OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

LIMNOS 20 YEARS

CONSTRUCTION OF A REED BED FILTER FOR THE TREATMENT OF SLUDGE IN MOJKOVAC, MONTENEGRO

1st PROGRESS REPORT

Ljubljana, December 2015

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

LIMNOS 20 YEARS

Project title	**CONSTRUCTION OF A REED BED FILTER FOR THE TREATMENT OF SLUDGE IN MOJKOVAC, MONTENEGRO**
Contract number	3000022717
Contracting Authority	United Nations Industrial Developmen organization (UNIDO) Wagramer Strasse 5, A-1220 Vienna, Austria
Contractor	LIMNOS Company for Applied Ecology Ltd. Požarnice 41 1351 Brezovica pri Ljubljani Slovenia Contact person: prof. Danijel Vrhovšek, PhD
Responsible project leader	Prof. Danijel Vrhovšek, PhD
Project collaborators	Gregor Plestenjak, PhD Tea Erjavec Haložan, BSc Geography and Slovenian Language Anja Potokar, BSc Water Management and Municipal Engineering Martin Vrhovšek, BSc Biology
Director	Marjana Vrhovšek, BSc Biology
Date	4.12.2015

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

*The project "*Construction of a reed bed filter for the treatment of sludge in Mojkovac, Montenegro*" was financed by the Slovenian Ministry of Economic Development and Technology.*

1 INTRODUCTION

1.1. About Mojkovac

Mojkovac municipality is located in Northern Montenegro. With 8.622 inhabitants Mojkovac is one of the smallest and least developed of the 21 municipalities in Montenegro. With 19.3% the poverty rate in the Northern Region is significantly higher than the national average. On the other hand, the region has substantial potential for the development of various types of tourism. With the development of tourism being one of the Montenegrin priorities for economic development, the protection of natural resources from environmental pollution is of utmost importance.

Mojkovac town is one of the most important agglomerations in Northern Montenegro. The town is located on the left shore of the Tara river upstream the Tara River Gorge. Tara River Gorge is the longest canyon in Montenegro and Europe and second longest in the world after Grand Canyon. The canyon is protected as a UNESCO World Heritage Site, and is a part of Biogradska Gora National Park and Durmitor National Park. Tara River combined with the beautiful landscape of the Tara River Gorge are valuable assets for the further development of the region's touristic potential in particular for water sports and water related recreational activities like angling, rafting, kayaking etc.

1.2. Wastewater treatment

The town is equipped with a biological wastewater treatment plant (mechanical, biological and chemical stage) with an installed capacity of 5.200 PE. The municipality lacks the landfill capacity to store high amount of untreated sludge and has no sustainable concept to manage this sludge. In the absence of storage capacity and a sludge treatment and management concept, untreated sludge is stored on the premises of the waste water treatment plant with the risk of being washed back to the Tara River in high intensity rainfall events. This would result in waterbody pollution of the Tara River, which is of crucial importance for the development of the touristic potential of the region. With waste water treatment and sludge management being among the highest priority issues in the area of environmental protection and development of the Durmitor regions, wider region of the national park "Biogradska Gora" high touristic potential a priority for the region. Conventional sludge treatment by means of a filter press requires high investment costs and results in high energy as well as operations and maintenance costs. Therefore an alternative technology that mimics the biochemical processes inherent in natural wetlands, called "reed beds", will be introduced for Mojkovac waste water treatment plant.

1.3. Eco-remediation measures and sludge reed bed filters

LIMNOS Company for Applied Ecology is engaged in research, development and application of natural ecosystems for the protection and restoration of the environment. The company provides

solutions that take into account the significance, structure and functioning of ecosystems (ECO-REMEDIATIONS-ERM).

Eco-remediation (ERM) measures offer ecological solutions for protection against and reduction of pollution. ERM measures are based on natural systems and processes and enable environment protection and restoration on the ecosystem level through enhancement of ecosystem capacities and services, especially self-purification and buffering functions. The functional parts of ERM measures are phytoremediation, bioremediation, micoremediation and similar processes. One of the main aims of ERM concept is to integrate, exchange, combine, and use multi-functionality of different kind of green technologies to obtain innovative and sustainable solutions for environmental protection.

ERM are mostly used in the form of constructed wetlands (CW) for wastewater treatment, vegetation covers for removal of pollutants and water retention, waste stabilization ponds, storm water ponds, vegetated drainage ditches, buffer zones, vegetation strips, watercourse revitalization etc. Due to complexity of the natural systems and processes, ERM offers a development of many new approaches to the environment protection and restoration. ERM systems are multifunctional: they increase the self-cleaning capacity of the environment, enable water retention and restore the habitats for wildlife. Similar to constructed wetlands for wastewater treatment, sludge reed bed technology usually called sludge drying reed beds (SDRB) uses plant uptake, in addition to evapotranspiration, microbial decomposition, and drainage, to stabilize and dewater the sludge. Sludge applied to SDRB is turned into a compost-like material that can be used as a soil conditioner. Reed beds act to dewater and reduce the organic content of the sludge, reduce the metals concentrations of the sludge, and stabilize the sludge for subsequent disposal. This is the result of the following: first, the reed root system provides oxygen to the sludge, which increases the activity and population of microorganisms that mineralize the sludge; second, the growth of the plants makes use of the nutrients, minerals, and water in the sludge.

The system will consists in two beds constructed in parallel and alternately fed which allowed sufficient rest period for dewatering and progressive mineralization of the sludge deposit.

The reed bed dewatering sewage sludge technology leads after 8 to 12 years operation to sludge humus, which offers many applications for an economically reasonable recycling of the earthy material. The final product smells like humus and does not resemble sewage sludge any more. Pathogens are reduced and some of the organic pollutants are degraded. Therefore the humification can contribute to an improvement of the acceptance of sludge reuse in agriculture or cultivation. Should the requirements for agricultural utilisation of the product not be met, the substrate can still be incinerated. The reduction of the water content makes it then easier to transport and more suitable for incineration plants.

The implementation of constructed reed bed filters is a cost effective and environmentally sound alternative for the drying and composting produced sludge in Mojkovac's WWTP. This technology, has been gaining acceptance worldwide for its simple and low-cost operation, minimal maintenance and significant sludge volume reduction.

1.4. Aim of the project

The proper utilization and disposal of sludge (biosolids) is one of the most critical issues facing wastewater treatment plants today. Nearly all WWTP plant operators face the problem of storing and disposing biosolids. Landfill costs are skyrocketing; incineration permits are expensive and difficult to obtain; and land application is limited by availability of permitted land. However, constructed wetland technology such as SDRB constitutes an environmentally sound technology which provides long-term storage and volume reduction of biosolids to mitigate these concerns.

Widely used worldwide SDRB technology features low construction costs and minimal day-to-day operation and maintenance costs. The system reduces water content, minimizes solids, and provides sufficient storage time to stabilize and mineralize biosolids prior to disposal.

As already mentioned the preservation of pristine quality of the water of Tara River for the realization of the Durmitor region's touristic development is of upmost importance. The modernization of existing wastewater plant in Mojkovac is therefore obligatory. Main aim of the project is to build SDRBs with all additional installations and facilities. Following the specific engineer requirements is our primary obligation in order to enable Mojkovac municipality to protect the environment and Tara River basin.

2 DOCUMENTATION

Before tender application and signing of the contract for sludge treatment in WWTP Mojkovac terms of references (TOR) were presented. TOR contained some general provision about contractor requirements and some general information about project. However most important provision in TOR was that the reed bed filter has to be built as per the detailed technical design and the bill of quantities (BOQ) of Request for Proposal.

2.1. General information from TOR:

Sludge generated in the existing wastewater treatment plant is currently only stored in a sludge thickener. Under this contract a system of sludge drying reed beds for dewatering and further treatment of the sludge shall be constructed. The system comprises:

- a siphon for removal of sludge from the cone of the existing thickener into
- a sludge pumping station. From this pumping station the sludge will be pumped to
- two sludge drying reed beds with a surface area of 450m¸ each (12m by 37,5m).
- Seepage will be returned to the wastewater treatment plant by
- a seepage pumping station.

The entire system which shall be constructed is described in the following. More details can be found in the specifications of the relevant positions in the BoQ.

2.2. Detailed technical design

A technical design was presented by Austrian company EcoSan Club. It contained general information about process description, current situation, design, operation and construction.

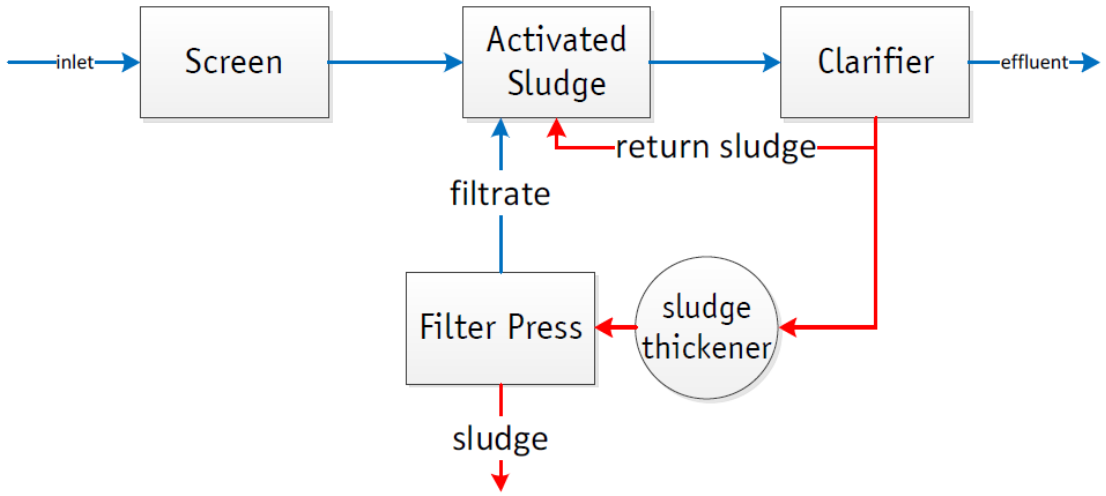


Figure 1:Current wastewater and sludge treatment on WWTP Mojkovac

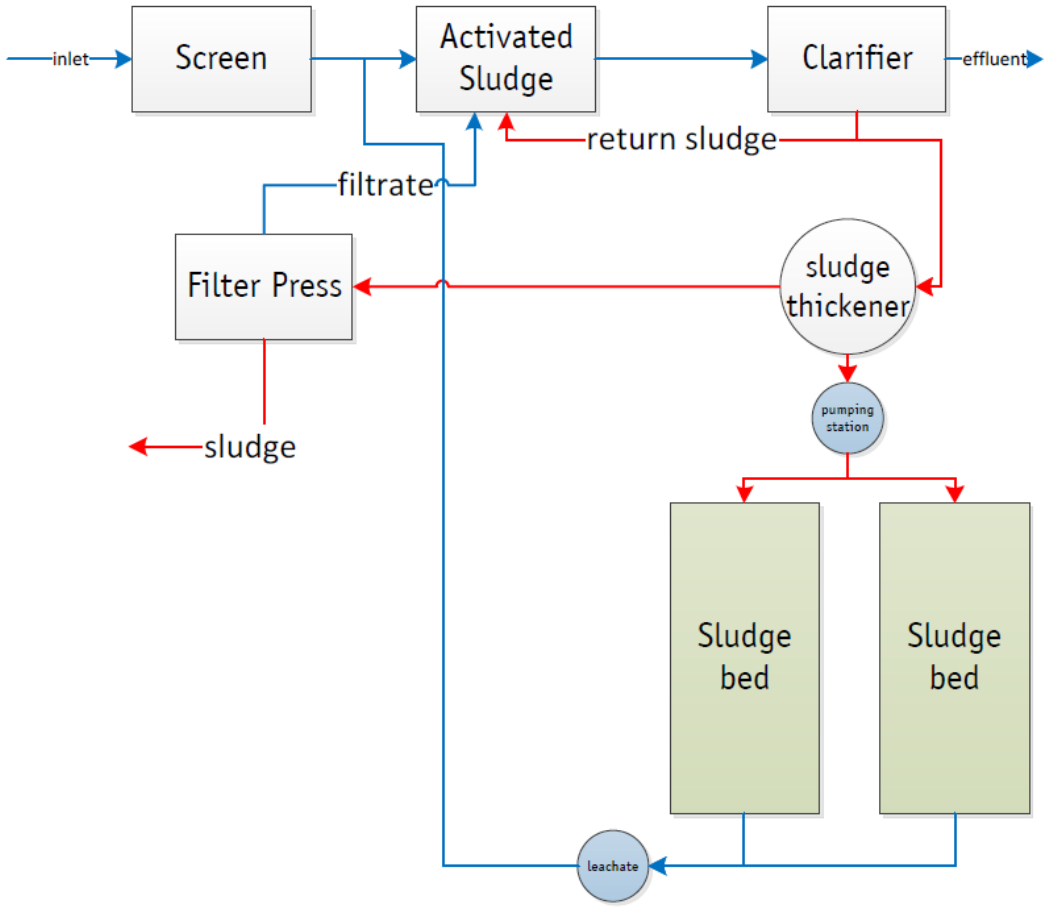


Figure 2: Proposed new flow scheme (EcoSan Club)

General and design information from technical design:

General:

Sludge drying reed beds may be realized as concrete basins or basins sealed with synthetic sheets (rubber, PE, PP). Commonly the depth is between 1,2 and 1,7m. Leachate will be recirculated to the wastewater treatment plant (inlet activated sludge tank).As a rough estimate the required specific surface area can be assumed with 0,25-0,50m²/PE. This assumption results in a total required (net) area of 1.300 to 2.600m² for 5.250 PE.

Design

Currently the treatment plant has a nominal capacity of 50% of the design capacity, i.e. app. 2.600PE. For this reason and also because the client confirmed that there will be no need for extension at least for the next 25 years the sludge treatment will be designed for a capacity of 2.600PE.

Load	2600	PE
Relative sludge generation activated sluge	80 g/PE/d	TSS
	55 g/PE/d	vTSS
	99 %	water content
Relative sludge generation P-precipitation	15 g/PE/d	TSS
	3 g/PE/d	vTSS
	99 %	water content
Thickener efficiency	95 %	water content
Sludge drying reed bed efficiency	60 %	water content

Thickener volume	170,9 m³	
Thickener volume effective	145,8 m³	minus clear water 0,5m
Thickener volume before last loading	146,2 m³	
Storage time theoretical	**30,6 d**	
Thickerner area	50,3 m²	
Surface load	0,5 m/d	
	4,9 kg/m²/d	<20-50

Surplus sludge after activated sludge	247,0 kg/d	
	24,7 m³/d	
Surplus sludge after thickener	247,0 kg/d	
	4,9 m³/d	
Sludge after dewatering in sludge drying bed	247,0 kg/d	
	0,6 m³/d	
	225,4 m³/a	
max. permissible sludge level increase	0,2 m/a	
Required area sludge drying reed bed	1126,9 m²	
Sludge after dewatering in sludge drying bed assuming full stabilisation	192,4 kg/d	
	0,5 m³/d	
	175,6 m³/a	
max. permissible sludge level increase	0,2 m/a	
Required net area sludge drying reed bed	**877,8 m²**	

discharge intervall	14 d	
no of beds	2 pcs	
max. height of 1 discharge	0,16 m	<0,2

Table 1: Design calculations provided by EcoSan Club

Also site construction site location and facility drawings were presented.

Figure 3: Site location by EcoSan Club

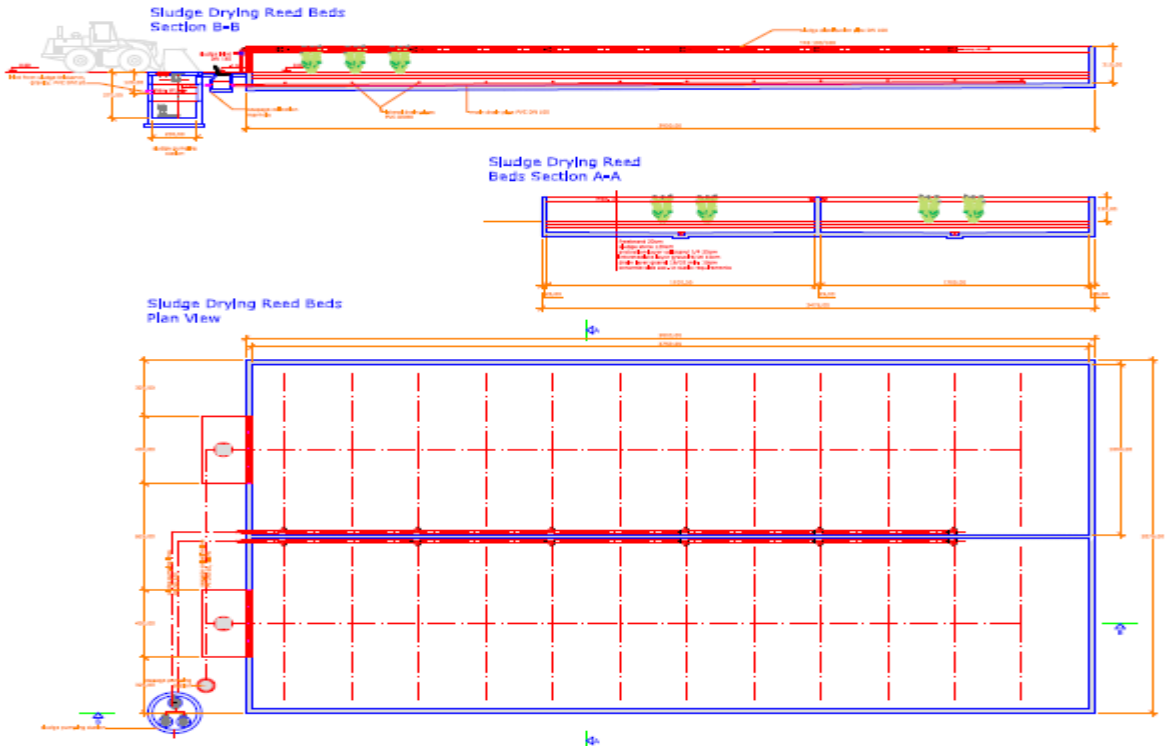


Figure 4: Facility drawings by EcoSan Club

Operation:

A sludge drying reed be will be used for a total design period of 8-12 years. At an interval of 2-3 weeks (depending on the season and the actual progress of dewatering) sludge will be pumped to the sludge drying reed bed, the quantity designed to achieve a maximum increase in sludge level of 20cm per year.

After reaching the maximum design sludge level a resting period of 12 months starts, during which no sludge will be added and the composting process completed. After this period the sludge will be removed from the sludge drying reed bed and the process starts afresh.

Depending on the actual quality and the intended utilization an additional storage period of the sludge may be required after removing it from the sludge drying reed bed.

3 CONSTRUCTION PERMIT

Upon signing of the contract between Limnos (the contractor) and Unido, the contractor tried to immediately start with the construction of SDRB for sludge treatment at Mojkovac WWTP. Unfortunately the documentation provided by EcoSan Club was insufficient to meet Montenegrin regulations for obtaining construction permit and possibility to start with the construction.

Therefore the first task was to connect with several Montenegrin partners who helped us with the preparation of documentation that would be sufficient to meet Montenegrin regulation to release construction permit.

The construction permit consists of:

- General documentation
- Urban technical requirements
- Construction description/plan
- Electro installations
- Safety at work elaborate

3.1. General documentation

All documents in the file for obtaining of construction permit have to be realised by companies that are viable and are registered in the Montenegrin Chamber of Engineers. Also all licences, insurance policies and detailed documentation with descriptions and calculations about each part of the project must be presented.

3.2. Urban technical requirements

In this part the contractor had to present detailed technical design that had to contain much more information compared to technical design released by EcoSan Club. First it was necessary to determine location of the object in the area predicted. Therefore a detailed geometrical survey of site location had to be done. With geometrical data the contractor could place the objects in space and prepare detailed drawing of the object with all necessary information for smooth construction.

Also, the initial BOQ was amended with several details. The contractor prepared detailed BOQ for each of the construction phases (construction, pipeline installation, electric installation) with real on site quantities.

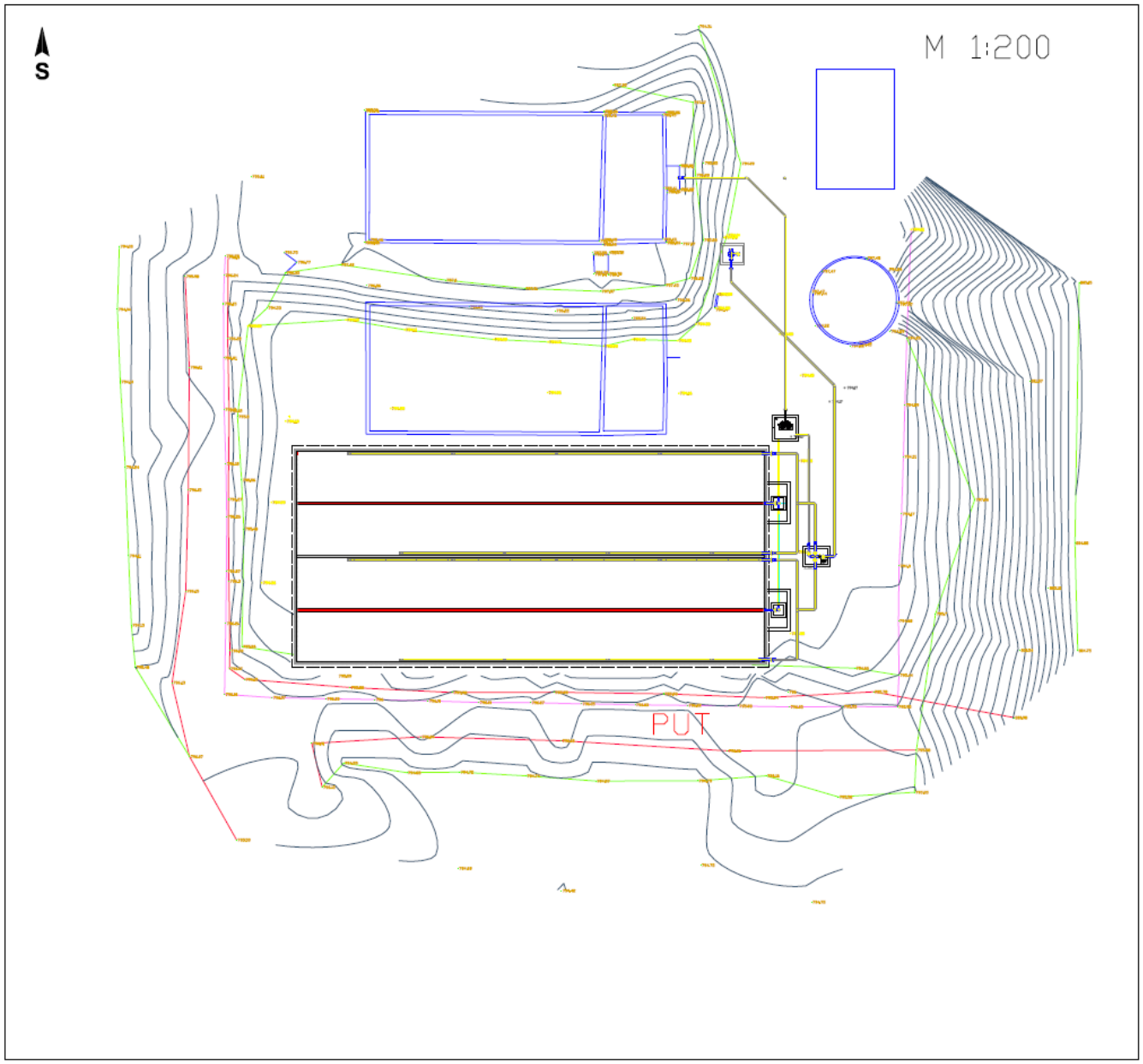


Figure 5: Final drawing of situation

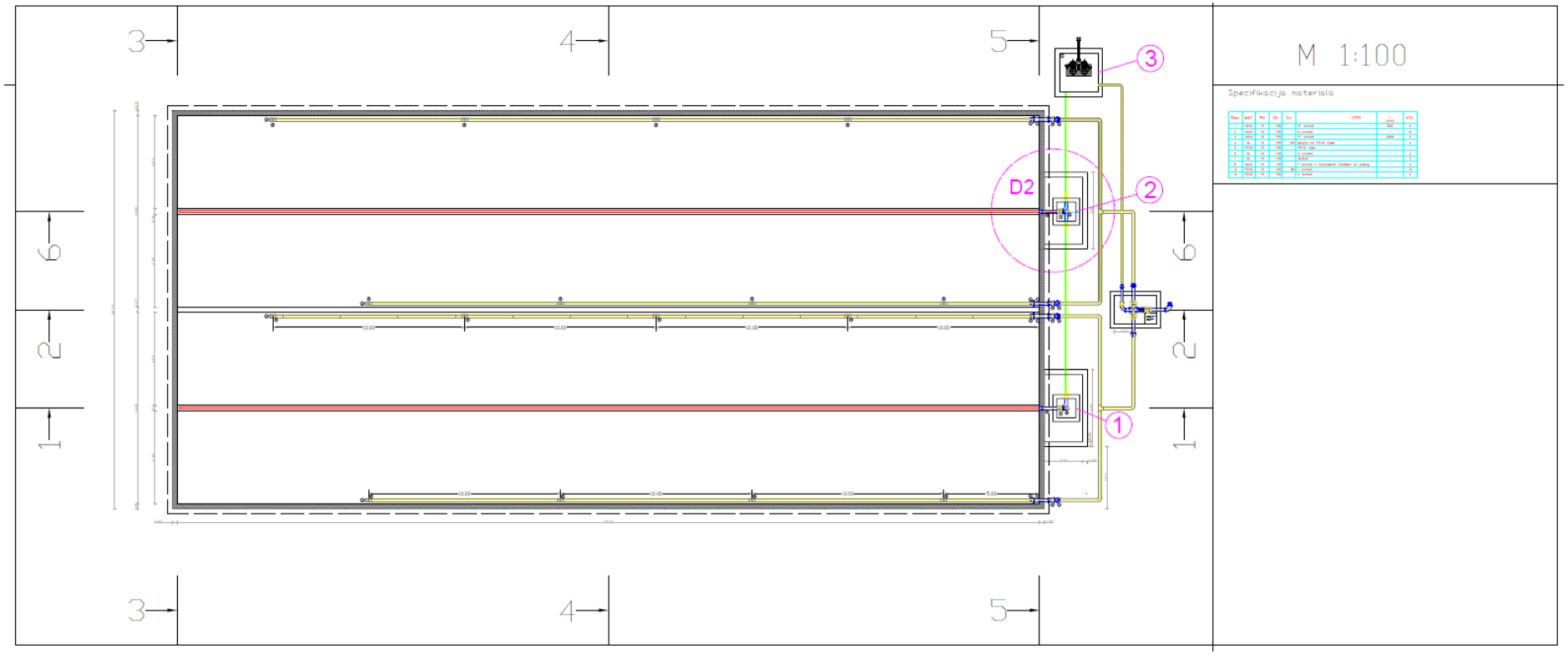


Figure 6: Ground plan of SDRB in Mojkovac WWTP

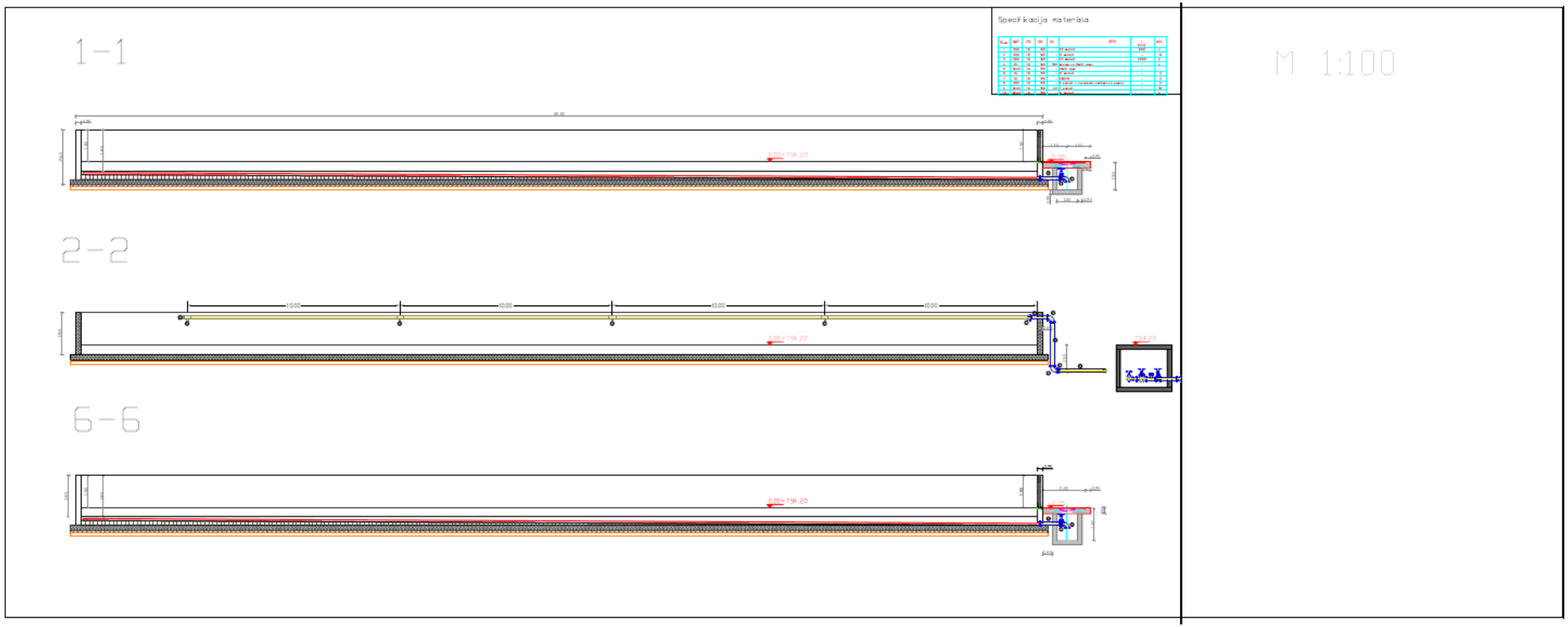


Figure 7: Longitudinal section of SDRB in Mojkovac WWTP

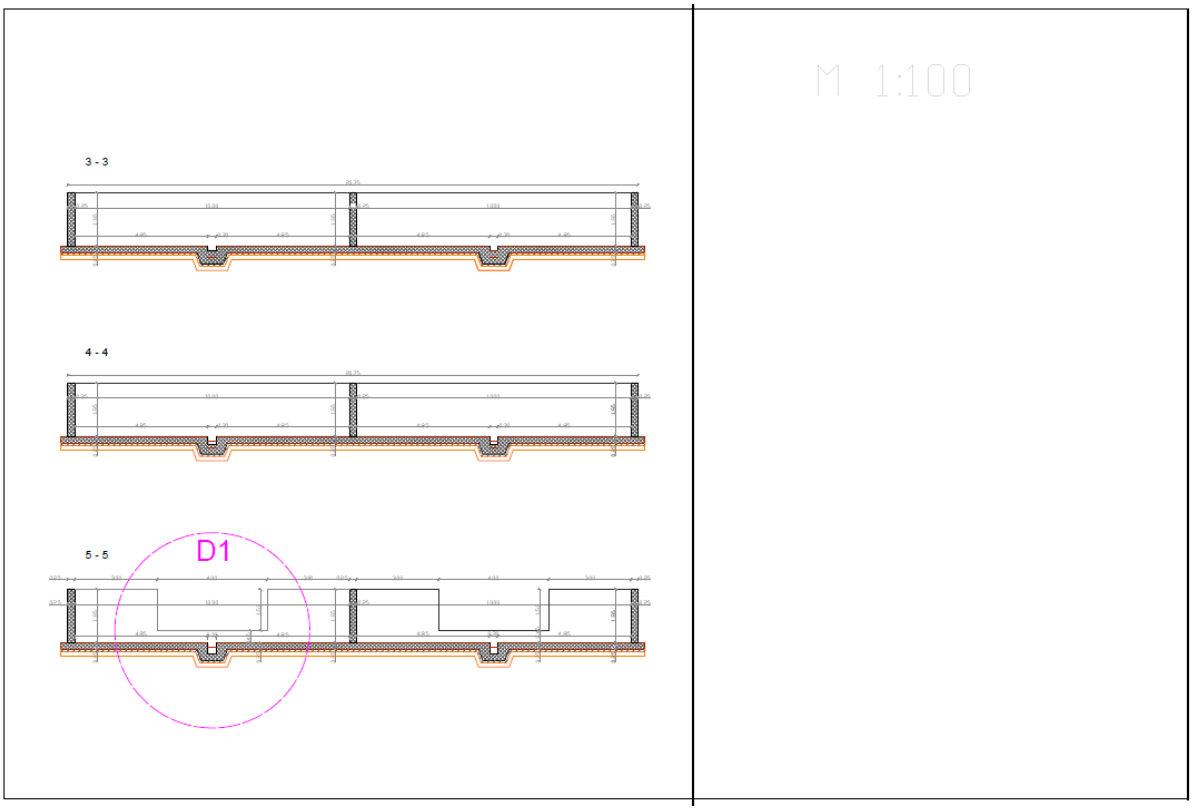


Figure 8: Transverse cross section of SDRB in Mojkovac WWTP

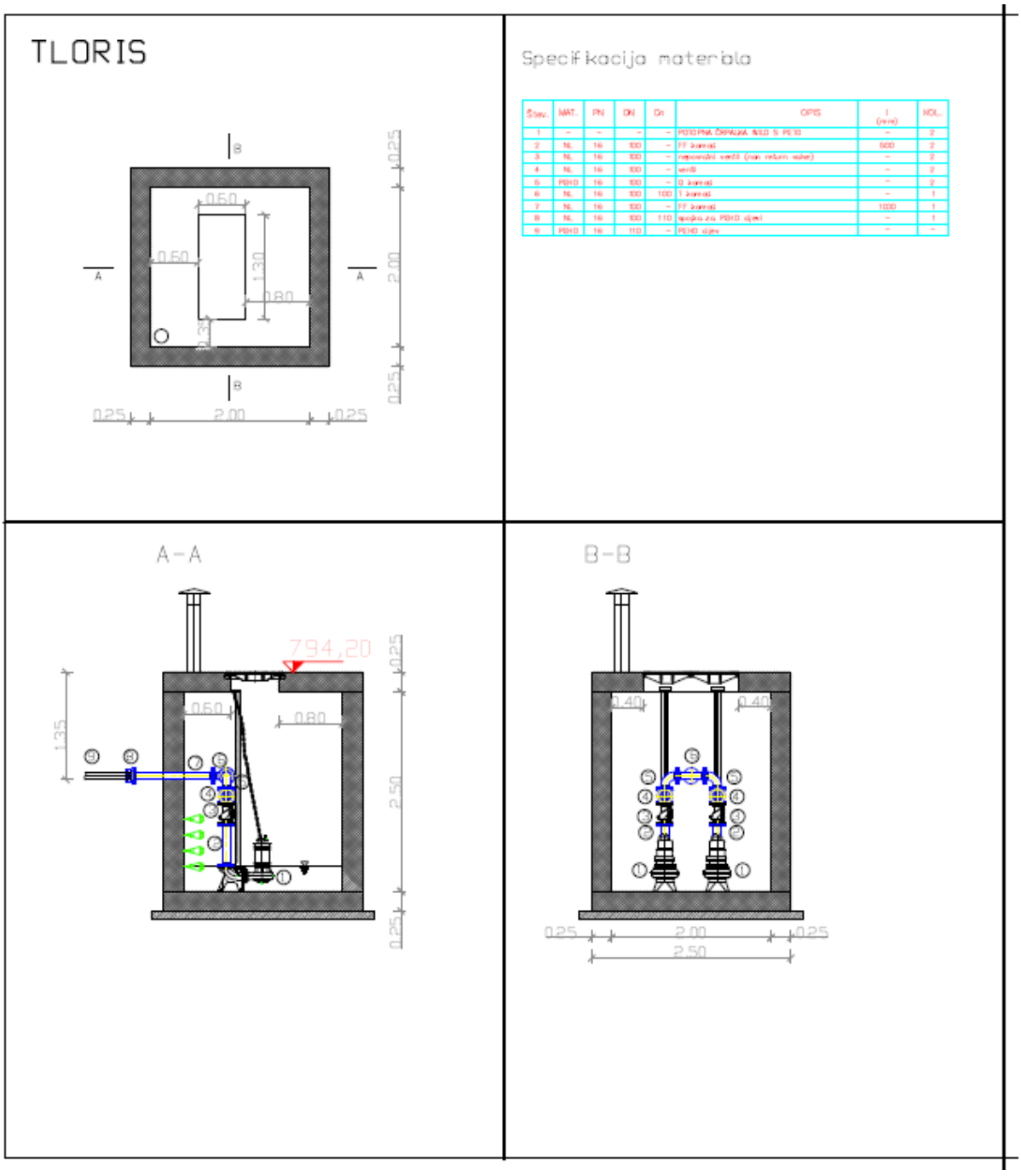


Figure 9: Detailed drawings of seepage pumping station

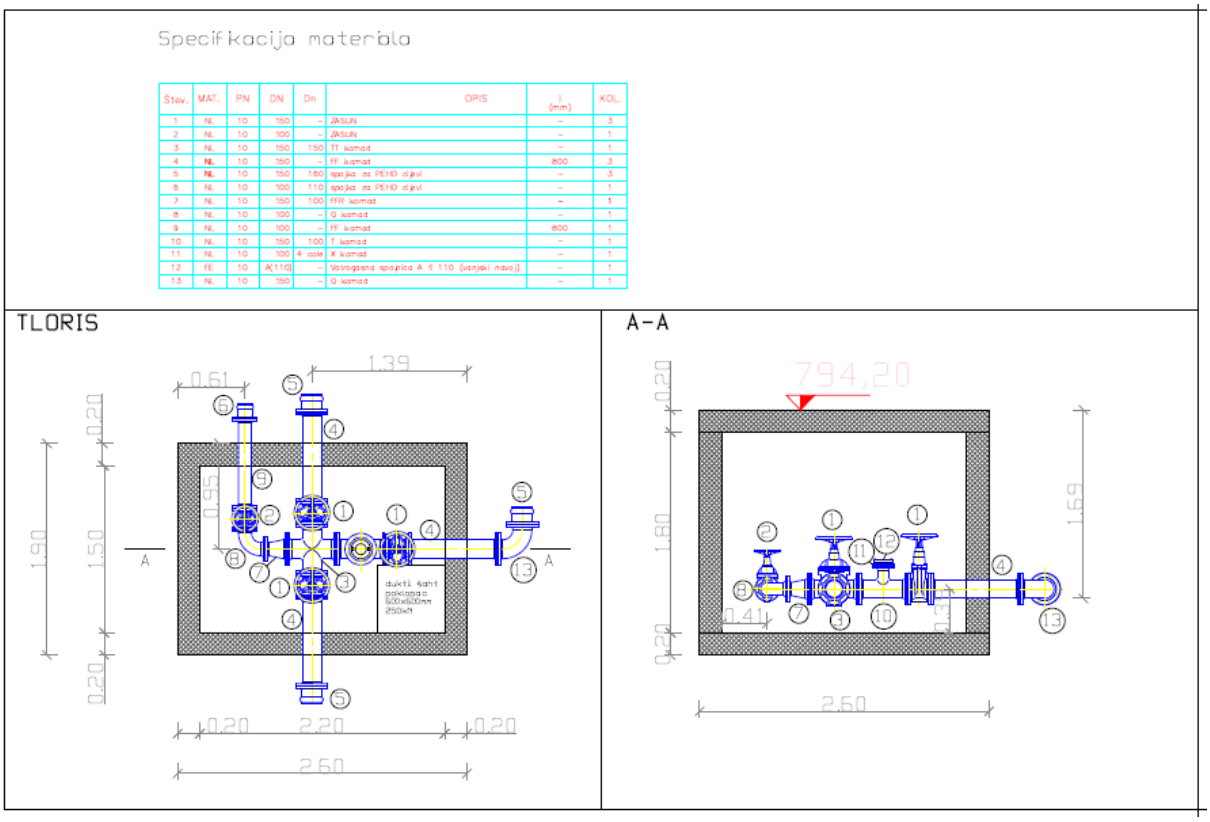


Figure 10: Detailed drawing of distribution manhole

3.3. Construction

For this part, detailed information about construction had to be provided. This part consists of:

- technical description,
- load analysis,
- static calculations and dimensioning,
- shuttering plans,
- Plans and details of reinforcement,
- reinforcement specification,
- recapitulation reinforcement,
- static calculations and dimensioning

3.3.1. Static calculations and dimensioning, load analysis

From construction permit documentation:

Osnovni podaci o modelu

STATIČKI PRORAČUN I DIMENZIONISANJE

Datoteka: Statički pror. - azen.twp
Datum proracuna: 10.12.2014

Nacin proracuna: 3D model

[X] Teorija I-og reda [X] Modalna analiza [ ] Stabilnost

[ ] Teorija II-og reda [X] Seizmicki proracun [ ] Faze gradjenja

[ ] Nelinearan proracun

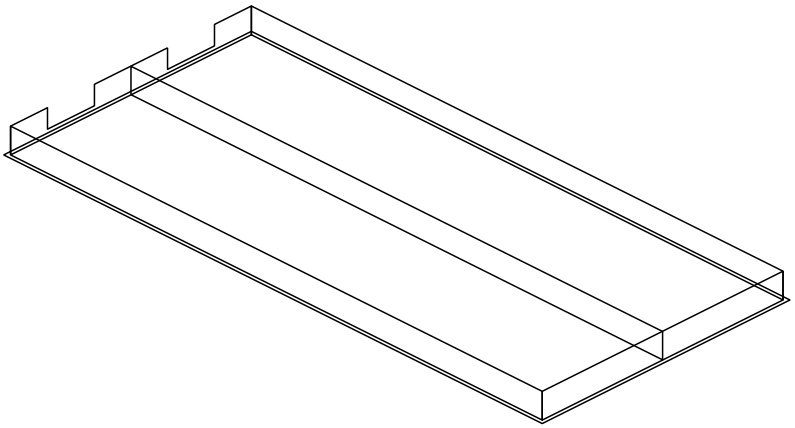
Velicina modela

Broj cvorova:	1677
Broj plocastih elemenata:	1616
Broj grednih elemenata:	0
Broj granicnih elemenata:	14604
Broj osnovnih slucajeva opterecenja:	6
Broj kombinacija opterecenja:	6

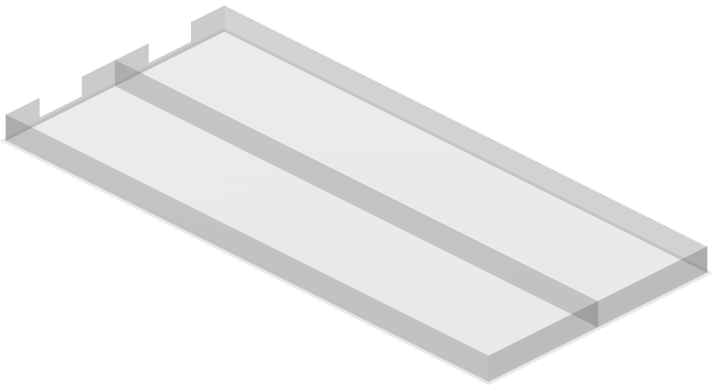
Jedinice mera

Duzina:	m [cm,mm]
Sila:	kN
Temperatura:	Celsius

Ulazni podaci - Konstrukcija



Izometrija



Izometrija

Tabela materijala

No	Naziv materijala	E[kN/m2]	μ	γ[kN/m3]	αt[1/C]	Em[kN/m2]	μm
1	Betoni MB 30	3.150e+7	0.20	25.00	1.000e-5	3.150e+7	0.20

Setovi ploca

No	d[m]	e[m]	Materijal	Tip proracuna	Ortotropija	E2[kN/m2]	G[kN/m2]	α
<1>	0.250	0.125	1	Tanka ploca	Izotropna			
<2>	0.250	0.125	1	Tanka ploca	Anizotropna	0.000e+0	0.000e+0	90.00

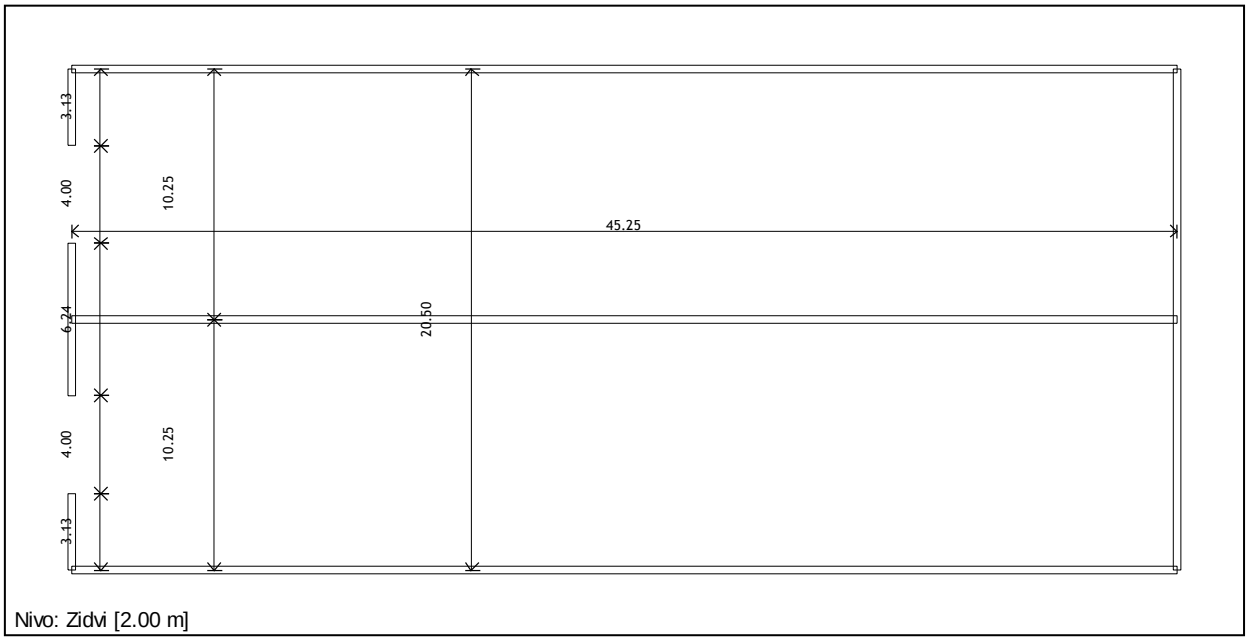
Sema nivoa

Naziv	z [m]	h [m]
Zidvi	2.00	2.00

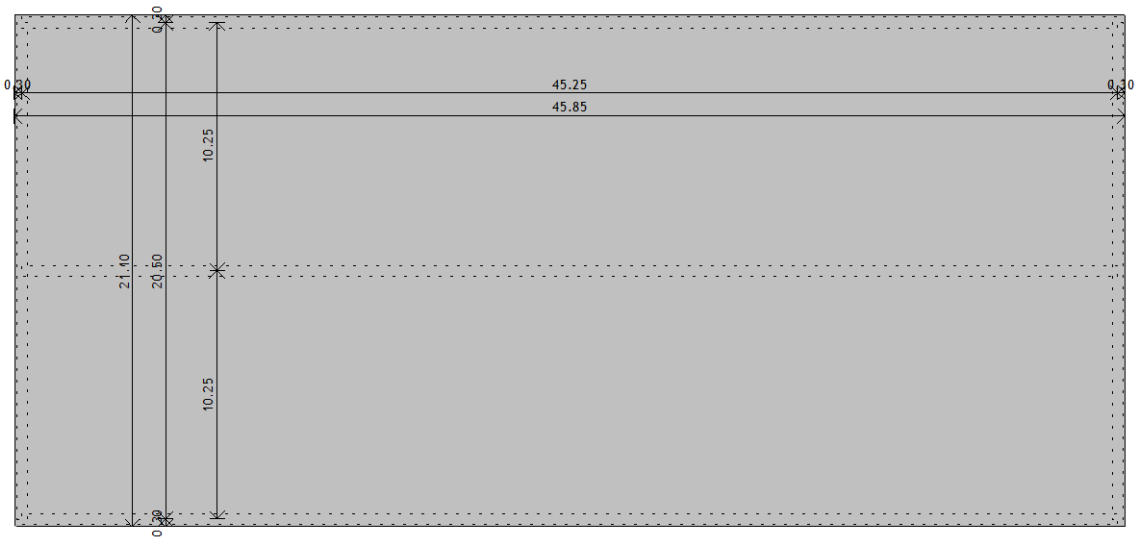
Tem. ploča	0.00	

Setovi povrsinskih oslonaca

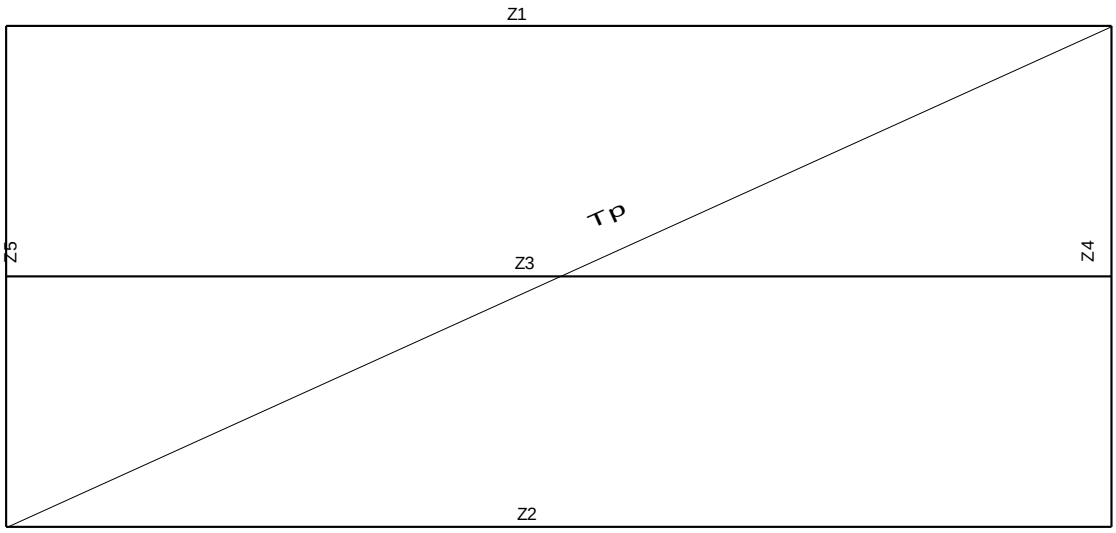
Set	K,R1	K,R2	K,R3
1	1.000e+4	1.000e+4	2.000e+4



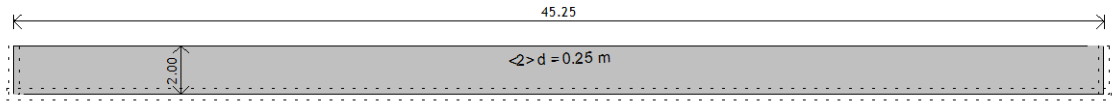
Nivo: Zidvi [2.00 m]



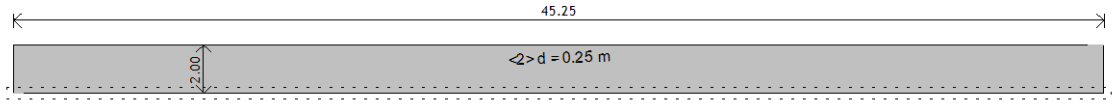
Nivo: Tem. ploča [0.00 m]



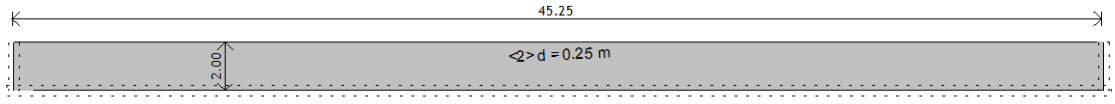
Dispozicija ramova



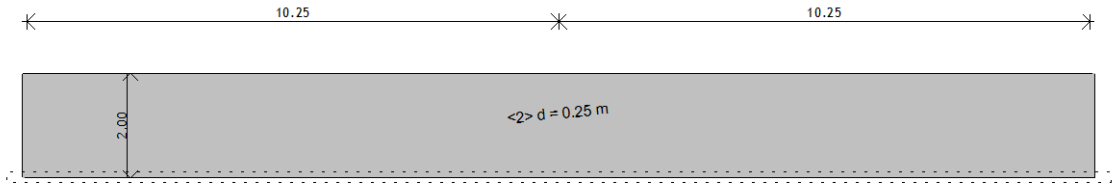
Ram: Z1



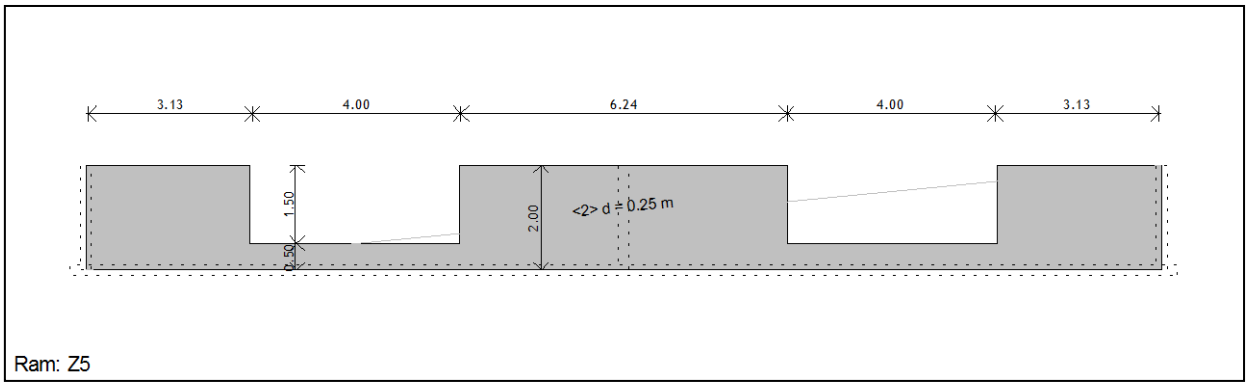
Ram: Z2



Ram: Z3



Ram: Z4



Ulazni podaci - Opterecenje

Analiza opterećenja

$p_h = \gamma \times h \times \lambda a$ (horizontalni pritisak na zidove)

$p_v = \gamma \times h$ (vertikalni pritisak na temeljnu ploču)

- γ - težina tla
- ρ - ugao trenja tla (najnepovoljniji)
- λa - koeficijenat pritiska tla (najnepovoljniji)
- h - dubina na kojoj djeluje pritisak

1. Bazeni prazani - sopstvena težina i spoljašni pritisak od tala

h= 0.45m; γ= 19.00 kN/m3; ρ=35º β=0º; λa =0.217;

- p_h = 19.00 x 0.45 x 0.217 = 1.90 kN/m²

2. Bazeni puni - pritisak na spoljašnje zidove i temaljnu ploču

h= 2.00m; γ= 20.00 kN/m3; ρ=20º β=0º; λa =0.49;

- p_h = 20.00 x 2.00 x 0.49 = 19.20 kN/m²
- p_v = 20.00 x 2.00 = 40.00 kN/m²

3. Bazen I pun, bazen II prazan- pritisak zidove i na temaljnu ploču bazena I

h= 2.00m; γ= 20.00 kN/m3; ρ=20º β=0º; λa =0.49;

- p_h = 20.00 x 2.00 x 0.49 = 19.20 kN/m²
- p_v = 20.00 x 2.00 = 40.00 kN/m²

4. Bazen I pun, bazen II filter slij i mašina za čišćenje - pritisak na zidove i temaljnu ploču bazena I i na ploču bazena II od filter sloja i od mašine za čišćenje

h= 2.00m; h2 = 0.45m; γ= 20.00 kN/m3; ρ=25º β=0º; λa =0.41;

- p_h = 20.00 x 0.45 x 0.41 = 3.60 kN/m²
- p_v = 20.00 x 0.45 = 9.00 kN/m²
- p_v = 17.00 kN/m² (pokretna od mašine za čišćenje 200 KN)

Lista slucajeva opterecenja

No	Naziv
1	1. stalno -(s.težina i pritisak zemlje sp (g)
2	2. korisno - (bazeni puni)
3	3. korisno (bazen I pun , bazen II prazan)
4	4. korisno (bazen I pun, bazen II filter sl
5	sx seizmika
6	sy seizmika
7	Komb.: I+II
8	Komb.: I+III
9	Komb.: I+IV
10	Komb.: 1.6xI+1.8xII
11	Komb.: 1.6xI+1.8xIII
12	Komb.: 1.6xI+1.8xIV

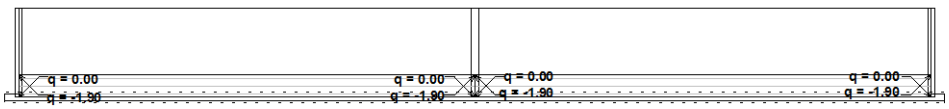
Opt. 1: 1. stalno -(s.težina i pritisak zemlje sp (g)

Ram: Z1

Opt. 1: 1. stalno -(s.težina i pritisak zemlje sp (g)

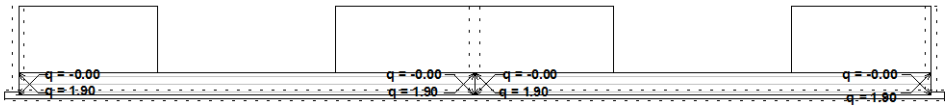
Ram: Z2

Opt. 1: 1. stalno -(s.težina i pritisak zemlje sp (g)



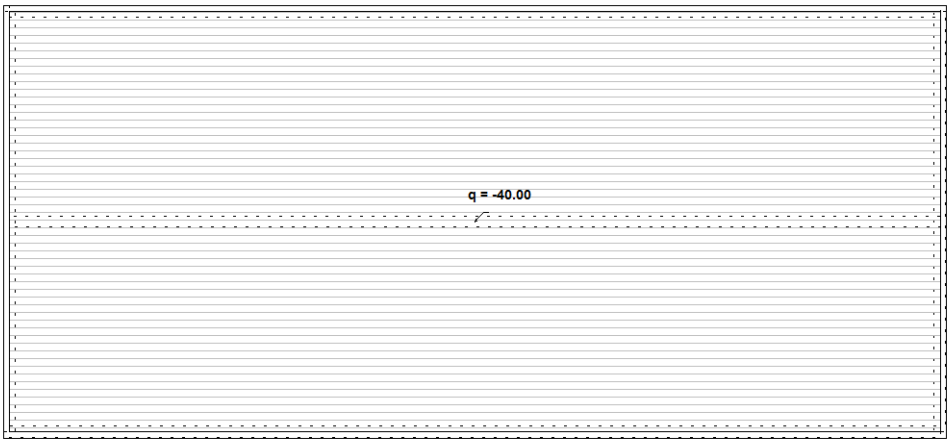
Ram: Z4

Opt. 1: 1. stalno -(s.težina i pritisak zemlje sp (g)



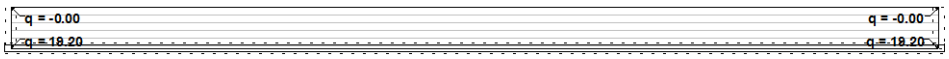
Ram: Z5

Opt. 2: 2. korisno - (bazeni puni)



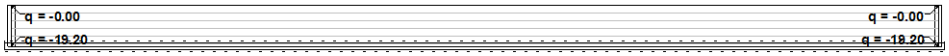
Nivo: Tem. ploča [0.00 m]

Opt. 2: 2. korisno - (bazeni puni)



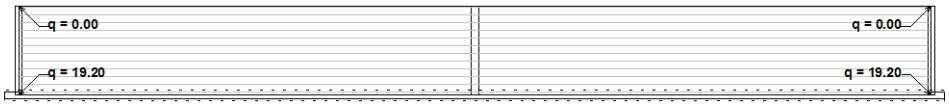
Ram: Z1

Opt. 2: 2. korisno - (bazeni puni)



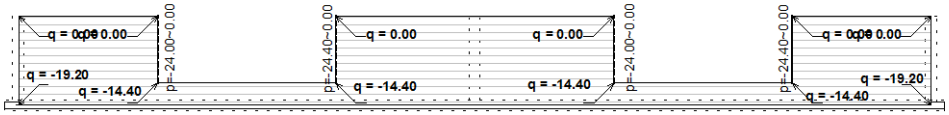
Ram: Z2

Opt. 2: 2. korisno - (bazeni puni)



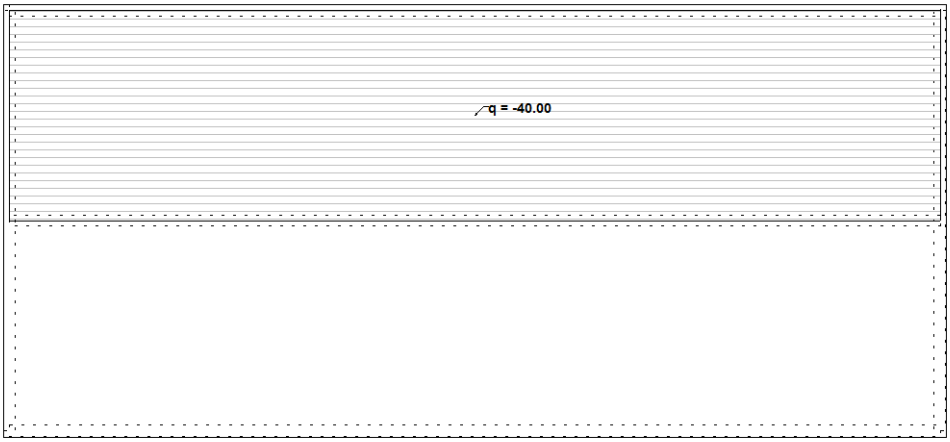
Ram: Z4

Opt. 2: 2. korisno - (bazeni puni)



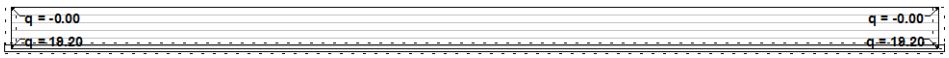
Ram: Z5

Opt. 3: 3. korisno (bazen I pun , bazen II prazan)



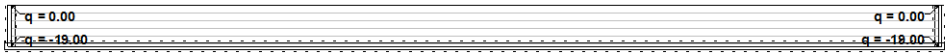
Nivo: Tem. ploča [0.00 m]

Opt. 3: 3. korisno (bazen I pun , bazen II prazan)



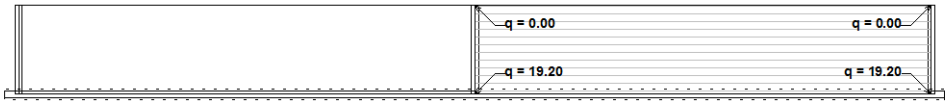
Ram: Z1

Opt. 3: 3. korisno (bazen I pun , bazen II prazan)



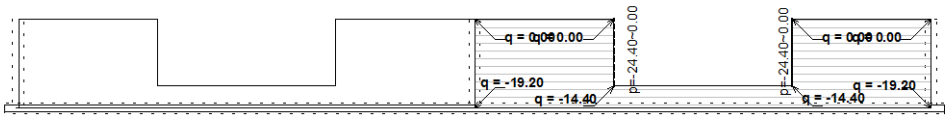
Ram: Z3

Opt. 3: 3. korisno (bazen I pun , bazen II prazan)



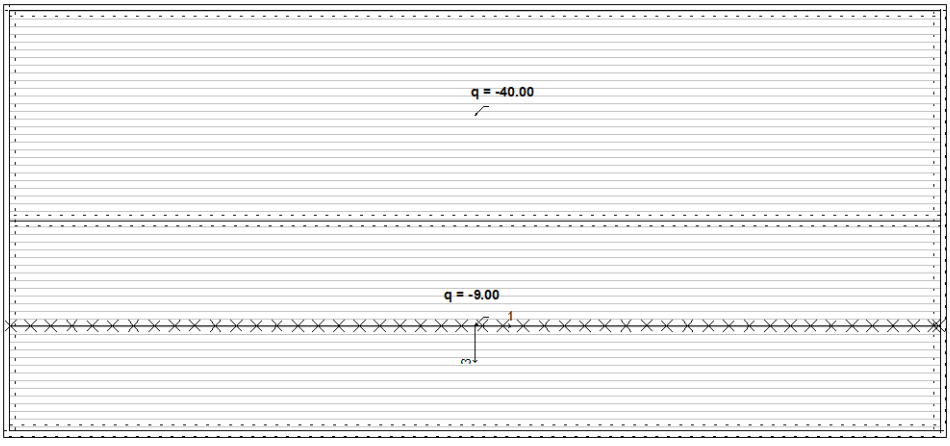
Ram: Z4

Opt. 3: 3. korisno (bazen I pun , bazen II prazan)



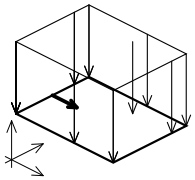
Ram: Z5

Opt. 4: 4. korisno (bazen I pun, bazen II filter sl



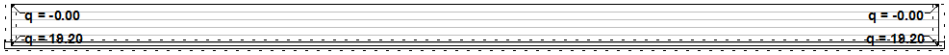
Nivo: Tem. ploča [0.00 m]

Pokretno opterecenje
Opterecenje 4: 4. korisno (bazen I pun, bazen II filter sl ΔL=1 m



Povrsinsko opterecenje								
No	q[kN/m2]	X1[m]	Y1[m]	X2[m]	Y2[m]	X	Y	Z
1	-17.00	0.00	1.50	4.00	-1.50	0.00	0.00	1.00

Opt. 4: 4. korisno (bazen I pun, bazen II filter sl

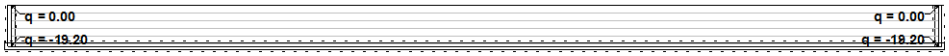


Ram: Z1

Opt. 4: 4. korisno (bazen I pun, bazen II filter sl

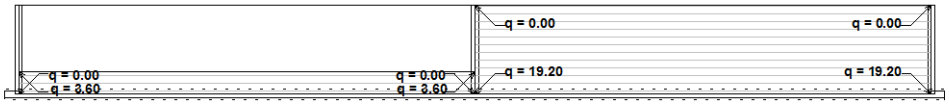
Ram: Z2

Opt. 4: 4. korisno (bazen I pun, bazen II filter sl



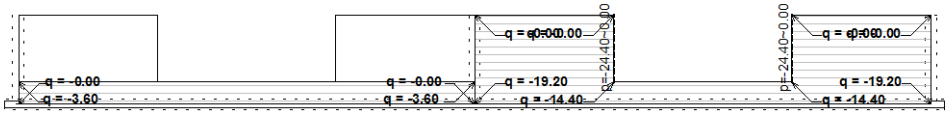
Ram: Z3

Opt. 4: 4. korisno (bazen I pun, bazen II filter sl



Ram: Z4

Opt. 4: 4. korisno (bazen I pun, bazen II filter sl



Ram: Z5

Napredne opcije seizmickog proracuna:

Spreceno oscilovanje u Z pravcu

Faktori opterecenja za proracun masa

No	Naziv	Koeficijent
1	1. stalno -(s.težina i pritisak zemlje sp (g)	1.00
2	2. korisno - (bazeni puni)	0.00
3	3. korisno (bazen I pun , bazen II prazan)	0.00
4	4. korisno (bazen I pun, bazen II filter sl	0.00

Raspored masa po visini objekta

Nivo	Z [m]	X [m]	Y [m]	Masa [T]	T/m2
Zidvi	2.00	23.77	10.25	107.36	
Tem. ploča	0.00	22.61	10.25	726.85	0.75
Ukupno:	0.26	22.76	10.25	834.21	

Polozaj centara krutosti po visini objekta

Nivo	Z [m]	X [m]	Y [m]
Zidvi	2.00	43.69	10.25
Tem. ploča	0.00	22.63	10.25

Ekscentricitet po visini objekta

Nivo	Z [m]	eox [m]	eoy [m]
Zidvi	2.00	19.92	0.00
Tem. ploča	0.00	0.02	0.00

Periodi oscilovanja konstrukcije

No	T [s]	f [Hz]
1	0.0659	15.1652
2	0.0652	15.3311
3	0.0602	16.6188

Seizmicki proracun

Seizmicki proracun: JUS (Ekvivalentno staticko opterecenje)

Kategorija tla:	II
Seizmicka zona:	VIII (Ks = 0.050)
Kategorija objekta:	II
Vrsta konstrukcije:	1
Kota ukljestenja:	Zd = 0.00 m

Ugao dejstva zemljotresa:

Naziv	T [sec]	α [°]
sx seizmika	0.060	0.00
sy seizmika	0.065	90.00

Raspored seizmickih sila po visini objekta (sx seizmika)

Nivo	Z [m]	S [kN]
Zidvi	2.00	39.90
Tem. ploča	0.00	39.95
	Σ=	79.85

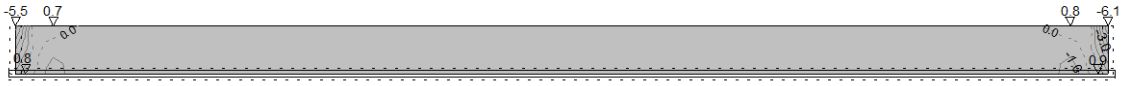
Raspored seizmickih sila po visini objekta (sy seizmika)

Nivo	Z [m]	S [kN]
Zidvi	2.00	39.90
Tem. ploča	0.00	39.95
	Σ=	79.85

Raspored masa po visini objekta

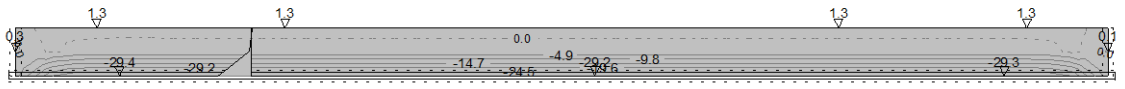
Nivo	Z [m]	X [m]	Y [m]	Masa [T]	T/m2
Zidvi	2.00	23.77	10.25	107.36	
Tem. ploča	0.00	22.61	10.25	726.85	0.75
Ukupno:	0.26	22.76	10.25	834.21	

Opt. 10: 1.6xI+1.8xII



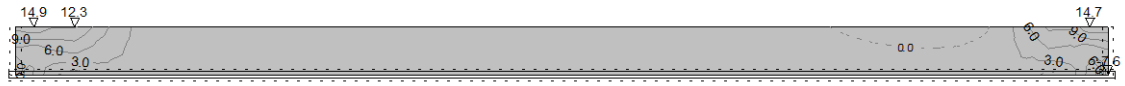
Ram: Z1
Uticaji u ploci: max Mx= 0.9 / min Mx= -6.1 kNm/m

Opt. 10: 1.6xI+1.8xII



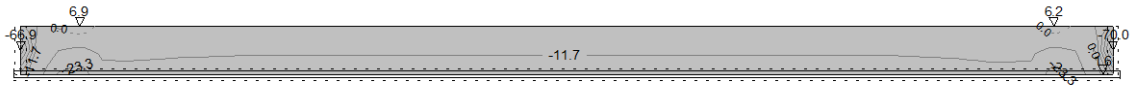
Ram: Z1
Uticaji u ploci: max My= 1.3 / min My= -29.4 kNm/m

Opt. 10: 1.6xI+1.8xII



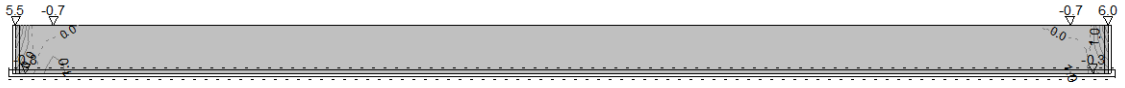
Ram: Z1
Uticaji u ploci: max Nx= 14.9 / min Nx= -7.6 kNm/m

Opt. 10: 1.6xI+1.8xII



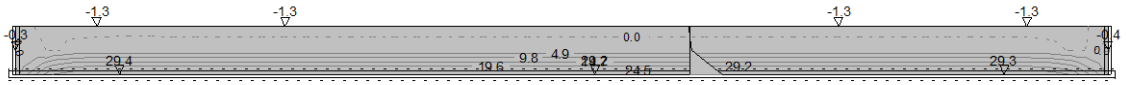
Ram: Z1
Uticaji u ploci: max Ny= 6.9 / min Ny= -70.0 kNm/m

Opt. 10: 1.6xI+1.8xII



Ram: Z2
Uticaji u ploci: max Mx= 6.0 / min Mx= -0.8 kNm/m

Opt. 10: 1.6xI+1.8xII

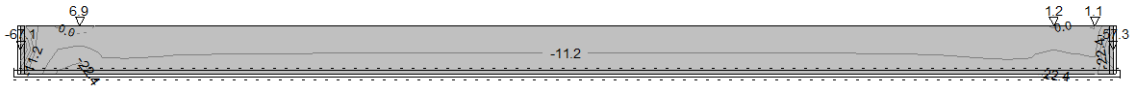


Ram: Z2
Uticaji u ploci: max My= 29.4 / min My= -1.3 kNm/m

Opt. 10: 1.6xI+1.8xII

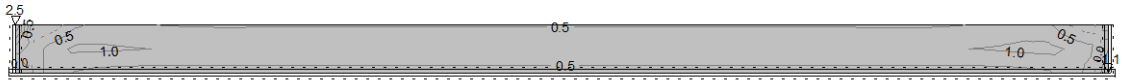
Ram: Z2
Uticaji u ploci: max Nx= 20.1 / min Nx= -6.6 kN/m

Opt. 10: 1.6xI+1.8xII



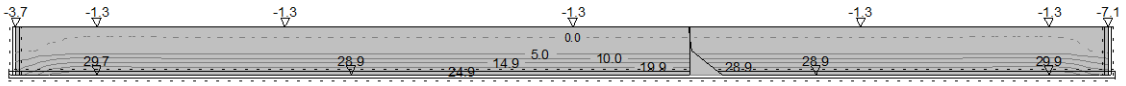
Ram: Z2
Uticaji u ploci: max Ny= 6.9 / min Ny= -67.1 kNm/m

Opt. 11: 1.6xI+1.8xIII



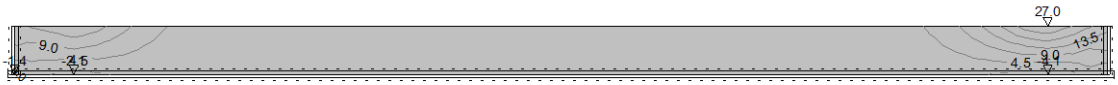
Ram: Z3
Uticaji u ploci: max Mx= 2.5 / min Mx= -1.1 kNm/m

Opt. 11: 1.6xI+1.8xIII



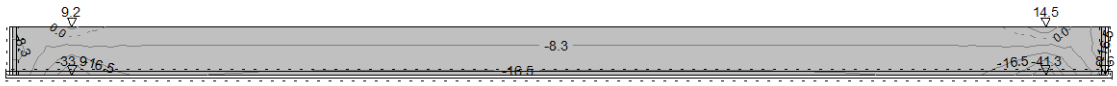
Ram: Z3
Uticaji u ploci: max My= 29.9 / min My= -7.1 kNm/m

Opt. 11: 1.6xI+1.8xIII



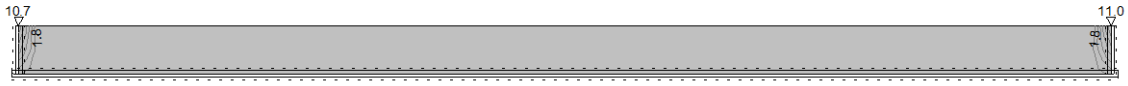
Ram: Z3
Uticaji u ploci: max Nx= 27.0 / min Nx= -4.1 kN/m

Opt. 11: 1.6xI+1.8xIII



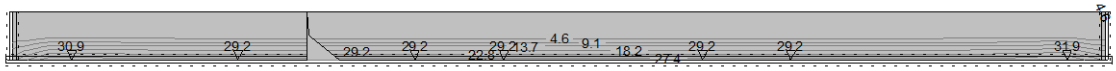
Ram: Z3
Uticaji u ploci: max Ny= 14.5 / min Ny= -41.3 kN/m

Opt. 12: 1.6xI+1.8xIV



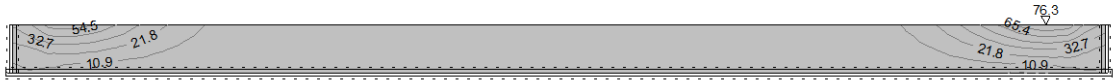
Ram: Z3
Uticaji u ploci: max Mx= 11.0 / min Mx= 0.3 kNm/m

Opt. 12: 1.6xI+1.8xIV



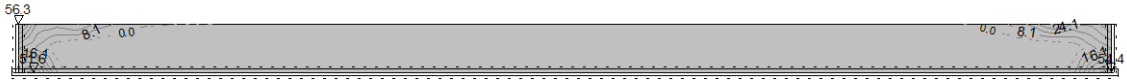
Ram: Z3
Uticaji u ploci: max My= 31.9 / min My= 0.0 kNm/m

Opt. 12: 1.6xI+1.8xIV



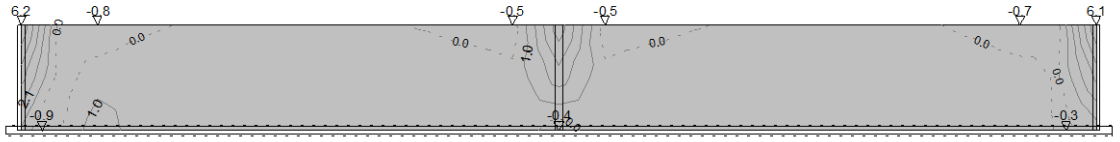
Ram: Z3
Uticaji u ploci: max Nx= 76.3 / min Nx= 0.0 kN/m

Opt. 12: 1.6xI+1.8xIV



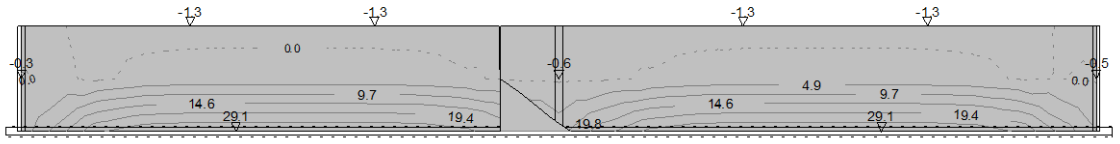
Ram: Z3
Uticaji u ploci: max Ny= 56.3 / min Ny= 0.0 kN/m

Opt. 10: 1.6xI+1.8xII



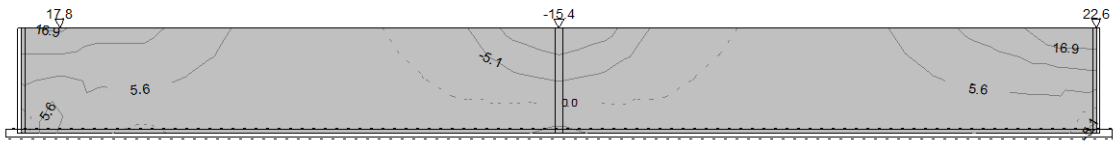
Ram: Z4
Uticaji u ploci: max Mx= 6.2 / min Mx= -0.9 kNm/m

Opt. 10: 1.6xI+1.8xII



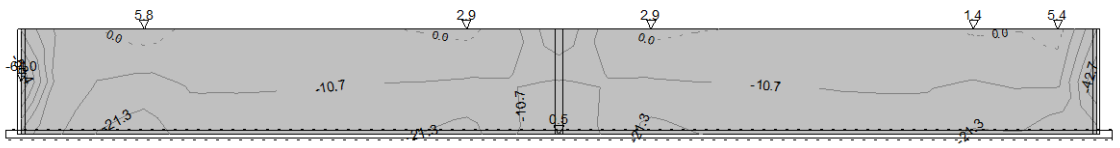
Ram: Z4
Uticaji u ploci: max My= 29.1 / min My= -1.3 kNm/m

Opt. 10: 1.6xI+1.8xII



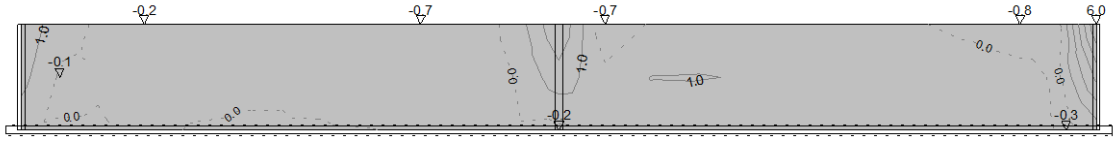
Ram: Z4
Uticaji u ploci: max Nx= 22.6 / min Nx= -15.4 kN/m

Opt. 10: 1.6xI+1.8xII



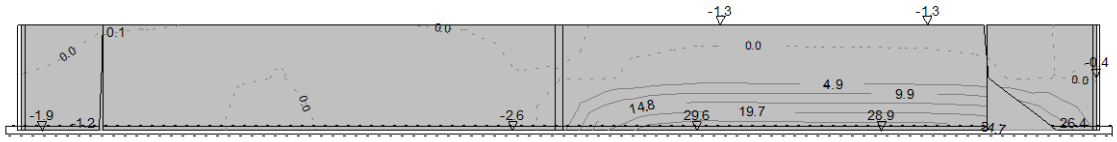
Ram: Z4
Uticaji u ploci: max Ny= 5.8 / min Ny= -64.0 kN/m

Opt. 11: 1.6xI+1.8xIII



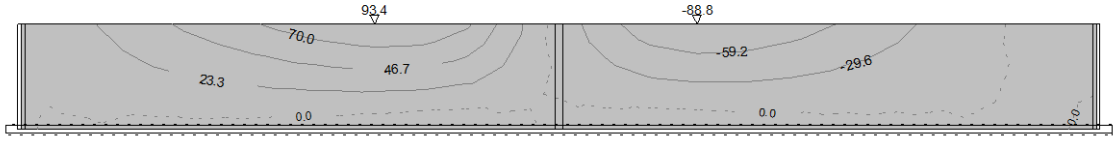
Ram: Z4
Uticaji u ploci: max Mx= 6.0 / min Mx= -0.8 kNm/m

Opt. 11: 1.6xI+1.8xIII



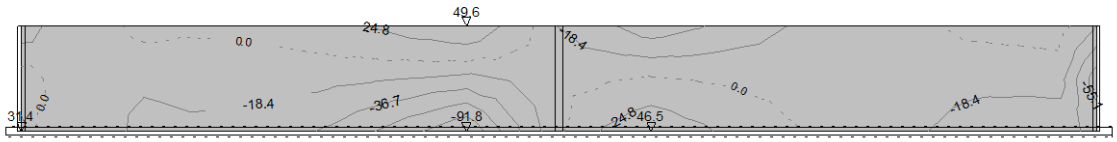
Ram: Z4
Uticaji u ploci: max My= 29.6 / min My= -2.6 kNm/m

Opt. 11: 1.6xI+1.8xIII



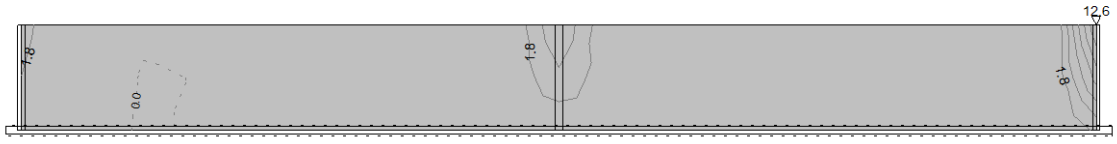
Ram: Z4
Uticaji u ploci: max Nx= 93.4 / min Nx= -88.8 kN/m

Opt. 11: 1.6xI+1.8xIII



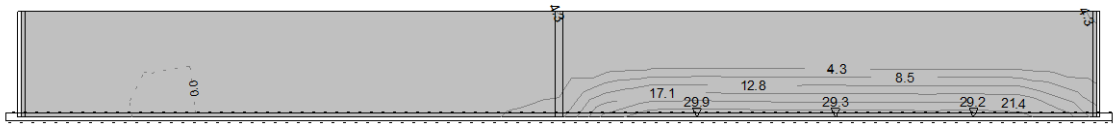
Ram: Z4
Uticaji u ploci: max Ny= 49.6 / min Ny= -91.8 kN/m

Opt. 12: 1.6xI+1.8xIV



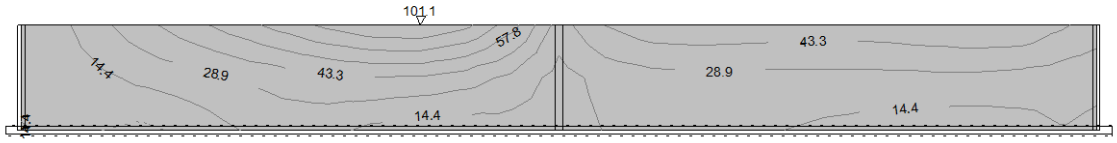
Ram: Z4
Uticaji u ploci: max Mx= 12.6 / min Mx= 0.0 kNm/m

Opt. 12: 1.6xI+1.8xIV



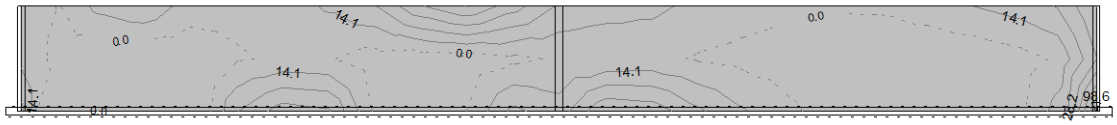
Ram: Z4
Uticaji u ploci: max My= 29.9 / min My= 0.0 kNm/m

Opt. 12: 1.6xI+1.8xIV



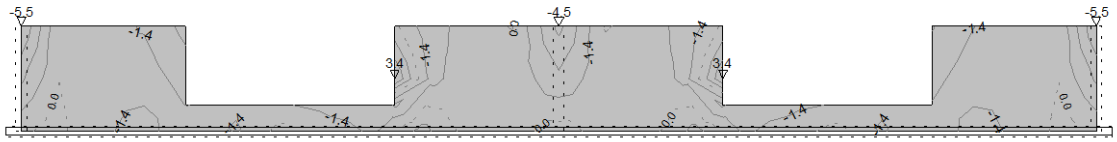
Ram: Z4
Uticaji u ploci: max Nx= 101.1 / min Nx= 0.0 kN/m

Opt. 12: 1.6xI+1.8xIV



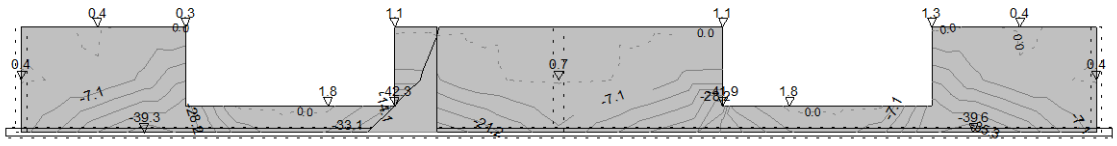
Ram: Z4
Uticaji u ploci: max Ny= 98.6 / min Ny= 0.0 kN/m

Opt. 10: 1.6xI+1.8xII



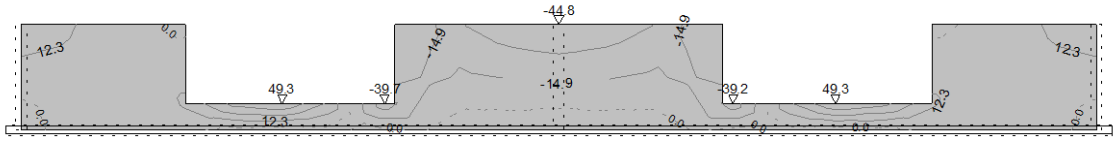
Ram: Z5
Uticaji u ploci: max Mx= 3.4 / min Mx= -5.5 kNm/m

Opt. 10: 1.6xI+1.8xII



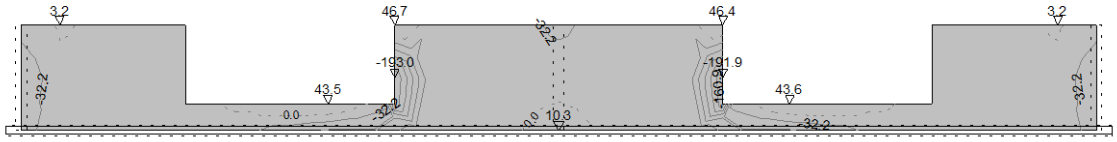
Ram: Z5
Uticaji u ploci: max My= 1.8 / min My= -42.3 kNm/m

Opt. 10: 1.6xI+1.8xII



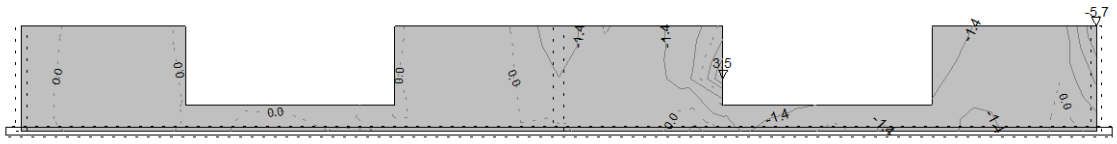
Ram: Z5
Uticaji u ploci: max Nx= 49.3 / min Nx= -44.8 kN/m

Opt. 10: 1.6xI+1.8xII



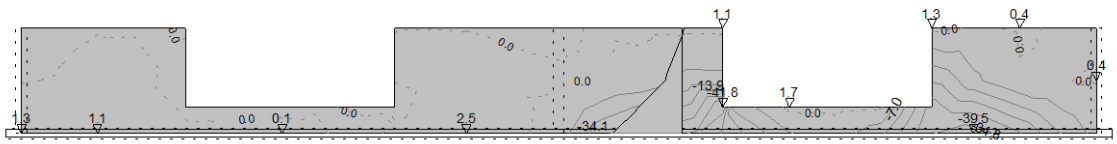
Ram: Z5
Uticaji u ploci: max Ny= 46.7 / min Ny= -193.0 kN/m

Opt. 11: 1.6xI+1.8xIII



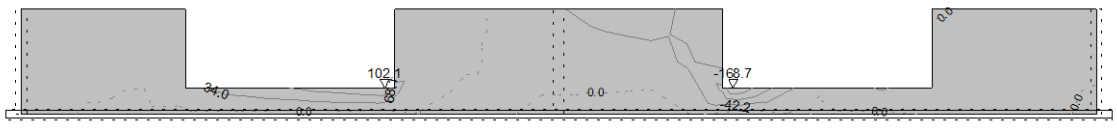
Ram: Z5
Uticaji u ploci: max Mx= 3.5 / min Mx= -5.7 kNm/m

Opt. 11: 1.6xI+1.8xIII



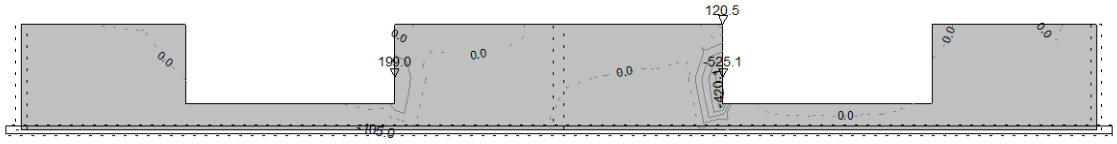
Ram: Z5
Uticaji u ploci: max My= 2.5 / min My= -41.8 kNm/m

Opt. 11: 1.6xI+1.8xIII



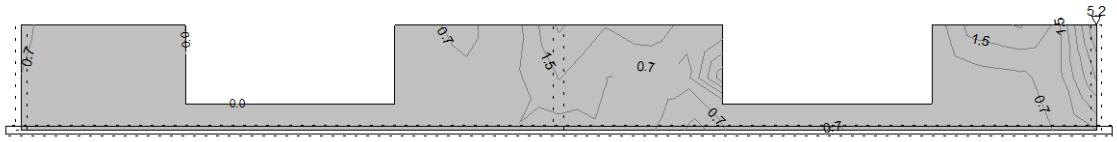
Ram: Z5
Uticaji u ploci: max Nx= 102.1 / min Nx= -168.7 kN/m

Opt. 11: 1.6xI+1.8xIII



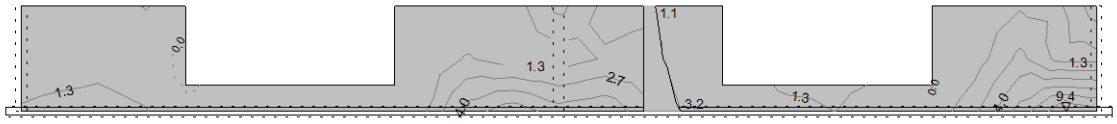
Ram: Z5
Uticaji u ploci: max Ny= 199.0 / min Ny= -525.1 kN/m

Opt. 12: 1.6xI+1.8xIV



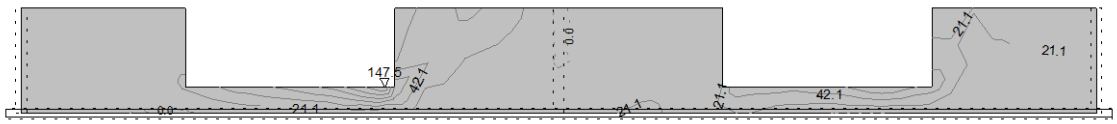
Ram: Z5
Uticaji u ploci: max Mx= 5.2 / min Mx= 0.0 kNm/m

Opt. 12: 1.6xI+1.8xIV



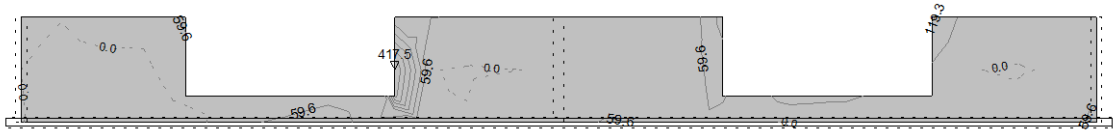
Ram: Z5
Uticaji u ploci: max My= 9.4 / min My= 0.0 kNm/m

Opt. 12: 1.6xI+1.8xIV



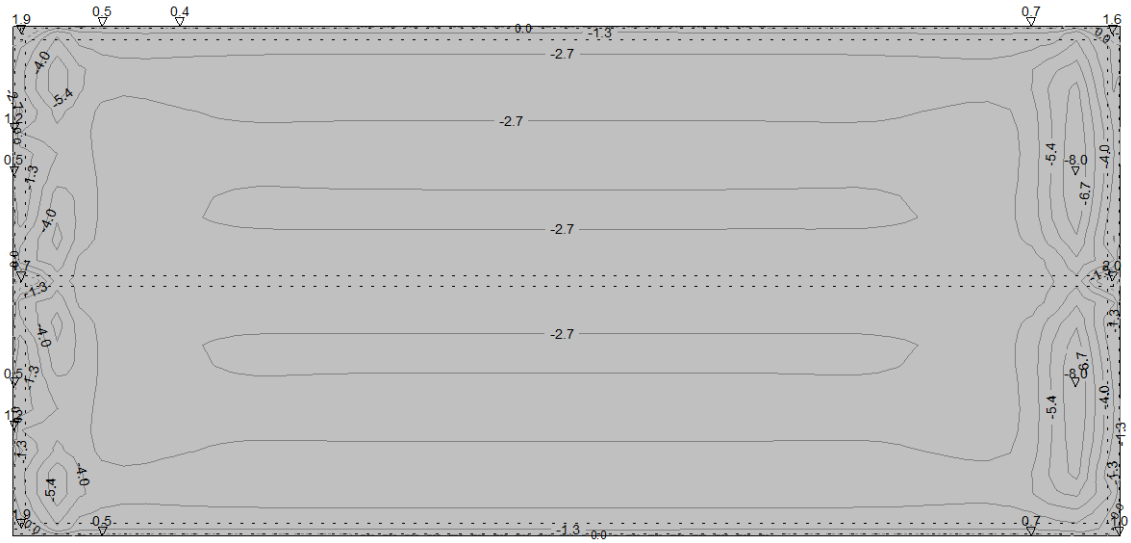
Ram: Z5
Uticaji u ploci: max Nx= 147.5 / min Nx= 0.0 kN/m

Opt. 12: 1.6xI+1.8xIV



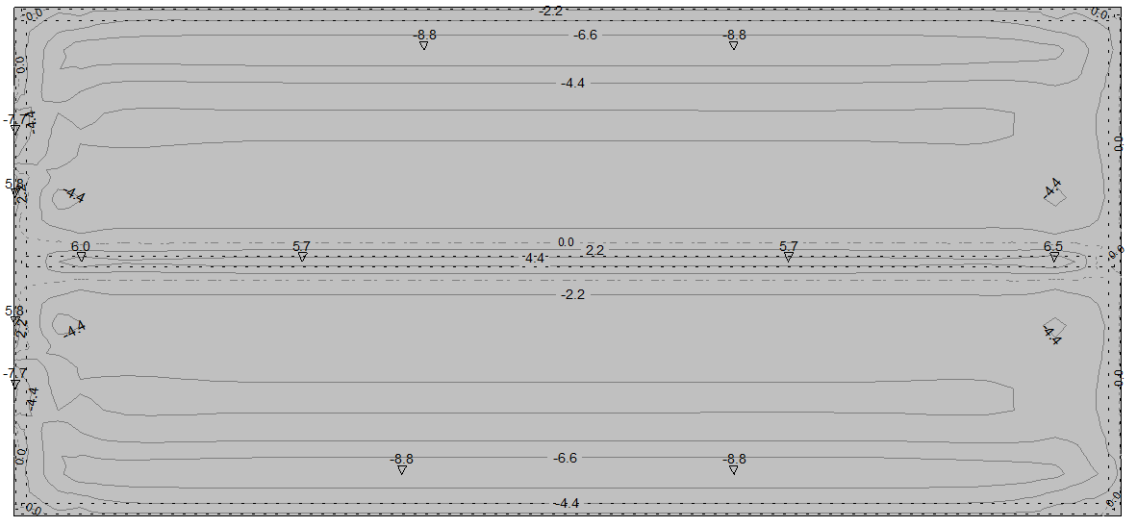
Ram: Z5
Uticaji u ploci: max Ny= 417.5 / min Ny= 0.0 kN/m

Opt. 10: 1.6xI+1.8xII



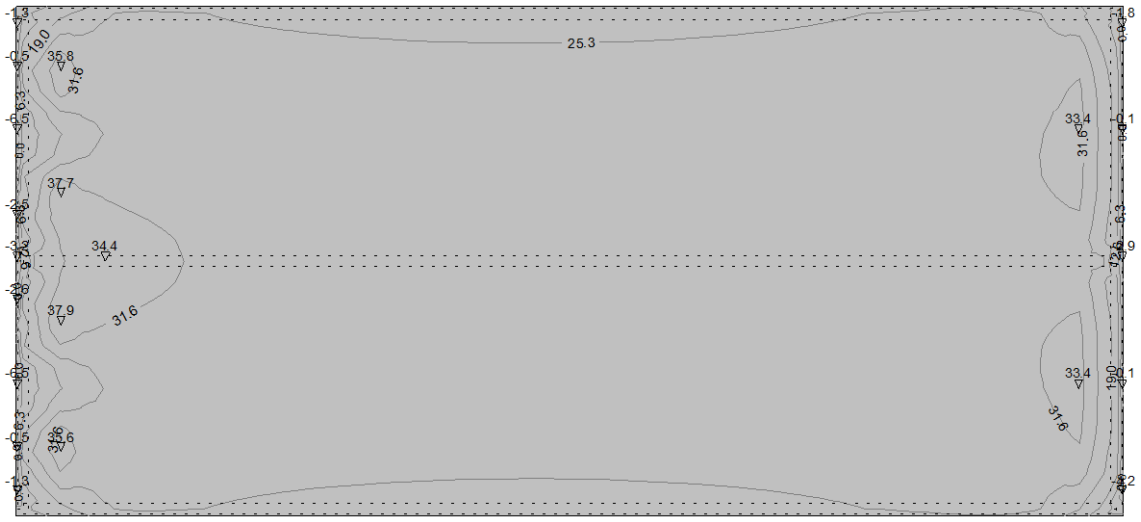
Nivo: Tem. ploča [0.00 m]
Uticaji u ploci: max Mx= 2.0 / min Mx= -8.0 kNm/m

Opt. 10: 1.6xI+1.8xII



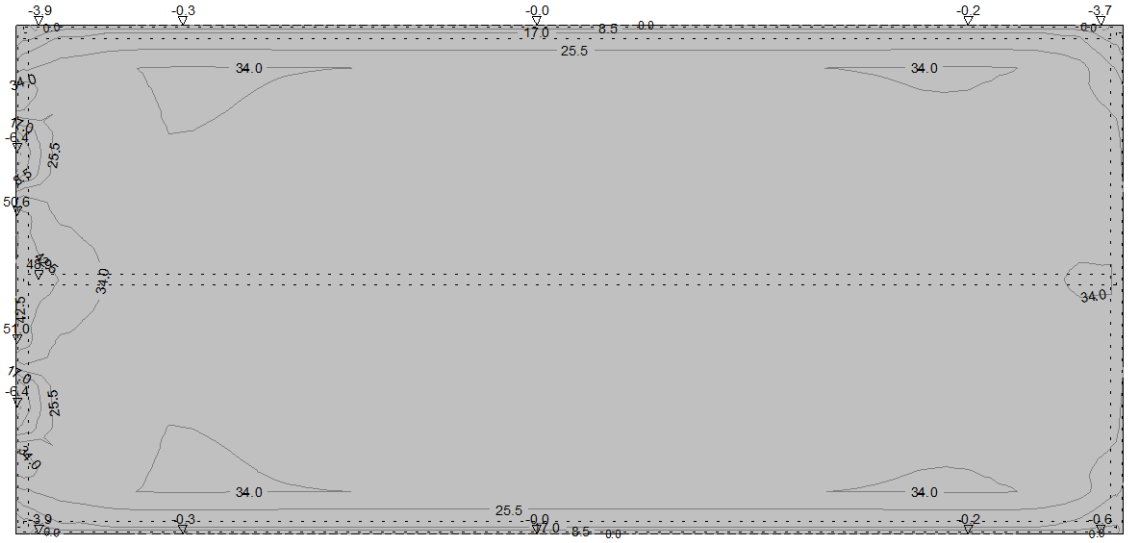
Nivo: Tem. ploča [0.00 m]
Uticaji u ploci: max My= 6.5 / min My= -8.8 kNm/m

Opt. 10: 1.6xI+1.8xII



Nivo: Tem. ploča [0.00 m]
Uticaji u ploci: max Nx= 37.9 / min Nx= -6.5 kN/m

Opt. 10: 1.6xI+1.8xII

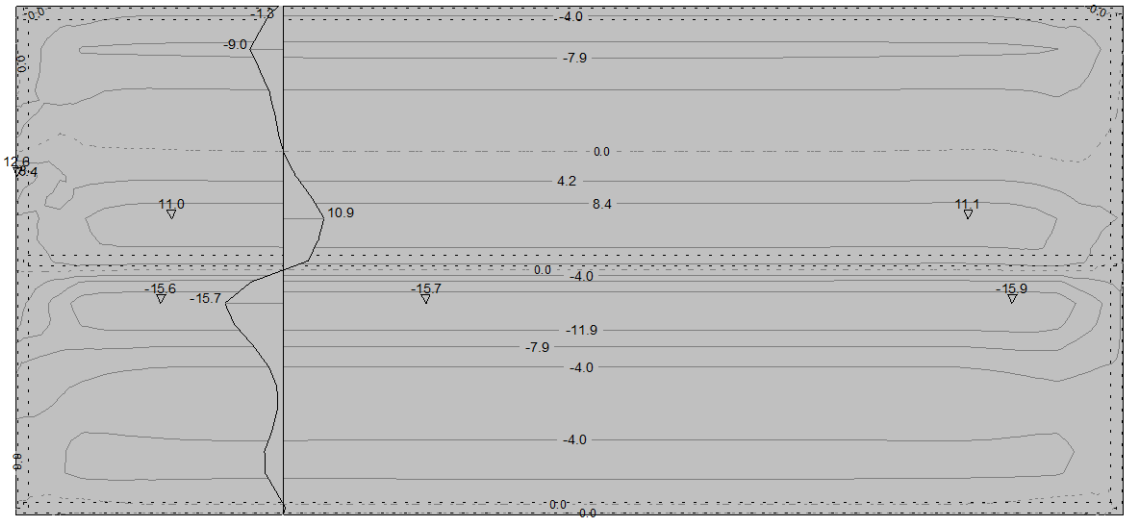


Nivo: Tem. ploča [0.00 m]
Uticaji u ploci: max Ny= 51.0 / min Ny= -6.4 kN/m

Opt. 11: 1.6xI+1.8xIII

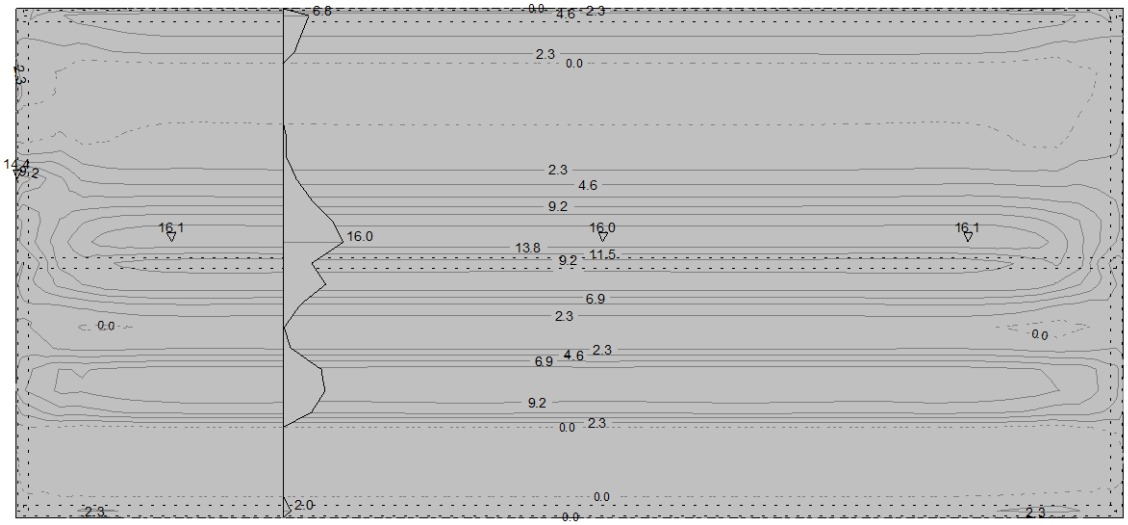
Nivo: Tem. ploča [0.00 m]
Uticaji u ploci: max Mx= 4.9 / min Mx= -9.8 kNm/m

Opt. 11: 1.6xI+1.8xIII



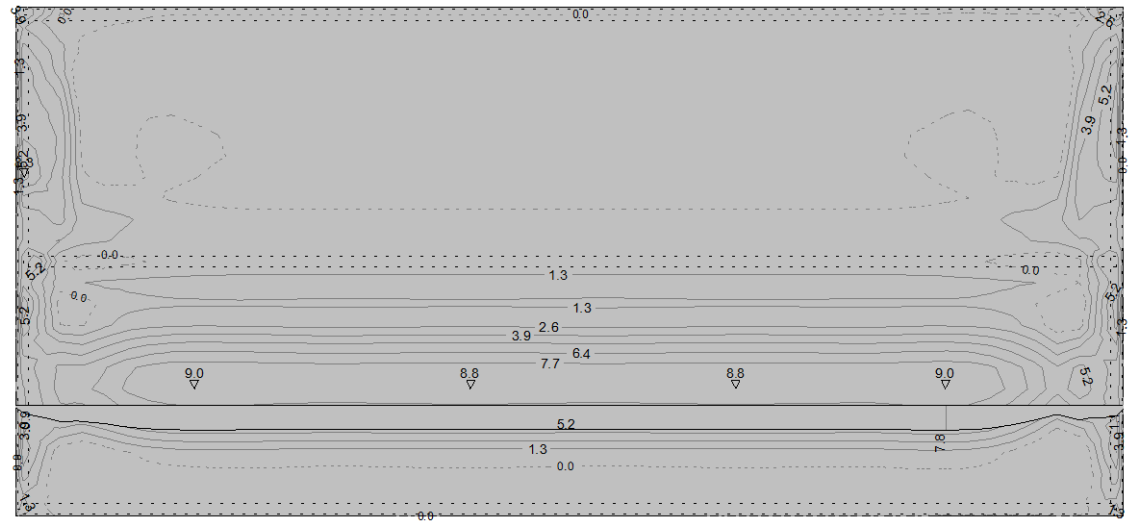
Nivo: Tem. ploča [0.00 m]
Uticaji u ploci: max My= 12.6 / min My= -15.9 kNm/m

Opt. 12: 1.6xI+1.8xIV



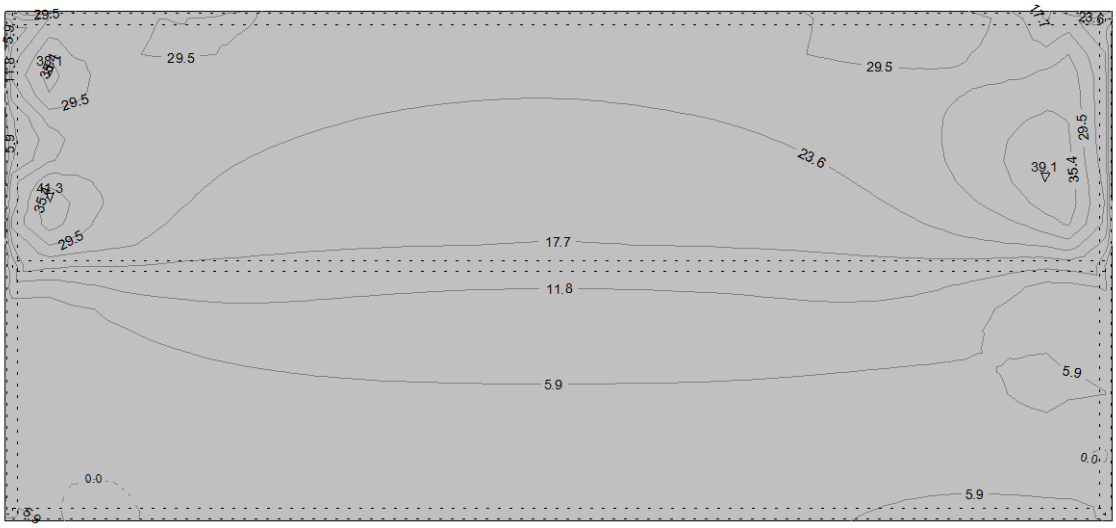
Nivo: Tem. ploča [0.00 m]
Uticaji u ploci: max My= 16.1 / min My= 0.0 kNm/m

Opt. 12: 1.6xI+1.8xIV



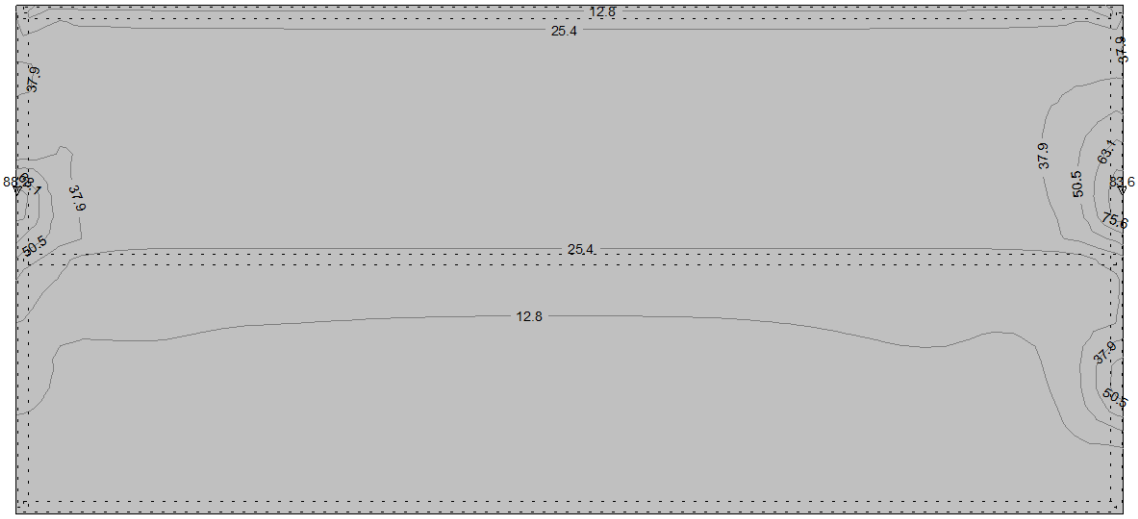
Nivo: Tem. ploča [0.00 m]
Uticaji u ploci: max Mx= 9.0 / min Mx= 0.0 kNm/m

Opt. 12: 1.6xI+1.8xIV



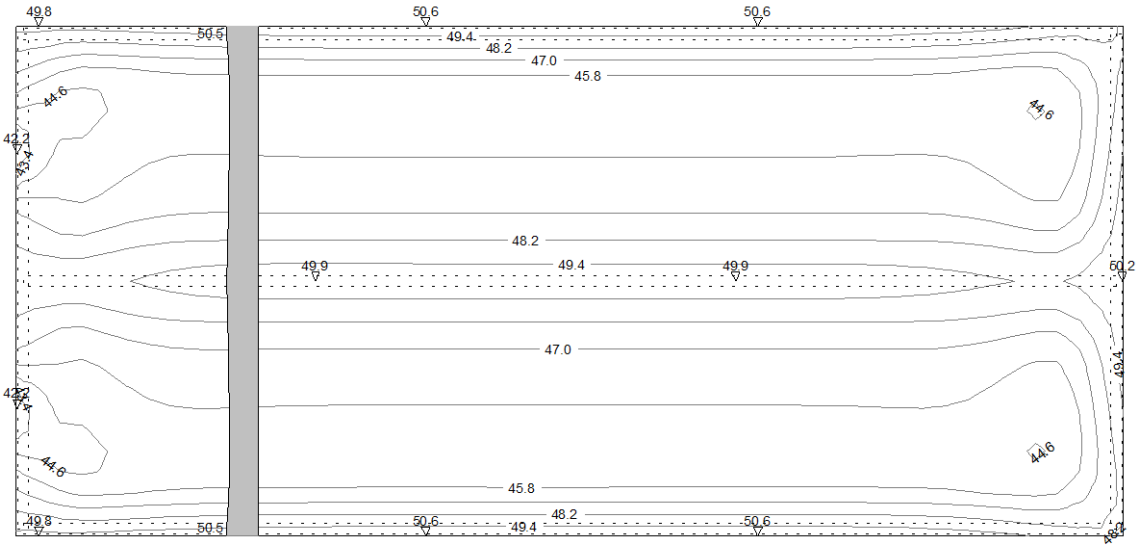
Nivo: Tem. ploča [0.00 m]
Uticaji u ploci: max Nx= 41.3 / min Nx= 0.0 kN/m

Opt. 12: 1.6xI+1.8xIV



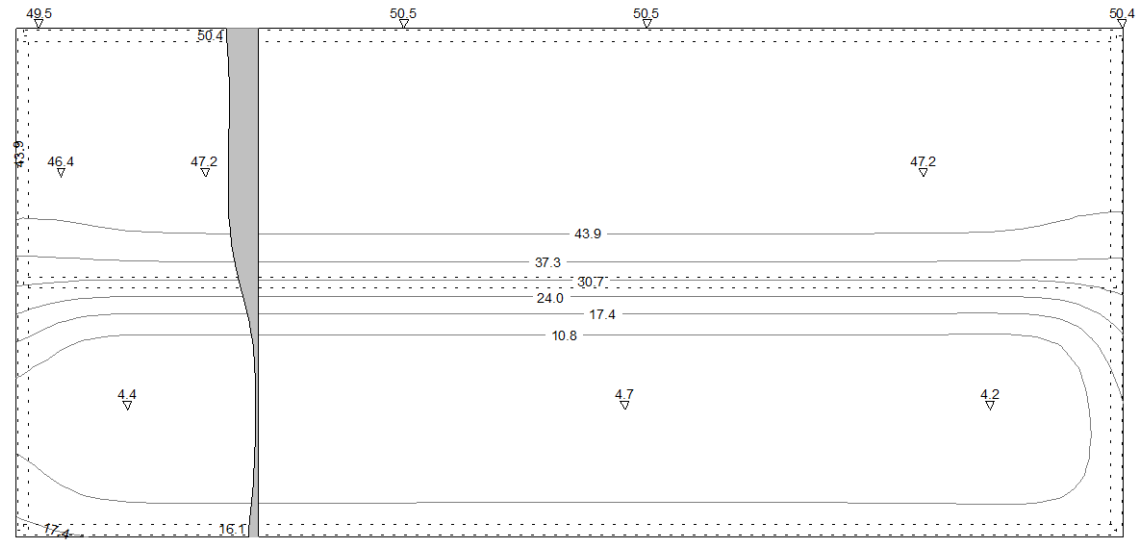
Nivo: Tem. ploča [0.00 m]
Uticaji u ploci: max Ny= 88.2 / min Ny= 0.2 kN/m

Opt. 7: I+II

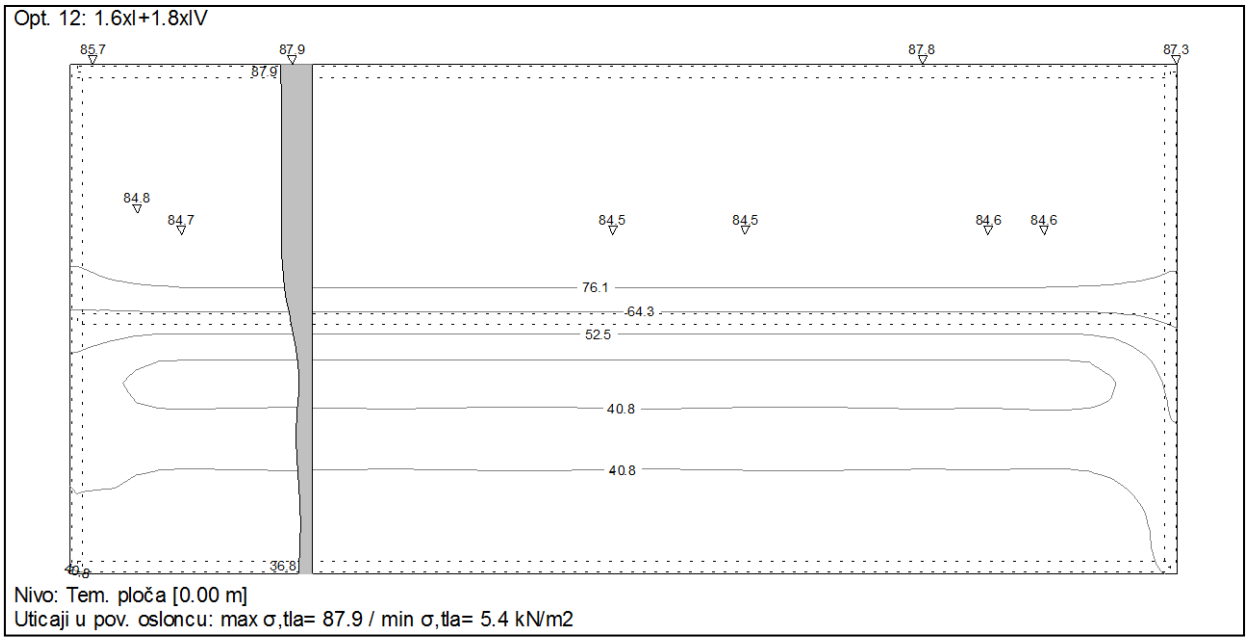


Nivo: Tem. ploča [0.00 m]
Uticaji u pov. osloncu: max σ,tla= 50.6 / min σ,tla= 42.2 kN/m2

Opt. 8: I+III



Nivo: Tem. ploča [0.00 m]
Uticaji u pov. osloncu: max σ,tla= 50.5 / min σ,tla= 4.2 kN/m2

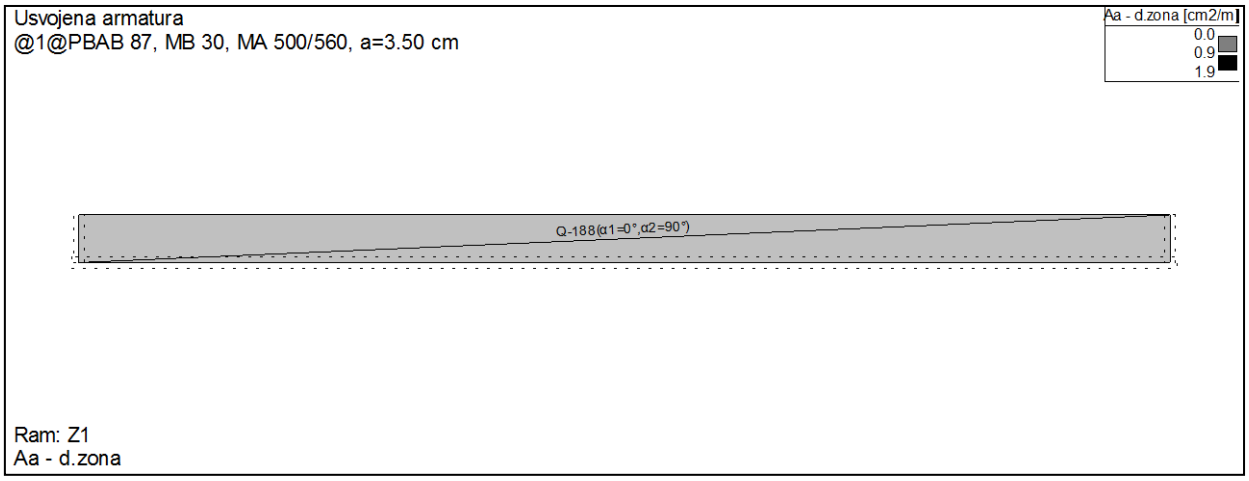

Opt. 12: 1.6xI+1.8xIV
85.7
87.9
87.9
87.8
87.3
84.8
84.7
84.5
84.5
84.6
84.6
76.1
64.3
52.5
40.8
40.8
36.8
Nivo: Tem. ploča [0.00 m]
Uticaji u pov. osloncu: max σ,tla= 87.9 / min σ,tla= 5.4 kN/m2

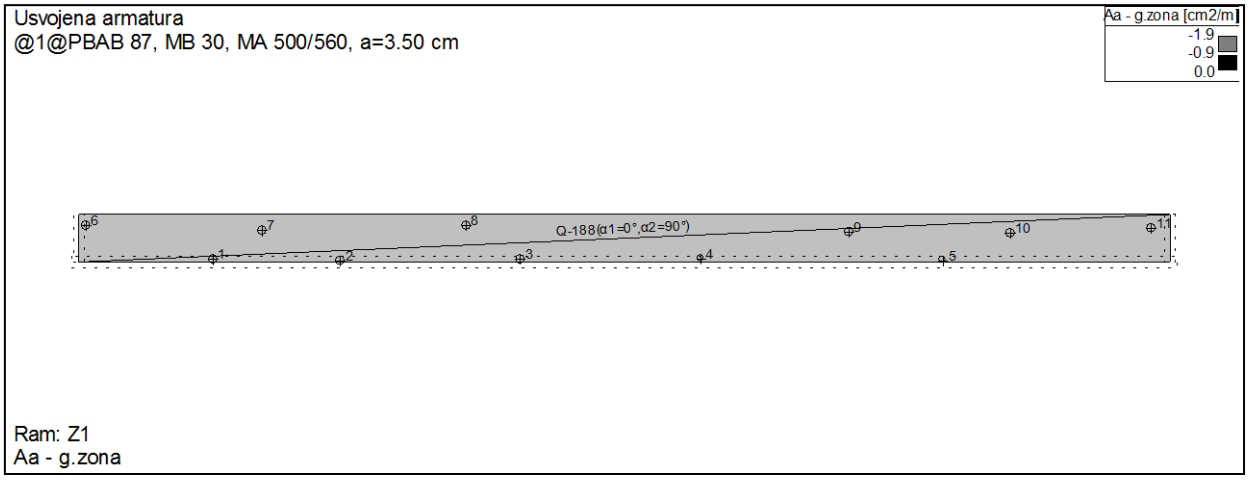
Merodavno opterecenje - @1@PBAB 87

Slucajevi opterecenja
I 1. stalno -(s.težina i pritisak zemlje sp (g) - <Stalno>
II 2. korisno - (bazeni puni) - <Korisno>
III 3. korisno (bazen I pun , bazen II prazan) - <Korisno>
IV 4. korisno (bazen I pun, bazen II filter sl - <Korisno>
V sx seizmika - <Seizmicko> (+/-)
VI sy seizmika - <Seizmicko> (+/-)

Ne kombinuj sa
I -> V, VI
II -> III, IV
III -> II, IV
IV -> II, III, V, VI
V -> I, IV, VI
VI -> I, IV, V

Kombinacije
01. 1.60×I+1.80×II
02. 1.60×I+1.80×IV
03. 1.60×I+1.80×III
04. I+1.80×III
05. I+1.80×IV
06. I+1.80×II
07. 0.65×III+1.30×V
08. 0.65×II-1.30×VI
09. 0.65×II+1.30×VI
10. 0.65×II+1.30×V
11. 0.65×II-1.30×V
12. 0.65×III-1.30×V
13. 0.65×III-1.30×VI
14. 0.65×III+1.30×VI
15. 1.60×I
16. 1.30×VI
17. -1.30×VI
18. 1.30×V
19. -1.30×V
20. I





Ram: Z1
@1@PBAB 87
d,pl=25.0 cm
MB 30
Gornja zona: MA 500/560 (a=3.5 cm)
Donja zona: MA 500/560 (a=3.5 cm)
Kompletna sema opterecenja

Tacka 1
X=5.2 m; Y=20.5 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -0.24 kNm
Nu = 3.30 kN
εb/εa = -0.076/10.000 ‰
Ag1 = 0.05 cm2/m
Ad1 = 0.06 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -21.11 kNm
Nu = -7.53 kN
εb/εa = -0.881/10.000 ‰
Ag2 = 1.84 cm2/m
Ad2 = 1.85 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Tacka 2
X=10.7 m; Y=20.5 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -0.24 kNm
Nu = 2.15 kN
εb/εa = -0.081/10.000 ‰
Nije potrebna armatura.
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -21.02 kNm
Nu = -11.45 kN
εb/εa = -0.882/10.000 ‰
Ag2 = 1.79 cm2/m
Ad2 = 1.80 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Tacka 3
X=18.0 m; Y=20.5 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -0.24 kNm
Nu = 1.78 kN
εb/εa = -0.083/10.000 ‰
Nije potrebna armatura.
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -21.02 kNm
Nu = -11.41 kN
εb/εa = -0.882/10.000 ‰
Ag2 = 1.79 cm2/m
Ad2 = 1.80 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Tacka 4
X=26.3 m; Y=20.5 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -0.24 kNm
Nu = 1.82 kN
εb/εa = -0.083/10.000 ‰
Nije potrebna armatura.
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -21.02 kNm
Nu = -11.36 kN
εb/εa = -0.882/10.000 ‰
Ag2 = 1.79 cm2/m
Ad2 = 1.80 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Tacka 5
X=35.5 m; Y=20.5 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -0.24 kNm
Nu = 2.20 kN
εb/εa = -0.081/10.000 ‰
Nije potrebna armatura.
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -21.02 kNm
Nu = -10.94 kN
εb/εa = -0.882/10.000 ‰
Ag2 = 1.80 cm2/m
Ad2 = 1.80 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Tacka 6
X=0.0 m; Y=20.5 m; Z=2.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 3.85 kNm
Nu = 31.80 kN
εb/εa = -0.320/10.000 ‰
Ag1 = 0.67 cm2/m
Ad1 = 0.67 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 1.62 kNm
Nu = 60.38 kN
εb/εa = -0.118/10.000 ‰
Ag2 = 0.77 cm2/m
Ad2 = 0.77 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Tacka 7
X=8.0 m; Y=20.5 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIII
Mu = -0.97 kNm
Nu = 1.11 kN
εb/εa = -0.177/10.000 ‰
Ag1 = 0.09 cm2/m
Ad1 = 0.10 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -1.71 kNm
Nu = -6.17 kN
εb/εa = -0.248/10.000 ‰
Ag2 = 0.08 cm2/m
Ad2 = 0.08 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Tacka 8
X=16.2 m; Y=20.5 m; Z=2.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -0.45 kNm
Nu = 1.83 kN
εb/εa = -0.116/10.000 ‰
Ag1 = 0.06 cm2/m
Ad1 = 0.06 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 1.30 kNm
Nu = -0.98 kN
εb/εa = -0.208/10.000 ‰
Ag2 = 0.10 cm2/m
Ad2 = 0.10 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Tacka 9
X=31.8 m; Y=20.5 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -0.98 kNm
Nu = 1.71 kN
εb/εa = -0.176/10.000 ‰
Ag1 = 0.10 cm2/m
Ad1 = 0.10 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

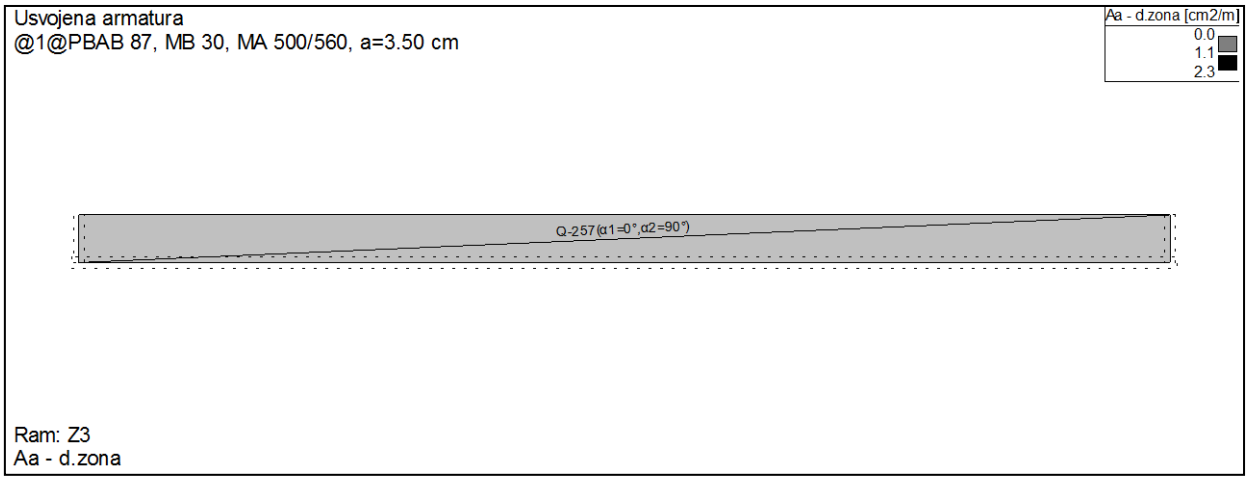
Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -1.72 kNm
Nu = -6.26 kN
εb/εa = -0.250/10.000 ‰
Ag2 = 0.08 cm2/m
Ad2 = 0.08 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

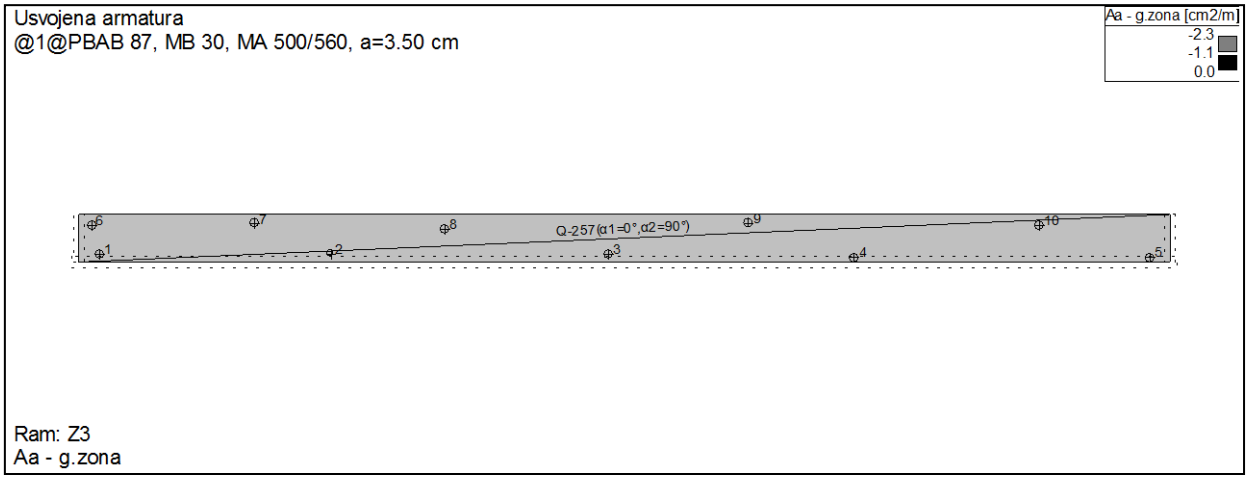
Tacka 10
X=38.2 m; Y=20.5 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIII
Mu = -0.98 kNm
Nu = 2.67 kN
εb/εa = -0.175/10.000 ‰
Ag1 = 0.11 cm2/m
Ad1 = 0.11 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -1.73 kNm
Nu = -5.99 kN
εb/εa = -0.249/10.000 ‰
Ag2 = 0.08 cm2/m
Ad2 = 0.09 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Tacka 11
X=44.5 m; Y=20.5 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 1.78 kNm
Nu = 19.27 kN
εb/εa = -0.211/10.000 ‰
Ag1 = 0.35 cm2/m
Ad1 = 0.36 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 1.17 kNm
Nu = 7.95 kN
εb/εa = -0.181/10.000 ‰
Ag2 = 0.18 cm2/m
Ad2 = 0.18 cm2/m
Usvojeno (gornja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Usvojeno (donja zona):
Q-188 Ø6/15 (1.88 cm2/m)
Procenat armiranja: 0.15%





Ram: Z3
@1@PBAB 87
d,pl=25.0 cm
MB 30
Gornja zona: MA 500/560 (a=3.5 cm)
Donja zona: MA 500/560 (a=3.5 cm)
Kompletna sema opterecenja

Tacka 1
X=0.6 m; Y=10.3 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 0.52 kNm
Nu = 9.38 kN
εb/εa = -0.105/10.000 ‰
Ag1 = 0.14 cm2/m
Ad1 = 0.14 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 16.60 kNm
Nu = 58.83 kN
εb/εa = -0.716/10.000 ‰
Ag2 = 2.11 cm2/m
Ad2 = 2.12 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 2
X=10.7 m; Y=10.3 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.25 kNm
Nu = 1.81 kN
εb/εa = -0.083/10.000 ‰
Nije potrebna armatura.
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 21.07 kNm
Nu = -8.11 kN
εb/εa = -0.879/10.000 ‰
Ag2 = 1.82 cm2/m
Ad2 = 1.83 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 3
X=21.7 m; Y=10.3 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.25 kNm
Nu = 1.33 kN
εb/εa = -0.084/10.000 ‰
Nije potrebna armatura.
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 21.07 kNm
Nu = -9.65 kN
εb/εa = -0.881/10.000 ‰
Ag2 = 1.81 cm2/m
Ad2 = 1.81 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 4
X=31.8 m; Y=10.3 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.25 kNm
Nu = 1.59 kN
εb/εa = -0.084/10.000 ‰
Nije potrebna armatura.
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 21.07 kNm
Nu = -9.10 kN
εb/εa = -0.881/10.000 ‰
Ag2 = 1.81 cm2/m
Ad2 = 1.82 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 5
X=44.6 m; Y=10.3 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 0.67 kNm
Nu = 9.35 kN
εb/εa = -0.125/10.000 ‰
Ag1 = 0.15 cm2/m
Ad1 = 0.15 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 18.61 kNm
Nu = 55.27 kN
εb/εa = -0.768/10.000 ‰
Ag2 = 2.27 cm2/m
Ad2 = 2.28 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 6
X=0.8 m; Y=10.3 m; Z=2.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 0.54 kNm
Nu = 43.35 kN
εb/εa = 0.214/10.000 ‰
Ag1 = 0.49 cm2/m
Ad1 = 0.49 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.87 kNm
Nu = 24.12 kN
εb/εa = -0.114/10.000 ‰
Ag2 = 0.33 cm2/m
Ad2 = 0.33 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 7
X=7.0 m; Y=10.3 m; Z=2.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 0.49 kNm
Nu = 16.61 kN
εb/εa = -0.075/10.000 ‰
Ag1 = 0.21 cm2/m
Ad1 = 0.22 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -1.28 kNm
Nu = -2.17 kN
εb/εa = -0.210/10.000 ‰
Ag2 = 0.09 cm2/m
Ad2 = 0.09 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 8
X=15.3 m; Y=10.3 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.99 kNm
Nu = 1.58 kN
εb/εa = -0.178/10.000 ‰
Ag1 = 0.10 cm2/m
Ad1 = 0.10 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

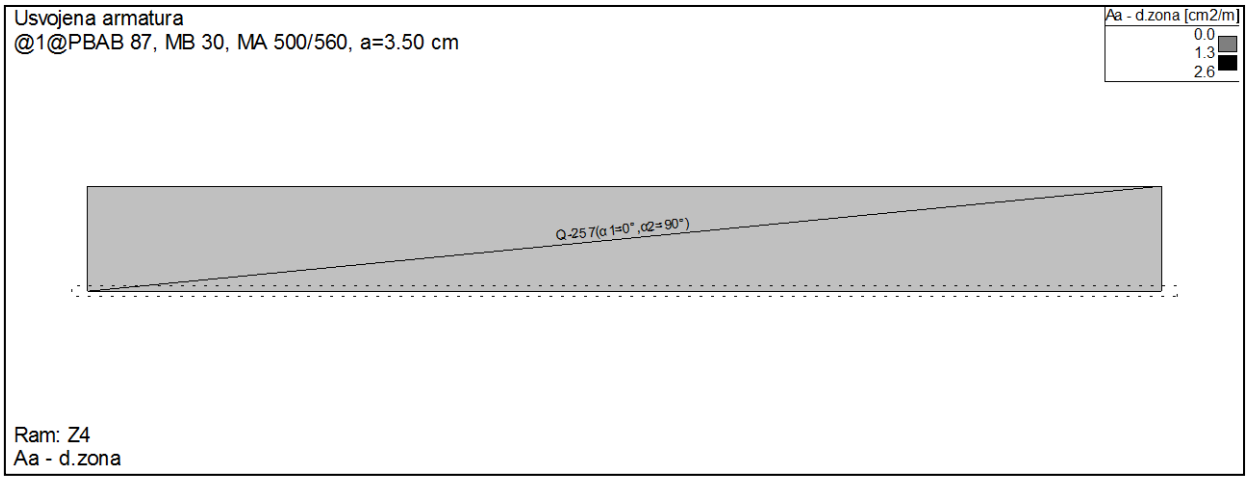
Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 1.75 kNm
Nu = -5.96 kN
εb/εa = -0.251/10.000 ‰
Ag2 = 0.09 cm2/m
Ad2 = 0.09 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

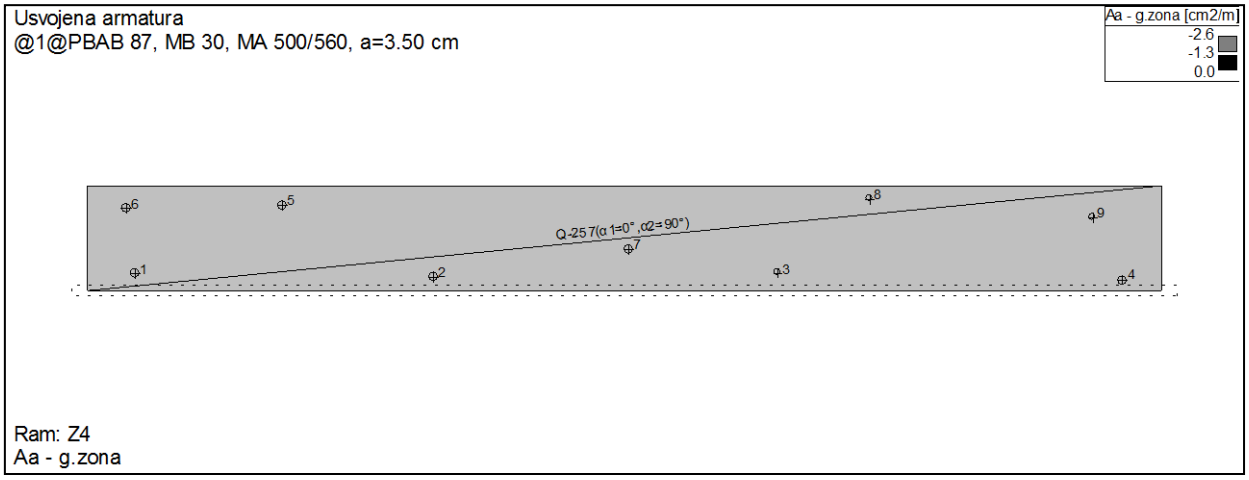
Tacka 9
X=28.1 m; Y=10.3 m; Z=2.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.48 kNm
Nu = 2.31 kN
εb/εa = -0.118/10.000 ‰
Ag1 = 0.06 cm2/m
Ad1 = 0.06 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -1.29 kNm
Nu = -1.15 kN
εb/εa = -0.208/10.000 ‰
Ag2 = 0.10 cm2/m
Ad2 = 0.10 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 10
X=40.0 m; Y=10.3 m; Z=2.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 0.59 kNm
Nu = 43.20 kN
εb/εa = 0.161/10.000 ‰
Ag1 = 0.50 cm2/m
Ad1 = 0.50 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIII
Mu = -1.28 kNm
Nu = -2.94 kN
εb/εa = -0.210/10.000 ‰
Ag2 = 0.08 cm2/m
Ad2 = 0.08 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%





Ram: Z4
@1@PBAB 87
d,pl=25.0 cm
MB 30
Gornja zona: MA 500/560 (a=3.5 cm)
Donja zona: MA 500/560 (a=3.5 cm)
Kompletna sema opterecenja

Tacka 1
X=45.3 m; Y=0.4 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -0.60 kNm
Nu = 7.78 kN
εb/εa = -0.121/10.000 ‰
Ag1 = 0.13 cm2/m
Ad1 = 0.13 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = 6.07 kNm
Nu = 0.54 kN
εb/εa = -0.454/10.000 ‰
Ag2 = 0.53 cm2/m
Ad2 = 0.54 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 2
X=45.3 m; Y=6.7 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.02 kNm
Nu = 10.81 kN
εb/εa = 0.818/10.000 ‰
Ag1 = 0.11 cm2/m
Ad1 = 0.11 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = 20.91 kNm
Nu = -12.31 kN
εb/εa = -0.879/10.000 ‰
Ag2 = 1.76 cm2/m
Ad2 = 1.77 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 3
X=45.3 m; Y=12.9 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.35 kNm
Nu = 21.19 kN
εb/εa = 0.030/10.000 ‰
Ag1 = 0.25 cm2/m
Ad1 = 0.25 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 21.68 kNm
Nu = 38.89 kN
εb/εa = -0.852/10.000 ‰
Ag2 = 2.38 cm2/m
Ad2 = 2.39 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 4
X=45.3 m; Y=19.9 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.28 kNm
Nu = 14.16 kN
εb/εa = -0.032/10.000 ‰
Ag1 = 0.17 cm2/m
Ad1 = 0.17 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 14.28 kNm
Nu = 30.01 kN
εb/εa = -0.683/10.000 ‰
Ag2 = 1.59 cm2/m
Ad2 = 1.60 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 5
X=45.3 m; Y=4.1 m; Z=2.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 0.49 kNm
Nu = 65.08 kN
εb/εa = 0.471/10.000 ‰
Ag1 = 0.70 cm2/m
Ad1 = 0.71 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.60xI+1.80xII
Mu = -1.29 kNm
Nu = -3.90 kN
εb/εa = -0.213/10.000 ‰
Ag2 = 0.07 cm2/m
Ad2 = 0.07 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 6
X=45.3 m; Y=0.7 m; Z=2.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xII
Mu = -0.46 kNm
Nu = 17.80 kN
εb/εa = -0.066/10.000 ‰
Ag1 = 0.23 cm2/m
Ad1 = 0.23 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.38 kNm
Nu = 1.52 kN
εb/εa = -0.106/10.000 ‰
Nije potrebna armatura.
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 7
X=45.3 m; Y=10.3 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 2.94 kNm
Nu = 8.58 kN
εb/εa = -0.303/10.000 ‰
Ag1 = 0.34 cm2/m
Ad1 = 0.35 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

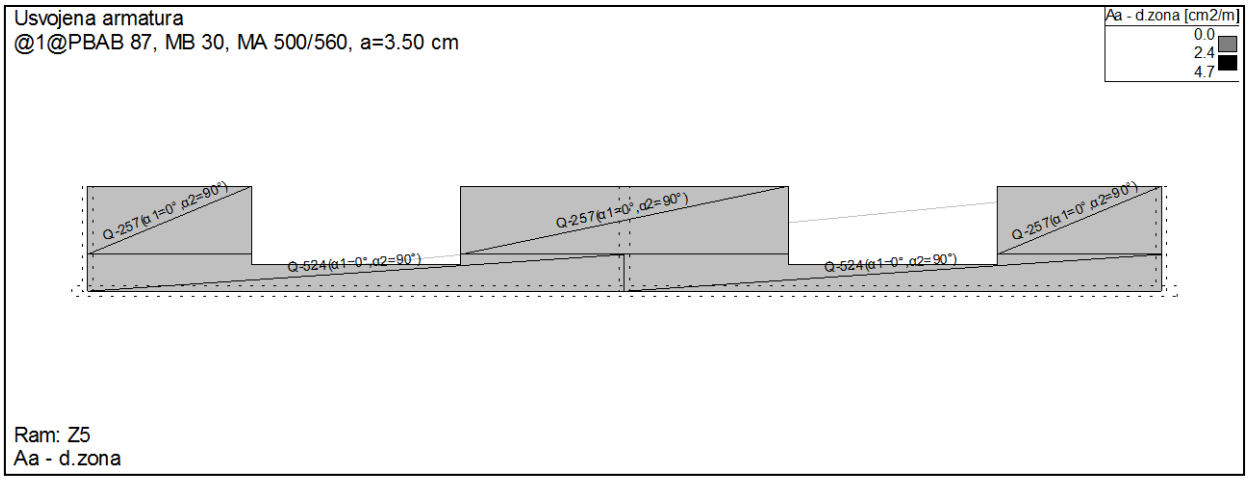
Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.26 kNm
Nu = 2.85 kN
εb/εa = -0.083/10.000 ‰
Ag2 = 0.05 cm2/m
Ad2 = 0.05 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

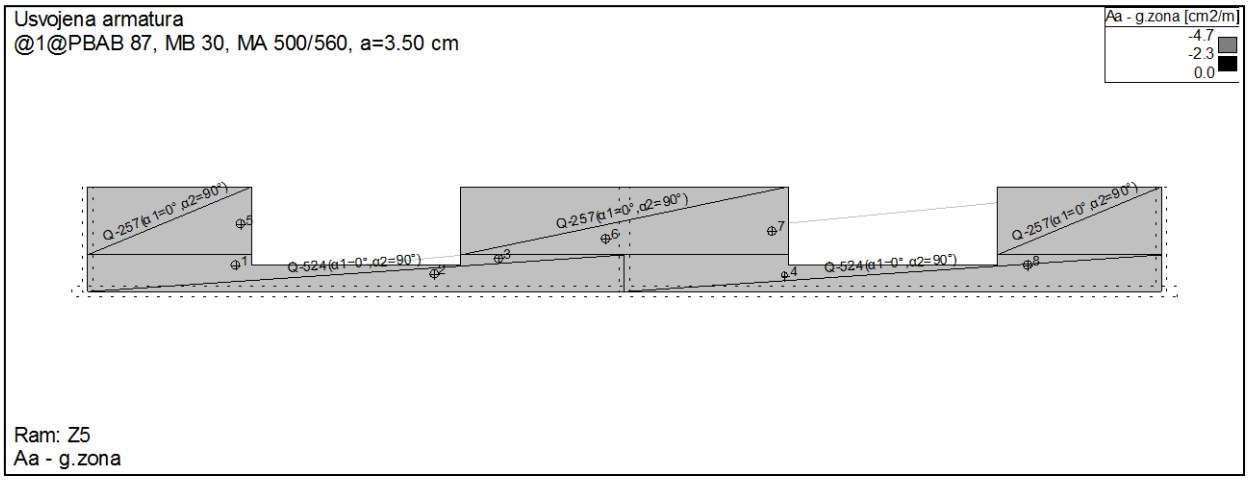
Tacka 8
X=45.3 m; Y=14.6 m; Z=2.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 0.45 kNm
Nu = 51.45 kN
εb/εa = 0.413/10.000 ‰
Ag1 = 0.56 cm2/m
Ad1 = 0.56 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -1.27 kNm
Nu = -1.88 kN
εb/εa = -0.208/10.000 ‰
Ag2 = 0.09 cm2/m
Ad2 = 0.09 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 9
X=45.3 m; Y=19.0 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 0.86 kNm
Nu = 23.80 kN
εb/εa = -0.112/10.000 ‰
Ag1 = 0.32 cm2/m
Ad1 = 0.32 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 1.99 kNm
Nu = -1.41 kN
εb/εa = -0.260/10.000 ‰
Ag2 = 0.16 cm2/m
Ad2 = 0.16 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%





Ram: Z5
@1@PBAB 87
d,pl=25.0 cm
MB 30
Gornja zona: MA 500/560 (a=3.5 cm)
Donja zona: MA 500/560 (a=3.5 cm)
Kompletna sema opterecenja

Tacka 1
X=0.0 m; Y=3.1 m; Z=0.5 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xII
Mu = -1.40 kNm
Nu = 14.80 kN
εb/εa = -0.189/10.000 ‰
Ag1 = 0.28 cm2/m
Ad1 = 0.28 cm2/m
Usvojeno (gornja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Usvojeno (donja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Procenat armiranja: 0.42%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -31.33 kNm
Nu = -15.61 kN
εb/εa = -1.090/10.000 ‰
Ag2 = 2.73 cm2/m
Ad2 = 2.74 cm2/m
Usvojeno (gornja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Usvojeno (donja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Procenat armiranja: 0.42%

Tacka 2
X=-0.0 m; Y=6.7 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xII
Mu = -1.22 kNm
Nu = 4.41 kN
εb/εa = -0.192/10.000 ‰
Ag1 = 0.15 cm2/m
Ad1 = 0.15 cm2/m
Usvojeno (gornja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Usvojeno (donja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Procenat armiranja: 0.42%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -15.17 kNm
Nu = -46.10 kN
εb/εa = -0.778/10.000 ‰
Ag2 = 0.87 cm2/m
Ad2 = 0.88 cm2/m
Usvojeno (gornja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Usvojeno (donja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Procenat armiranja: 0.42%

Tacka 3
X=0.0 m; Y=7.8 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.54 kNm
Nu = 43.82 kN
εb/εa = 0.223/10.000 ‰
Ag1 = 0.50 cm2/m
Ad1 = 0.50 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -9.00 kNm
Nu = 1.85 kN
εb/εa = -0.558/10.000 ‰
Ag2 = 0.82 cm2/m
Ad2 = 0.82 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 4
X=0.0 m; Y=13.4 m; Z=0.5 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.18 kNm
Nu = 29.79 kN
εb/εa = 0.563/10.000 ‰
Ag1 = 0.32 cm2/m
Ad1 = 0.32 cm2/m
Usvojeno (gornja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Usvojeno (donja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Procenat armiranja: 0.42%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -41.91 kNm
Nu = -134.51 kN
εb/εa = -1.382/10.000 ‰
Ag2 = 2.50 cm2/m
Ad2 = 2.51 cm2/m
Usvojeno (gornja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Usvojeno (donja zona):
Q-524 Ø10/15 (5.24 cm2/m)
Procenat armiranja: 0.42%

Tacka 5
X=0.0 m; Y=2.3 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 0.40 kNm
Nu = 7.29 kN
εb/εa = -0.091/10.000 ‰
Ag1 = 0.11 cm2/m
Ad1 = 0.11 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -8.76 kNm
Nu = -2.25 kN
εb/εa = -0.554/10.000 ‰
Ag2 = 0.75 cm2/m
Ad2 = 0.75 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 6
X=0.0 m; Y=10.3 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 1.51 kNm
Nu = 3.89 kN
εb/εa = -0.217/10.000 ‰
Ag1 = 0.17 cm2/m
Ad1 = 0.17 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

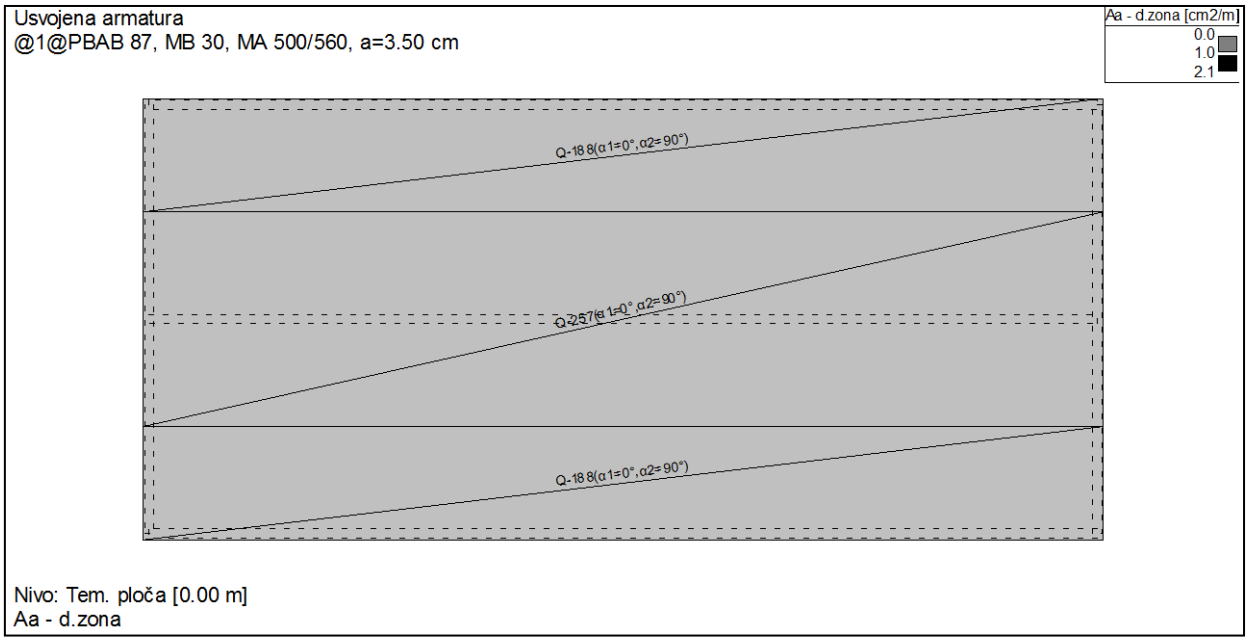
Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.64 kNm
Nu = 3.66 kN
εb/εa = -0.136/10.000 ‰
Ag2 = 0.09 cm2/m
Ad2 = 0.09 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

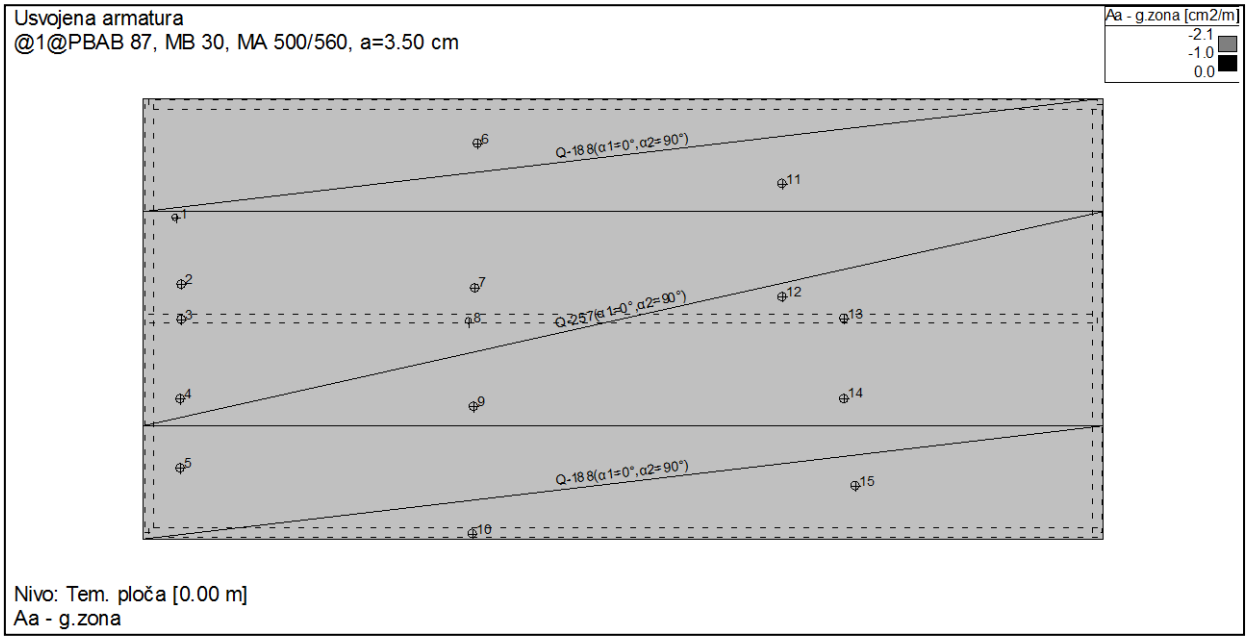
Tacka 7
X=0.0 m; Y=13.4 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 3.50 kNm
Nu = 7.70 kN
εb/εa = -0.334/10.000 ‰
Ag1 = 0.38 cm2/m
Ad1 = 0.39 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 0.18 kNm
Nu = 141.06 kN
εb/εa = 0.834/10.000 ‰
Ag2 = 1.42 cm2/m
Ad2 = 1.43 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Tacka 8
X=0.0 m; Y=18.2 m; Z=1.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 0.33 kNm
Nu = 15.12 kN
εb/εa = -0.042/10.000 ‰
Ag1 = 0.19 cm2/m
Ad1 = 0.19 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -8.74 kNm
Nu = -2.13 kN
εb/εa = -0.554/10.000 ‰
Ag2 = 0.75 cm2/m
Ad2 = 0.75 cm2/m
Usvojeno (gornja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Usvojeno (donja zona):
Q-257 Ø7/15 (2.57 cm2/m)
Procenat armiranja: 0.21%





Nivo: Tem. ploča [0.00 m]
@1@PBAB 87
d,pl=25.0 cm
MB 30
Gornja zona: MA 500/560 (a=3.5 cm)
Donja zona: MA 500/560 (a=3.5 cm)
Kompletna sema opterecenja

Tacka 1
X=1.5 m; Y=14.6 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = -10.41 kNm
Nu = 0.00 kN
εb/εa = -0.604/10.000 ‰
Ag1 = 0.93 cm2/m
Ad1 = 0.93 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 3.96 kNm
Nu = 0.00 kN
εb/εa = -0.366/10.000 ‰
Ag2 = 0.34 cm2/m
Ad2 = 0.34 cm2/m

Tacka 2
X=1.5 m; Y=12.0 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = -10.48 kNm
Nu = 0.00 kN
εb/εa = -0.606/10.000 ‰
Ag1 = 0.93 cm2/m
Ad1 = 0.94 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 9.71 kNm
Nu = 0.00 kN
εb/εa = -0.581/10.000 ‰
Ag2 = 0.86 cm2/m
Ad2 = 0.86 cm2/m

Tacka 3
X=1.5 m; Y=10.3 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xII
Mu = -3.43 kNm
Nu = 0.00 kN
εb/εa = -0.340/10.000 ‰
Ag1 = 0.30 cm2/m
Ad1 = 0.30 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 9.32 kNm
Nu = 0.00 kN
εb/εa = -0.570/10.000 ‰
Ag2 = 0.82 cm2/m
Ad2 = 0.83 cm2/m

Tacka 4
X=1.5 m; Y=6.7 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = -6.53 kNm
Nu = 0.00 kN
εb/εa = -0.474/10.000 ‰
Ag1 = 0.57 cm2/m
Ad1 = 0.58 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = -8.79 kNm
Nu = 0.00 kN
εb/εa = -0.552/10.000 ‰
Ag2 = 0.77 cm2/m
Ad2 = 0.78 cm2/m

Tacka 5
X=1.5 m; Y=3.2 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = -5.37 kNm
Nu = 0.00 kN
εb/εa = -0.428/10.000 ‰
Ag1 = 0.47 cm2/m
Ad1 = 0.47 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.60xI+1.80xII
Mu = -6.52 kNm
Nu = 0.00 kN
εb/εa = -0.473/10.000 ‰
Ag2 = 0.57 cm2/m
Ad2 = 0.57 cm2/m

Tacka 6
X=15.3 m; Y=19.0 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = -3.50 kNm
Nu = 0.00 kN
εb/εa = -0.343/10.000 ‰
Ag1 = 0.30 cm2/m
Ad1 = 0.30 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = -17.25 kNm
Nu = 0.00 kN
εb/εa = -0.786/10.000 ‰
Ag2 = 1.56 cm2/m
Ad2 = 1.56 cm2/m

Tacka 7
X=15.3 m; Y=12.0 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xII
Mu = -2.60 kNm
Nu = 0.00 kN
εb/εa = -0.296/10.000 ‰
Ag1 = 0.22 cm2/m
Ad1 = 0.23 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 13.62 kNm
Nu = 0.00 kN
εb/εa = -0.693/10.000 ‰
Ag2 = 1.21 cm2/m
Ad2 = 1.22 cm2/m

Tacka 8
X=15.3 m; Y=10.3 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -1.97 kNm
Nu = 0.00 kN
εb/εa = -0.255/10.000 ‰
Ag1 = 0.17 cm2/m
Ad1 = 0.17 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 7.33 kNm
Nu = 0.00 kN
εb/εa = -0.502/10.000 ‰
Ag2 = 0.64 cm2/m
Ad2 = 0.64 cm2/m

Tacka 9
X=15.3 m; Y=5.9 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 8.51 kNm
Nu = 0.00 kN
εb/εa = -0.542/10.000 ‰
Ag1 = 0.75 cm2/m
Ad1 = 0.75 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 10.52 kNm
Nu = 0.00 kN
εb/εa = -0.606/10.000 ‰
Ag2 = 0.93 cm2/m
Ad2 = 0.93 cm2/m

Tacka 10
X=15.3 m; Y=-0.0 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xII
Mu = -1.44 kNm
Nu = 0.00 kN
εb/εa = -0.219/10.000 ‰
Ag1 = 0.12 cm2/m
Ad1 = 0.12 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -3.57 kNm
Nu = 0.00 kN
εb/εa = -0.346/10.000 ‰
Ag2 = 0.31 cm2/m
Ad2 = 0.31 cm2/m

Tacka 11
X=30.0 m; Y=16.4 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = -2.73 kNm
Nu = 0.00 kN
εb/εa = -0.303/10.000 ‰
Ag1 = 0.24 cm2/m
Ad1 = 0.24 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = -3.65 kNm
Nu = 0.00 kN
εb/εa = -0.351/10.000 ‰
Ag2 = 0.32 cm2/m
Ad2 = 0.32 cm2/m

Tacka 12
X=30.0 m; Y=11.1 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = -2.08 kNm
Nu = 0.00 kN
εb/εa = -0.263/10.000 ‰
Ag1 = 0.18 cm2/m
Ad1 = 0.18 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 15.99 kNm
Nu = 0.00 kN
εb/εa = -0.755/10.000 ‰
Ag2 = 1.43 cm2/m
Ad2 = 1.44 cm2/m

Tacka 13
X=33.6 m; Y=10.3 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xII
Mu = -1.95 kNm
Nu = 0.00 kN
εb/εa = -0.255/10.000 ‰
Ag1 = 0.17 cm2/m
Ad1 = 0.17 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = 7.14 kNm
Nu = 0.00 kN
εb/εa = -0.496/10.000 ‰
Ag2 = 0.63 cm2/m
Ad2 = 0.63 cm2/m

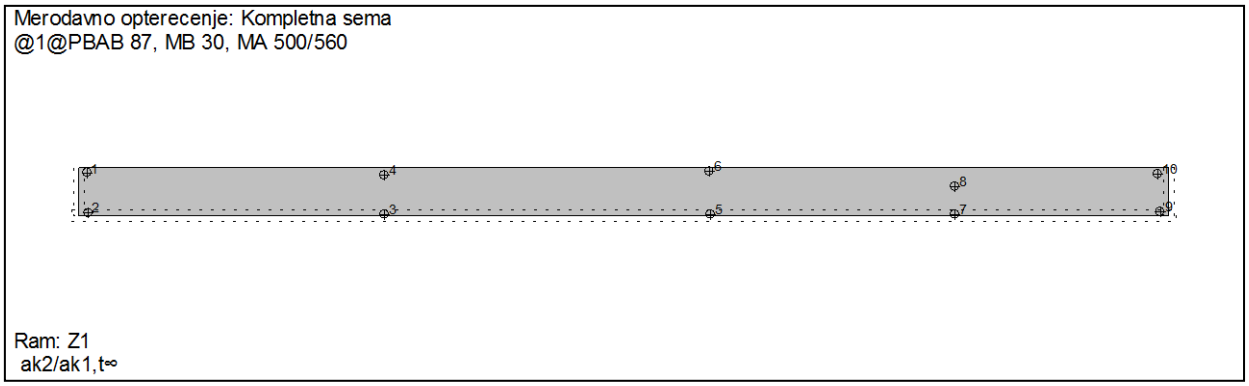
Tacka 14
X=33.6 m; Y=6.7 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.00xI+1.80xIV
Mu = 5.84 kNm
Nu = 0.00 kN
εb/εa = -0.446/10.000 ‰
Ag1 = 0.51 cm2/m
Ad1 = 0.51 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = -8.48 kNm
Nu = 0.00 kN
εb/εa = -0.543/10.000 ‰
Ag2 = 0.75 cm2/m
Ad2 = 0.75 cm2/m

Tacka 15
X=33.6 m; Y=2.3 m; Z=0.0 m
Pravac 1: (α=0°)
Merodavna kombinacija:
1.60xI+1.80xII
Mu = -3.36 kNm
Nu = 0.00 kN
εb/εa = -0.336/10.000 ‰
Ag1 = 0.29 cm2/m
Ad1 = 0.29 cm2/m

Pravac 2: (α=90°)
Merodavna kombinacija:
1.60xI+1.80xIV
Mu = -10.02 kNm
Nu = 0.00 kN
εb/εa = -0.591/10.000 ‰
Ag2 = 0.89 cm2/m
Ad2 = 0.89 cm2/m

Proračun prslona



Ram: Z1 - @1@PBAB 87
MB 30 (d,pl=25.0 cm)
Gornja zona: MA 500/560 (a=3.5 cm)
Donja zona: MA 500/560 (a=3.5 cm)
Eb(t0) = 3.15e+007 kN/m2
Ea = 2e+008 kN/m2
fbzs = 1958.35 kN/m2
φ = 0.85
X = 0.80
εs = 1.000‰
k1 = 0.40
β1 = 1.00

Tacka 1
X=0.0 m; Y=20.5 m; Z=2.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 2
X=0.4 m; Y=20.5 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 3
X=12.5 m; Y=20.5 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 4
X=12.5 m; Y=20.5 m; Z=2.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 5
X=26.3 m; Y=20.5 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 6
X=26.3 m; Y=20.5 m; Z=2.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 7
X=36.4 m; Y=20.5 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 8
X=36.4 m; Y=20.5 m; Z=1.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 9
X=44.8 m; Y=20.5 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 10
X=44.5 m; Y=20.5 m; Z=2.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

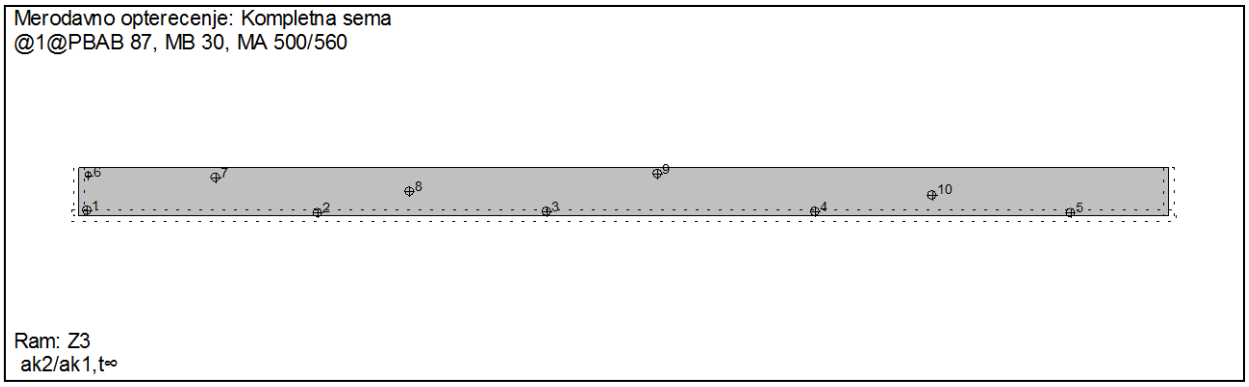
T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline



Ram: Z3 - @1@PBAB 87
MB 30 (d,pl=25.0 cm)
Gornja zona: MA 500/560 (a=3.5 cm)
Donja zona: MA 500/560 (a=3.5 cm)
Eb(t0) = 3.15e+007 kN/m2
Ea = 2e+008 kN/m2
fbzs = 1958.35 kN/m2
φ = 0.85
X = 0.80
εs = 1.000‰
k1 = 0.40
β1 = 1.00

Tacka 1
X=0.6 m; Y=10.3 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 2
X=9.8 m; Y=10.3 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 3
X=19.9 m; Y=10.3 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 4
X=30.9 m; Y=10.3 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 5
X=41.0 m; Y=10.3 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 6
X=0.8 m; Y=10.3 m; Z=2.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 7
X=5.2 m; Y=10.3 m; Z=2.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 8
X=13.5 m; Y=10.3 m; Z=1.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 9
X=24.5 m; Y=10.3 m; Z=2.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 10
X=35.5 m; Y=10.3 m; Z=1.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

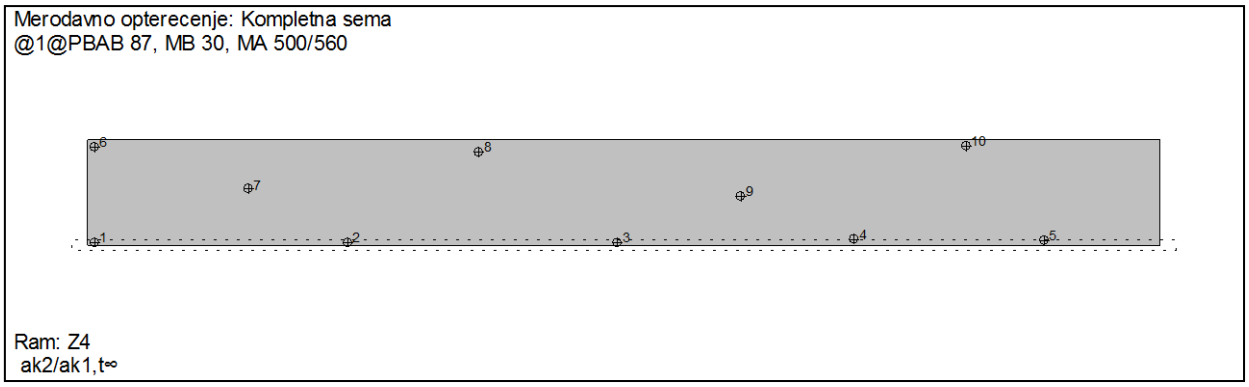
T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline



Ram: Z4 - @1@PBAB 87
MB 30 (d,pl=25.0 cm)
Gornja zona: MA 500/560 (a=3.5 cm)
Donja zona: MA 500/560 (a=3.5 cm)
Eb(t0) = 3.15e+007 kN/m2
Ea = 2e+008 kN/m2
fbzs = 1958.35 kN/m2
φ = 0.85
X = 0.80
εs = 1.000‰
k1 = 0.40
β1 = 1.00

Tacka 1
X=45.3 m; Y=0.0 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 2
X=45.3 m; Y=5.0 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 3
X=45.3 m; Y=10.3 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 4
X=45.3 m; Y=14.6 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 5
X=45.3 m; Y=18.2 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 6
X=45.3 m; Y=0.0 m; Z=2.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 7
X=45.3 m; Y=3.2 m; Z=1.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 8
X=45.3 m; Y=7.6 m; Z=2.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 9
X=45.3 m; Y=12.9 m; Z=1.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 10
X=45.3 m; Y=16.4 m; Z=2.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

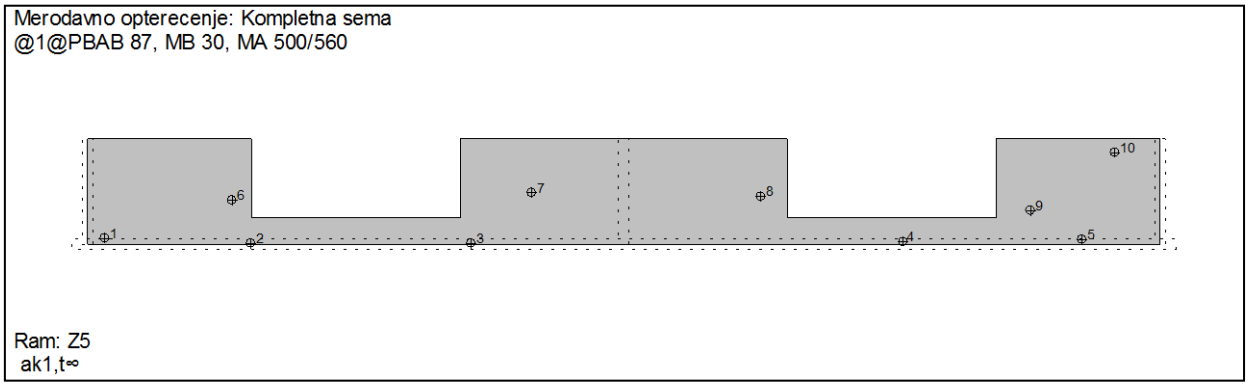
T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline



Ram: Z5 - @1@PBAB 87
MB 30 (d,pl=25.0 cm)
Gornja zona: MA 500/560 (a=3.5 cm)
Donja zona: MA 500/560 (a=3.5 cm)
Eb(t0) = 3.15e+007 kN/m2
Ea = 2e+008 kN/m2
fbzs = 1958.35 kN/m2
φ = 0.85
X = 0.80
εs = 1.000‰
k1 = 0.40
β1 = 1.00

Tacka 1
X=-0.0 m; Y=0.6 m; Z=0.0 m
Gornja zona
Ø10/15 α = 0°
Ø10/15 α = 90°
Donja zona
Ø10/15 α = 0°
Ø10/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 2
X=-0.0 m; Y=3.2 m; Z=0.0 m
Gornja zona
Ø10/15 α = 0°
Ø10/15 α = 90°
Donja zona
Ø10/15 α = 0°
Ø10/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 3
X=-0.0 m; Y=7.6 m; Z=0.0 m
Gornja zona
Ø10/15 α = 0°
Ø10/15 α = 90°
Donja zona
Ø10/15 α = 0°
Ø10/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 4
X=0.0 m; Y=15.5 m; Z=0.0 m
Gornja zona
Ø10/15 α = 0°
Ø10/15 α = 90°
Donja zona
Ø10/15 α = 0°
Ø10/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 5
X=0.0 m; Y=19.0 m; Z=0.0 m
Gornja zona
Ø10/15 α = 0°
Ø10/15 α = 90°
Donja zona
Ø10/15 α = 0°
Ø10/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 6
X=0.0 m; Y=2.3 m; Z=1.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 7
X=0.0 m; Y=8.5 m; Z=1.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 8
X=0.0 m; Y=12.7 m; Z=1.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 9
X=0.0 m; Y=18.2 m; Z=1.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 10
X=0.0 m; Y=19.8 m; Z=2.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

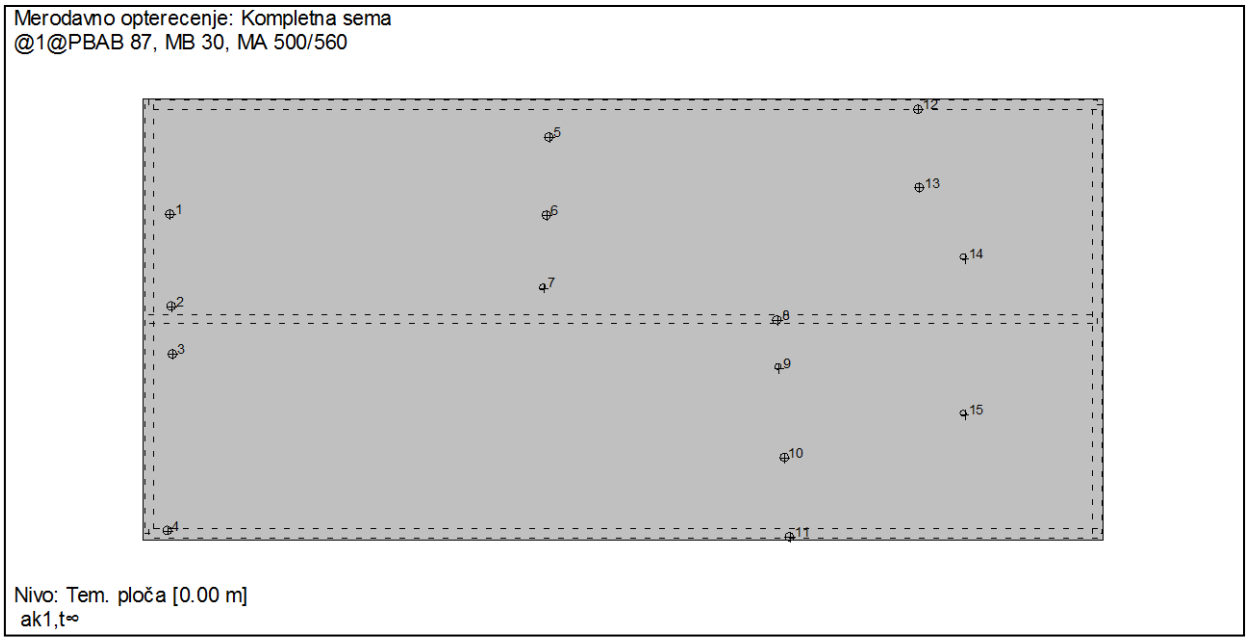
T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline



Nivo: Tem. ploča [0.00 m] - @1@PBAB 87
MB 30 (d,pl=25.0 cm)
Gornja zona: MA 500/560 (a=3.5 cm)
Donja zona: MA 500/560 (a=3.5 cm)
Eb(t0) = 3.15e+007 kN/m2
Ea = 2e+008 kN/m2
fbzs = 1958.35 kN/m2
φ = 0.85
X = 0.80
εs = 1.000‰
k1 = 0.40
β1 = 1.00

Tacka 1
X=1.5 m; Y=15.5 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 2
X=1.5 m; Y=11.1 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 3
X=1.5 m; Y=8.5 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 4
X=0.4 m; Y=0.0 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 5
X=19.0 m; Y=19.0 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 6
X=19.0 m; Y=15.5 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 7
X=19.0 m; Y=12.0 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 8
X=30.0 m; Y=10.3 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°

Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 9
X=30.0 m; Y=7.6 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 10
X=30.0 m; Y=3.2 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 11
X=30.9 m; Y=-0.3 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 12
X=36.4 m; Y=20.5 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 13
X=37.3 m; Y=16.4 m; Z=0.0 m
Gornja zona
Ø6/15 α = 0°
Ø6/15 α = 90°
Donja zona
Ø6/15 α = 0°
Ø6/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 14
X=39.1 m; Y=12.9 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Tacka 15
X=39.1 m; Y=5.9 m; Z=0.0 m
Gornja zona
Ø7/15 α = 0°
Ø7/15 α = 90°
Donja zona
Ø7/15 α = 0°
Ø7/15 α = 90°

Pravac 1: (α=0°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

Pravac 2: (α=90°)

T = 0 Presek bez prsline

T = ∞ Presek bez prsline

3.3.2. Plans and details of reinforcement

From construction permit documentation:

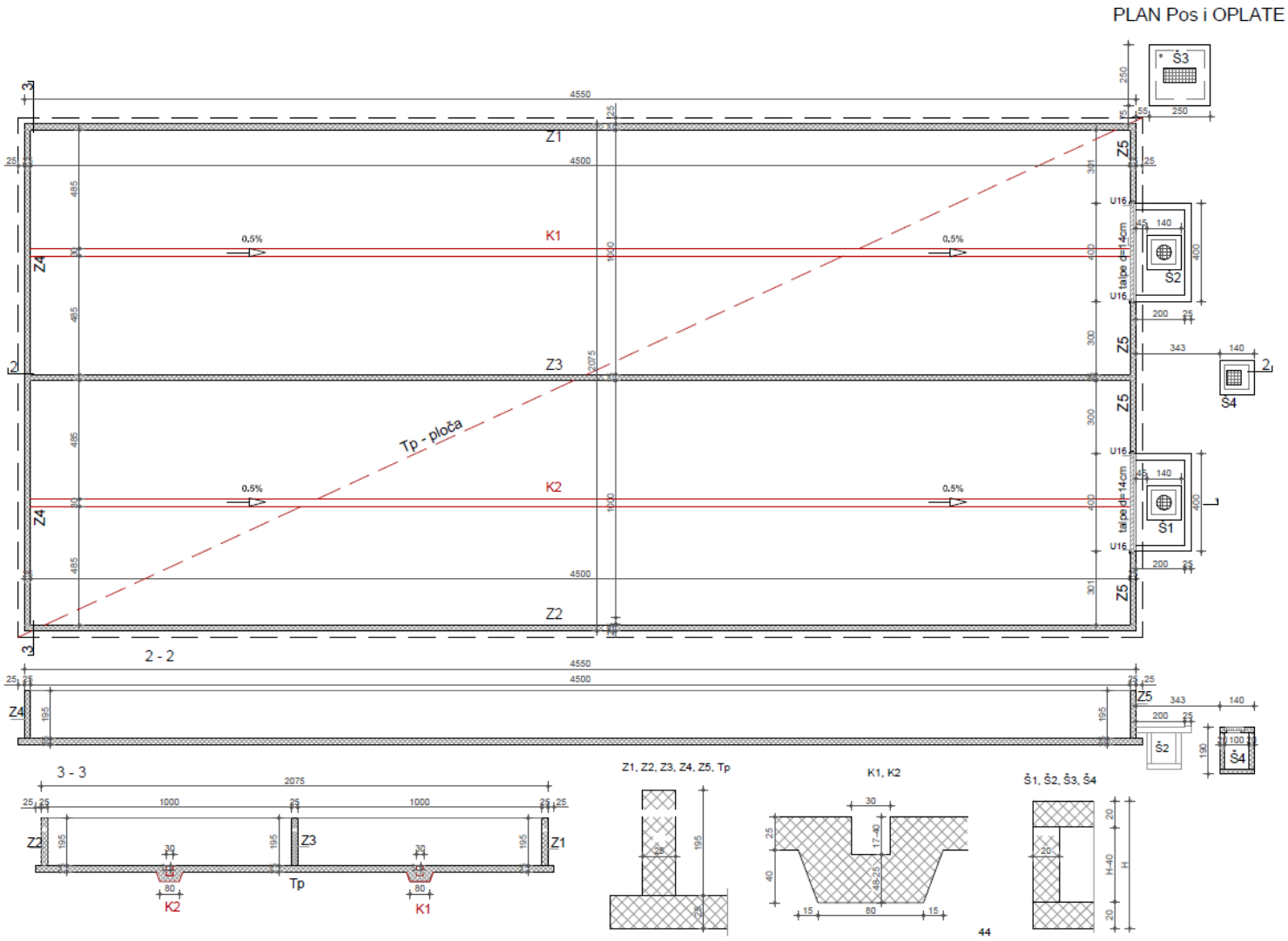


Figure 11: Static scheme 1

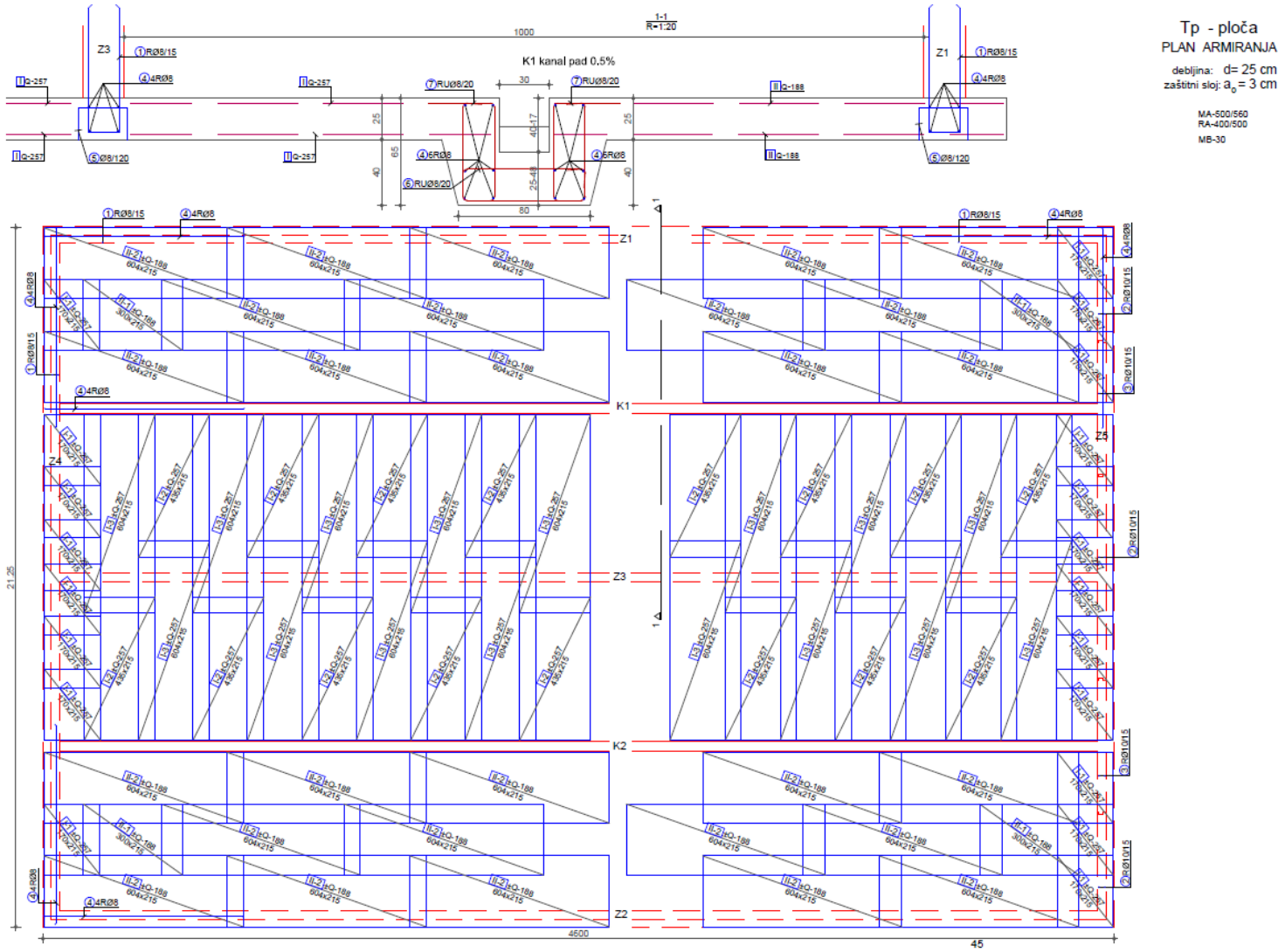


Figure 12: Static scheme 2

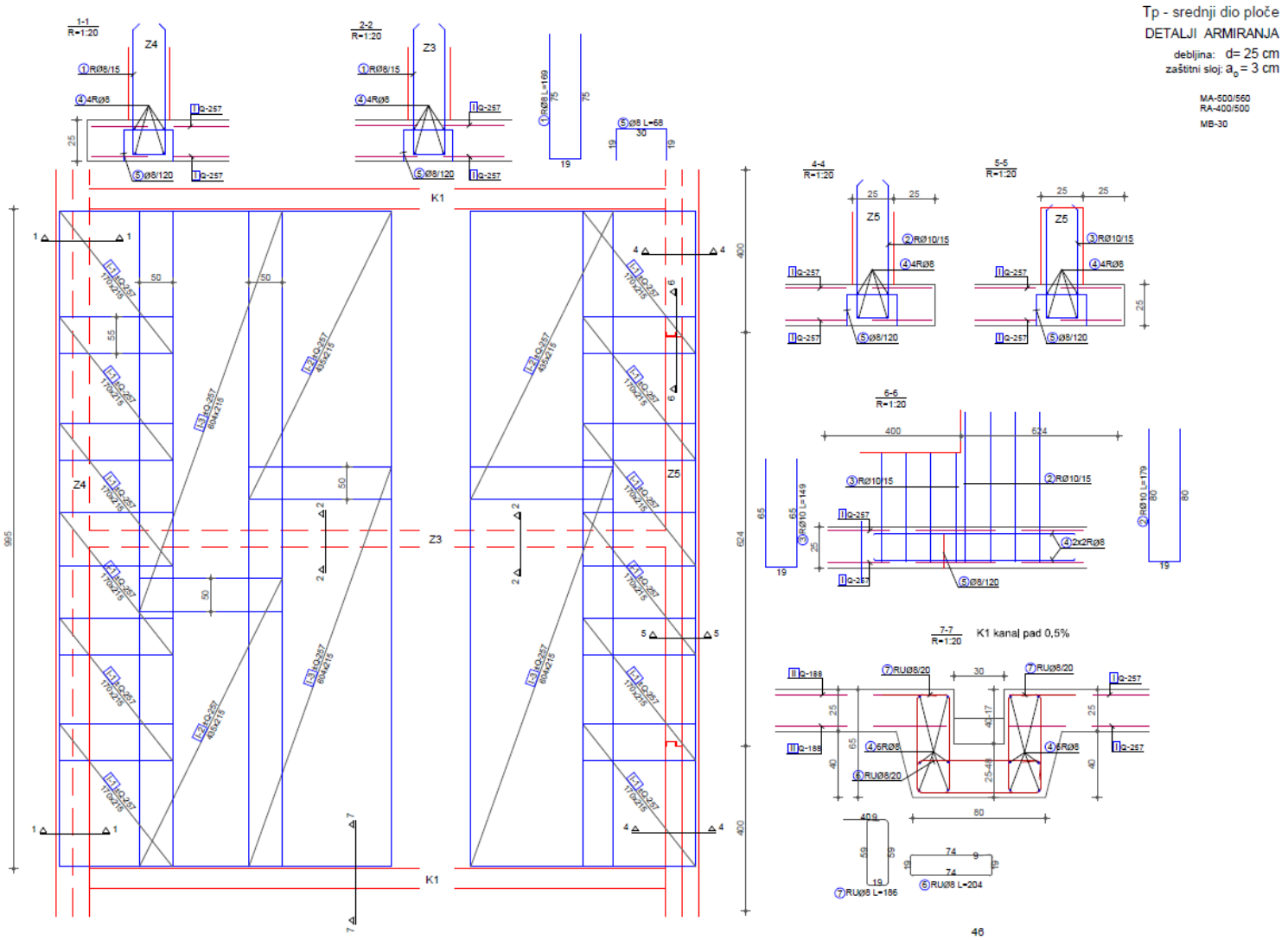


Figure 13: Static scheme 3

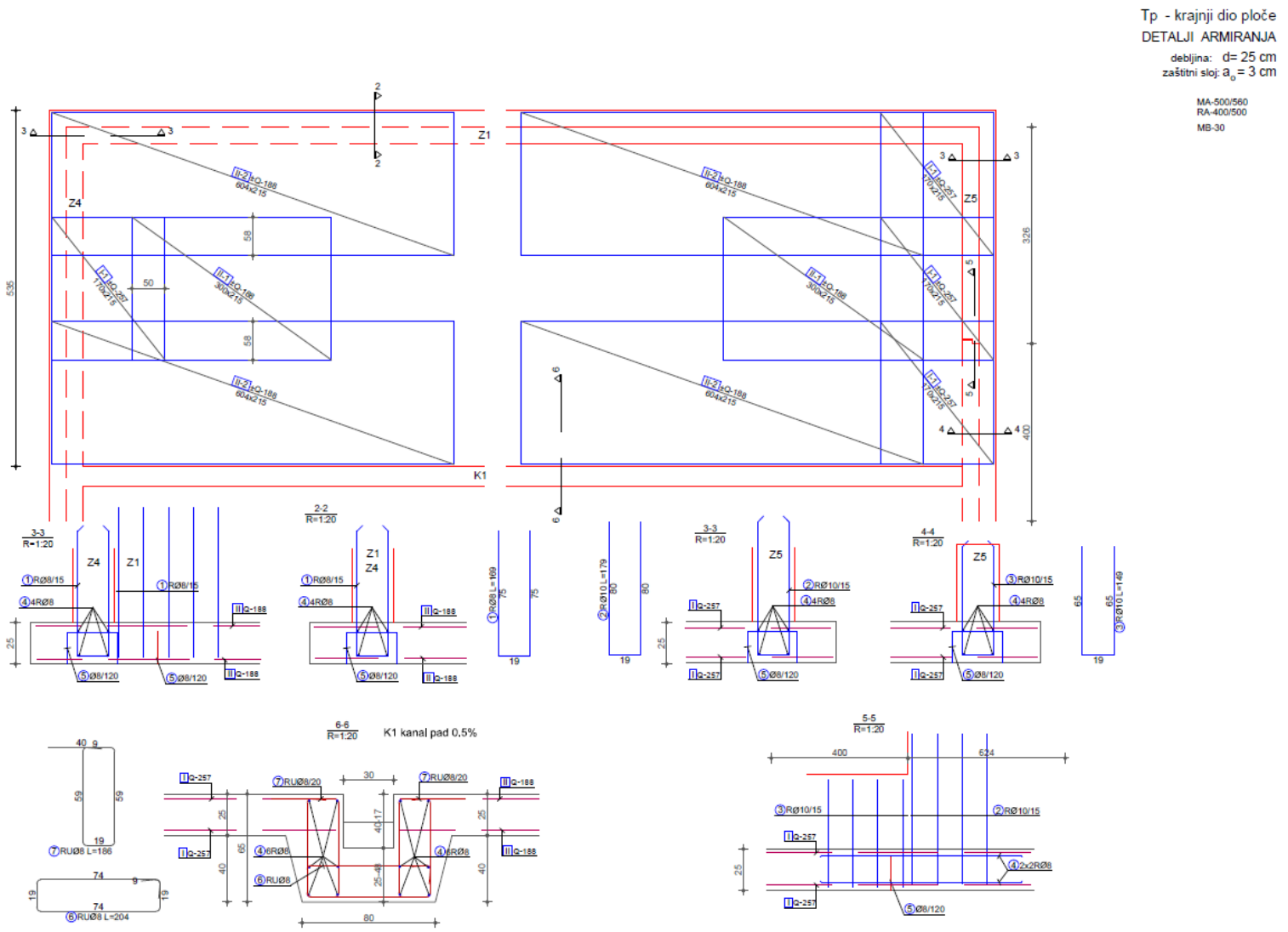


Figure 14: static scheme 4

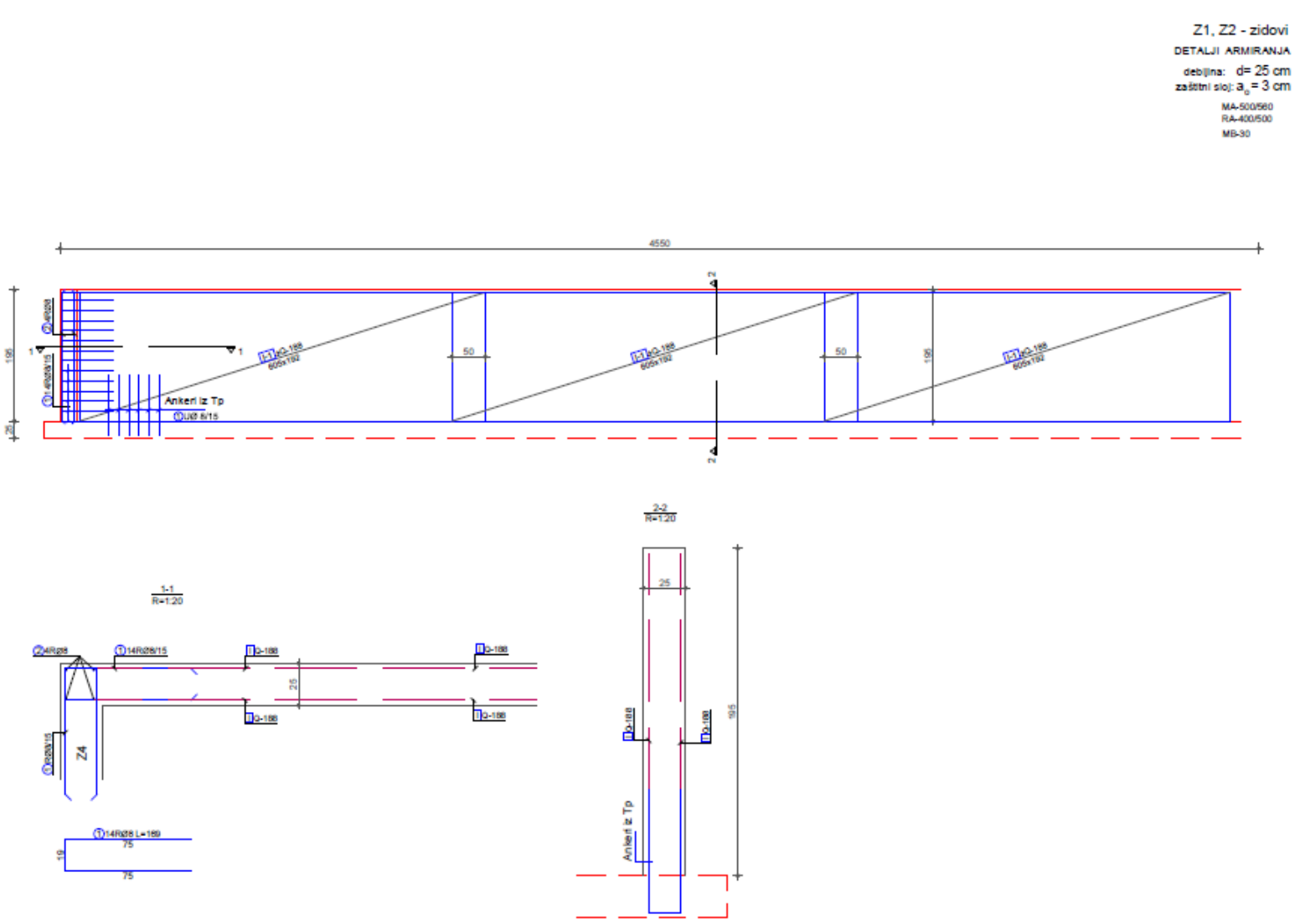


Figure 15: Static scheme 5

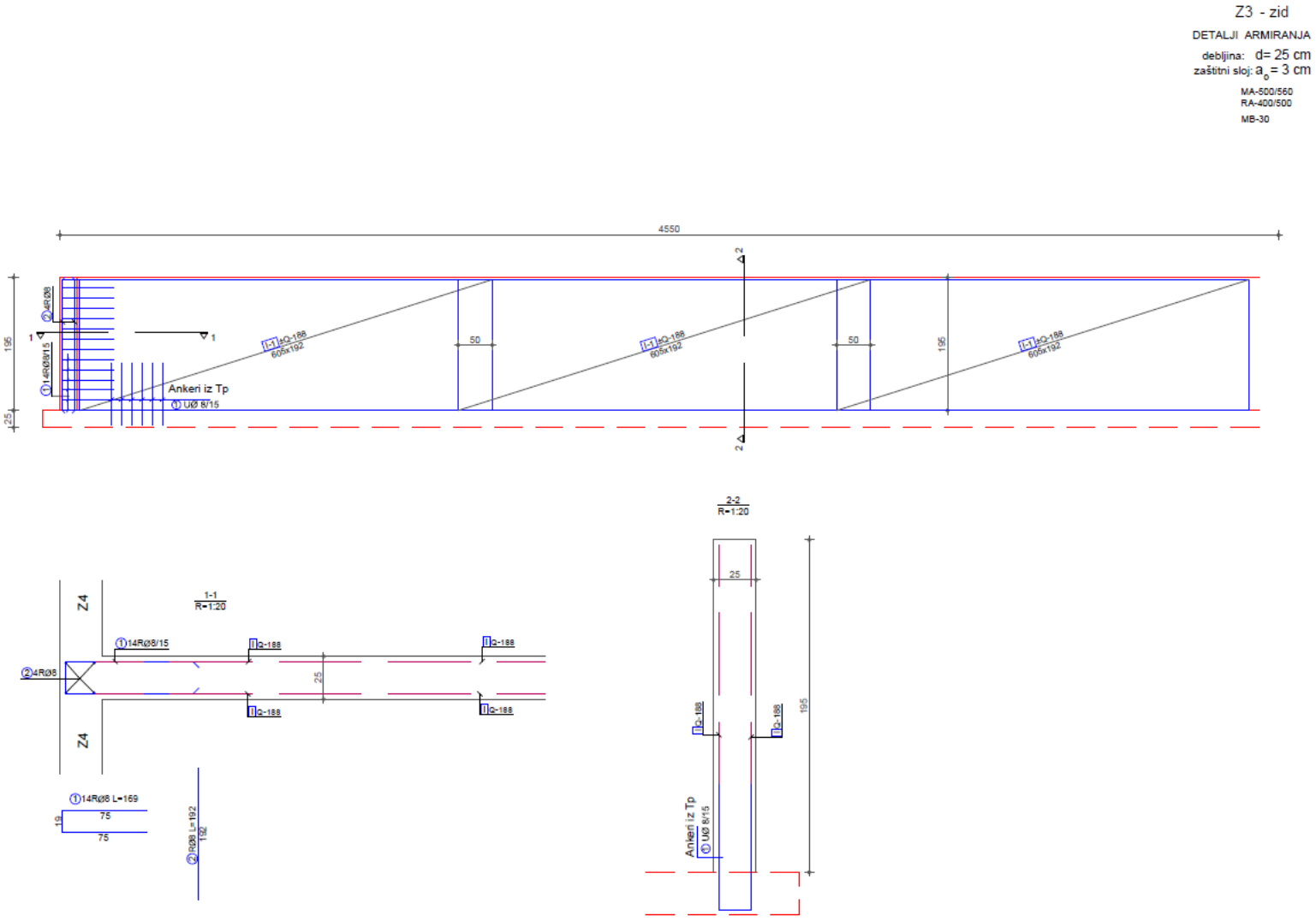


Figure 16: Static scheme 6

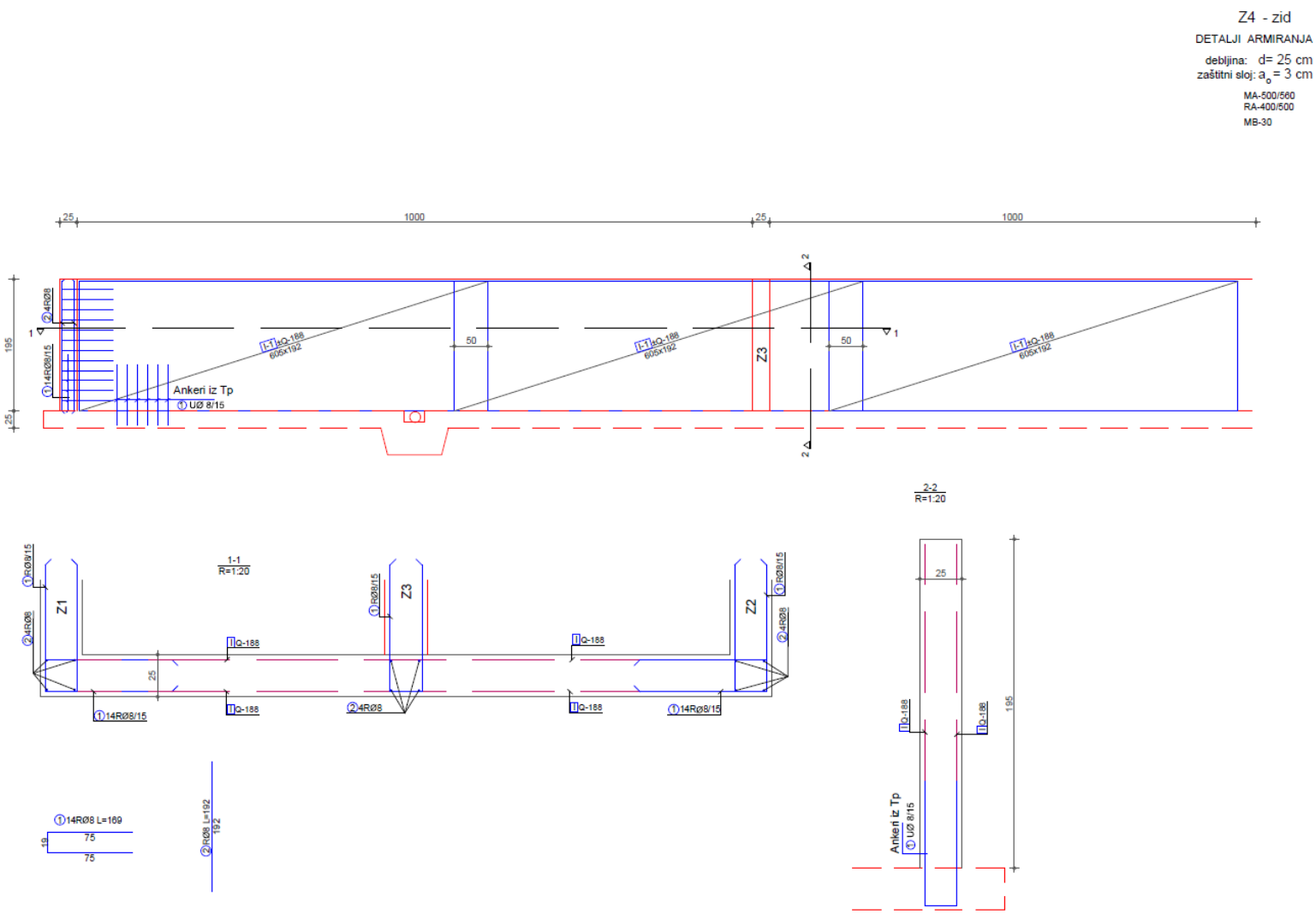


Figure 17: Static scheme 7

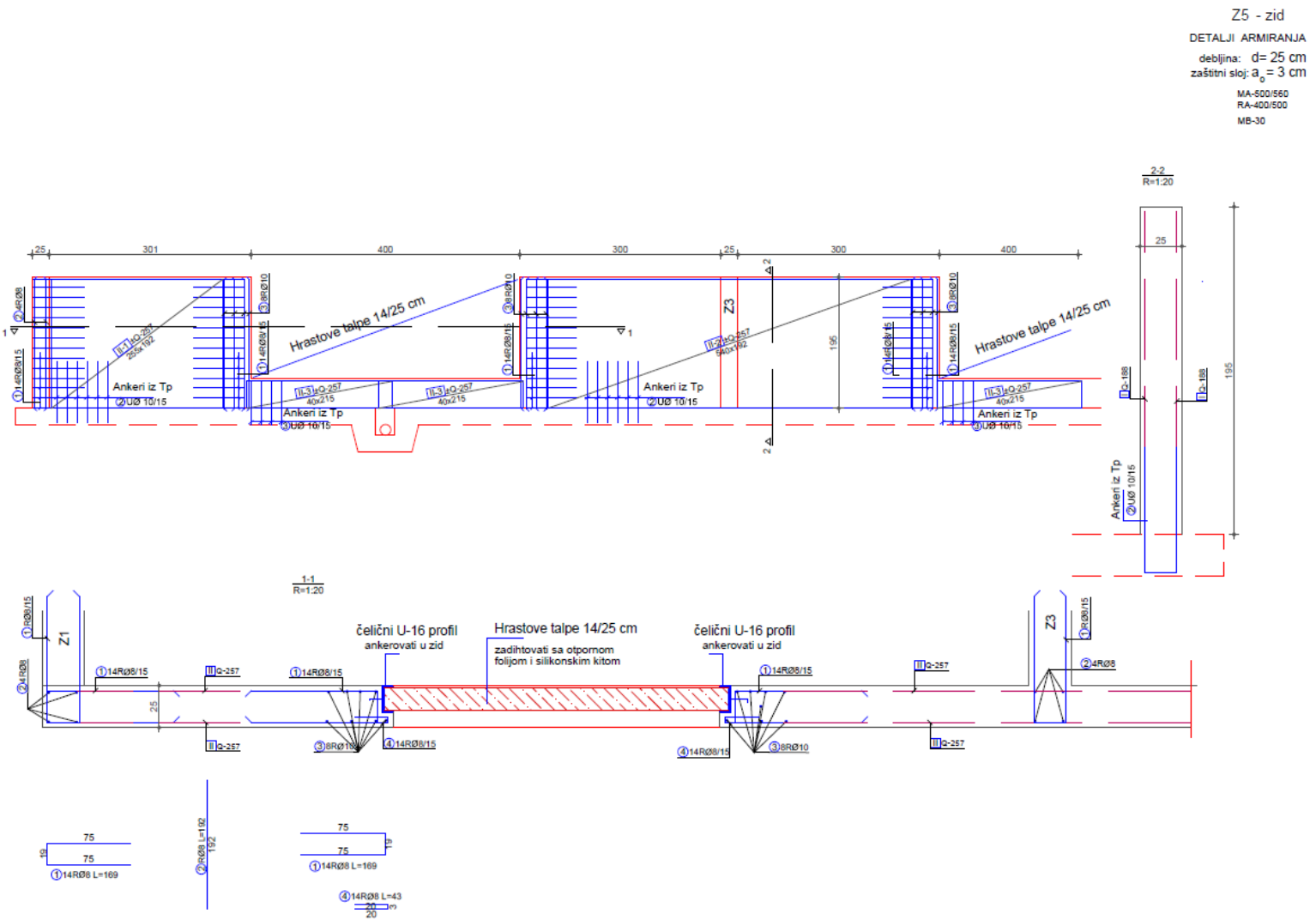


Figure 18: Static scheme 8

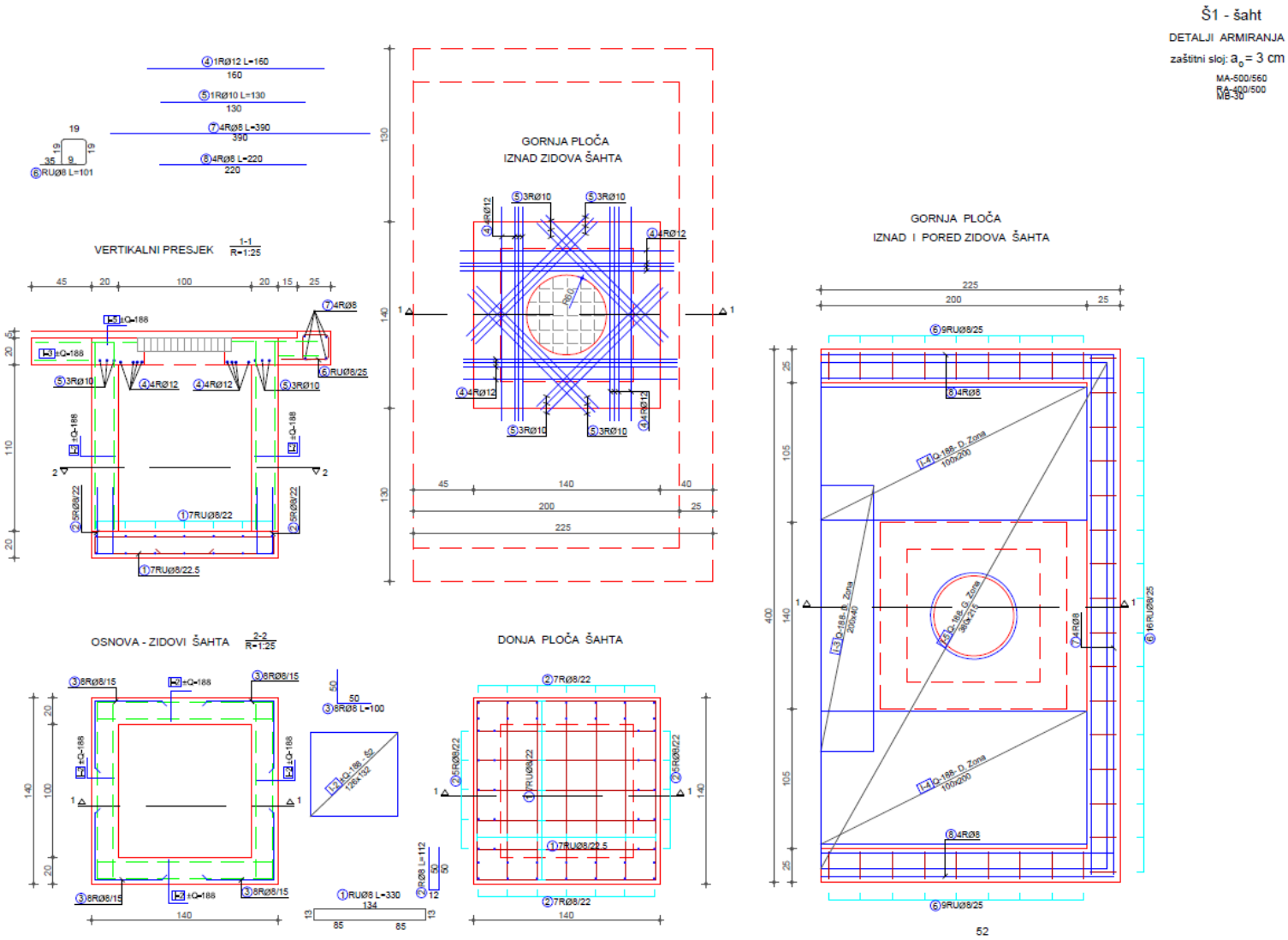


Figure 19: Static scheme 9

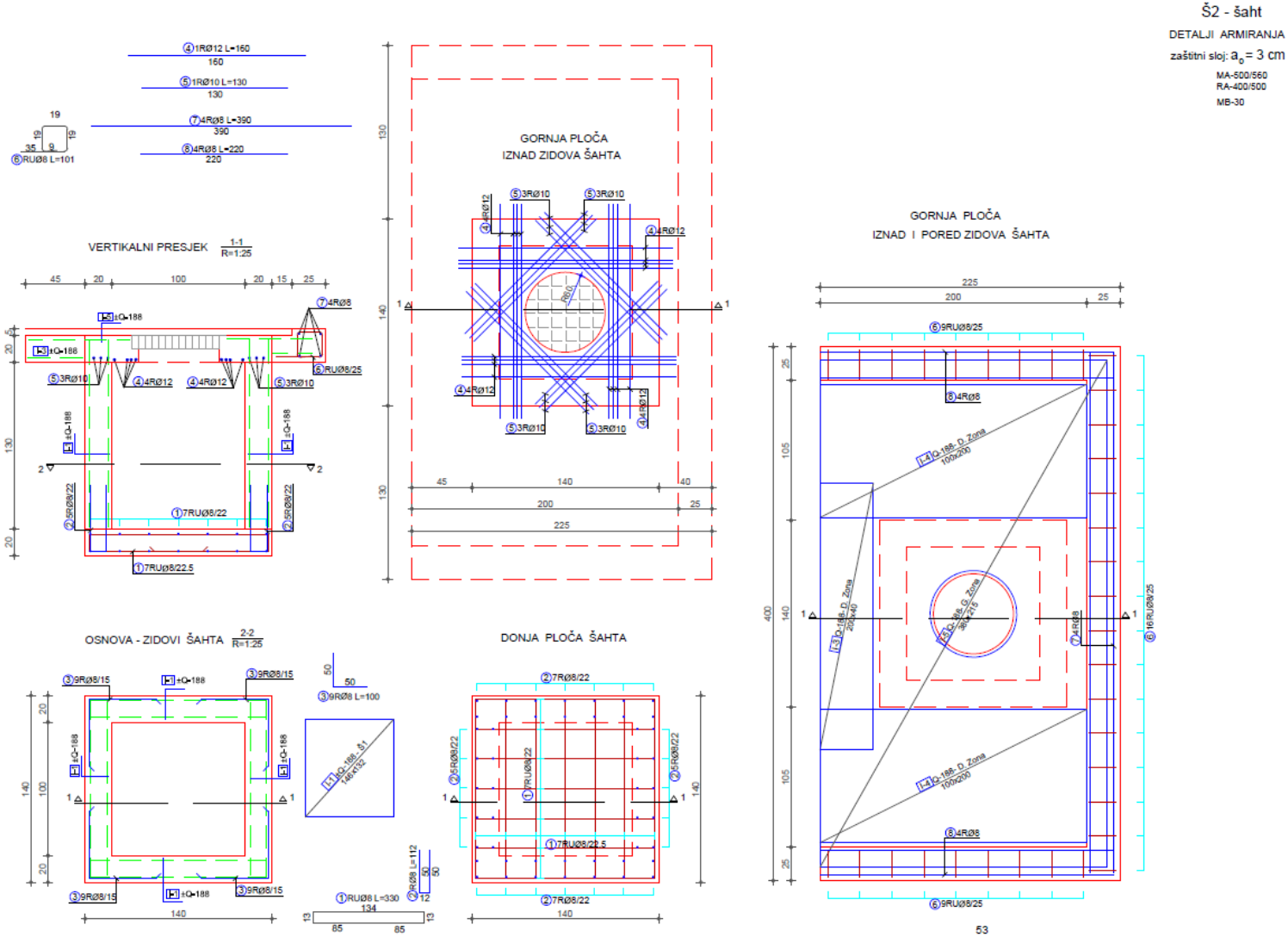


Figure 20: Static scheme 10

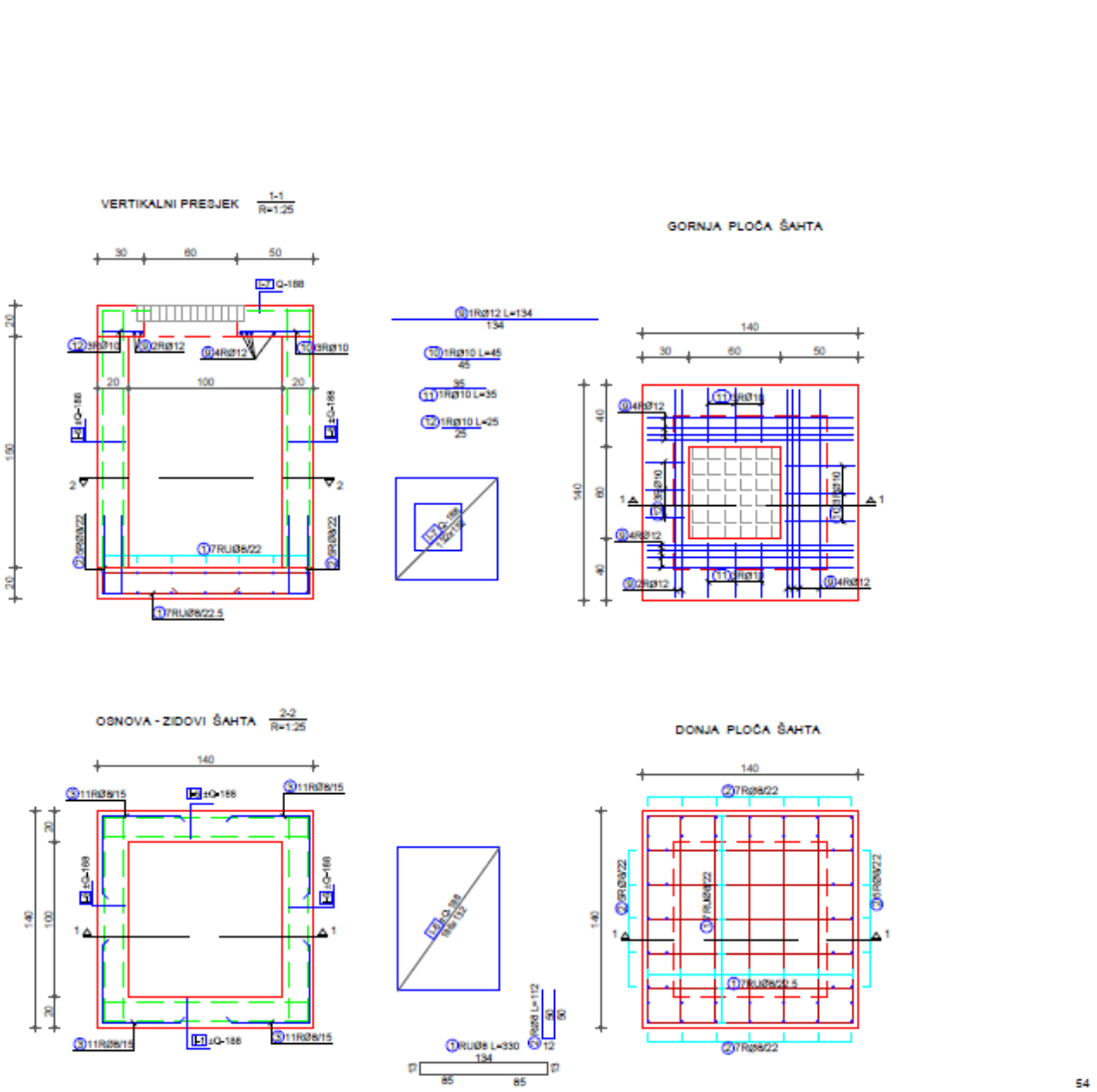


Figure 21: Static scheme 11

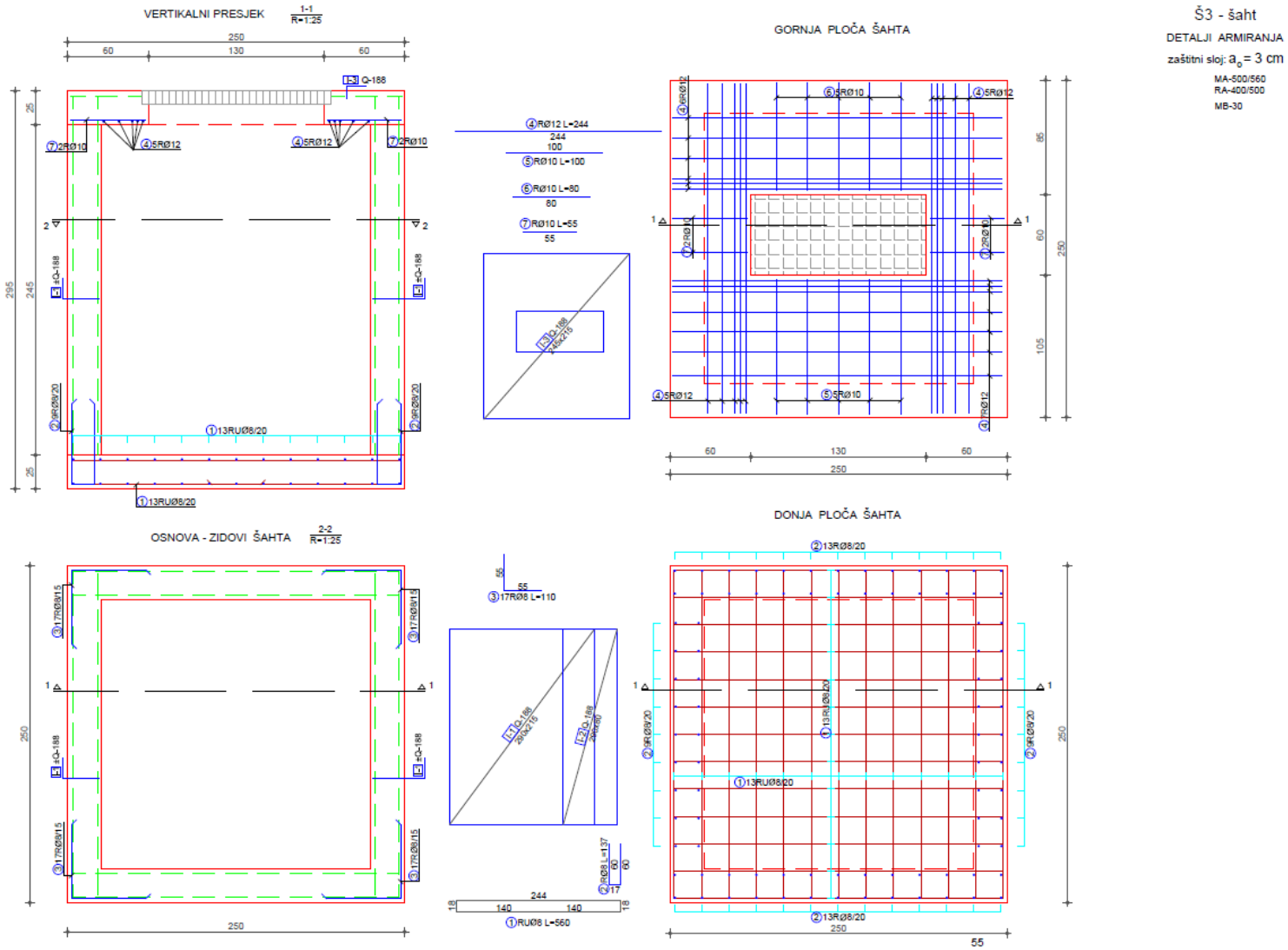
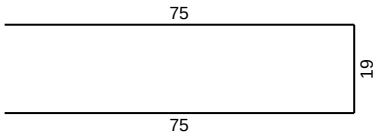
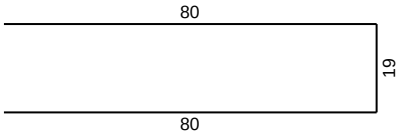
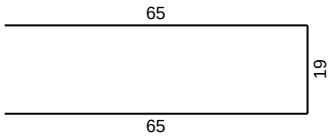
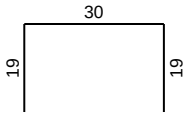
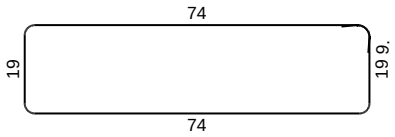
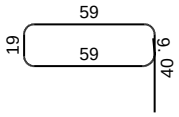
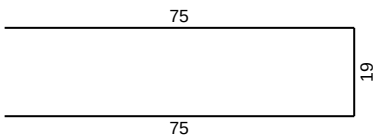
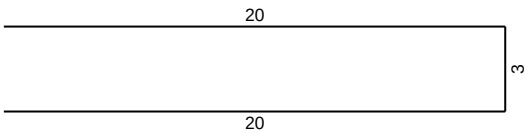
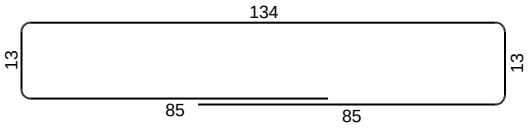
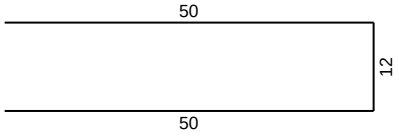
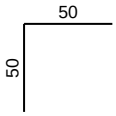
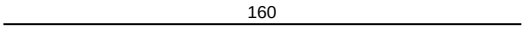
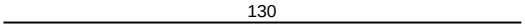
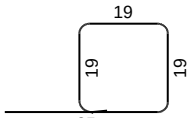
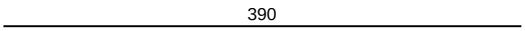
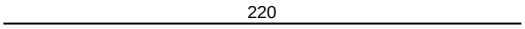
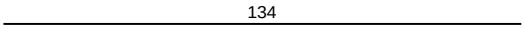
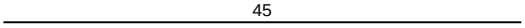
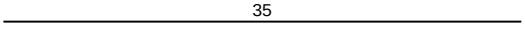
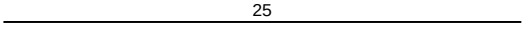
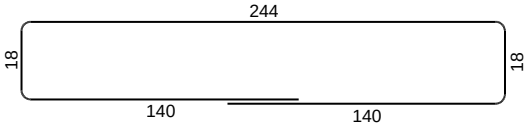
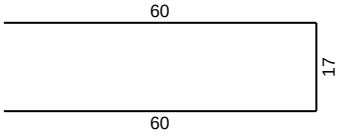
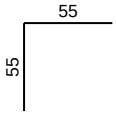
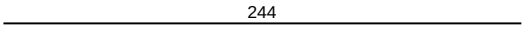
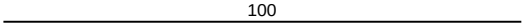


Figure 22: Static scheme 12

3.3.3. Reinforcement specification and recapitulation

From construction permit documentation:

Šipke - specifikacija						
ozn.	Oblik i mjere [cm]	RA GA	Ø Ø	lg [m]	n [ком.]	dužna (lg x n) [m]
Tp, K1, K2 - ploča i kanali - DONJA i GORNJA ZONA i ANKERI ZIDOVA (1 ком.)						
1		RA1	8	1.69	1044	1764.36
2		RA1	10	1.79	84	150.36
3		RA1	10	1.49	56	83.44
4		RA1	8	6.00	258	1548.00
5		GA	8	0.68	150	102.00
6		RA1	8	2.04	456	930.24
7		RA1	8	1.86	912	1696.32
Z1, Z2, Z3, Z4, Z5 - zidovi (1 ком.)						
1		RA1	8	1.69	196	331.24
2		RA1	8	1.92	24	46.08
3		RA1	10	1.92	32	61.44
4		RA1	8	0.43	56	24.08

Šipke - specifikacija						
ozn.	Oblik i mjere [cm]	RA GA	Ø Ø	lg [m]	n [ком.]	dužna (lg x n) [m]
Š1, Š2, Š4 - šahte (1 ком.)						
1		RA1	8	3.30	42	138.60
2		RA1	8	1.12	72	80.64
3		RA1	8	1.00	112	112.00
4		RA1	12	1.60	32	51.20
5		RA1	10	1.30	24	31.20
6		RA1	8	1.01	68	68.68
7		RA1	8	3.90	8	31.20
8		RA1	8	2.20	16	35.20
9		RA1	12	1.34	14	18.76
10		RA1	10	0.45	3	1.35
11		RA1	10	0.35	6	2.10
12		RA1	10	0.25	3	0.75
Š3 - šaht (1 ком.)						
1		RA1	8	5.60	26	145.60
2		RA1	8	1.37	44	60.28
3		RA1	8	1.10	68	74.80
4		RA1	12	2.44	23	56.12
5		RA1	10	1.00	5	5.00

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

LIMNOS 20 YEARS

Šipke - specifikacija						
ozn.	Oblik i mjere [cm]	RA GA	Ø Ø	lg [m]	n [ком.]	dužna (lg x n) [m]
6	80	RA1	10	0.80	5	4.00
7	55	RA1	10	0.55	4	2.20

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

LIMNOS 20 YEARS

Šipke - rekapitulacija			
Ø [mm]	lgn [m]	Jed. tezina [kg/m']	Tezina [kg]
GA			
8	102.00	0.40	40.29
Ukupno			40.29
RA1			
8	7087.32	0.41	2898.71
10	341.84	0.65	221.85
12	126.08	0.92	115.99
Ukupno			3236.56

Mreže - specifikacija						
Pozicija	Oznaka mreže	B [cm]	L [cm]	n	Jedinižna težina [kg/m2]	Ukupna težina [kg]
Tp, K1, K2 - ploča i kanali - DONJA i GORNJA ZONA i ANKERI ZIDOVA (1 ком.)						
I-1	Q-257	215	170	40	4.02	587.72
I-2	Q-257	215	435	52	4.02	1955.05
I-3	Q-257	215	604	52	4.02	2714.59
II-1	Q-188	215	300	8	2.96	152.74
II-2	Q-188	215	604	92	2.96	3536.35
Ukupno						8946.45
Z1, Z2, Z3, Z4, Z5 - zidovi (1 ком.)						
I-1	Q-188	192	605	56	2.96	1925.47
II-1	Q-257	192	255	4	4.02	78.73
II-2	Q-257	192	540	2	4.02	83.36
II-3	Q-257	215	40	8	4.02	27.66
Ukupno						2115.21
Š1, Š2, Š4 - šahte (1 ком.)						
I-1	Q-188	132	146	8	2.96	45.64
I-2	Q-188	132	126	8	2.96	39.38
I-3	Q-188	40	200	4	2.96	9.47
I-4	Q-188	200	100	8	2.96	47.36
I-5	Q-188	215	380	4	2.96	96.73
I-6	Q-188	132	186	8	2.96	58.14
I-7	Q-188	132	132	1	2.96	5.16
Ukupno						301.88
Š3 - šaht (1 ком.)						
I-1	Q-188	215	290	7	2.96	129.19
I-2	Q-188	80	290	7	2.96	48.07
I-3	Q-188	215	245	1	2.96	15.59
Ukupno						192.85

Provision of services related to the construction of a reed bed filter for the treatment of sludge in Mojkovac, Montenegro
1st Progress Report.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

LIMNOS 20 YEARS

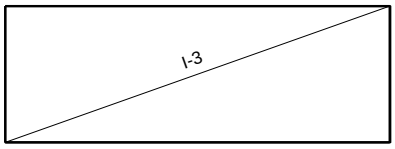
Mreže - rekapitulacija					
Tip mreže	B [cm]	L [cm]	n	Jedinična težina [kg/m2]	Ukupna težina [kg]
Q-257	215	605	109	4.02	5699.63
Q-188	215	605	169	2.96	6506.87
Ukupno					12206.50

Mreže - plan sječenja

Tp, K1, K2 - ploča i kanali - DONJA i GORNJA ZONA i ANKERI ZIDOVA

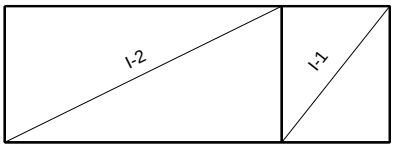
Q-257

52x



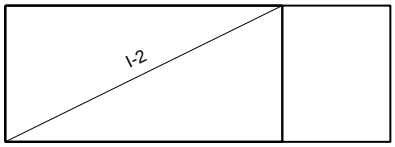
I-3 215 x 604

40x



I-2 215 x 435
I-1 215 x 170

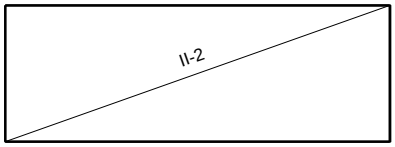
12x



I-2 215 x 435

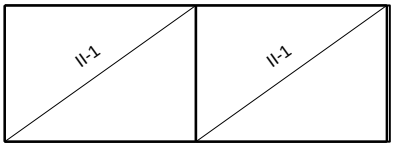
Q-188

92x



II-2 215 x 604

4x

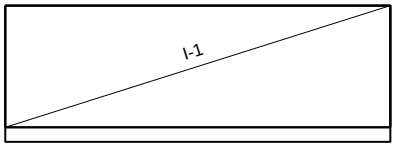


II-1 215 x 300
II-1 215 x 300

Z1, Z2, Z3, Z4, Z5 - zidovi

Q-188

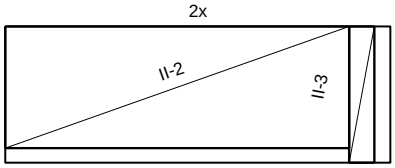
56x



I-1 192 x 605

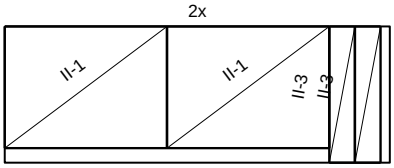
Q-257

2x



II-2 192 x 540
II-3 215 x 40

2x



II-1 192 x 255
II-1 192 x 255
II-3 215 x 40
II-3 215 x 40

Mreže - plan sječenja

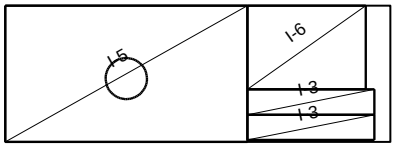
1x

II-3 215 x 40
II-3 215 x 40

Š1, Š2, Š4 - šahte

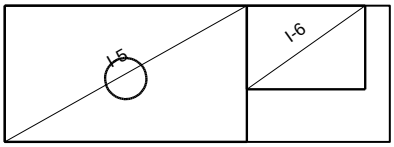
Q-188

2x



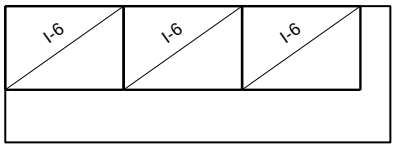
I-5 215 x 380
I-6 132 x 186
I-3 40 x 200
I-3 40 x 200

2x



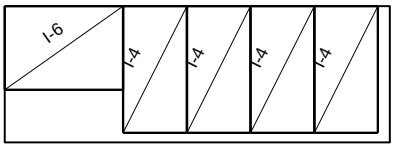
I-5 215 x 380
I-6 132 x 186

1x



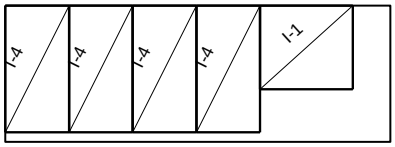
I-6 132 x 186
I-6 132 x 186
I-6 132 x 186

1x



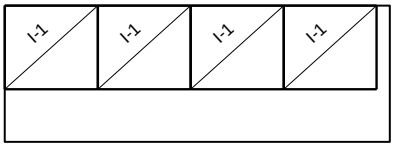
I-6 132 x 186
I-4 200 x 100
I-4 200 x 100
I-4 200 x 100
I-4 200 x 100

1x



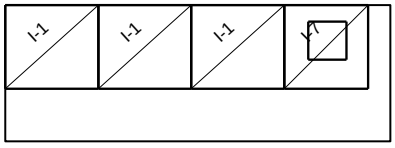
I-4 200 x 100
I-4 200 x 100
I-4 200 x 100
I-4 200 x 100
I-1 132 x 146

1x



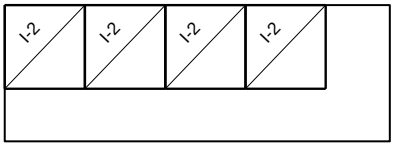
I-1 132 x 146
I-1 132 x 146
I-1 132 x 146
I-1 132 x 146

1x



I-1 132 x 146
I-1 132 x 146
I-1 132 x 146
I-7 132 x 132

2x

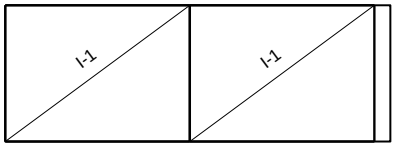


I-2 132 x 126
I-2 132 x 126
I-2 132 x 126
I-2 132 x 126

Š3 - šaht

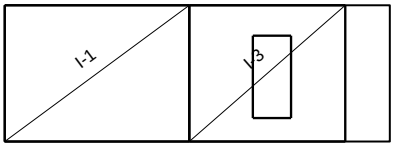
Q-188

3x



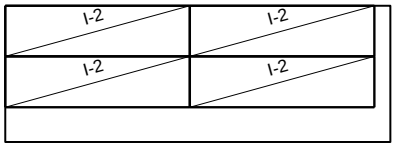
I-1 215 x 290
I-1 215 x 290

1x



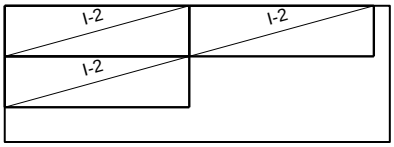
I-1 215 x 290
I-3 215 x 245

1x



I-2 80 x 290
I-2 80 x 290
I-2 80 x 290
I-2 80 x 290

1x



I-2 80 x 290
I-2 80 x 290
I-2 80 x 290

3.4. Electro installation

For this part of the project also detailed documentation had to be prepared. This section consists of:

- General documentation,
- Textual part,
- Technical part.
- Graphical documentation.

3.4.1. Graphical documentation

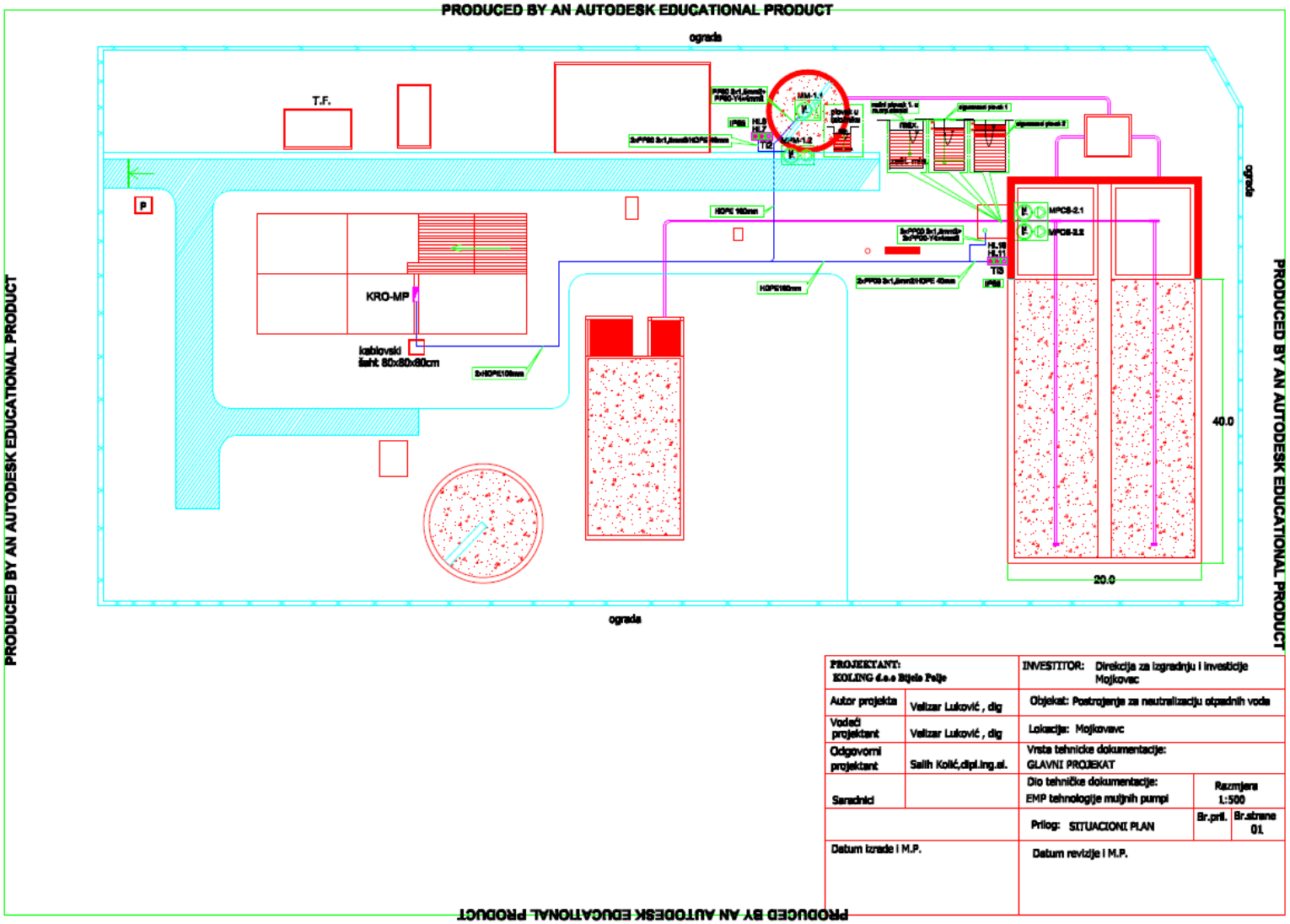


Figure 23: Detailed drawing of electrical installation for SDRB in Mojkovac WWTP

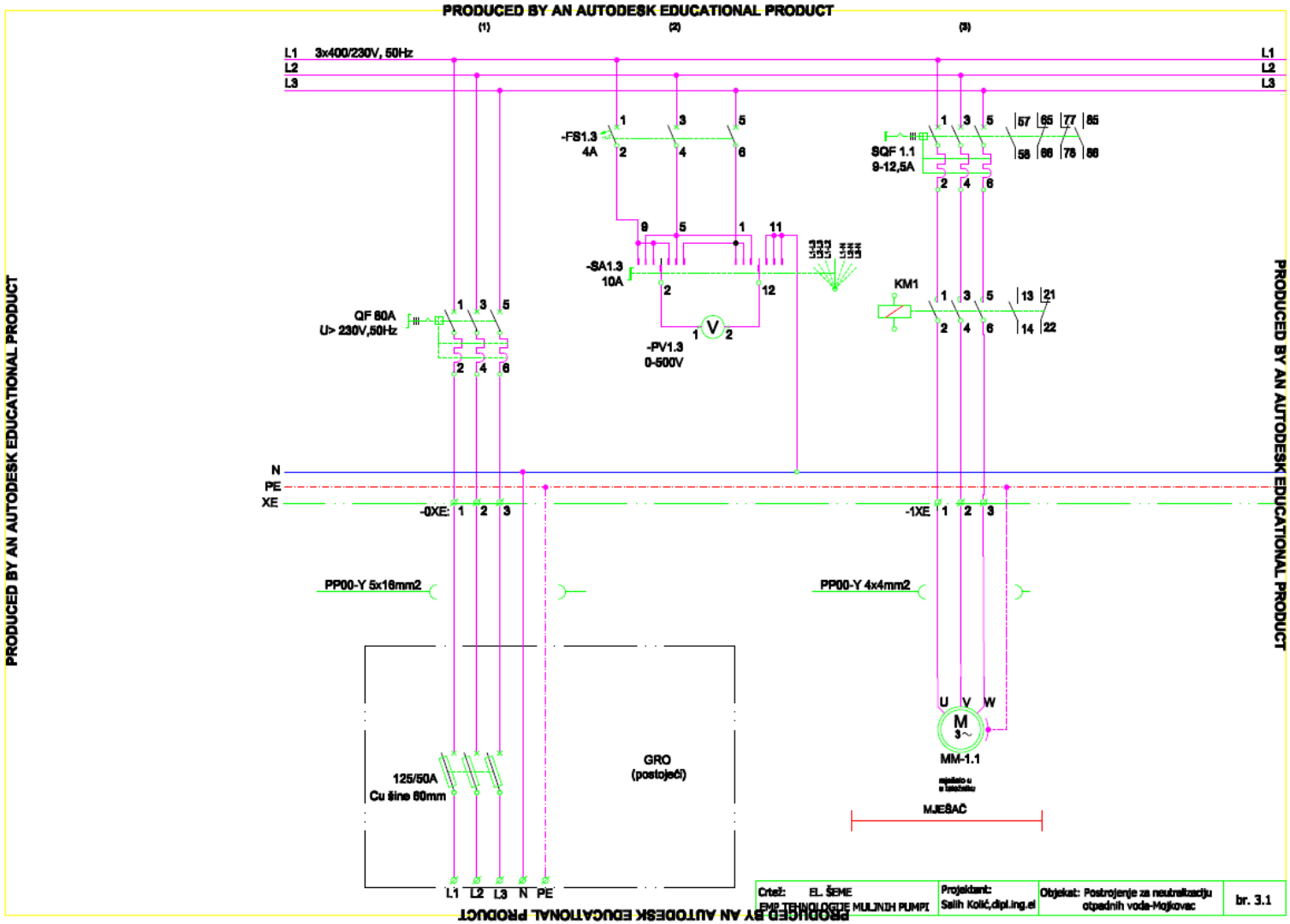


Figure 24: Electrical installation scheme 1

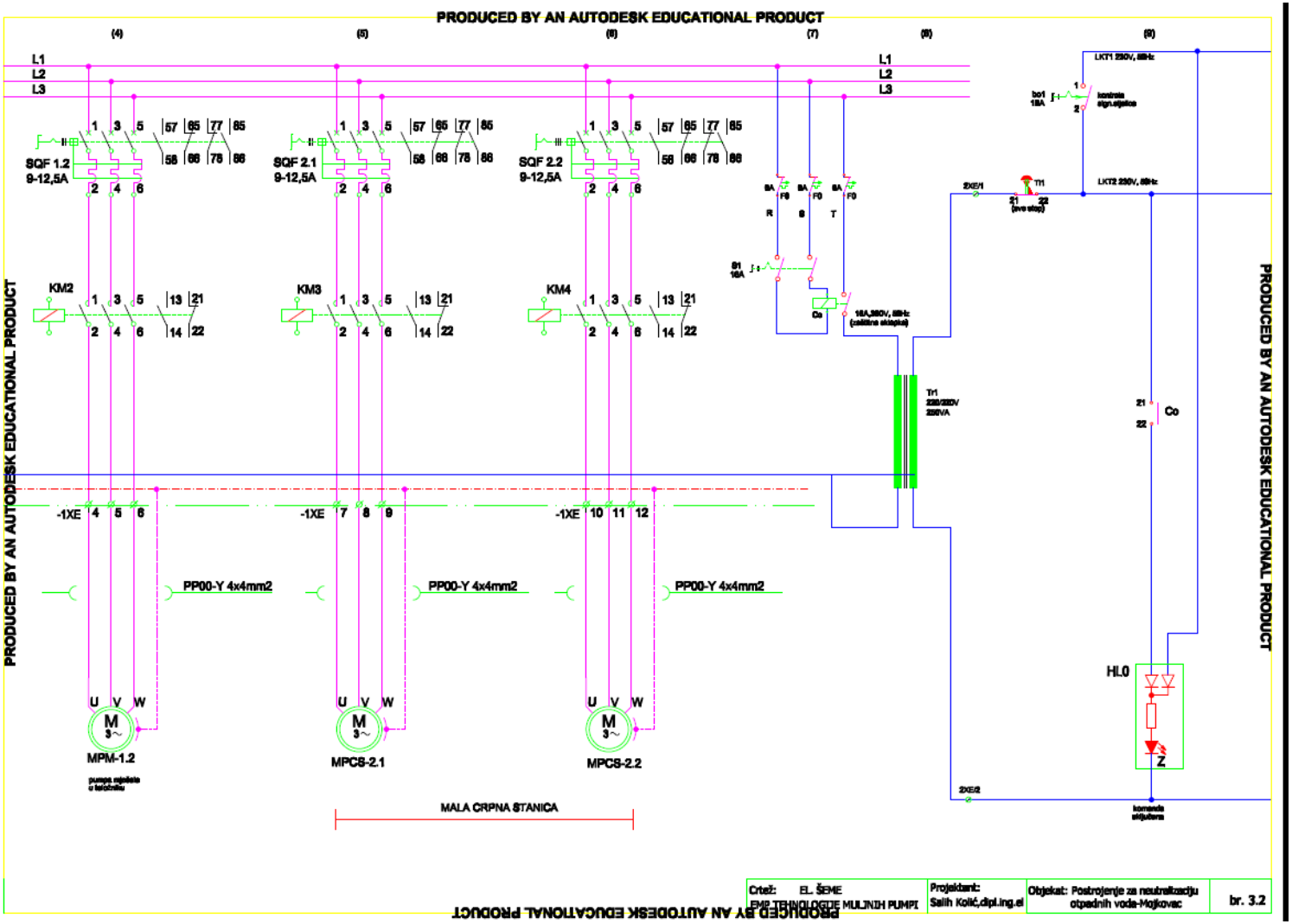


Figure 25: Electrical installation scheme 2

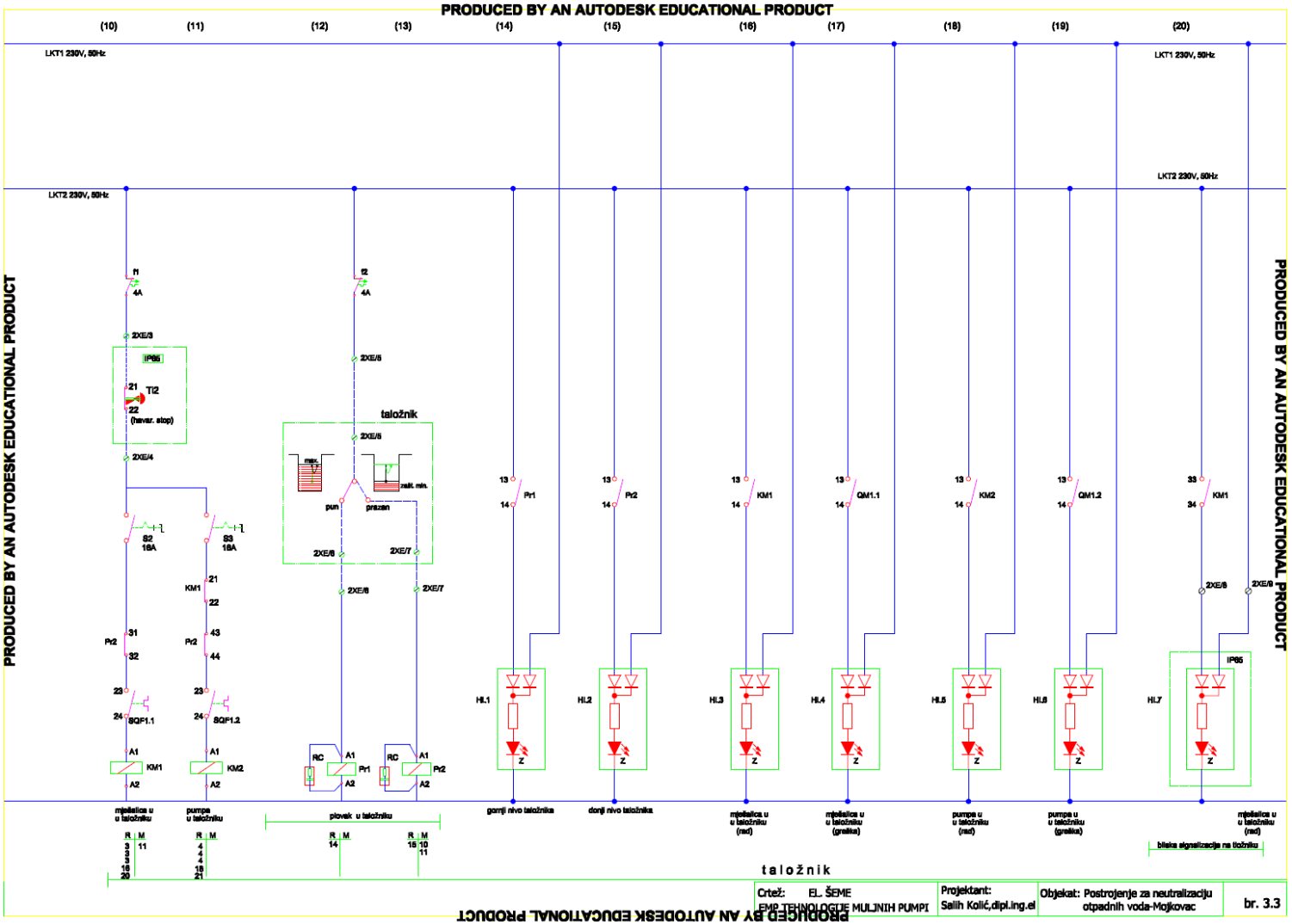


Figure 26: Electrical installation scheme 3

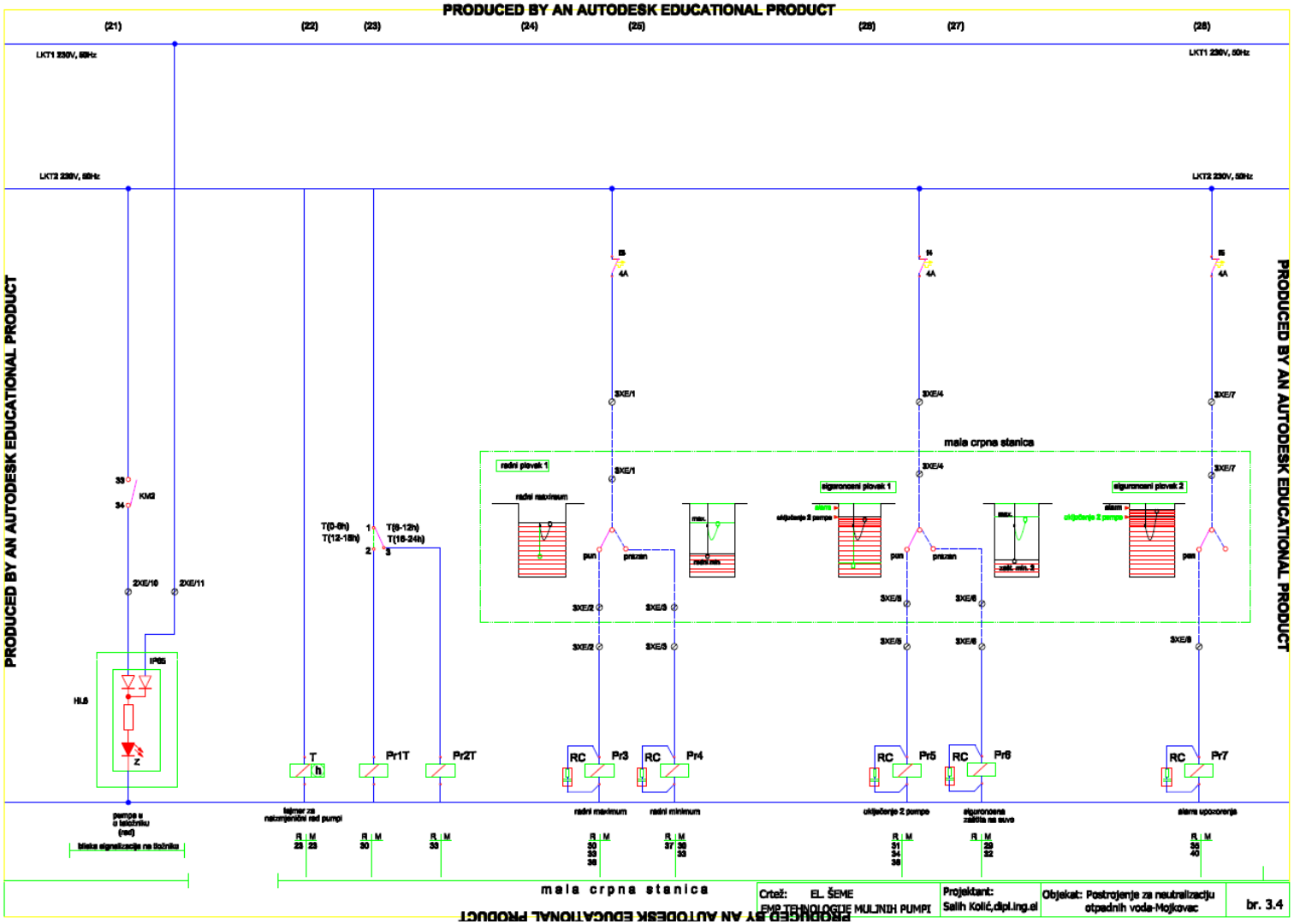


Figure 27: Electrical installation scheme 4

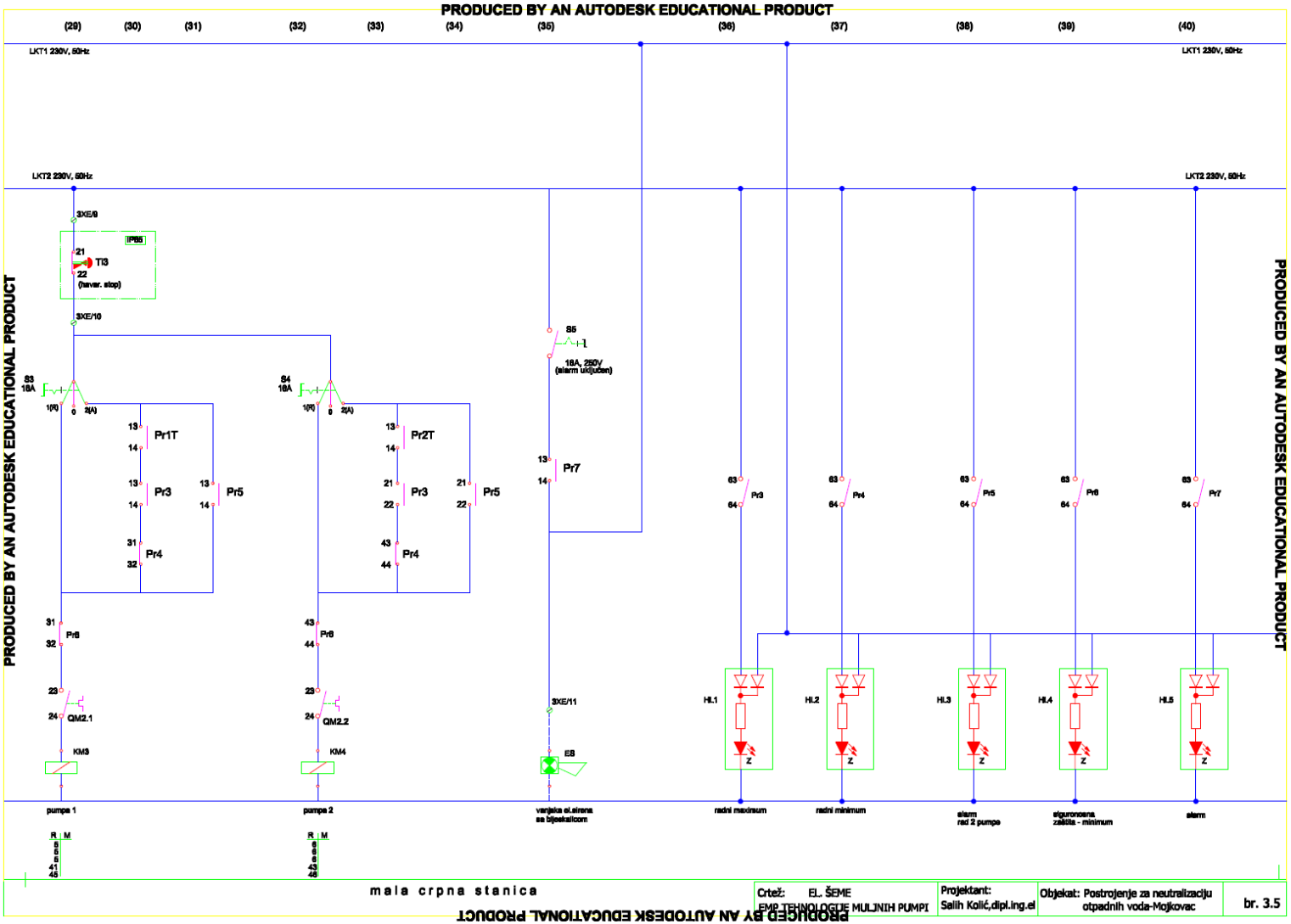


Figure 28: Electrical installation scheme 5

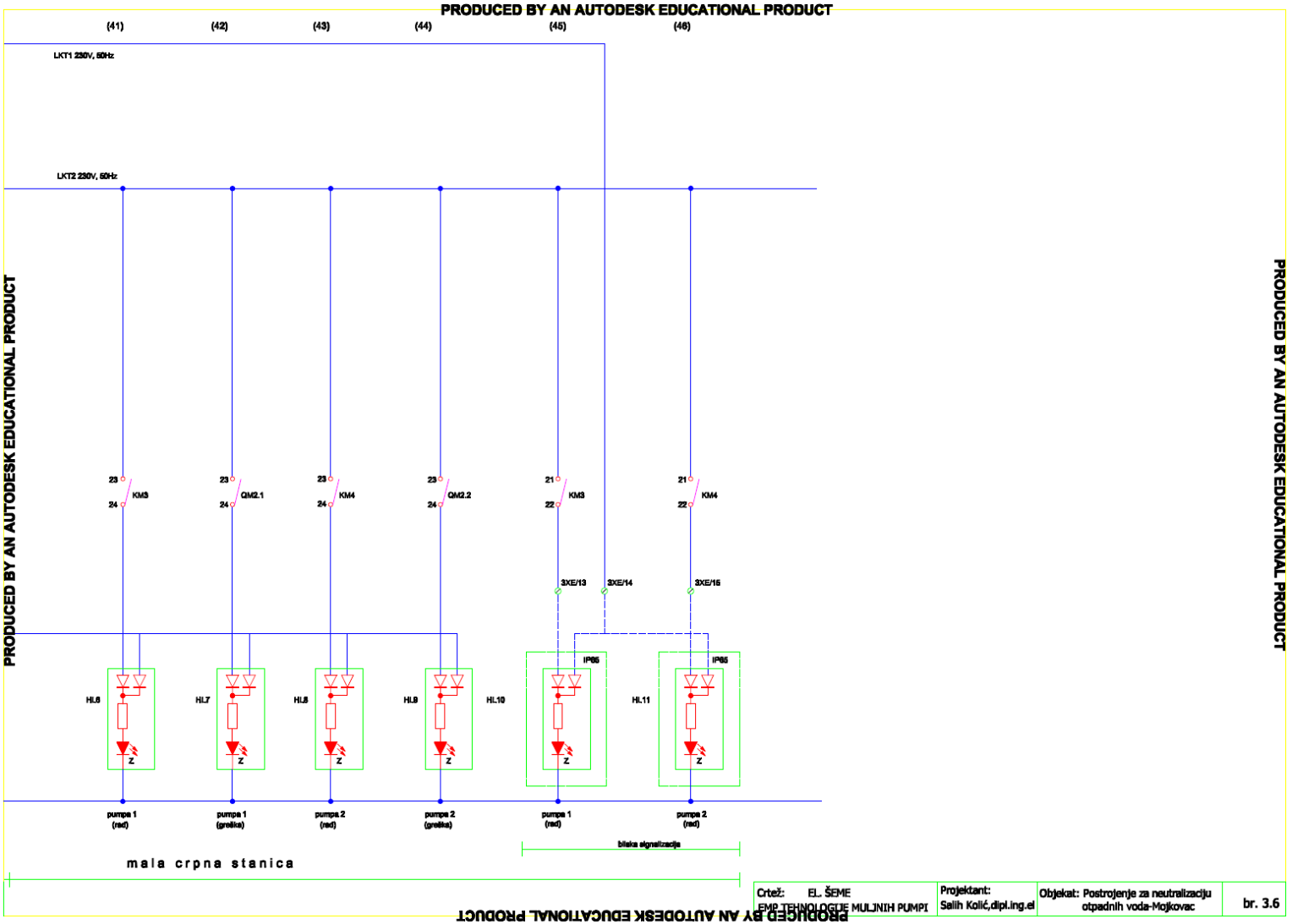


Figure 29: Electrical installation scheme 6

4 CHANGES TO INITIAL DETAILED TECHNICAL DESIGN

During the process of obtaining construction permit, a lot of questions were raised, and the contractor had to find optimal solutions to amend the initial technical design for optimal operation of sludge treatment at Mojkovac WWTP. Numerous national legislation rules had to be taken into account.

Below is the description of implemented changes the contractor suggested. All changes were discussed with Mr. Lechner, chief engineer, who is author of initial technical design by EcoSan Club.

4.1. Change 1

First issue was the placement of SDRB basins to the predicted location. After meeting with local authorities on November 2014 in Mojkovac, the contractor realized that the same area that was predicted for SDRB is also predicted for possible WWTP expansion.

According to EcoSan club each of the drying beds have to have 450 m^2 (12 m by 37,5 m), total 900m^2. After receiving geometrical survey data the contractor decided to change the dimensions of the basins. The total area for each and total basin stayed the same. We only changed the width and length of basins to 10 m and 45 m, respectively.

4.2. Change 2

In the initial design, the withdrawal of sludge from sludge thickener was planned with the use of siphon (which would also have to be equipped with air pump to suck air out of pipe) that would be installed into sludge thickener and connected to a pumping station from were sludge would be distributed on the SDRB. The pumping station would also have to be equipped with two pumps, with capacity of 40l/s each.

Due to the insufficient initial technical data on the system functioning, the contractor suggested new solutions. Previously proposed system could be difficult to maintain and has low control and can be costly and man demanding. We also strongly believe that flow rate of 40l/s for each pump in a pumping station is very overrated and can't be economically and functionally justified.

When looking for appropriate solution the contractor observed to efficient transfer of sludge in WWTP, that is already in function. The sludge in the WWTP is produced during microbial phase of wastewater purification in nitrification and denitrification basins. Before clean purified water is released as the outflow to environment all the solids (sludge) has to settle in the secondary clarifier. For the undisturbed process of wastewater purification sludge must constantly circulate between secondary clarifiers and purification basins (nitrification, denitrification). In each extreme case, when

not enough sludge is circulating or too much sludge is circulating, the purification efficiency is endangered. Until now all excess sludge had been pumped to the sludge thickener where it is stored.

The contractors' suggestion is to connect SDRB pipe system to the sludge pipeline system that already exists. For that a new pipeline has to be connected to a shaft where sludge can be distributed into purification basins or to sludge thickener. For the sludge pumping on the SDRB we can also use existing pumps that are suitable for sludge pumping and have enough capacity to be able to distribute sludge on reed beds.

Instead of constructing a pumping station for sludge distribution the contractor proposes to construct only a distribution manhole that will be equipped with appropriate vents to easily select on which SDRB basin sludge should be distributed.

4.3. Change 3

According to technical design, sludge distribution on SDRB would go via pipeline that is installed only on one side wall of each basin.

The contractor believes that such distribution, considering the predicted 40l/s pump power, would lead to disturbances in plant growth. Sludge would hit the plant with such power that plants would not be able to grow normally.

The solutions for the pumps have already been described above. With the usage of the existing pumps (less flow), the sludge would calmly be distributed to SDRB. In addition, the contractor proposes another solution for sludge distribution; sludge will be distributed from each side of the wall of each basin, meaning that sludge would be distributed evenly, to the both sides of the basin. With this a more equal distribution of sludge on whole area is achieved and also an interrupted hydraulic regime in the SDRB.

4.4. Change 4

All water income onto SDRB (sludge distribution, precipitation) is removed out of basins via drainage that lead to seepage pumping station. In technical design one submerged pump is predicted to be installed in this pumping station.

The contractor observes that installation of only one pump in seepage pumping station threaten to be the weakest point of the whole system. In case of big rain event, of several days of precipitation, a lot of water would be collected in SDRB basins (area of 900 m^2). In the worst case would even be if the pump in the seepage pumping station would malfunction, this would leed to spilling of drainage water on WWTP premises.

To avoid worst case scenario the contractor predicted installation of two pumps in the seepage pumping station. One would usually operate, while the other would be in stand by in case of malfunction of the first one or in case of intense precipitation events as described above.

5 CONSTRUCTION PROGRESS

5.1. General information about construction progress

After intensive and challenging administrative process, the construction permit for construction of sludge drying reed beds (SDRB) was obtained in the middle of April. Due to the late payment of funds from Slovenian government, the green light (the amendment to the contract) was secured in the beginning of September. Meanwhile the negotiations with construction firms from Montenegro took place and preparatory works were finished. After confirmation of proposed changes (presented in first and second report of changes to technical design) by Chief Engineer (Mr. Lechner) the construction of SDRB in Mojkovac began in the October 2015.

5.2. Preparatory works

Due to possible extension of Mojkovac WWTP, a lack of space for SDRB implementation occurred, therefore fencing around this section of WWTP had to be removed (Figure 1 and Figure 2). Fence was removed on the top of embankment surrounding the area (Figure 2).

Figure 30: Initial appearance of the predicted area for SDRB implementation to Mojkovac WWTP

Figure 31: Final appearance after finishing preparatory works

5.3. Earthworks

In October, the excavation of SDRB began to requested/required depth (figure 3). After the end of excavation the tampon zone was inserted at the bottom. The whole area was levelled to be totally flat. After levelling, the whole tampon zone was treated with tape vibrator to compact the bottom layer (Figure 2). After compacting the tampon zone, official survey company checked hardness resistance for entire area and gave green light for beginning of concrete works.

Figure 32: Excavator used for earthworks

Figure 33: Compacting the tampon zone with tape vibrator

Figure 34: Depth of excavation

5.4. Concrete works

Before concreting, entire surface was cleaned. On whole area lining concrete was placed as the bottom layer. All concrete works are done according to static design calculations and required standards presented in documentation.

Figure 35: Lining concrete and reinforce steel placement for bottom plate of SDRB

For the reinforcement only new, free from damage and loose rust reinforced steel was used

Figure 36: Material used for reinforcement

Figure 37: Formwork for the drainage trench placed in the middle of each bed

Figure 38: Detail of final trench concreting.

Figure 39: Finishing concrete works for trenches and bottom plates of SDRB

Figure 40: Preparation of side walls formwork

Figure 41: Concrete works on middle wall

Figure 42: Closure of concrete works on walls

Figure 43: Formwork installation for seepage manholes.

6 BOQ status

The construction of SDRB was planned to take place in two stages. The plan for the first stage is to finish all construction works (preparatory works, earthworks, concrete works). The second phase consists of pipeline installation, all electrical and hardware equipment installation and finally, all clearing works.

Due to overlapping of this two phases all efforts have been orientated into construction of SDRB basins. We have to be aware that construction workers are in constant race with time, due to possible early winter conditions on high altitude plateau (800 m a.m.s.l) where Mojkovac lies.

The abovementioned overlapping occurs due obligatory pipeline installation in each drainage trench before installation of sand filter layer into each basin. For now, more than 80 % of all construction works have been finished, which can be seen in presented figures and costs distribution in detailed BoQ (Table 2, prices without VAT) and BoQ consensed (Table 3, VAT included).

Gr.	No.	Text	Quantity	Unit	Fee	Unitprice	Total	1. payment	2. payment
LG	**--**	**GENERAL CONDITIONS**							
Summe --		**GENERAL CONDITIONS**					**0,00**		
LG	**01**	**ON-SITE OVERHEAD COST**							
U1	**0101**	**Non recurring cost**							
GP	010101	Construction site equipment							
	010101A	Set-up construction site equipment	1,00	LS	1.000,00	1.000,00	1.000,00	1.000,00	
GP	010107	Removing construction site equipment							
	010107A	Removing construction site equipment	1,00	pcs	1.000,00	1.000,00	1.000,00		1000
GP	010111	Provide small site office for engineer							
	010111A	Provide small site office for engineer	1,00	pcs	500,00	500,00	500,00	500,00	
GP	010122	Signboard							
	010122B	Signboard	1,00	pcs	300,00	300,00	300,00	300,00	
U1	**0102**	**Time dependent cost of construction site**							
GP	010201	Cost for equipment							
	010201A	Cost for equipment	1,00	LS	2.500,00	2.500,00	2.500,00	1.500,00	1000
GP	010205	Wait time for equipment							
	010205A	Wait time for equipment	50,00	d	10,00	10,00	500,00		500
GP	010208	Maintain engineers office							
	010208A	Maintain engineers office	180,00	d	10,00	10,00	1.800,00	900,00	900
Summe 01		**ON-SITE OVERHEAD COST**					**7.600,00**	**4.200,00**	**3.400,00**
LG	**02**	**PREPARATORY AND FINISHING WORKS**							
U1	**0202**	**Preparatory and finishing works**							
GP	020201	Clearing							

	020201A	Clearing area	1.000,00	m2	3,50	3,50	3.500,00	2.500,00	1000
GP	020263	Final cleaning							
	020263A	Final cleaning of tanks	2,00	pcs	900,00	900,00	1.800,00		1800
	020263B	Final cleaning of basins	2,00	pcs	900,00	900,00	1.800,00		1800
	020263D	Final cleaning of construction site	1,00	LS	2.000,00	2.000,00	2.000,00		2000
Summe 02		**PREPARATORY AND FINISHING WORKS**					**9.100,00**	**2.500,00**	**6.600,00**
LG	**03**	**EARTHWORK**							
U1	**0301**	**Road construction**							
GP	030101	Cutting of paving							
	030101A	Cutting of bituminous paving 5-15cm	6,00	m	10,00	10,00	60,00		60
U1	**0302**	**Topsoil**							
GP	030201	Remove topsoil							
	030201A	Remove topsoil	200,00	m3	4,00	4,00	800,00	600,00	200
GP	030206	Replace topsoil							
	030206A	Replace Topsoil	40,00	m3	25,00	25,00	1.000,00	800,00	200
GP	030211	Recultivate topsoil							
	030211B	Recultivate topsoil	400,00	m2	2,50	2,50	1.000,00		1000
U1	**0303**	**Excavation**							
GP	030310	Trench excavation							
	030310A	Trench excavation	65,00	m3	7,00	7,00	455,00		455
	030310C	Surcharge excavation in rock	30,00	m3	16,00	16,00	480,00	380,00	100
	030320C	Excavation of sludge pumping station	1,00	LS	500,00	500,00	500,00	500,00	
	030320D	Excavation of seepage pumping station	1,00	LS	300,00	300,00	300,00	300,00	
	030320E	Excavation of sludge drying reed beds	1,00	LS	5.000,00	5.000,00	5.000,00	5.000,00	
U1	**0306**	**Protection of lines and cable works**							
GP	030601	Protection of lines							

	030601A	Protection of lines longitudinally < DN200	20,00	m	20,00	20,00	400,00		400
	030601F	Protection of lines across < DN00	10,00	m	10,00	10,00	100,00		100
GP	030602	Installation of cables							
	030602B	Installation of clables DN >25-50mm	150,00	m	5,00	5,00	750,00		750
	030602D	Installation of warning tape	150,00	m	2,00	2,00	300,00	300,00	
GP	030603	Bedding of cables							
	030603B	Bedding with plastic protection covers	75,00	m2	4,00	4,00	300,00		300
GP	030608	Supply protection covers							
	030608A	Supply plastic protection covers	150,00	m	2,00	2,00	300,00		300
	030608C	Supply warning tape	150,00	m	0,25	0,25	37,50	37,50	
U1	**0307**	**Backfilling**							
GP	030701	Backfilling of trenches							
	030701A	Backfilling of trenches in unpaved areas	45,00	m3	5,50	5,50	247,50		247,5
GP	030703	Bedding of pipelines							
	030703D	Bedding with sand	15,00	m3	18,00	18,00	270,00		270
U1	**0351**	**Supply of material for earthworks**							
GP	035101	Extraneous material supply							
	035101B	Sand for cable bedding	7,50	m3	15,00	15,00	112,50		112,5
	035101E	Sand or chips for pipe bedding	15,00	m3	20,00	20,00	300,00		300
Summe 03		**EARTHWORK**					**12.712,50**	**7.917,50**	**4.795,00**
LG	**04**	**DRAINAGE**							
U1	**0410**	**Pumping station**							
GP	041001	Pumping Station, erect and dismantle							
	041001A	Pump 5-15kW	1,00	ST	500,00	500,00	500,00		500
GP	041010	Operate pump station							
	041010A	Pump 5-15kW	500,00	h	3,00	3,00	1.500,00		1500

Summe 04		**DRAINAGE**					**2.000,00**	**0,00**	**2.000,00**
LG	**11**	**CONCRETE WORKS**							
U1	**1160**	**Concrete structures wastewater treatment**							
GP	116010	Concrete structures wastewater treatment							
	116010A	Sludge drying reed beds	1,00	LS	60.000,00	60.000,00	60.000,00	50.000,00	10000
	116010D	Sludge drying reed beds	1,00	LS		0,00	0,00		
Summe 11		**CONCRETE WORKS**					**60.000,00**	**50.000,00**	**10.000,00**
LG	**18**	**ROADWORKS**							
U1	**1801**	**Set up equipment for asphalt coating**							
GP	180101	Set up equipment for asphalt coating							
	180101A	Set up equipment for asphalt coating	1,00	LS	500,00	500,00	500,00		500
GP	180104	Time dependent cost							
	180104A	Time dependent cost for asphalt coating	1,00	LS	500,00	500,00	500,00		500
GP	180106	Remove equipment for asphalt coating							
	180106A	Remove equipment for asphalt coating	1,00	pcs	300,00	300,00	300,00		300
U1	**1803**	**Earthworks for road construction**							
GP	180301	Excavation at contractors choice							
	180301B	Excavation >2,5m width	100,00	m3	4,00	4,00	400,00	400,00	
GP	180311	Subplane							
	180311B	Subplane	200,00	m2	2,00	2,00	400,00	400,00	
GP	180314	Antifreeze layer total							
	180314B	Antifreeze layer >2,50 m width	60,00	m3	5,00	5,00	300,00	300,00	
GP	180318	Subbase							
	180318F	Base course 15-20cm >2,5m width	40,00	m3	4,00	4,00	160,00	160,00	

U1	**1805**	**Bit. base- and load bearing cover layers**							
GP	180508	Load bearing cover layer							
	180508B	BTD16- B70/100 g.2,5m breit	200,00	m2	10,00	10,00	2.000,00	2.000,00	
U1	**1812**	**Shoulders**							
GP	181201	Shoulders							
	181201A	Gravel 0/32	50,00	m2	10,00	10,00	500,00	500,00	
Summe 18		**ROADWORKS**					**5.060,00**	**3.760,00**	**1.300,00**
LG	**20**	**Sewer pipes**							
U1	**2012**	**PE-sewer pipes total**							
GP	201201	PE-sewer pipes total							
	201201C	PE-sewer pipes DN/OD160 tot.	25,00	m	20,00	20,00	500,00		500
GP	201204	Surcharge fittings for sewer pipes							
	201204A	Surcharge PE sewer pipes	1,00	LS	500,00	500,00	500,00		500
Summe 20		**Sewer pipes**					**1.000,00**	**0,00**	**1.000,00**
LG	**21**	**WATER SUPPLY AND PRESSURE PIPES**							
U1	**2105**	**HDPE-water pipelines**							
GP	210505	HDPE pipe PN10							
	210505G	HDPE pipe PN10 DN/OD 75	35,00	m	12,00	12,00	420,00		420
GP	210510	Surcharge for fittings							
	210510A	Surcharge PE fittings	1,00	LS	350,00	350,00	350,00		350
U1	**2140**	**Valves**							
GP	214002	Flanged valve, short, PN 16							
	214002J	Flanged valve, short, PN 16, DN 150	2,00	pcs	295,00	295,00	590,00		590
	214002L	Flanged valve, short, PN 16, DN 250	1,00	ST	420,00	420,00	420,00		420

U1	**2165**	**Hand wheels**							
GP	216501	Hand wheels for valves							
	216501B	Handwheel for valve, 125/150 tot.	1,00	pcs	55,00	55,00	55,00		55
	216501C	Handwheel for valve, 200 ges.	1,00	ST	65,00	65,00	65,00		65
Summe 21		**WATER SUPPLY AND PRESSURE PIPES**					**1.900,00**	**0,00**	**1.900,00**
LG	**22**	**PRE-FABRIACTED MANHOLES**							
U1	**2201**	**Concrete parts for pre-fab. manholes tot.**							
GP	220101	Manhole bottom DN800, total							
	220101A	Manhole bottom DN800 straight in-out DN150	2,00	pcs	500,00	500,00	1.000,00		1000
GP	220121	Manhole ring concrete							
	220121B	Manhole ring DN 800	2,00	m	300,00	300,00	600,00		600
GP	220140	Concrete pre-fabricated pumping stations							
	220140A	Sludge pumping station	1,00	ls	3.000,00	3.000,00	3.000,00		3000
	220140B	Seepage pumping station	1,00	ls	1.000,00	1.000,00	1.000,00		1000
Summe 22		**PRE-FABRIACTED MANHOLES**					**5.600,00**	**0,00**	**5.600,00**
LG	**23**	**COVERS, FRAMES AND STEPS**							
U1	**2307**	**Cover for gully**							
GP	230705	Hinged gully cover 600/600							
	230705C	Hinged gully CI 600/600 class E	2,00	pcs	250,00	250,00	500,00		500
Summe 23		**COVERS, FRAMES AND STEPS**					**500,00**	**0,00**	**500,00**
LG	**30**	**TRANSPORT AND DISPOSAL**							
U1	**3001**	**Loading and transport**							
GP	300101	Movement of material for backfilling							
	300101A	Movement of material for backfilling	35,00	m3	5,00	5,00	175,00		175

U1	**3004**	**Removal of surplus material**							
GP	300401	Removal of surplus material							
	300401A	Transport cost	15,00	m3	7,00	7,00	105,00	75,00	30
	300401B	Cost for disposal	15,00	m3	50,00	50,00	750,00	500,00	
Summe 30		**TRANSPORT AND DISPOSAL**					**1.030,00**	**575,00**	**205,00**
LG	**31**	**FORCE ACCOUNT WORK**							
U1	**3101**	**Force account work**							
GP	310101	Building construction							
	310101A	Technician	20,00	h	7,00	7,00	140,00	100,00	40,00
	310101B	Foreman	40,00	h	15,00	15,00	600,00	300,00	300,00
	310101D	Craftsman	40,00	h	15,00	15,00	600,00	300,00	300,00
	310101F	Unskilled labour	80,00	h	5,00	5,00	400,00	200,00	200,00
GP	310102	Installation							
	310102A	Technician	20,00	h	7,00	7,00	140,00	70,00	70,00
	310102B	Foreman	40,00	h	15,00	15,00	600,00	300,00	300,00
	310102C	Craftsman	40,00	h	15,00	15,00	600,00	300,00	300,00
	310102D	Unskilled labour	80,00	h	5,00	5,00	400,00	200,00	200,00
U1	**3102**	**Equipment**							
GP	310201	Equipment for Earthworks							
	310201A	Tipper lorry 16to.	40,00	h	15,00	15,00	600,00	400,00	200,00
	310201G	Backhoe loader 40-60kW	40,00	h	20,00	20,00	800,00	400,00	400,00
	310201H	Excavator 80-100kW	20,00	h	35,00	35,00	700,00	500,00	200,00
	310201Q	Grader	20,00	h	30,00	30,00	600,00	300,00	300,00
	310201R	Vibrating roller 5t	20,00	h	17,00	17,00	340,00	200,00	140,00
GP	310202	Other Equipment							
	310202A	Compressor <5m3/min	40,00	h	10,00	10,00	400,00	300,00	100,00
	310202B	Compressor <10m3/min	40,00	h	15,00	15,00	600,00	500,00	100,00

	310202C	Hydraulic hammer	40,00	h	15,00	15,00	600,00	500,00	100,00
	310202D	Vibro tamper 60kg	20,00	h	25,00	25,00	500,00	400,00	100,00
	310202E	Plate vibrator 30kg	20,00	h	20,00	20,00	400,00	300,00	100,00
	310202F	Plate vibrator 80kg	20,00	h	15,00	15,00	300,00	200,00	100,00
	310202G	Plate vibrator 200kg	20,00	h	35,00	35,00	700,00	500,00	200,00
	310202I	Generator <10kVA	40,00	h	11,00	11,00	440,00	200,00	240,00
	310202J	Generator >10-50kVA	40,00	h	25,00	25,00	1.000,00	300,00	700,00
	310202L	MIG welding machine	10,00	h	11,00	11,00	110,00	50,00	60,00
	310202M	Stick welding machine	5,00	h	5,00	5,00	25,00	15,00	10,00
U1	**3103**	**Handtools**							
GP	310301	Electrical handtools							
	310301A	Electrical handtools	100,00	h	3,00	3,00	300,00		300,00
U1	**3151**	**Material for force account work**							
GP	315101	Material for force account work							
	315101A	Material for force account work	2.000,00	BU	0,70	0,70	1.400,00	500,00	900,00
Summe 31		**FORCE ACCOUNT WORK**					**13.295,00**	**7.335,00**	**5.960,00**
LG	**40**	**DOCUMENTATION**							
GP	400201	As built drawings							
	400201A	As built drawings WWTP	1,00	LS	1.500,00	1.500,00	1.500,00	1.500,00	
U1	**4010**	**Photos**							
GP	401001	Photos							
	401001A	Digital photos	1,00	LS	200,00	200,00	200,00	200,00	
Summe 40		**DOCUMENTATION**					**1.700,00**	**1.700,00**	**0,00**
LG	**50**	**NON STANDARDISED STRUCTURES**							
U1	**5001**	**Sludge Treatment**							

GP	500105	Sludge drying reed beds							
	500105A	Sludge drying reed beds	1,00	LS	5.000,00	5.000,00	5.000,00	5.000,00	
GP	500106	Siphon							
	500106A	Siphon	1,00	LS	1.000,00	1.000,00	1.000,00	1.000,00	
Summe 50		**NON STANDARDISED STRUCTURES**					**6.000,00**	**6.000,00**	**0,00**

Table 2: Detiled costs distribution between two payments and construction phases (without VAT)

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

LIMNOS 20 YEARS

Pos.	No.	Text	Total	1. payment	2. payment
LG	--	GENERAL CONDITIONS	0,00	**0,00**	0,00
LG	01	ON-SITE OVERHEAD COST	9.120,00	**5.040,00**	4.080,00
LG	02	PREPARATORY AND FINISHING WORKS	10.920,00	**3.000,00**	7.920,00
LG	03	EARTHWORK	15.255,00	**9.501,00**	5.754,00
LG	04	DRAINAGE	2.400,00	**0,00**	2.400,00
LG	11	CONCRETE WORKS	72.000,00	**60.000,00**	12.000,00
LG	18	ROADWORKS	6.072,00	**4.512,00**	1.560,00
LG	20	Sewer pipes	1.200,00	**0,00**	1.200,00
LG	21	WATER SUPPLY AND PRESSURE PIPES	2.280,00	**0,00**	2.280,00
LG	22	PRE-FABRIACTED MANHOLES	6.720,00	**0,00**	6.720,00
LG	23	COVERS, FRAMES AND STEPS	600,00	**0,00**	600,00
LG	30	TRANSPORT AND DISPOSAL	1.236,00	**690,00**	246,00
LG	31	FORCE ACCOUNT WORK	15.954,00	**8.802,00**	7.152,00
LG	40	DOCUMENTATION	2.040,00	**2.040,00**	0,00
LG	50	NON STANDARDISED STRUCTURES	7.200,00	**7.200,00**	0,00
		Sum	152.997,00	**100.785,00**	51.912,00

Table 3: Costs distribution between two payments and construction phases (VAT included)

7 REMAINING TASKS

For the first phase the distribution shaft, drainage shafts and small pumping station have to be finished. The contractor is convinced that the first phase would be finished until the end of this year (2015). The remaining objects are not so demanding, they can be constructed even in a case of snow.

Meanwhile the second phase of pipeline installation and electrical and hardware equipment installation will be consucted. We also hope that second phase will be finished until the end of this year.

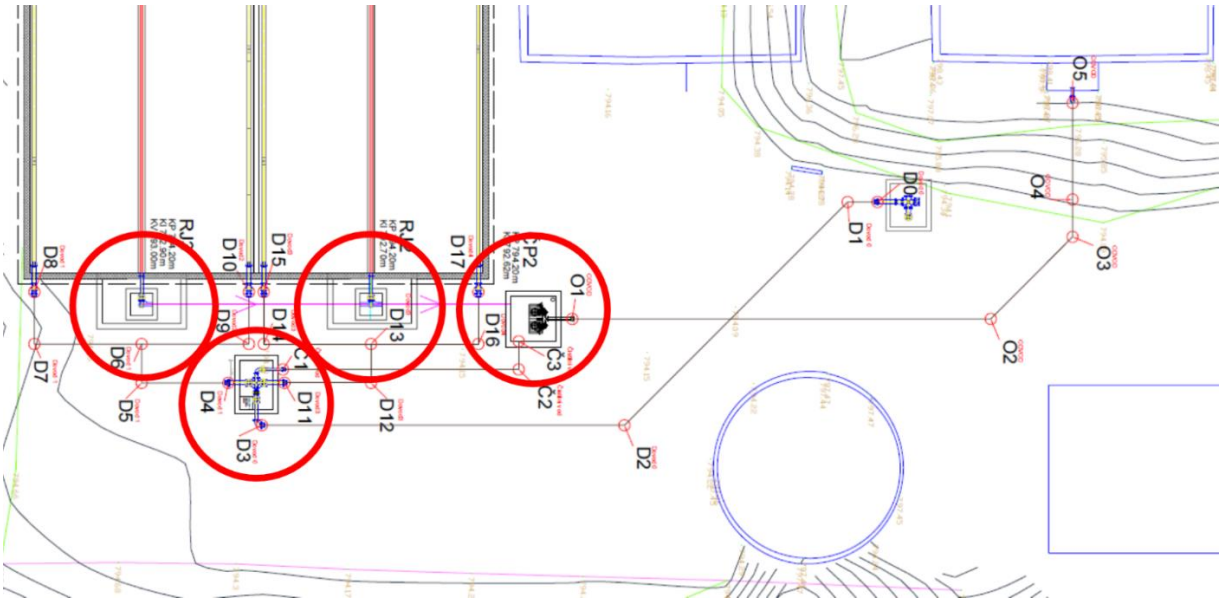


Figure 44: Remaining objects to be built

There are only plants left that have to be planted. We have to be aware that SDRB sludge treatment is a shared, biological - mechanical process. Due to the possibly harsh winter conditions in Mojkovac, the final works and project closure can be expected in the spring of next year.