



**ANENSKÁ STUDÁNKA – DOMOV U STUDÁNKY
- ODKANALIZOVÁNÍ OBJEKTU Č.P. 25
K.Ú. ANENSKÁ STUDÁNKA**

E.4 Dokladová část – statika potrubí

Zadávací podmínky

Použité potrubí: RC Protect PE 100 RC, PN 10, SN 16, De 63

Krytí nad vrcholem potrubí: 0,8 m

Zatížení provozem: D 400

Hladina spodní vody: 2 m pod povrchem

Obsypový materiál: lomová prosívka 0-8

Stupeň zhutnění obsypu: 95% PS

Result

Calculation OK

Given values

Pipe type	PE 100 RC	Pipe dimension (mm)	63
Soil type	Sand	Please note: the chosen pipe diameter is below 110 mm, but has been set at 110 mm for calculation purpose	
Safety class	Normal	Control class	Normal
Partial coefficient - safety class	2.27	Partial coefficient - control class	1.50
Max. negative pressure in pipe (kPa)	Compression class Normal > 95% SP		
Installation type	Normal trench and normal up to high compaction	Installation factor %	1.0 %
Bedding/bedding layer	Normal levelling layer	Bedding factor %	2.00 %
Traffic load	Heavy traffic load	Max. negative pressure in pipe (kPa)	0.00
Soil cover above pipe top (m) = H	0.80	Distance from ground level to ground-water level (m) = Hw	2.00
Relative density - below ground-water level (kN/m³)	10.00	Relative density - above ground-water level (kN/m³)	20.00
Calculated diameter of pipe (mm)	63.00	Pipe ring stiffness	16.00
<u>Load combination 1.1 Deformation calculation serviceability limit state</u>			
Average stress from traffic load (q_{tm}) kN/m²	63.19	Short-term deformation from variable load (traffic)	0.9 %
Load factor C regarding the stiffness ratio of pipe to backfilling material (applied)	1.13	Short-term deformation from permanent load (soil)	0.2 %

Characteristic traffic load q_{tk} kN/m ² (Formula 9)	71.20	Deformation from installation (Table 2.9)	1.0 %
Additional soil cover for determination of soil modulus E_{td} when influenced by heavy road traffic load (Table 2.8)	3.00	Average deformation	2.1 %
delta H factor dependent on type of road traffic load	1.0	Short-term maximum deformation (Page 42)	<u>4.1 %</u>
Tangent modulus of backfill above ground-water E_{td} (Formula 11) - kN/m ²	5376	Long-term deformation from load (formula 16)	1.7 %
Secant modulus of backfill above ground-water E_{sd} (Formula 12) - kN/m ²	3495	Long-term max. deformation (Formula 15)	5.3 %
Reduction factor for ground-water influence on soil E-moduli (formula 13)	1.60		
Tangent modulus of backfill below ground-water E_{td} (Formula 11 x Formula 13) - kN/m ²	8602		
Secant modulus of backfill below ground-water E_{sd} (Formula 12 x Formula 13) - kN/m ²	5592		

Short-term maximum deformation (Page 42) 4.1 % < 9.0 % (Pipematerial: PE100) - OK

Load deformation 2.1 Deformation calculation ultimate limit state

Calculated ring stiffness (kN/m ²)	13.33	Calculated max. buckling pressure (kN/m ²)	1004.93
Calculated tangent modulus (kN/m ²)	3796.28	Design load (kN/m ²)	132.56
Reduction factor beta	0.84	Design buckling pressure (kN/m ²)	845.69

Buckling load combination 2.1 - q_d (Formula 20) kN/m² 132.56 < Buckling load combination 2.1 - $\beta x q_b$ (Formula 22) 845.69 - OK

Při dodržení zadávacích podmínek potrubí RC Protect PE 100 RC, PN 10, SN 16, De 63 vyhoví a jeho deformace nepřesáhne hodnotu 4,1%. Tato deformace je počítána při prázdném potrubí bez vnitřního přetlaku.

Zadávací podmínky

Použité potrubí: RC Protect PE 100 RC, PN 10, SN 16, De 63

Krytí nad vrcholem potrubí: 1,5 m

Zatížení provozem: D 400

Hladina spodní vody: 2 m pod povrchem

Obsypový materiál: lomová prosívka 0-8

Stupeň zhutnění obsypu: 95% PS

Result

Calculation OK

Given values

Pipe type	PE 100 RC	Pipe dimension (mm)	63
Soil type	Sand	Please note: the chosen pipe diameter is below 110 mm, but has been set at 110 mm for calculation purpose	
Safety class	Normal	Control class	Normal
Partial coefficient - safety class	2.27	Partial coefficient - control class	1.50
Max. negative pressure in pipe (kPa)	Compression class Normal > 95% SP		
Installation type	Normal trench and normal up to high compaction	Installation factor %	1.0 %
Bedding/bedding layer	Normal levelling layer	Bedding factor %	2.00 %
Traffic load	Heavy traffic load	Max. negative pressure in pipe (kPa)	0.00
Soil cover above pipe top (m) = H	1.50	Distance from ground level to ground-water level (m) = Hw	2.00
Relative density - below ground-water level (kN/m³)	10.00	Relative density - above ground-water level (kN/m³)	20.00
Calculated diameter of pipe (mm)	63.00	Pipe ring stiffness	16.00

Load combination 1.1 Deformation calculation serviceability limit state

Average stress from traffic load (q_{tm}) kN/m²	30.29	Short-term deformation from variable load (traffic)	0.5 %
Load factor C regarding the stiffness ratio of pipe to backfilling material (applied)	1.01	Short-term deformation from permanent load (soil)	0.5 %
Characteristic traffic load q_{tk} kN/m² (Formula 9)	30.69	Deformation from installation (Table 2.9)	1.0 %
Additional soil cover for	1.55	Average deformation	1.9 %

determination of soil modulus E_{td}
when influenced by heavy road
traffic load (Table 2.8)

delta H factor dependent on type of road traffic load	1.0	Short-term maximum deformation (Page 42)	<u>3.9 %</u>
Tangent modulus of backfill above ground-water E_{td} (Formula 11) - kN/m^2	4552	Long-term deformation from load (formula 16)	1.4 %
Secant modulus of backfill above ground-water E_{sd} (Formula 12) - kN/m^2	2959	Long-term max. deformation (Formula 15)	4.9 %
Reduction factor for ground-water influence on soil E-moduli (formula 13)	1.13		
Tangent modulus of backfill below ground-water E_{td} (Formula 11 x Formula 13) - kN/m^2	5158		
Secant modulus of backfill below ground-water E_{sd} (Formula 12 x Formula 13) - kN/m^2	3353		

Short-term maximum deformation (Page 42) 3.9 % < 9.0 % (Pipematerial: PE100) - OK

Load deformation 2.1 Deformation calculation ultimate limit state

Calculated ring stiffness (kN/m^2)	13.33	Calculated max. buckling pressure (kN/m^2)	924.63
Calculated tangent modulus (kN/m^2)	2276.46	Design load (kN/m^2)	79.90
Reduction factor beta	0.85	Design buckling pressure (kN/m^2)	789.59

Buckling load combination 2.1 - q_d (Formula 20) kN/m^2 79.90 < Buckling load combination 2.1 - $\beta x q_b$ (Formula 22) 789.59 - OK

Při dodržení zadávacích podmínek potrubí RC Protect PE 100 RC, PN 10, SN 16, De 63 vyhoví a jeho deformace nepřesáhne hodnotu 3,9 %. Tato deformace je počítána při prázdném potrubí bez vnitřního přetlaku.

Zadávací podmínky

Použité potrubí: RC Protect PE 100 RC, PN 10, SN 16, De 63

Krytí nad vrcholem potrubí: 1,5 m

Zatížení provozem: D 400

Hladina spodní vody: 0,5 m pod povrchem

Obsypový materiál: lomová prosívka 0-8 mm

Stupeň zhutnění obsypu: 95% PS

Result

Calculation OK

Given values

Pipe type	PE 100 RC	Pipe dimension (mm)	63
Soil type	Sand	Please note: the chosen pipe diameter is below 110 mm, but has been set at 110 mm for calculation purpose	
Safety class	Normal	Control class	Normal
Partial coefficient - safety class	2.27	Partial coefficient - control class	1.50
Max. negative pressure in pipe (kPa)	Compression class Normal > 95% SP		
Installation type	Normal trench and normal up to high compaction	Installation factor %	1.0 %
Bedding/bedding layer	Normal levelling layer	Bedding factor %	2.00 %
Traffic load	Heavy traffic load	Max. negative pressure in pipe (kPa)	0.00
Soil cover above pipe top (m) = H	1.50	Distance from ground level to ground-water level (m) = Hw	0.50
Relative density - below ground-water level (kN/m³)	10.00	Relative density - above ground-water level (kN/m³)	20.00
Calculated diameter of pipe (mm)	63.00	Pipe ring stiffness	16.00

Load combination 1.1 Deformation calculation serviceability limit state

Average stress from traffic load (q_{tm}) kN/m²	30.29	Short-term deformation from variable load (traffic)	0.6 %
Load factor C regarding the stiffness ratio of pipe to backfilling material (applied)	1.01	Short-term deformation from permanent load (soil)	0.6 %
Characteristic traffic load q_{tk} kN/m² (Formula 9)	30.69	Deformation from installation (Table 2.9)	1.0 %
Additional soil cover for	1.55	Average deformation	2.2 %

determination of soil modulus E_{td}
when influenced by heavy road
traffic load (Table 2.8)

delta H factor dependent on type of road traffic load	1.0	Short-term maximum deformation (Page 42)	<u>4.2 %</u>
Tangent modulus of backfill above ground-water E_{td} (Formula 11) - kN/m^2	4552	Long-term deformation from load (formula 16)	1.8 %
Secant modulus of backfill above ground-water E_{sd} (Formula 12) - kN/m^2	2959	Long-term max. deformation (Formula 15)	5.4 %
Reduction factor for ground-water influence on soil E-moduli (formula 13)	0.73		
Tangent modulus of backfill below ground-water E_{td} (Formula 11 x Formula 13) - kN/m^2	3338		
Secant modulus of backfill below ground-water E_{sd} (Formula 12 x Formula 13) - kN/m^2	2170		

Short-term maximum deformation (Page 42) 4.2 % < 9.0 % (Pipematerial: PE100) - OK

Load deformation 2.1 Deformation calculation ultimate limit state

Calculated ring stiffness (kN/m^2)	13.33	Calculated max. buckling pressure (kN/m^2)	791.81
Calculated tangent modulus (kN/m^2)	1473.00	Design load (kN/m^2)	70.22
Reduction factor beta	0.84	Design buckling pressure (kN/m^2)	663.90

Buckling load combination 2.1 - q_d (Formula 20) kN/m^2 70.22 < Buckling load combination 2.1 - $\beta x q_b$ (Formula 22) 663.90 - OK

Při dodržení zadávacích podmínek potrubí RC Protect PE 100 RC, PN 10, SN 16, De 63 vyhoví a jeho deformace nepřesáhne hodnotu 4,2 %. Tato deformace je počítána při prázdném potrubí bez vnitřního přetlaku.

Zadávací podmínky

Použité potrubí: RC Protect PE 100 RC, PN 10, SN 16, De 63

Krytí nad vrcholem potrubí: 0,8 m

Zatížení provozem: D 400

Hladina spodní vody: 0,5 m pod povrchem

Obsypový materiál: lomová prosívka 0-8 mm

Stupeň zhutnění obsypu: 95% PS

Result

Calculation OK

Given values

Pipe type	PE 100 RC	Pipe dimension (mm)	63
Soil type	Sand	Please note: the chosen pipe diameter is below 110 mm, but has been set at 110 mm for calculation purpose	
Safety class	Normal	Control class	Normal
Partial coefficient - safety class	2.27	Partial coefficient - control class	1.50
Max. negative pressure in pipe (kPa)	Compression class Normal > 95% SP		
Installation type	Normal trench and normal up to high compaction	Installation factor %	1.0 %
Bedding/bedding layer	Normal levelling layer	Bedding factor %	2.00 %
Traffic load	Heavy traffic load	Max. negative pressure in pipe (kPa)	0.00
Soil cover above pipe top (m) = H	0.80	Distance from ground level to ground-water level (m) = H_w	0.50
Relative density - below ground-water level (kN/m³)	10.00	Relative density - above ground-water level (kN/m³)	20.00
Calculated diameter of pipe (mm)	63.00	Pipe ring stiffness	16.00

Load combination 1.1 Deformation calculation serviceability limit state

Average stress from traffic load (q_{tm}) kN/m²	63.19	Short-term deformation from variable load (traffic)	1.4 %
Load factor C regarding the stiffness ratio of pipe to backfilling material (applied)	1.13	Short-term deformation from permanent load (soil)	0.4 %
Characteristic traffic load q_{tk} kN/m² (Formula 9)	71.20	Deformation from installation (Table 2.9)	1.0 %
Additional soil cover for	3.00	Average deformation	2.8 %

determination of soil modulus E_{td}
when influenced by heavy road
traffic load (Table 2.8)

delta H factor dependent on type of road traffic load	1.0	Short-term maximum deformation (Page 42)	<u>4.8 %</u>
Tangent modulus of backfill above ground-water E_{td} (Formula 11) - kN/m^2	5376	Long-term deformation from load (formula 16)	2.6 %
Secant modulus of backfill above ground-water E_{sd} (Formula 12) - kN/m^2	3495	Long-term max. deformation (Formula 15)	6.5 %
Reduction factor for ground-water influence on soil E-moduli (formula 13)	0.85		
Tangent modulus of backfill below ground-water E_{td} (Formula 11 x Formula 13) - kN/m^2	4570		
Secant modulus of backfill below ground-water E_{sd} (Formula 12 x Formula 13) - kN/m^2	2971		

Short-term maximum deformation (Page 42) 4.8 % < 9.0 % (Pipematerial: PE100) - OK

Load deformation 2.1 Deformation calculation ultimate limit state

Calculated ring stiffness (kN/m^2)	13.33	Calculated max. buckling pressure (kN/m^2)	926.50
Calculated tangent modulus (kN/m^2)	2016.77	Design load (kN/m^2)	108.87
Reduction factor beta	0.80	Design buckling pressure (kN/m^2)	745.36

Buckling load combination 2.1 - q_d (Formula 20) kN/m^2 108.87 < Buckling load combination 2.1 - $\beta x q_b$ (Formula 22) 745.36 - OK

Při dodržení zadávacích podmínek potrubí RC Protect PE 100 RC, PN 10, SN 16, De 63 vyhoví a jeho deformace nepřesáhne hodnotu 4,8%. Tato deformace je počítána při prázdném potrubí bez vnitřního přetlaku.