture;
- when cutting the rebar rods with machines for segments less than 0.3 m long, apply devices that prevent their scattering;
- to protect the workplace when processing the sturd of the fixture, which favors the dimensions of the layout, and in the two-way layouts, in addition, to divide the layout in the middle of the longitudinal metal safety net height of at least 1 m;

Store the prepared fixtures in designated areas;

- to cover the ends of the fixture with shields in common passages less than 1 m wide.

Elements of the frame of the rebar must be packaged taking into account the conditions of their lifting, storage and transporting to the place of installation.

It is not allowed to supply and install fittings near electrically voltage wires.

When installing fittings in the formwork, the lower rods should be placed on the linings to avoid finger injuries.

The supply of light reinforcement nets and frames into the pit or trench is made by descending on the decks.

It is not allowed to leave the installed fixtures on the weight.

In order to avoid overloading the scaffolding, it is not allowed to store the stock of rebar on them.

In the production of reinforcement works it is forbidden:

- to work with untested scaffolding and from floorings laid on random unstable supports;
- to be on the frame until it is finally installed and liberated;

Leave the installed fixture without fixing;

Clean the fixture without protective glasses and tight mittens;

- to cut the rebar rods, which are stronger and more in diameter than the technical performance of the machine;

- when working on machines for flexible fixtures to lengthen the levers sections of pipes, as well as to rely on these levers;

- to occupy passages and a workplace at the machine with reinforcement blanks;

- start working on faulty equipment, use faulty tools and equipment.

When working with arc welding machines, the following requirements must be met:

The link during the full shift should work in one place, excluding crossings;

Workplace planning should ensure the comfortable position of the worker while working;

The size of the workplace should be sufficient to accommodate the material, mechanisms and devices;

- When installing the nets by hand closer to the fixture should be the heaviest of them and the devices most commonly used.

When erecting high foundations should use devices of safe work in the workplace (inventory, sites, fences), reliable in operation, with possible easy and fast their installation and disassembly, for passage on reinforcement structures should arrange transitional bridges, ladders and other means of wetting and fixtures, some of which are presented in drawings 12 and 13.

On the construction site it is necessary to place fire shields with primary means of firefighting.

Breaks in work for rest of workers should be timed to technological stops of cranes, the end of work on a deli or construction, etc.

3.17 Need for logistical resources

The need for machines, equipment and mechanisms for the installation of reinforced products in the construction of monolithic tape foundations, given in Table 3,is determined by taking into account the volume of work performed and technical characteristics. All the machines are listed in Table B.2 in Appendix B.

Work on the installation and installation of reinforcement grids, frames and blocks is carried out by a link in the composition, according to Table B-3 in Appendix B.

All loading and unloading work is performed by fixtures of 2 discharges in the links.

The links working on the installation of the rebar are provided by the front of the work, sufficient for the organization of labor workers, but not less than 12 m.

All the units of fixtures should be part of a complex brigade of final products, in which each link is entrusted with one type of work. This allows for higher productivity.

The number of links of rebarers should be completed taking into account the development of the leading link - concrete workers.

The shift task of each link is the rule of the development of the mechanism - the crane.

The cost of labor and machine time for the installation of flat grids, frames and spatial blocks are calculated according to the "Single standards and rates for construction, installation and repair and construction work" introduced in 1987 and are given in Table B-4 in Appendix B.

3.18 Building general plan

The basic data required for the development of a building master plan are:

Master plan of the territory with existing and under construction buildings, as well as underground communications networks;

A calendar plan for the production of work with a schedule of labor requirements;

Necessary construction machines and mechanisms;

The required amount of the need for general construction structural elements, products and bulk and non-bulk resources;

The number, list and dimensions of structures and buildings, as well as temporary warehouses at the construction site;

Standard information on the development of building general plans. In general, construction master plans can be dredged at various stages of the construction business.

The explanatory notes show the function of the building master plan, its purpose and for what period (for example, the installation of foundation blocks, the installation of roofing elements or in the installation of structures in general) was developed. It is required to clarify the requirements enshrined in the base of its implementation. After that, we give the necessary calculations and give an explanatory note.

In the explanatory notes, you need to show the installation drawings of structural elements, materials and products, show the design site, its geometric indicators and installation methods.

3.19 Calculation of electrical supply

The calculation of the required power of transformers is made according to the formula:

$$p_c = 1.05 \cdot (\frac{\tau_1 \Sigma P_H}{\cos\varphi} + \Sigma P_p + \tau_2 \Sigma P_{OB} + \tau_3 \Sigma P_{OH} + \tau_4 \Sigma P_{CB} \quad (24)$$

where 1.05 - coefficient taking into account power losses in the low-voltage network;

ΣP_H - the sum of the rated powers of all installed electric motors, kW;

ΣP_p - power consumption for production needs (soil thawing, concrete electric heating, etc.), kW;

ΣP_{OB} - total power of indoor lighting fixtures, kW;

ΣP_{OH} - the same for outdoor lighting, kW;

ΣP_{CB} - the sum of the rated powers of all installed welding transformers, kW;

Cosφ - power factor equal to 0.8;

λ1 - coefficient of simultaneity of work (with the number of consumers: 6 equals 0.6 from 5 to 8-0.5; more than 8-0.4);

λ2 - coefficient of simultaneity for indoor electric lighting, equal to 0.8;

λ_3 - coefficient of simultaneity for outdoor lighting, equal to 0.9;

λ_4 - coefficient of simultaneous operation of welding transformers with numbers: 3 = 0.8; from 3 to 5 = 0.6; 5 ÷ 8 = 0.5 and over 8 = 0.4.

$$P_0 = 1{,}05\left(\frac{0{,}4\cdot 90}{0{,}8} + 60 + 0{,}8\cdot 2 + 0{,}9\cdot 50 + 0{,}6\cdot 133.4\right) = 221.34 \text{ кВт}$$

Solar panels needed for the building is:

$$Solar\ panel\ watts \cdot average\ hours\ of\ sun\ light \cdot 75\% = Daly - watt\ hours$$

Where 75 percent is – percentage for all variables we have going over.

I have chosen 250-watts solar panels of "Tirna Solar Energy " for the building which can get maximum five hours of sunlight per day.

$$250 \cdot 1 \cdot 75\% = 187.5 watt\ per\ hour$$

$$Number\ of\ solar\ panel = \frac{221340}{187.5} = 1080$$

3.20 Calculating the site's need for temporary buildings and storage sites

To provide the construction site with the necessary administrative, sanitary - amenity and industrial premises, and on-site warehouses, the project should provide for a number of temporary buildings and structures.

Calculation of the areas of temporary buildings and structures is carried out according to standard indicators.

Administrative buildings. The total area of the office premises STP for the line personnel of the construction site (site managers, foremen, foremen) is determined by the formula:

$$S_{TP} = S_H.N$$

$$S_{TP} = 0.75 \cdot 20 = 15m^2$$

where S_H - is the normative indicator of the area;

N - the number of employees in the most numerous shift (engineers,

3.21 Occupational health and safety in construction

General requirements

The organization and performance of work in the construction industry, the building materials industry and the construction industry must be carried out in compliance with the requirements of the Labor Code of the Republic of Kazakhstan, as well as other regulatory legal acts containing state regulatory requirements for occupational health and safety ":

- building codes and regulations, codes of practice for design and construction;
- intersectoral and sectoral rules and standard instructions for labor protection and safety, approved in the prescribed manner;
- state standards of the labor safety standards system in force in the Republic of Kazakhstan;
- requirements and rules of labor protection and safety, rules for construction and safe operation, safety instructions;
- state sanitary and epidemiological standards, hygienic standards, sanitary rules and regulations in force in the Republic of Kazakhstan.

Participants in the construction of objects (customers, designers, contractors, suppliers, as well as manufacturers of building materials and structures, manufacturers of construction equipment and production equipment) are liable for violations of the requirements of regulatory documents specified in clause 5.1.1. and clause 5.1.2.

Responsibility for compliance with the requirements of safety and labor protection during the operation of machines, hand-held electric and pneumatic machines, technological equipment is assigned to:

- for the technical condition of construction machines, mechanisms, production equipment, tools, technological equipment, including protective equipment - for the organization on whose balance sheet they are, and when they are transferred for temporary use (lease) - for the organization (person) defined by the contract;
- for ensuring the requirements for the safe production of work - for the organizations performing the work.

The general contractor or lessor is obliged, when performing work on construction sites with the involvement of subcontractors or tenants:

- to develop, together with them, measures to ensure safe working conditions, mandatory for all organizations and persons involved in the construction;
- to ensure the implementation of the planned activities and the coordination of the actions of subcontractors and tenants in terms of the implementation of labor safety measures in the areas of work assigned to them.

When performing work on the territory of the construction site and work sites with the involvement of contractors (including citizens engaged in self-employment), the person carrying out the construction is obliged to:

- develop, together with the contractors involved, an action plan that ensures safe working conditions, mandatory for all organizations and persons involved in the construction;

- to ensure the implementation of the planned activities and coordination of the actions of subcontractors and tenants in terms of the implementation of safety and labor protection measures in the areas of work assigned to them;

- when concluding work contracts, provide for the mutual responsibility of the parties for the implementation of measures to ensure safe working conditions on the territory of the construction site and work areas.

- Before starting construction and installation work on the territory of the organization, the customer and the general contractor with the participation of subcontractors and the administration of the operating organization are required to issue an admission certificate in the prescribed form. The heads of construction organizations and the operating organization are responsible for the implementation of the measures provided for by the admission act.

Before starting work in conditions of industrial risk, it is necessary to identify areas hazardous to people, within which hazardous production factors constantly operate or may act, whether or not related to the nature of the work performed.

3.21 Organization of production areas, work areas and workplaces

Production areas (sites of construction and industrial enterprises with construction objects located on them, production and sanitary buildings and structures), work areas and workplaces must be prepared to ensure the safe production of work.

Preparatory activities must be completed before the start of the work. Compliance with the labor protection and safety requirements of industrial areas, buildings and structures, work areas and workplaces of newly built or reconstructed industrial facilities is determined when they are accepted for operation.

The completion of the preparatory work at the construction site must be accepted according to the act on the implementation of labor safety measures.

Production equipment, fixtures and tools used to organize the workplace must meet the labor safety requirements and EN 1.01.002-94.

Production areas, work areas and workplaces must be provided with the necessary means of collective or individual protection of workers, primary fire extinguishing equipment, as well as communication, signaling and other technical means of ensuring safe working conditions in accordance with the requirements of the current regulatory legal acts.

Places of temporary or permanent residence of workers (sanitary facilities, resting places and passages for people), when arranging and maintaining production areas, work sites, should be located outside hazardous areas.

Hazardous areas must be marked with safety signs and inscriptions of the prescribed form.

Moving loads over ceilings, when production, residential or office premises, where people may be, fall into hazardous areas, is not allowed.

The admission to the production area of unauthorized persons, as well as drunken workers or not employed in work in this area, is prohibited.

While on the territory of a construction or production site, in production and utility rooms, at work sites and workplaces, employees, as well as representatives of other organizations, are obliged to comply with the internal labor regulations related to labor protection adopted in this organization.

Geographically separate premises, sites, work areas, workplaces must be provided with telephone or radio communications.

Workers, managers, specialists and employees must be provided with overalls, footwear and other personal protective equipment, in accordance with the Rules for providing employees with special clothing, special footwear and other personal and collective protective equipment, sanitary facilities and devices at the expense of the employer.

4 Economic part

4.1 Calculation of the estimated cost of construction

The estimated cost of construction is the necessary material resources, which is determined on the basis of design materials and standards in accordance with the legislation of the Republic of Kazakhstan.

The basis for construction is the estimated cost necessary to determine the indicator of investment funds for construction, to form a price for construction, serves as a guideline for customers when purchasing and concluding a contract, settlements for work performed by a contract in accordance with the current legislation of the Republic of Kazakhstan.

The cost of products at the design stage is determined according to the enlarged resource estimate norms.

This section shows the cost, that is, the required capital for the construction.

The composition of the above consists of: construction cost, including design and survey work, the price of equipment, the price of installation of equipment, etc.

Capital investment is determined by drawing up a consolidated estimate.

In the estimated summary calculation of construction, the funds are distributed according to the following divisions:

- Costs of preparatory work on the territory;
- The main elements of the object;
- Elements of service and auxiliary character.
- Elements of the energy economy;
- Objects of transport facilities and communications.
- External networks and structures of water supply, sewerage, heat supply and gas supply.
- Landscaping and gardening of the territory.
- Temporary buildings and structures.
- Costs are secondary.
- Directorates of the enterprise.
- Training of personnel.
- Exploration and design work.

We find the construction cost of the estimated structures and buildings of the main and secondary nature using general estimated norms in 2019 prices.

For housing and civil construction, Chapter 3 includes the estimated cost of such objects as: utility buildings; checkpoints, greenhouses in hospital and scientific towns; waste bins, etc .; buildings and structures for cultural and domestic purposes, designed to serve workers and located within the territory allotted for the construction of enterprises; nature conservation work, work on the protection of cultural monuments, etc.

4.2 Calculation of investment costs for construction

Investment costs for construction include all costs of the customer for the project and are compiled in the form of a consolidated estimate of the cost of construction.

The consolidated estimate of the construction cost additionally includes the following cost items:

- the cost of the services of an engineer;
- training of operational personnel;
- the cost of design and survey work;
- the cost of examination of design and estimate documentation;
- costs for the implementation of architectural supervision SNiP RK 1.03-03-2002.

The cost of design and survey work is determined in accordance with the general provisions for determining the cost of design work for construction in the Republic of Kazakhstan .

4.3 Technical and economic indicators of the project

For the implementation of the investment project, it is planned to use borrowed funds. But at the same time, according to the legislation of the Republic of Kazakhstan, 15percent of the total investment should be financed from its own funds.

The required capital investments for the construction of the facility are 250 million tenge.

The full estimated cost of underground work (local, consolidated, facility) of the facility is attached in Appendix C.

CONCLUSION

New technologies are developed every day to build homes, cost-effectively, quickly, and with the needs of the engineering and architectural community involved in the design, planning and planning of buildings. The designer is responsible for the drafting of the building, as well as for the direction of the engineers and architects. The designer must know his job and be able to follow the instructions of the engineer and be able to draw the required building drawing, site plans, layout plans, etc. In accordance with the requirements.

The main type of urban development is multi-storey residential buildings. The operation of such houses allows us to rationally use the territory, reduce urban transport facilities, the length of engineering networks, and streets.

In the world housing construction, a large share is occupied by multi-storey residential buildings.

The use of multi-storey residential buildings primarily provides the goal of saving urban areas, since during the construction of multi-storey residential buildings we can significantly increase the population density. The growth of cities is "wide" and exacerbates the transport problem and increases the length of engineering networks. For the selection of types of multi-storey residential buildings in large cities, the urban planning situation is considered, as well as the conditions for the reconstruction of the central regions.

The general contractor or lessor is obliged, when performing work on construction sites with the involvement of subcontractors or tenants:

- to develop, together with them, measures to ensure safe working conditions, mandatory for all organizations and persons involved in the construction;

- to ensure the implementation of the planned activities and the coordination of the actions of subcontractors and tenants in terms of the implementation of labor safety measures in the areas of work assigned to them.

When performing work on the territory of the construction site and work sites with the involvement of contractors (including citizens engaged in self-employment), the person carrying out the construction is obliged to:

- develop, together with the contractors involved, an action plan that ensures safe working conditions, mandatory for all organizations and persons involved in the construction.

THE LIST OF REFERENCES

1 NTP PK08-03-2012 “Design of earthquake-resistant buildings. Part. Monolithic reinforced concrete buildings”.

2 SP RK 3.02-107-2014 3.02-107-2014 "Public buildings and structures".

3 SP RK 3.02-107-20142.02-01-2014 "Fire safety of buildings and structures."

4 SP RK 3.02-107-20142.04-01-2017 "Construction climatology".

5 SP RK 3.02-107-20142.04-04-2013 "Construction heat engineering".

6 NTP RK 02-01-1.1-2011 (to SN RK EN 1992-1-1: 2004). Design concrete and reinforced concrete structures of buildings and structures made of heavy (normal) concretes made without prestressing fittings. Astana 2015.

7 Guidelines for the design of concrete and reinforced concrete heavy concrete structures (without prestressing). Moscow,

2011.

8 Textbook for course and diploma design construction processes about the construction of the underground part of the building / Study guide to

9 ENiR Collection E2. Mechanized and manual earthworks.

10 ENiR Collection E4. Assembly of prefabricated and installation of monolithic reinforced concrete structures.

11 ENiR Collection E9. Heat supply systems,

water supply, gas supply and sewerage.

12 ENiR Collection E5. Installation of metal structures.

13 Khamzin S.K., Karasev A.K. "Construction production technology". Moscow, 2006.

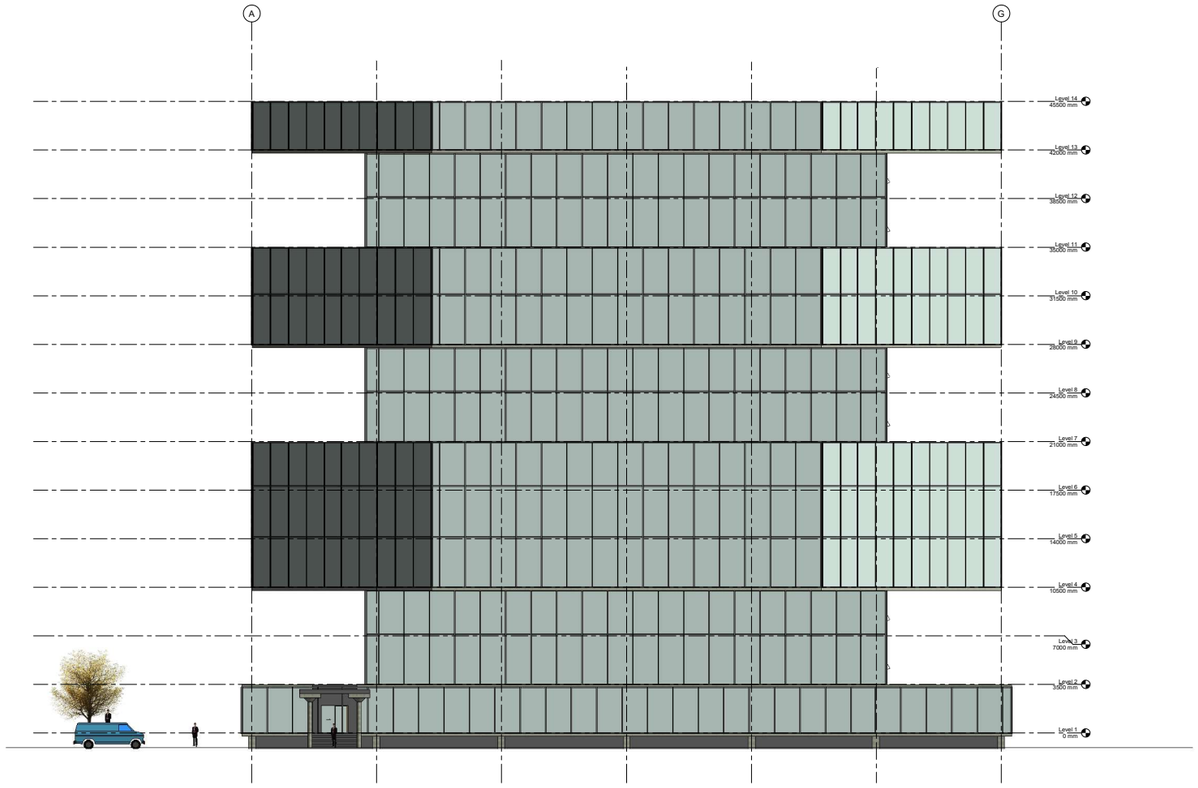
14 Guidelines for the development of the organization's project construction as part of course and diploma projects for students full-time and part-time building specialties. Brest, 2002.

15 SN RK 2.04-01-2011 "Natural and artificial lighting".

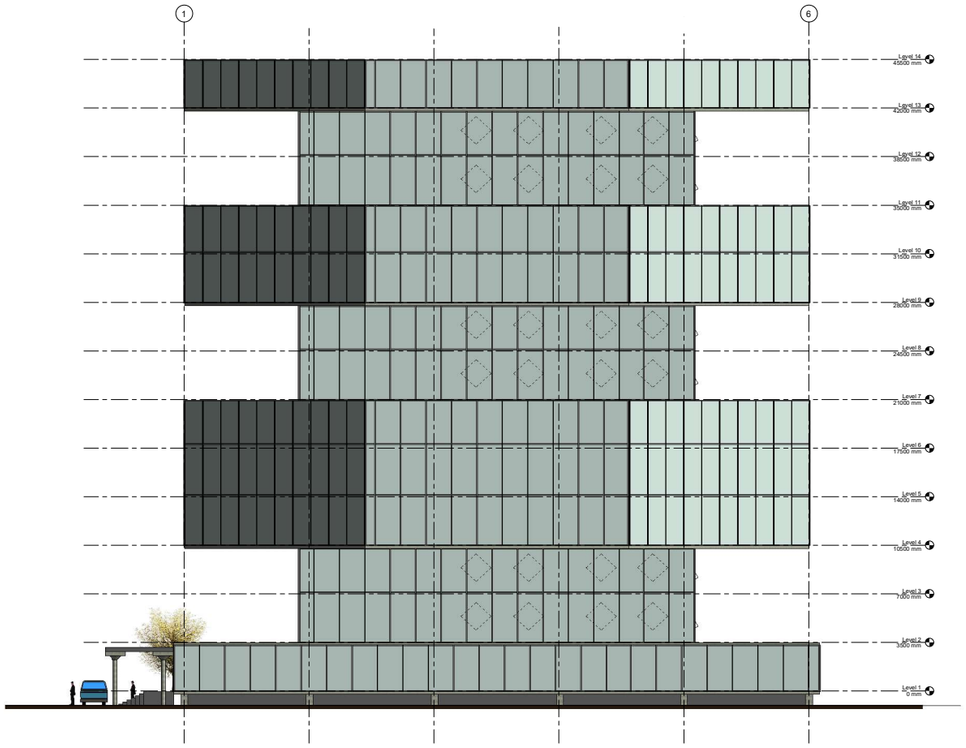
16 SN RK 1.03-05-2011 "Occupational health and safety in construction ".

17 Design of the installation of erection cranes at the construction site site: ucheb.-method. allowance / S.V. Kaloshin, A.B. Ponomarev, A.V. Zakharov, D.G. Goldtooth. - Perm: Publishing house of Permanat. issled. polytechnic un-ta, 2016.

Front View



Side View

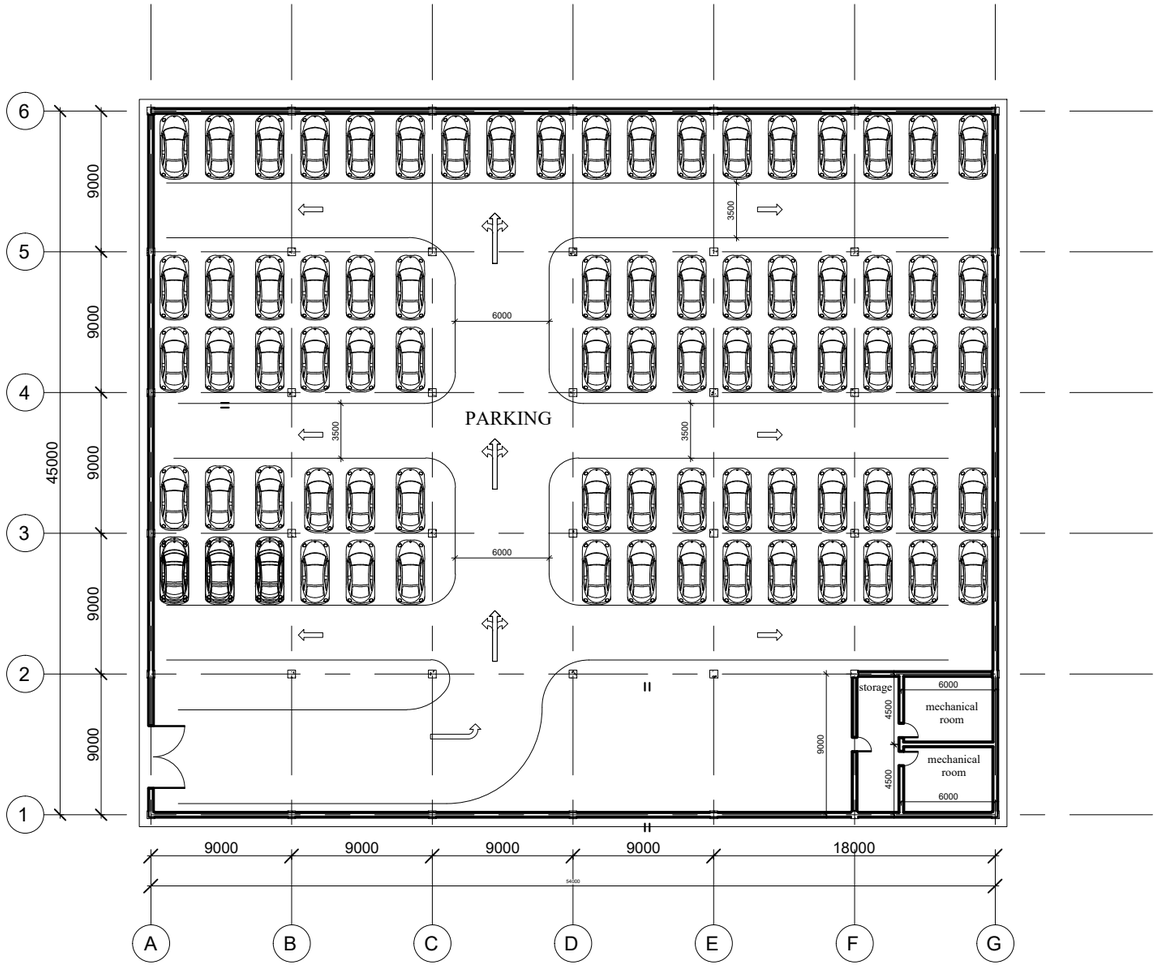


						KazNITU - 5B072900-Civil Engineering-02.08.02 - 2021 - DP
						Administrative building with solar heating system in Almaty
Ch	Sheet	List	No Doc	Singn	Date	
H.Department		**Kozyukova.N.V**				Architectural and analytical part
Supervisor		**Kyzylbayev N.K**				
Consultant		**Kyzylbayev N.K**				
Norm controller		**Bek A.A**				Elevations view
Fulfilled		Frotan S				

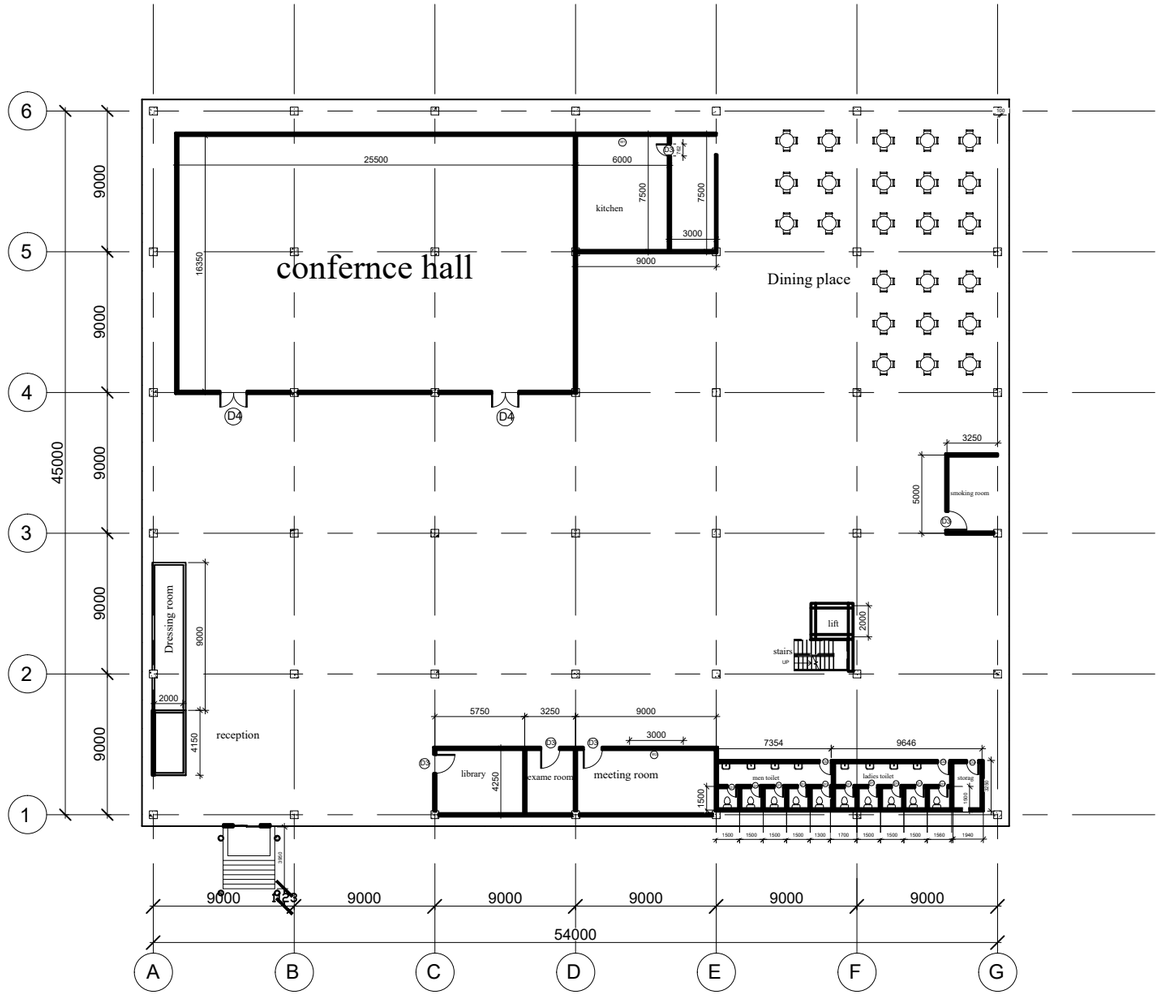
Stage	Sheet	Sheets
DP	1	9

Satbayev University

Basement



Ground floor



Area of the rooms

NO	Room	Area
1	Mechanical room	27m2
2	Confernce hall	417m2
3	Kitchen	45m2
4	Library	24.5m2
5	Exam room	13.8m2
6	Meeting room	38.2m2
7	Men tiolet	2.25m2
8	Female toilet	2.25m2
9	Storage	6m2

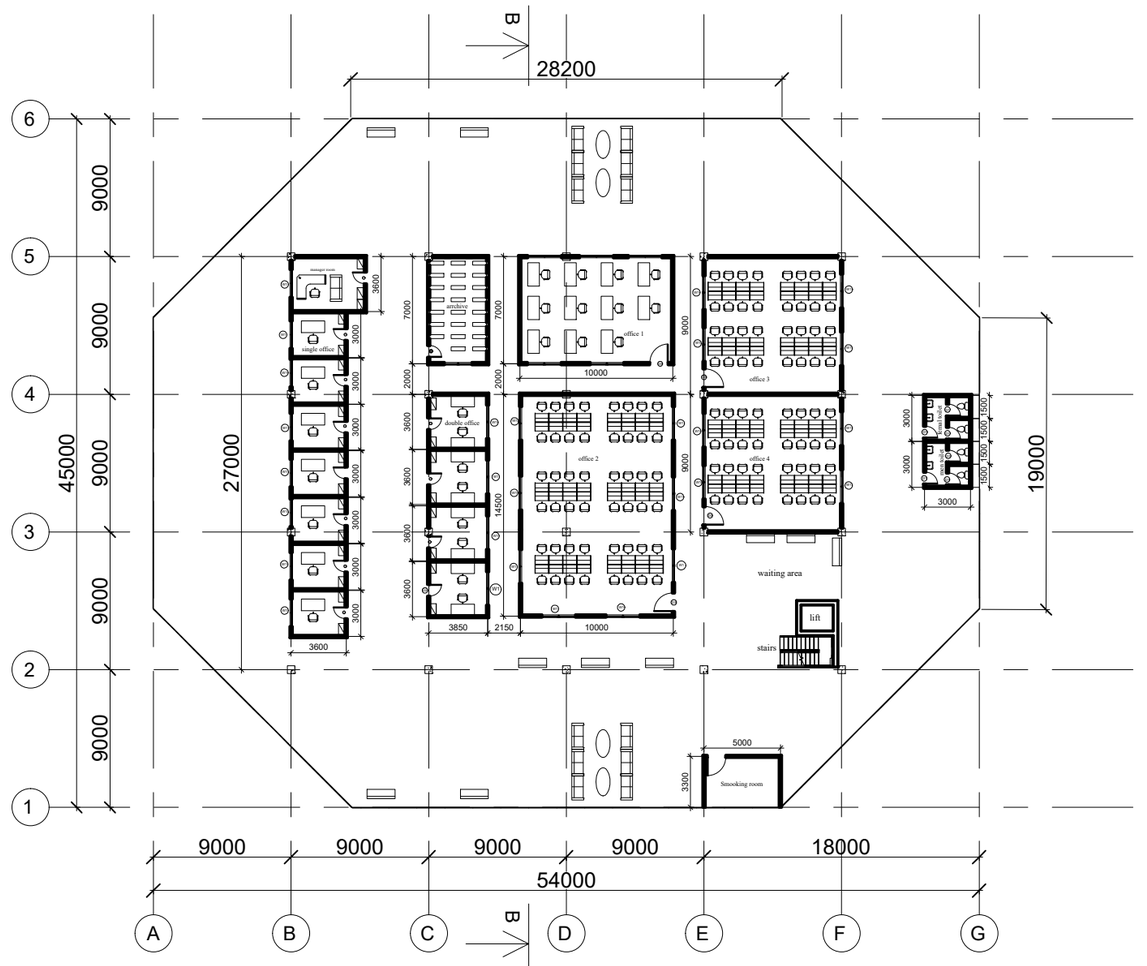
Dimension of the door and windows

Door	Dimension
D1	600X1900mm
D2	810x2000mm
D3	860x2000
D4	1700x2000
Window	Dimension
W1	2200x2000mm
W2	3000x2000mm

Ch	Sheet	List	No doc	Sign	Date	KazNITU - 5B072900-Civil Engineering-02.08.02 - 2021 - DP			
						Administrative building with solar heating system in Almaty			
H.Department		Kozyukova.N.V				Architectural and analytical part	Stage	Sheet	Sheets
Supervisor		Kyzylbayev N.K					DP	2	9
Consultant		Kyzylbayev N.K							
Norm controller		Bek A.A				Basement and Ground floor	Civil Engineering and building materials department		
Fulfilled		Frotan S							

Plane of +3500,+7000,+14000,+17500,+24500,+31500,+38500

Plane of +10500,+21000,+28000,+36000,+42000



Area of the rooms

NO	Room	Area
1	Manager room	16.9m2
2	Single office	10.8m2
3	Double office	14.6m2
4	Office 1	24.5m2
5	Office 2	145m2
6	Office 3	81m2
7	Office 4	81m2
8	Female toilet	2.3m2
9	Male toilet	2.3m2

Dimension of the door and windows

Door	Dimension
D1	600X1900mm
D2	810x2000mm
D3	860x2000
Window	Dimension
W1	2200x2000mm

Ch	Sheet	List	No doc	Sign	Date
H.Department		Kozyukova.N.V			
Supervisor		Kyzylbayev N.K			
Consultant		Kyzylbayev N.K			
Norm controller		Bek A.A			
Fulfilled		Frotan S			

KazNITU - 5B072900-Civil Engineering-02.08.02 - 2021 - DP

Administrative building with solar heating system in Almaty

Architectural and analytical part	Stage	Sheet	Sheets
	DP	3	9
Plans	Civil Engineering and building materials department		

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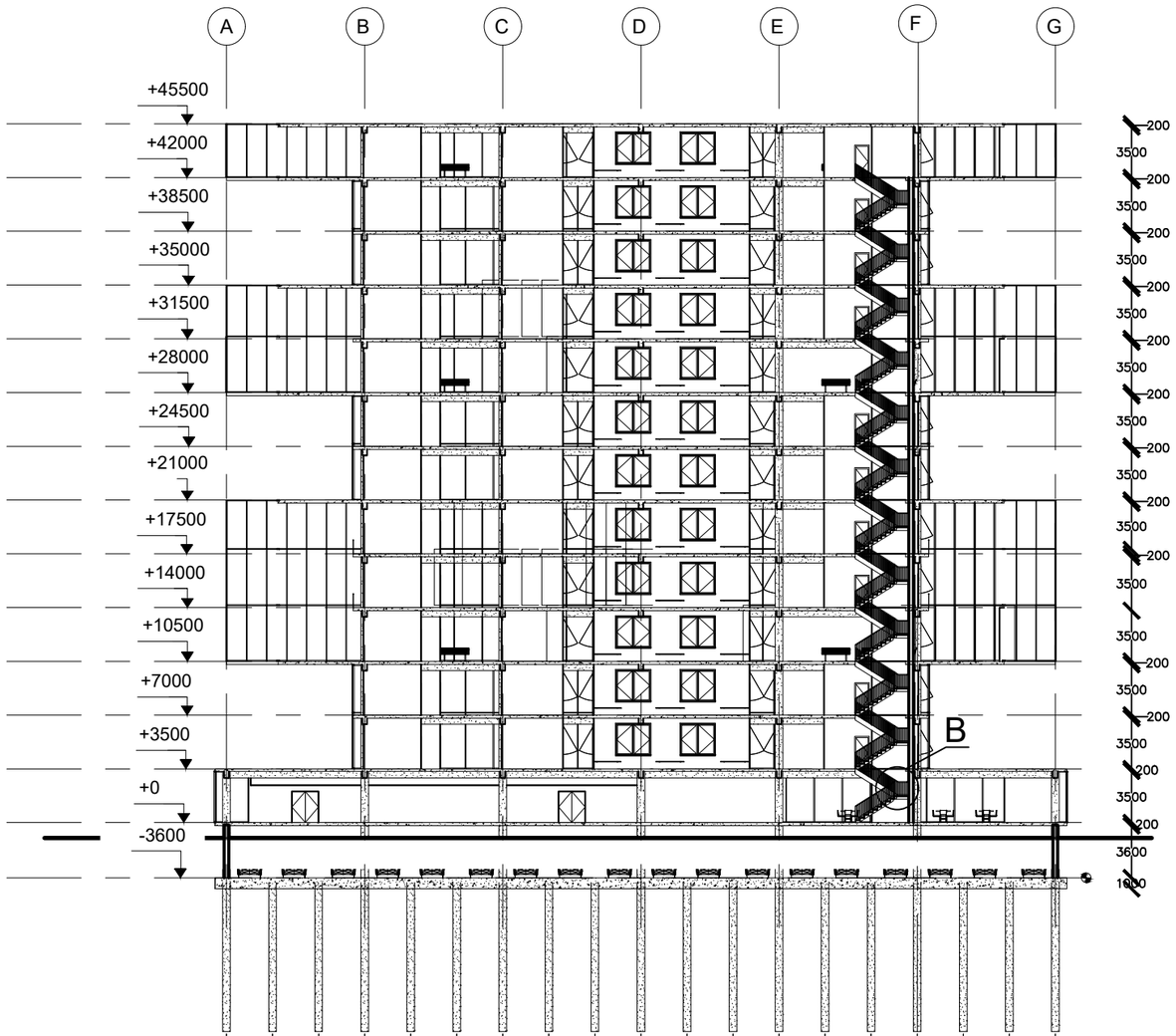
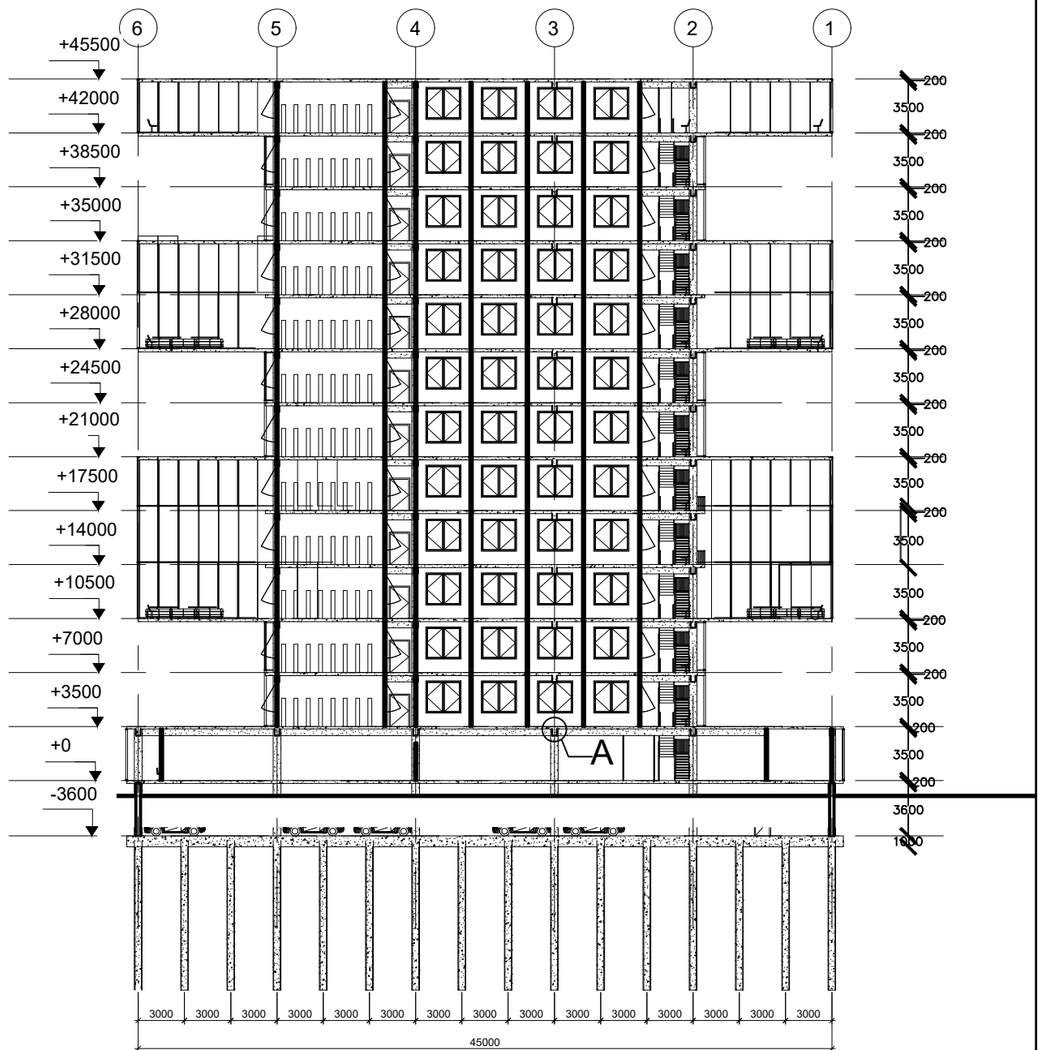
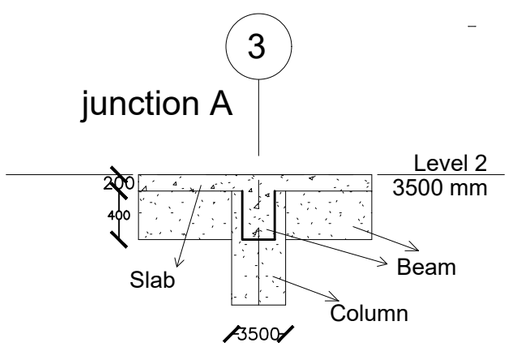
Section-A



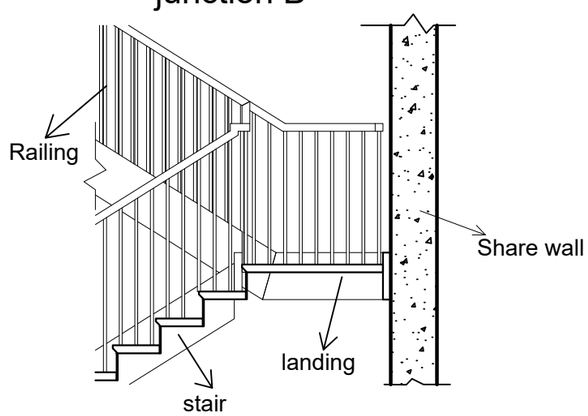
Section B



junction A



junction B



						KazNITU - 5B072900-Civil Engineering-02.08.02 - 2021 - DP
						Administrative building with solar heating system in Almaty
Ch	Sheet	List	No doc	Sign	Date	
H.Department		Kozyukova.N.V				Architectural and analytical part
Supervisor		Kyzylbayev N.K				
Consultant		Kyzylbayev N.K				
Norm controller		Bek A.A				Sections of the building
Fulfilled		Frotan S				

Stage	Sheet	Sheets
DP	4	9

Civil Engineering and building materials department

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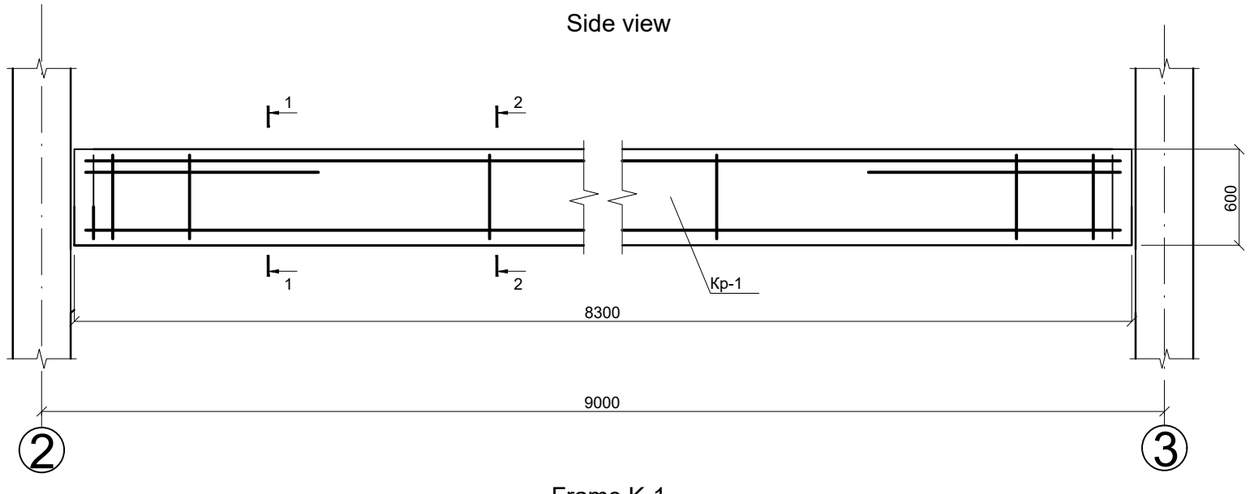
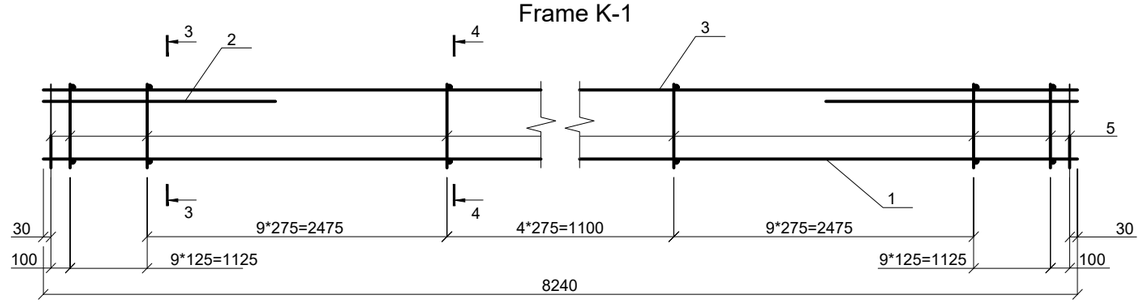
Side view



Frame K-1



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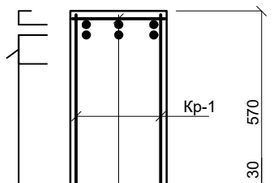

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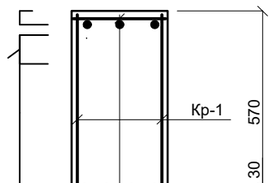

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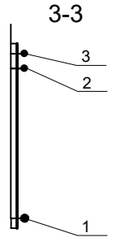

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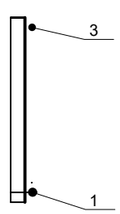

reinforcement specification

Position	Design C	Diameter, steel grade	Length мм	Num.	Mass Kg-1m	Note
1	EU 2-2004	Ø25S500	8300	4	3.87	
2	EU 2-2004	Ø25S500	2525	3	3.87	
3	EU 2-2004	Ø25S500	8300	3	3.87	
4	EU 2-2004	Ø10S275	1000	40	0.617	
		Material				
		C30/35				35

Steel consumption

Frame	Reinforcement products		
	Reinforcement class		
	S500	S275	Total
	EU 2-2004		
	Ø25	Ø10	
K-1	168.18	30	198.18

Ch	Sheet	List	No doc	Sign	Date	KazNITU - 5B072900-Civil Engineering-02.08.02 - 2021 - DP			
						Administrative building with solar heating system in Almaty			
H.Department		Kozyukova.N.V				Calculation and design part	Stage	Sheet	Sheets
Supervisor		Kyzylbayev N.K					DP	5	9
Consultant		Zhambakina Z.M							
Norm controller		Bek A.A				CB1 Beam	Civil Engineering and building materials department		
Fulfilled		Frotan S							

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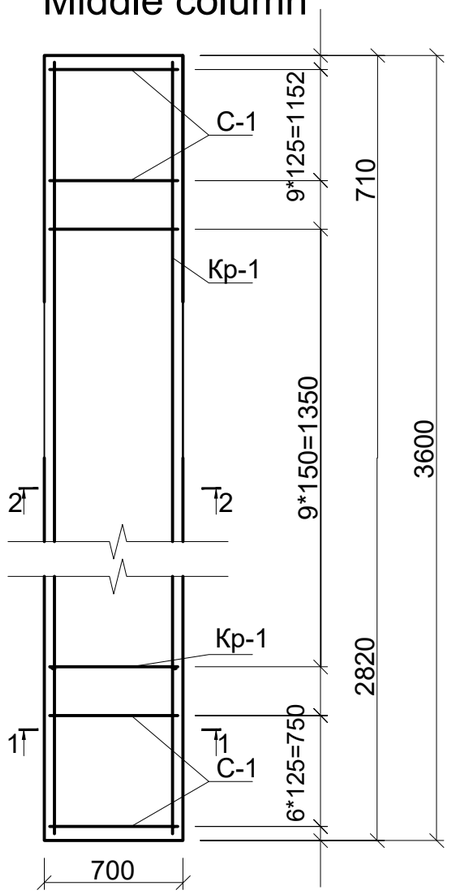
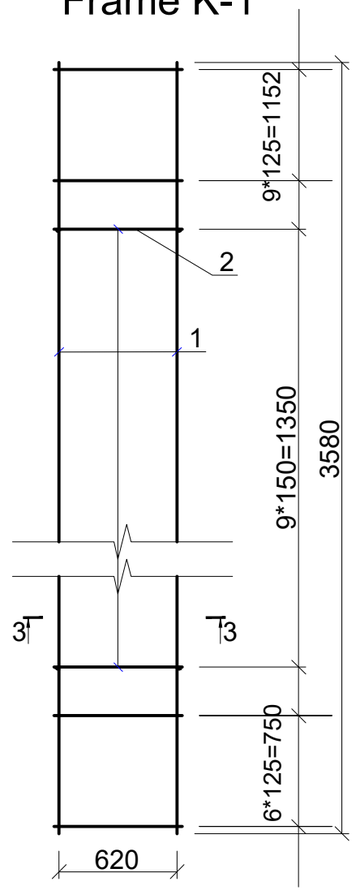
Middle column



Frame K-1



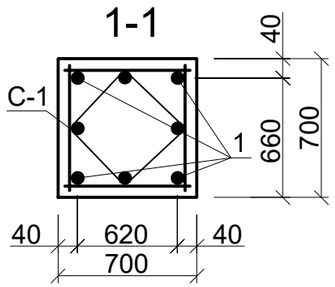
Column reinforcement specification

position	Design C	Diameter, steel grade	Length поз. мм	NO. шт.	Mass per. kg.	Note
1	EU 2-2004	Ø36S500	3600	8	7.99	
2	EU 2-2004	Ø10S275	660	24	0.62	
			Material			
			C30/35			35

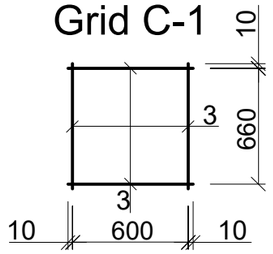
Column steel consumption

Brand	Reinforcement products		
	reinforcement class		
	S500	S275	Total
	EU 2-2004		
	Ø36	Ø10	
K-1	230.1	9.8	240

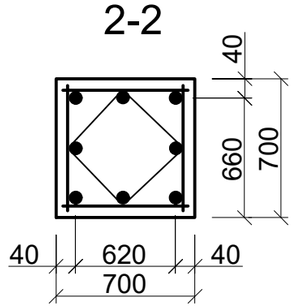
1-1



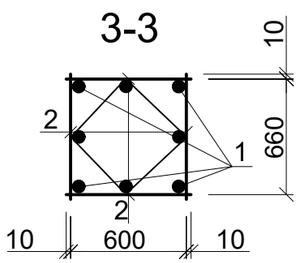
Grid C-1



2-2



3-3



Ch	Sheet	List	No doc	Sign	Date
H.Department		Kozyukova.N.V			
Supervisor		Kyzylbayev N.K			
Consultant		Zhambakina Z.M			
Norm controller		Bek A.A			
Fulfilled		Frotan S			

KazNITU - 5B072900-Civil Engineering-02.08.02 - 2021 - DP

Administrative building with solar heating system in Almaty

Calculation and design part	Stage	Sheet	Sheets
	DP	6	9
CC1 Column	Civil Engineering and building materials department		

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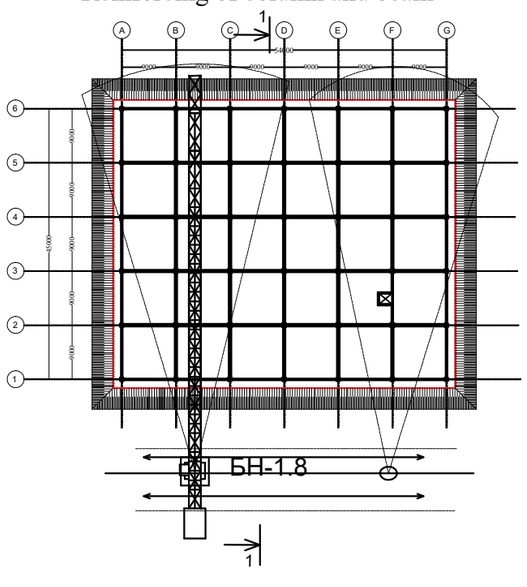
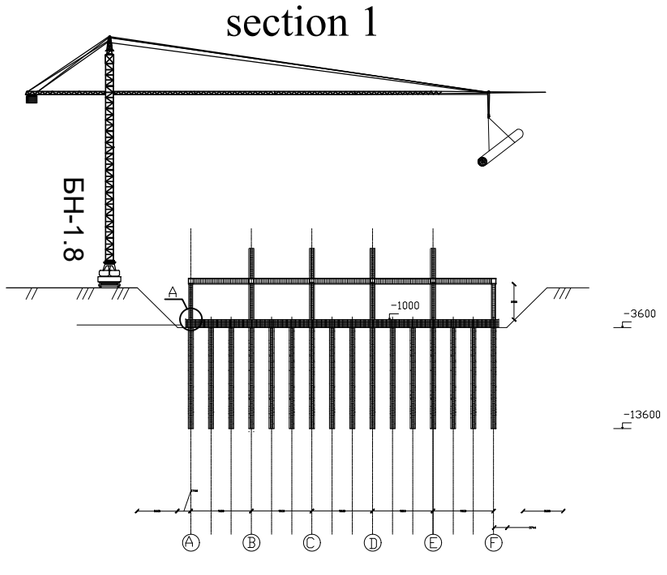
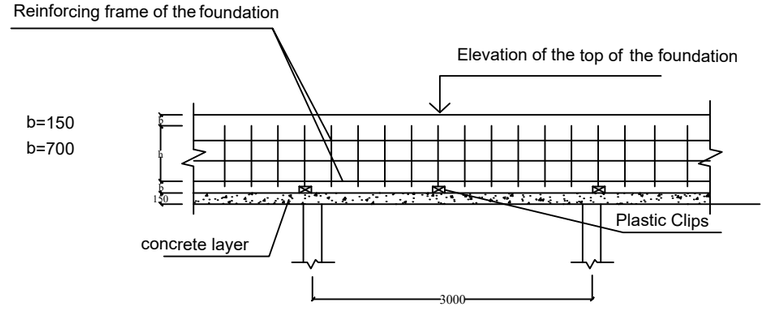
Reinforcing of column and beam



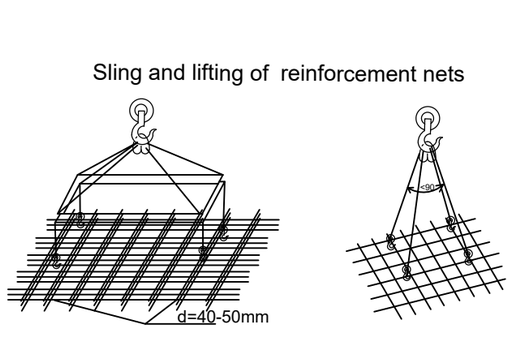
section 1



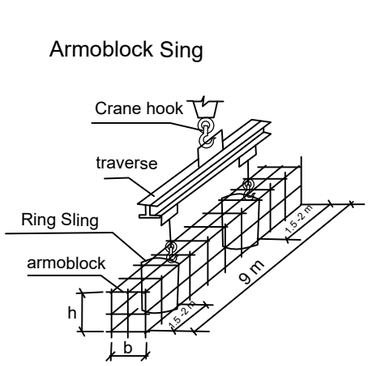
Flat Frame Scheme of foundation



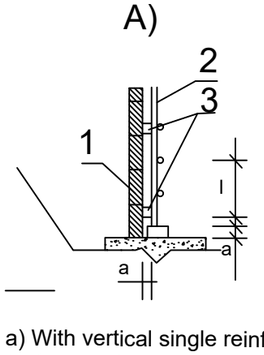
Sling and lifting of reinforcement nets



Armoblock Sing

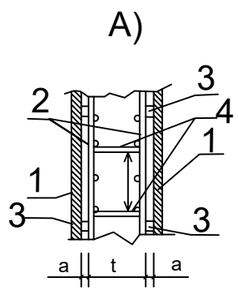


A)



a) With vertical single reinforcement:
1 - formwork;
2 - rebar mesh (frames);
3 - plastic retainer;
a protective layer of concrete (projected);

A)



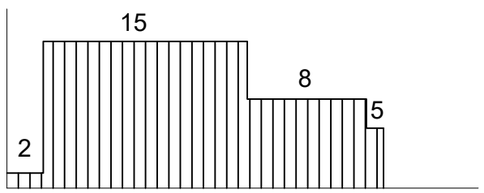
b) with vertical double reinforcement:
1 - formwork;
2 - rebar mesh (frames);
3 - plastic retainer;
4 - fixture shorts;
a - protective layer of concrete (project),
t - the distance between the grids.

Working schedule

№ п/п	Name of works	Scope of work		expenses labor per / day	required machines		prod. works in the day	number of shifts	number work in shift	Operating schedule (Day)
		units.	Qty		name	number mash				
1	Toe and laying of concrete pads.	kg	50	7.5			2	1	2	2
2	Toe nets or frames.	t	60.45	17.4	БН-1.8	1	0,5	2	2	15
3	Installation of nets or frames in the formwork	t	60.45	17.4	БН-1.8	1		2	2	8
4	Reconciliation of installed grids or frames	t	0.9	11.6	DEKO 160A MMA	4	13	2	2	5

$$K_{нер} = \frac{n_{max}}{n_{ср}} = \frac{15}{18.5} = 0.81 \leq 1,5$$

$$n_{ср} = \frac{Q}{П} = \frac{425.9}{23} = 18.5$$



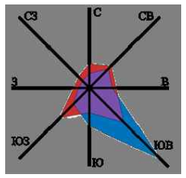
Technical and economic indicators

№	Name	Unite	Number
1	Labor costs	man-day	425.9
2	Duration	day	23

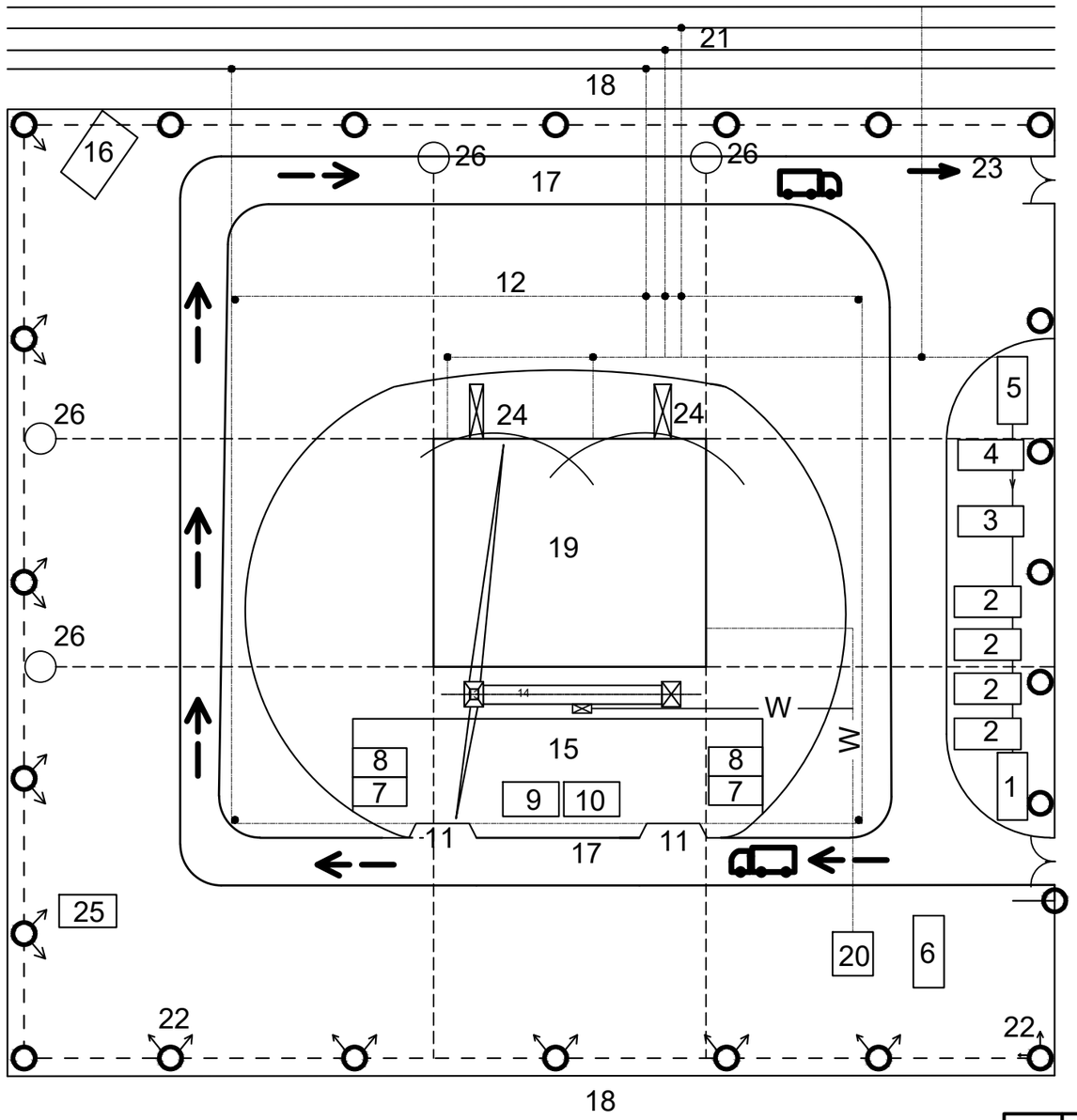
Safety precautions

In the manufacture of reinforced concrete work, it is necessary to strictly comply with the requirements of SNiP III-4-80 "Safety measures in construction" and observe certain rules:
1. The dismantling of the formwork of the foundations is carried out with the permission of the manufacturer of the work, which is given after concrete reaches strength, ensuring the safety of surfaces and edges of the corners of concrete structures.
1. The materials from disassembly are immediately lowered to the ground, sorted, the protruding nails, staples are removed and stored in stacks by stamps.
2. Electric arc welding is carried out by persons having the relevant certificates for the right to perform welding work.
3. All lifting machines, mechanisms and devices before operation are checked in accordance with the rules of Gosgortekhnadzor.
4. When mounting valves, the crane works on outriggers.
5. During the operation of the cranes, it is prohibited for people to stay in the zone of its operation. The transfer of cargo over workers is not allowed.
6. The fed-in reinforcing mesh is lowered above the place of its installation by no less than 80 cm and only then do the fitters direct their design position.
7. Walking on reinforcing elements is allowed only on ladders 0.3-0.4 m wide.
8. It is forbidden to swing the suspended load and leave it unattended, as well as to carry out installation in case of a wind of more than 6 points.
9. It is forbidden to operate a jib crane directly under the wires of existing power lines of any voltage.
10. The descent of workers into the pit or trench is permitted only by stairs.
11. If cracks appear in the slopes of the pit or trench that threaten to collapse, it is necessary to fix the walls or reduce the steepness of the slope before starting work.
12. Connect welding transformers to the network only with the help of closed circuit breakers. 14. The voltage at the terminals of the welding transformers at the time of ignition of the arc should not exceed 70 V. You can switch the jumpers on the steps of the transformer only when the switch is turned off.
15. It is forbidden to repair, repair, adjust and clean the transformer when it is energized.
16. Moving the welding transformer to another catch is only permitted when disconnecting it from the mains.
17. The electric wires on the conveyors and from the conveyor to the circuit breaker are enclosed in rubber hoses, the conveyor frame is grounded.

Ch	Sheet	List	No doc	Sign	Date	KazNITU - 5B072900-Civil Engineering-02.08.02 - 2021 - DP		
						Administrative building with solar heating system in Almaty		
H.Department		Kozyukova.N.V				Organizational and technological part	Stage: DP	Sheet: 7 / Sheets: 9
Supervisor		Kyzylbayev N.K						
Consultant		Kyzylbayev N.K						
Norm controller		Bek A.A				Reinforcing	Civil Engineering and building materials department	
Fulfilled		Frotan S						



General Plan of the building



Specifications

NO	Place	NO	Place	NO	Place
1	Foreman	11	Areas for unloading vehicles	21	Inputs and networks of permanent and temporary communications
2	Inventory household premises for workers	12	Fire-fighting water supply with hydrants	22	lighting masts
3	Dining room	13	Tower crane	23	Car wash area
4	Shower room	14	Crane tracks	24	Assembly hoists
5	Toilet	15	Construction storage area	25	Site for garbage containers
6	Material warehouse	16	A parking lot for construction machines and mechanisms	26	Signs of fixing the main axes of the building
7	Warehouse of elevator equipment	17	Temporary highways		
8	Plumbing equipment warehouse	18	Temporary fence with two gates and checkpoints		
9	Platform for lifting devices and containers	19	Building under construction		
10	Area for receiving mortar and concrete	20	Temporary transformer substation		

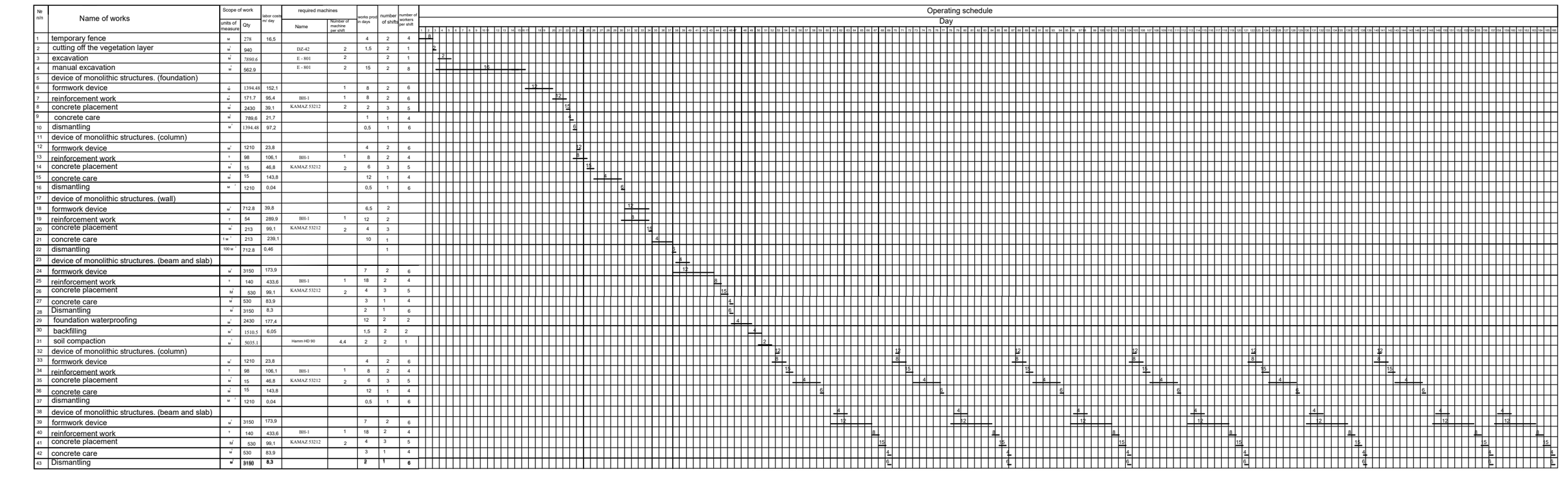
						KazNITU - 5B072900-Civil Engineering-02.08.02 - 2021 - DP
						Administrative building with solar heating system in Almaty
Ch	Sheet	List	No doc	Sign	Date	
H.Department		Kozyukova.N.V				Organizational and technological part
Supervisor		Kyzylbayev N.K				Stage: DP; Sheet: 8; Sheets: 9
Consultant		Kyzylbayev N.K				
Norm controller		Bek A.A				General plan
Fulfilled		Frotan S				Civil Engineering and building materials department

PRODUCED BY AN AUTODESK STUDENT VERSION
PRODUCED BY AN AUTODESK STUDENT VERSION

Calendar Schedule

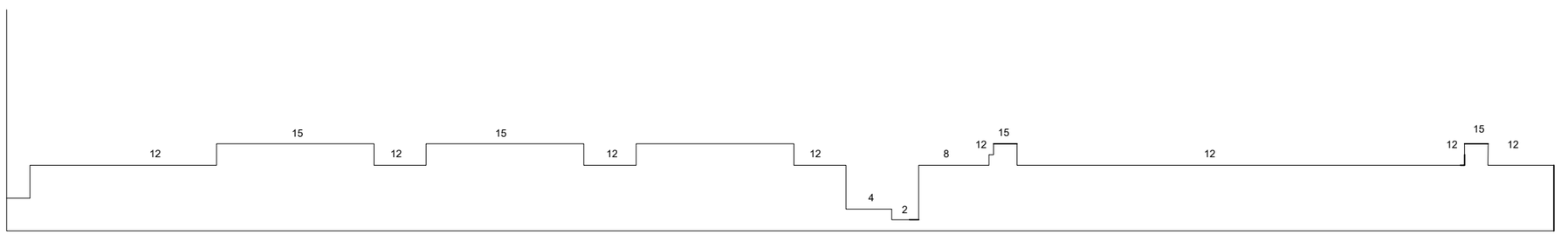
№ n/n	Name of works	Scope of work: units of measure	Scope of work: Qty	labor costs m/ day	required machines: Name	required machines: Number of machine per shift	works prod in days	number of shifts	number of workers per shift
1	temporary fence	м	278	16,5			4	2	4
2	cutting off the vegetation layer	м²	940		DZ-42	2	1,5	2	1
3	excavation	м³	7890.6		E - 801	2		2	1
4	manual excavation	м³	562.9		E - 801	2	15	2	8
5	device of monolithic structures. (foundation)								
6	formwork device	м²	1394.48	152,1		1	8	2	6
7	reinforcement work	т	171.7	95,4	BH-1	1	8	2	6
8	concrete placement	м³	2430	39,1	KAMAZ 53212	2	2	3	5
9	concrete care	м³	789,6	21,7			1	1	4
10	dismantling	м²	1394.48	97,2			0,5	1	6
11	device of monolithic structures. (column)								
12	formwork device	м²	1210	23,8			4	2	6
13	reinforcement work	т	98	106,1	BH-1	1	8	2	4
14	concrete placement	м³	15	46,8	KAMAZ 53212	2	6	3	5
15	concrete care	м³	15	143,8			12	1	4
16	dismantling	м²	1210	0,04			0,5	1	6
17	device of monolithic structures. (wall)								
18	formwork device	м²	712.8	39,8			6,5	2	
19	reinforcement work	т	54	289,9	BH-1	1	12	2	
20	concrete placement	м³	213	99,1	KAMAZ 53212	2	4	3	
21	concrete care	1 м²	213	239,1			10	1	
22	dismantling	100 м²	712.8	0,46				1	
23	device of monolithic structures. (beam and slab)								
24	formwork device	м²	3150	173,9			7	2	6
25	reinforcement work	т	140	433,6	BH-1	1	18	2	4
26	concrete placement	м³	530	99,1	KAMAZ 53212	2	4	3	5
27	concrete care	м³	530	83,9			3	1	4
28	Dismantling	м²	3150	8,3			2	1	6
29	foundation waterproofing	м²	2430	177,4			12	2	2
30	backfilling	м³	1510.5	6,05			1,5	2	2
31	soil compaction	м³	5035.1		Hamm HD 90	4,4	2	2	1
32	device of monolithic structures. (column)								
33	formwork device	м²	1210	23,8			4	2	6
34	reinforcement work	т	98	106,1	BH-1	1	8	2	4
35	concrete placement	м³	15	46,8	KAMAZ 53212	2	6	3	5
36	concrete care	м³	15	143,8			12	1	4
37	dismantling	м²	1210	0,04			0,5	1	6
38	device of monolithic structures. (beam and slab)								
39	formwork device	м²	3150	173,9			7	2	6
40	reinforcement work	т	140	433,6	BH-1	1	18	2	4
41	concrete placement	м³	530	99,1	KAMAZ 53212	2	4	3	5
42	concrete care	м³	530	83,9			3	1	4
43	Dismantling	м²	3150	8,3			2	1	6

Operating schedule — Day



$$Кнер = \frac{nmax}{nср} = \frac{15}{26} = 0.57 \leq 1,5$$

$$nср = \frac{Q}{П} = \frac{4320}{166} = 26$$



Statement of the needs of machines and mechanisms

Name	mark	Note
1.Bulldozer	DZ-42	Cutting vegetable backfill
2. Excavator with back shovel	Hitachi ZX350LCK-5G	Soil development in dump and transport funds
3. Self-propelled roller	Hamm HD 90	Soil compaction
4. Dump truck	MAN TGX 50.480 8x8 BB-WW	Removal of soil
5. Concrete pump	KAMAZ 53212	Concrete supply
6. Tower crane	BH-1	Delivery of goods

Technical and economic indicators

№	Name	Unite	Number
1	Labor costs	man-day	4320
2	Duration	day	166

Ch	Sheet	List	No doc	Sign	Date
H.Department		Kozyukova.N.V			
Supervisor		Kyzylbayev N.K			
Consultant		Kyzylbayev N.K			
Norm controller		Bek A.A			
Fulfilled		Frotan S			

KazNITU - 5B072900-Civil Engineering-02.08.02 - 2021 - DP

Administrative building with solar heating system in Almaty

Organizational and technological part

Stage	Sheet	Sheets
DP	9	9

Calendar Schedule

Civil Engineering and building materials department

Appendixes

Appendix A

Table A.1 - Collection of loads

Downloads		
Dead weight		Auto.
Floor construction	Layer thickness, m density, kg / m3	Characteristic load, kg / m2
For the basement:		
Waterproofing material	0.01 1200	12
polystyrene foam	0.2 40	8
Cement-sand screed	0.06 1800	108
Basement total:		128
For a typical floor:		
Cement-sand screed	0.06 1800	108
Moisture resistant plywood	0.1 600	60
Oak parquet	0.015 1800	27
Sum for a typical floor:		194
For flat roofs:		
Concrete slope layer	0.05 1800	90
Vapor barrier		0.015
polystyrene foam	0.2 40	8
Bituminous waterproofing	0.02 1400	28
Everything for a flat roof:		126.015
Wall construction	Layer thickness, m density, kg / m3	Characteristic load, kg/m
External self-supporting walls (wall height 3.5m):		
Insulated glass for curtain wall	0.1 2500	210
Partitions (height 3.5m)		
Gypsum board	0.01 724	7.24
Soundproofing Isomer	0.06 14	0.84

Continuation of Appendix A

Continuation of Table A- Collection of loads

Downloads	Layer thickness, m density, kg / m3	Characteristic load, kg / m2
Drywall	0.01 724	7.24
Total for partitions:		15.32
Horizontal pressure from the ground	Characteristics	
Course soil	= 280 kg⁄cm	
	= 1.88 t⁄m	
	= 36deg.	
	= 0	
Payment		
Horizontal intensity of active soil pressure at 2.6m		
Ground level with respect to clean floor 1m		
=1.9T/m2		
Live loads according to EN1991		
Overlap and floors	5 kN / m2	
Stairs	5 kN / m2	

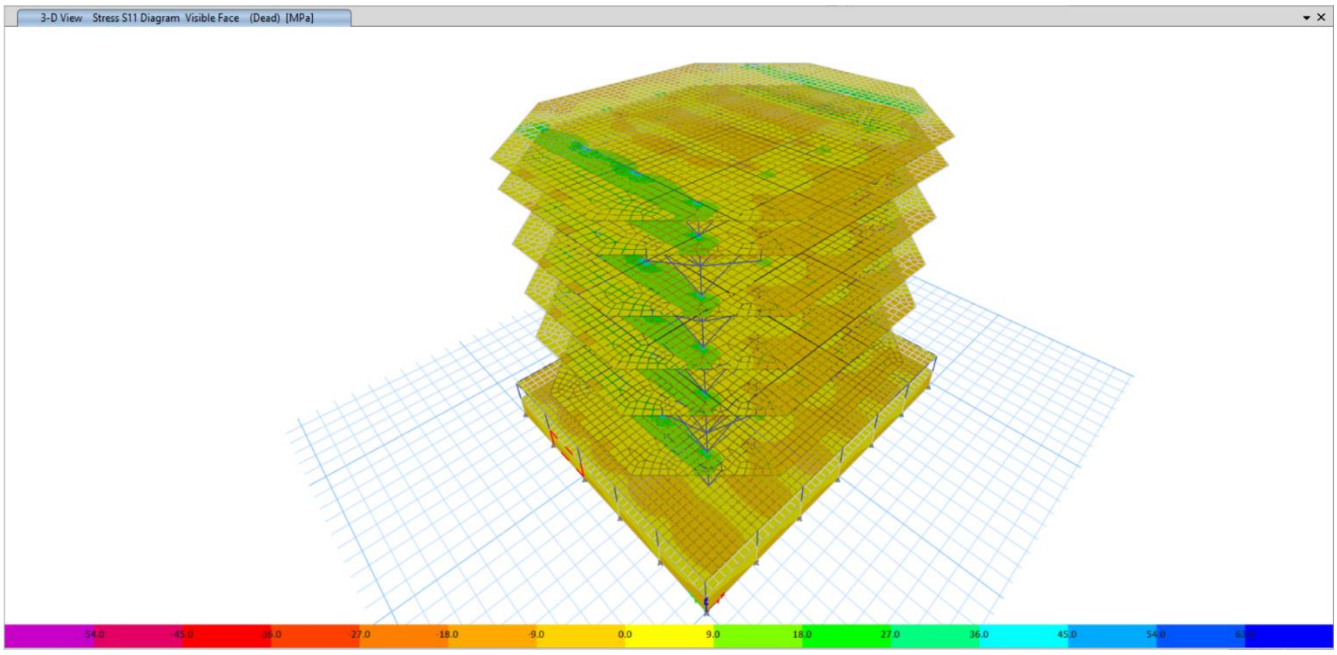


Figure A.1 – stresses on the floors due to dead load

Continuation of Appendix A

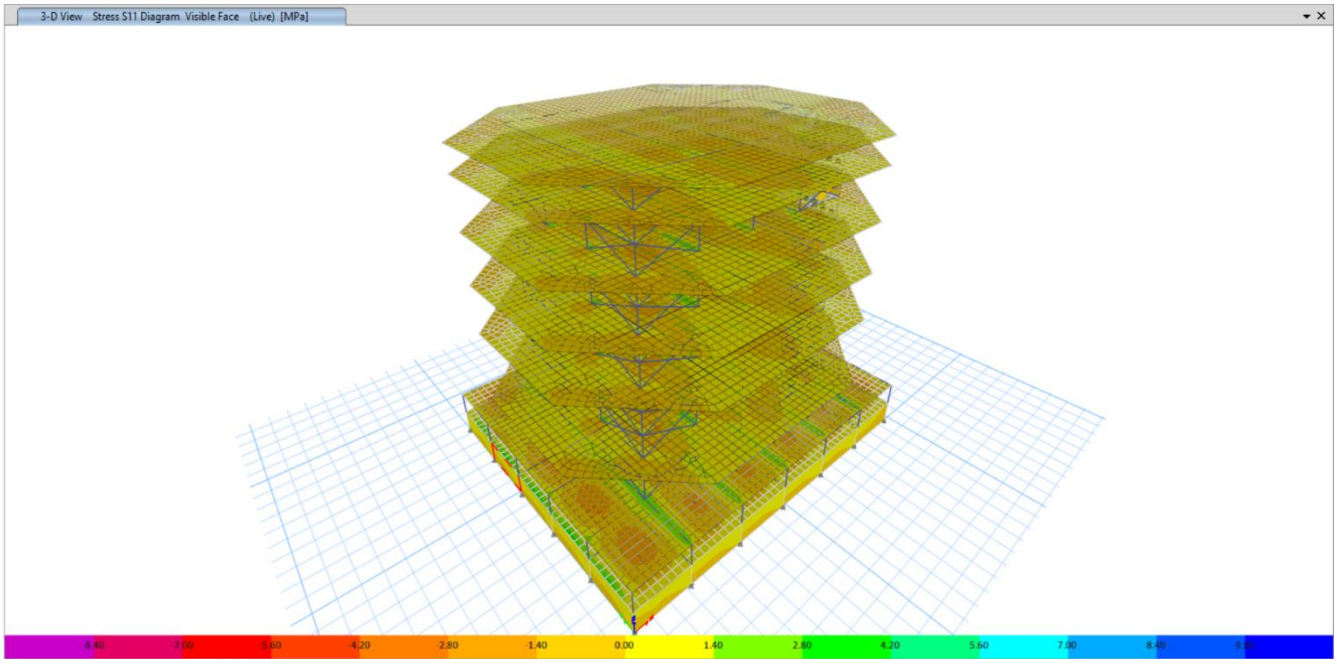


Figure A.2 - stresses on the floors due to live load

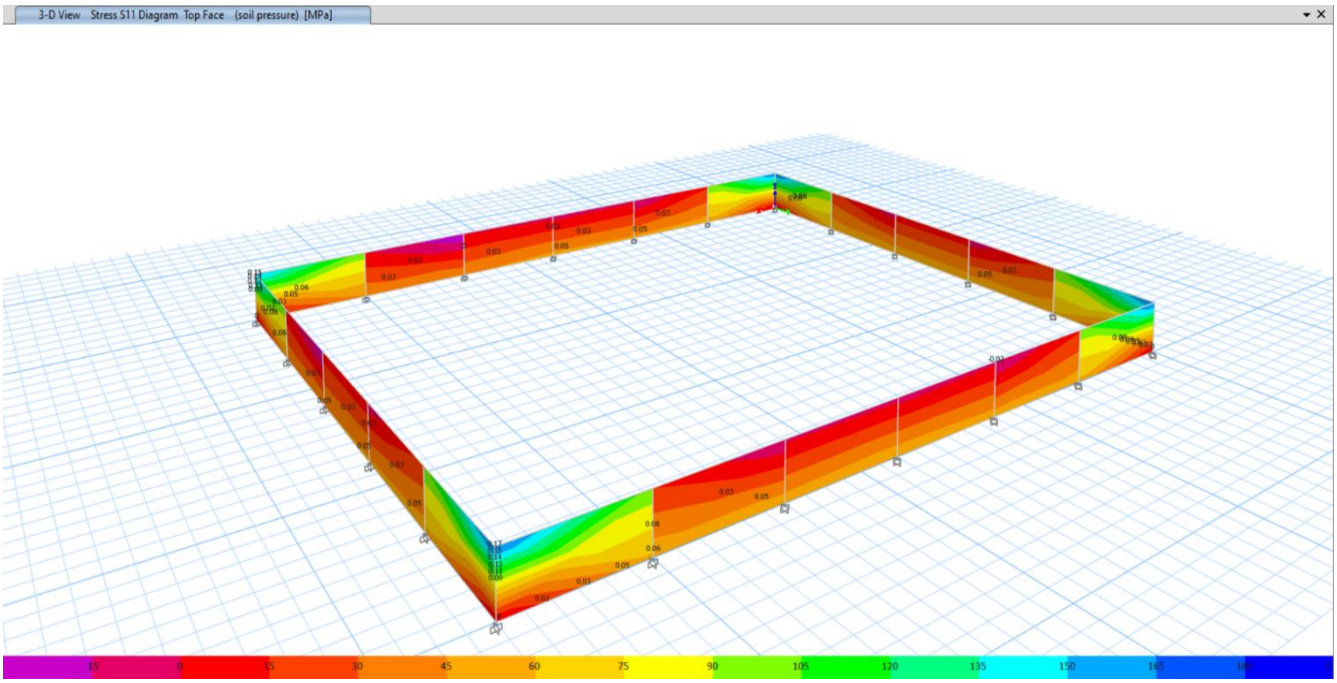


Figure A.3 - Ground pressure

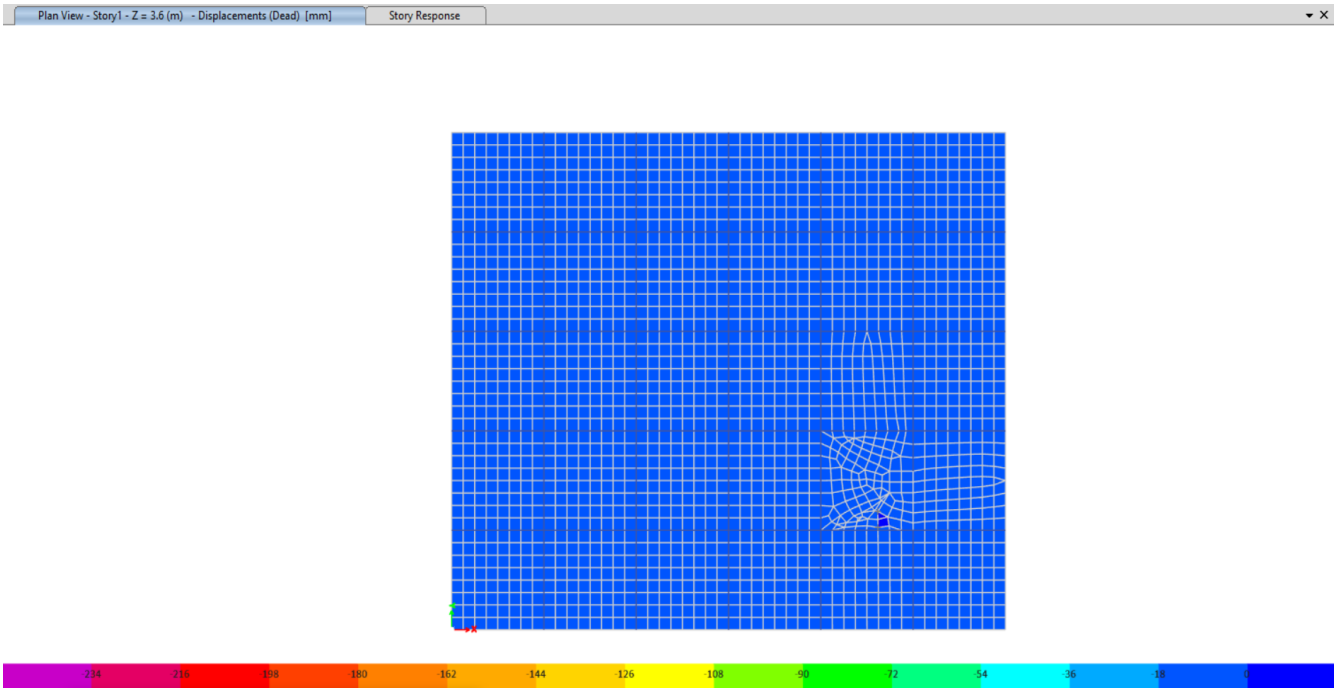


Figure A.4 – Isofields of base dirift along the x and y axis

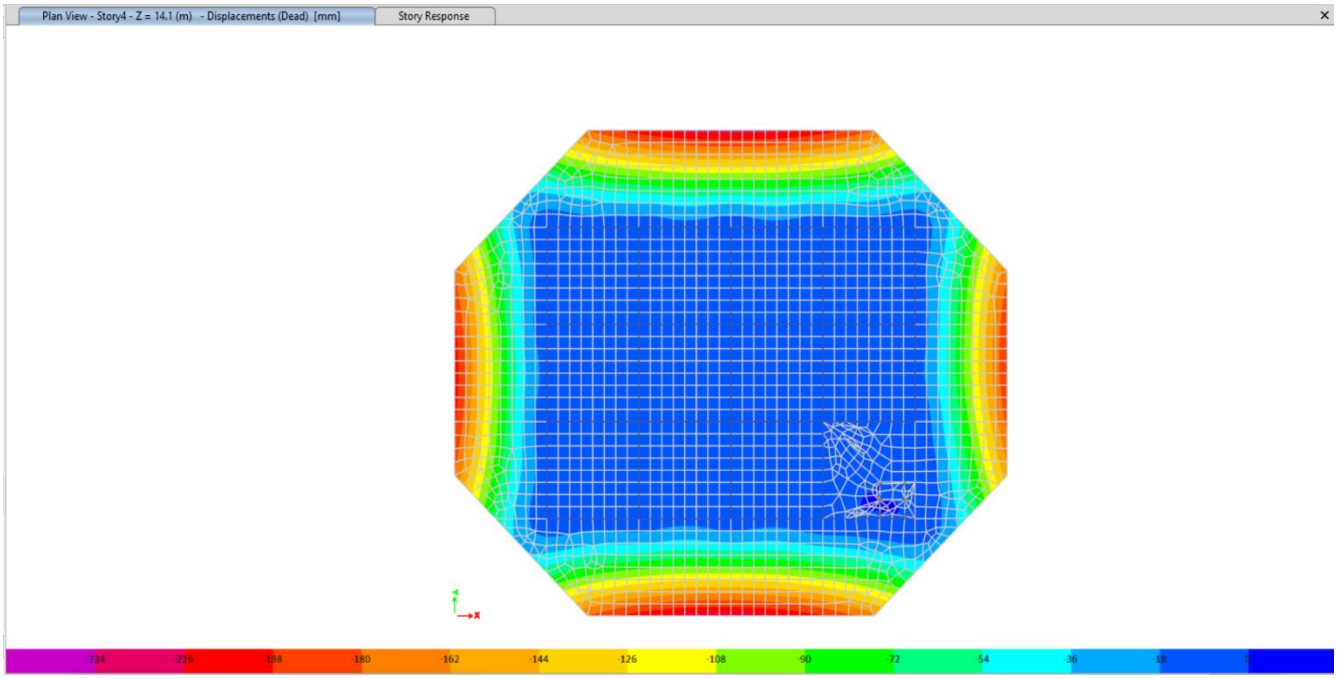


Figure A.5 – slab deflection along Z axis

Continuation of Appendix A

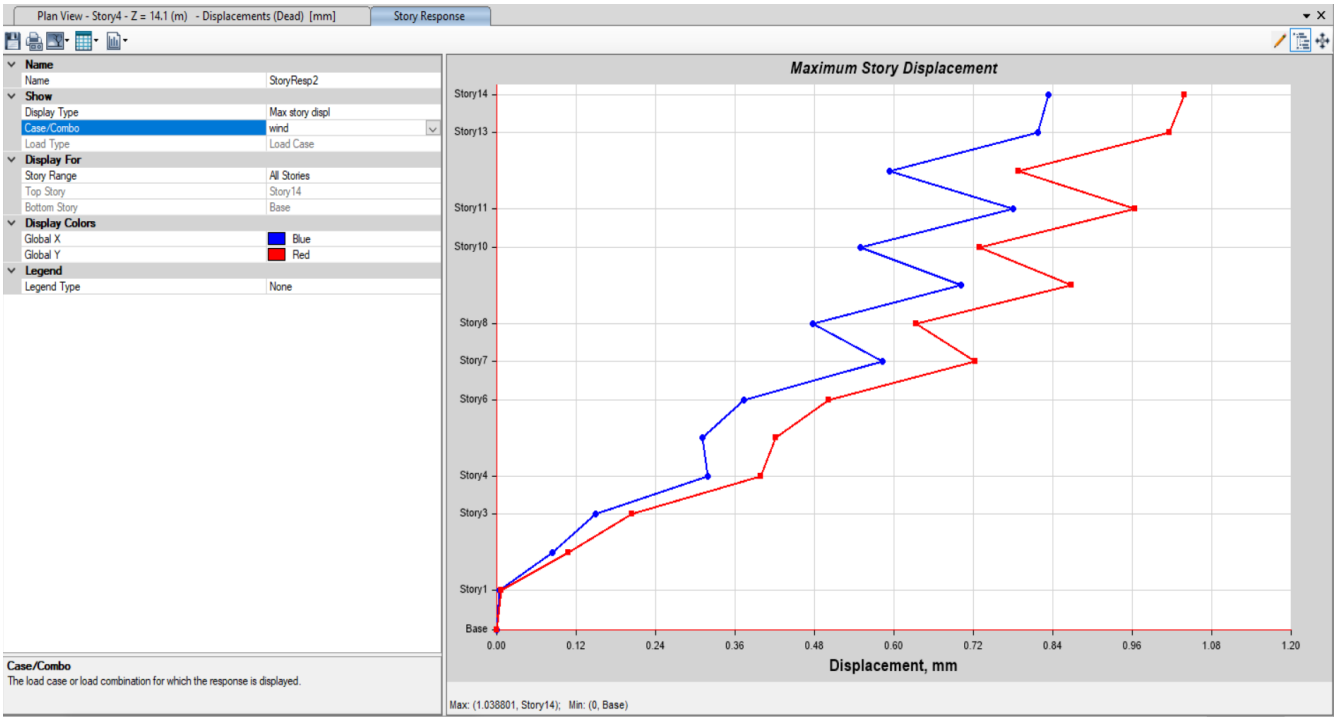
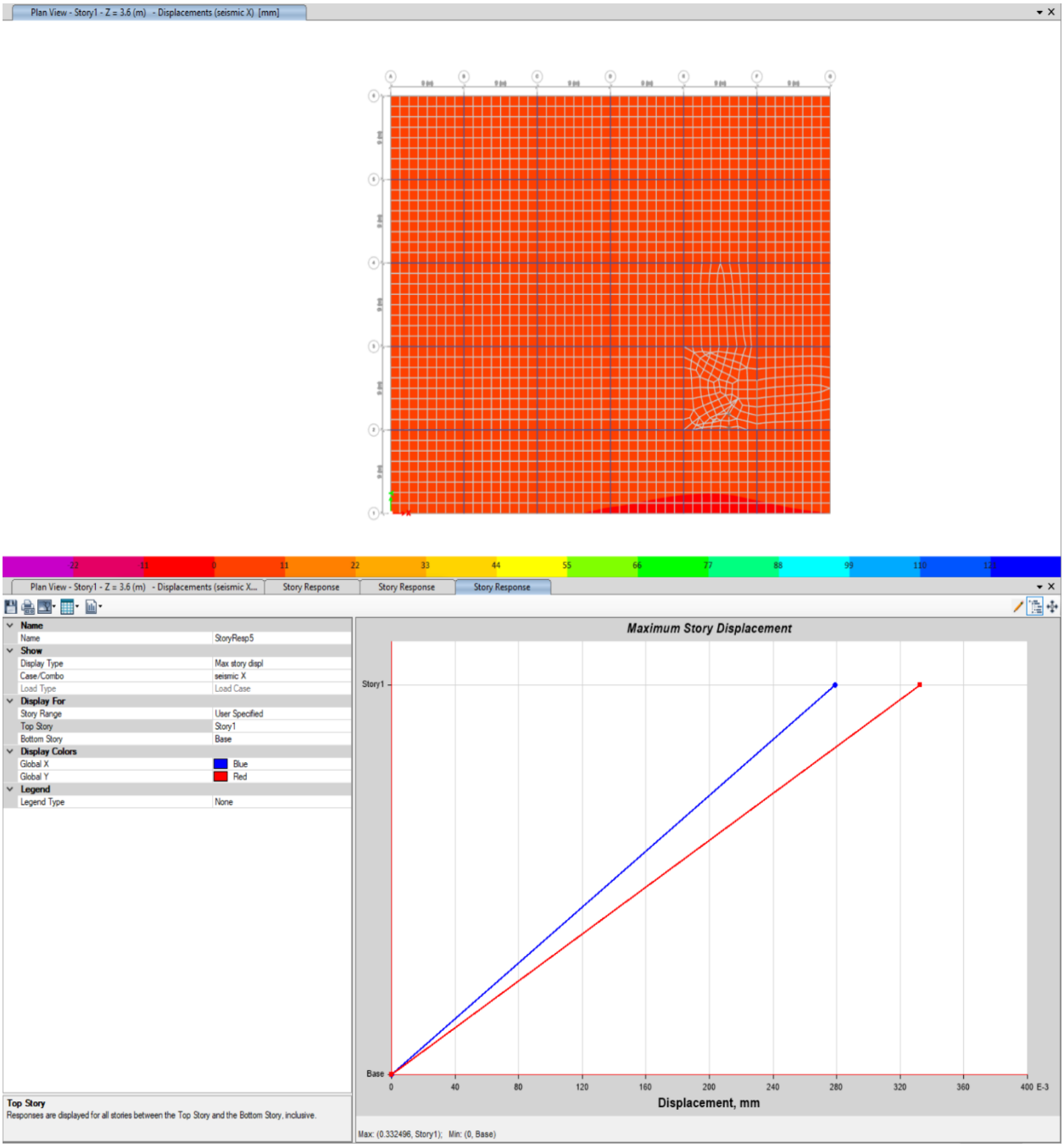
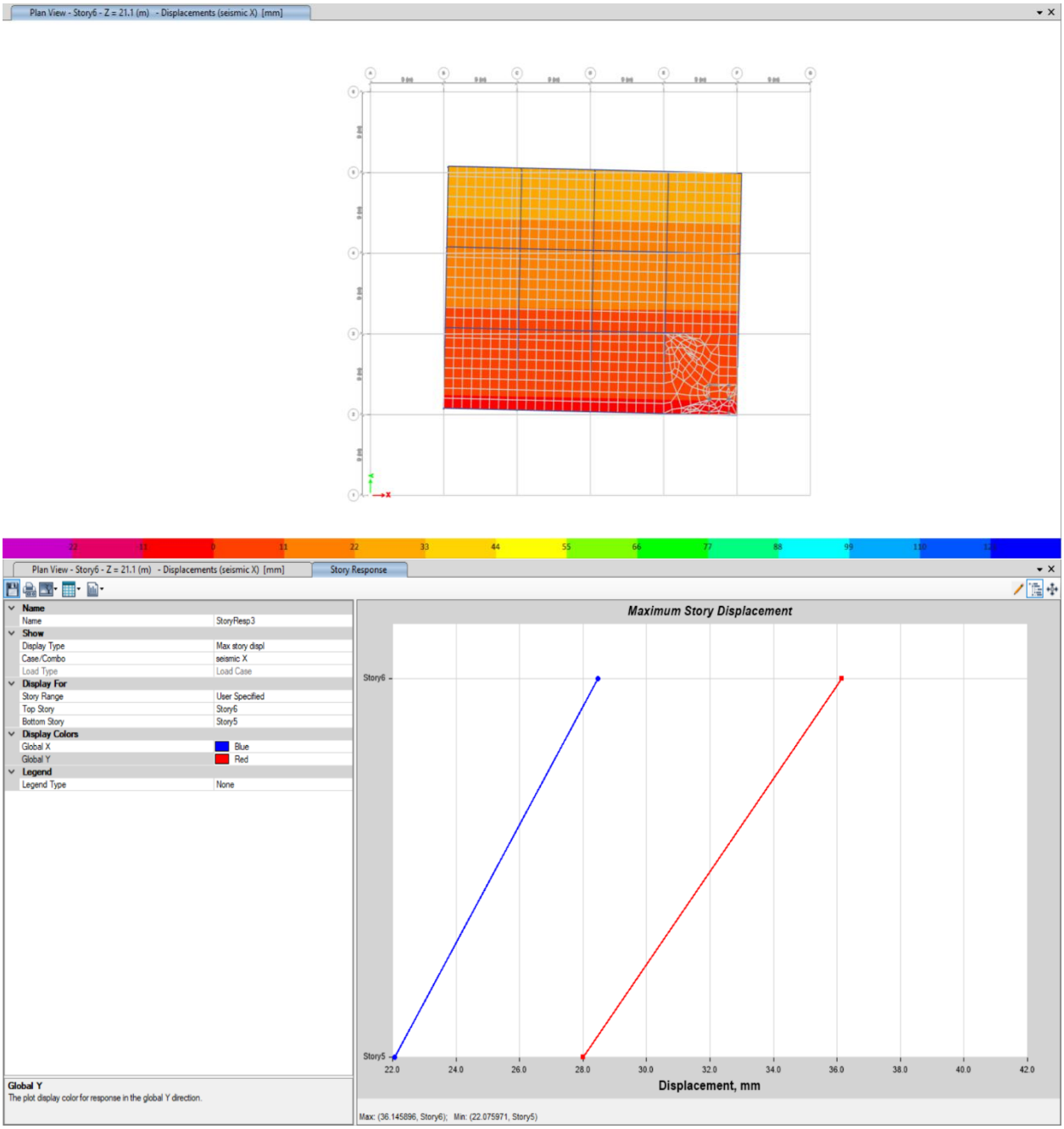


Figure A.6 – Displacement from the wind along the Y-axis

Continuation of Appendix A



Figures A.7 - Diagram of displacements of the first floor slab from seismic along X



Figures A.8 - Diagram of displacements of the floor slab of the 6th floor from seismic along X

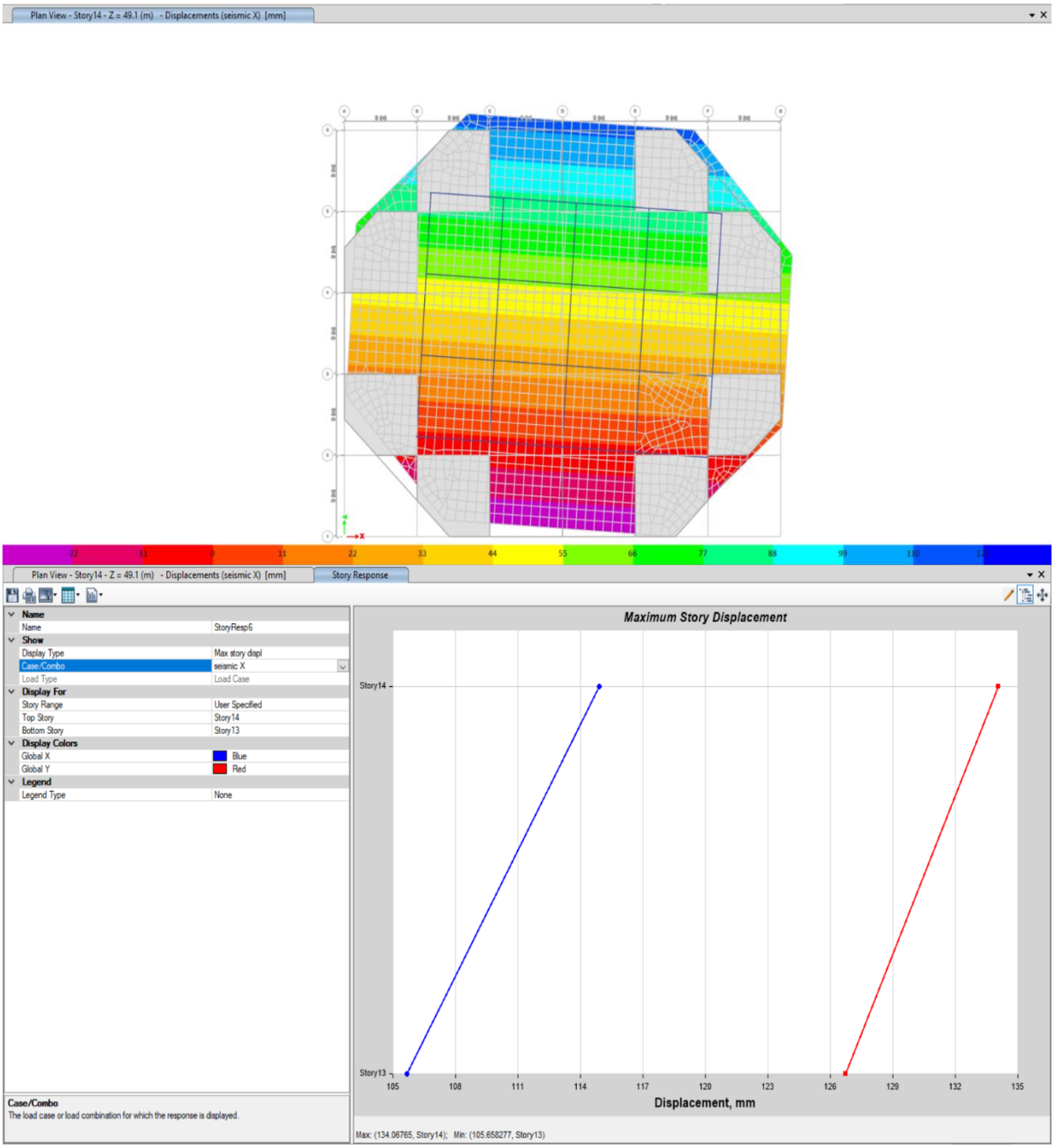


Figure A.9 -Diagram of displacements of the floor of the 14th floor from seismic along X

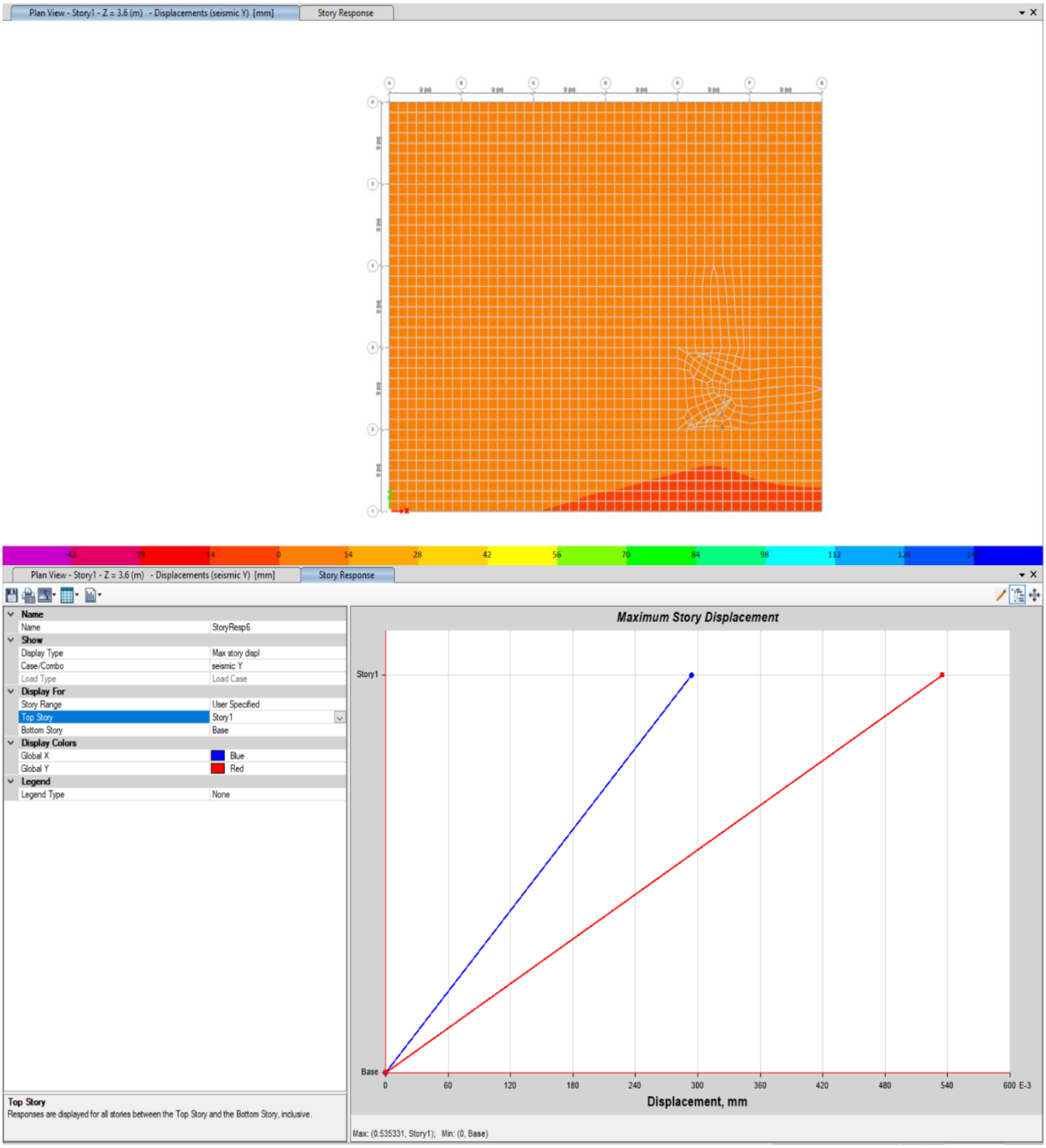


Figure A.10 - Diagram of displacements of the first floor slab from seismic survey along Y

Continuation of Appendix A

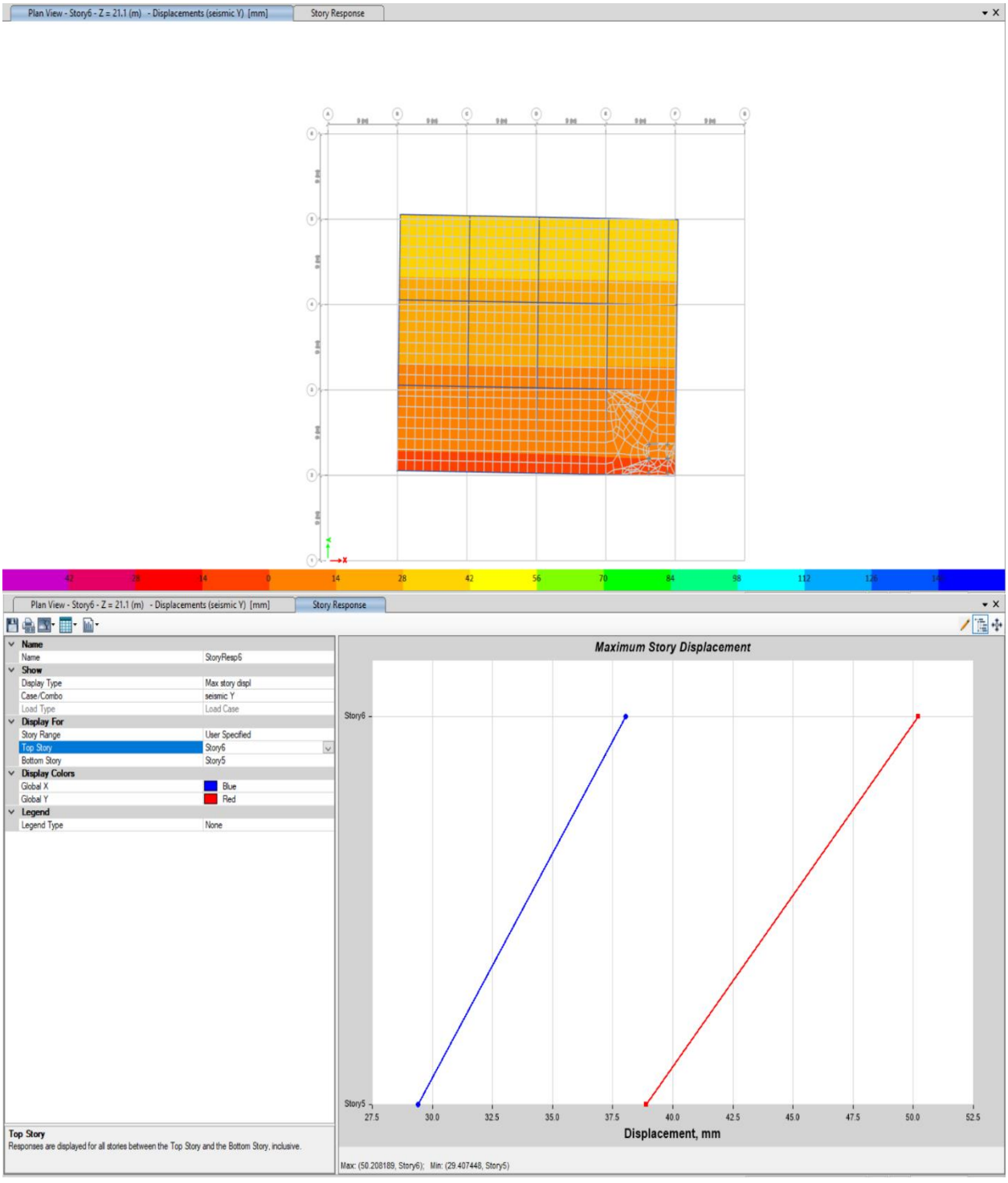


Figure A-11 - Diagram of displacements of floor 2 floor from seismic survey along Y

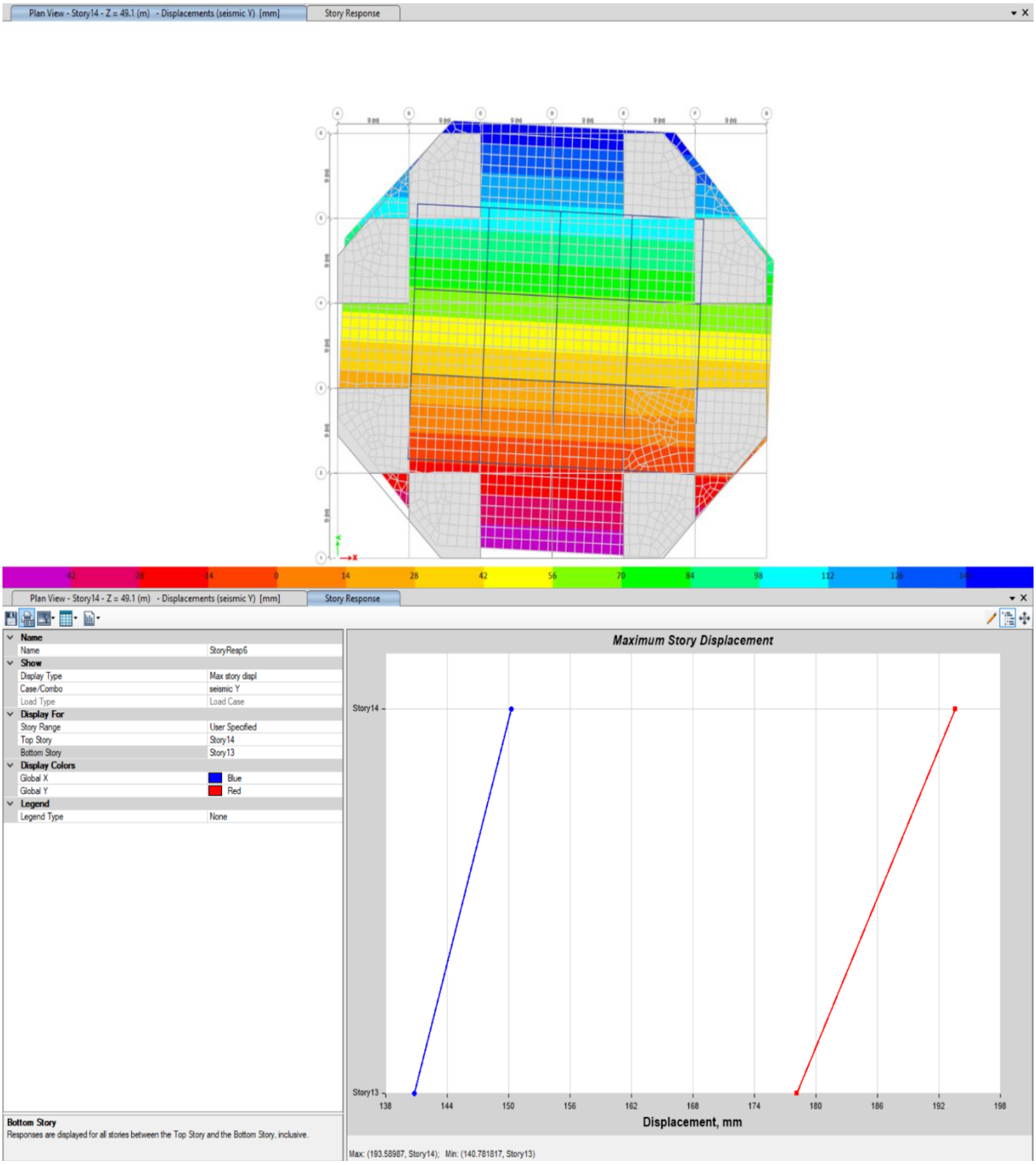


Figure A-12 - Diagram of displacements of the 1st floor slab from seismic survey along Y

Appendix B

Table B-1. Operations and Controls

Kind of control	Controlled operations	Control (method, volume)	documentation
entrance	check: The availability of a quality document The quality of the fixtures (if necessary, take the required measurements and sampling for testing); The quality of preparation and marking of the base of the base; The correctness of the installation and fixing of the formwork.	visual Visual, measurable Same thing checkup	Passport (certificate), work history
operating	check: The order of assembly of the elements of the reinforcement frame, the quality of welding (binding) of the frame nodes; The accuracy of the installation of rebar products in terms and height, reliability of their fixation; the size of the protective layer of concrete.	Technical inspection of all elements Same thing Same thing	Production journal
Matching assessment	check: Compliance with the provisions of the installed fixtures to the design; The size of the protective layer of concrete; Reliability of fixing fixtures in the formwork; the quality of welding (binding) of the frame nodes.	Visual, measurable measuring Technical inspection of all elements Same thing	Act of examination of hidden works

Continuation of Appendix B

Table B.2 - Requirement for Machines, Mechanisms, Tools and Devices

Name of equipment	Type, brand, GOST	Technical performance	destination	Number per link, piece.
Caterpillar crane	BH-1	L_{pp} 50m	Installation of the fixture	1
Transformer welding	TS-500	N q 380/220 B	Manual arc welding	2
Flat blunt-nosed file	Type A100 No. 1 GOST 1465-80	R 0.8kg	To strip the ends of the welded rebar	3
Hammer locksmith with round brisk	Type A GOST 2310-77		For subsistence work	2
Hammer shank	Type MSP-1 GOST 11042-90		To strip the welds	2
Pincers				2
Hand-cutting clippers			For cutting the fixture	3
Sledgehammer No 3	GOST 11402-75		To edit the fixture	1
Lom mounting	LM-24		To move the rebar	4
Key wrenched	GOST 7275-75			1
The flats combined	GOST 5547-93			1
The screwdriver is plumbing and mounting	GOST 24437-93		For repairs	3
Gas welder key	Yong 20.020 R.C. 716-78			1
Electric Power Holder	ED-3105VI GOST 14651-78	$d_{EL\ q}$ 4 - 6 mm R 0.42 kg	Pinning the electrode	2
Manual arc welding tool kit	ENI-300 TU 36-1162-81			1
Name of ???	Type, brand, GOST	Technical performance	destination	Number per link, piece.
Cutter injector medium power	R2A-01 TU 2605-523-81			1
Strop four-branch hook	4SK1-10.0/5000 GOST 25573-82		Lifting, moving and feeding cargo	1
Conductor universal	R.C. 80-268-001	3000´1040´300 R q 48kg	Build rebar	2
Toolbox	R.H. I.III.00.000 CNIIOMTP			1

Continuation of Appendix B

Continuation of table B.2- Requirement for Machines, Mechanisms, Tools and Devices

Name of equipment	Type, brand, GOST	Technical performance	destination	Number per link, piece.
Fixer for temporary fixture mesh	R.2. 615-76 TSNIIOMTP		Fixing the rebar nets at a 90-degree angle	10
clamp	R.C. 615-76			2
Fixers for temporary fixture frames	R.C. 70-121-001 TSNIIOMTP	$d_{art.}$ 25 ÷ 38 mm		10
Stem compression device	R.C. 615-76 TSNIIOMTP	d 20 ÷ 36 mm	Fixing for 3-cores. Reinforcement	2
Steel brush			To clean the rebar	3
Metal container box for clamps				2
Penal for electrodes	R.C. 649-76			2
Acetylene editor	DAP-1-65 GOST 13861-89		Feeding acetylene into the burner	1
Oxygen cylinder single-stage gearbox	DCP-1-65 GOST 13861-89		Oxygen supply to the burner	1
stepladder	Project 0471.00			2
stepladder	L-380			2
Roulette measuring metal	P3-2 GOST 7502-98		For the rebar marking	2
Roulette measuring metal in a closed case	P3-10 ГОСТ 7502-98		For the rebar marking	2
Plumb steel construction	OT-400 GOST 7948-80		To reconcile the fixture	2
Construction level	US2-300 GOST 9416-83			1
slide gauge	SC-1-125 GOST 166-89		To measure the diameter of the rebar	1
Welder template set	SS-2 TU 36-1163-76			1
Meter folding wooden	OST 149-76		For the rebar marking	2
Helmet construction	GOST 12.4.087-84			5
Sleeves special	Type G GOST 12.4.010-75			4 pairs
Protective glasses closed with direct ventilation	3P-2-80			2
Safety belt	GOST P 50849-96			5

Continuation of Appendix B

Continuation of table B.2- Requirement for Machines, Mechanisms, Tools and Devices

Name of equipment	Type, brand, GOST	Technical performance	destination	Number per link, piece.
Protective glasses closed with indirect ventilation	3N5-80			2
Shield protective facial for electric welder (with light filter)	Type NN GOST 12.4.035-78			2
Rubber uniforms	GOST 5375-79			5
Rubber gloves	GOST 20010-93			2
Dielectric rubber mat	GOST 4997-75			2
The device is protective-disconnecting	IE-9813 TU 22-4677-80			2
Respirator mask				4
Direct grinding machine				1
Electrohydrocuscus				1

Table B.3 - Composition of specialized links and distribution of worbetween them

The name of the installed items	Line-up		How to work
	profession	quantity	
Armature nets weighing 20 to 100 kg	Fixture-installer:		Installation of nets manually with the supply to the place of laying crane in packages from vehicles without intermediate storage
	2 discharges	2	
	3 grades	1	
	total:	3	
100 - 500 kg of armature nets	Fixture-installer:		Installation of crane from vehicles
	2 discharges	3	
	3 grades	1	
	total:	4	
Armature nets weighing between 600 and 3,000 kg using supports and frames	Fixture-installer:		Installation of crane from vehicles
	2 discharges	3	
	4th class	1	
	total:	4	
Enlarging the assembly of spatial frames and blocks in the on-site workshop	Fixture:		Assembling on the stand crane nets and frames in blocks with electrical grip and staging elements of rigidity
	2 discharges	1	
	4th class	1	
	total:	2	

Continuation of Appendix B

Table B.4 - Calculating labor and machine time costs for installation of rebar grids, frames and blocks Final product rebar.

Justification (NINR et al. norms)	The name of the works	Units. ism.	Volume of work	Time standards		Labor costs	
				workers, people.-h.	machinists, people,-h., (machine work, mash-h.)	workers, people.-h.	machinists, people,-h., (machine work, mash-h.)
E1-5 No 2 No 11	Supply of reinforcement nets, flat and spatial frames by crane to the installation site	171 tonnes	0,10	3,2	1,6	0,32	0,16
	Assembling and consolidating spatial blocks and frames with a crane on the site of the enlarged assembly	171 tonnes	0,05	80	42,0	4,0	2,10
	Loading and transporting spatial blocks and frames to the installation site	171 tonnes	0,05	16,0	6,0	0,8	0,30
E4-1-44A T 1. p. 3 (applied)	Installation of crane spatial blocks and frames in the design position	1 block	5	4,1	0,28	20,50	1,40
E4-1-44 Table. 1	Installation of flat nets and frames with a crane in the design position	1 mesh, frame	17	0,6	0,1	12,0	1,7
	Welding (binding) nodes of reinforcement mesh connections, frames	1 т	10,0	1,2	-	12,0	-

Appendix C

OBJECT ESTIMATE

Estimated Cost	**107500000** Thous.Tenge
Normative Labor Intensity	**13.213** Thous.pers.h
Estimated Wages	**5495.41** Thous.Tenge

Compiled in prices for 01.1. 2001 y

№ п/п	No. of estimates and calculations	Name of works and costs	Estimated Cost, Thous. Tenge				Normative Labor Intensity	Estimated Wages
			construction and installation works	equipment, furniture and inventory	other costs	Total		
1	2	3	4	5	6	7	8	9
1	1	Administrative Building	2764501	--	--	107500000	38.082	2736.023
2		**Total**	2764501	--	--	**2764501**	38.082	2736.023
3		Temporary buildings and structures	30409.511	--	--	30409.511	38.082	2736.023
4		Return of materials from temporary buildings and structures	4561.42665	--	--	4561.42665	38.082	2736.023
5		**Total**	30409.511	--	--	**30409.511**	38.082	2736.023
6		**Total**	2794910.511	--	--	**2794910.511**	38.082	2736.023
7		Additional costs in the production of work in the winter	33538.92613	--	--	33538.92613	38.082	2736.023
8		Seniority costs			27949.10511	27949.10511	38.082	2736.023
9		Additional vacation costs			11179.64204	11179.64204	38.082	2736.023
10		**Total**	**33538.92613**		**39128.74715**	**72667.67329**	38.082	2736.023
11		**Total**	2828449.437		39128.74715	2867578.184	38.082	2736.023
12		Including refundable amounts	4561.42665		--	4561.42665	38.082	2736.023
13		**Total according to the estimated calculation in the base prices of 2001.**	2828449.437		39128.74715	2867578.184	38.082	2736.023
14		Total estimated at current prices in 2021.	9673297.075		133820.3153	9807117.39	38.082	2736.023
15		Including refundable amounts in current prices	15600.07914			15600.07914	38.082	2736.023
16		Taxes, fees, mandatory payments,			196142.3478	196142.3478	38.082	2736.023
17		Estimated cost at current price level	9673297.075		329962.6631	10003259.74	38.082	2736.023
18		НДС (12%)			1200391.169	1200391.169	38.082	2736.023
19		Construction cost	9673297.075		1530353.832	11203650.91	38.082	2736.023

Figure C.1- Objective estimation

Continuation of Appendix C

Estimated calculation of the cost of construction in the amount of 21r 9c	107500000	Thous.Teng
including refundable amounts: 16r 9c	**7266.10738**	Thous.Teng
value added tax 17r9c	559110.697	Thous.Teng

ESTIMATE CALCULATION OF THE COST OF CONSTRUCTION

Compiled in prices for 01.1. 2001 y

№ п/п	No. of estimates and calculations	Name of works and costs	Estimated cost, Thous.Tenge			Total, Thous. Tenge
			construction and installation works	equipment, furniture and inventory	other costs	
1	2	3	4	5	6	7
1	1	Administrative Building	1287632	--	--	1287632
2		**Total=1 row**	1287632	--	--	**1287632**
3		Temporary buildings and structures 1,1%*2 row 7column	14163.952	--	--	14163.952
4		Return of materials from temporary buildings and structures 15%*3r7c	2124.5928	--	--	2124.5928
5		**Total=3 row**	14163.952	--	--	**14163.952**
6		**Total 2r+5r**	1301795.952	--	--	**1301795.952**
7		Additional costs in the production of work in the winter1,2%*6r7c	15621.55142	--	--	15621.55142
8		Seniority costs 1%*6r7c			13017.95952	13017.95952
9		Additional vacation costs 0,4%*6r7c			5207.183808	5207.183808
10		**Total 7r+8r+9r**	**15621.55142**		**18225.14333**	**33846.69475**
11		**Total 6r+10r**	1317417.503		18225.14333	1335642.647
12		Including refundable amounts=4r	2124.5928		--	2124.5928
13		**Total according to the estimated calculation in the base prices of 2001..=11r**	1317417.503		18225.14333	1335642.647
14		Total estimated at current prices in 2021. 13r*3,42	4505567.862		62329.99018	4567897.852
15		Including refundable amounts in current prices 12r7c*3,42	7266.107376			7266.107376
16		Taxes, fees, mandatory payments,2%*14r7c			91357.95704	91357.95704
17		Estimated cost at current price level 14r+16r	4505567.862		153687.9472	4659255.809
18		НДС (12%)*17r7c			559110.6971	559110.6971
19		Construction cost17r+18r	4505567.862		712798.6443	5218366.506

Figure C.2- calculation of the cost of the construction

Continuation of Appendix B

OBJECT ESTIMATE

Estimated Cost	**107500000**	Thous.Tenge
Normative Labor Intensity	**13.213**	Thous.pers.h
Estimated Wages	**6000**	Thous.Tenge

Compiled in prices for 01.1. 2001 y

№ п/п	No. of estimates and calculations	Name of works and costs	Estimated Cost, Thous. Tenge				Normative Labor Intensity	Estimated Wages
			construction and installation works	equipment, furniture and inventory	other costs	Total		
1	2	3	4	5	6	7	8	9
1	1	Administrative Building	151687	--	--	107500000	38.082	2736.023
2		**Total**	151687	--	--	**107500000**	38.082	2736.023
3		Temporary buildings and structures	1182500	--	--	1182500	38.082	2736.023
4		Return of materials from temporary buildings and structures	177375	--	--	177375	38.082	2736.023
5		**Total**	1182500	--	--	**1182500**	38.082	2736.023
6		**Total**	1334187	--	--	**1334187**	38.082	2736.023
7		Additional costs in the production of work in the winter	16010.244	--	--	16010.244	38.082	2736.023
8		Seniority costs			13341.87	13341.87	38.082	2736.023
9		Additional vacation costs			5336.748	5336.748	38.082	2736.023
10		**Total**	**16010.244**		**18678.618**	**34688.862**	38.082	2736.023
11		**Total**	1350197.244		18678.618	1368875.862	38.082	2736.023
12		Including refundable amounts	177375		--	177375	38.082	2736.023
13		**Total according to the estimated calculation in the base prices of 2001.**	1350197.244		18678.618	1368875.862	38.082	2736.023
14		Total estimated at current prices in 2021.	4617674.574		63880.87356	4681555.448	38.082	2736.023
15		Including refundable amounts in current prices	606622.5			606622.5	38.082	2736.023
16		Taxes, fees, mandatory payments,			93631.10896	93631.10896	38.082	2736.023
17		Estimated cost at current price level	4617674.574		157511.9825	4775186.557	38.082	2736.023
18		НДС (12%)			573022.3868	573022.3868	38.082	2736.023
19		Construction cost	4617674.574		730534.3694	5348208.944	38.082	2736.023

Figure C.3 – objective estimate

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РЕСПУБЛИКИ КАЗАХСТАН
КАЗАХСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ
имени К.И. САТПАЕВА

RESPONSE

OF THE SUPERVISOR
for the graduation project

Salehuddin Frotan
5B072900-Civil Engineering

Topic: **«Administrative building with solar heating system in Almaty»**

The student Salehuddin Frotan showed good preparation and professional literacy during the study.

Salehuddin Frotan completed his thesis in full and completed the literacy for further work in this specialty.

All sections are made at a good level and fully meet the requirements for the thesis. An analytical review of the selected design of the administrative building was carried out, the seismicity of the city of Almaty was taken into account. The architectural-planning and structural sections were developed in accordance with the issued task. The technical and economic review and construction production technology have been developed at a good level.

The thesis is completed at a good level and meets the requirements for bachelor's theses. Salehuddin Frotan deserves a high score of 91 points.

Supervisor
Master of technical science, senior- lecturer
_____Kyzylbayev N.K.

«30» may 2021 yr.

Протокол анализа Отчета подобия Научным руководителем

Заявляю, что я ознакомился(-ась) с Полным отчетом подобия, который был сгенерирован Системой выявления и предотвращения плагиата в отношении работы:

Автор: Фротан Салехуддин

Название: Administrative building with solar heating system in Almaty

Координатор:Нурлан Кызылбаев

Коэффициент подобия 1:2.7

Коэффициент подобия 2:0.6

Замена букв:93

Интервалы:0

Микропробелы:45

Белые знаки: 0

После анализа Отчета подобия констатирую следующее:

☐ обнаруженные в работе заимствования являются добросовестными и не обладают признаками плагиата. В связи с чем, признаю работу самостоятельной и допускаю ее к защите;

☐ обнаруженные в работе заимствования не обладают признаками плагиата, но их чрезмерное количество вызывает сомнения в отношении ценности работы по существу и отсутствием самостоятельности ее автора. В связи с чем, работа должна быть вновь отредактирована с целью ограничения заимствований;

☐ обнаруженные в работе заимствования являются недобросовестными и обладают признаками плагиата, или в ней содержатся преднамеренные искажения текста, указывающие на попытки сокрытия недобросовестных заимствований. В связи с чем, не допускаю работу к защите.

Обоснование:

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…… ……

Дата *Подпись Научного руководителя*

Протокол анализа Отчета подобия

заведующего кафедрой / начальника структурного подразделения

Заведующий кафедрой / начальник структурного подразделения заявляет, что ознакомился(-ась) с Полным отчетом подобия, который был сгенерирован Системой выявления и предотвращения плагиата в отношении работы:

Автор: Фротан Салехуддин

Название: Administrative building with solar heating system in Almaty

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Коэффициент подобия 1:2.7

Коэффициент подобия 2:0.6

Замена букв:93

Интервалы:0

Микропробелы:45

Белые знаки:0

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☐ обнаруженные в работе заимствования не обладают признаками плагиата, но их чрезмерное количество вызывает сомнения в отношении ценности работы по существу и отсутствием самостоятельности ее автора. В связи с чем, работа должна быть вновь отредактирована с целью ограничения заимствований;
☐ обнаруженные в работе заимствования являются недобросовестными и обладают признаками плагиата, или в ней содержатся преднамеренные искажения текста, указывающие на попытки сокрытия недобросовестных заимствований. В связи с чем, работа не допускается к защите.

Обоснование:

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Дата *Подпись заведующего кафедрой /*

начальника структурного подразделения

Окончательное решение в отношении допуска к защите, включая обоснование:

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начальника структурного подразделения