



ЕВРОПЕЙСКИ СЪЮЗ  
Европейски фонд  
за Регионално развитие



Оперативна програма "Регионално развитие" 2007-2013

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Инвестираме във Вашето бъдеще!

Проектът се финансира от Европейския фонд за регионално развитие и от държавния бюджет на Република България

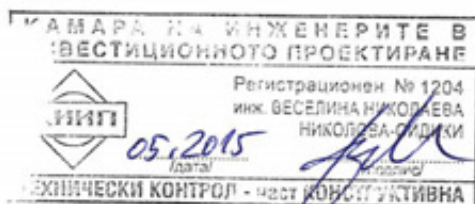
Изготвяне на инвестиционни проекти по проект: „Подготовка на инвестиционни проекти в град Велико Търново за следващия програмен период“, който се осъществява с финансовата подкрепа на Оперативна програма "Регионално развитие" 2007-2013 г., по обособени позиции.

ОБОСОБЕНА ПОЗИЦИЯ N1 " Подготовка на инвестиционни проекти за обект 1 „ Градска среда в ж.к. „Чолаковци" и обект 2 „ Пешеходна алея между жк „Чолаковци" и жк „Бузлуджа"

ОБЕКТ 2: ПЕШЕХОДНА АЛЕЯ МЕЖДУ ЖК „ЧОЛАКОВЦИ" И ЖК „БУЗЛУДЖА"

ВЪЗЛОЖИТЕЛ: Община Велико Търново

## КОНСТРУКТИВНИ ИЗЧИСЛЕНИЯ



ПРОЕКТАНТ:



/ инж. Николай Николов /

Този проектът е изпълнен с финансовата подкрепа на Оперативна програма "Регионално развитие 2007-2013", съфинансирана от Европейския фонд за регионално развитие. Цялата отговорност за съдържанието на публикацията се носи от „Никифоров Студио“ ЕООД и при никакви обстоятелства не може да се счита, че тази публикация отразява официалното становище на Европейския съюз и Управляващия орган

## Основни данни за модела

Обект: Пешеходна алея между жк „Чолаковци“ и жк „Бузлуджа“  
Населено място: гр. Велико Търново  
Инвеститор: Община Велико Търново  
Проектант: НИКИФОРОВ СТУДИО ЕООД

Файл: Parapet Aleia.twp  
Дата на изчислението: 11.5.2015

Начин на изчислението: 3D модел

- ☒ Теория от I ред      ☐ Модален анализ      ☐ Стабилност  
☐ Теория от II ред      ☐ Изчисление - Сеизмичност      ☐ Етапи на строежа  
☐ Нелинеен анализ

### Височина на модела

Брой възли: 20  
Брой плочи и стени: 0  
Брой греди и колони: 18  
Брой гранични елементи: 60  
Брой основни случаи на натоварване: 3  
Брой комбинации на натоварване: 4

### Мерни единици

Дължина: m [cm,mm]  
Сила: kN  
Температура: Celsius

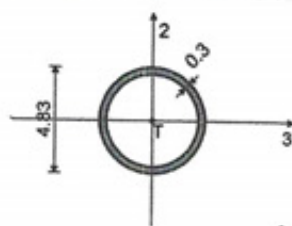
## Входни данни - Конструкция

Таблица на материалите

No	Наименование на материала	E[kN/m <sup>2</sup> ]	$\mu$	$\gamma$ [kN/m <sup>3</sup> ]	$\alpha$ [1/C]	E <sub>m</sub> [kN/m <sup>2</sup> ]	$\mu$ <sub>m</sub>
1	Стомана	2.100e+8	0.30	78.50	1.000e-5	2.100e+8	0.30

Съкупности на гредите

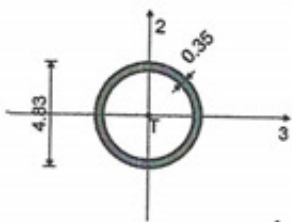
№: 1 Сечение: D= 48.3x3, Фиктивен ексцентрицитет



[cm]

Мат.	A1	A2	A3	I1	I2	I3
1 - Стомана	4.270e-4	2.134e-4	2.134e-4	2.199e-7	1.100e-7	1.100e-7

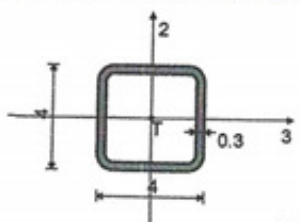
№: 2 Сечение: D= 48.3x3.5, Фиктивен ексцентрицитет



[cm]

Мат.	A1	A2	A3	I1	I2	I3
1 - Стомана	4.930e-4	2.462e-4	2.462e-4	2.486e-7	1.243e-7	1.243e-7

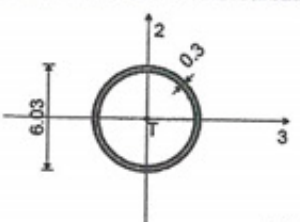
№: 3 Сечение: НОР □ 40x40x3, Фиктивен ексцентрицитет



[cm]

Мат.	A1	A2	A3	I1	I2	I3
1 - Стомана	4.210e-4	2.400e-4	2.400e-4	1.563e-7	8.620e-8	8.620e-8

№: 4 Сечение: D= 60.3x3, Фиктивен ексцентрицитет



[cm]

Мат.	A1	A2	A3	I1	I2	I3
1 - Стомана	5.400e-4	2.699e-4	2.699e-4	4.443e-7	2.222e-7	2.222e-7

Съкупности на точковите опори

	K,R1	K,R2	K,R3	K,M1	K,M2	K,M3
1	1.000e+10	1.000e+10	1.000e+10	1.000e+10	1.000e+10	1.000e+10

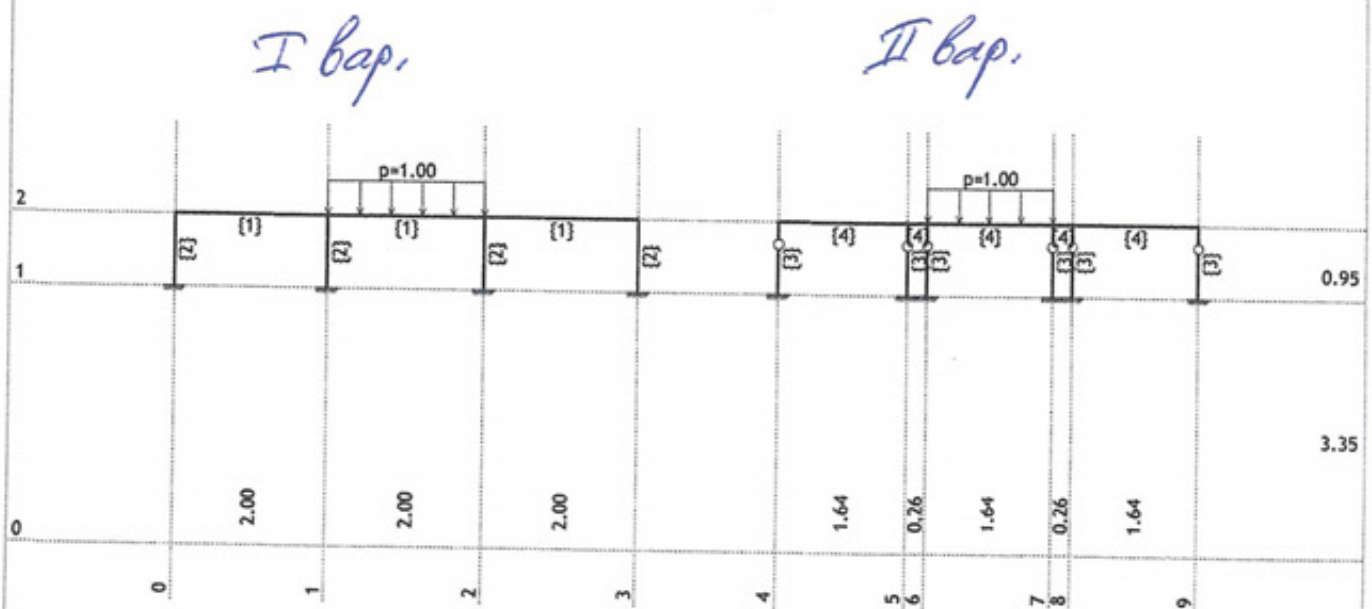
# Входни данни - Натоварване

Случаи на натоварване

LC	Наименование
1	(g)
2	Q vert.
3	Q hor.
4	Комб.: GQvert.K (I+II)

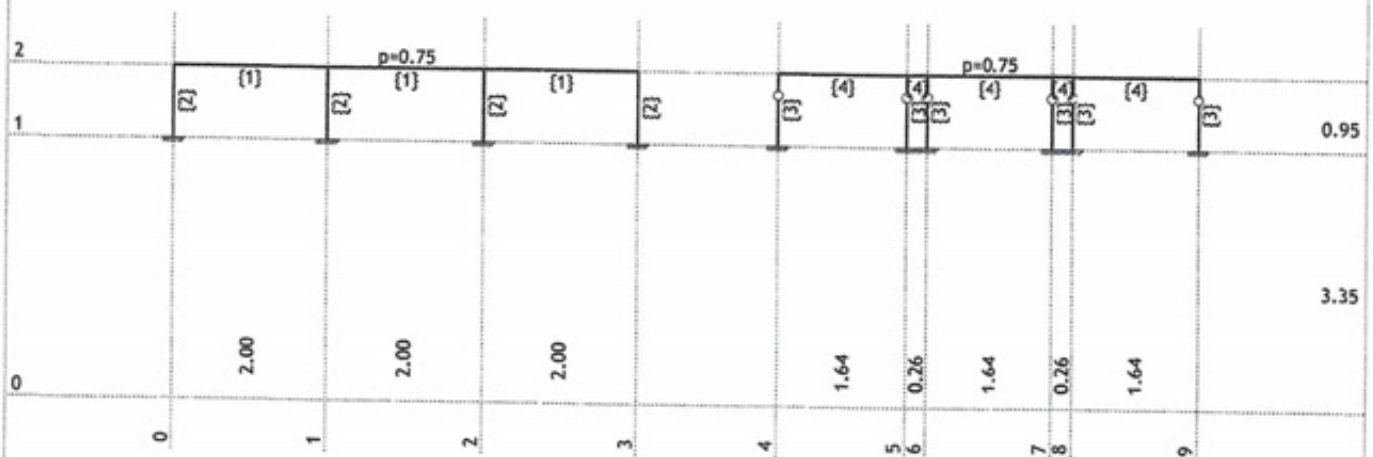
LC	Наименование
5	Комб.: GQ hor.K (I+III)
6	Комб.: GQvert. (I+1.5xII)
7	Комб.: GQ hor. (I+1.5xIII)

Натов. 2: Q vert.



Рамка: X\_1

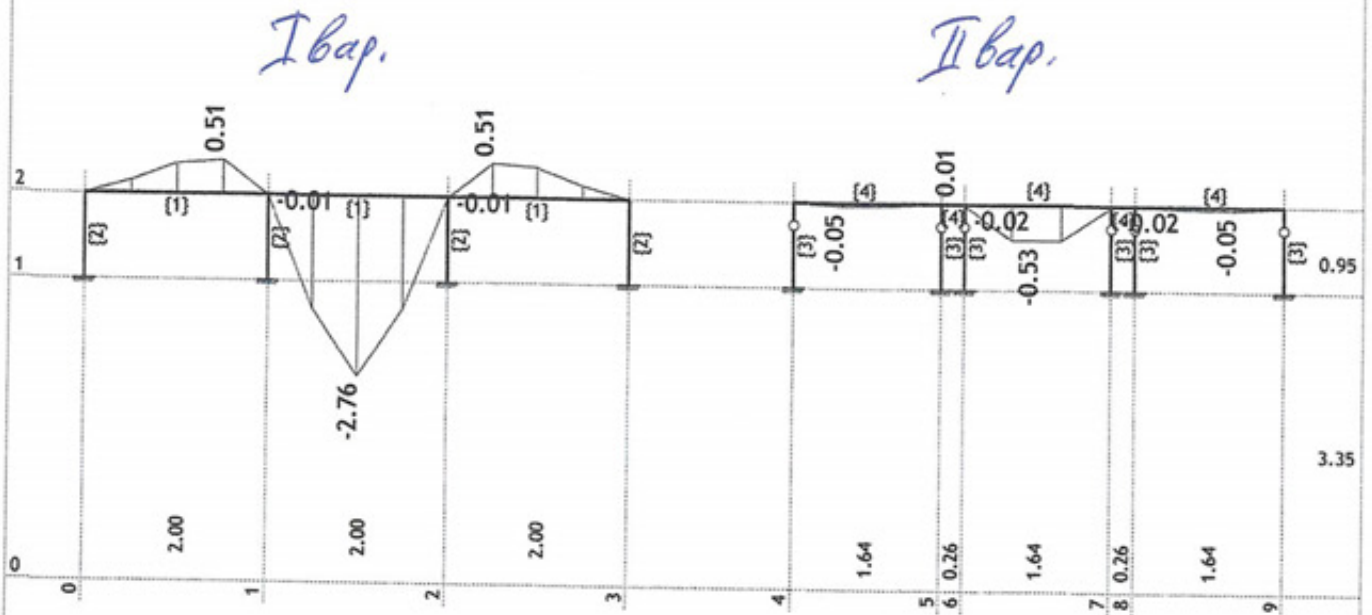
Натов. 3: Q hor.



Рамка: X\_1



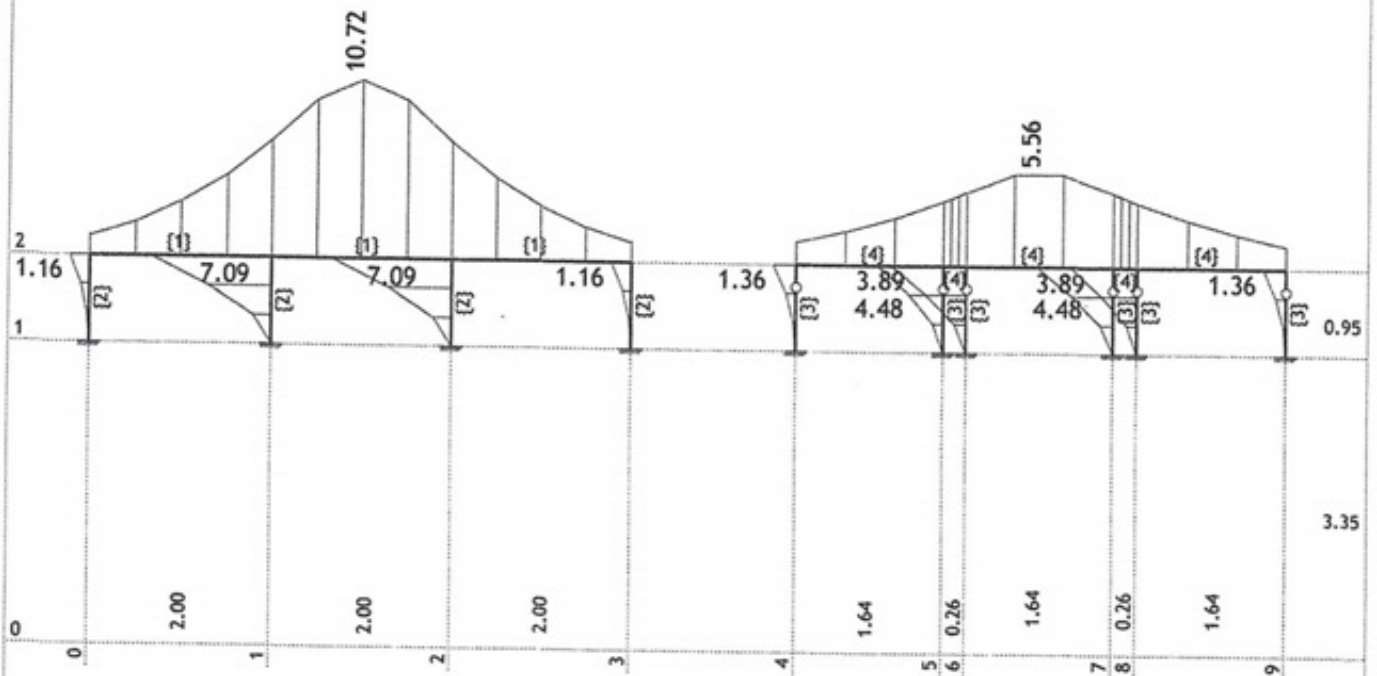
Натов. 4: GQvert.K



Рамка: X\_1

Резултати в гредата: max  $Z_0 = 0.51$  / min  $Z_0 = -2.76$  m / 1000

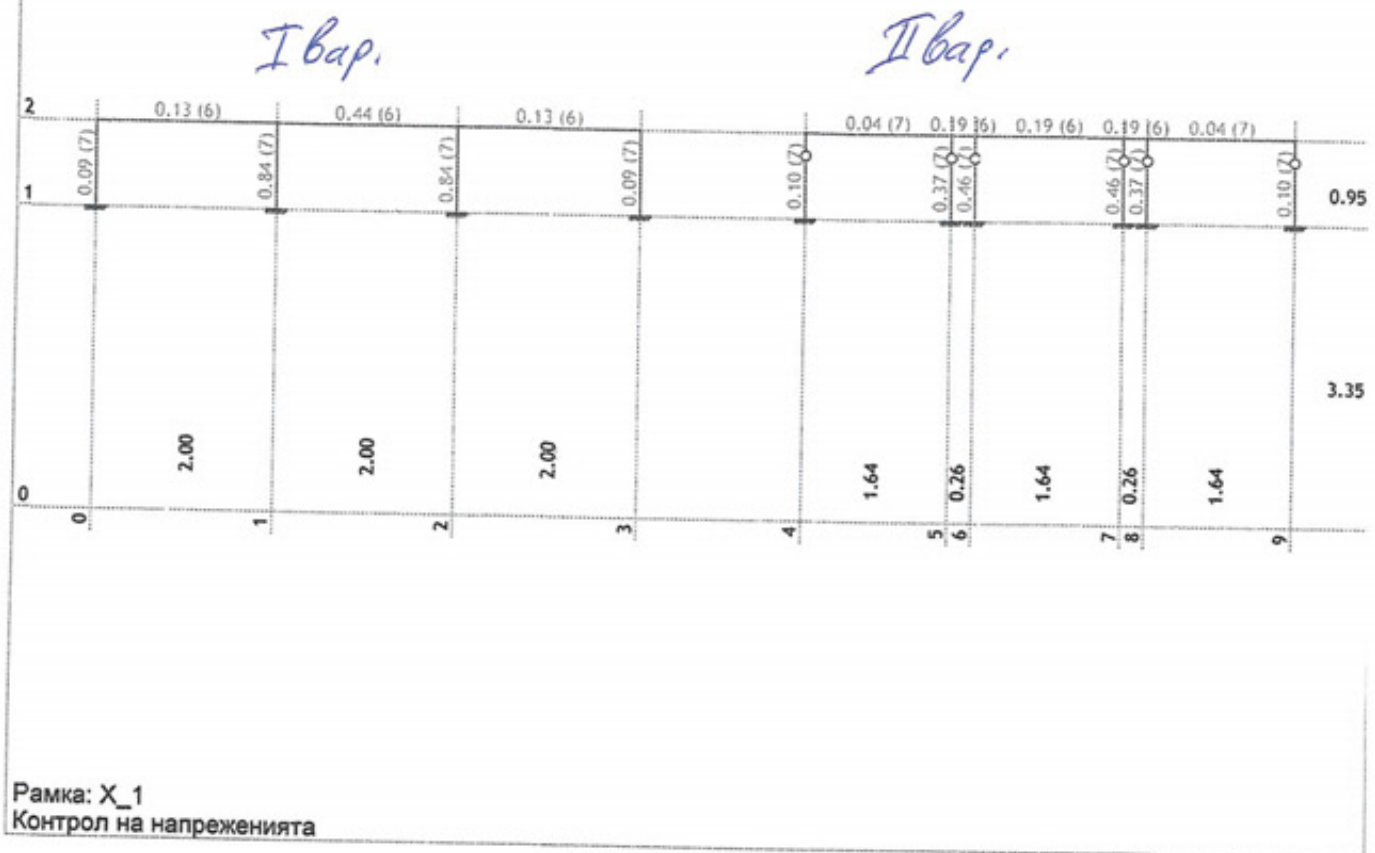
Натов. 5: GQ hor.K



Рамка: X\_1

Резултати в гредата: max  $Y_0 = 10.72$  / min  $Y_0 = -0.00$  m / 1000

Оразмеряване (стомана)



Окончателно приет- I вар.



## Cantilever wall analysis

### Input data

#### Project

Task: ПЕШЕХОДНА АЛЕЯ МЕЖДУ ЖК "ЧОЛАКОВЦИ" И ЖК "БУЗЛУДЖА", гр. В. ТЪРНОВО  
 Customer: Община Велико Търново  
 Date: 7.5.2015 г.

Name: Project

Stage: analysis - 1 - 0



#### Settings

Bulgaria - EN 1997

Materials and standards

Concrete structures: EN 1992-1-1 (EC2)

Coefficients EN 1992-1-1: standard

#### Settings

Bulgaria - EN 1997

Materials and standards

Concrete structures: EN 1992-1-1 (EC2)

Coefficients EN 1992-1-1: standard

#### Wall analysis

Active earth pressure calculation: Coulomb

Passive earth pressure calculation: Caquot-Kerisel

Earthquake analysis: Mononobe-Okabe

Shape of earth wedge: Calculate as skew

Base key:

The base key is considered as inclined footing bottom

Allowable eccentricity: 0.333

Verification methodology: according to EN 1997

Design approach: 2 - reduction of actions and resistances

#### Partial factors on actions (A)

##### Permanent design situation

		Unfavourable	Favourable
Permanent actions	$\gamma_G =$	1.35 [-]	1.00 [-]
Variable actions	$\gamma_Q =$	1.50 [-]	0.00 [-]
Water load	$\gamma_w =$	1.35 [-]	

#### Partial factors for resistances (R)

##### Permanent design situation

Partial factor on overturning	$\gamma_{Re} =$	1.40 [-]
Partial factor on sliding resistance	$\gamma_{Rn} =$	1.10 [-]



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Partial factors for resistances (R)  
Permanent design situation

Partial factor on bearing capacity :

$$\gamma_{Rv} = 1,40 [-]$$

Partial factors for variable actions  
Permanent design situation

Factor for combination value :

$$\psi_0 = 0,70 [-]$$

Factor for frequent value :

$$\psi_1 = 0,50 [-]$$

Factor for quasi-permanent value :

$$\psi_2 = 0,30 [-]$$

Material of structure

Unit weight  $\gamma = 25,00 \text{ kN/m}^3$

Analysis of concrete structures carried out according to the standard EN 1992-1-1 (EC2)

Concrete : C 20/25

Cylinder compressive strength

$$f_{ck} = 20,00 \text{ MPa}$$

Tensile strength

$$f_{ctm} = 2,20 \text{ MPa}$$

Longitudinal steel : B500

Yield strength

$$f_{yk} = 500,00 \text{ MPa}$$

Geometry of structure

i/m	Coordinates	Depth
	X [m]	Z [m]
1	0,00	0,00
2	0,00	1,35
3	0,00	1,80
4	-0,90	1,80
5	-0,50	1,35

6	-0,90	1,35
8	-0,45	1,35
7	-0,45	0,00

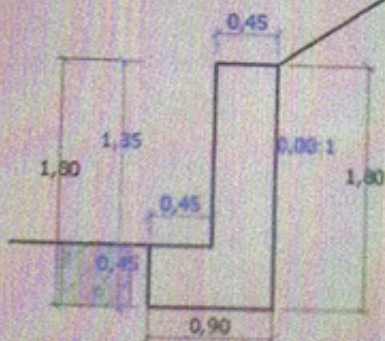
The origin [0,0] is located at the most upper right point of the wall.  
Wall section area = 1,01 m<sup>2</sup>



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Name: Geometry

Stage: analysis 1-3



Basic soil parameters

No.	Name	Pattern	$\gamma$ [kN/m <sup>3</sup> ]	$c_{eff}$ [kPa]	$\phi_{eff}$ [°]	$\gamma_{sat}$ [kN/m <sup>3</sup> ]
1	Gravelly silt (MG), consistency firm		25.00	8.00	19.00	13.00

All soils are considered as cohesionless for at rest pressure analysis

Soil parameters

Gravelly silt (MG), consistency firm

Unit weight:  $\gamma = 19.00 \text{ kN/m}^3$

Stress-state: effective

Angle of internal friction:  $\phi_{eff} = 29.00^\circ$

Cohesion of soil:  $c_{eff} = 8.00 \text{ kPa}$

Angle of friction struc.-soil:  $\delta = 13.00^\circ$

Soil: cohesionless

Saturated unit weight:  $\gamma_{sat} = 25.00 \text{ kN/m}^3$

Geological profile and assigned soils

No.	Layer [m]	Assigned soil	Pattern
1	1.80	Gravelly silt (MG), consistency firm	
2	-	Gravelly silt (MG), consistency firm	



# ПЕШЕХОДНА АЛЕЯ МЕЖДУ ЖК "ЧОЛАКОВЦИ" И ЖК "БУЗЛУДЖА", гр. В. ТЪРНЕВО

Name: Profile and assignment

Stage: analysis - 1 - 0



Foundation

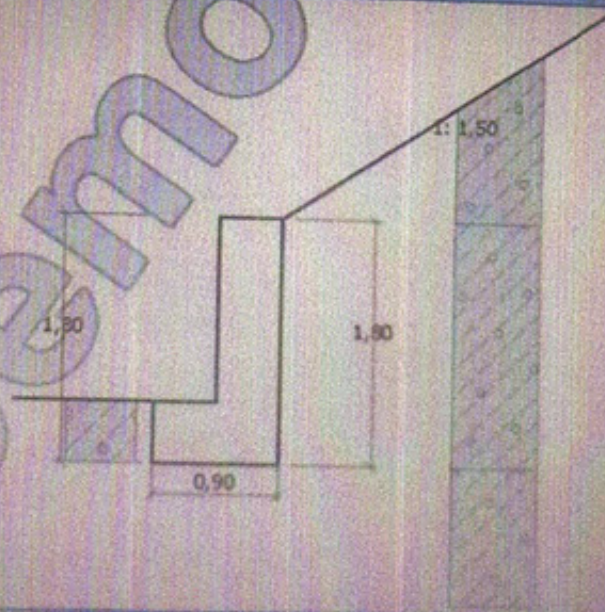
Type of foundation: soil from geological profile

Terrain profile

Terrain behind construction has the slope 1: 1,50 (slope angle is 33,69 °).

Name: Terrain

Stage: analysis - 1 - 0





### Water influence

Ground water table is located below the structure.

### Resistance on front face of the structure

Resistance on front face of the structure: at rest

Soil on front face of the structure - Gravelly silt (MG), consistency firm

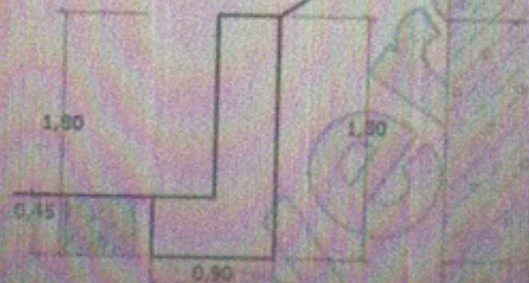
Soil thickness in front of structure

$h = 0,45$  m

Terrain in front of structure is flat.

Name: FF resistance

Stage - analysis: 1-0



### Settings of the stage of construction

Design situation: permanent

The wall is free to move. Active earth pressure is therefore assumed.

### Verification No. 1

Forces acting on construction

Name	$F_{int}$ [kNm]	App. PL z [m]	$F_{ext}$ [kNm]	App. PL x [m]	Coeff. overtur.	Coeff. sliding	Coeff. sliding
Weight - wall	0,00	-0,76	25,31	0,58	1,000	1,000	1,350
FF resistance	-0,99	-0,15	0,00	0,00	1,000	1,000	1,000
Active pressure	13,36	-0,41	3,08	0,90	1,350	1,350	1,000

### Verification of complete wall

#### Check for overturning stability

Resisting moment  $M_{res} = 13,25$  kNm/m

Overtuning moment  $M_{ovt} = 7,31$  kNm/m

Wall for overturning is **SATISFACTORY**

#### Check for slip

Resisting horizontal force  $H_{res} = 20,40$  kN/m



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Active horizontal force  $H_{act} = 17,05 \text{ kN/m}$

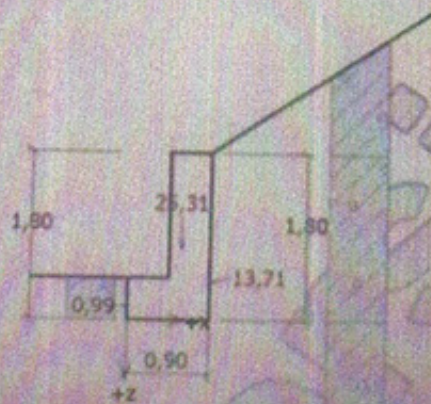
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Maximum stress in footing bottom : 41,40 kPa

Name: Verification

Stage: analysis 1.1



Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [m]	Stress [kPa]
1	-0.63	37,26	12,37	0,000	41,40
2	2,02	29,48	17,05	0,076	38,62

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	0,57	26,40	12,37

Verification of foundation soil

Eccentricity verification

Max. eccentricity of normal force  $e = 0,076$

Maximum allowable eccentricity  $e_{plw} = 0,333$

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Design bearing capacity of foundation soil  $R = 200,00 \text{ kPa}$

Partial factor on bearing capacity  $\gamma_{Rv} = 1,40$

Max. stress at footing bottom  $\sigma = 41,40 \text{ kPa}$

Bearing capacity of foundation soil  $R_d = 142,86 \text{ kPa}$

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY



## Dimensioning No. 1

Forces acting on construction

Item	$F_{hor}$ [kN/m]	App. Pt. z [m]	$F_{vert}$ [kN/m]	App. Pt. x [m]	Coef. moment	Coef. norm. force	Coef. shear force
Weight - wall	0,00	-0,67	15,17	0,23	1,000	1,350	1,000
Pressure at rest	18,18	-0,45	0,00	0,45	1,350	1,000	1,350

Wall stem check

Reinforcement and dimensions of the cross-section

Bar diameter = 12,0 mm

Number of bars = 6,66

Reinforcement cover = 30,0 mm

Cross-section width = 1,00 m

Cross-section depth = 0,45 m

Reinforcement ratio  $\rho = 0,18 \% > 0,13 \% = \rho_{min}$

Position of neutral axis  $x = 0,03 \text{ m} < 0,26 \text{ m} = x_{max}$

Ultimate shear force  $V_{Ed} = 143,01 \text{ kN} > 24,54 \text{ kN} = V_{Ed}$

Ultimate moment  $M_{Ed} = 131,56 \text{ kNm} > 11,03 \text{ kNm} = M_{Ed}$

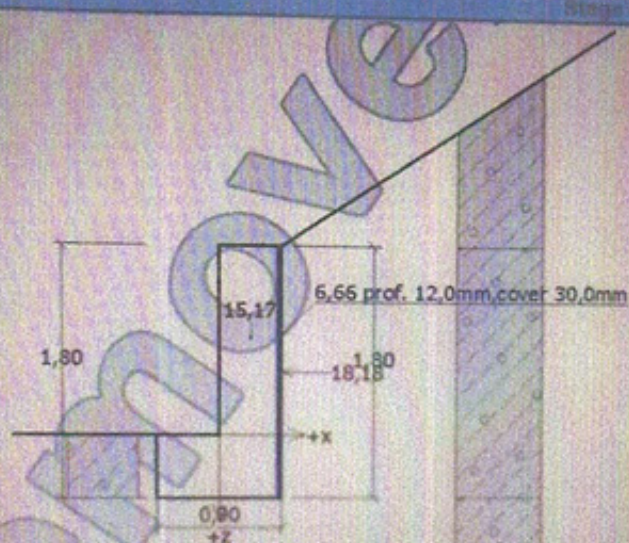
Cross-section is **SATISFACTORY**.

Stage - analysis

Stage - analysis

Name: Dimensioning

Stage - analysis



## Dimensioning No. 2

Forces acting on construction

Item	$F_{hor}$ [kN/m]	App. Pt. z [m]	$F_{vert}$ [kN/m]	App. Pt. x [m]	Coef. moment
Weight - wall	0,00	-0,76	25,31	0,58	1,350
PF resistance	-0,99	-0,15	0,00	0,00	1,000
Active pressure	13,36	-0,41	3,08	0,60	1,000



SECTION

ПЕШЕХОДНА АЛЕЯ МЕЖДУ ЖК "ЧОЛАКОВЦИ" И ЖК "БУЗЛУДЖА", гр. В. ТЪРНОВО

### Front wall jump check

Reinforcement and dimensions of the cross-section

Bar diameter = 12,0 mm

Number of bars = 6,66

Reinforcement cover = 30,0 mm

Cross-section width = 1,00 m

Cross-section depth = 0,45 m

Reinforcement ratio  $\rho = 0,18 \% > 0,13 \% = \rho_{min}$

Position of neutral axis  $x = 0,03 \text{ m} < 0,26 \text{ m} = x_{max}$

Ultimate shear force  $V_{Rd} = 143,01 \text{ kN} > 17,58 \text{ kN} = V_{Ed}$

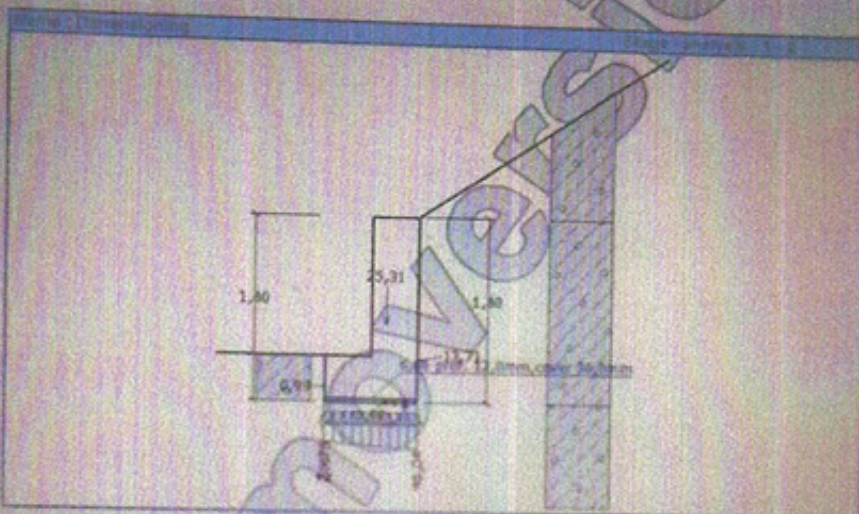
Ultimate moment  $M_{Rd} = 131,56 \text{ kNm} > 4,03 \text{ kNm} = M_{Ed}$

Cross-section is **SATISFACTORY**.

Stage: Dimensioning

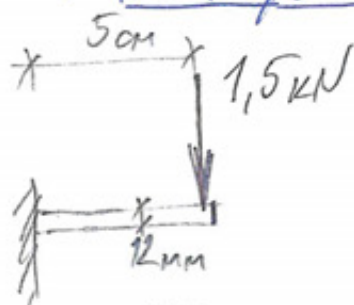
Stage: analysis: 1-2

Cross-section is **SATISFACTORY**.





Оразмеряване болтовете за хващане  
на дървени греди към парапета.



$$M_{\max} = 1,5 \cdot 0,05 = 0,075 \text{ kNm} = 7,5 \text{ kN} \cdot \text{cm}$$

$$W_{M12} = \frac{I_y}{z_{\max}} = \frac{\pi \cdot d^3}{32} = \frac{\pi \cdot 10^3}{32} = 0,17 \text{ cm}^3$$

$$\sigma_{\max} = \frac{7,5}{0,17} = 44,12 \text{ kN/cm}^2$$

$$\text{За } M 16 \rightarrow W_{M16} = \frac{\pi \cdot 19^3}{32} = 0,27 \text{ cm}^3$$

$$\sigma_{\max} = \frac{7,5}{0,27} = 27,78 \text{ kN/cm}^2 < 40 \text{ kN/cm}^2$$

$\Rightarrow$  Болт M 16, клас 4.6

