

Příloha k TZ

STANOVENÍ ZATÍŽITELNOSTI MOSTU

I. Technická zpráva

I.1 Úvod

Náplní této kapitoly je stanovení zatížitelnosti Mostu přes Želetavku ev.č. 41017-5. Hodnota dosavadní zatížitelnosti mostu uvedená v pasportu Silniční databanky Ostrava (SDO) je $V_n=17t$, $V_r=20t$ $V_e=36t$ podle výpočtu V-CZEN (Zatížitelnost stanovená podrobným statickým výpočtem z roku 2002).

I.2 Technická část

I.2.1 Popis mostní konstrukce, jejího stavu, závad a poruch

viz část D.1.2.1 Technická zpráva

I.2.2 Použité materiály

Pevnosti betonů jsou známy z diagnostického průzkumu z roku 2009 [8].

Nosná konstrukce – železový beton

- *betony (ČSN EN 206-1)*

| | |
|---------------|---------|
| oblouky | C 20/25 |
| závěsy | C 20/25 |
| ostatní prvky | C 12/15 |

- *výztuž*

| | |
|-----|---|
| C34 | $f_{yk} = 280 \text{ MPa}$ (dle zkoušky tahem [10]) |
|-----|---|

Spodní stavba

| | |
|-------|---------------------|
| Opěry | prostý beton C12/15 |
|-------|---------------------|

I.3 Použité podklady

Dokumentace mostního objektu

- Zaměření stávajícího stavu mostu (Transconsult, s.r.o.Hradec Králové 03/2019)

Normy

- [1] ČSN 73 6222 Zatížitelnost mostů pozemních komunikací (04/2009)
- [2] ČSN ISO 13822 Zásady navrhování konstrukcí-Hodnocení existujících konstrukcí (08/2005)
- [3] ČSN 73 6221 Prohlídky mostů pozemních komunikací (03/2011)
- [4] ČSN EN 1990 Eurokód: Zásady navrhování konstrukcí (02/2011)
- [5] ČSN EN 1991: Eurokód 1-Zatížení konstrukcí
- [6] ČSN EN 1992-1-1 Eurokód 2: Navrhování betonových konstrukcí-Část 1-1: Obecná pravidla a pravidla pro pozemní stavby (07/2011)
- [7] ČSN EN 1992-2 Eurokód 2: Navrhování betonových konstrukcí-Část 2: Betonové mosty

Diagnostické průzkumy mostu

- [8] Diagnostický průzkum – Pontex s.r.o. 10/2009
- [9] Doplnkový diagnostický průzkum – Mostní vývoj, s.r.o, DIAGNOSTIKA 10/2017
- [10] Diagnostický průzkum – Transconsult 04/2019
- [11] Trhací zkoušky betonářské výztuže – Dekra 3/2019

Ostatní podklady

- [12] TP 200 - STANOVENÍ ZATÍŽITELNOSTI MOSTŮ PK navržených podle norem a předpisů platných před účinností EN - Technické podmínky (Ministerstvo dopravy 12/2008)

1.4 Výpočet

1.4.1 Postup výpočtu

Stanovení zatížitelnosti je provedeno dle ČSN 73 6222 [1]. Jedná se o „*odborné statické zhodnocení*“ (čl.11.4), které vychází z diagnostik mostu (2009, 2017) doplněných o trhací zkoušky výztuže mostu (2019) .Zatížitelnost mostu je stanovena *podrobným statickým výpočtem* (čl. 6.4) dle platných ČSN EN pro zatížení a navrhování mostů, resp. ověřování existujících konstrukcí.

Výpočet zatížitelnosti mostu je proveden na základě posouzení únosnosti rozhodujících prvků mostní konstrukce v jejich rozhodujících průřezích. Posouzeny jsou rozhodující průřezy rozhodujících prvků oblouku, doplnkově příčníky a deska mostovky.

U průřezů prvků oblouku a desky mostovky, kde byl způsob vyztužení ověřen, je zatížitelnost stanovena přímo s uvažováním reálného množství a kvality výztuže a vlastností betonu.

Poznámka: Při výpočtu bylo zohledněno prostorové spolupůsobení nosné konstrukce s přihlédnutím k současnému stavu. Zjištěné skutečnosti byly zohledněny při posouzení konstrukce.

1.4.2 Zatížení

Pro stanovení zatížitelnosti jsou zatížení stálá (jejich umístění a velikosti) stanovena na základě prohlídky mostu. Hodnoty stálých a nedopravních zatížení jsou uvažovány dle [2] a [5]. Užité zatížení (zatěžovací schémata pro jednotlivé zatížitelnosti) jsou stanovena dle [1].

1.4.3 Geometrické parametry

Jsou užity skutečné rozměry mostní konstrukce, zjištěné při prohlídce mostu.

1.4.4 Výpočetní model

Pro výpočet nosné konstrukce byl sestaven prostorový model z dvourozměrných a jednorozměrných (příčníky) konečných prvků, zohledňující skutečné rozměry a prostorové působení šikmé nosné konstrukce.

Pozn.: Výpočet byl proveden za předpokladu lineární závislosti napětí na přetvoření v hlavních částech průřezu. Dále byl použit výpočetní program pro návrh a posouzení železobetonových průřezů.

1.4.5 Materiálové charakteristiky

pro výpočet dle [6] ČSN EN1992-1-1 Eurokód 2: Navrhování betonových konstrukcí
dílčí součinitel betonu $\gamma_c = 1,5$

dílčí součinitel výztuže γ_s — 1,15

Beton - C 12/15

návrhová pevnost v tlaku..... f_{cd} = 8,0 MPa

návrhová pevnost v tahu..... f_{ctd} = 0,73 MPa

Beton - C 20/25

návrhová pevnost v tlaku..... f_{cd} = 13,33 MPa

návrhová pevnost v tahu..... f_{ctd} = 1,00 MPa

Beton-C 30/37

návrhová pevnost v tlaku..... f_{cd} = 20,00 MPa

návrhová pevnost v tahu..... f_{ctd} = 1,33 MPa

Výztuž

návrhová pevnost v tahu na základě výsledků zkoušek

návrhová pevnost v tahu do ϕ 16 mm..... f_{yd} = 243,5 MPa

Pozn.: návrhové pevnosti výztužné oceli dle zkoušením výztuže tahem. Zjištění pevností betonu dle diagnostického průzkumu [8] [9]

Závěr

Výpočtem byla určena zatížitelnost klenbového mostu Mostu přes Želetavku ev.č. 41017-5. Přepočet neřeší zatížitelnost spodní stavby.

Normální zatížitelnost určená statickým výpočtem je 28 t a výhradní zatížitelnost 55 t.

v Hradci Králové
listopad 2019

Luboš Velehradský

Protokol o zkoušce tahem

Protokoll von Zugversuch

Report of Tensile Test

Zákazník Kunde Client

Číslo vzorku Prüfstück-Nr. Tested piece No.

TRANSCONSULT s.r.o. Nerudova 37, Hradec Králové 500 02
1-3

Popis vzorku Prüfstückbeschreibung Description of tested piece

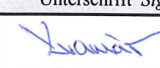
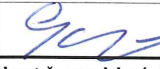
Betonářská výztuž |

Zkouška tahem Zugversuch Tensile test

 podle nach acc. to QT - 810 - 001 (ČSN EN ISO 6892-1^F)

| Vzorek Probe Tested piece | Vzorek Probe Tested piece | | | | Zatížení Behtung Load | | Mez kluzu Streckgrenze Yield point $R_{eH}, R_{p0,2}$ [MPa] | Pevnost Zugfestigkeit Tensile strength R_m [MPa] | Délka Länge Length | | Tažnost Bruchdehnung Elongation A [%] | Kontrakce Kontraktion Contraction Z [%] | Místo lomu Lage des Bruches Location of rupture *** | |
|---|--|-------------------------------|-------------------------------|--------|--|--|---|--|---|---|--|--|--|---|
| | Tvar Form Form * | Poloha Lage Position ** | Rozměry Maße Dimensions | | Průřez Querschnitt Cross section S_0 [mm ²] | Mez kluzu Streckgr. Yield load F_e [kN] | | | Mez pevn. Zugfestigk. Ultimate load F_m [kN] | Počáteční Anfangs Initial L_0 (D ₀) [mm] | | | | Po přetržení nach Bruch Past fracture L_u (D _u) [mm] |
| | | | a [mm] Ø [mm] | b (mm) | | | | | | | | | | |
| vzorek 1 | R | - | 5,0 | - | 19,63 | 5,56 | 7,69 | 283 | 391 | 25 | 35,1 | 40,5 | - | - |
| vzorek 2 | R | - | 5,0 | - | 19,63 | 5,66 | 7,49 | 288 | 381 | 25 | 36,1 | 44,5 | - | - |
| vzorek 3 | R | - | 5,0 | - | 19,63 | 5,64 | 7,81 | 287 | 398 | 25 | 35,0 | 40,0 | - | - |
| Nejistota měření Meßungsicherheit Uncertainty of measure ***** | | | | | | | | ±2,2 | ±1,6 | - | ±0,52 | - | - | - |
| Zkoušky byly provedeny v rozsahu teplot stanovených normou Die Proben waren in Temperaturbereich festgesetzten mit der Norm durchgeführt The tests were carried out in a temperature range specified by the standard | | | | | | | | | | | | | | |
| V rámci aktualizace norem v návaznosti na normu: Im Rahmen der Normaktualisierung ersetzt durch die Norm: In acc. with rules of the standard up-date in relation to standard: | | | | | | | | | | | | | | |
| F) | - | | | | | | | | | | | | | |
| * | F = Plochá tyč Flachzugprobe flat specimen R = válcová tyč Rundzugprobe round specimen | | | | | | | | | | | | | |
| S | Segmentová tyč Bogenstückprobe segment specimen T = Trubka Röhre tube | | | | | | | | | | | | | |
| ** | l = podélná längs longitudinal q = příčná quer transverse t = tangenciální tangential tangential | | | | | | | | | | | | | |
| *** | SK = svarový kov Schweißgut deposited metal ZM = základní materiál Grundwerkstoff parent base | | | | | | | | | | | | | |
| TOZ | tepelně ovlivněná zóna Warmeeinflusszone heat affected zone | | | | | | | | | | | | | |
| ***** | Uvedená nejistota je rozšíř. nejistotou na základě směrodatné odchylky násobené koeficientem k=2, který zaručuje interval spolehlivosti přibližně 95% Die angeführte Unsicherheit ist eine erweiterte Unsicherheit auf Grund der mit dem Koeffizient k=2 multiplizierten mittleren Abweichung, wobei dieser Koeffizient ein Intervall der Zuverlässigkeit von ungefähr 95% garantiert Present uncertainty is extended uncertainty based on the authoritative abnormality multiplied by coefficient k=2 which warrants a confidence interval of approximately 95% | | | | | | | | | | | | | |
| Příprava vzorku Vorbereitung der Probe Preparation of tested piece: provozovna Pardubice | | | | | | | | | | | | | | |
| Zkušební zařízení Prüfmaschine Test machine: ZD 40 | | | | | | | | | | | | | | |
| Odchylky od zkušební postupu Abweichungen aus der Prüfverfahren Deviation from testing procedure: ----- | | | | | | | | | | | | | | |



| Poznámka Bemerkung Note | | Dne Datum Date | Jméno Name Name Funkce Funktion Duty | Podpis Unterschrift Signature |
|-----------------------------|-----------------|--|---|---|
| Zkoušející Prüfer Examiner | | 01.04.2019 | Petr Kramář prac. mech. zkušební |  |
| Schválil Bewillige Approved | | 01.04.2019 | Vojtěch Slavík prac. mech. zkušební |  |
| Strana Seite Page | z aus of 1 1 | Výsledky zkoušek se vztahují pouze k uvedenému vzorku Prüfergebnisse nur für angeführte Probe gelten The results of tests are valid for mentioned tested piece only Tento protokol nesmí být bez písemného souhlasu zkušební laboratoře reprodukován jinak než celý Dieser Protokoll kann in unvollständiger Form nur mit schriftlicher Zustimmung des Prüflabor reproduziert werden This report can be reproduced in incomplete form only with written consent of testing laboratory | | |

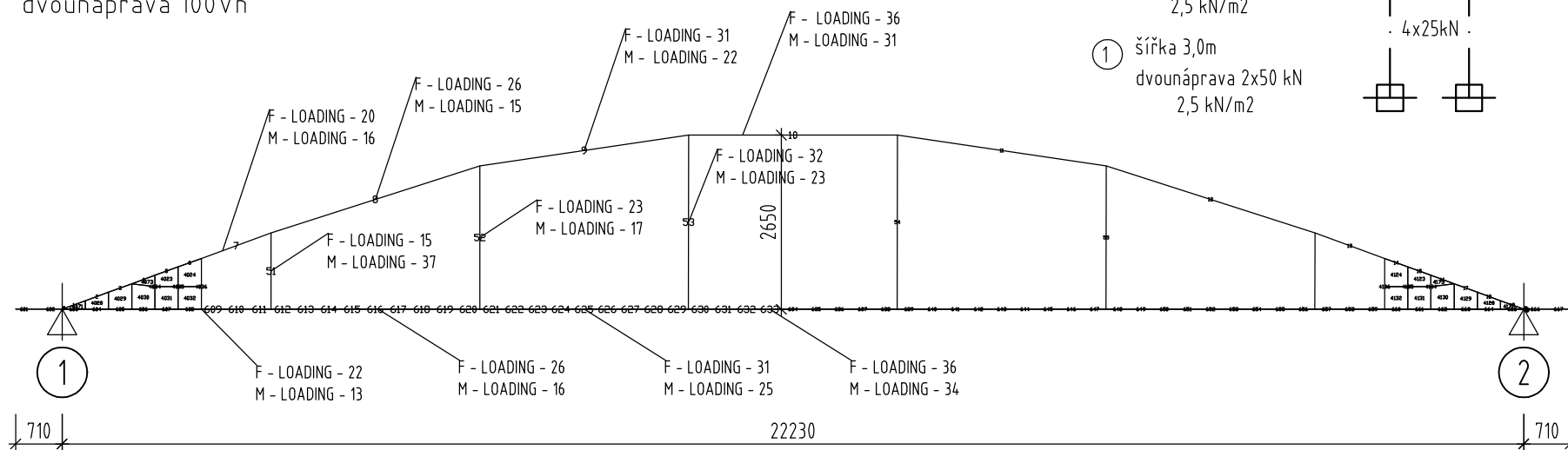
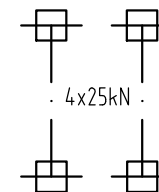
Zatežovací stavy

NORMÁLNÍ ZATÍŽITELNOST
dvounáprava 100Vn

ZATĚŽOVACÍ PRUHY

② šířka 3,0m
dvounáprava 2x50 kN
2,5 kN/m²

① šířka 3,0m
dvounáprava 2x50 kN
2,5 kN/m²



\$ ***** Zatezovací soustavy pro výpočet zatížitelnosti *****

SET 402 ELEM == GRID FROM 2003 TO 2016 BY 1 TO 3191 BY 18

LOADING 11 'rovnomerne zatizeni vozovky (2,5 vn)'

ELEM LOADS

402 SET SURFACE FORCE GLOBAL UNIFORM PZ -2.5

LOADING 13 '13'

ELEM LOADS

| | | | | | |
|-------|-------|-------|-------|---------------------------------|----------|
| 22213 | 22214 | 22231 | 22232 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22159 | 22160 | 22177 | 22178 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22208 | 22209 | 22226 | 22227 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22154 | 22155 | 22172 | 22173 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22206 | 22207 | 22224 | 22225 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22152 | 22153 | 22170 | 22171 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22201 | 22202 | 22219 | 22220 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22147 | 22148 | 22165 | 22166 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |

LOADING 15 '15'

ELEM LOADS

| | | | | | |
|-------|-------|-------|-------|---------------------------------|----------|
| 22249 | 22250 | 22267 | 22268 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22195 | 22196 | 22213 | 22214 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22244 | 22245 | 22262 | 22263 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22190 | 22191 | 22208 | 22209 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22242 | 22243 | 22260 | 22261 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22188 | 22189 | 22206 | 22207 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22237 | 22238 | 22255 | 22256 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22183 | 22184 | 22201 | 22202 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |

LOADING 16 '16'

ELEM LOADS

| | | | | | |
|-------|-------|-------|-------|---------------------------------|----------|
| 22267 | 22268 | 22285 | 22286 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22213 | 22214 | 22231 | 22232 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22262 | 22263 | 22280 | 22281 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22208 | 22209 | 22226 | 22227 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22260 | 22261 | 22278 | 22279 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22206 | 22207 | 22224 | 22225 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22255 | 22256 | 22273 | 22274 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22201 | 22202 | 22219 | 22220 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |

LOADING 17 '17'

ELEM LOADS

| | | | | | |
|-------|-------|-------|-------|---------------------------------|----------|
| 22285 | 22286 | 22303 | 22304 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22231 | 22232 | 22249 | 22250 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22280 | 22281 | 22298 | 22299 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22226 | 22227 | 22244 | 22245 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22278 | 22279 | 22296 | 22297 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22224 | 22225 | 22242 | 22243 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22273 | 22274 | 22291 | 22292 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22219 | 22220 | 22237 | 22238 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |

LOADING 20 '20'

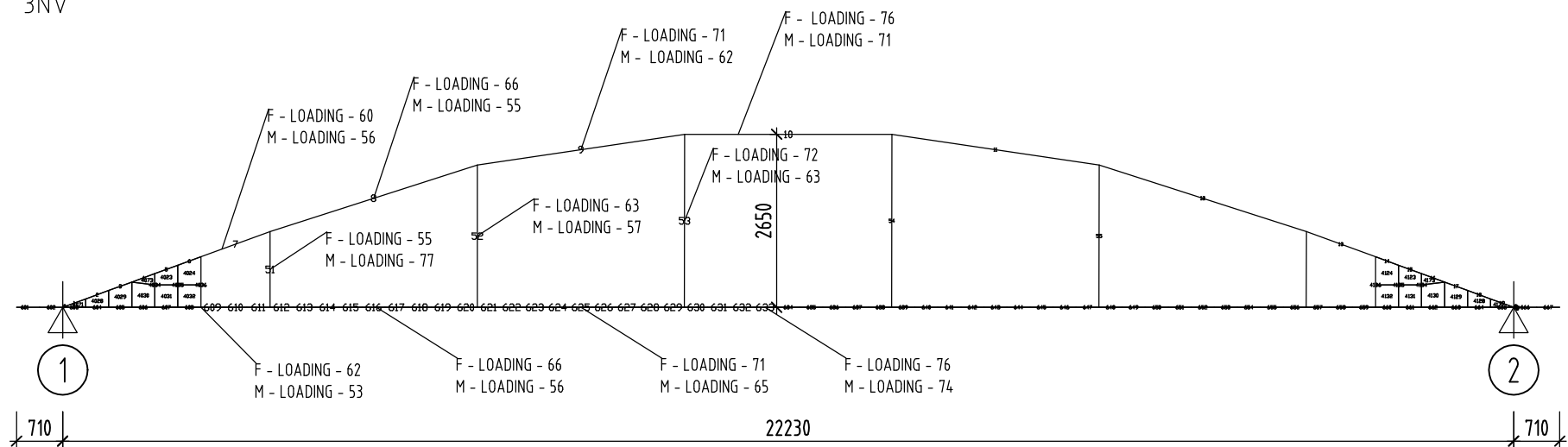
ELEM LOADS

| | | | | | |
|-------|-------|-------|-------|---------------------------------|----------|
| 22339 | 22340 | 22357 | 22358 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22285 | 22286 | 22303 | 22304 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22334 | 22335 | 22352 | 22353 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22280 | 22281 | 22298 | 22299 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22332 | 22333 | 22350 | 22351 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22278 | 22279 | 22296 | 22297 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22327 | 22328 | 22345 | 22346 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22273 | 22274 | 22291 | 22292 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |

| | | | | | | | | | |
|---------|-------|-------|-------|---------|-------|--------|---------|----|----------|
| LOADING | 22 | '22' | | | | | | | |
| ELEM | LOADS | | | | | | | | |
| 22375 | 22376 | 22393 | 22394 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22321 | 22322 | 22339 | 22340 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22370 | 22371 | 22388 | 22389 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22316 | 22317 | 22334 | 22335 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22368 | 22369 | 22386 | 22387 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22314 | 22315 | 22332 | 22333 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22363 | 22364 | 22381 | 22382 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22309 | 22310 | 22327 | 22328 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| LOADING | 23 | '23' | | | | | | | |
| ELEM | LOADS | | | | | | | | |
| 22393 | 22394 | 22411 | 22412 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22339 | 22340 | 22357 | 22358 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22388 | 22389 | 22406 | 22407 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22334 | 22335 | 22352 | 22353 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22386 | 22387 | 22404 | 22405 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22332 | 22333 | 22350 | 22351 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22381 | 22382 | 22399 | 22400 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22327 | 22328 | 22345 | 22346 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| LOADING | 25 | '25' | | | | | | | |
| ELEM | LOADS | | | | | | | | |
| 22429 | 22430 | 22447 | 22448 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22375 | 22376 | 22393 | 22394 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22427 | 22428 | 22445 | 22446 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22373 | 22374 | 22391 | 22392 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22425 | 22426 | 22443 | 22444 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22371 | 22372 | 22389 | 22390 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22420 | 22421 | 22438 | 22439 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22366 | 22367 | 22384 | 22385 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| LOADING | 26 | '26' | | | | | | | |
| ELEM | LOADS | | | | | | | | |
| 22447 | 22448 | 22465 | 22466 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22393 | 22394 | 22411 | 22412 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22442 | 22443 | 22460 | 22461 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22388 | 22389 | 22406 | 22407 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22440 | 22441 | 22458 | 22459 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22386 | 22387 | 22404 | 22405 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22435 | 22436 | 22453 | 22454 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22381 | 22382 | 22399 | 22400 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| LOADING | 31 | '31' | | | | | | | |
| ELEM | LOADS | | | | | | | | |
| 22537 | 22538 | 22555 | 22556 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22483 | 22484 | 22501 | 22502 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22532 | 22533 | 22550 | 22551 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22478 | 22479 | 22496 | 22497 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22530 | 22531 | 22548 | 22549 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22476 | 22477 | 22494 | 22495 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22525 | 22526 | 22543 | 22544 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22471 | 22472 | 22489 | 22490 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| LOADING | 32 | '32' | | | | | | | |
| ELEM | LOADS | | | | | | | | |
| 22555 | 22556 | 22573 | 22574 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22501 | 22502 | 22519 | 22520 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -48.1942 |
| 22550 | 22551 | 22568 | 22569 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |
| 22496 | 22497 | 22514 | 22515 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -43.3748 |

| | | | | | |
|-----------------|-------|-------|-------|---------------------------------|----------|
| 22548 | 22549 | 22566 | 22567 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22494 | 22495 | 22512 | 22513 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22543 | 22544 | 22561 | 22562 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22489 | 22490 | 22507 | 22508 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| LOADING 34 '34' | | | | | |
| ELEM LOADS | | | | | |
| 22591 | 22592 | 22609 | 22610 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22537 | 22538 | 22555 | 22556 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22586 | 22587 | 22604 | 22605 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22532 | 22533 | 22550 | 22551 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22584 | 22585 | 22602 | 22603 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22530 | 22531 | 22548 | 22549 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22579 | 22580 | 22597 | 22598 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22525 | 22526 | 22543 | 22544 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| LOADING 36 '36' | | | | | |
| ELEM LOADS | | | | | |
| 22627 | 22628 | 22645 | 22646 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22573 | 22574 | 22591 | 22592 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22622 | 22623 | 22640 | 22641 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22568 | 22569 | 22586 | 22587 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22620 | 22621 | 22638 | 22639 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22566 | 22567 | 22584 | 22585 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22615 | 22616 | 22633 | 22634 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22561 | 22562 | 22579 | 22580 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| LOADING 37 '37' | | | | | |
| ELEM LOADS | | | | | |
| 22645 | 22646 | 22663 | 22664 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22591 | 22592 | 22609 | 22610 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22640 | 22641 | 22658 | 22659 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22586 | 22587 | 22604 | 22605 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22638 | 22639 | 22656 | 22657 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22584 | 22585 | 22602 | 22603 | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22633 | 22634 | 22651 | 22652 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |
| 22579 | 22580 | 22597 | 22598 | SURFACE FORCE GLOBAL UNIFORM PZ | -48.1942 |

VÝHRADNÍ ZATÍŽITELNOST 3NV



| | | |
|---------|-----------|-----------|
| | | |
| $V_r/8$ | $3/16V_r$ | $3/16V_r$ |
| | | |
| $V_r/8$ | $3/16V_r$ | $3/16V_r$ |

\$ ***** Zatezovací soustavy pro vypocet výhradní zatizitelnosti *****

LOADING 53 '53'
ELEM LOADS
22213 22214 22231 22232 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22159 22160 22177 22178 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22033 22051 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748
22208 22209 22226 22227 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22154 22155 22172 22173 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22028 22046 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748

LOADING 55 '55'
ELEM LOADS
22249 22250 22267 22268 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22195 22196 22213 22214 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22069 22087 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748
22244 22245 22262 22263 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22190 22191 22208 22209 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22064 22082 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748

LOADING 56 '56'
ELEM LOADS
22267 22268 22285 22286 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22213 22214 22231 22232 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22087 22105 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748
22262 22263 22280 22281 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22208 22209 22226 22227 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22082 22100 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748

LOADING 57 '57'
ELEM LOADS
22285 22286 22303 22304 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22231 22232 22249 22250 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22105 22123 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748
22280 22281 22298 22299 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22226 22227 22244 22245 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22100 22118 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748

LOADING 60 '60'
ELEM LOADS
22339 22340 22357 22358 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22285 22286 22303 22304 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22159 22177 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748
22334 22335 22352 22353 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22280 22281 22298 22299 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22154 22172 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748

LOADING 62 '62'
ELEM LOADS
22375 22376 22393 22394 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22321 22322 22339 22340 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22195 22213 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748
22370 22371 22388 22389 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22316 22317 22334 22335 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22190 22208 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748

LOADING 63 '63'
ELEM LOADS
22393 22394 22411 22412 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22339 22340 22357 22358 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22213 22231 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748
22388 22389 22406 22407 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22334 22335 22352 22353 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22208 22226 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748

LOADING 65 '65'
ELEM LOADS
22429 22430 22447 22448 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22375 22376 22393 22394 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22249 22267 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748
22424 22425 22442 22443 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22370 22371 22388 22389 SURFACE FORCE GLOBAL UNIFORM PZ -32.5311
22244 22262 SURFACE FORCE GLOBAL UNIFORM PZ -43.3748

LOADING 66 '66'
ELEM LOADS
22447 22448 22465 22466 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456
22393 22394 22411 22412 SURFACE FORCE GLOBAL UNIFORM PZ -36.1456

| | | | | | |
|-------|-------|-------|-------|---------------------------------|----------|
| 22267 | 22285 | | | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22442 | 22443 | 22460 | 22461 | SURFACE FORCE GLOBAL UNIFORM PZ | -32.5311 |
| 22388 | 22389 | 22406 | 22407 | SURFACE FORCE GLOBAL UNIFORM PZ | -32.5311 |
| 22262 | 22280 | | | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |

LOADING 71 '71'

| ELEM | LOADS | | | | |
|-------|-------|-------|-------|---------------------------------|----------|
| 22537 | 22538 | 22555 | 22556 | SURFACE FORCE GLOBAL UNIFORM PZ | -36.1456 |
| 22483 | 22484 | 22501 | 22502 | SURFACE FORCE GLOBAL UNIFORM PZ | -36.1456 |
| 22357 | 22375 | | | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22532 | 22533 | 22550 | 22551 | SURFACE FORCE GLOBAL UNIFORM PZ | -32.5311 |
| 22478 | 22479 | 22496 | 22497 | SURFACE FORCE GLOBAL UNIFORM PZ | -32.5311 |
| 22352 | 22370 | | | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |

LOADING 72 '72'

| ELEM | LOADS | | | | |
|-------|-------|-------|-------|---------------------------------|----------|
| 22555 | 22556 | 22573 | 22574 | SURFACE FORCE GLOBAL UNIFORM PZ | -36.1456 |
| 22501 | 22502 | 22519 | 22520 | SURFACE FORCE GLOBAL UNIFORM PZ | -36.1456 |
| 22375 | 22393 | | | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22550 | 22551 | 22568 | 22569 | SURFACE FORCE GLOBAL UNIFORM PZ | -32.5311 |
| 22496 | 22497 | 22514 | 22515 | SURFACE FORCE GLOBAL UNIFORM PZ | -32.5311 |
| 22370 | 22388 | | | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |

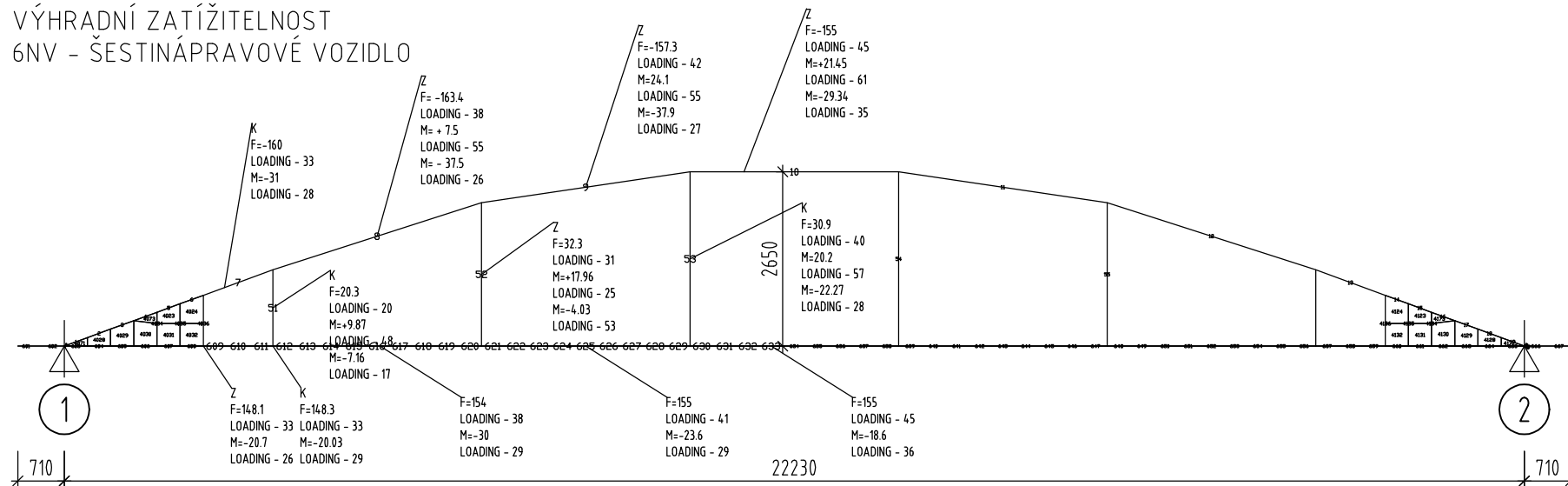
LOADING 74 '74'

| ELEM | LOADS | | | | |
|-------|-------|-------|-------|---------------------------------|----------|
| 22591 | 22592 | 22609 | 22610 | SURFACE FORCE GLOBAL UNIFORM PZ | -36.1456 |
| 22537 | 22538 | 22555 | 22556 | SURFACE FORCE GLOBAL UNIFORM PZ | -36.1456 |
| 22411 | 22429 | | | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22586 | 22587 | 22604 | 22605 | SURFACE FORCE GLOBAL UNIFORM PZ | -32.5311 |
| 22532 | 22533 | 22550 | 22551 | SURFACE FORCE GLOBAL UNIFORM PZ | -32.5311 |
| 22406 | 22424 | | | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |

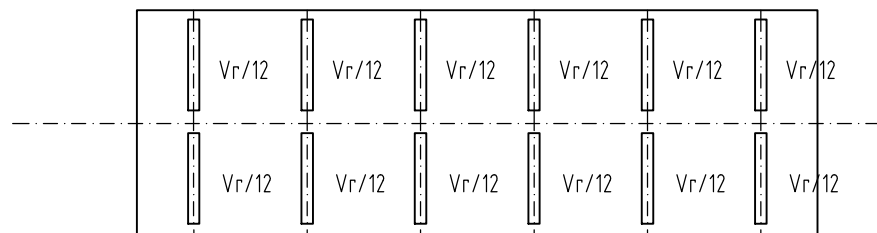
LOADING 76 '76'

| ELEM | LOADS | | | | |
|-------|-------|-------|-------|---------------------------------|----------|
| 22627 | 22628 | 22645 | 22646 | SURFACE FORCE GLOBAL UNIFORM PZ | -36.1456 |
| 22573 | 22574 | 22591 | 22592 | SURFACE FORCE GLOBAL UNIFORM PZ | -36.1456 |
| 22447 | 22465 | | | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |
| 22622 | 22623 | 22640 | 22641 | SURFACE FORCE GLOBAL UNIFORM PZ | -32.5311 |
| 22568 | 22569 | 22586 | 22587 | SURFACE FORCE GLOBAL UNIFORM PZ | -32.5311 |
| 22442 | 22460 | | | SURFACE FORCE GLOBAL UNIFORM PZ | -43.3748 |

VÝHRADNÍ ZATÍŽITELNOST 6NV - ŠESTINÁPRAVOVÉ VOZIDLO



6NV - ŠESTINÁPRAVOVÉ VOZIDLO



\$ *****
\$ ***** ZATEZOVACI STAVY *****
\$ *****

\$ Zatezovací soustavy pro vypocet výhradní zatizitelnosti 6NV*

LOADING 17 '17'

ELEM LOADS

| | | | | | | | | | | | |
|-------|----|-------|-------|----|-------|---------|-------|--------|---------|----|---------|
| 22280 | TO | 22286 | 22298 | TO | 22304 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22208 | TO | 22214 | 22226 | TO | 22232 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22136 | TO | 22142 | 22154 | TO | 22160 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22064 | TO | 22070 | 22082 | TO | 22088 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |

LOADING 20 '20'

ELEM LOADS

| | | | | | | | | | | | |
|-------|----|-------|-------|----|-------|---------|-------|--------|---------|----|---------|
| 22334 | TO | 22340 | 22352 | TO | 22358 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22262 | TO | 22268 | 22280 | TO | 22286 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22190 | TO | 22196 | 22208 | TO | 22214 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22118 | TO | 22124 | 22136 | TO | 22142 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |

LOADING 25 '25'

ELEM LOADS

| | | | | | | | | | | | |
|-------|----|-------|-------|----|-------|---------|-------|--------|---------|----|---------|
| 22424 | TO | 22430 | 22442 | TO | 22448 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22352 | TO | 22358 | 22370 | TO | 22376 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22280 | TO | 22286 | 22298 | TO | 22304 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22208 | TO | 22214 | 22226 | TO | 22232 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22118 | TO | 22124 | 22136 | TO | 22142 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |

LOADING 26 '26'

ELEM LOADS

| | | | | | | | | | | | |
|-------|----|-------|-------|----|-------|---------|-------|--------|---------|----|---------|
| 22442 | TO | 22448 | 22460 | TO | 22466 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22370 | TO | 22376 | 22388 | TO | 22394 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22298 | TO | 22304 | 22316 | TO | 22322 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22226 | TO | 22232 | 22244 | TO | 22250 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22136 | TO | 22142 | 22154 | TO | 22160 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22064 | TO | 22070 | 22082 | TO | 22088 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |

LOADING 27 '27'

ELEM LOADS

| | | | | | | | | | | | |
|-------|----|-------|-------|----|-------|---------|-------|--------|---------|----|---------|
| 22460 | TO | 22466 | 22478 | TO | 22484 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22388 | TO | 22394 | 22406 | TO | 22412 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22316 | TO | 22322 | 22334 | TO | 22340 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22244 | TO | 22250 | 22262 | TO | 22268 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22154 | TO | 22160 | 22172 | TO | 22178 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22082 | TO | 22088 | 22100 | TO | 22106 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |

LOADING 28 '28'

ELEM LOADS

| | | | | | | | | | | | |
|-------|----|-------|-------|----|-------|---------|-------|--------|---------|----|---------|
| 22478 | TO | 22484 | 22496 | TO | 22502 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22406 | TO | 22412 | 22424 | TO | 22430 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22334 | TO | 22340 | 22352 | TO | 22358 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22262 | TO | 22268 | 22280 | TO | 22286 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22172 | TO | 22178 | 22190 | TO | 22196 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22100 | TO | 22106 | 22118 | TO | 22124 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |

LOADING 29 '29'

ELEM LOADS

| | | | | | | | | | | | |
|-------|----|-------|-------|----|-------|---------|-------|--------|---------|----|---------|
| 22496 | TO | 22502 | 22514 | TO | 22520 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22424 | TO | 22430 | 22442 | TO | 22448 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22352 | TO | 22358 | 22370 | TO | 22376 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22280 | TO | 22286 | 22298 | TO | 22304 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22190 | TO | 22196 | 22208 | TO | 22214 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22118 | TO | 22124 | 22136 | TO | 22142 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |

LOADING 31 '31'

ELEM LOADS

| | | | | | | | | | | | |
|-------|----|-------|-------|----|-------|---------|-------|--------|---------|----|---------|
| 22532 | TO | 22538 | 22550 | TO | 22556 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22460 | TO | 22466 | 22478 | TO | 22484 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22388 | TO | 22394 | 22406 | TO | 22412 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22316 | TO | 22322 | 22334 | TO | 22340 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22226 | TO | 22232 | 22244 | TO | 22250 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22154 | TO | 22160 | 22172 | TO | 22178 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |

LOADING 33 '33'

ELEM LOADS

| | | | | | | | | | | | |
|-------|----|-------|-------|----|-------|---------|-------|--------|---------|----|---------|
| 22568 | TO | 22574 | 22586 | TO | 22592 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
|-------|----|-------|-------|----|-------|---------|-------|--------|---------|----|---------|

| | | | | | | | | | | | |
|-----------------|----|-------|-------|----|-------|---------|-------|--------|---------|----|---------|
| 22496 | TO | 22502 | 22514 | TO | 22520 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22424 | TO | 22430 | 22442 | TO | 22448 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22352 | TO | 22358 | 22370 | TO | 22376 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22262 | TO | 22268 | 22280 | TO | 22286 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22190 | TO | 22196 | 22208 | TO | 22214 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| LOADING 35 '35' | | | | | | | | | | | |
| ELEM LOADS | | | | | | | | | | | |
| 22604 | TO | 22610 | 22622 | TO | 22628 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22532 | TO | 22538 | 22550 | TO | 22556 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22460 | TO | 22466 | 22478 | TO | 22484 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22388 | TO | 22394 | 22406 | TO | 22412 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22298 | TO | 22304 | 22316 | TO | 22322 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22226 | TO | 22232 | 22244 | TO | 22250 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| LOADING 36 '36' | | | | | | | | | | | |
| ELEM LOADS | | | | | | | | | | | |
| 22622 | TO | 22628 | 22640 | TO | 22646 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22550 | TO | 22556 | 22568 | TO | 22574 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22478 | TO | 22484 | 22496 | TO | 22502 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22406 | TO | 22412 | 22424 | TO | 22430 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22316 | TO | 22322 | 22334 | TO | 22340 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22244 | TO | 22250 | 22262 | TO | 22268 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| LOADING 38 '38' | | | | | | | | | | | |
| ELEM LOADS | | | | | | | | | | | |
| 22658 | TO | 22664 | 22676 | TO | 22682 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22586 | TO | 22592 | 22604 | TO | 22610 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22514 | TO | 22520 | 22532 | TO | 22538 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22442 | TO | 22448 | 22460 | TO | 22466 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22352 | TO | 22358 | 22370 | TO | 22376 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22280 | TO | 22286 | 22298 | TO | 22304 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| LOADING 40 '40' | | | | | | | | | | | |
| ELEM LOADS | | | | | | | | | | | |
| 22694 | TO | 22700 | 22712 | TO | 22718 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22622 | TO | 22628 | 22640 | TO | 22646 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22550 | TO | 22556 | 22568 | TO | 22574 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22478 | TO | 22484 | 22496 | TO | 22502 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22388 | TO | 22394 | 22406 | TO | 22412 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22316 | TO | 22322 | 22334 | TO | 22340 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| LOADING 41 '41' | | | | | | | | | | | |
| ELEM LOADS | | | | | | | | | | | |
| 22712 | TO | 22718 | 22730 | TO | 22736 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22640 | TO | 22646 | 22658 | TO | 22664 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22568 | TO | 22574 | 22586 | TO | 22592 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22496 | TO | 22502 | 22514 | TO | 22520 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22406 | TO | 22412 | 22424 | TO | 22430 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22334 | TO | 22340 | 22352 | TO | 22358 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| LOADING 42 '42' | | | | | | | | | | | |
| ELEM LOADS | | | | | | | | | | | |
| 22730 | TO | 22736 | 22748 | TO | 22754 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22658 | TO | 22664 | 22676 | TO | 22682 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22586 | TO | 22592 | 22604 | TO | 22610 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22514 | TO | 22520 | 22532 | TO | 22538 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22424 | TO | 22430 | 22442 | TO | 22448 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22352 | TO | 22358 | 22370 | TO | 22376 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| LOADING 45 '45' | | | | | | | | | | | |
| ELEM LOADS | | | | | | | | | | | |
| 22784 | TO | 22790 | 22802 | TO | 22808 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22712 | TO | 22718 | 22730 | TO | 22736 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22640 | TO | 22646 | 22658 | TO | 22664 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22568 | TO | 22574 | 22586 | TO | 22592 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22478 | TO | 22484 | 22496 | TO | 22502 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22406 | TO | 22412 | 22424 | TO | 22430 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| LOADING 48 '48' | | | | | | | | | | | |
| ELEM LOADS | | | | | | | | | | | |
| 22838 | TO | 22844 | 22856 | TO | 22862 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22766 | TO | 22772 | 22784 | TO | 22790 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22694 | TO | 22700 | 22712 | TO | 22718 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22622 | TO | 22628 | 22640 | TO | 22646 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22532 | TO | 22538 | 22550 | TO | 22556 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |
| 22460 | TO | 22466 | 22478 | TO | 22484 | SURFACE | FORCE | GLOBAL | UNIFORM | PZ | -8.3790 |

LOADING 53 '53'

| ELEM | LOADS | |
|-------|-------------------------|---|
| 22928 | TO 22934 22946 TO 22952 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22856 | TO 22862 22874 TO 22880 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22784 | TO 22790 22802 TO 22808 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22712 | TO 22718 22730 TO 22736 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22622 | TO 22628 22640 TO 22646 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22550 | TO 22556 22568 TO 22574 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |

LOADING 55 '55'

| ELEM | LOADS | |
|-------|-------------------------|---|
| 22964 | TO 22970 22982 TO 22988 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22892 | TO 22898 22910 TO 22916 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22820 | TO 22826 22838 TO 22844 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22748 | TO 22754 22766 TO 22772 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22658 | TO 22664 22676 TO 22682 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22586 | TO 22592 22604 TO 22610 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |

LOADING 57 '57'

| ELEM | LOADS | |
|-------|-------------------------|---|
| 23000 | TO 23006 23018 TO 23024 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22928 | TO 22934 22946 TO 22952 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22856 | TO 22862 22874 TO 22880 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22784 | TO 22790 22802 TO 22808 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22694 | TO 22700 22712 TO 22718 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22622 | TO 22628 22640 TO 22646 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |

LOADING 61 '61'

| ELEM | LOADS | |
|-------|-------------------------|---|
| 23072 | TO 23078 23090 TO 23096 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 23000 | TO 23006 23018 TO 23024 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22928 | TO 22934 22946 TO 22952 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22856 | TO 22862 22874 TO 22880 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22766 | TO 22772 22784 TO 22790 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |
| 22694 | TO 22700 22712 TO 22718 | SURFACE FORCE GLOBAL UNIFORM PZ -8.3790 |

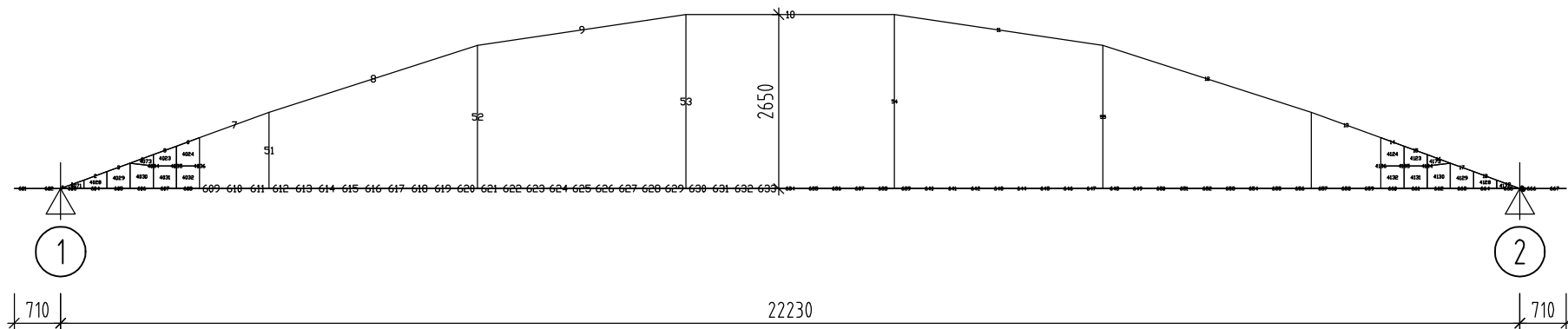
A

B

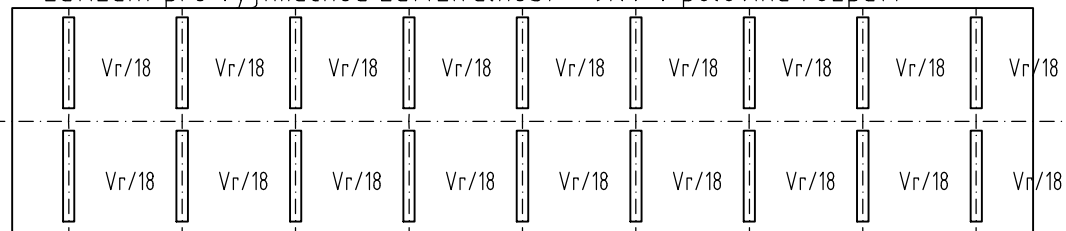
C

D

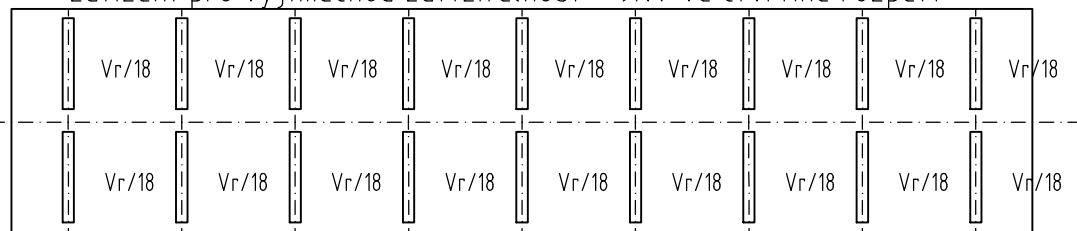
VYJÍMEČNÁ ZATÍŽITELNOST
9NV - DEVÍTÍNÁPRAVOVÉ VOZIDLO



zatížení pro vyjíměčnou zatížitelnost - 9NV v polovině rozpětí



zatížení pro vyjíměčnou zatížitelnost - 9NV ve čtvrtině rozpětí



A

B

C

D

\$ ***** Zatezovací soustavy pro výpočet výjimečné zatížitelnosti *****

SET 405 ELEM == GRID FROM 2330 TO 2337 BY 1 TO 2960 BY 18
SET 406 ELEM == GRID FROM 2006 TO 2013 BY 1 TO 2636 BY 18

LOADING 41 '9NV v polovine'

ELEM LOADS

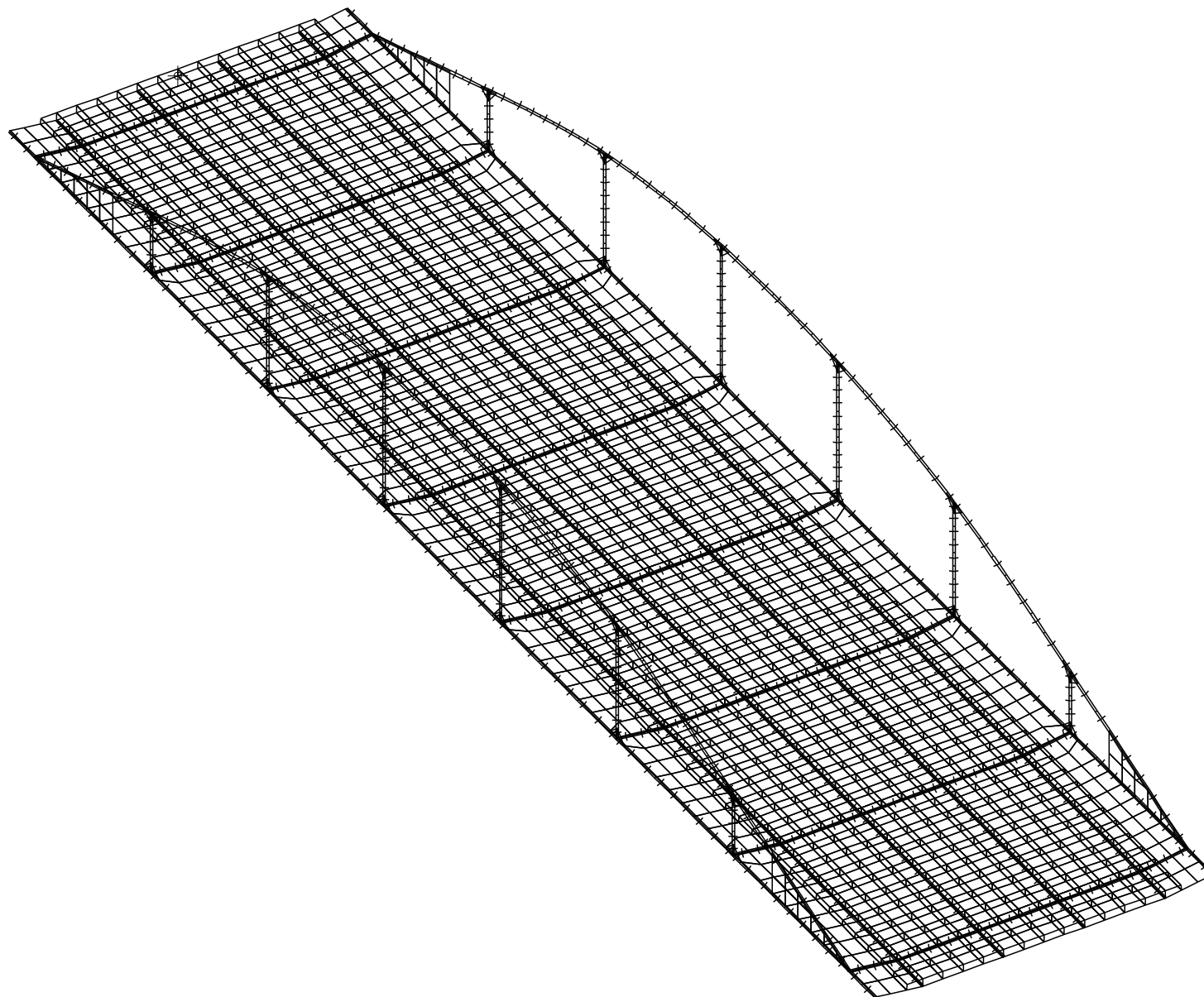
405 SET SURFACE FORCE GLOBAL UNIFORM PZ -2.37169149

LOADING 42 '9NV ve čtvrtine'

ELEM LOADS

406 SET SURFACE FORCE GLOBAL UNIFORM PZ -2.37169149

Výpočetní model



Výpočetní model

SCALE REDUCTION
X 1.000
Y 1.000
Z 1.000
SCALE LENGTH
60.29550

GEOMETRY

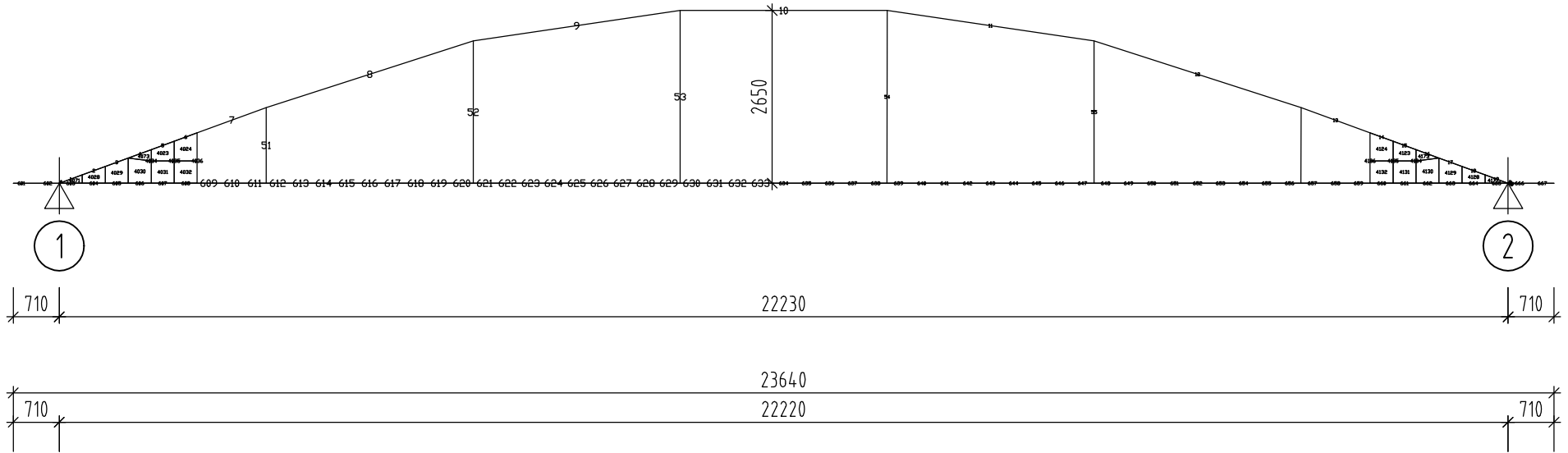
Backovice obl most -
podrobnejsi model

DATE
NOV 28, 1911
TIME
10:17:20

ICES STRUOL
VERSION MAN-MBB

TRANSCONSULT
HRAD. KRALOVE

SCHÉMA MODELU



| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 600 | 601 | 602 | 603 | 604 | 605 | 606 | 607 | 608 | 609 | 610 | 611 | 612 | 613 | 614 | 615 | 616 | 617 | 618 | 619 | 620 | 621 | 622 | 623 | 624 | 625 | 626 | 627 | 628 | 629 | 630 | 631 | 632 | 633 | 634 | 635 | 636 | 637 | 638 | 639 | 640 | 641 | 642 | 643 | 644 | 645 | 646 | 647 | 648 | 649 | 650 | 651 | 652 | 653 | 654 | 655 | 656 | 657 | 658 | 659 | 660 | 661 | 662 | 663 | 664 | 665 | 666 | 667 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 | 2056 | 2057 | 2058 | 2059 | 2060 | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 | 2076 | 2077 | 2078 | 2079 | 2080 | 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 | 2096 | 2097 | 2098 | 2099 | 2100 | 2101 | 2102 | 2103 | 2104 | 2105 | 2106 | 2107 | 2108 | 2109 | 2110 | 2111 | 2112 | 2113 | 2114 | 2115 | 2116 | 2117 | 2118 | 2119 | 2120 | 2121 | 2122 | 2123 | 2124 | 2125 | 2126 | 2127 | 2128 | 2129 | 2130 | 2131 | 2132 | 2133 | 2134 | 2135 | 2136 | 2137 | 2138 | 2139 | 2140 | 2141 | 2142 | 2143 | 2144 | 2145 | 2146 | 2147 | 2148 | 2149 | 2150 | 2151 | 2152 | 2153 | 2154 | 2155 | 2156 | 2157 | 2158 | 2159 | 2160 | 2161 | 2162 | 2163 | 2164 | 2165 | 2166 | 2167 | 2168 | 2169 | 2170 | 2171 | 2172 | 2173 | 2174 | 2175 | 2176 | 2177 | 2178 | 2179 | 2180 | 2181 | 2182 | 2183 | 2184 | 2185 | 2186 | 2187 | 2188 | 2189 | 2190 | 2191 | 2192 | 2193 | 2194 | 2195 | 2196 | 2197 | 2198 | 2199 | 2200 | 2201 | 2202 | 2203 | 2204 | 2205 | 2206 | 2207 | 2208 | 2209 | 2210 | 2211 | 2212 | 2213 | 2214 | 2215 | 2216 | 2217 | 2218 | 2219 | 2220 | 2221 | 2222 | 2223 | 2224 | 2225 | 2226 | 2227 | 2228 | 2229 | 2230 | 2231 | 2232 | 2233 | 2234 | 2235 | 2236 | 2237 | 2238 | 2239 | 2240 | 2241 | 2242 | 2243 | 2244 | 2245 | 2246 | 2247 | 2248 | 2249 | 2250 | 2251 | 2252 | 2253 | 2254 | 2255 | 2256 | 2257 | 2258 | 2259 | 2260 | 2261 | 2262 | 2263 | 2264 | 2265 | 2266 | 2267 | 2268 | 2269 | 2270 | 2271 | 2272 | 2273 | 2274 | 2275 | 2276 | 2277 | 2278 | 2279 | 2280 | 2281 | 2282 | 2283 | 2284 | 2285 | 2286 | 2287 | 2288 | 2289 | 2290 | 2291 | 2292 | 2293 | 2294 | 2295 | 2296 | 2297 | 2298 | 2299 | 2300 | 2301 | 2302 | 2303 | 2304 | 2305 | 2306 | 2307 | 2308 | 2309 | 2310 | 2311 | 2312 | 2313 | 2314 | 2315 | 2316 | 2317 | 2318 | 2319 | 2320 | 2321 | 2322 | 2323 | 2324 | 2325 | 2326 | 2327 | 2328 | 2329 | 2330 | 2331 | 2332 | 2333 | 2334 | 2335 | 2336 | 2337 | 2338 | 2339 | 2340 | 2341 | 2342 | 2343 | 2344 | 2345 | 2346 | 2347 | 2348 | 2349 | 2350 | 2351 | 2352 | 2353 | 2354 | 2355 | 2356 | 2357 | 2358 | 2359 | 2360 | 2361 | 2362 | 2363 | 2364 | 2365 | 2366 | 2367 | 2368 | 2369 | 2370 | 2371 | 2372 | 2373 | 2374 | 2375 | 2376 | 2377 | 2378 | 2379 | 2380 | 2381 | 2382 | 2383 | 2384 | 2385 | 2386 | 2387 | 2388 | 2389 | 2390 | 2391 | 2392 | 2393 | 2394 | 2395 | 2396 | 2397 | 2398 | 2399 | 2400 | 2401 | 2402 | 2403 | 2404 | 2405 | 2406 | 2407 | 2408 | 2409 | 2410 | 2411 | 2412 | 2413 | 2414 | 2415 | 2416 | 2417 | 2418 | 2419 | 2420 | 2421 | 2422 | 2423 | 2424 | 2425 | 2426 | 2427 | 2428 | 2429 | 2430 | 2431 | 2432 | 2433 | 2434 | 2435 | 2436 | 2437 | 2438 | 2439 | 2440 | 2441 | 2442 | 2443 | 2444 | 2445 | 2446 | 2447 | 2448 | 2449 | 2450 | 2451 | 2452 | 2453 | 2454 | 2455 | 2456 | 2457 | 2458 | 2459 | 2460 | 2461 | 2462 | 2463 | 2464 | 2465 | 2466 | 2467 | 2468 | 2469 | 2470 | 2471 | 2472 | 2473 | 2474 | 2475 | 2476 | 2477 | 2478 | 2479 | 2480 | 2481 | 2482 | 2483 | 2484 | 2485 | 2486 | 2487 | 2488 | 2489 | 2490 | 2491 | 2492 | 2493 | 2494 | 2495 | 2496 | 2497 | 2498 | 2499 | 2500 | 2501 | 2502 | 2503 | 2504 | 2505 | 2506 | 2507 | 2508 | 2509 | 2510 | 2511 | 2512 | 2513 | 2514 | 2515 | 2516 | 2517 | 2518 | 2519 | 2520 | 2521 | 2522 | 2523 | 2524 | 2525 | 2526 | 2527 | 2528 | 2529 | 2530 | 2531 | 2532 | 2533 | 2534 | 2535 | 2536 | 2537 | 2538 | 2539 | 2540 | 2541 | 2542 | 2543 | 2544 | 2545 | 2546 | 2547 | 2548 | 2549 | 2550 | 2551 | 2552 | 2553 | 2554 | 2555 | 2556 | 2557 | 2558 | 2559 | 2560 | 2561 | 2562 | 2563 | 2564 | 2565 | 2566 | 2567 | 2568 | 2569 | 2570 | 2571 | 2572 | 2573 | 2574 | 2575 | 2576 | 2577 | 2578 | 2579 | 2580 | 2581 | 2582 | 2583 | 2584 | 2585 | 2586 | 2587 | 2588 | 2589 | 2590 | 2591 | 2592 | 2593 | 2594 | 2595 | 2596 | 2597 | 2598 | 2599 | 2600 | 2601 | 2602 | 2603 | 2604 | 2605 | 2606 | 2607 | 2608 | 2609 | 2610 | 2611 | 2612 | 2613 | 2614 | 2615 | 2616 | 2617 | 2618 | 2619 | 2620 | 2621 | 2622 | 2623 | 2624 | 2625 | 2626 | 2627 | 2628 | 2629 | 2630 | 2631 | 2632 | 2633 | 2634 | 2635 | 2636 | 2637 | 2638 | 2639 | 2640 | 2641 | 2642 | 2643 | 2644 | 2645 | 2646 | 2647 | 2648 | 2649 | 2650 | 2651 | 2652 | 2653 | 2654 | 2655 | 2656 | 2657 | 2658 | 2659 | 2660 | 2661 | 2662 | 2663 | 2664 | 2665 | 2666 | 2667 | 2668 | 2669 | 2670 | 2671 | 2672 | 2673 | 2674 | 2675 | 2676 | 2677 | 2678 | 2679 | 2680 | 2681 | 2682 | 2683 | 2684 | 2685 | 2686 | 2687 | 2688 | 2689 | 2690 | 2691 | 2692 | 2693 | 2694 | 2695 | 2696 | 2697 | 2698 | 2699 | 2700 | 2701 | 2702 | 2703 | 2704 | 2705 | 2706 | 2707 | 2708 | 2709 | 2710 | 2711 | 2712 | 2713 | 2714 | 2715 | 2716 | 2717 | 2718 | 2719 | 2720 | 2721 | 2722 | 2723 | 2724 | 2725 | 2726 | 2727 | 2728 | 2729 | 2730 | 2731 | 2732 | 2733 | 2734 | 2735 | 2736 | 2737 | 2738 | 2739 | 2740 | 2741 | 2742 | 2743 | 2744 | 2745 | 2746 | 2747 | 2748 | 2749 | 2750 | 2751 | 2752 | 2753 | 2754 | 2755 | 2756 | 2757 | 2758 | 2759 | 2760 | 2761 | 2762 | 2763 | 2764 | 2765 | 2766 | 2767 | 2768 | 2769 | 2770 | 2771 | 2772 | 2773 | 2774 | 2775 | 2776 | 2777 | 2778 | 2779 | 2780 | 2781 | 2782 | 2783 | 2784 | 2785 | 2786 | 2787 | 2788 | 2789 | 2790 | 2791 | 2792 | 2793 | 2794 | 2795 | 2796 | 2797 | 2798 | 2799 | 2800 | 2801 | 2802 | 2803 | 2804 | 2805 | 2806 | 2807 | 2808 | 2809 | 2810 | 2811 | 2812 | 2813 | 2814 | 2815 | 2816 | 2817 | 2818 | 2819 | 2820 | 2821 | 2822 | 2823 | 2824 | 2825 | 2826 | 2827 | 2828 | 2829 | 2830 | 2831 | 2832 | 2833 | 2834 | 2835 | 2836 | 2837 | 2838 | 2839 | 2840 | 2841 | 2842 | 2843 | 2844 | 2845 | 2846 | 2847 | 2848 | 2849 | 2850 | 2851 | 2852 | 2853 | 2854 | 2855 | 2856 | 2857 | 2858 | 2859 | 2860 | 2861 | 2862 | 2863 | 2864 | 2865 | 2866 | 2867 | 2868 | 2869 | 2870 | 2871 | 2872 | 2873 | 2874 | 2875 | 2876 | 2877 | 2878 | 2879 | 2880 | 2881 | 2882 | 2883 | 2884 | 2885 | 2886 | 2887 | 2888 | 2889 | 2890 | 2891 | 2892 | 2893 | 2894 | 2895 | 2896 | 2897 | 2898 | 2899 | 2900 | 2901 | 2902 | 2903 | 2904 | 2905 | 2906 | 2907 | 2908 | 2909 | 2910 | 2911 | 2912 | 2913 | 2914 | 2915 | 2916 | 2917 | 2918 | 2919 | 2920 | 2921 | 2922 | 2923 | 2924 | 2925 | 2926 | 2927 | 2928 | 2929 | 2930 | 2931 | 2932 | 2933 | 2934 | 2935 | 2936 | 2937 | 2938 | 2939 | 2940 | 2941 | 2942 | 2943 | 2944 | 2945 | 2946 | 2947 | 2948 | 2949 | 2950 | 2951 | 2952 | 2953 | 2954 | 2955 | 2956 | 2957 | 2958 | 2959 | 2960 | 2961 | 2962 | 2963 | 2964 | 2965 | 2966 | 2967 | 2968 | 2969 | 2970 | 2971 | 2972 | 2973 | 2974 | 2975 | 2976 | 2977 | 2978 | 2979 | 2980 | 2981 | 2982 | 2983 | 2984 | 2985 | 2986 | 2987 | 2988 | 2989 | 2990 | 2991 | 2992 | 2993 | 2994 | 2995 | 2996 | 2997 | 2998 | 2999 | 3000 | 3001 | 3002 | 3003 | 3004 | 3005 | 3006 | 3007 | 3008 | 3009 | 3010 | 3011 | 3012 | 3013 | 3014 | 3015 | 3016 | 3017 | 3018 | 3019 | 3020 | 3021 | 3022 | 3023 | 3024 | 3025 | 3026 | 3027 | 3028 | 3029 | 3030 | 3031 | 3032 | 3033 | 3034 | 3035 | 3036 | 3037 | 3038 | 3039 | 3040 | 3041 | 3042 | 3043 | 3044 | 3045 | 3046 | 3047 | 3048 | 3049 | 3050 | 3051 | 3052 | 3053 | 3054 | 3055 | 3056 | 3057 | 3058 | 3059 | 3060 | 3061 | 3062 | 3063 | 3064 | 3065 | 3066 | 3067 | 3068 | 3069 | 3070 | 3071 | 3072 | 3073 | 3074 | 3075 | 3076 | 3077 | 3078 | 3079 | 3080 | 3081 | 3082 | 3083 | 3084 | 3085 | 3086 | 3087 | 3088 | 3089 | 3090 | 3091 | 3092 | 3093 | 3094 | 3095 | 3096 | 3097 | 3098 | 3099 | 3100 | 3101 | 3102 | 3103 | 3104 | 3105 | 3106 | 3107 | 3108 | 3109 | 3110 | 3111 | 3112 | 3113 | 3114 | 3115 | 3116 | 3117 | 3118 | 3119 | 3120 | 3121 | 3122 | 3123 | 3124 | 3125 | 3126 | 3127 | 3128 | 3129 | 3130 | 3131 | 3132 | 3133 | 3134 | 3135 | 3136 | 3137 | 3138 | 3139 | 3140 | 3141 | 3142 | 3143 | 3144 | 3145 | 3146 | 3147 | 3148 | 3149 | 3150 | 3151 | 3152 | 3153 | 3154 | 3155 | 3156 | 3157 | 3158 | 3159 | 3160 | 3161 | 3162 | 3163 | 3164 | 3165 | 3166 | 3167 | 3168 | 3169 | 3170 | 3171 | 3172 | 3173 | 3174 | 3175 | 3176 | 3177 | 3178 | 3179 | 3180 | 3181 | 3182 | 3183 | 3184 | 3185 | 3186 | 3187 | 3188 | 3189 | 3190 | 3191 | 3192 | 3193 | 3194 | 3195 | 3196 | 3197 | 3198 | 3199 | 3200 | 3201 | 3202 | 3203 | 3204 | 3205 | 3206 | 3207 | 3208 | 3209 | 3210 | 3211 | 3212 | 3213 | 3214 | 3215 | 3216 | 3217 | 3218 | 3219 | 3220 | 3221 | 3222 | 3223 | 3224 | 3225 | 3226 | 3227 | 3228 | 3229 | 3230 | 3231 | 3232 | 3233 | 3234 | 3235 | 3236 | 3237 | 3238 | 3239 | 3240 | 3241 | 3242 | 3243 | 3244 | 3245 | 3246 | 3247 | 3248 | 3249 | 3250 | 3251 | 3252 | 3253 | 3254 | 3255 | 3256 | 3257 | 3258 | 3259 | 3260 | 3261 | 3262 | 3263 | 3264 | 3265 | 3266 | 3267 | 3268 | 3269 | 3270 | 3271 | 3272 | 3273 | 3274 | 3275 | 3276 | 3277 | 3278 | 3279 | 3280 | 3281 | 3282 | 3283 | 3284 | 3285 |

```

$ *****
STRUDL 'GEOM' 'Backovice obl most - podprobnejši model'
$ *****

UNITS MET KNEW DEG CENTIG SEC JOU MASSOFF
DUMP MESSAGE
DUMP TIME
$*****
$ HORNİ PAS
$*****
  NEWSSET    202    'HORNİ PAS'
  TYPE SPACE FRAME

JOINT COORDINATES
1  0.7056   -3.460   0.1229
2  1.0583   -3.460   0.2519
3  1.4111   -3.460   0.3810
4  1.7639   -3.460   0.5101
5  2.1167   -3.460   0.6392
6  2.4694   -3.460   0.7683
7  2.8222   -3.460   0.8974
8  3.1750   -3.460   1.0267
9  3.5278   -3.460   1.1558
10 3.8806   -3.460   1.2847
11 4.2333   -3.460   1.4130
12 4.5861   -3.460   1.5400
13 4.9389   -3.460   1.6645
14 5.2917   -3.460   1.7856
15 5.6444   -3.460   1.9022
16 5.9972   -3.460   2.0135
17 6.3500   -3.460   2.1185
18 6.7028   -3.460   2.2164
19 7.0556   -3.460   2.3062
20 7.4083   -3.460   2.3875
21 7.7611   -3.460   2.4605
22 8.1139   -3.460   2.5257
23 8.4667   -3.460   2.5834
24 8.8194   -3.460   2.6342
25 9.1722   -3.460   2.6784
26 9.5250   -3.460   2.7163
27 9.8778   -3.460   2.7483
28 10.2306  -3.460   2.7748
29 10.5833  -3.460   2.7958
30 10.9361  -3.460   2.8117
31 11.2889  -3.460   2.8222
32 11.6417  -3.460   2.8275
33 11.9944  -3.460   2.8275
34 12.3472  -3.460   2.8222
35 12.7000  -3.460   2.8117
36 13.0528  -3.460   2.7958
37 13.4056  -3.460   2.7748
38 13.7583  -3.460   2.7483
39 14.1111  -3.460   2.7163
40 14.4639  -3.460   2.6784
41 14.8167  -3.460   2.6342
42 15.1694  -3.460   2.5834
43 15.5222  -3.460   2.5257
44 15.8750  -3.460   2.4605
45 16.2278  -3.460   2.3875
46 16.5806  -3.460   2.3062
47 16.9333  -3.460   2.2164
48 17.2861  -3.460   2.1185
49 17.6389  -3.460   2.0135
50 17.9917  -3.460   1.9022
51 18.3444  -3.460   1.7856
52 18.6972  -3.460   1.6645
53 19.0500  -3.460   1.5400
54 19.4028  -3.460   1.4130
55 19.7556  -3.460   1.2847
56 20.1083  -3.460   1.1558
57 20.4611  -3.460   1.0267
58 20.8139  -3.460   0.8974
59 21.1667  -3.460   0.7683
60 21.5194  -3.460   0.6392
61 21.8722  -3.460   0.5101
62 22.2250  -3.460   0.3810
63 22.5778  -3.460   0.2519
64 22.9306  -3.460   0.1229

```

MEM INCIDENCES

1 1 2
63 63 64

VARY MEMBERS FROM 1 TO 63 BY 1

MOVE SET 202 INCR JOI 10000 ELEM 10000 DY 6.92

CHANGE

JOINT COORDINATES

| | | | |
|----|---------|--------|--------|
| 9 | 3.6806 | -3.460 | 1.2116 |
| 11 | 4.0806 | -3.460 | 1.3574 |
| 18 | 6.8556 | -3.460 | 2.2553 |
| 20 | 7.2556 | -3.460 | 2.3523 |
| 27 | 10.0306 | -3.460 | 2.7598 |
| 29 | 10.4306 | -3.460 | 2.7867 |
| 36 | 13.2056 | -3.460 | 2.7867 |
| 38 | 13.6056 | -3.460 | 2.7598 |
| 45 | 16.3806 | -3.460 | 2.3523 |
| 47 | 16.7806 | -3.460 | 2.2553 |
| 54 | 19.5556 | -3.460 | 1.3574 |
| 56 | 19.9556 | -3.460 | 1.2116 |

| | | | |
|-------|---------|-------|--------|
| 10009 | 3.6806 | 3.460 | 1.2116 |
| 10011 | 4.0806 | 3.460 | 1.3574 |
| 10018 | 6.8556 | 3.460 | 2.2553 |
| 10020 | 7.2556 | 3.460 | 2.3523 |
| 10027 | 10.0306 | 3.460 | 2.7598 |
| 10029 | 10.4306 | 3.460 | 2.7867 |
| 10036 | 13.2056 | 3.460 | 2.7867 |
| 10038 | 13.6056 | 3.460 | 2.7598 |
| 10045 | 16.3806 | 3.460 | 2.3523 |
| 10047 | 16.7806 | 3.460 | 2.2553 |
| 10054 | 19.5556 | 3.460 | 1.3574 |
| 10056 | 19.9556 | 3.460 | 1.2116 |

ADD

MEMBER PROPERTIES

202 **SET AX** 0.4964 **IX** 6.91E-02 **IY** 0.0333601 **IZ** 0.01377715

\$*****

\$ DESKA MOSTOVKY

\$*****

NEWSET 207 'DESKA MOSTOVKY'

TYPE SHELL

JOINT COORDINATES

| | | | |
|------|-------|--------|-------|
| 2001 | 0.000 | 3.460 | 0.123 |
| 2002 | 0.000 | 3.154 | 0.084 |
| 2003 | 0.000 | 2.822 | 0.042 |
| 2004 | 0.000 | 2.490 | 0.000 |
| 2005 | 0.000 | 2.075 | 0.000 |
| 2006 | 0.000 | 1.660 | 0.000 |
| 2007 | 0.000 | 1.245 | 0.000 |
| 2008 | 0.000 | 0.830 | 0.000 |
| 2009 | 0.000 | 0.415 | 0.000 |
| 2010 | 0.000 | 0.000 | 0.000 |
| 2011 | 0.000 | -0.415 | 0.000 |
| 2012 | 0.000 | -0.830 | 0.000 |
| 2013 | 0.000 | -1.245 | 0.000 |
| 2014 | 0.000 | -1.660 | 0.000 |
| 2015 | 0.000 | -2.075 | 0.000 |
| 2016 | 0.000 | -2.490 | 0.000 |
| 2017 | 0.000 | -2.822 | 0.042 |
| 2018 | 0.000 | -3.154 | 0.084 |
| 2019 | 0.000 | -3.460 | 0.123 |

| | | | |
|------|--------|-------|-------|
| 3274 | 23.636 | 3.460 | 0.123 |
| 3275 | 23.636 | 3.154 | 0.084 |
| 3276 | 23.636 | 2.822 | 0.042 |
| 3277 | 23.636 | 2.490 | 0.000 |
| 3278 | 23.636 | 2.075 | 0.000 |
| 3279 | 23.636 | 1.660 | 0.000 |
| 3280 | 23.636 | 1.245 | 0.000 |
| 3281 | 23.636 | 0.830 | 0.000 |

| | | | |
|------|--------|--------|-------|
| 3282 | 23.636 | 0.415 | 0.000 |
| 3283 | 23.636 | 0.000 | 0.000 |
| 3284 | 23.636 | -0.415 | 0.000 |
| 3285 | 23.636 | -0.830 | 0.000 |
| 3286 | 23.636 | -1.245 | 0.000 |
| 3287 | 23.636 | -1.660 | 0.000 |
| 3288 | 23.636 | -2.075 | 0.000 |
| 3289 | 23.636 | -2.490 | 0.000 |
| 3290 | 23.636 | -2.822 | 0.042 |
| 3291 | 23.636 | -3.154 | 0.084 |
| 3292 | 23.636 | -3.460 | 0.123 |

| | | | | |
|------|------------|------|---------|-------|
| VARY | JOINT FROM | 2001 | TO 3274 | BY 19 |
| VARY | JOINT FROM | 2002 | TO 3275 | BY 19 |
| VARY | JOINT FROM | 2003 | TO 3276 | BY 19 |
| VARY | JOINT FROM | 2004 | TO 3277 | BY 19 |
| VARY | JOINT FROM | 2005 | TO 3278 | BY 19 |
| VARY | JOINT FROM | 2006 | TO 3279 | BY 19 |
| VARY | JOINT FROM | 2007 | TO 3280 | BY 19 |
| VARY | JOINT FROM | 2008 | TO 3281 | BY 19 |
| VARY | JOINT FROM | 2009 | TO 3282 | BY 19 |
| VARY | JOINT FROM | 2010 | TO 3283 | BY 19 |
| VARY | JOINT FROM | 2011 | TO 3284 | BY 19 |
| VARY | JOINT FROM | 2012 | TO 3285 | BY 19 |
| VARY | JOINT FROM | 2013 | TO 3286 | BY 19 |
| VARY | JOINT FROM | 2014 | TO 3287 | BY 19 |
| VARY | JOINT FROM | 2015 | TO 3288 | BY 19 |
| VARY | JOINT FROM | 2016 | TO 3289 | BY 19 |
| VARY | JOINT FROM | 2017 | TO 3290 | BY 19 |
| VARY | JOINT FROM | 2018 | TO 3291 | BY 19 |
| VARY | JOINT FROM | 2019 | TO 3292 | BY 19 |

ELEMENT INCIDENCES

2001 2001 2002 2021 2020

2018 2018 2019 2038 2037

3189 3255 3256 3275 3274

VARY ELEMENTS FROM 2001 TO 2018 BY 1 TO 3189 BY 18

ELEMENT PROPERTIES

| | | | | |
|------|---------|-------|-------------|-------------|
| 2001 | TO 3189 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2002 | TO 3190 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2003 | TO 3191 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2004 | TO 3192 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2005 | TO 3193 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2006 | TO 3194 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2007 | TO 3195 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2008 | TO 3196 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2009 | TO 3197 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2010 | TO 3198 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2011 | TO 3199 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2012 | TO 3200 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2013 | TO 3201 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2014 | TO 3202 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2015 | TO 3203 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2016 | TO 3204 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2017 | TO 3205 | BY 18 | TYPE 'FQSE' | THICK 0.150 |
| 2018 | TO 3206 | BY 18 | TYPE 'FQSE' | THICK 0.150 |

\$*****

\$ SPOJENI HL NOSNIKU

\$*****

NEWSET 209 'SPOJENI HL NOSNIKU'

TYPE SHELL

JOINT COORDINATES

| | | | |
|------|--------|---------|---------|
| 4001 | 0.0000 | -3.4600 | 1.4984 |
| 4009 | 2.8222 | -3.4600 | 1.4984 |
| 4055 | 0.0000 | -3.4600 | -0.5649 |
| 4063 | 2.8222 | -3.4600 | -0.5649 |

VARY JOINT FROM 4001 TO 4009 BY 1 TO 4055 BY 9

ELEMENT INCIDENCES

4001 4001 4010 4011 4002

4008 4008 4017 4018 4009

4041 4046 4055 4056 4047

VARY ELEMENTS FROM 4001 TO 4008 BY 1 TO 4041 BY 8

JOINT COORDINATES

4071 1.0584 -3.46 0.2519
4072 2.1167 -3.46 0.6392

CHANGE**JOINT COORDINATES**

4026 2.4695 -3.46 0.7683
4027 2.8222 -3.46 0.8974
4032 1.4111 -3.46 0.381
4033 1.7639 -3.46 0.5101

ELEMENT INCIDENCES

4022 4024 4033 4072 4025
4023 4072 4034 4035 4026
4027 4030 4039 4071 4031
4028 4071 4040 4041 4032

ADD**ELEMENT INCIDENCES**

4071 4039 4040 4071
4072 4031 4071 4032
4073 4033 4034 4072
4074 4025 4072 4026

DEL ELEM 4033 **TO** 4048

DEL ELEM 4001 **TO** 4016

DEL ELEM 4017 **TO** 4022

DEL ELEM 4074 4025 4026 4027 4072

\$*****

\$ *OZRCADLENY KONEC*

\$*****

NEWSET 210 'KONEC'

MOVE SET 209 **INCR JOINT** 100 **ELEM** 100

MIRROR SET 210 **AT X=** 11.818

SET 211 == **UNION OF SETS** 209 210

NEWSET 212 'KONEC'

MOVE SET 211 **INCR JOI** 10000 **ELEM** 10000 **DY** 6.92

SET 213 == **UNION OF SETS** 211 212

ELEMENT PROPERTIES

\$ 4071 4072 4073 4074 4171 4172 4173 4174 **TYPE** 'FTSE' **THICK** 0.300
4071 4073 4171 4173 **TYPE** 'FTSE' **THICK** 0.300
\$ 14071 14072 14073 14074 14171 14172 14173 14174 **TYPE** 'FTSE' **THICK** 0.300
14071 14073 14171 14173 **TYPE** 'FTSE' **THICK** 0.300
213 **SET** **TYPE** 'FQSE' **THICK** 0.300

\$*****

\$ *DOLNI PAS*

\$*****

NEWSET 203 'DOLNI PAS'

TYPE SPACE FRAME

MEM INCIDENCES

101 2001 2020
601 2019 2038

167 3255 3274
667 3273 3292

VARY MEMBERS FROM 101 **TO** 167 **BY** 1

VARY MEMBERS FROM 601 **TO** 667 **BY** 1

SET 305 **JOINTS** == 2209 2380 2551 2722 2893 3064 2191 2362 2533 2704 2875 3046

SET 306 **JOINTS** == 2247 2418 2589 2760 2931 3102 2229 2400 2571 2742 2913 3084

MOVE SET 305 **DX** 0.1525

MOVE SET 306 **DX** -0.1525

MEMBER PROPERTIES

203 **SET** **AX** 0.36399395 **IX** 3.94E-02 **IY** 0.01236948 **IZ** 0.00985514

\$*****

\$ *SVISLICE*

\$*****

NEWSET 204 'SVISLICE'

TYPE SPACE FRAME**JOINT COORDINATES**

| | | | |
|------|--------|--------|--------|
| 1201 | 3.8806 | -3.460 | 1.2847 |
| 1202 | 3.8806 | -3.460 | 1.0847 |
| 1203 | 3.8806 | -3.460 | 0.8309 |
| 1204 | 3.8806 | -3.460 | 0.5769 |
| 1205 | 3.8806 | -3.460 | 0.3229 |
| 1206 | 3.8806 | -3.460 | 0.1229 |

| | | | |
|------|--------|--------|--------|
| 1207 | 7.0556 | -3.460 | 2.3062 |
| 1208 | 7.0556 | -3.460 | 2.1062 |
| 1209 | 7.0556 | -3.460 | 1.8511 |
| 1210 | 7.0556 | -3.460 | 1.5964 |
| 1211 | 7.0556 | -3.460 | 1.3417 |
| 1212 | 7.0556 | -3.460 | 1.0870 |
| 1213 | 7.0556 | -3.460 | 0.8323 |
| 1214 | 7.0556 | -3.460 | 0.5776 |
| 1215 | 7.0556 | -3.460 | 0.3229 |
| 1216 | 7.0556 | -3.460 | 0.1229 |

| | | | |
|------|---------|--------|--------|
| 1217 | 10.2306 | -3.460 | 2.7748 |
| 1218 | 10.2306 | -3.460 | 2.5748 |
| 1219 | 10.2306 | -3.460 | 2.3246 |
| 1220 | 10.2306 | -3.460 | 2.0983 |
| 1221 | 10.2306 | -3.460 | 1.8242 |
| 1222 | 10.2306 | -3.460 | 1.5740 |
| 1223 | 10.2306 | -3.460 | 1.3237 |
| 1224 | 10.2306 | -3.460 | 1.0735 |
| 1225 | 10.2306 | -3.460 | 0.8459 |
| 1226 | 10.2306 | -3.460 | 0.5731 |
| 1227 | 10.2306 | -3.460 | 0.3229 |
| 1228 | 10.2306 | -3.460 | 0.1229 |

| | | | |
|------|---------|--------|--------|
| 1229 | 13.4056 | -3.460 | 2.7748 |
| 1230 | 13.4056 | -3.460 | 2.5748 |
| 1231 | 13.4056 | -3.460 | 2.3246 |
| 1232 | 13.4056 | -3.460 | 2.0983 |
| 1233 | 13.4056 | -3.460 | 1.8242 |
| 1234 | 13.4056 | -3.460 | 1.5740 |
| 1235 | 13.4056 | -3.460 | 1.3237 |
| 1236 | 13.4056 | -3.460 | 1.0735 |
| 1237 | 13.4056 | -3.460 | 0.8459 |
| 1238 | 13.4056 | -3.460 | 0.5731 |
| 1239 | 13.4056 | -3.460 | 0.3229 |
| 1240 | 13.4056 | -3.460 | 0.1229 |

| | | | |
|------|---------|--------|--------|
| 1241 | 16.5806 | -3.460 | 2.3062 |
| 1242 | 16.5806 | -3.460 | 2.1062 |
| 1243 | 16.5806 | -3.460 | 1.8511 |
| 1244 | 16.5806 | -3.460 | 1.5964 |
| 1245 | 16.5806 | -3.460 | 1.3417 |
| 1246 | 16.5806 | -3.460 | 1.0870 |
| 1247 | 16.5806 | -3.460 | 0.8323 |
| 1248 | 16.5806 | -3.460 | 0.5776 |
| 1249 | 16.5806 | -3.460 | 0.3229 |
| 1250 | 16.5806 | -3.460 | 0.1229 |

| | | | |
|------|---------|--------|--------|
| 1251 | 19.7556 | -3.460 | 1.2847 |
| 1252 | 19.7556 | -3.460 | 1.0847 |
| 1253 | 19.7556 | -3.460 | 0.8309 |
| 1254 | 19.7556 | -3.460 | 0.5769 |
| 1255 | 19.7556 | -3.460 | 0.3229 |
| 1256 | 19.7556 | -3.460 | 0.1229 |

MEM INCIDENCES

| | | |
|------|------|------|
| 1201 | 1201 | 1202 |
| 1205 | 1205 | 1206 |

| | | |
|------|------|------|
| 1207 | 1207 | 1208 |
| 1215 | 1215 | 1216 |

| | | |
|------|------|------|
| 1217 | 1217 | 1218 |
| 1227 | 1227 | 1228 |

| | | |
|------|------|------|
| 1229 | 1229 | 1230 |
| 1239 | 1239 | 1240 |

1241 1241 1242
1249 1249 1250

1251 1251 1252
1255 1255 1256

VARY MEMBERS FROM 1201 TO 1205 BY 1
VARY MEMBERS FROM 1207 TO 1215 BY 1
VARY MEMBERS FROM 1217 TO 1227 BY 1
VARY MEMBERS FROM 1229 TO 1239 BY 1
VARY MEMBERS FROM 1241 TO 1249 BY 1
VARY MEMBERS FROM 1251 TO 1255 BY 1

MOVE SET 204 INCR JOI 10000 ELEM 10000 DY 6.92

MEMBER PROPERTIES

204 SET AX 0.216 IX 1.66E-02 IY 0.003645 IZ 0.0041472

\$*****

\$ PODELNIKY

\$*****

NEWSET 205 'PODELNIKY'

TYPE SPACE FRAME

MEM INCIDENCES

201 2004 2023
301 2008 2027
401 2012 2031
501 2016 2035

267 3258 3277
367 3262 3281
467 3266 3285
567 3270 3289

VARY MEMBERS FROM 201 TO 267 BY 1
VARY MEMBERS FROM 301 TO 367 BY 1
VARY MEMBERS FROM 401 TO 467 BY 1
VARY MEMBERS FROM 501 TO 567 BY 1

MEMBER PROPERTIES

201 TO 267 AX 0.09126279 IX 6.83E-04 IY 0.00393054 IZ 0.00477831
301 TO 367 AX 0.0540538 IX 2.39E-04 IY 0.00189326 IZ 0.00022798
401 TO 467 AX 0.0540538 IX 2.39E-04 IY 0.00189326 IZ 0.00022798
501 TO 567 AX 0.09126279 IX 6.83E-04 IY 0.00393054 IZ 0.00477831

\$*****

\$ PRICNIKY

\$*****

NEWSET 206 'PRICNIKY'

TYPE SPACE FRAME

MEM INCIDENCES

701 2039 2040
731 2210 2211
761 2381 2382
791 2552 2553
821 2723 2724
851 2894 2895
881 3065 3066
911 3236 3237

718 2056 2057
748 2227 2228
778 2398 2399
808 2569 2570
838 2740 2741
868 2911 2912
898 3082 3083
928 3253 3254

VARY MEMBERS FROM 701 TO 718 BY 1
VARY MEMBERS FROM 731 TO 748 BY 1
VARY MEMBERS FROM 761 TO 778 BY 1
VARY MEMBERS FROM 791 TO 808 BY 1
VARY MEMBERS FROM 821 TO 838 BY 1
VARY MEMBERS FROM 851 TO 868 BY 1
VARY MEMBERS FROM 881 TO 898 BY 1

VARY MEMBERS FROM 911 TO 928 BY 1

MEMBER PROPERTIES

SET 9 MEM == GRID FROM 701 TO 703 BY 1 TO 911 BY 30
SET 10 MEM == GRID FROM 704 TO 715 BY 1 TO 914 BY 30
SET 11 MEM == GRID FROM 716 TO 718 BY 1 TO 926 BY 30

MEMBER PROPERTIES

9 SET AX 0.28088309 IX 1.59E-02 IY 0.00457965 IZ 0.03436
10 SET AX 0.28088309 IX 1.59E-02 IY 0.03436 IZ 0.00457965
11 SET AX 0.28088309 IX 1.59E-02 IY 0.00457965 IZ 0.03436

\$*****

\$ ZAVETROVANI

\$*****

NEWSET 215 'ZAVETROVANI'
TYPE SHELL

ELEMENT INCIDENCES

15001 9 10 1202
15002 10 11 1202

15003 1205 2228 2209
15004 1205 2247 2228

15005 18 19 1208
15006 19 20 1208

15007 1215 2399 2380
15008 1215 2418 2399

15009 27 28 1218
15010 28 29 1218

15011 1227 2570 2551
15012 1227 2589 2570

15013 36 37 1230
15014 37 38 1230

15015 1239 2741 2722
15016 1239 2760 2741

15017 45 46 1242
15018 46 47 1242

15019 1249 2912 2893
15020 1249 2931 2912

15021 54 55 1252
15022 55 56 1252

15023 1255 3083 3064
15024 1255 3102 3083

15051 10009 10010 11202
15052 10010 10011 11202

15053 11205 2210 2191
15054 11205 2229 2210

15055 10018 10019 11208
15056 10019 10020 11208

15057 11215 2381 2362
15058 11215 2400 2381

15059 10027 10028 11218
15060 10028 10029 11218

15061 11227 2552 2533
15062 11227 2571 2552

15063 10036 10037 11230
15064 10037 10038 11230

15065 11239 2723 2704
15066 11239 2742 2723

15067 10045 10046 11242
15068 10046 10047 11242

15069 11249 2894 2875
15070 11249 2913 2894

15071 10054 10055 11252
15072 10055 10056 11252

15073 11255 3065 3046
15074 11255 3084 3065

ELEMENT PROPERTIES

215 **SET TYPE** 'FTSE' THICK 0.15

\$*****

\$ DESKA MOSTOVKY SPARAHUJICI

\$*****

NEWSET 216 'DESKA MOSTOVKY SPARAHUJICI'

TYPE SHELL

SET 301 **ELEM** == **GRID FROM** 2003 **TO** 2016 **BY** 1 **TO** 3191 **BY** 18

SET 301 **JOINTS** == **ADJACENT TO ELEMENTS** 301 **SET**

MOVE SET 301 **INCR** JOI 20000 **ELEM** 20000 **DZ** 0.140

SET 302 **JOINTS** == 22003 **TO** 23276 **BY** 19

SET 303 **JOINTS** == 22017 **TO** 23290 **BY** 19

MOVE SET 302 **DY** -0.012 **DZ** -0.042

MOVE SET 303 **DY** 0.012 **DZ** -0.042

CHANGE

ELEMENT PROPERTIES

216 **SET TYPE** 'FQSE' THICK 0.130

ADD

\$*****

\$ SPRAHUJICI PRVKY PODELNE

\$*****

NEWSET 217 'SPRAHUJICI PRVKY PODELNE'

ELEMENT INCIDENCES

30001 2003 2022 22022 22003

30015 2017 2036 22036 22017

30991 3257 3276 23276 23257

31005 3271 3290 23290 23271

VARY ELEMENTS FROM 30001 **TO** 30015 **BY** 1 **TO** 30991 **BY** 15

ELEMENT PROPERTIES

217 **SET TYPE** 'FQSE' THICK 0.003

\$*****

\$ SPRAHUJICI PRVKY PRICNE

\$*****

NEWSET 218 'SPRAHUJICI PRVKY PRICNE'

ELEMENT INCIDENCES

40001 2041 2042 22042 22041

40014 2054 2055 22055 22054

40099 3238 3239 23239 23238

40112 3251 3252 23252 23251

VARY ELEMENTS FROM 40001 **TO** 40014 **BY** 1 **TO** 40099 **BY** 14

ELEMENT PROPERTIES

218 **SET TYPE** 'FQSE' THICK 0.003

\$*****

\$ SPOJENI CASTI MODELU

\$*****

COMPRESS JOINTS

REPLACE JOINTS WITHIN TOLERANCE 0.01

COMPRESS JOINTS

```

$ *****
$                               LOZISKA
$ *****

SET 50 JOINTS == 1 64 10001 10064

JOINT 50 SET STATUS SUPP
JOINT RELEASES
$ definitivni ulozeni
    1 MOM X Y           KFY 20000
    64 MOM X Y Z FOR X KFY 20000
    10001 MOM X Y Z      KFY 20000
    10064 MOM X Y Z FOR X KFY 20000

$ *****
$ ***** KONSTANTY *****
$ *****
CONSTANTS
$ ----- BETON C -----
CTE 0.000012 202 SET 203 SET 204 SET 205 SET 206 SET 207 SET 213 SET 215 SET 216 SET
DENSITY 25. 202 SET 203 SET 204 SET 205 SET 206 SET 207 SET 213 SET 215 SET 216 SET
POISSON 0.15 202 SET 203 SET 204 SET 205 SET 206 SET 207 SET 213 SET 215 SET 216 SET
$ ----- BETON C12/15 -----
E 27000000 205 SET 206 SET 207 SET
$ ----- BETON C22/25 -----
E 30000000 202 SET 203 SET 204 SET 213 SET 215 SET 216 SET
$ ----- BETON C25/30 -----
E 31000000 216 SET

$ ----- OCEL SPRAZENI -----
CTE 0.000001 217 SET 218 SET
DENSITY 0.01 217 SET 218 SET
POISSON 0.3 217 SET 218 SET
E 210000000 217 SET 218 SET

$ INACTIVE ELEM SET 207
$ INACTIVE ELEM 202 SET 203 SET 204 SET 205 SET 206 SET 212 SET

$ *****
$ ***** ZATEZOVACI STAVY *****
$ *****

LOADING 1 'STALE ZATIZENI'
ELEM LOADS
GENER DEAD LOAD GRA DIR -Z FOR ALL

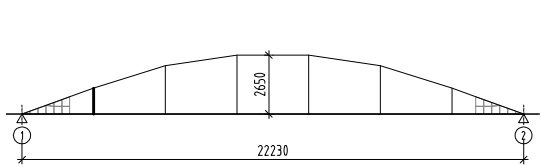
SET 401 ELEM == GRID FROM 2001 TO 2018 BY 1 TO 3189 BY 18

LOADING 2 'KONSTRUKCE VOZOVKY'
ELEM LOADS
$ ** nova kce
401 SET SURFACE FORCE GLOBAL UNIFORM PZ -2.2
$ ** puvodni kce
$ ** 401 SET SURFACE FORCE GLOBAL UNIFORM PZ -5.5

```

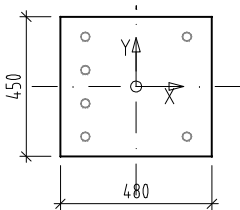
Výpočet zatíženosti

SVISLICE 1
Schéma



Průřezové charakteristiky

| | | |
|-----------------|----------|----------------|
| h | 0.450 | m |
| d | 0.480 | m |
| A | 0.216 | m ² |
| z _h | 0.225 | m |
| z _d | 0.225 | m |
| I _y | 0.003645 | m ⁴ |
| i _y | 0.130 | m |
| Wy _h | 0.0162 | m ³ |
| Wy _d | 0.0162 | m ³ |



bez vzpěru

c

1

Materiály
beton
výztuž

C20/25
6xØ28

| | | prut | | | | | |
|----|---|---------|-------|------|------|-------|-------|
| ZS | Zatížení | | prvek | uzel | FX | My | |
| | | | | | kN | kNm | |
| 1 | VLASTNÍ HMOTNOST | [Výslec | 1 | 1204 | 1205 | 56.10 | 23.28 |
| 2 | KONSTRUKCE VOZOVKY | [Výslec | 2 | 1204 | 1205 | 13.11 | 3.15 |
| 11 | zatížení pro norm zatížitelnost - rovnoměrné 2.5 | [Výslec | 11 | 1204 | 1205 | 12.43 | 2.89 |
| 36 | zatížení pro normální zatížitelnost - max M | [Výslec | 36 | 1204 | 1205 | -2.12 | 7.21 |
| 15 | zatížení pro normální zatížitelnost - max N | [Výslec | 15 | 1204 | 1205 | 47.73 | -6.91 |
| 76 | zatížení pro výhradní zatížitelnost - max M | [Výslec | 76 | 1204 | 1205 | -1.88 | 4.58 |
| 55 | zatížení pro výhradní zatížitelnost - max N | [Výslec | 55 | 1204 | 1205 | 28.54 | -4.66 |
| 41 | zatížení pro výjimečnou zatížitelnost - 9NV v polovině rozpětí | [Výslec | 41 | 1204 | 1205 | -0.18 | 2.73 |
| 42 | zatížení pro výjimečnou zatížitelnost - 9NV ve čtvrtině rozpětí | [Výslec | 42 | 1204 | 1205 | 7.43 | -0.01 |

1

$$\xi \cdot \gamma = 1.35 \cdot 0.85 = 1.1475$$
$$(M, N)_{Rd1} = 1.1475 \cdot (M, N)_{G1} + 1.35 \cdot \delta \cdot (M, N)_{q,b}$$
$$\delta \cdot (M, N)_{q,b} = \frac{(M, N)_{Rd1} - 1.1475 \cdot (M, N)_{G1}}{1.35}$$

2

$$\gamma = 1.35, \psi = 0.75$$
$$(M, N)_{Rd1} = 1.35 \cdot (M, N)_{G1} + 1.35 \cdot 0.75 \cdot \delta \cdot (M, N)_{q,b}$$
$$\delta \cdot (M, N)_{q,b} = \frac{(M, N)_{Rd1} - 1.35 \cdot (M, N)_{G1}}{1.35 \cdot 0.75}$$

Únosnost průřezu

Zbývá na zatížení vozidly

1

$$\delta \cdot (M, N)_{q,b}$$

Zbývá na zatížení vozidly

2

$$\delta \cdot (M, N)_{q,b}$$

| N | M |
|------|------|
| kN | kNm |
| 56.1 | 23.3 |
| 13.1 | 3.1 |
| 12.4 | 2.9 |
| -2.1 | 7.2 |
| 47.7 | -6.9 |
| -1.9 | 4.6 |
| 28.5 | -4.7 |
| -0.2 | 2.7 |
| 7.4 | 0.0 |

| Nrd | Mrd |
|-------|-------|
| kN | kNm |
| 182.9 | 131.0 |
| 898.4 | 0.0 |
| 182.9 | 131.0 |
| 457.0 | -81.7 |
| 457.0 | 81.7 |
| 457.0 | 81.7 |

Vn_M
Vn_N
Vr_M
Vr_N
Ve_1/2
Ve_1/4

| N | M |
|-------|-------|
| 76.6 | 74.6 |
| 606.6 | -22.5 |
| 76.6 | 74.6 |
| 329.8 | -69.1 |
| 279.7 | 38.1 |
| 279.7 | 38.1 |

Vn_M
Vn_N
Vr_M
Vr_N
Ve_1/2
Ve_1/4

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| 1.70 | -1.18 |
| 0.25 | -0.13 |
| 0.24 | -0.12 |
| 0.44 | -0.46 |
| -0.21 | 0.65 |
| 0.27 | -0.29 |
| -0.16 | 0.42 |
| 0.17 | -0.17 |
| 0.03 | 0.04 |

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| 8.93 | -7.24 |
| 4.16 | 4.16 |
| 8.93 | -7.24 |
| -2.93 | 7.16 |
| 7.16 | -2.93 |
| 7.16 | -2.93 |

| | |
|-------|-------|
| 183.6 | 132.3 |
| 898.4 | 0.0 |
| 183.6 | 132.3 |
| 449.1 | -80.3 |
| 449.1 | 80.3 |
| 449.1 | 80.3 |

| δ | | | N | M |
|------|-----|-----|-------|-------|
| 1.2 | 3NV | Va | 6.19 | 6.15 |
| 1.2 | 3NV | Va | 8.40 | 4.66 |
| 1.25 | 3NV | Vrw | | 13.02 |
| 1.25 | 3NV | Vrw | 9.24 | 11.85 |
| 1.05 | 9NV | Vew | | 13.30 |
| 1.05 | 9NV | Vew | 35.84 | |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 82.0 | t |
| Zatížitelnost normální Vn | 62.1 | t |
| Zatížitelnost výhradní Vr | 130.2 | t |
| Zatížitelnost výhradní Vr | 92.4 | t |
| Zatížitelnost výjimečná Ve | 133.0 | t |
| Zatížitelnost výjimečná Ve | 358.4 | t |

| N | M |
|-------|--------|
| 88.4 | 94.1 |
| 795.0 | -35.2 |
| 88.4 | 94.1 |
| 359.1 | -115.9 |
| 359.1 | 45.5 |
| 359.1 | 45.5 |

Vn_M
Vn_N
Vr_M
Vr_N
Ve_1/2
Ve_1/4

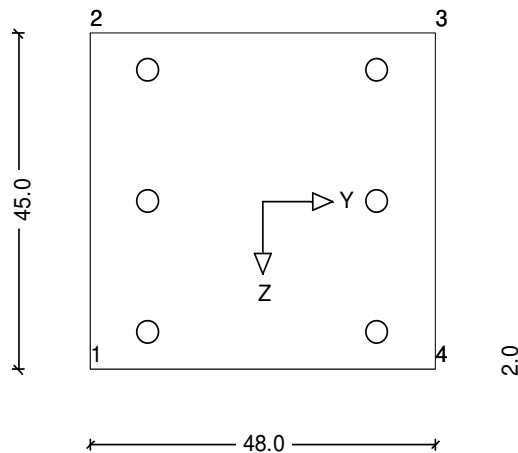
| δ | | | N | M |
|------|-----|-----|-------|-------|
| 1.2 | 3NV | Va | 7.14 | 7.77 |
| 1.2 | 3NV | Va | 11.01 | 7.31 |
| 1.25 | 6NV | Vrw | | 16.44 |
| 1.25 | 6NV | Vrw | 10.06 | 19.88 |
| 1.05 | 9NV | Vew | | 15.88 |
| 1.05 | 9NV | Vew | 46.01 | |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 95.2 | t |
| Zatížitelnost normální Vn | 97.4 | t |
| Zatížitelnost výhradní Vr | 164.4 | t |
| Zatížitelnost výhradní Vr | 100.6 | t |
| Zatížitelnost výjimečná Ve | 158.8 | t |
| Zatížitelnost výjimečná Ve | 460.1 | t |



Obloukový most

Soubor: Svislice3 fy 280.zwv



Bereich: Závěs svislice, Querschnitt: SV

RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Závěs svislice

Soubor: ZWAX.ZWA

Protokol zadání

* Mezní stav únosnosti pro ohyb s normálovou silou CSN EN 1992-1-1

Počítá se s průřezem netto tlačené zóny betonu

| Materiál - č. | Pevnost (N/mm ²) | E-Modul (N/mm ²) | Dov.přetvoření (o/oo) | |
|---------------|------------------------------|------------------------------|-----------------------|-------------|
| | | | hrana | střed |
| Beton | $f_{c,d} = 10.7$ | $E_c = 30000.$ | tlak | -3.50 -2.00 |
| Výztuž 2 | $f_{y,d} = 243.5$ | $E_s = 200000.$ | tah | 10.00 1.22 |
| Předp.kabel 3 | $f_{p,d} = 1304.3$ | $E_p = 195000.$ | | |

Průřez: SV

Výpočet jako netlačený prvek.

Počítá se vzdálenost vnější tahové výztuže od okraje

Polygonální dílčí průřez 1
Beton (=materiál 1)

Souřadnice

| y (m) | z (m) | Bod |
|--------|--------|-----|
| -0.240 | 0.225 | 1 |
| -0.240 | -0.225 | 2 |
| 0.240 | -0.225 | 3 |
| 0.240 | 0.225 | 4 |



Bodová, úseková, kruhová výztuž

| Č. Druh | Sada | Č.-mat. | Průřez | | As | Bod 1 | | Bod 2 | | zrca- dlit |
|---------|------|---------|--------|-----|-----|--------|--------|--------|--------|---------------|
| | | | min | max | | y1 (m) | z1 (m) | y2 (m) | z2 (m) | |
| 1 Bod | 1 | 2 | 6.2 | 6.2 | cm2 | -0.160 | -0.175 | | | y, z, y |
| 5 Bod | 1 | 2 | 6.2 | 6.2 | cm2 | -0.160 | 0.000 | | | na z |

Poloha: SV 3 - 1226

| ZS | NS (kN) | MSy (kNm) | MSz (kNm) |
|----|---------|-----------|-----------|
| 1 | 359.9 | -97.9 | 0.0 |
| 2 | 898.0 | 0.0 | 0.0 |
| 3 | 298.5 | -110.0 | 0.0 |
| 4 | 590.0 | -56.9 | 0.0 |
| 5 | 368.8 | -98.0 | 0.0 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Závěs svislice

Výsledek

Průřez: SV Poloha: SV 3 - 1226

Průř. charakteristiky - brutto $I_1 = 0.003645 \text{ m}^4$ $y_s = 0.0000 \text{ m}$
 $A = 0.2160 \text{ m}^2$ $\alpha = 0.00$ $I_2 = 0.004147 \text{ m}^4$ $z_s = 0.0000 \text{ m}$

Výztuž (S=Sada M=Materiál)

| As | min.As | | max.As | stáv.As | | Souřadnice (m) | | | | Eps.0 | | |
|------|--------|---|--------|---------|-------|----------------|----------------------------|--------|----|-------|------|--|
| Č. | S | M | (cm2) | (cm2) | (cm2) | cm2/m | y1 | z1 | y2 | z2 | o/oo | |
| 1 | 1 | 2 | 6.15 | 6.15 | 6.15 | | -0.160 | -0.175 | | | | |
| 2 | 1 | 2 | 6.15 | 6.15 | 6.15 | | -0.160 | 0.175 | | | | |
| 3 | 1 | 2 | 6.15 | 6.15 | 6.15 | | 0.160 | 0.175 | | | | |
| 4 | 1 | 2 | 6.15 | 6.15 | 6.15 | | 0.160 | -0.175 | | | | |
| 5 | 1 | 2 | 6.15 | 6.15 | 6.15 | | -0.160 | 0.000 | | | | |
| 6 | 1 | 2 | 6.15 | 6.15 | 6.15 | | 0.160 | 0.000 | | | | |
| Suma | | | 36.90 | 36.91 | 36.91 | | nutná.As/Abrutto = 1.709 % | | | | | |

Návrh na MSÚ As = 36.9 cm²

| ZS | Vnitřní účinky na MSÚ | | | Přetvoření (o/oo) | | | Beta | Gama | Využití |
|----|-----------------------|----------|----------|-------------------|--------|-------|-------|-------|---------|
| | N (kN) | My (kNm) | Mz (kNm) | Eps.1 | Eps.2 | Eps.s | (°) | | |
| 1 | 363. | -99. | 0. | -1.697 | 11.462 | 10.00 | 180.0 | 1.000 | 0.990 |
| 2 | 899. | 0. | 0. | 1.217 | 1.217 | 1.22 | 0.0 | 1.000 | 0.999 |
| 3 | 300. | -110. | 0. | -1.874 | 11.484 | 10.00 | 180.0 | 1.000 | 0.997 |
| 4 | 591. | -57. | 0. | -1.065 | 11.383 | 10.00 | 180.0 | 1.000 | 0.998 |
| 5 | 369. | -98. | 0. | -1.683 | 11.460 | 10.00 | 180.0 | 1.000 | 1.001 |

| ZS | ----Tlaková výslednice----- | | | | -----Tahová výslednice----- | | | | Rameno |
|----|-----------------------------|-------|-------|---------------------|-----------------------------|-------|--------|---------------------|--------|
| | (kN) | y (m) | z (m) | A (m ²) | (kN) | y (m) | z (m) | A (m ²) | (m) |
| 1 | -236. | 0.000 | 0.197 | 0.0279 | 599. | 0.000 | -0.087 | 0.00246 | 0.2846 |
| 2 | | | | | 899. | 0.000 | 0.000 | 0.00369 | |
| 3 | -300. | 0.000 | 0.193 | 0.0303 | 599. | 0.000 | -0.087 | 0.00246 | 0.2810 |
| 4 | -86. | 0.000 | 0.211 | 0.0185 | 677. | 0.000 | -0.057 | 0.00369 | 0.2687 |
| 5 | -231. | 0.000 | 0.197 | 0.0277 | 599. | 0.000 | -0.087 | 0.00246 | 0.2849 |



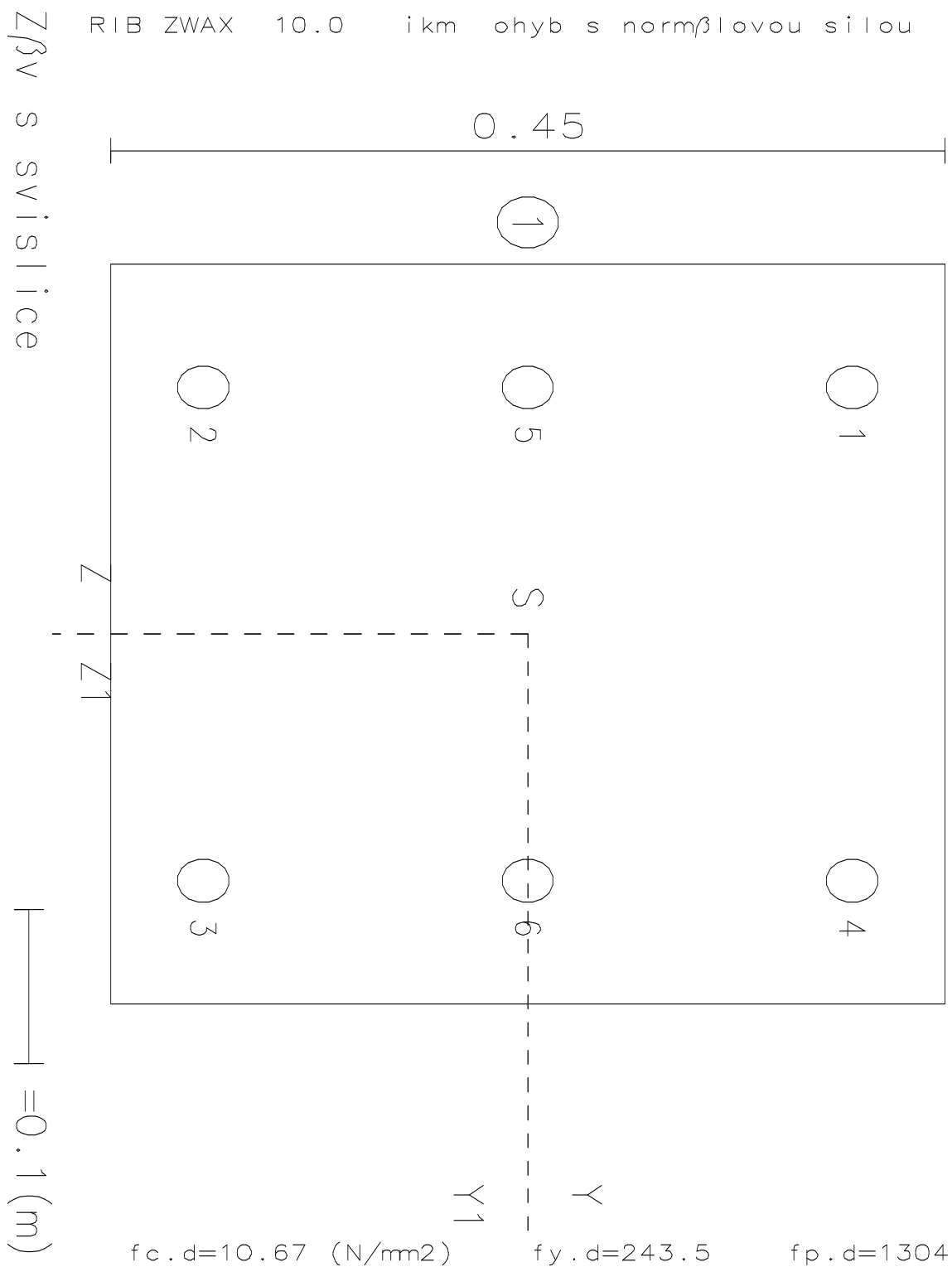
RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Závěs svislice

| Výztuž Č. | Eps.0 (o/oo) | y (m) | z (m) | ZS | Eps.s (o/oo) | Sigma N/mm2 |
|--------------|-----------------|----------|----------|----|-----------------|----------------|
| 1 | 6.2 | -0.160 | -0.175 | 1 | 10.000 | 243 |
| 2 | 6.2 | -0.160 | 0.175 | 1 | -0.235 | -47 |
| 3 | 6.2 | 0.160 | 0.175 | 1 | -0.235 | -47 |
| 4 | 6.2 | 0.160 | -0.175 | 1 | 10.000 | 243 |
| 5 | 6.2 | -0.160 | 0.000 | 1 | 4.883 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 1 | 4.883 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 2 | 1.217 | 243 |
| 2 | 6.2 | -0.160 | 0.175 | 2 | 1.217 | 243 |
| 3 | 6.2 | 0.160 | 0.175 | 2 | 1.217 | 243 |
| 4 | 6.2 | 0.160 | -0.175 | 2 | 1.217 | 243 |
| 5 | 6.2 | -0.160 | 0.000 | 2 | 1.217 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 2 | 1.217 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 3 | 10.000 | 243 |
| 2 | 6.2 | -0.160 | 0.175 | 3 | -0.390 | -78 |
| 3 | 6.2 | 0.160 | 0.175 | 3 | -0.390 | -78 |
| 4 | 6.2 | 0.160 | -0.175 | 3 | 10.000 | 243 |
| 5 | 6.2 | -0.160 | 0.000 | 3 | 4.805 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 3 | 4.805 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 4 | 10.000 | 243 |
| 2 | 6.2 | -0.160 | 0.175 | 4 | 0.318 | 64 |
| 3 | 6.2 | 0.160 | 0.175 | 4 | 0.318 | 64 |
| 4 | 6.2 | 0.160 | -0.175 | 4 | 10.000 | 243 |
| 5 | 6.2 | -0.160 | 0.000 | 4 | 5.159 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 4 | 5.159 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 5 | 10.000 | 243 |
| 2 | 6.2 | -0.160 | 0.175 | 5 | -0.222 | -44 |
| 3 | 6.2 | 0.160 | 0.175 | 5 | -0.222 | -44 |
| 4 | 6.2 | 0.160 | -0.175 | 5 | 10.000 | 243 |
| 5 | 6.2 | -0.160 | 0.000 | 5 | 4.889 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 5 | 4.889 | 243 |



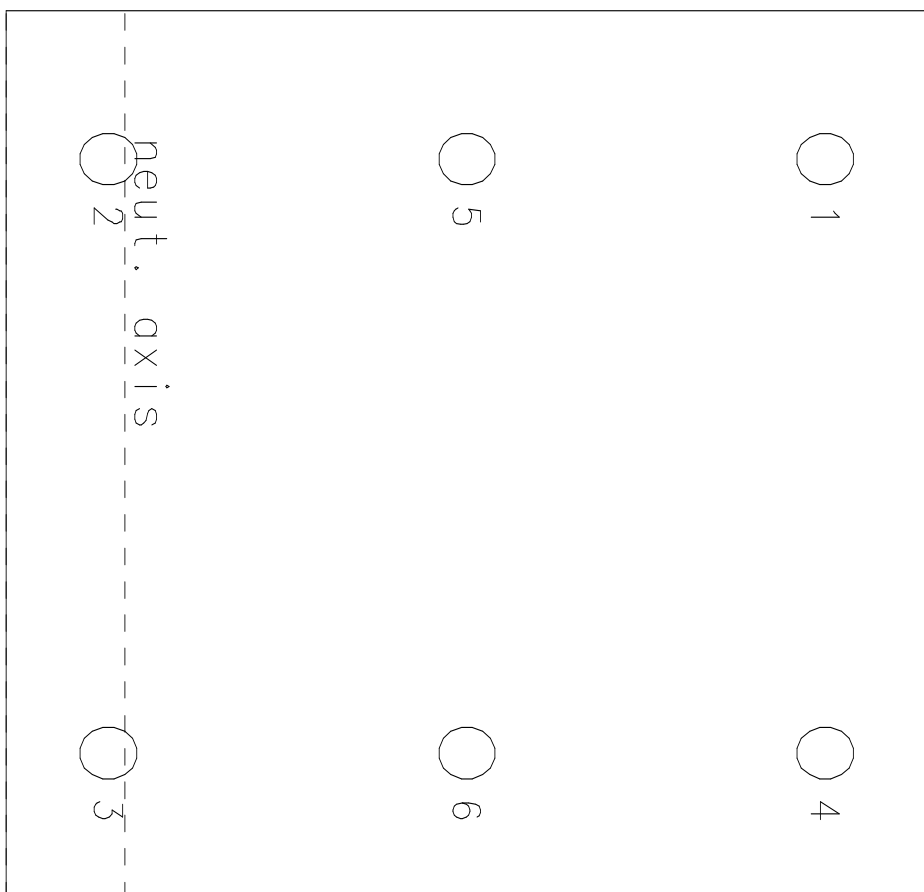
1 RIB ZWAX 10.0 i km ohyb s normálovou silou





Sec: 1 Poloha: 1 ZS: 1 $A_s=36.91 \text{ cm}^2$ MS využití=1.01 >1 Nm.990

$E_{ps2}=11.46$



$N=363.4 \text{ kN}$ $M_y=-98.9 \text{ kNm}$

$E_{ps1}=-1.70$

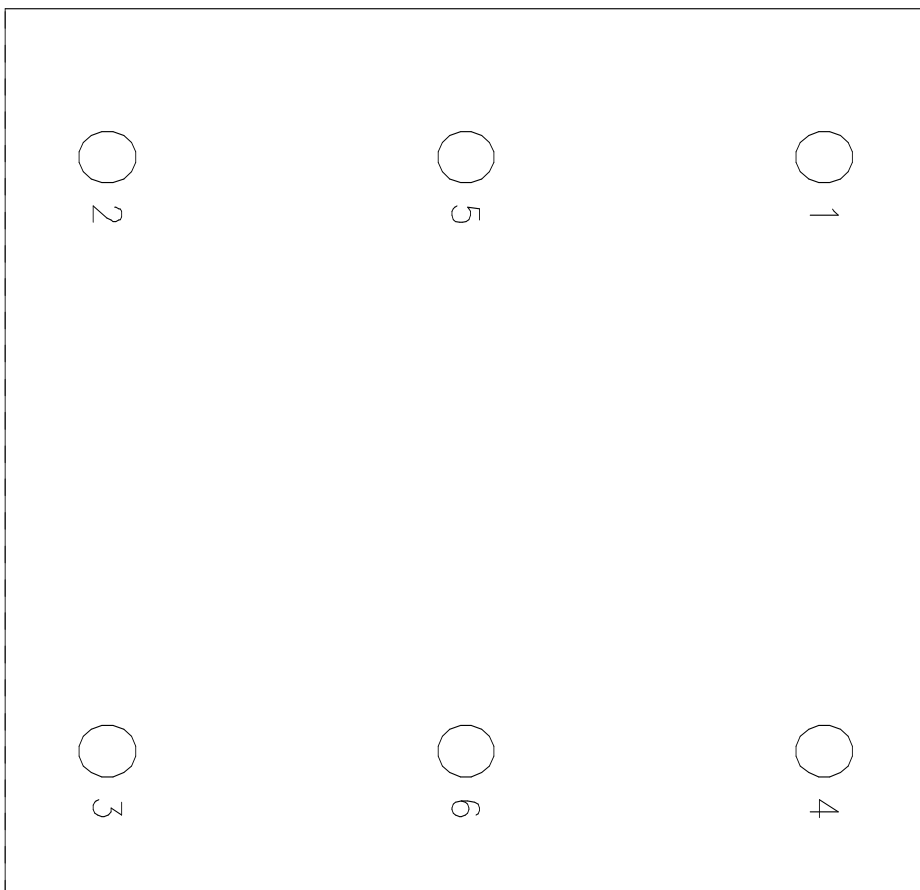
Zřív svislice

$l=0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 2 $A_s=36.91 \text{ cm}^2$ MS vyuziti=1.01 >1 Nm.999

$E_{ps1}=1.22$



$N=898.6 \text{ kN}$ $M_y=0 \text{ kNm}$

$E_{ps2}=1.22$

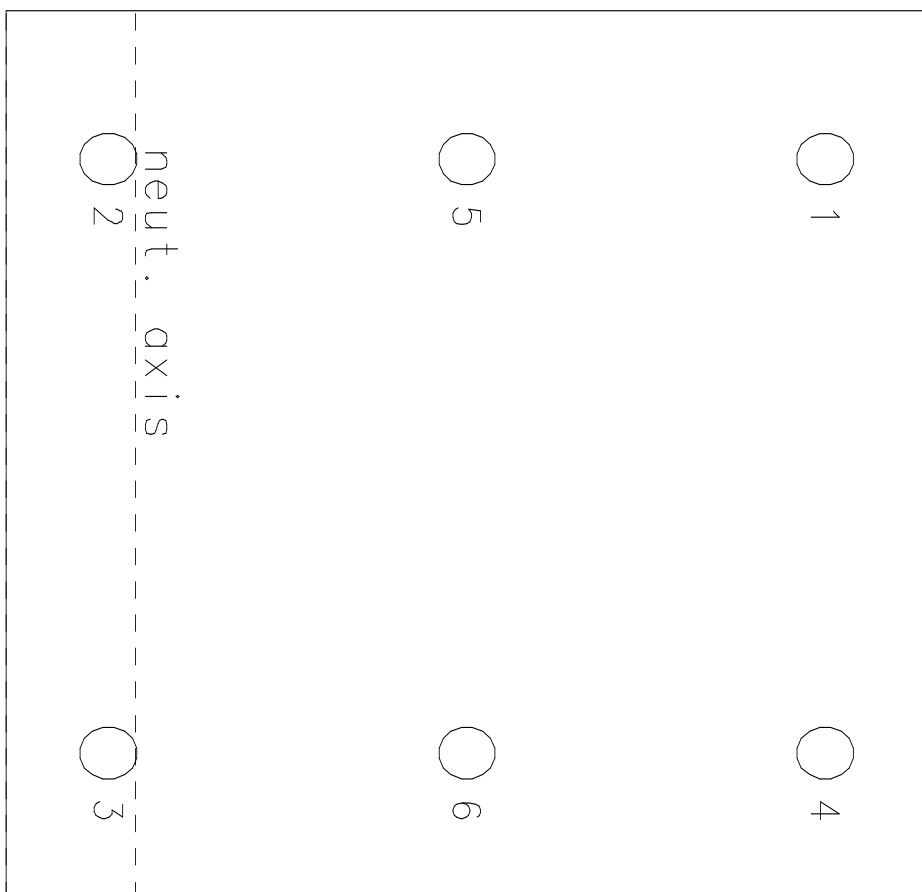
Zřv s svíslice

$l=0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 3 $A_s=36.91 \text{ cm}^2$ MS využití=1.01 >1 Nm.997

$$E_{ps2}=11.48$$



$$N=299.5 \text{ kN} \quad M_y=-110.4 \text{ kNm}$$

$$E_{ps1}=-1.87$$

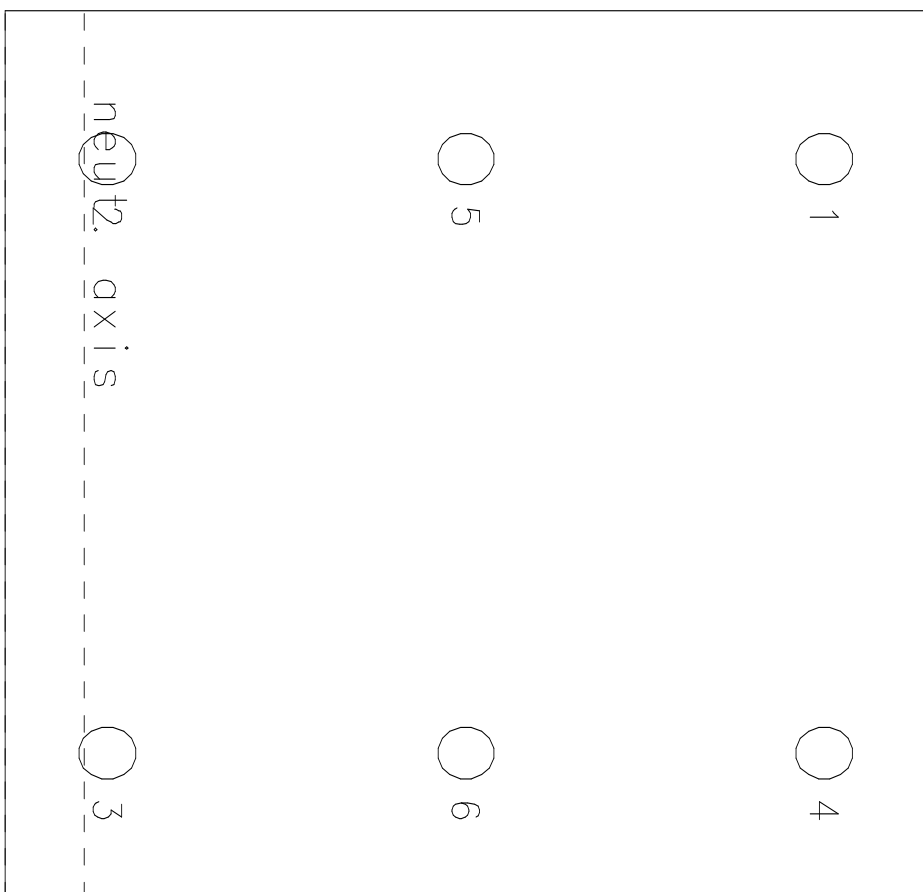
Zβv s svíslíce

$$l=0.1 \text{ (m)}$$



Sec: 1 Poloha: 1 ZS: 4 $A_s=36.91 \text{ cm}^2$ MS využití=1.01 >1 Nm.998

$$E_{ps2}=11.38$$



$$N=590.9 \text{ kN} \quad M_y=-57 \text{ kNm}$$

$$E_{ps1}=-1.07$$

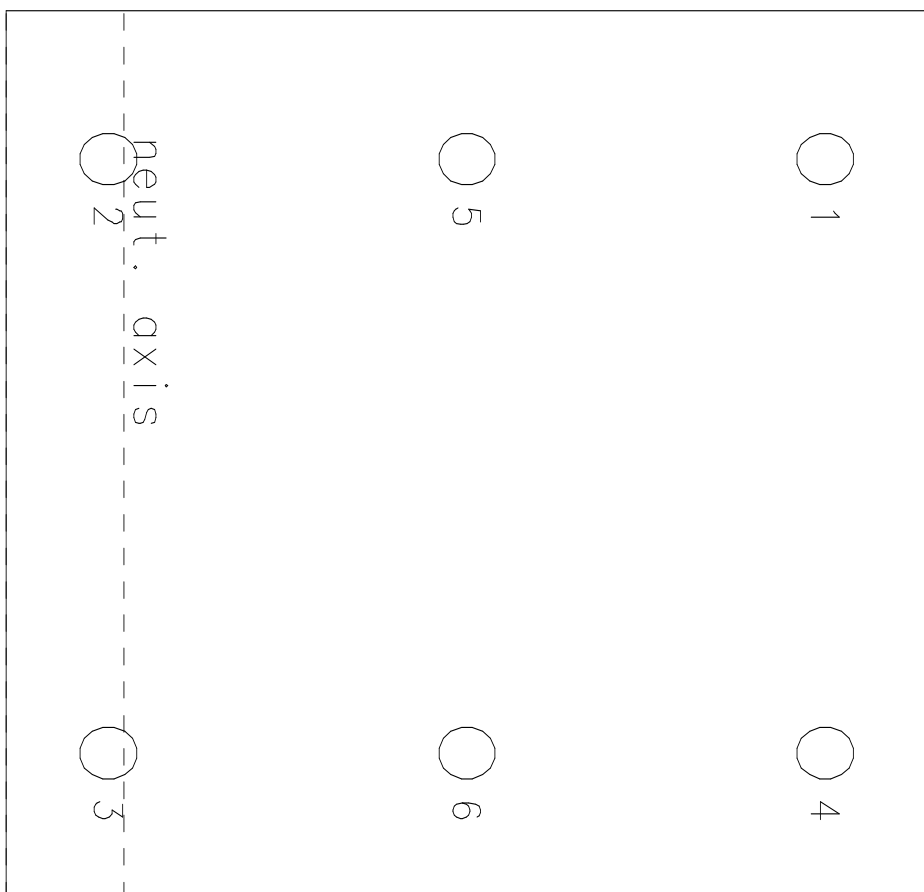
Zřv s svíslíce

$$l=0.1 \text{ (m)}$$



Sec: 1 Poloha: 1 ZS: 5 $A_s=36.91 \text{ cm}^2$ MS využití=1.01 >1 Nm1.00

$E_{ps2}=11.46$



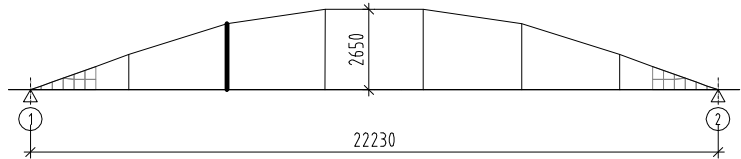
$N=368.5 \text{ kN}$ $M_y=-97.9 \text{ kNm}$

$E_{ps1}=-1.68$

$Z_{\beta v}$ s svíslíce

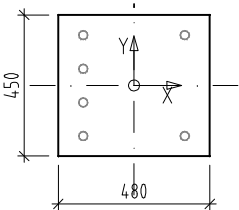
$l=0.1 \text{ (m)}$

SVISLICE 2
Schéma



Průřezové charakteristiky

| | | |
|-----------------|----------|----------------|
| h | 0.450 | m |
| d | 0.480 | m |
| A | 0.216 | m ² |
| z _h | 0.225 | m |
| z _d | 0.225 | m |
| I _y | 0.003645 | m ⁴ |
| i _y | 0.130 | m |
| Wy _h | 0.0162 | m ³ |
| Wy _d | 0.0162 | m ³ |



bez vzpěru

c

1

Materiály
beton
výztuž

C20/25
6xØ28

| | | prut | | | | | |
|----|---|---------|-------|------|------|--------|-------|
| ZS | Zatížení | ZS | prvek | uzel | FX | My | |
| 1 | VLASTNÍ HMOTNOST | [Výslec | 1 | 1208 | 1208 | 161.91 | 2.53 |
| 2 | KONSTRUKCE VOZOVKY | [Výslec | 2 | 1208 | 1208 | 26.36 | 0.39 |
| 11 | zatížení pro norm zatížitelnost - rovnoměrné 2.5 | [Výslec | 11 | 1208 | 1208 | 24.36 | 0.35 |
| 17 | zatížení pro normální zatížitelnost - max M | [Výslec | 17 | 1208 | 1208 | 35.54 | 23.65 |
| 23 | zatížení pro normální zatížitelnost - max N | [Výslec | 23 | 1208 | 1208 | 55.63 | 14.36 |
| 25 | zatížení pro výhradní zatížitelnost - max M - 6NV | [Výslec | 25 | 1208 | 1208 | 19.82 | 9.28 |
| 31 | zatížení pro výhradní zatížitelnost - max N - 6NV | [Výslec | 31 | 1208 | 1208 | 21.66 | 7.33 |
| 42 | zatížení pro výjimečnou zatížitelnost - 9NV ve čtvrtině rozpětí | [Výslec | 42 | 1208 | 1208 | 11.76 | 3.74 |

1

$$\xi \cdot \gamma = 1.35 \cdot 0.85 = 1.1475$$
$$(M, N)_{Rd1} = 1.1475 \cdot (M, N)_{G1} + 1.35 \cdot \delta \cdot (M, N)_{q,b}$$
$$\delta \cdot (M, N)_{q,b} = \frac{(M, N)_{Rd1} - 1.1475 \cdot (M, N)_{G1}}{1.35}$$

$$\gamma = 1.35, \psi = 0.75$$
$$(M, N)_{Rd1} = 1.35 \cdot (M, N)_{G1} + 1.35 \cdot 0.75 \cdot \delta \cdot (M, N)_{q,b}$$
$$\delta \cdot (M, N)_{q,b} = \frac{(M, N)_{Rd1} - 1.35 \cdot (M, N)_{G1}}{1.35 \cdot 0.75}$$

Únosnost průřezu

Zbývá na zatížení vozidly

1

$$\delta \cdot (M, N)_{q,b}$$

Zbývá na zatížení vozidly

2

$$\delta \cdot (M, N)_{q,b}$$

| N | M |
|-------|------|
| kN | kNm |
| 161.9 | 2.5 |
| 26.4 | 0.4 |
| 24.4 | 0.3 |
| 35.5 | 23.7 |
| 55.6 | 14.4 |
| 19.8 | 9.3 |
| 21.7 | 7.3 |
| 11.8 | 3.7 |

| Nrd | Mrd |
|-------|------|
| kN | kNm |
| 426.7 | 87.3 |
| 550.0 | 64.6 |
| 404.1 | 91.4 |
| 451.2 | 82.8 |
| 460.3 | 81.1 |

Vn_M
Vn_N
Vr_M
Vr_N
Ve_1/4

| N | M |
|-------|------|
| 156.0 | 62.2 |
| 247.4 | 45.4 |
| 139.3 | 65.2 |
| 174.2 | 58.9 |
| 180.9 | 57.6 |

Vn_M
Vn_N
Vr_M
Vr_N
Ve_1/4

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| 0.91 | 0.59 |
| 0.15 | 0.10 |
| 0.13 | 0.09 |
| 1.62 | -1.30 |
| 1.14 | -0.63 |
| 0.66 | -0.48 |
| 0.55 | -0.35 |
| 0.29 | -0.18 |

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| 7.36 | -3.41 |
| 6.53 | -1.44 |
| 7.51 | -3.77 |
| 7.20 | -3.02 |
| 7.14 | -2.88 |

| δ | | | N | M |
|----------|-----|-----|-------|-------|
| 1.2 | 3NV | Va | 2.17 | 2.16 |
| 1.2 | 3NV | Va | 2.58 | 2.57 |
| 1.25 | 6NV | Vrw | 5.62 | 5.62 |
| 1.25 | 6NV | Vrw | 6.43 | 6.43 |
| 1.05 | 9NV | Vew | 14.66 | 14.65 |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 28.8 | t |
| Zatížitelnost normální Vn | 34.3 | t |
| Zatížitelnost výhradní Vr | 56.2 | t |
| Zatížitelnost výhradní Vr | 64.3 | t |
| Zatížitelnost výjimečná Ve | 146.5 | t |

| N | M |
|-------|------|
| 170.4 | 82.3 |
| 292.2 | 59.9 |
| 148.1 | 86.4 |
| 194.6 | 77.9 |
| 203.6 | 76.2 |

Vn_M
Vn_N
Vr_M
Vr_N
Ve_1/4

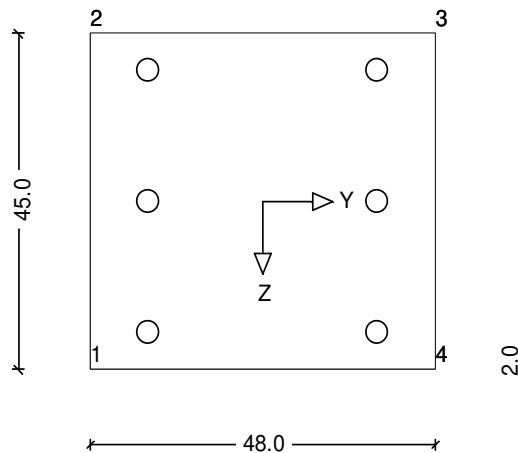
| δ | | | N | M |
|----------|-----|-----|-------|-------|
| 1.2 | 3NV | Va | 2.37 | 2.86 |
| 1.2 | 3NV | Va | 3.04 | 3.40 |
| 1.25 | 6NV | Vrw | 5.98 | 7.44 |
| 1.25 | 6NV | Vrw | 7.19 | 8.51 |
| 1.05 | 9NV | Vew | 16.49 | 19.39 |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 31.6 | t |
| Zatížitelnost normální Vn | 40.6 | t |
| Zatížitelnost výhradní Vr | 59.8 | t |
| Zatížitelnost výhradní Vr | 71.9 | t |
| Zatížitelnost výjimečná Ve | 164.9 | t |



Obloukový most

Soubor: Svislice2 fy 280.zwv



Bereich: Závěs svislice, Querschnitt: SV

RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Závěs svislice

Soubor: ZWAX.ZWA

Protokol zadání

* Mezní stav únosnosti pro ohyb s normálovou silou CSN EN 1992-1-1

Počítá se s průřezem netto tlačené zóny betonu

| Materiál - č. | Pevnost (N/mm ²) | E-Modul (N/mm ²) | Dov. přetvoření (o/oo) | |
|---------------|------------------------------|------------------------------|------------------------|-------------|
| | | | hrana | střed |
| Beton | $f_{c,d} = 10.7$ | $E_c = 30000.$ | tlak | -3.50 -2.00 |
| Výztuž 2 | $f_{y,d} = 243.5$ | $E_s = 200000.$ | tah | 10.00 1.22 |
| Předp.kabel 3 | $f_{p,d} = 1304.3$ | $E_p = 195000.$ | | |

Průřez: SV

Výpočet jako netlačený prvek.

Počítá se vzdálenost vnější tahové výztuže od okraje

Polygonální dílčí průřez 1
Beton (=materiál 1)

Souřadnice

| y (m) | z (m) | Bod |
|--------|--------|-----|
| -0.240 | 0.225 | 1 |
| -0.240 | -0.225 | 2 |
| 0.240 | -0.225 | 3 |
| 0.240 | 0.225 | 4 |



Bodová, úseková, kruhová výztuž

| Č. Druh | Sada | Č.-mat. | Průřez | | As | Bod 1 | | Bod 2 | | zrca- dlit |
|---------|------|---------|--------|-----|-----|--------|--------|--------|--------|---------------|
| | | | min | max | | y1 (m) | z1 (m) | y2 (m) | z2 (m) | |
| 1 Bod | 1 | 2 | 6.2 | 6.2 | cm2 | -0.160 | -0.175 | | | y, z, y |
| 5 Bod | 1 | 2 | 6.2 | 6.2 | cm2 | -0.160 | 0.000 | | | na z |

Poloha: SV 2 - 1208

| ZS | NS (kN) | MSy (kNm) | MSz (kNm) |
|----|---------|-----------|-----------|
| 1 | 424.7 | 86.9 | 0.0 |
| 2 | 547.7 | 64.3 | 0.0 |
| 3 | 404.0 | 91.4 | 0.0 |
| 4 | 450.7 | 82.7 | 0.0 |
| 5 | 460.2 | 81.1 | 0.0 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Závěs svislice

Výsledek**Průřez: SV Poloha: SV 2 - 1208**

Průř. charakteristiky - brutto $I_1 = 0.003645 \text{ m}^4$ $y_s = 0.0000 \text{ m}$
 $A = 0.2160 \text{ m}^2$ $\alpha = 0.00$ $I_2 = 0.004147 \text{ m}^4$ $z_s = 0.0000 \text{ m}$

Výztuž (S=Sada M=Materiál)

| As | min.As | | max.As | stáv.As | | Souřadnice (m) | | | | Eps.0 | | |
|------|--------|---|--------|---------|-------|----------------|----------------------------|--------|----|-------|------|--|
| Č. | S | M | (cm2) | (cm2) | (cm2) | cm2/m | y1 | z1 | y2 | z2 | o/oo | |
| 1 | 1 | 2 | 6.15 | 6.15 | 6.15 | | -0.160 | -0.175 | | | | |
| 2 | 1 | 2 | 6.15 | 6.15 | 6.15 | | -0.160 | 0.175 | | | | |
| 3 | 1 | 2 | 6.15 | 6.15 | 6.15 | | 0.160 | 0.175 | | | | |
| 4 | 1 | 2 | 6.15 | 6.15 | 6.15 | | 0.160 | -0.175 | | | | |
| 5 | 1 | 2 | 6.15 | 6.15 | 6.15 | | -0.160 | 0.000 | | | | |
| 6 | 1 | 2 | 6.15 | 6.15 | 6.15 | | 0.160 | 0.000 | | | | |
| Suma | | | 36.90 | 36.91 | 36.90 | | nutná.As/Abrutto = 1.708 % | | | | | |

Návrh na MSÚ As = 36.9 cm²

| ZS | Vnitřní účinky na MSÚ | | | Přetvoření (o/oo) | | | Beta | Gama | Využití |
|----|-----------------------|----------|----------|-------------------|--------|-------|------|-------|---------|
| | N (kN) | My (kNm) | Mz (kNm) | Eps.1 | Eps.2 | Eps.s | (°) | | |
| 1 | 427. | 87. | 0. | -1.521 | 11.440 | 10.00 | 0.0 | 1.000 | 0.995 |
| 2 | 550. | 65. | 0. | -1.180 | 11.398 | 10.00 | 0.0 | 1.000 | 0.996 |
| 3 | 404. | 91. | 0. | -1.584 | 11.448 | 10.00 | 0.0 | 1.000 | 1.000 |
| 4 | 451. | 83. | 0. | -1.452 | 11.432 | 10.00 | 0.0 | 1.000 | 0.999 |
| 5 | 460. | 81. | 0. | -1.427 | 11.428 | 10.00 | 0.0 | 1.000 | 1.000 |

| ZS | ----Tlaková výslednice----- | | | | -----Tahová výslednice----- | | | | Rameno |
|----|-----------------------------|-------|--------|---------------------|-----------------------------|-------|-------|---------------------|--------|
| | (kN) | y (m) | z (m) | A (m ²) | (kN) | y (m) | z (m) | A (m ²) | (m) |
| 1 | -172. | 0.000 | -0.203 | 0.0253 | 599. | 0.000 | 0.087 | 0.00246 | 0.2900 |
| 2 | -102. | 0.000 | -0.210 | 0.0203 | 652. | 0.000 | 0.066 | 0.00369 | 0.2760 |
| 3 | -195. | 0.000 | -0.200 | 0.0262 | 599. | 0.000 | 0.087 | 0.00246 | 0.2877 |
| 4 | -148. | 0.000 | -0.206 | 0.0243 | 599. | 0.000 | 0.087 | 0.00246 | 0.2932 |
| 5 | -139. | 0.000 | -0.207 | 0.0240 | 599. | 0.000 | 0.087 | 0.00369 | 0.2944 |



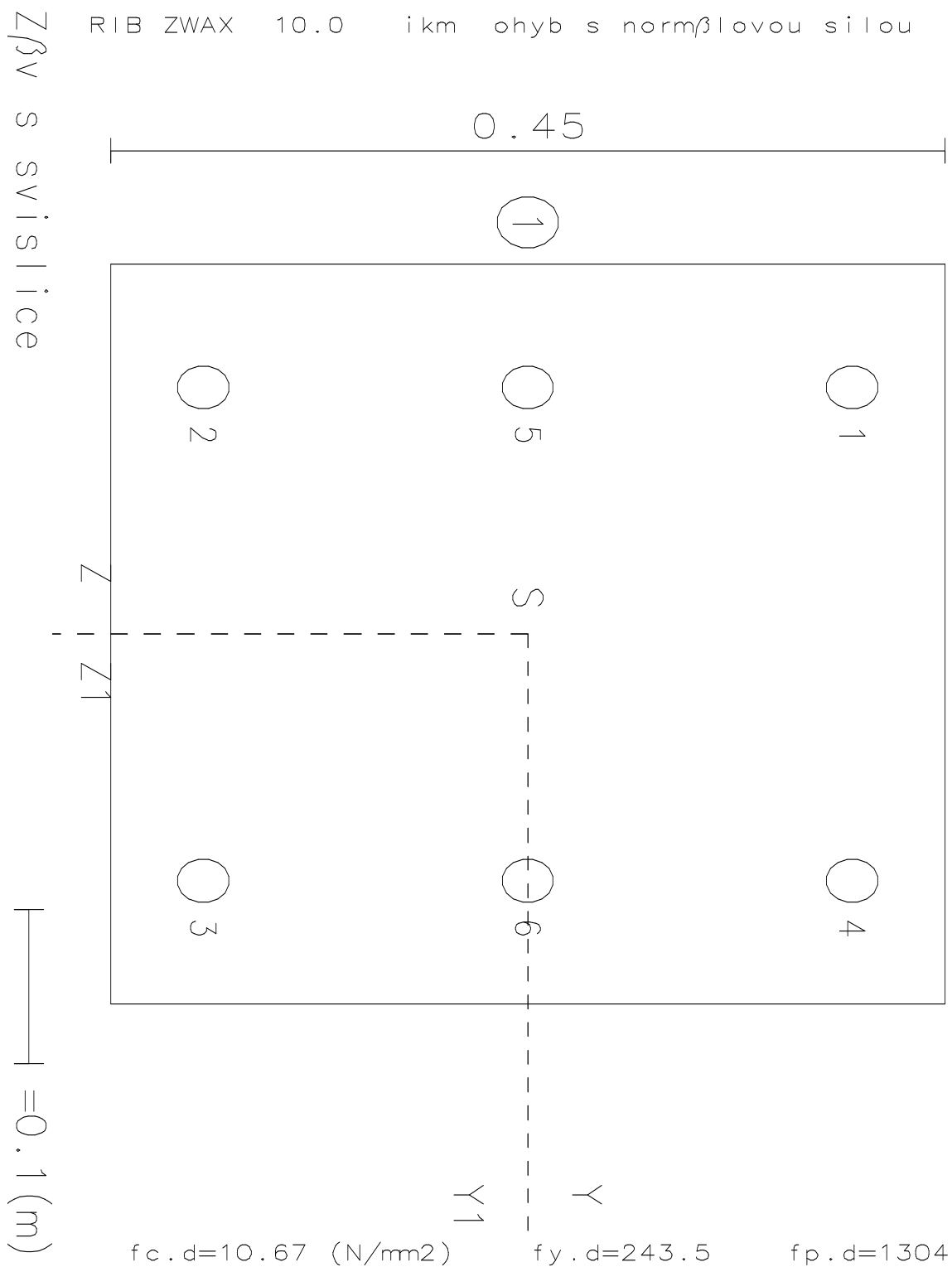
RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

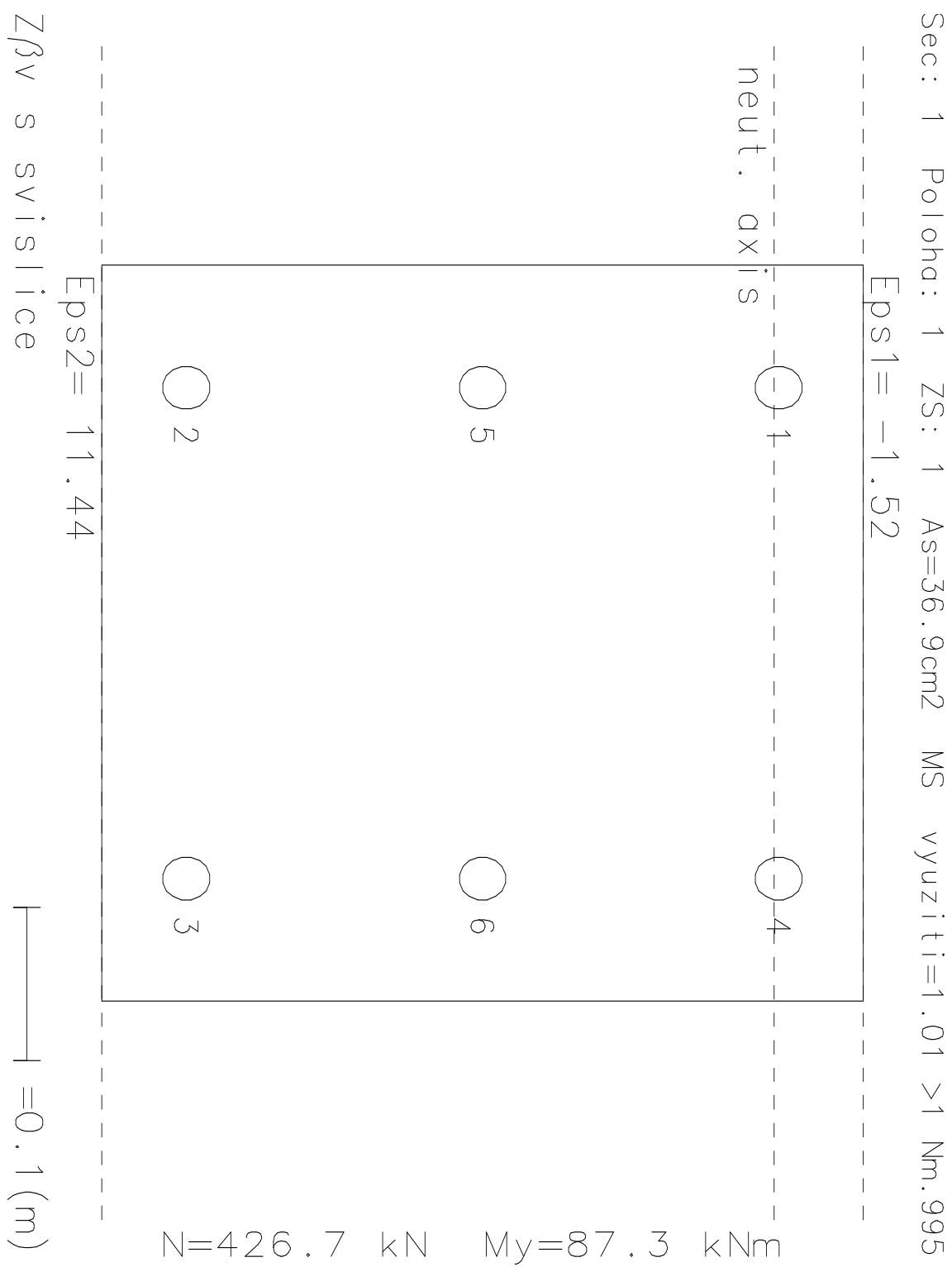
Závěs svislice

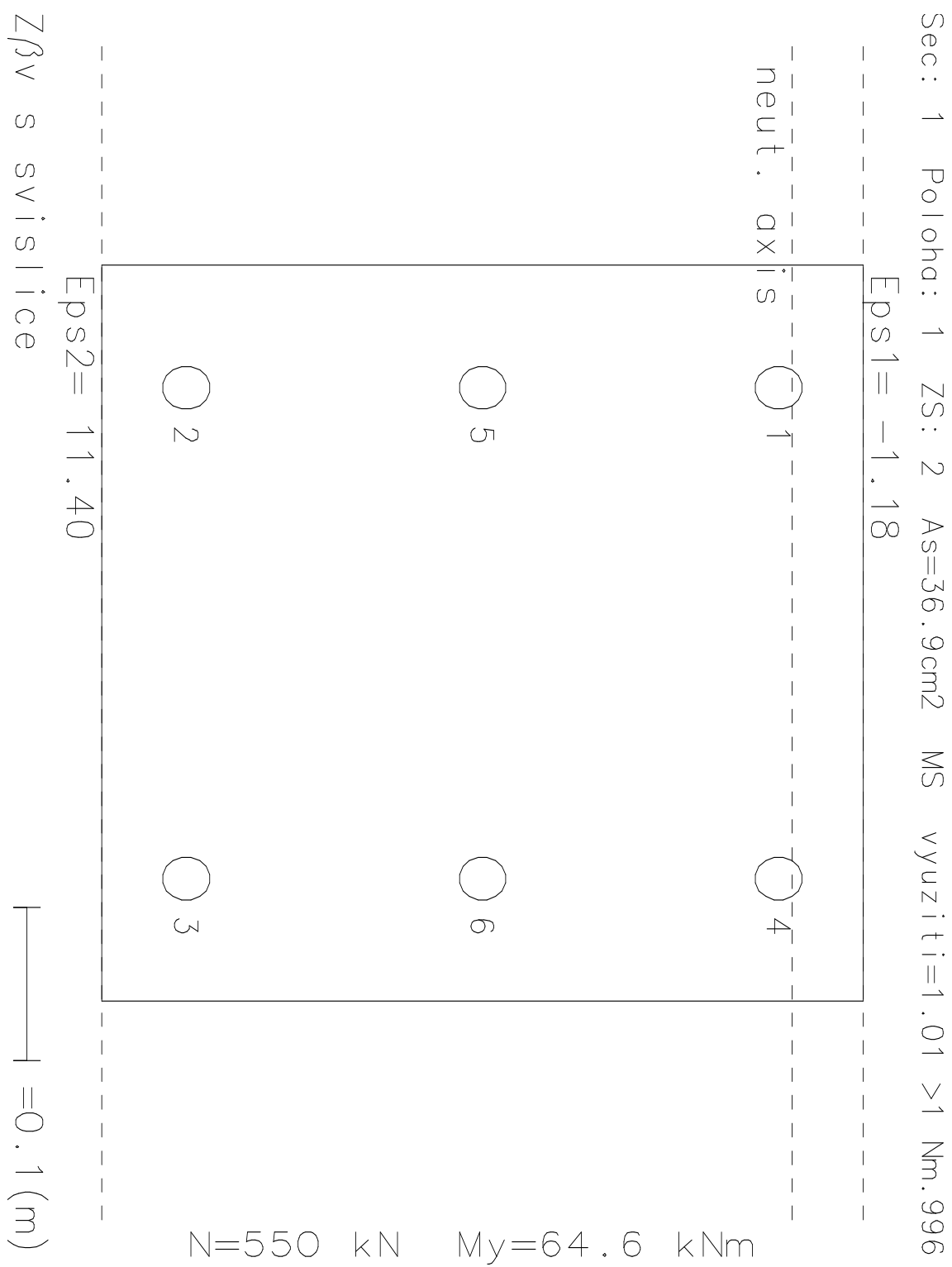
| Výztuž Č. | Eps.0 (o/oo) | y (m) | z (m) | ZS | Eps.s (o/oo) | Sigma N/mm2 |
|--------------|-----------------|----------|----------|----|-----------------|----------------|
| 1 | 6.2 | -0.160 | -0.175 | 1 | -0.081 | -16 |
| 2 | 6.2 | -0.160 | 0.175 | 1 | 10.000 | 243 |
| 3 | 6.2 | 0.160 | 0.175 | 1 | 10.000 | 243 |
| 4 | 6.2 | 0.160 | -0.175 | 1 | -0.081 | -16 |
| 5 | 6.2 | -0.160 | 0.000 | 1 | 4.960 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 1 | 4.960 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 2 | 0.217 | 43 |
| 2 | 6.2 | -0.160 | 0.175 | 2 | 10.000 | 243 |
| 3 | 6.2 | 0.160 | 0.175 | 2 | 10.000 | 243 |
| 4 | 6.2 | 0.160 | -0.175 | 2 | 0.217 | 43 |
| 5 | 6.2 | -0.160 | 0.000 | 2 | 5.109 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 2 | 5.109 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 3 | -0.136 | -27 |
| 2 | 6.2 | -0.160 | 0.175 | 3 | 10.000 | 243 |
| 3 | 6.2 | 0.160 | 0.175 | 3 | 10.000 | 243 |
| 4 | 6.2 | 0.160 | -0.175 | 3 | -0.136 | -27 |
| 5 | 6.2 | -0.160 | 0.000 | 3 | 4.932 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 3 | 4.932 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 4 | -0.021 | -4 |
| 2 | 6.2 | -0.160 | 0.175 | 4 | 10.000 | 243 |
| 3 | 6.2 | 0.160 | 0.175 | 4 | 10.000 | 243 |
| 4 | 6.2 | 0.160 | -0.175 | 4 | -0.021 | -4 |
| 5 | 6.2 | -0.160 | 0.000 | 4 | 4.990 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 4 | 4.990 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 5 | 0.002 | 0 |
| 2 | 6.2 | -0.160 | 0.175 | 5 | 10.000 | 243 |
| 3 | 6.2 | 0.160 | 0.175 | 5 | 10.000 | 243 |
| 4 | 6.2 | 0.160 | -0.175 | 5 | 0.002 | 0 |
| 5 | 6.2 | -0.160 | 0.000 | 5 | 5.001 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 5 | 5.001 | 243 |

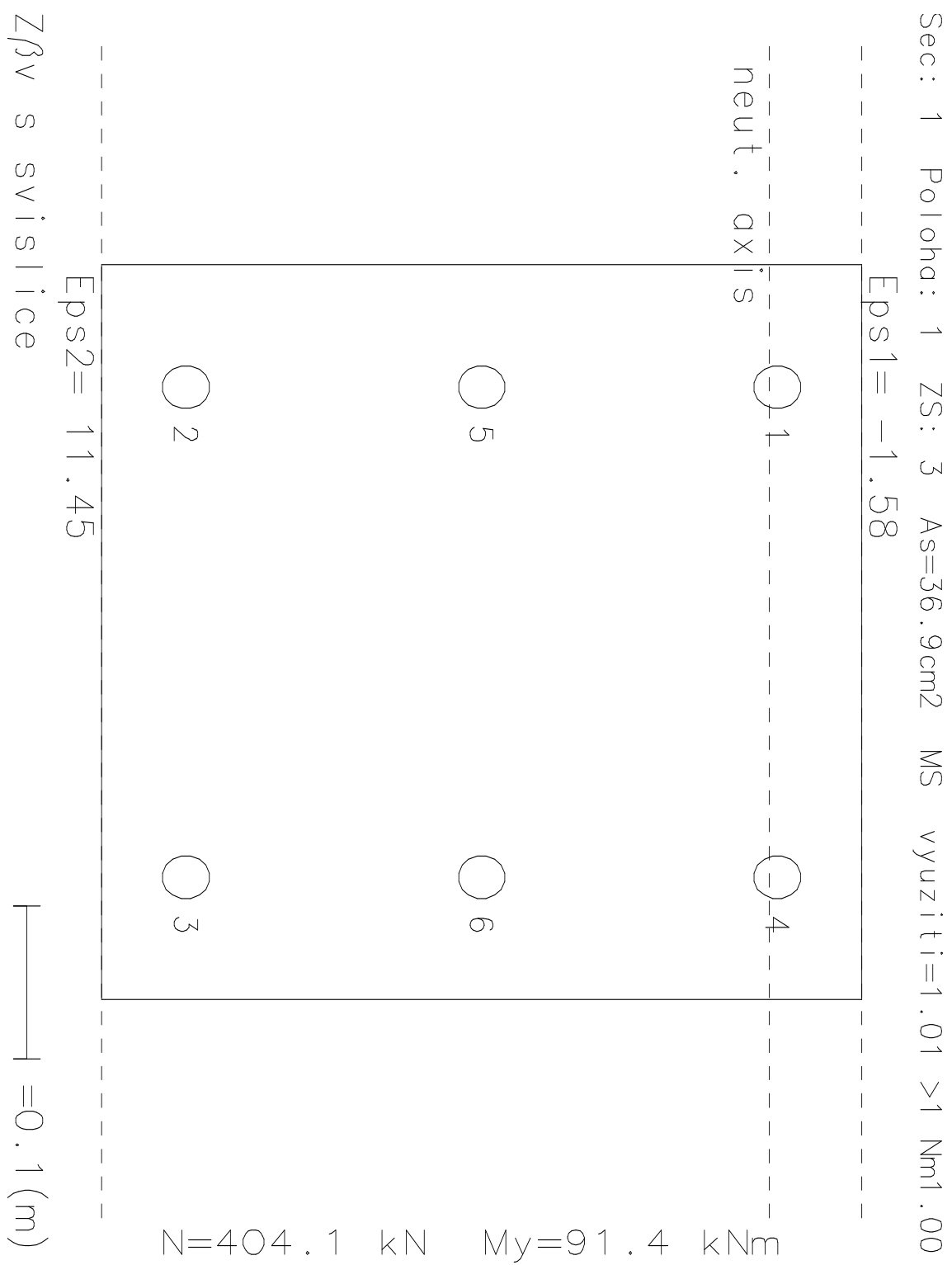


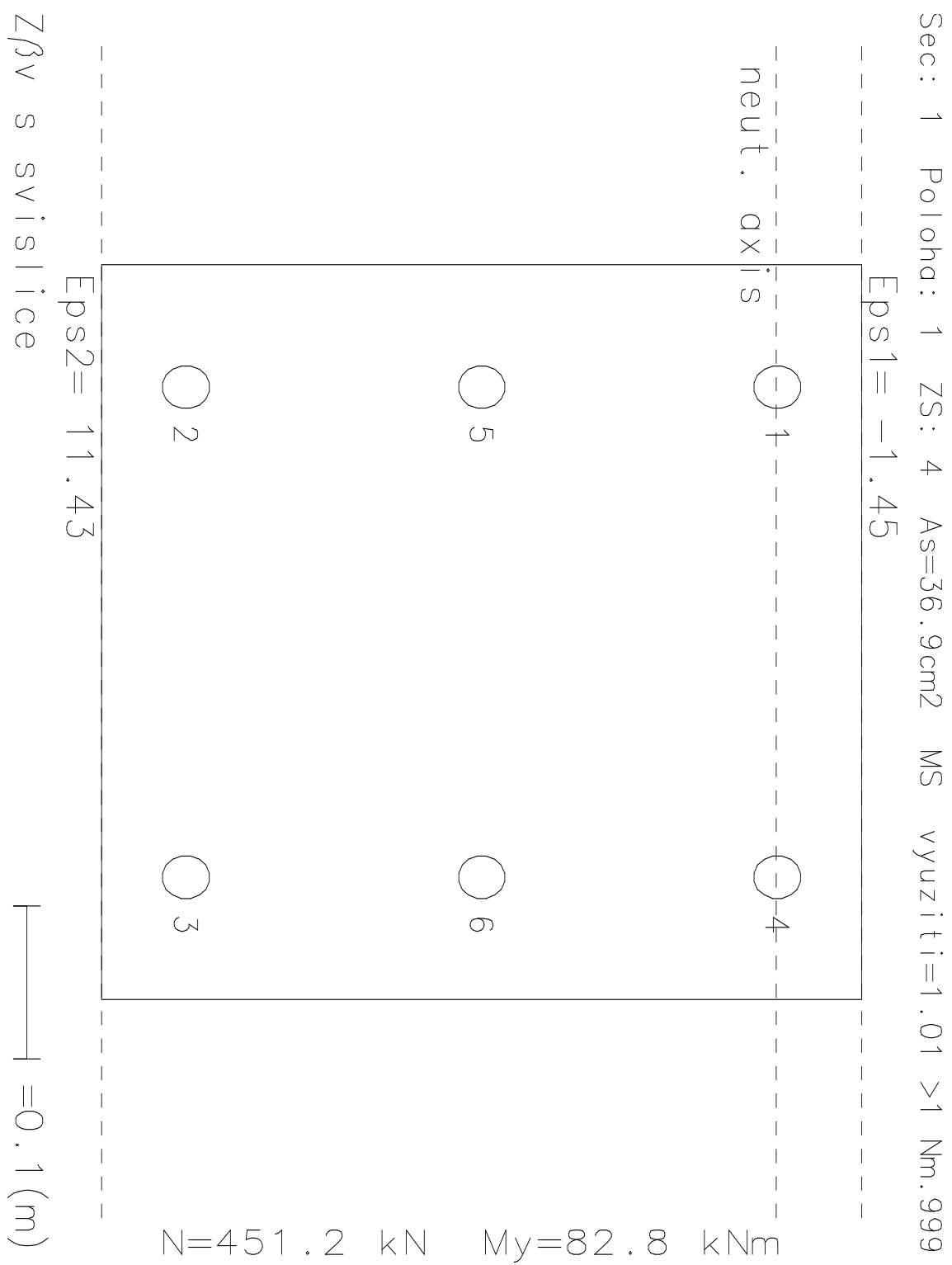
Výsledková grafika

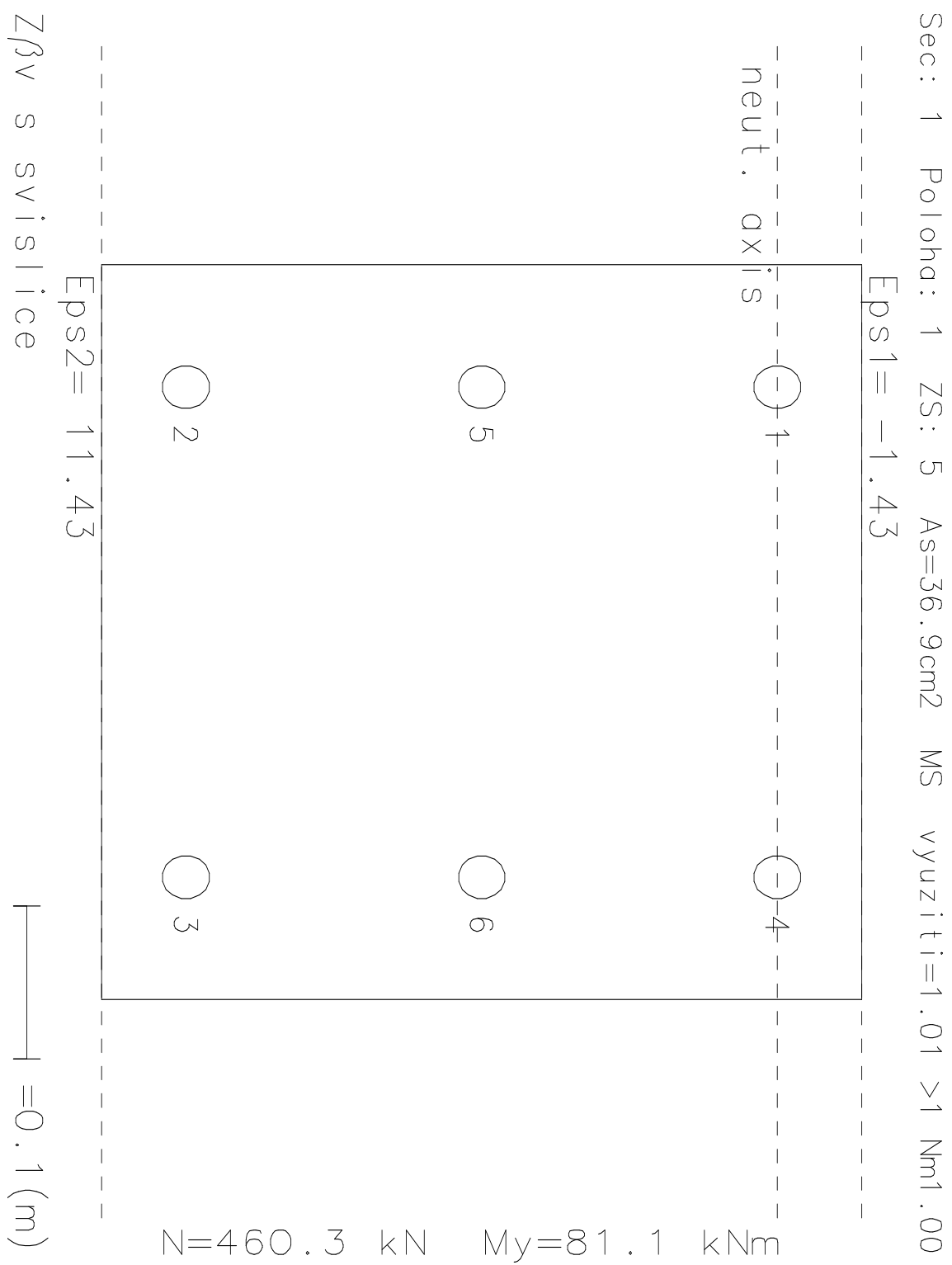








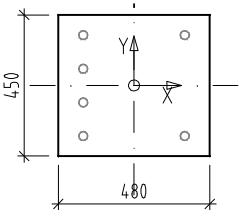




SVISLICE 3
Schéma

Průřezové charakteristiky

| | | |
|-----------------|----------|----------------|
| h | 0.450 | m |
| d | 0.480 | m |
| A | 0.216 | m ² |
| z _h | 0.225 | m |
| z _d | 0.225 | m |
| I _y | 0.003645 | m ⁴ |
| i _y | 0.130 | m |
| Wy _h | 0.0162 | m ³ |
| Wy _d | 0.0162 | m ³ |



bez vzpěru

c

1

Materiály
beton
výztuž

C20/25
6xØ28

MODEL 1 - Rámově spojený horní a dolní pás oblouku, zarámované svislice

| ZS | Zatížení | | | prut | | | |
|----|---|---------|-------|------|------|--------|--------|
| | | ZS | prvek | uzel | FX | My | |
| 1 | VLASTNÍ HMOTNOST | [Výslec | 1 | 1226 | 1227 | 137.27 | 1.54 |
| 2 | KONSTRUKCE VOZOVKY | [Výslec | 2 | 1226 | 1227 | 24.40 | 0.17 |
| 11 | zatížení pro norm zatížitelnost - rovnoměrné 2.5 | [Výslec | 11 | 1226 | 1227 | 22.59 | 0.16 |
| 23 | zatížení pro normální zatížitelnost - max M | [Výslec | 23 | 1226 | 1227 | 19.63 | -24.32 |
| 32 | zatížení pro normální zatížitelnost - max N | [Výslec | 32 | 1226 | 1227 | 53.37 | -3.91 |
| 28 | zatížení pro výhradní zatížitelnost - max M - 6NV | [Výslec | 28 | 1226 | 1227 | 12.07 | -11.95 |
| 40 | zatížení pro výhradní zatížitelnost - max N - 6NV | [Výslec | 40 | 1226 | 1227 | 20.93 | -3.04 |
| 42 | zatížení pro výjimečnou zatížitelnost - 9NV ve čtvrtině rozpětí | [Výslec | 42 | 1226 | 1227 | 10.18 | -5.55 |

1

$$\xi \cdot \gamma = 1.35 \cdot 0.85 = 1.1475$$
$$(M,N)_{Rd1} = 1.1475 \cdot (M,N)_{G1} + 1.35 \cdot \delta \cdot (M,N)_{q,b}$$
$$\delta \cdot (M,N)_{q,b} = \frac{(M,N)_{Rd1} - 1.1475 \cdot (M,N)_{G1}}{1.35}$$

$$\gamma = 1.35, \psi = 0.75$$
$$(M,N)_{Rd1} = 1.35 \cdot (M,N)_{G1} + 1.35 \cdot 0.75 \cdot \delta \cdot (M,N)_{q,b}$$
$$\delta \cdot (M,N)_{q,b} = \frac{(M,N)_{Rd1} - 1.35 \cdot (M,N)_{G1}}{1.35 \cdot 0.75}$$

Únosnost průřezu

Zbývá na zatížení vozidly

1

$$\delta \cdot (M,N)_{q,b}$$

Zbývá na zatížení vozidly

2

$$\delta \cdot (M,N)_{q,b}$$

| N | M |
|-------|-------|
| kN | kNm |
| 137.3 | 1.5 |
| 24.4 | 0.2 |
| 22.6 | 0.2 |
| 19.6 | -24.3 |
| 53.4 | -3.9 |
| 12.1 | -12.0 |
| 20.9 | -3.0 |
| 10.2 | -5.6 |

| Nrd | Mrd |
|-------|--------|
| kN | kNm |
| 363.4 | -98.9 |
| 898.6 | 0.0 |
| 299.5 | -110.4 |
| 590.9 | -57.0 |
| 368.5 | -97.9 |

Vn_M
Vn_N
Vr_M
Vr_N
Ve_1/4

| N | M |
|-------|-------|
| 131.8 | -74.7 |
| 528.2 | -1.5 |
| 84.4 | -83.2 |
| 300.3 | -43.7 |
| 135.5 | -74.0 |

Vn_M
Vn_N
Vr_M
Vr_N
Ve_1/4

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| 0.73 | 0.54 |
| 0.12 | 0.10 |
| 0.11 | 0.09 |
| -1.41 | 1.59 |
| 0.01 | 0.49 |
| -0.68 | 0.79 |
| -0.09 | 0.28 |
| -0.30 | 0.39 |

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| -4.42 | 7.79 |
| 4.16 | 4.16 |
| -5.43 | 8.20 |
| -0.78 | 6.25 |
| -4.34 | 7.75 |

| δ | | | N | M |
|------|-----|-----|-------|-------|
| 1.2 | 3NV | Va | 2.60 | 2.58 |
| 1.2 | 3NV | Va | 5.79 | |
| 1.25 | 3NV | Vrw | 5.60 | 5.57 |
| 1.25 | 3NV | Vrw | 11.48 | 11.48 |
| 1.05 | 9NV | Vew | 12.68 | 12.69 |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 34.4 | t |
| Zatížitelnost normální Vn | 77.3 | t |
| Zatížitelnost výhradní Vr | 55.7 | t |
| Zatížitelnost výhradní Vr | 114.8 | t |
| Zatížitelnost výjimečná Ve | 126.8 | t |

| N | M |
|-------|--------|
| 143.3 | -100.0 |
| 671.9 | -2.3 |
| 80.2 | -111.3 |
| 368.0 | -58.6 |
| 148.4 | -99.0 |

Vn_M
Vn_N
Vr_M
Vr_N
Ve_1/4

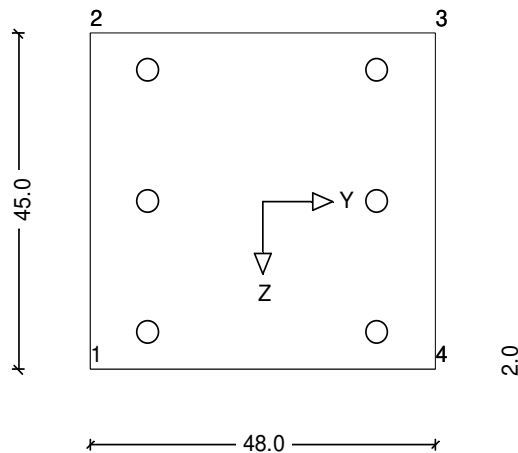
| δ | | | N | M |
|------|-----|-----|-------|-------|
| 1.2 | 3NV | Va | 2.83 | 3.45 |
| 1.2 | 3NV | Va | 7.37 | |
| 1.25 | 6NV | Vrw | 5.32 | 7.45 |
| 1.25 | 6NV | Vrw | 14.06 | 15.39 |
| 1.05 | 9NV | Vew | 13.88 | 16.98 |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 37.7 | t |
| Zatížitelnost normální Vn | 98.3 | t |
| Zatížitelnost výhradní Vr | 53.2 | t |
| Zatížitelnost výhradní Vr | 140.6 | t |
| Zatížitelnost výjimečná Ve | 138.8 | t |



Obloukový most

Soubor: Svislice3 fy 280.zwv



Bereich: Závěs svislice, Querschnitt: SV

RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Závěs svislice

Soubor: ZWAX.ZWA

Protokol zadání

* Mezní stav únosnosti pro ohyb s normálovou silou CSN EN 1992-1-1

Počítá se s průřezem netto tlačené zóny betonu

| Materiál - č. | Pevnost (N/mm ²) | E-Modul (N/mm ²) | Dov. přetvoření (o/oo) | |
|---------------|------------------------------|------------------------------|------------------------|-------------|
| | | | hrana | střed |
| Beton | $f_{c,d} = 10.7$ | $E_c = 30000.$ | tlak | -3.50 -2.00 |
| Výztuž 2 | $f_{y,d} = 243.5$ | $E_s = 200000.$ | tah | 10.00 1.22 |
| Předp.kabel 3 | $f_{p,d} = 1304.3$ | $E_p = 195000.$ | | |

Průřez: SV

Výpočet jako netlačený prvek.

Počítá se vzdálenost vnější tahové výztuže od okraje

Polygonální dílčí průřez 1
Beton (=materiál 1)

Souřadnice

| y (m) | z (m) | Bod |
|--------|--------|-----|
| -0.240 | 0.225 | 1 |
| -0.240 | -0.225 | 2 |
| 0.240 | -0.225 | 3 |
| 0.240 | 0.225 | 4 |



Bodová, úseková, kruhová výztuž

| Č. Druh | Sada | Č.-mat. | Průřez | | As | Bod 1 | | Bod 2 | | zrca- dlit |
|---------|------|---------|--------|-----|-----|--------|--------|--------|--------|---------------|
| | | | min | max | | y1 (m) | z1 (m) | y2 (m) | z2 (m) | |
| 1 Bod | 1 | 2 | 6.2 | 6.2 | cm2 | -0.160 | -0.175 | | | y, z, y |
| 5 Bod | 1 | 2 | 6.2 | 6.2 | cm2 | -0.160 | 0.000 | | | na z |

Poloha: SV 3 - 1226

| ZS | NS (kN) | MSy (kNm) | MSz (kNm) |
|----|---------|-----------|-----------|
| 1 | 359.9 | -97.9 | 0.0 |
| 2 | 898.0 | 0.0 | 0.0 |
| 3 | 298.5 | -110.0 | 0.0 |
| 4 | 590.0 | -56.9 | 0.0 |
| 5 | 368.8 | -98.0 | 0.0 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Závěs svislice

Výsledek**Průřez: SV Poloha: SV 3 - 1226**

Průř. charakteristiky - brutto $I_1 = 0.003645 \text{ m}^4$ $y_s = 0.0000 \text{ m}$
 $A = 0.2160 \text{ m}^2$ $\alpha = 0.00$ $I_2 = 0.004147 \text{ m}^4$ $z_s = 0.0000 \text{ m}$

Výztuž (S=Sada M=Materiál)

| As | min.As | | max.As | stáv.As | | Souřadnice (m) | | | | Eps.0 | | |
|------|--------|---|--------|---------|-------|----------------|----------------------------|--------|----|-------|------|--|
| Č. | S | M | (cm2) | (cm2) | (cm2) | cm2/m | y1 | z1 | y2 | z2 | o/oo | |
| 1 | 1 | 2 | 6.15 | 6.15 | 6.15 | | -0.160 | -0.175 | | | | |
| 2 | 1 | 2 | 6.15 | 6.15 | 6.15 | | -0.160 | 0.175 | | | | |
| 3 | 1 | 2 | 6.15 | 6.15 | 6.15 | | 0.160 | 0.175 | | | | |
| 4 | 1 | 2 | 6.15 | 6.15 | 6.15 | | 0.160 | -0.175 | | | | |
| 5 | 1 | 2 | 6.15 | 6.15 | 6.15 | | -0.160 | 0.000 | | | | |
| 6 | 1 | 2 | 6.15 | 6.15 | 6.15 | | 0.160 | 0.000 | | | | |
| Suma | | | 36.90 | 36.91 | 36.91 | | nutná.As/Abrutto = 1.709 % | | | | | |

Návrh na MSÚ As = 36.9 cm²

| ZS | Vnitřní účinky na MSÚ | | | Přetvoření (o/oo) | | | Beta | Gama | Využití |
|----|-----------------------|----------|----------|-------------------|--------|-------|-------|-------|---------|
| | N (kN) | My (kNm) | Mz (kNm) | Eps.1 | Eps.2 | Eps.s | (°) | | |
| 1 | 363. | -99. | 0. | -1.697 | 11.462 | 10.00 | 180.0 | 1.000 | 0.990 |
| 2 | 899. | 0. | 0. | 1.217 | 1.217 | 1.22 | 0.0 | 1.000 | 0.999 |
| 3 | 300. | -110. | 0. | -1.874 | 11.484 | 10.00 | 180.0 | 1.000 | 0.997 |
| 4 | 591. | -57. | 0. | -1.065 | 11.383 | 10.00 | 180.0 | 1.000 | 0.998 |
| 5 | 369. | -98. | 0. | -1.683 | 11.460 | 10.00 | 180.0 | 1.000 | 1.001 |

| ZS | ----Tlaková výslednice----- | | | | -----Tahová výslednice----- | | | | Rameno |
|----|-----------------------------|-------|-------|---------------------|-----------------------------|-------|--------|---------------------|--------|
| | (kN) | y (m) | z (m) | A (m ²) | (kN) | y (m) | z (m) | A (m ²) | (m) |
| 1 | -236. | 0.000 | 0.197 | 0.0279 | 599. | 0.000 | -0.087 | 0.00246 | 0.2846 |
| 2 | | | | | 899. | 0.000 | 0.000 | 0.00369 | |
| 3 | -300. | 0.000 | 0.193 | 0.0303 | 599. | 0.000 | -0.087 | 0.00246 | 0.2810 |
| 4 | -86. | 0.000 | 0.211 | 0.0185 | 677. | 0.000 | -0.057 | 0.00369 | 0.2687 |
| 5 | -231. | 0.000 | 0.197 | 0.0277 | 599. | 0.000 | -0.087 | 0.00246 | 0.2849 |



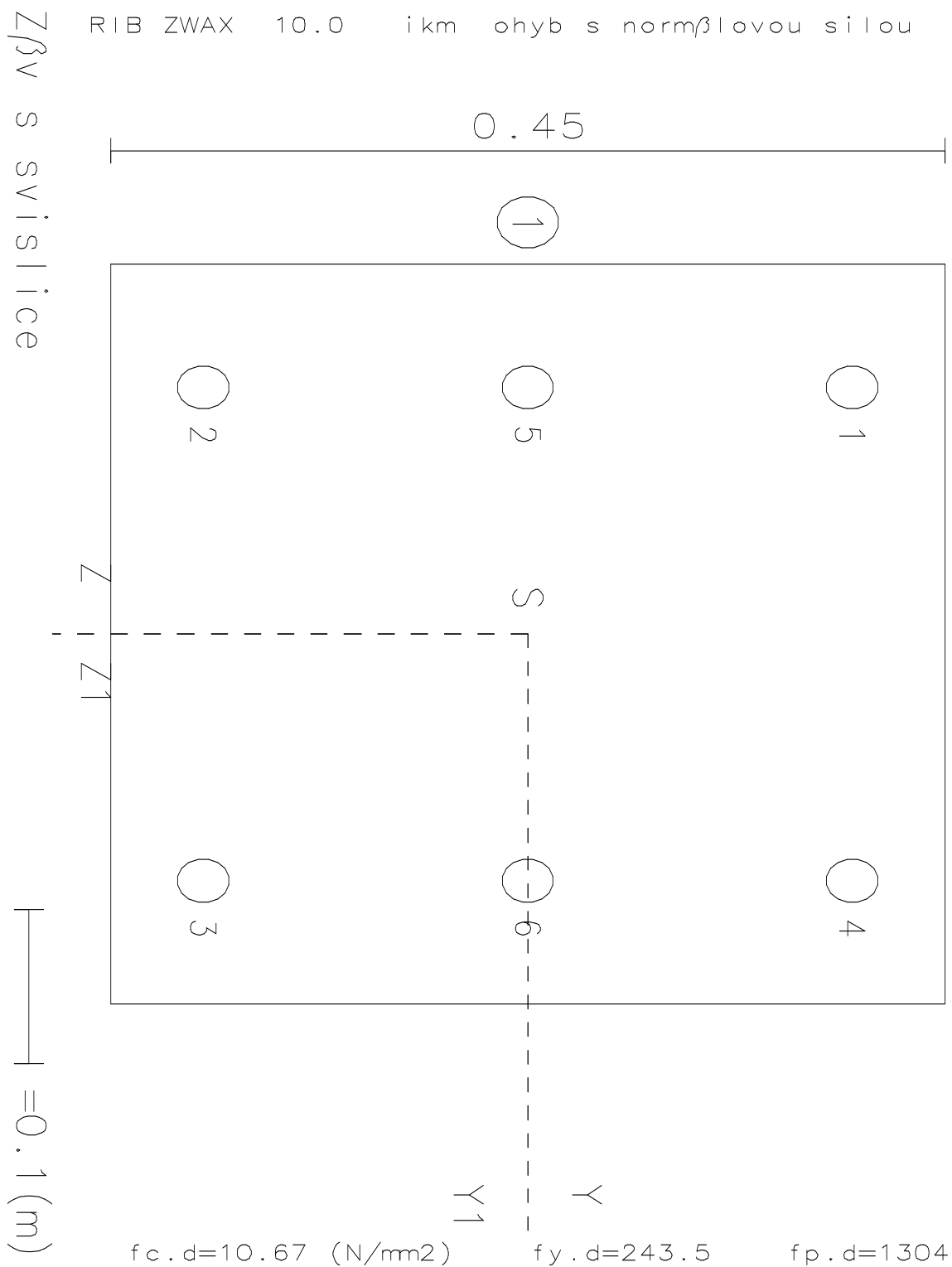
RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Závěs svislice

| Výztuž Č. | Eps.0 (o/oo) | y (m) | z (m) | ZS | Eps.s (o/oo) | Sigma N/mm2 |
|--------------|-----------------|----------|----------|----|-----------------|----------------|
| 1 | 6.2 | -0.160 | -0.175 | 1 | 10.000 | 243 |
| 2 | 6.2 | -0.160 | 0.175 | 1 | -0.235 | -47 |
| 3 | 6.2 | 0.160 | 0.175 | 1 | -0.235 | -47 |
| 4 | 6.2 | 0.160 | -0.175 | 1 | 10.000 | 243 |
| 5 | 6.2 | -0.160 | 0.000 | 1 | 4.883 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 1 | 4.883 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 2 | 1.217 | 243 |
| 2 | 6.2 | -0.160 | 0.175 | 2 | 1.217 | 243 |
| 3 | 6.2 | 0.160 | 0.175 | 2 | 1.217 | 243 |
| 4 | 6.2 | 0.160 | -0.175 | 2 | 1.217 | 243 |
| 5 | 6.2 | -0.160 | 0.000 | 2 | 1.217 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 2 | 1.217 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 3 | 10.000 | 243 |
| 2 | 6.2 | -0.160 | 0.175 | 3 | -0.390 | -78 |
| 3 | 6.2 | 0.160 | 0.175 | 3 | -0.390 | -78 |
| 4 | 6.2 | 0.160 | -0.175 | 3 | 10.000 | 243 |
| 5 | 6.2 | -0.160 | 0.000 | 3 | 4.805 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 3 | 4.805 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 4 | 10.000 | 243 |
| 2 | 6.2 | -0.160 | 0.175 | 4 | 0.318 | 64 |
| 3 | 6.2 | 0.160 | 0.175 | 4 | 0.318 | 64 |
| 4 | 6.2 | 0.160 | -0.175 | 4 | 10.000 | 243 |
| 5 | 6.2 | -0.160 | 0.000 | 4 | 5.159 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 4 | 5.159 | 243 |
| | | | | | | |
| 1 | 6.2 | -0.160 | -0.175 | 5 | 10.000 | 243 |
| 2 | 6.2 | -0.160 | 0.175 | 5 | -0.222 | -44 |
| 3 | 6.2 | 0.160 | 0.175 | 5 | -0.222 | -44 |
| 4 | 6.2 | 0.160 | -0.175 | 5 | 10.000 | 243 |
| 5 | 6.2 | -0.160 | 0.000 | 5 | 4.889 | 243 |
| 6 | 6.2 | 0.160 | 0.000 | 5 | 4.889 | 243 |



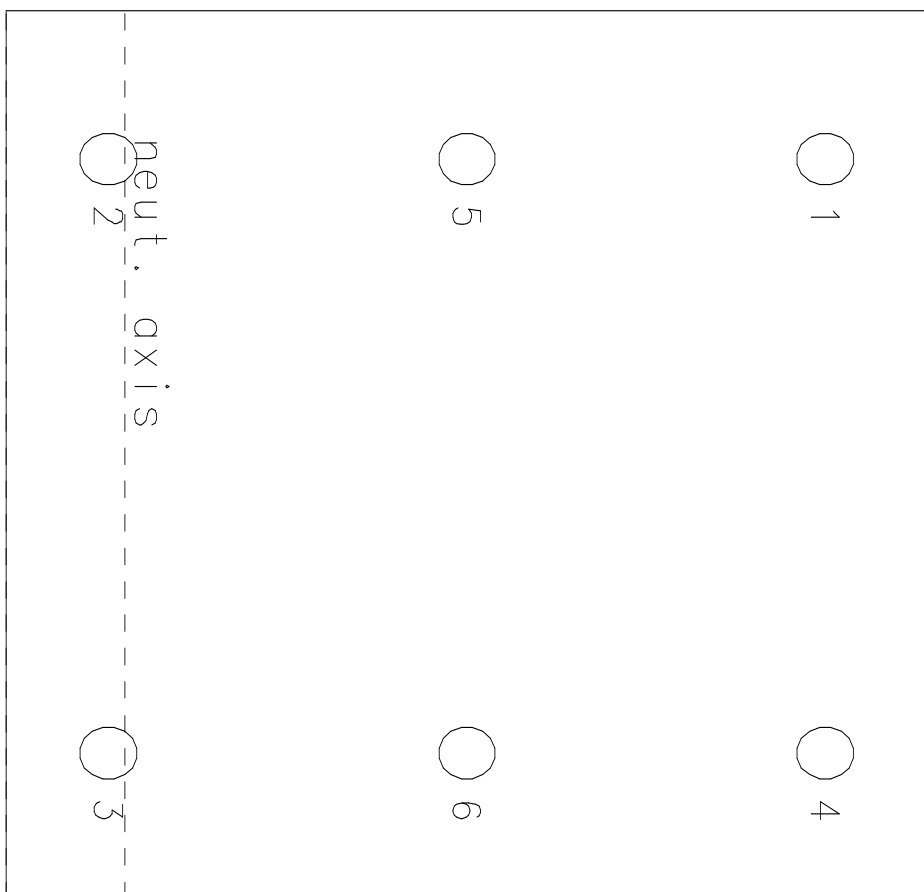
Výsledková grafika





Sec: 1 Poloha: 1 ZS: 1 $A_s=36.91 \text{ cm}^2$ MS využití=1.01 >1 Nm.990

$E_{ps2}=11.46$



$N=363.4 \text{ kN}$ $M_y=-98.9 \text{ kNm}$

$E_{ps1}=-1.70$

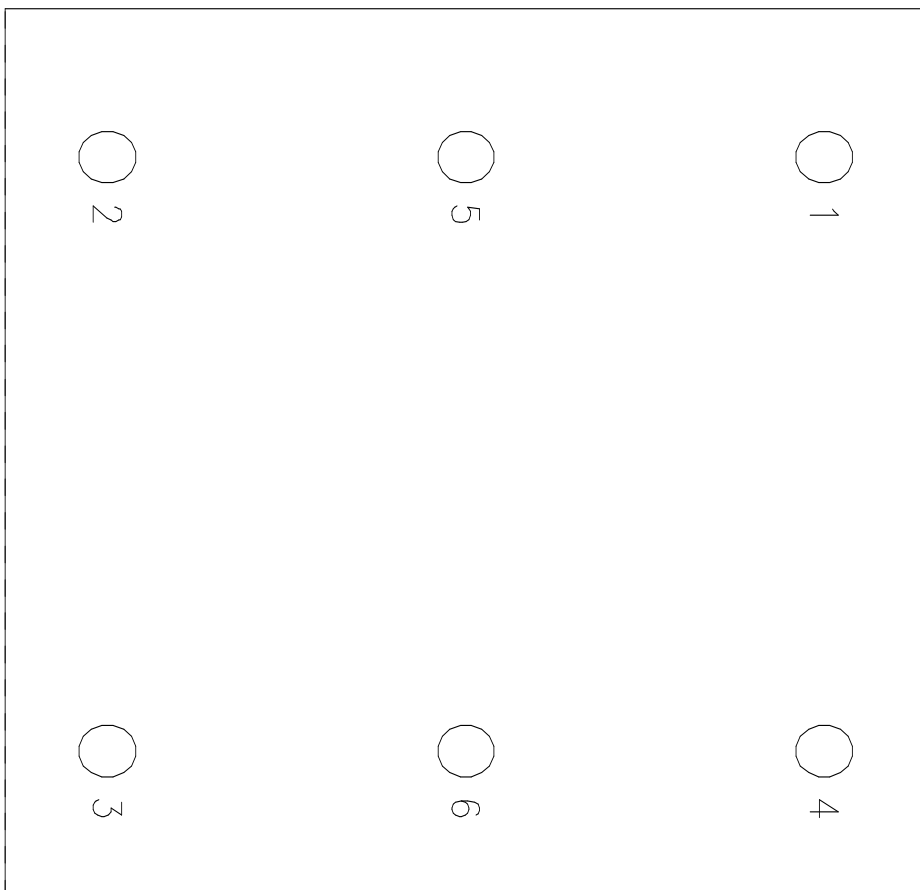
Zřív svislice

$l=0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 2 $A_s=36.91 \text{ cm}^2$ MS vyuziti=1.01 >1 Nm.999

$E_{ps1}=1.22$



$N=898.6 \text{ kN}$ $M_y=0 \text{ kNm}$

$E_{ps2}=1.22$

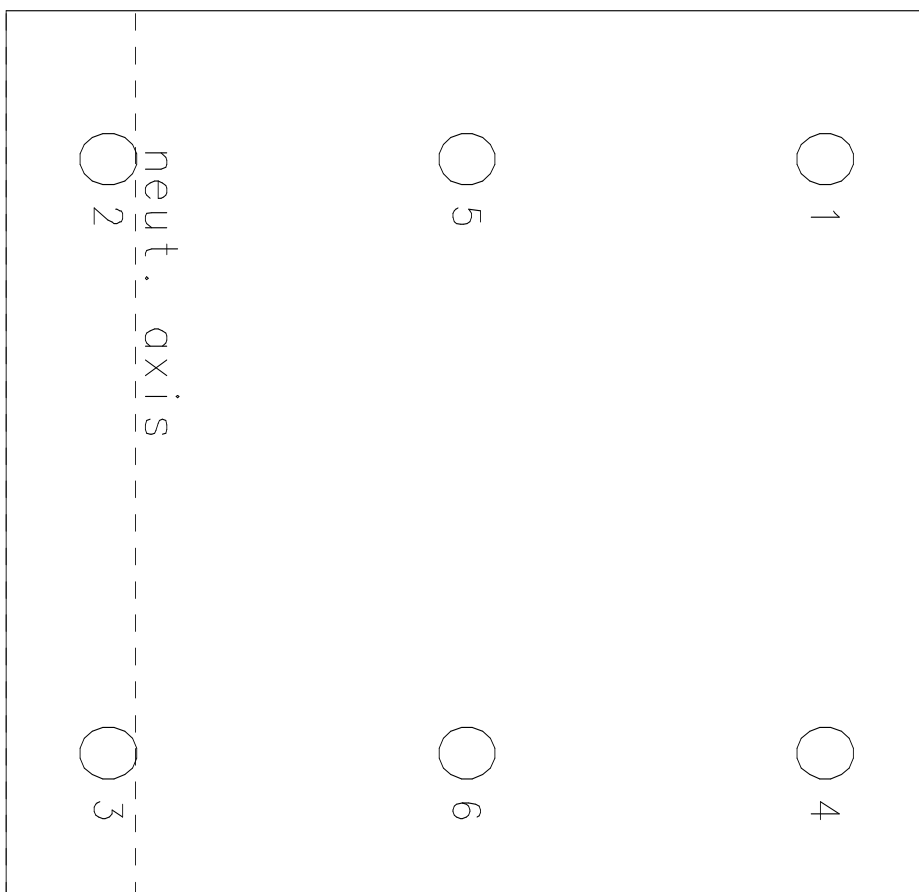
Z β_v s svislíce

$l=0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 3 $A_s=36.91 \text{ cm}^2$ MS využití=1.01 >1 Nm.997

$$E_{ps2}=11.48$$



$$N=299.5 \text{ kN} \quad M_y=-110.4 \text{ kNm}$$

$$E_{ps1}=-1.87$$

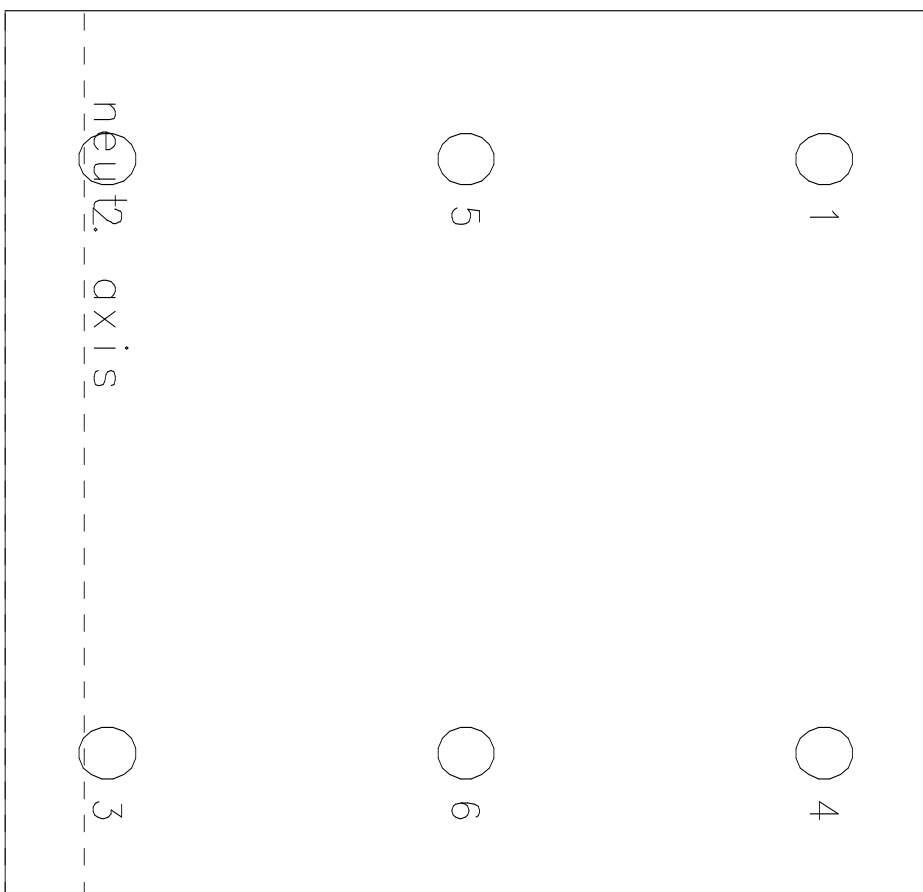
Zřív svislice

$$l=0.1 \text{ (m)}$$



Sec: 1 Poloha: 1 ZS: 4 $A_s=36.91 \text{ cm}^2$ MS využití=1.01 >1 Nm.998

$E_{ps2}=11.38$



$N=590.9 \text{ kN}$ $M_y=-57 \text{ kNm}$

$E_{ps1}=-1.07$

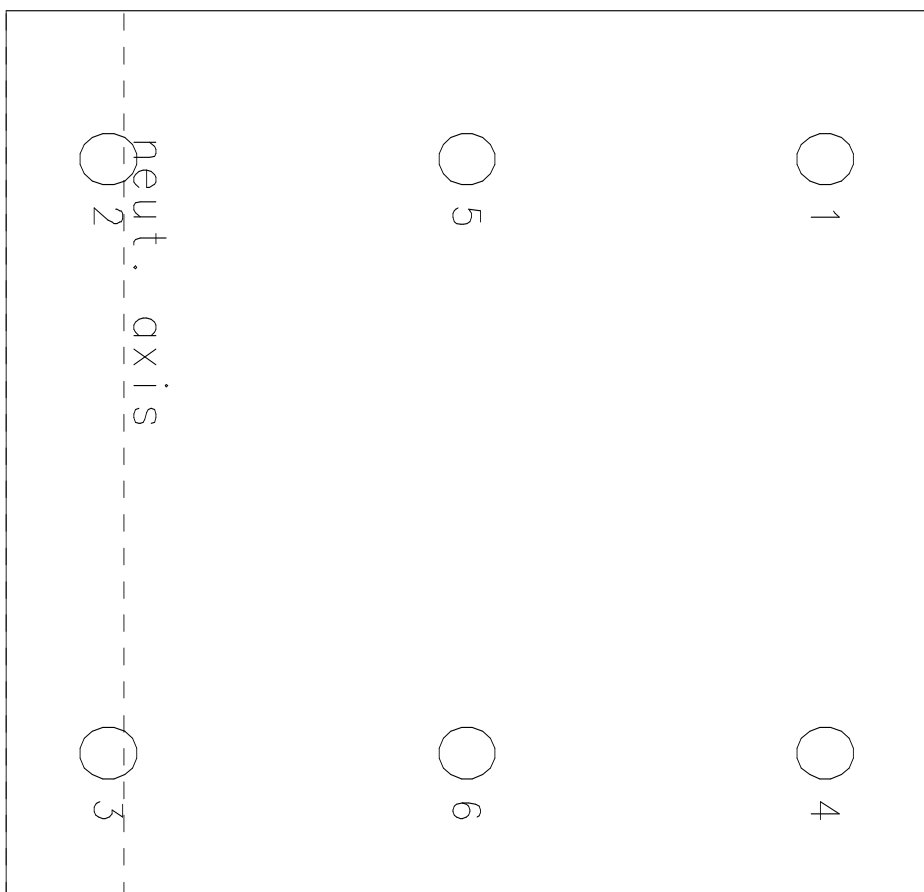
Zβv s svíslíce

$l=0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 5 $A_s=36.91 \text{ cm}^2$ MS využití=1.01 >1 Nm1.00

$E_{ps2}=11.46$



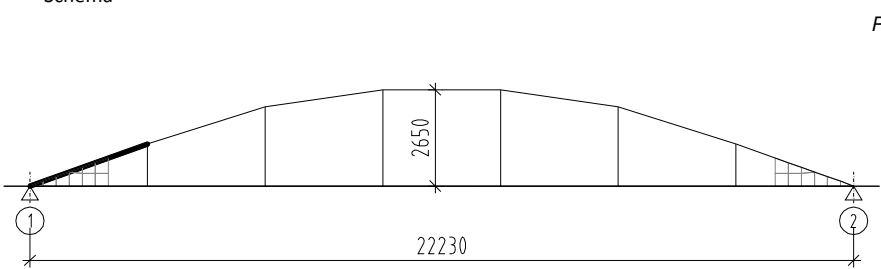
$N=368.5 \text{ kN}$ $M_y=-97.9 \text{ kNm}$

$E_{ps1}=-1.68$

$Z_{\beta v}$ s svíslíce

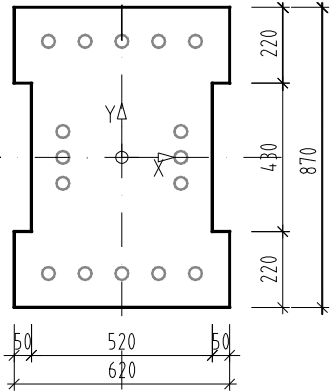
$l=0.1 \text{ (m)}$

HORNÍ PÁS
Schéma



Průřezové charakteristiky

| | | |
|-------|-----------|----------------|
| | 0.870 | m |
| | 0.620 | m |
| | 0.4964 | m ² |
| | 0.435 | m |
| | 0.435 | m |
| | 0.0333601 | m ⁴ |
| | 0.259 | m |
| I_h | 0.0767 | m ³ |
| I_d | 0.0767 | m ³ |



Vzpěr

| | |
|---|--------|
| S | 22.9 m |
| c | 1 |

Materiály
beton
výztuž

C20/25
16xØ37

MODEL 1 - Rámově spojený horní a dolní pás oblouku, zarámované svislice

| ZS | Zatížení | | ZS | prut | uzel | FX | My |
|----|---|----------|----|------|------|----------|---------|
| | | | | | | kN | kNm |
| 1 | VLASTNÍ HMOTNOST | [Výslec] | 1 | 9 | 10 | -1297.07 | -177.28 |
| 2 | KONSTRUKCE VOZOVKY | [Výslec] | 2 | 9 | 10 | -167.90 | -24.32 |
| 11 | zatížení pro norm zatížitelnost - rovnoměrné 2.5 | [Výslec] | 11 | 9 | 10 | -155.46 | -22.60 |
| 16 | zatížení pro normální zatížitelnost - max M | [Výslec] | 16 | 9 | 10 | -155.26 | -55.38 |
| 20 | zatížení pro normální zatížitelnost - max N | [Výslec] | 20 | 9 | 10 | -164.73 | -42.29 |
| 56 | zatížení pro výhradní zatížitelnost - max M | [Výslec] | 56 | 9 | 10 | -89.61 | -33.35 |
| 60 | zatížení pro výhradní zatížitelnost - max N | [Výslec] | 60 | 9 | 10 | -104.28 | -29.66 |
| 41 | zatížení pro výjimečnou zatížitelnost - 9NV v polovině rozpětí | [Výslec] | 41 | 9 | 10 | -58.39 | -4.00 |
| 42 | zatížení pro výjimečnou zatížitelnost - 9NV ve čtvrtině rozpětí | [Výslec] | 42 | 9 | 10 | -61.69 | -12.38 |

| N | M |
|---------|--------|
| kN | kNm |
| -1297.1 | -177.3 |
| -167.9 | -24.3 |
| -155.5 | -22.6 |
| -155.3 | -55.4 |
| -164.7 | -42.3 |
| -89.6 | -33.4 |
| -104.3 | -29.7 |
| -58.4 | -4.0 |
| -61.7 | -12.4 |

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| -4.92 | -0.30 |
| -0.66 | -0.02 |
| -0.61 | -0.02 |
| -1.03 | 0.41 |
| -0.88 | 0.22 |
| -0.62 | 0.25 |
| -0.60 | 0.18 |
| -0.17 | -0.07 |
| -0.29 | 0.04 |

| Nrd | Mrd |
|---------|---------|
| kN | kNm |
| -4822.0 | -1019.0 |
| -5160.0 | -935.7 |
| -4181.0 | -1136.0 |
| -4618.0 | -1066.0 |
| -6504.0 | -561.6 |
| -5176.0 | -931.7 |

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| -23.00 | 3.57 |
| -22.60 | 1.81 |
| -23.24 | 6.39 |
| -23.20 | 4.60 |
| -20.43 | -5.78 |
| -22.58 | 1.72 |

Únosnost průřezu

| | | |
|--------|---------|---------|
| Vn_M | -4822.0 | -1019.0 |
| Vn_N | -5160.0 | -935.7 |
| Vr_M | -4181.0 | -1136.0 |
| Vr_N | -4618.0 | -1066.0 |
| Ve_1/2 | -6504.0 | -561.6 |
| Ve_1/4 | -5176.0 | -931.7 |

1

$$\xi \cdot \gamma = 1.35 \cdot 0.85 = 1.1475$$
$$(M, N)_{Rd1} = 1.1475 \cdot (M, N)_{G1} + 1.35 \cdot \delta \cdot (M, N)_{q,b}$$
$$\delta \cdot (M, N)_{q,b} = \frac{(M, N)_{Rd1} - 1.1475 \cdot (M, N)_{G1}}{1.35}$$

2

$$\gamma = 1.35, \psi = 0.75$$
$$(M, N)_{Rd1} = 1.35 \cdot (M, N)_{G1} + 1.35 \cdot 0.75 \cdot \delta \cdot (M, N)_{q,b}$$
$$\delta \cdot (M, N)_{q,b} = \frac{(M, N)_{Rd1} - 1.35 \cdot (M, N)_{G1}}{1.35 \cdot 0.75}$$

Zbývá na zatížení vozidly

1

$$\delta \cdot (M, N)_{q,b}$$

| | N | M |
|--------|---------|--------|
| Vn_M | -2326.6 | -583.5 |
| Vn_N | -2577.0 | -521.7 |
| Vr_M | -1851.8 | -670.1 |
| Vr_N | -2175.5 | -618.3 |
| Ve_1/2 | -3572.5 | -244.6 |
| Ve_1/4 | -2588.8 | -518.8 |

| δ | | | N | M |
|------|-----|-----|-------|-------|
| 1.2 | 3NV | Va | 6.24 | 6.23 |
| 1.2 | 3NV | Va | 6.71 | 6.70 |
| 1.25 | 6NV | Vrw | 16.53 | 16.07 |
| 1.25 | 6NV | Vrw | 16.69 | 16.67 |
| 1.05 | 9NV | Vew | 58.27 | 58.26 |
| 1.05 | 9NV | Vew | 39.97 | 39.92 |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 83.1 | t |
| Zatížitelnost normální Vn | 89.3 | t |
| Zatížitelnost výhradní Vr | 160.7 | t |
| Zatížitelnost výhradní Vr | 166.7 | t |
| Zatížitelnost výjimečná Ve | 582.6 | t |
| Zatížitelnost výjimečná Ve | 399.2 | t |

Zbývá na zatížení vozidly

2

$$\delta \cdot (M, N)_{q,b}$$

| | N | M |
|--------|---------|--------|
| Vn_M | -2809.2 | -737.6 |
| Vn_N | -3143.0 | -655.3 |
| Vr_M | -2176.1 | -853.2 |
| Vr_N | -2607.7 | -784.0 |
| Ve_1/2 | -4470.4 | -285.9 |
| Ve_1/4 | -3158.8 | -651.4 |

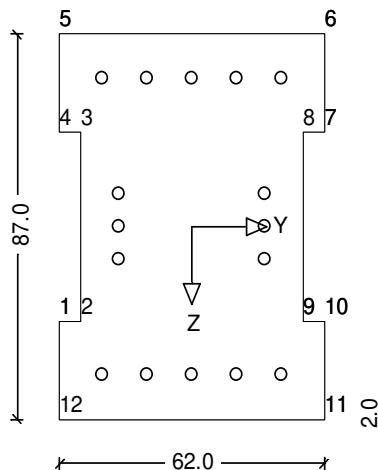
| δ | | | N | M |
|------|-----|-----|-------|-------|
| 1.2 | 3NV | Va | 7.53 | 7.88 |
| 1.2 | 3NV | Va | 8.18 | 8.42 |
| 1.25 | 6NV | Vrw | 19.43 | 20.46 |
| 1.25 | 6NV | Vrw | 20.01 | 21.14 |
| 1.05 | 9NV | Vew | 72.92 | 68.07 |
| 1.05 | 9NV | Vew | 48.77 | 50.12 |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 100.5 | t |
| Zatížitelnost normální Vn | 109.1 | t |
| Zatížitelnost výhradní Vr | 194.3 | t |
| Zatížitelnost výhradní Vr | 200.1 | t |
| Zatížitelnost výjimečná Ve | 680.7 | t |
| Zatížitelnost výjimečná Ve | 487.7 | t |



Obloukový most

Soubor: Horní pás.zwv



Bereich: Horní pás, Querschnitt: HP

RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Horní pás

Soubor: ZWAX.ZWA

Protokol zadání

* Mezní stav únosnosti pro ohyb s normálovou silou CSN EN 1992-1-1

Počítá se s průřezem netto tlačené zóny betonu

| Materiál - č. | Pevnost (N/mm ²) | E-Modul (N/mm ²) | Dov.přetvoření (o/oo) | |
|---------------|------------------------------|------------------------------|-----------------------|-------------|
| | | | hrana | střed |
| Beton | $f_{c,d} = 10.7$ | $E_c = 30000.$ | tlak | -3.50 -2.00 |
| Výztuž 2 | $f_{y,d} = 182.6$ | $E_s = 200000.$ | tah | 10.00 0.91 |
| Předp.kabel 3 | $f_{p,d} = 1304.3$ | $E_p = 195000.$ | | |

Průřez: HP

Výpočet jako netlačený prvek.

Počítá se vzdálenost vnější tahové výztuže od okraje

Polygonální dílčí průřez 1
Beton (=materiál 1)

Souřadnice

| y (m) | z (m) | Bod |
|--------|--------|-----|
| -0.310 | 0.215 | 1 |
| -0.260 | 0.215 | 2 |
| -0.260 | -0.215 | 3 |
| -0.310 | -0.215 | 4 |
| -0.310 | -0.435 | 5 |



| | | |
|--------|--------|----|
| 0.310 | -0.435 | 6 |
| 0.310 | -0.215 | 7 |
| 0.260 | -0.215 | 8 |
| 0.260 | 0.215 | 9 |
| 0.310 | 0.215 | 10 |
| 0.310 | 0.435 | 11 |
| -0.310 | 0.435 | 12 |

Bodová, úseková, kruhová výztuž

| Č. Druh | Sada | Č.-mat. | Průřez | | As | Bod 1 | | Bod 2 | | zrca- dlit |
|---------|------|---------|--------|------|-----|--------|--------|--------|--------|---------------|
| | | | min | max | | y1 (m) | z1 (m) | y2 (m) | z2 (m) | |
| 1 Bod | 1 | 2 | 10.8 | 10.8 | cm2 | -0.211 | -0.336 | | | y, z, y |
| 5 Bod | 1 | 2 | 10.8 | 10.8 | cm2 | -0.106 | -0.336 | | | y, z, y |
| 9 Bod | 1 | 2 | 10.8 | 10.8 | cm2 | 0.000 | -0.336 | | | na y |
| 11 Bod | 1 | 2 | 10.8 | 10.8 | cm2 | -0.170 | 0.000 | | | na z |
| 13 Bod | 1 | 2 | 10.8 | 10.8 | cm2 | -0.170 | 0.075 | | | y, z, y |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Horní pás

Poloha: 9

| ZS | NS (kN) | MSy (kNm) | MSz (kNm) |
|----|---------|-----------|-----------|
| 1 | -4802.0 | -1015.0 | 0.0 |
| 2 | -5156.0 | -935.0 | 0.0 |
| 3 | -4110.0 | -1135.0 | 0.0 |
| 4 | -4602.0 | -1062.0 | 0.0 |
| 5 | -6497.0 | -561.0 | 0.0 |
| 6 | -5161.0 | -929.0 | 0.0 |

Výsledek

Průřez: HP Poloha: 9

Průř. charakteristiky - brutto I1 = 0.033360 m4 ys = 0.0000 m
A = 0.4964 m2 Alfa = 0.00 I2 = 0.013777 m4 zs = 0.0000 m

Výztuž (S=Sada M=Materiál)

| As | min.As | | max.As | stáv.As | | Souřadnice (m) | | | Eps.0 |
|------|--------|---|--------|---------|-------------|----------------------------|--------|----|---------|
| Č. | S | M | (cm2) | (cm2) | (cm2) cm2/m | y1 | z1 | y2 | z2 o/oo |
| 1 | 1 | 2 | 10.75 | 10.75 | 10.75 | -0.211 | -0.336 | | |
| 2 | 1 | 2 | 10.75 | 10.75 | 10.75 | -0.211 | 0.336 | | |
| 3 | 1 | 2 | 10.75 | 10.75 | 10.75 | 0.211 | 0.336 | | |
| 4 | 1 | 2 | 10.75 | 10.75 | 10.75 | 0.211 | -0.336 | | |
| 5 | 1 | 2 | 10.75 | 10.75 | 10.75 | -0.106 | -0.336 | | |
| 6 | 1 | 2 | 10.75 | 10.75 | 10.75 | -0.106 | 0.336 | | |
| 7 | 1 | 2 | 10.75 | 10.75 | 10.75 | 0.106 | 0.336 | | |
| 8 | 1 | 2 | 10.75 | 10.75 | 10.75 | 0.106 | -0.336 | | |
| 9 | 1 | 2 | 10.75 | 10.75 | 10.75 | 0.000 | -0.336 | | |
| 10 | 1 | 2 | 10.75 | 10.75 | 10.75 | 0.000 | 0.336 | | |
| 11 | 1 | 2 | 10.75 | 10.75 | 10.75 | -0.170 | 0.000 | | |
| 12 | 1 | 2 | 10.75 | 10.75 | 10.75 | 0.170 | 0.000 | | |
| 13 | 1 | 2 | 10.75 | 10.75 | 10.75 | -0.170 | 0.075 | | |
| 14 | 1 | 2 | 10.75 | 10.75 | 10.75 | -0.170 | -0.075 | | |
| 15 | 1 | 2 | 10.75 | 10.75 | 10.75 | 0.170 | -0.075 | | |
| 16 | 1 | 2 | 10.75 | 10.75 | 10.75 | 0.170 | 0.075 | | |
| Suma | | | 172.00 | 172.02 | 172.00 | nutná.As/Abrutto = 3.465 % | | | |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Horní pás

Návrh na MSÚ As = 172.0 cm²

| ZS | Vnitřní účinky na MSÚ | | | Přetvoření (o/oo) | | | Beta | Gama | Využití |
|----|-----------------------|----------|----------|-------------------|-------|-------|-------|-------|---------|
| | N (kN) | My (kNm) | Mz (kNm) | Eps.1 | Eps.2 | Eps.s | | | |
| 1 | -4822. | -1019. | 0. | -3.500 | 0.974 | 0.47 | 180.0 | 1.000 | 0.996 |
| 2 | -5160. | -936. | 0. | -3.500 | 0.783 | 0.30 | 180.0 | 1.000 | 0.999 |
| 3 | -4197. | -1159. | 0. | -3.500 | 1.315 | 0.77 | 180.0 | 1.000 | 0.979 |
| 4 | -4617. | -1066. | 0. | -3.500 | 1.083 | 0.56 | 180.0 | 1.000 | 0.997 |
| 5 | -6504. | -562. | 0. | -3.500 | 0.078 | -0.33 | 180.0 | 1.000 | 0.999 |
| 6 | -5176. | -932. | 0. | -3.500 | 0.774 | 0.29 | 180.0 | 1.000 | 0.997 |

| ZS | ----Tlaková výslednice----- | | | | -----Tahová výslednice----- | | | | Rameno |
|----|-----------------------------|-------|-------|---------------------|-----------------------------|-------|--------|---------------------|--------|
| | (kN) | y (m) | z (m) | A (m ²) | (kN) | y (m) | z (m) | A (m ²) | |
| 1 | -5322. | 0.000 | 0.160 | 0.3789 | 500. | 0.000 | -0.336 | 0.00538 | 0.4959 |
| 2 | -5478. | 0.000 | 0.151 | 0.3978 | 318. | 0.000 | -0.336 | 0.00538 | 0.4873 |
| 3 | -5022. | 0.000 | 0.176 | 0.3508 | 825. | 0.000 | -0.336 | 0.00538 | 0.5116 |
| 4 | -5221. | 0.000 | 0.165 | 0.3689 | 604. | 0.000 | -0.336 | 0.00538 | 0.5012 |
| 5 | -6504. | 0.000 | 0.086 | 0.4846 | | | | | |
| 6 | -5485. | 0.000 | 0.151 | 0.3987 | 309. | 0.000 | -0.336 | 0.00538 | 0.4869 |

| Výztuž Č. | Eps.0 (o/oo) | y (m) | z (m) | ZS | Eps.s (o/oo) | Sigma N/mm ² |
|--------------|-----------------|----------|----------|----|-----------------|----------------------------|
| | | | | | | |
| 1 | 10.8 | -0.211 | -0.336 | 1 | 0.465 | 93 |
| 2 | 10.8 | -0.211 | 0.336 | 1 | -2.991 | -183 |
| 3 | 10.8 | 0.211 | 0.336 | 1 | -2.991 | -183 |
| 4 | 10.8 | 0.211 | -0.336 | 1 | 0.465 | 93 |
| 5 | 10.8 | -0.106 | -0.336 | 1 | 0.465 | 93 |
| 6 | 10.8 | -0.106 | 0.336 | 1 | -2.991 | -183 |
| 7 | 10.8 | 0.106 | 0.336 | 1 | -2.991 | -183 |
| 8 | 10.8 | 0.106 | -0.336 | 1 | 0.465 | 93 |
| 9 | 10.8 | 0.000 | -0.336 | 1 | 0.465 | 93 |
| 10 | 10.8 | 0.000 | 0.336 | 1 | -2.991 | -183 |
| 11 | 10.8 | -0.170 | 0.000 | 1 | -1.263 | -183 |
| 12 | 10.8 | 0.170 | 0.000 | 1 | -1.263 | -183 |
| 13 | 10.8 | -0.170 | 0.075 | 1 | -1.649 | -183 |
| 14 | 10.8 | -0.170 | -0.075 | 1 | -0.877 | -175 |
| 15 | 10.8 | 0.170 | -0.075 | 1 | -0.877 | -175 |
| 16 | 10.8 | 0.170 | 0.075 | 1 | -1.649 | -183 |
| | | | | | | |
| 1 | 10.8 | -0.211 | -0.336 | 2 | 0.296 | 59 |
| 2 | 10.8 | -0.211 | 0.336 | 2 | -3.013 | -183 |
| 3 | 10.8 | 0.211 | 0.336 | 2 | -3.013 | -183 |
| 4 | 10.8 | 0.211 | -0.336 | 2 | 0.296 | 59 |
| 5 | 10.8 | -0.106 | -0.336 | 2 | 0.296 | 59 |
| 6 | 10.8 | -0.106 | 0.336 | 2 | -3.013 | -183 |
| 7 | 10.8 | 0.106 | 0.336 | 2 | -3.013 | -183 |
| 8 | 10.8 | 0.106 | -0.336 | 2 | 0.296 | 59 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Horní pás

| Výztuž Č. | Eps.0 (o/oo) | y (m) | z (m) | ZS | Eps.s (o/oo) | Sigma N/mm2 |
|--------------|-----------------|----------|----------|----|-----------------|----------------|
| 9 | 10.8 | 0.000 | -0.336 | 2 | 0.296 | 59 |
| 10 | 10.8 | 0.000 | 0.336 | 2 | -3.013 | -183 |
| 11 | 10.8 | -0.170 | 0.000 | 2 | -1.358 | -183 |
| 12 | 10.8 | 0.170 | 0.000 | 2 | -1.358 | -183 |
| 13 | 10.8 | -0.170 | 0.075 | 2 | -1.728 | -183 |
| 14 | 10.8 | -0.170 | -0.075 | 2 | -0.989 | -183 |
| 15 | 10.8 | 0.170 | -0.075 | 2 | -0.989 | -183 |
| 16 | 10.8 | 0.170 | 0.075 | 2 | -1.728 | -183 |
| | | | | | | |
| 1 | 10.8 | -0.211 | -0.336 | 3 | 0.767 | 153 |
| 2 | 10.8 | -0.211 | 0.336 | 3 | -2.952 | -183 |
| 3 | 10.8 | 0.211 | 0.336 | 3 | -2.952 | -183 |
| 4 | 10.8 | 0.211 | -0.336 | 3 | 0.767 | 153 |
| 5 | 10.8 | -0.106 | -0.336 | 3 | 0.767 | 153 |
| 6 | 10.8 | -0.106 | 0.336 | 3 | -2.952 | -183 |
| 7 | 10.8 | 0.106 | 0.336 | 3 | -2.952 | -183 |
| 8 | 10.8 | 0.106 | -0.336 | 3 | 0.767 | 153 |
| 9 | 10.8 | 0.000 | -0.336 | 3 | 0.767 | 153 |
| 10 | 10.8 | 0.000 | 0.336 | 3 | -2.952 | -183 |
| 11 | 10.8 | -0.170 | 0.000 | 3 | -1.092 | -183 |
| 12 | 10.8 | 0.170 | 0.000 | 3 | -1.092 | -183 |
| 13 | 10.8 | -0.170 | 0.075 | 3 | -1.508 | -183 |
| 14 | 10.8 | -0.170 | -0.075 | 3 | -0.677 | -135 |
| 15 | 10.8 | 0.170 | -0.075 | 3 | -0.677 | -135 |
| 16 | 10.8 | 0.170 | 0.075 | 3 | -1.508 | -183 |
| | | | | | | |
| 1 | 10.8 | -0.211 | -0.336 | 4 | 0.562 | 112 |
| 2 | 10.8 | -0.211 | 0.336 | 4 | -2.978 | -183 |
| 3 | 10.8 | 0.211 | 0.336 | 4 | -2.978 | -183 |
| 4 | 10.8 | 0.211 | -0.336 | 4 | 0.562 | 112 |
| 5 | 10.8 | -0.106 | -0.336 | 4 | 0.562 | 112 |
| 6 | 10.8 | -0.106 | 0.336 | 4 | -2.978 | -183 |
| 7 | 10.8 | 0.106 | 0.336 | 4 | -2.978 | -183 |
| 8 | 10.8 | 0.106 | -0.336 | 4 | 0.562 | 112 |
| 9 | 10.8 | 0.000 | -0.336 | 4 | 0.562 | 112 |
| 10 | 10.8 | 0.000 | 0.336 | 4 | -2.978 | -183 |
| 11 | 10.8 | -0.170 | 0.000 | 4 | -1.208 | -183 |
| 12 | 10.8 | 0.170 | 0.000 | 4 | -1.208 | -183 |
| 13 | 10.8 | -0.170 | 0.075 | 4 | -1.603 | -183 |
| 14 | 10.8 | -0.170 | -0.075 | 4 | -0.813 | -163 |
| 15 | 10.8 | 0.170 | -0.075 | 4 | -0.813 | -163 |
| 16 | 10.8 | 0.170 | 0.075 | 4 | -1.603 | -183 |
| | | | | | | |
| 1 | 10.8 | -0.211 | -0.336 | 5 | -0.329 | -66 |
| 2 | 10.8 | -0.211 | 0.336 | 5 | -3.093 | -183 |
| 3 | 10.8 | 0.211 | 0.336 | 5 | -3.093 | -183 |
| 4 | 10.8 | 0.211 | -0.336 | 5 | -0.329 | -66 |
| 5 | 10.8 | -0.106 | -0.336 | 5 | -0.329 | -66 |



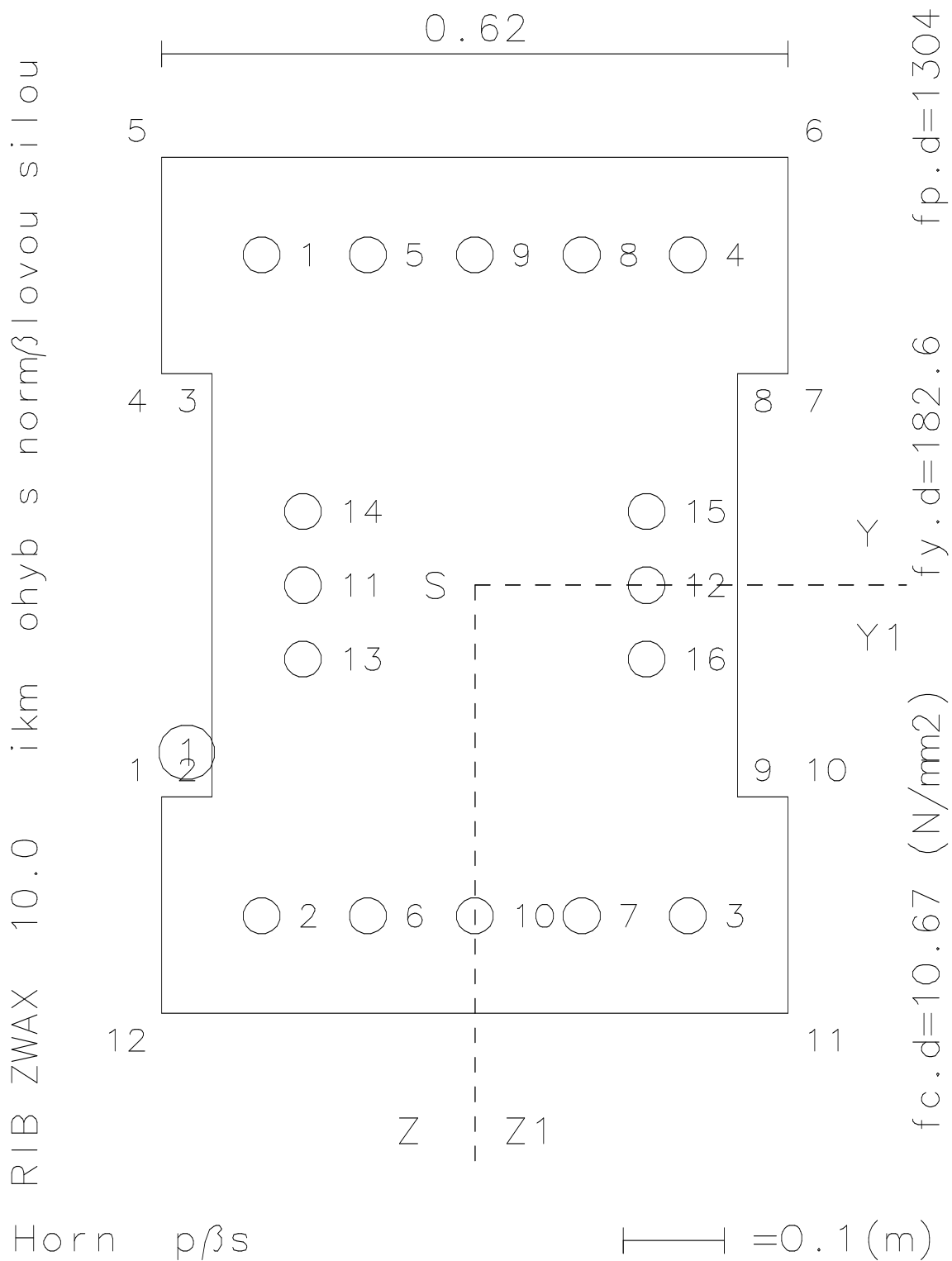
RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Horní pás

| Výztuž Č. | Eps.0 (cm2) | Eps.0 (o/oo) | y (m) | z (m) | ZS | Eps.s (o/oo) | Sigma N/mm2 |
|--------------|----------------|-----------------|----------|----------|----|-----------------|----------------|
| 6 | 10.8 | | -0.106 | 0.336 | 5 | -3.093 | -183 |
| 7 | 10.8 | | 0.106 | 0.336 | 5 | -3.093 | -183 |
| 8 | 10.8 | | 0.106 | -0.336 | 5 | -0.329 | -66 |
| 9 | 10.8 | | 0.000 | -0.336 | 5 | -0.329 | -66 |
| 10 | 10.8 | | 0.000 | 0.336 | 5 | -3.093 | -183 |
| 11 | 10.8 | | -0.170 | 0.000 | 5 | -1.711 | -183 |
| 12 | 10.8 | | 0.170 | 0.000 | 5 | -1.711 | -183 |
| 13 | 10.8 | | -0.170 | 0.075 | 5 | -2.019 | -183 |
| 14 | 10.8 | | -0.170 | -0.075 | 5 | -1.402 | -183 |
| 15 | 10.8 | | 0.170 | -0.075 | 5 | -1.402 | -183 |
| 16 | 10.8 | | 0.170 | 0.075 | 5 | -2.019 | -183 |
| 1 | 10.8 | | -0.211 | -0.336 | 6 | 0.288 | 58 |
| 2 | 10.8 | | -0.211 | 0.336 | 6 | -3.014 | -183 |
| 3 | 10.8 | | 0.211 | 0.336 | 6 | -3.014 | -183 |
| 4 | 10.8 | | 0.211 | -0.336 | 6 | 0.288 | 58 |
| 5 | 10.8 | | -0.106 | -0.336 | 6 | 0.288 | 58 |
| 6 | 10.8 | | -0.106 | 0.336 | 6 | -3.014 | -183 |
| 7 | 10.8 | | 0.106 | 0.336 | 6 | -3.014 | -183 |
| 8 | 10.8 | | 0.106 | -0.336 | 6 | 0.288 | 58 |
| 9 | 10.8 | | 0.000 | -0.336 | 6 | 0.288 | 58 |
| 10 | 10.8 | | 0.000 | 0.336 | 6 | -3.014 | -183 |
| 11 | 10.8 | | -0.170 | 0.000 | 6 | -1.363 | -183 |
| 12 | 10.8 | | 0.170 | 0.000 | 6 | -1.363 | -183 |
| 13 | 10.8 | | -0.170 | 0.075 | 6 | -1.731 | -183 |
| 14 | 10.8 | | -0.170 | -0.075 | 6 | -0.994 | -183 |
| 15 | 10.8 | | 0.170 | -0.075 | 6 | -0.994 | -183 |
| 16 | 10.8 | | 0.170 | 0.075 | 6 | -1.731 | -183 |

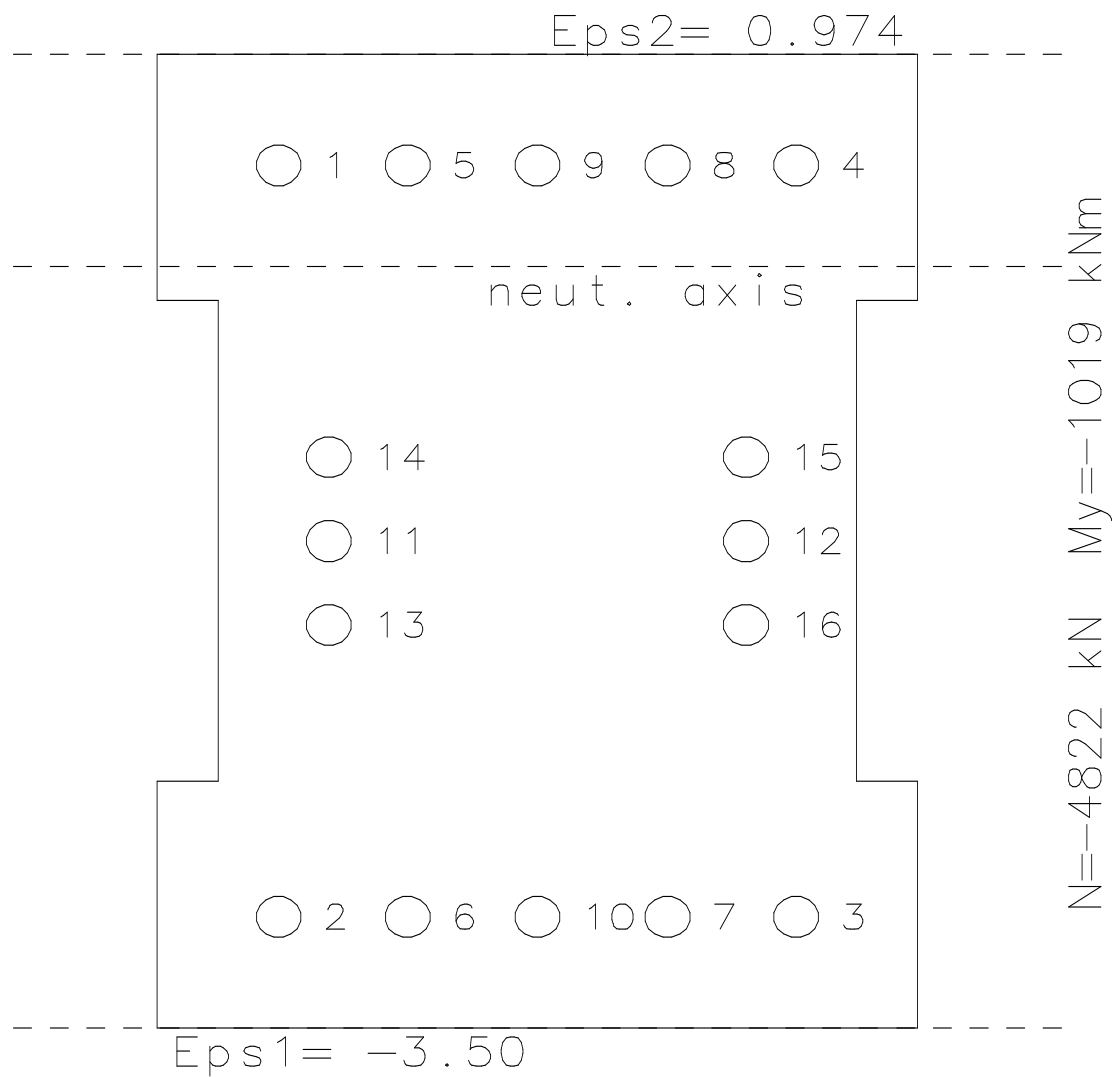


Výsledková grafika





Sec: 1 Poloha: 1 ZS: 1 As=172cm² MS vyuziti=1.01 >1 Nm.996

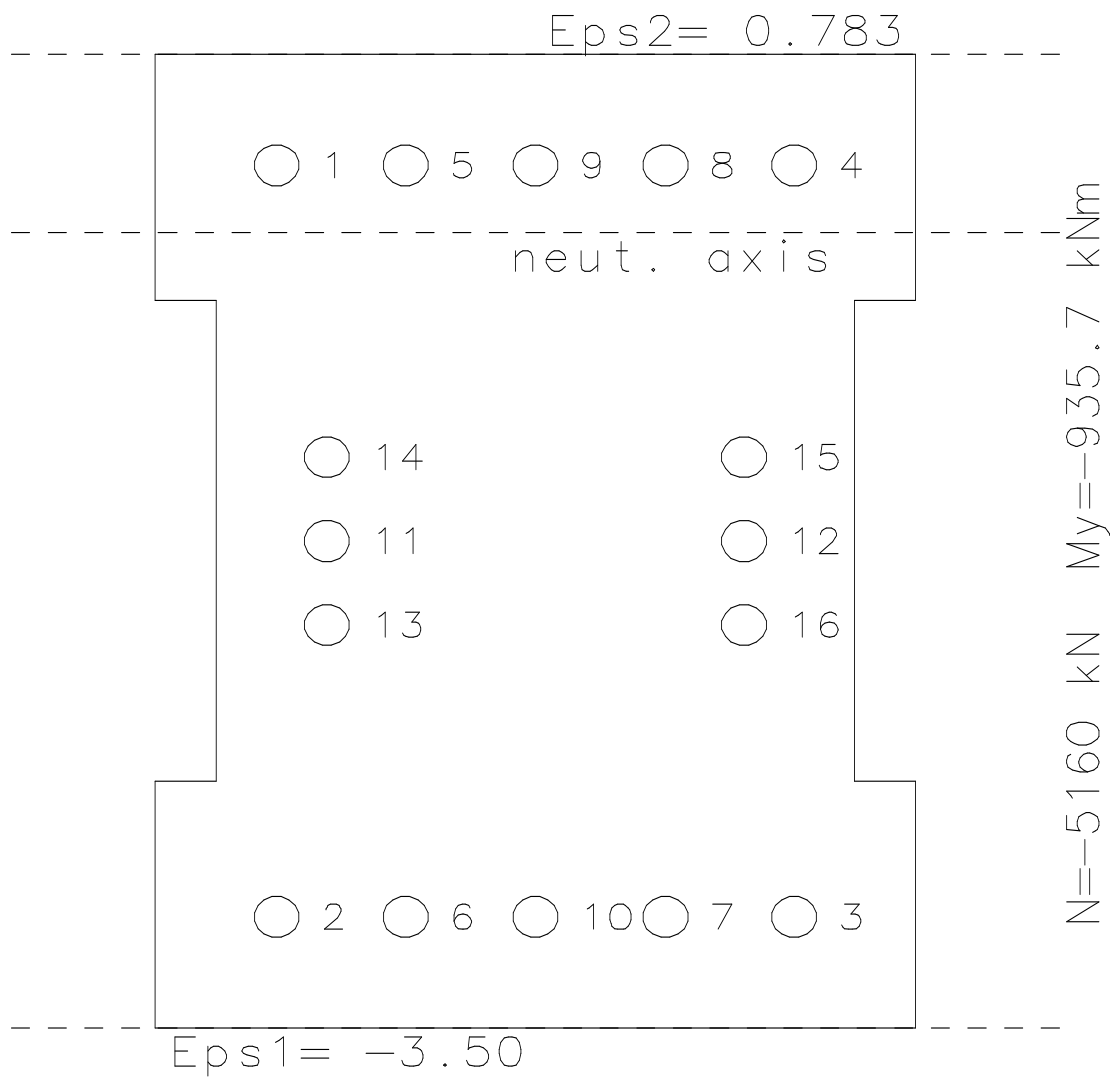


Horn $\rho\beta_s$

$\text{---} = 0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 2 As=172cm² MS vyuziti=1.01 >1 Nm.999

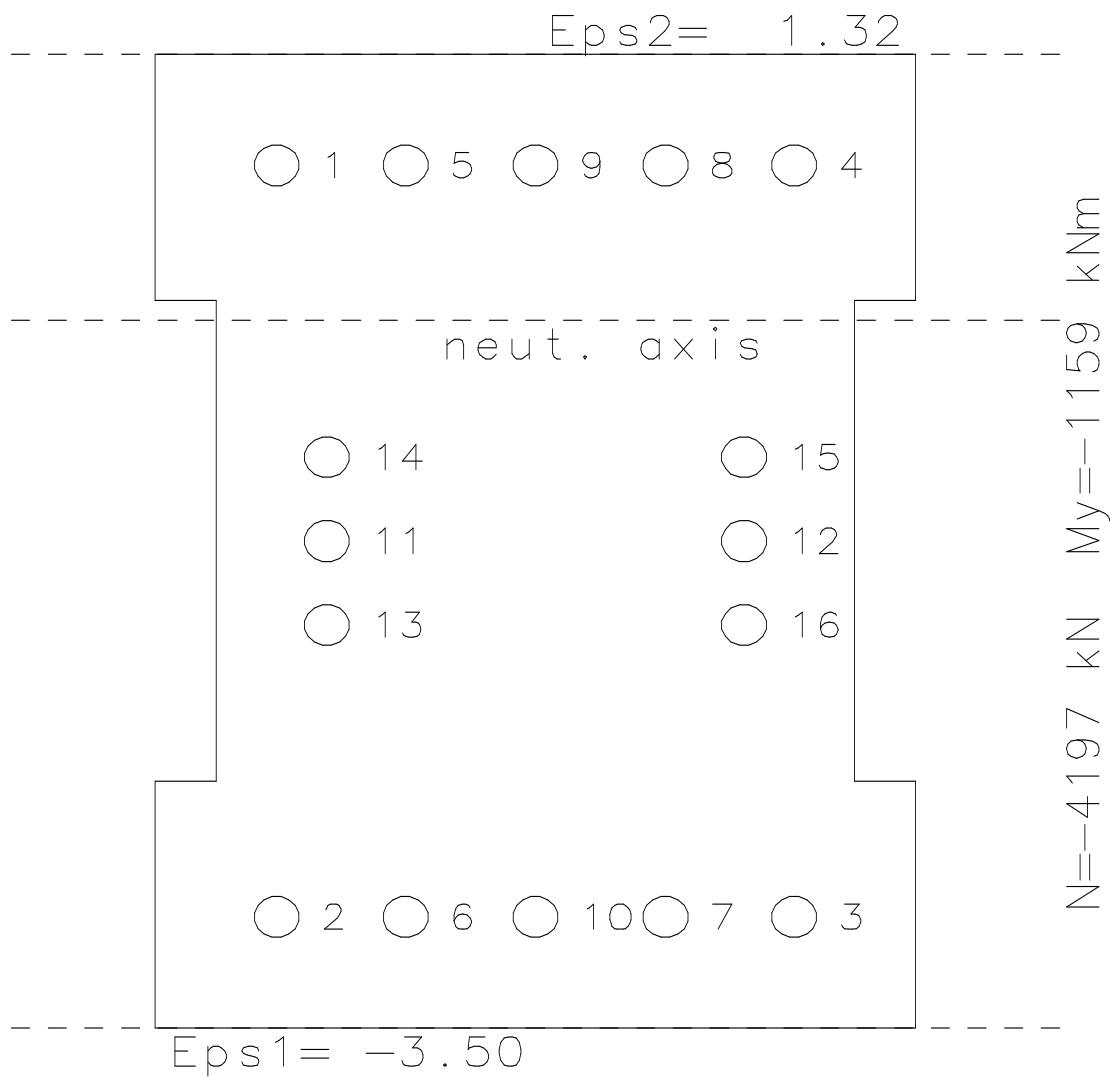


Horn $p\beta s$

$\text{---} = 0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 3 As=172cm² MS vyuziti=1.01 >1 Nm.979

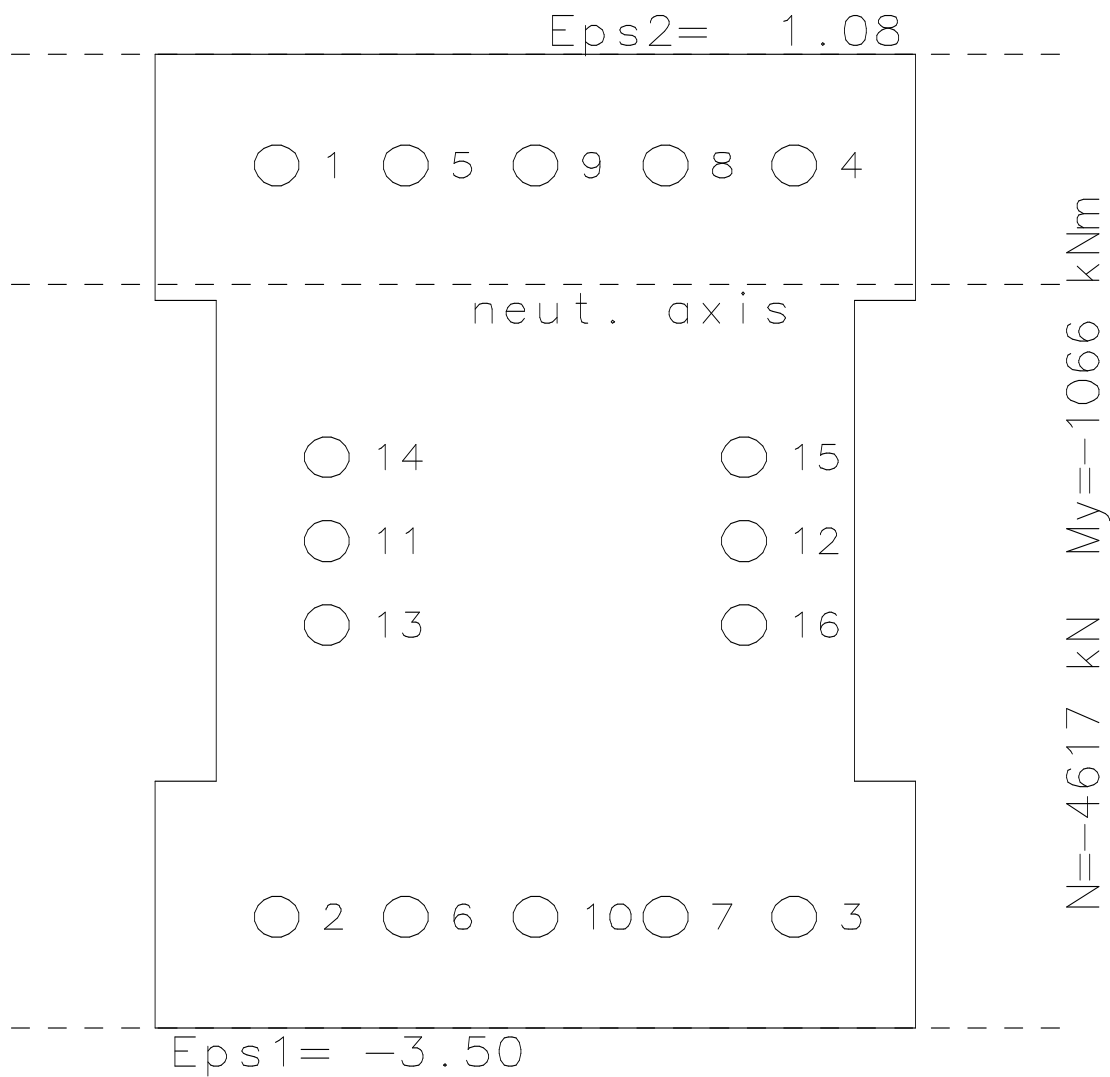


Horn $p\beta s$

$\text{---} = 0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 4 As=172cm² MS vyuziti=1.01 >1 Nm.997

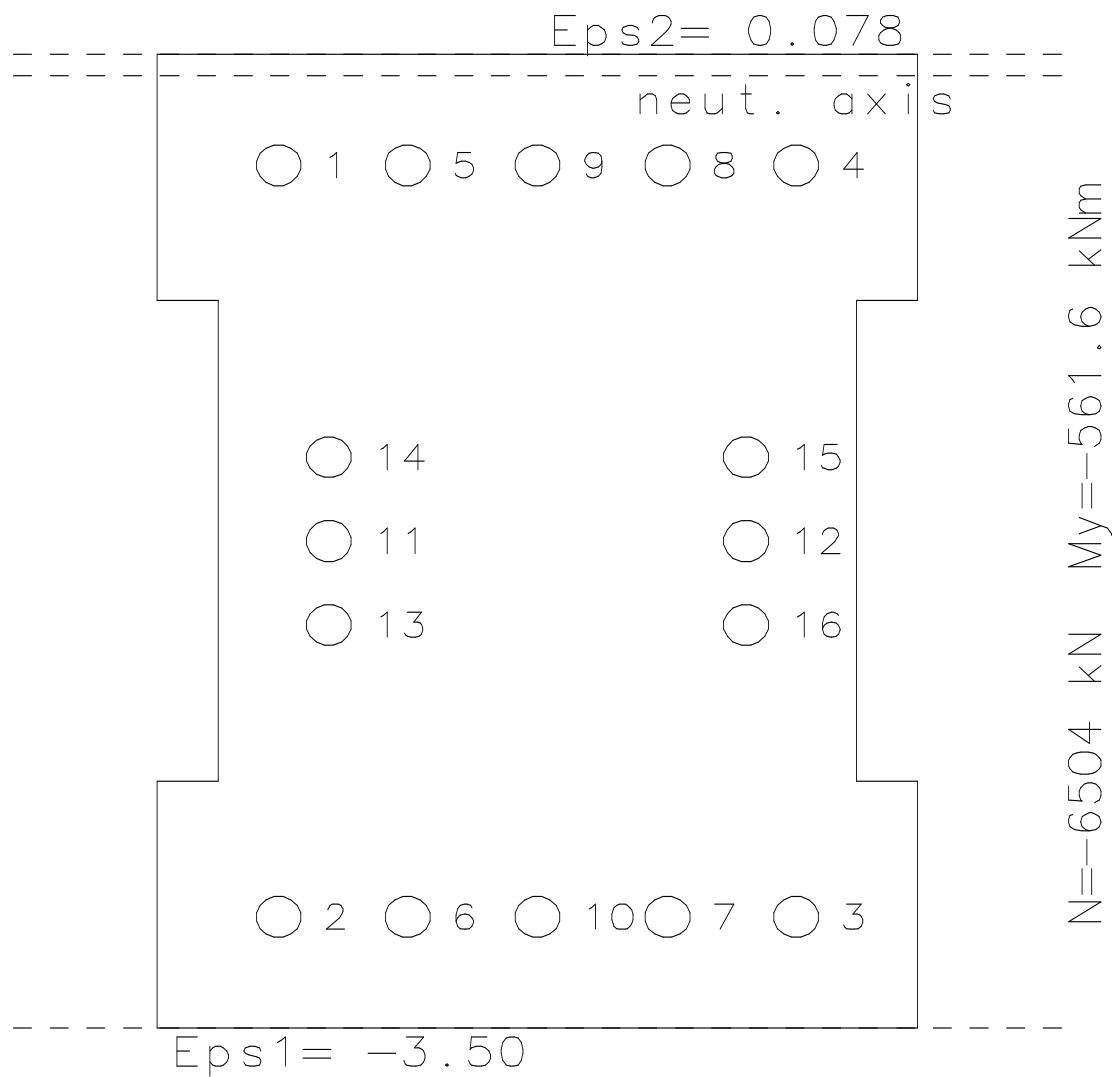


Horn $p\beta s$

$\text{---} = 0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 5 As=172cm² MS vyuziti=1.01 >1 Nm.999

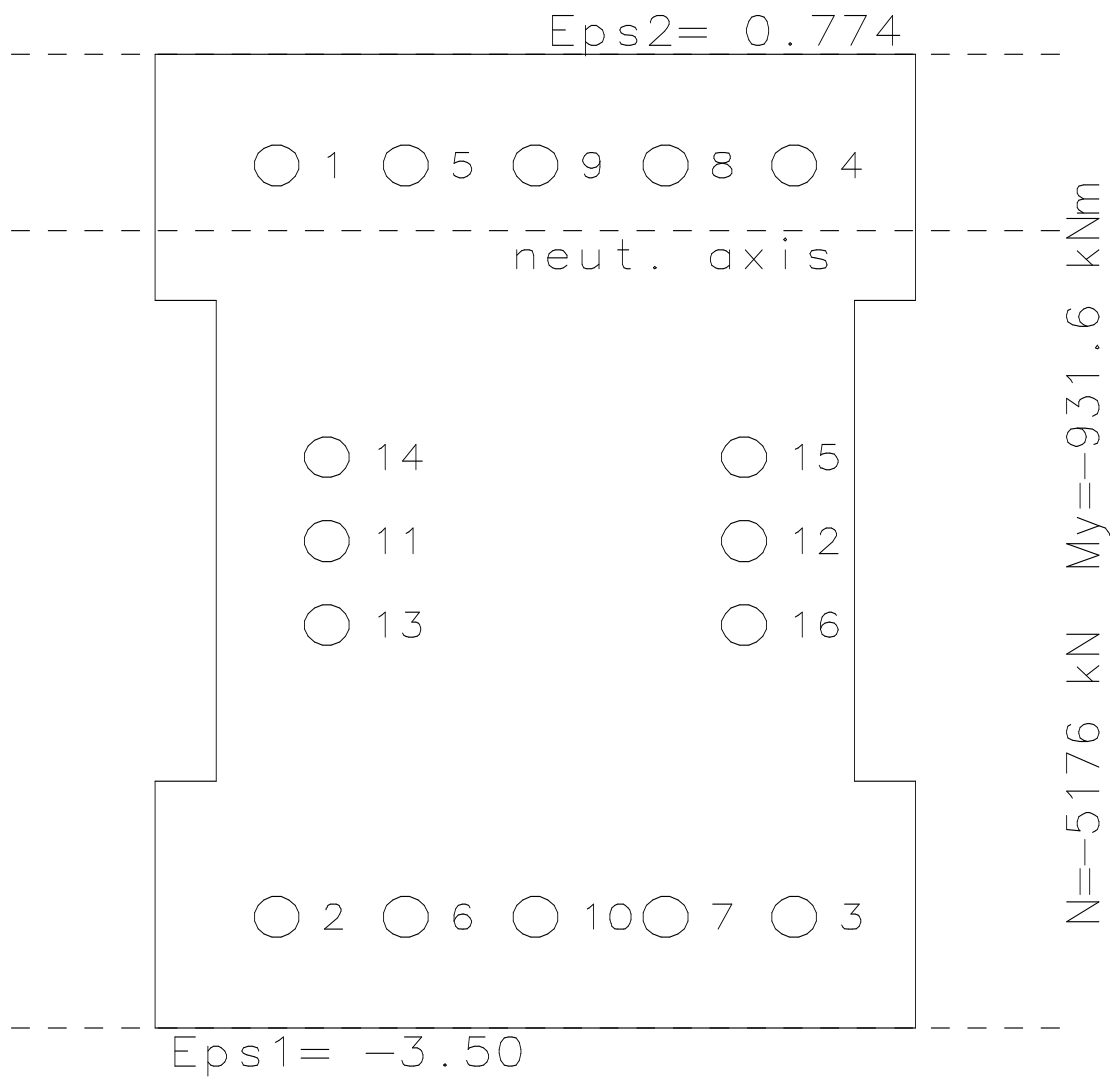


Horn $p\beta s$

$\text{---} = 0.1 \text{ (m)}$

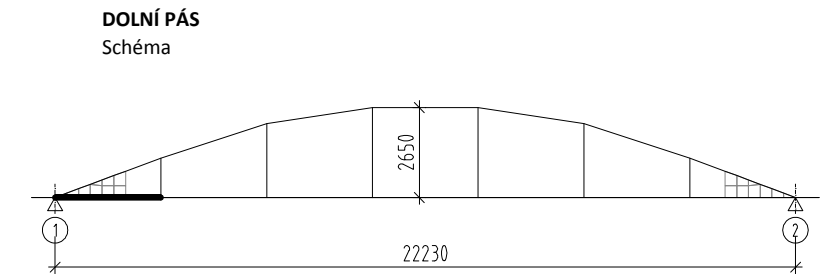


Sec: 1 Poloha: 1 ZS: 6 As=172cm² MS vyuziti=1.01 >1 Nm.997



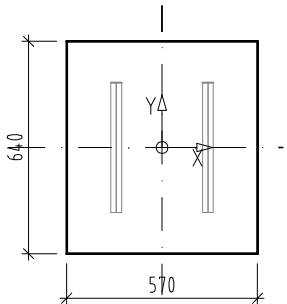
Horn $p\beta s$

$\text{---} = 0.1 \text{ (m)}$



Průřezové charakteristiky

| | | |
|-----------------|------------|----------------|
| h | 0.639 | m |
| d | 0.570 | m |
| A | 0.36399395 | m ² |
| z _h | 0.310 | m |
| z _d | 0.328 | m |
| I _y | 0.01239876 | m ⁴ |
| i _y | 0.185 | m |
| Wy _h | 0.0400 | m ³ |
| Wy _d | 0.0378 | m ³ |



bez vzpěru
c

1

Materiály
beton
výztuž

C20/25
4x 16x400

| | | prut | | | | | |
|----|---|---------|-------|------|------|--------|--------|
| ZS | Zatížení | ZS | prvek | uzel | FX | My | |
| 1 | VLASTNÍ HMOTNOST | [Výslec | 1 | 611 | 2228 | 506.92 | -75.63 |
| 2 | KONSTRUKCE VOZOVKY | [Výslec | 2 | 611 | 2228 | 65.39 | -10.26 |
| 11 | zatížení pro norm zatížitelnost - rovnoměrné 2.5 | [Výslec | 11 | 611 | 2228 | 60.58 | -10.03 |
| 13 | zatížení pro normální zatížitelnost - max M | [Výslec | 13 | 611 | 2228 | 46.77 | -19.18 |
| 22 | zatížení pro normální zatížitelnost - max N | [Výslec | 22 | 611 | 2228 | 62.20 | -9.78 |
| 53 | zatížení pro výhradní zatížitelnost - max M | [Výslec | 53 | 611 | 2228 | 26.16 | -11.25 |
| 62 | zatížení pro výhradní zatížitelnost - max N | [Výslec | 62 | 611 | 2228 | 41.81 | -8.74 |
| 41 | zatížení pro výjimečnou zatížitelnost - 9NV v polovině rozpětí | [Výslec | 41 | 611 | 2228 | 23.48 | -2.21 |
| 42 | zatížení pro výjimečnou zatížitelnost - 9NV ve čtvrtině rozpětí | [Výslec | 42 | 611 | 2228 | 23.41 | -5.10 |

| N | M |
|-------|-------|
| kN | kNm |
| 506.9 | -75.6 |
| 65.4 | -10.3 |
| 60.6 | -10.0 |
| 46.8 | -19.2 |
| 62.2 | -9.8 |
| 26.2 | -11.3 |
| 41.8 | -8.7 |
| 23.5 | -2.2 |
| 23.4 | -5.1 |

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| -0.50 | 3.40 |
| -0.08 | 0.45 |
| -0.08 | 0.43 |
| -0.35 | 0.64 |
| -0.07 | 0.43 |
| -0.21 | 0.37 |
| -0.10 | 0.35 |
| 0.01 | 0.12 |
| -0.06 | 0.20 |

| Nrd | Mrd |
|--------|--------|
| kN | kNm |
| 1639.0 | -368.1 |
| 2016.0 | -317.5 |
| 1348.0 | -403.9 |
| 1824.0 | -343.9 |
| 2396.0 | -261.4 |
| 1794.0 | -348.0 |

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| -4.71 | 14.25 |
| -2.41 | 13.94 |
| -6.41 | 14.40 |
| -3.60 | 14.12 |
| 0.04 | 13.50 |
| -3.78 | 14.14 |

Únosnost průřezu

| | | |
|--------|--------|--------|
| Vn_M | 1639.0 | -368.1 |
| Vn_N | 2016.0 | -317.5 |
| Vr_M | 1348.0 | -403.9 |
| Vr_N | 1824.0 | -343.9 |
| Ve_1/2 | 2396.0 | -261.4 |
| Ve_1/4 | 1794.0 | -348.0 |

Zbývá na zatížení vozidly

| | |
|---|-----------------------------|
| 1 | $\delta \cdot (M, N)_{q,b}$ |
|---|-----------------------------|

| | | |
|--------|--------|--------|
| | N | M |
| Vn_M | 727.6 | -199.7 |
| Vn_N | 1006.9 | -162.2 |
| Vr_M | 512.1 | -226.2 |
| Vr_N | 864.6 | -181.7 |
| Ve_1/2 | 1288.3 | -120.6 |
| Ve_1/4 | 842.4 | -184.8 |

| | | | | |
|------|-----|-----|-------|-------|
| δ | | | N | M |
| 1.2 | 3NV | Va | 5.65 | 5.70 |
| 1.2 | 3NV | Va | 6.83 | 6.82 |
| 1.25 | 6NV | Vrw | 15.66 | 16.08 |
| 1.25 | 6NV | Vrw | 16.55 | 16.63 |
| 1.05 | 9NV | Vew | 52.26 | 51.96 |
| 1.05 | 9NV | Vew | 34.27 | 34.51 |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 75.3 | t |
| Zatížitelnost normální Vn | 91.0 | t |
| Zatížitelnost výhradní Vr | 156.6 | t |
| Zatížitelnost výhradní Vr | 165.5 | t |
| Zatížitelnost výjimečná Ve | 519.6 | t |
| Zatížitelnost výjimečná Ve | 342.7 | t |

Zbývá na zatížení vozidly

| | |
|---|-----------------------------|
| 2 | $\delta \cdot (M, N)_{q,b}$ |
|---|-----------------------------|

| | | |
|--------|--------|--------|
| | N | M |
| Vn_M | 855.7 | -249.0 |
| Vn_N | 1228.0 | -199.1 |
| Vr_M | 568.3 | -284.4 |
| Vr_N | 1038.4 | -225.1 |
| Ve_1/2 | 1603.3 | -143.7 |
| Ve_1/4 | 1008.8 | -229.2 |

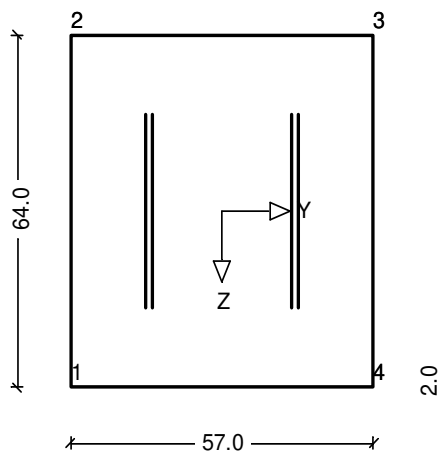
| | | | | |
|------|-----|-----|-------|-------|
| δ | | | N | M |
| 1.2 | 3NV | Va | 6.64 | 7.11 |
| 1.2 | 3NV | Va | 8.33 | 8.37 |
| 1.25 | 6NV | Vrw | 17.38 | 20.22 |
| 1.25 | 6NV | Vrw | 19.87 | 20.60 |
| 1.05 | 9NV | Vew | 65.04 | 61.88 |
| 1.05 | 9NV | Vew | 41.03 | 42.80 |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 88.6 | t |
| Zatížitelnost normální Vn | 111.1 | t |
| Zatížitelnost výhradní Vr | 173.8 | t |
| Zatížitelnost výhradní Vr | 198.7 | t |
| Zatížitelnost výjimečná Ve | 618.8 | t |
| Zatížitelnost výjimečná Ve | 410.3 | t |



Obloukový most

Soubor: Dolní pás.zwv



Bereich: Dolní pás, Querschnitt: DP

RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Dolní pás

Soubor: ZWAX.ZWA

Protokol zadání

* Mezní stav únosnosti pro ohyb s normálovou silou CSN EN 1992-1-1

Počítá se s průřezem netto tlačené zóny betonu

| Materiál - č. | Pevnost (N/mm ²) | E-Modul (N/mm ²) | Dov. přetvoření (o/oo) | |
|---------------|------------------------------|------------------------------|------------------------|-------|
| | | | hrana | střed |
| Beton | $f_{c,d} = 10.7$ | $E_c = 30000.$ | tlak | -3.50 |
| Výztuž 2 | $f_{y,d} = 182.6$ | $E_s = 200000.$ | tah | 10.00 |
| Předp.kabel 3 | $f_{p,d} = 1304.3$ | $E_p = 195000.$ | | 0.91 |

Průřez: DP

Výpočet jako netlačený prvek.

Počítá se vzdálenost vnější tahové výztuže od okraje

Polygonální dílčí průřez 1
Beton (=materiál 1)

Souřadnice

| y (m) | z (m) | Bod |
|--------|--------|-----|
| -0.285 | 0.320 | 1 |
| -0.285 | -0.320 | 2 |
| 0.285 | -0.320 | 3 |
| 0.285 | 0.320 | 4 |



Bodová, úseková, kruhová výztuž

| Č. Druh | Sada | Č.-mat. | Průřez | | As | Bod 1 | | Bod 2 | | zrca- |
|---------|------|---------|--------|-------|--------------------|--------|--------|--------|--------|-------|
| | | | min | max | | y1 (m) | z1 (m) | y2 (m) | z2 (m) | |
| 1 Úsek | 1 | 2 | 140.0 | 140.0 | cm ² /m | 0.130 | -0.175 | 0.130 | 0.175 | na z |
| 3 Úsek | 1 | 2 | 140.0 | 140.0 | cm ² /m | -0.145 | -0.175 | -0.145 | 0.175 | na z |

Poloha: DP 611 - 2228

| ZS | NS (kN) | MSy (kNm) | MSz (kNm) |
|----|---------|-----------|-----------|
| 1 | 1639.0 | -368.1 | 0.0 |
| 2 | 2016.0 | -317.5 | 0.0 |
| 3 | 1348.0 | -403.9 | 0.0 |
| 4 | 1824.0 | -343.9 | 0.0 |
| 5 | 2396.0 | -261.4 | 0.0 |
| 6 | 1794.0 | -348.0 | 0.0 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Dolní pás

Výsledek

Průřez: DP Poloha: DP 611 - 2228

Průř. charakteristiky - brutto $I_1 = 0.012452 \text{ m}^4$ $y_s = 0.0000 \text{ m}$
 $A = 0.3648 \text{ m}^2$ $\text{Alfa} = 0.00$ $I_2 = 0.009877 \text{ m}^4$ $z_s = 0.0000 \text{ m}$

Výztuž (S=Sada M=Materiál)

| As | min.As | | max.As | nutná As | | Souřadnice (m) | | | | Eps.0 | |
|------|--------|---|--------|----------|--------|-------------------------------|--------|--------|--------|-------|------|
| Č. | S | M | (cm2) | (cm2) | (cm2) | cm2/m | y1 | z1 | y2 | z2 | o/oo |
| 1 | 1 | 2 | 49.00 | 49.00 | 49.00 | 140.0 | 0.130 | -0.175 | 0.130 | 0.175 | |
| 2 | 1 | 2 | 49.00 | 49.00 | 49.00 | 140.0 | -0.130 | -0.175 | -0.130 | 0.175 | |
| 3 | 1 | 2 | 49.00 | 49.00 | 49.00 | 140.0 | -0.145 | -0.175 | -0.145 | 0.175 | |
| 4 | 1 | 2 | 49.00 | 49.00 | 49.00 | 140.0 | 0.145 | -0.175 | 0.145 | 0.175 | |
| Suma | | | 196.00 | 196.00 | 196.00 | stávající.As/Abutto = 5.373 % | | | | | |

Návrh na MSÚ As = 196.0 cm²

| ZS | Vnitřní účinky na MSÚ | | | Přetvoření (o/oo) | | | Beta | Gama | Využití |
|----|-----------------------|----------|----------|-------------------|--------|-------|-------|-------|---------|
| | N (kN) | My (kNm) | Mz (kNm) | Eps.1 | Eps.2 | Eps.s | (°) | | |
| 1 | 1639. | -368. | 0. | -3.500 | 8.061 | 5.44 | 180.0 | 1.000 | 1.000 |
| 2 | 2016. | -317. | 0. | -3.500 | 9.090 | 6.24 | 180.0 | 1.000 | 1.000 |
| 3 | 1348. | -404. | 0. | -3.500 | 7.405 | 4.93 | 180.0 | 1.000 | 1.000 |
| 4 | 1824. | -344. | 0. | -3.500 | 8.533 | 5.81 | 180.0 | 1.000 | 1.000 |
| 5 | 2396. | -261. | 0. | -3.500 | 10.487 | 7.32 | 180.0 | 1.000 | 1.000 |
| 6 | 1794. | -348. | 0. | -3.500 | 8.452 | 5.74 | 180.0 | 1.000 | 1.000 |

| ZS | ----Tlaková výslednice----- | | | | -----Tahová výslednice----- | | | | Rameno |
|----|-----------------------------|-------|-------|---------------------|-----------------------------|-------|--------|---------------------|--------|
| | (kN) | y (m) | z (m) | A (m ²) | (kN) | y (m) | z (m) | A (m ²) | (m) |
| 1 | -1183. | 0.000 | 0.224 | 0.1104 | 2822. | 0.000 | -0.037 | 0.01687 | 0.2604 |
| 2 | -989. | 0.000 | 0.237 | 0.1014 | 3005. | 0.000 | -0.028 | 0.01776 | 0.2643 |
| 3 | -1339. | 0.000 | 0.215 | 0.1171 | 2687. | 0.000 | -0.043 | 0.01622 | 0.2581 |
| 4 | -1086. | 0.000 | 0.230 | 0.1061 | 2910. | 0.000 | -0.032 | 0.01730 | 0.2622 |
| 5 | -815. | 0.000 | 0.251 | 0.0913 | 3211. | 0.000 | -0.018 | 0.01875 | 0.2684 |
| 6 | -1102. | 0.000 | 0.229 | 0.1068 | 2895. | 0.000 | -0.033 | 0.01722 | 0.2619 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Dolní pás

| Výztuž Č. | Eps.0 (cm2) | Eps.0 (o/oo) | y (m) | z (m) | ZS | Eps.s (o/oo) | Sigma N/mm2 |
|--------------|----------------|-----------------|----------|----------|----|-----------------|----------------|
| 1 | 49.0 | | 0.130 | -0.175 | 1 | 5.442 | 183 |
| | | | 0.130 | 0.175 | 1 | -0.881 | -176 |
| 2 | 49.0 | | -0.130 | -0.175 | 1 | 5.442 | 183 |
| | | | -0.130 | 0.175 | 1 | -0.881 | -176 |
| 3 | 49.0 | | -0.145 | -0.175 | 1 | 5.442 | 183 |
| | | | -0.145 | 0.175 | 1 | -0.881 | -176 |
| 4 | 49.0 | | 0.145 | -0.175 | 1 | 5.442 | 183 |
| | | | 0.145 | 0.175 | 1 | -0.881 | -176 |
| 1 | 49.0 | | 0.130 | -0.175 | 2 | 6.238 | 183 |
| | | | 0.130 | 0.175 | 2 | -0.648 | -130 |
| 2 | 49.0 | | -0.130 | -0.175 | 2 | 6.238 | 183 |
| | | | -0.130 | 0.175 | 2 | -0.648 | -130 |
| 3 | 49.0 | | -0.145 | -0.175 | 2 | 6.238 | 183 |
| | | | -0.145 | 0.175 | 2 | -0.648 | -130 |
| 4 | 49.0 | | 0.145 | -0.175 | 2 | 6.238 | 183 |
| | | | 0.145 | 0.175 | 2 | -0.648 | -130 |
| 1 | 49.0 | | 0.130 | -0.175 | 3 | 4.934 | 183 |
| | | | 0.130 | 0.175 | 3 | -1.029 | -183 |
| 2 | 49.0 | | -0.130 | -0.175 | 3 | 4.934 | 183 |
| | | | -0.130 | 0.175 | 3 | -1.029 | -183 |
| 3 | 49.0 | | -0.145 | -0.175 | 3 | 4.934 | 183 |
| | | | -0.145 | 0.175 | 3 | -1.029 | -183 |
| 4 | 49.0 | | 0.145 | -0.175 | 3 | 4.934 | 183 |
| | | | 0.145 | 0.175 | 3 | -1.029 | -183 |
| 1 | 49.0 | | 0.130 | -0.175 | 4 | 5.807 | 183 |
| | | | 0.130 | 0.175 | 4 | -0.774 | -155 |
| 2 | 49.0 | | -0.130 | -0.175 | 4 | 5.807 | 183 |
| | | | -0.130 | 0.175 | 4 | -0.774 | -155 |
| 3 | 49.0 | | -0.145 | -0.175 | 4 | 5.807 | 183 |
| | | | -0.145 | 0.175 | 4 | -0.774 | -155 |
| 4 | 49.0 | | 0.145 | -0.175 | 4 | 5.807 | 183 |
| | | | 0.145 | 0.175 | 4 | -0.774 | -155 |
| 1 | 49.0 | | 0.130 | -0.175 | 5 | 7.318 | 183 |
| | | | 0.130 | 0.175 | 5 | -0.331 | -66 |
| 2 | 49.0 | | -0.130 | -0.175 | 5 | 7.318 | 183 |
| | | | -0.130 | 0.175 | 5 | -0.331 | -66 |
| 3 | 49.0 | | -0.145 | -0.175 | 5 | 7.318 | 183 |
| | | | -0.145 | 0.175 | 5 | -0.331 | -66 |
| 4 | 49.0 | | 0.145 | -0.175 | 5 | 7.318 | 183 |
| | | | 0.145 | 0.175 | 5 | -0.331 | -66 |



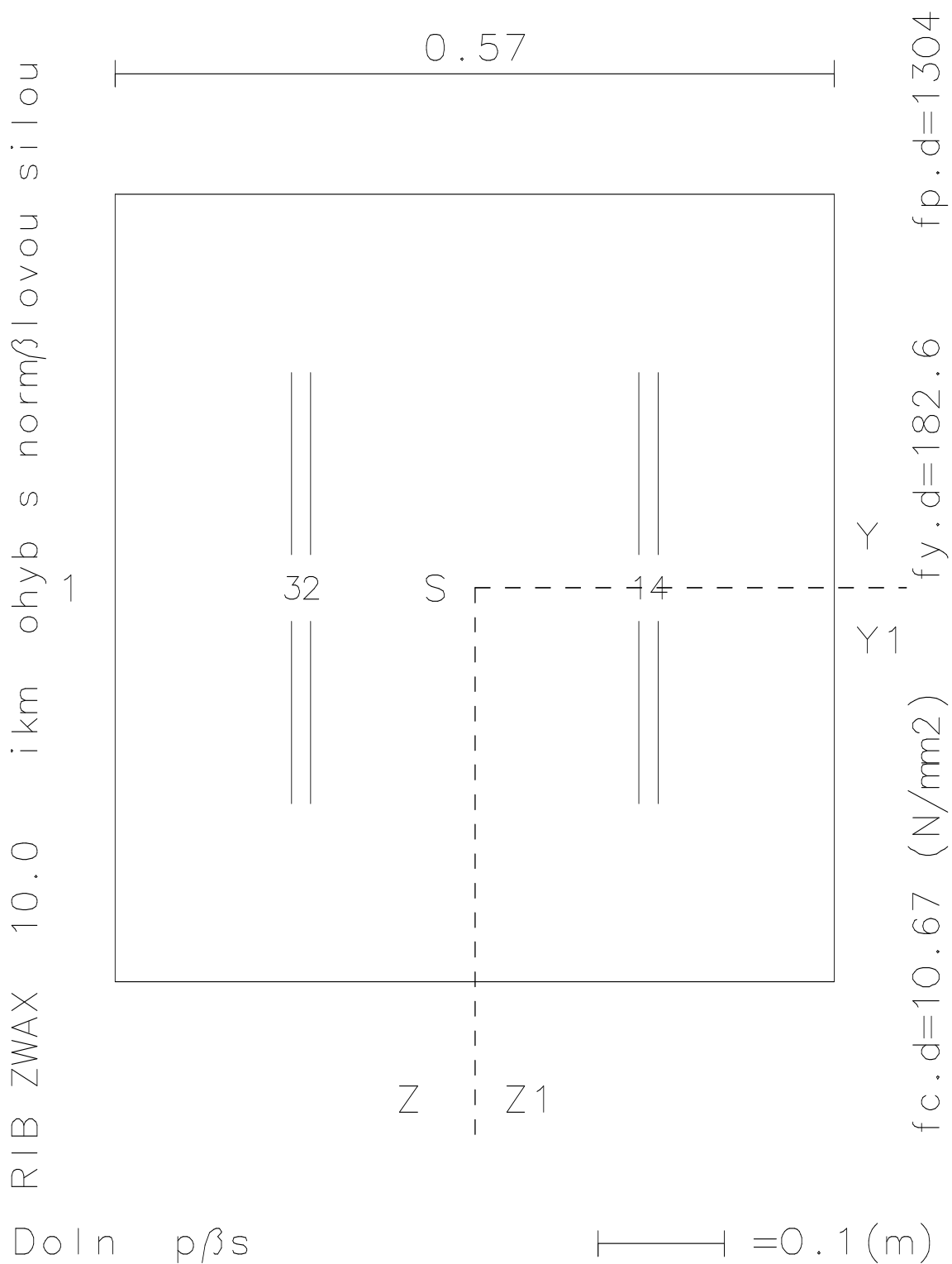
RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Dolní pás

| Výztuž Č. | Eps.0 (cm2) | Eps.0 (o/oo) | y (m) | z (m) | ZS | Eps.s (o/oo) | Sigma N/mm2 |
|--------------|----------------|-----------------|----------|----------|----|-----------------|----------------|
| 1 | 49.0 | | 0.130 | -0.175 | 6 | 5.744 | 183 |
| | | | 0.130 | 0.175 | 6 | -0.792 | -158 |
| 2 | 49.0 | | -0.130 | -0.175 | 6 | 5.744 | 183 |
| | | | -0.130 | 0.175 | 6 | -0.792 | -158 |
| 3 | 49.0 | | -0.145 | -0.175 | 6 | 5.744 | 183 |
| | | | -0.145 | 0.175 | 6 | -0.792 | -158 |
| 4 | 49.0 | | 0.145 | -0.175 | 6 | 5.744 | 183 |
| | | | 0.145 | 0.175 | 6 | -0.792 | -158 |

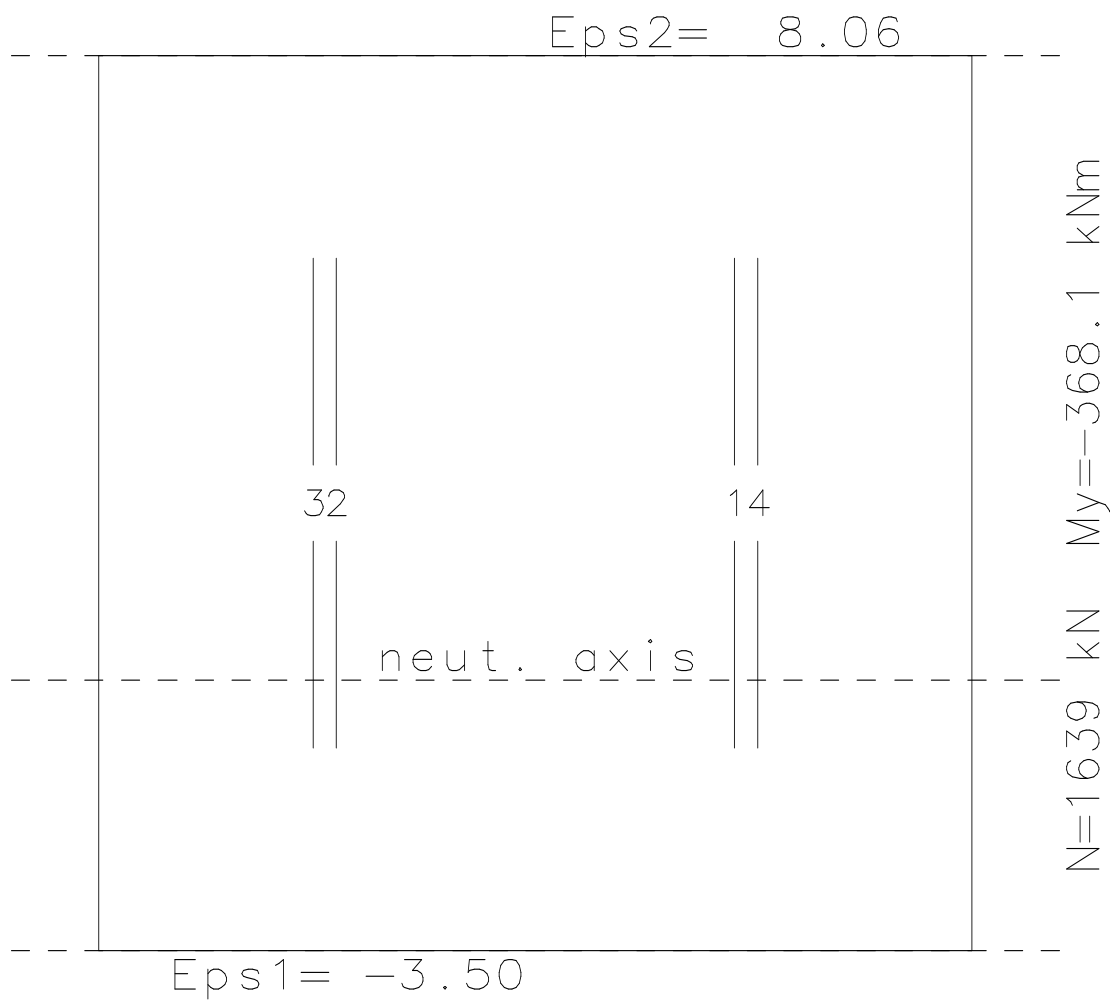


Výsledková grafika





Sec: 1 Poloha: 1 ZS: 1 As=196cm² MS vyuziti=1.01 >1 Nm1.00

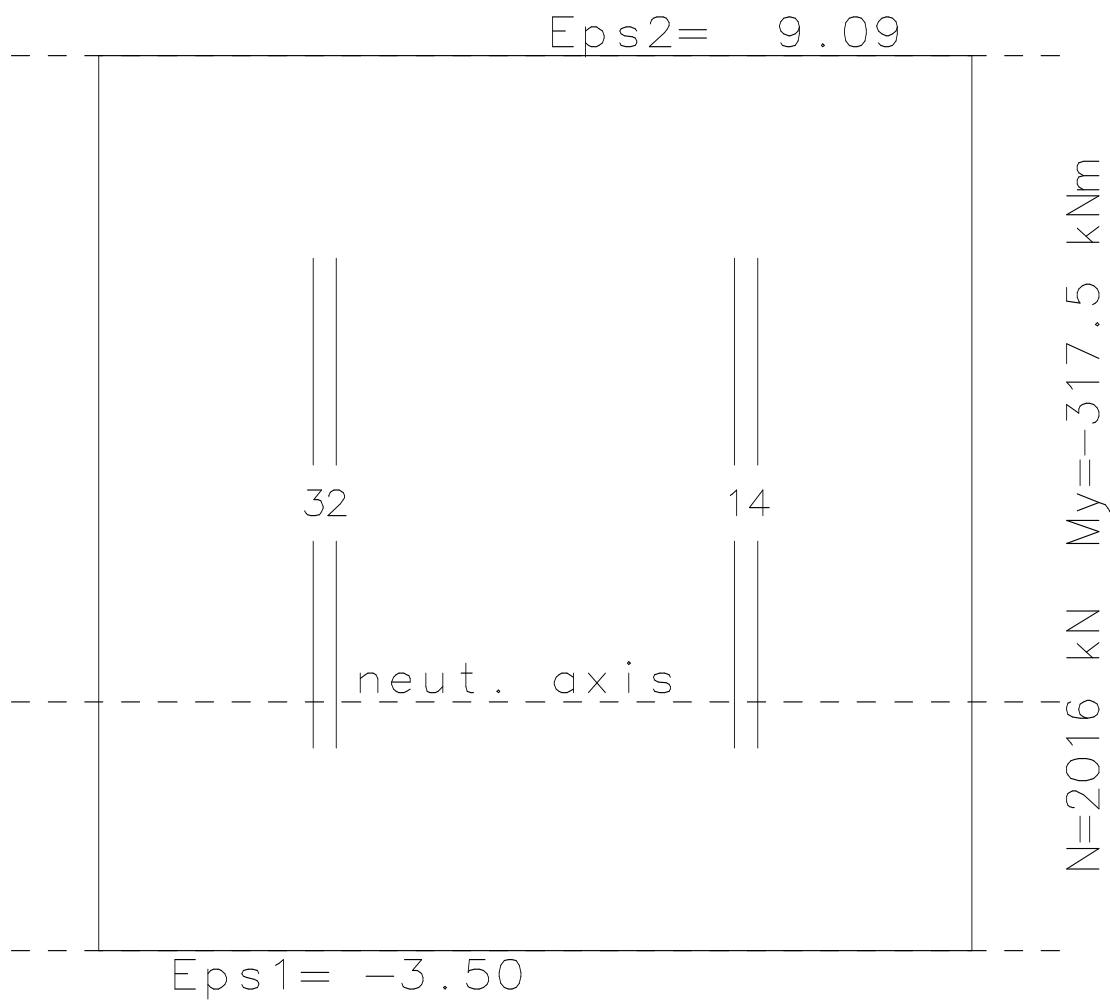


DoIn $p\beta s$

$\text{---} = 0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 2 As=196cm² MS vyuziti=1.01 >1 Nm1.00

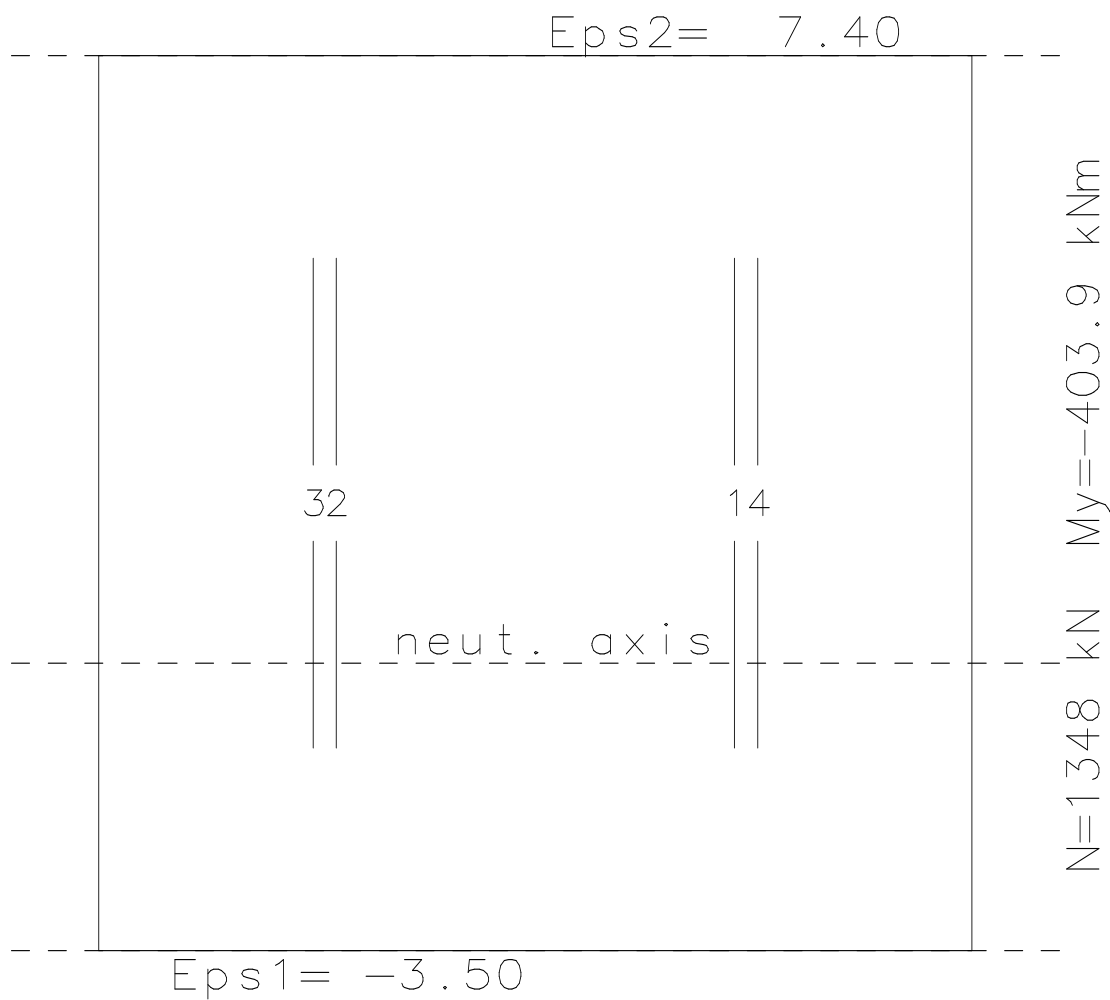


DoIn $p\beta s$

$\text{---} = 0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 3 As=196cm² MS vyuziti=1.01 >1 Nm1.00

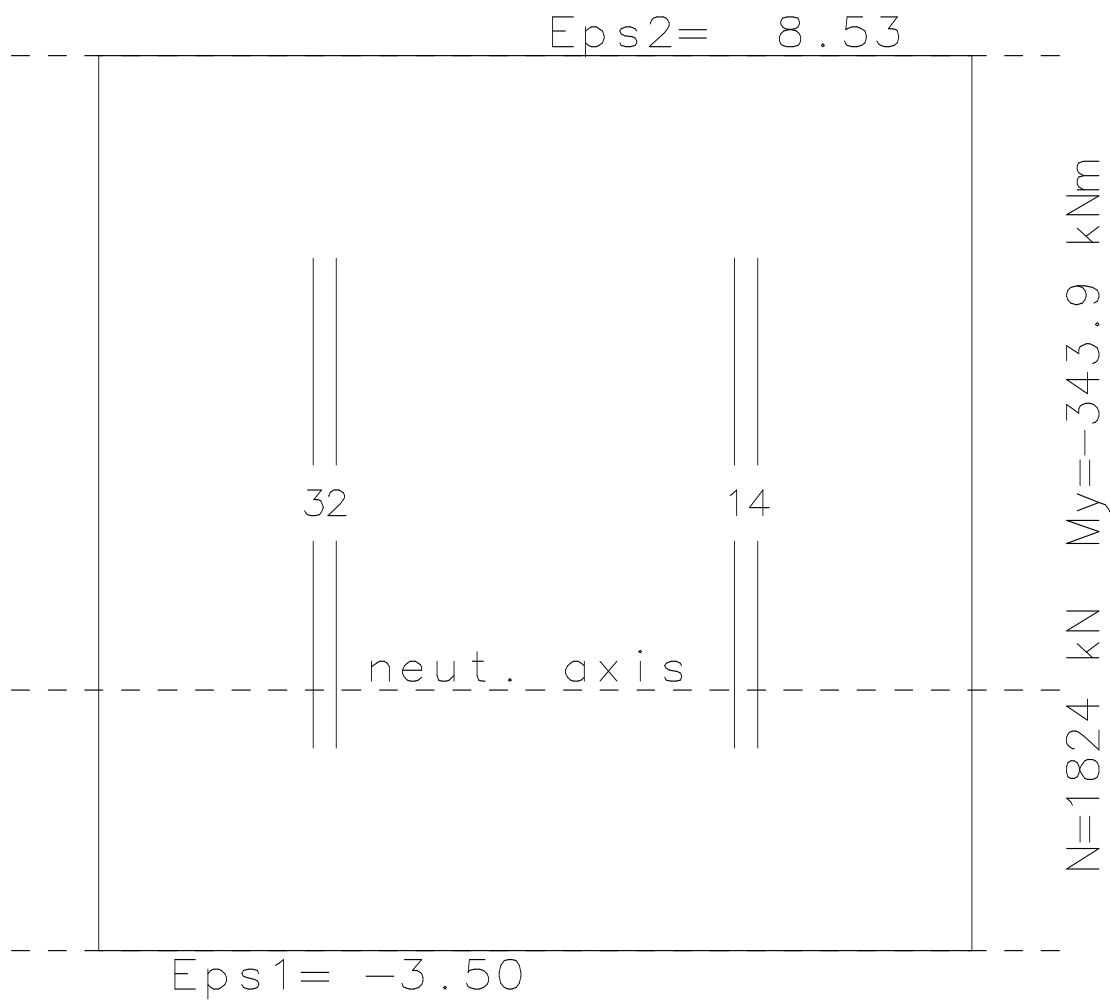


DoIn $p\beta s$

$\text{---} = 0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 4 As=196cm² MS vyuziti=1.01 >1 Nm1.00

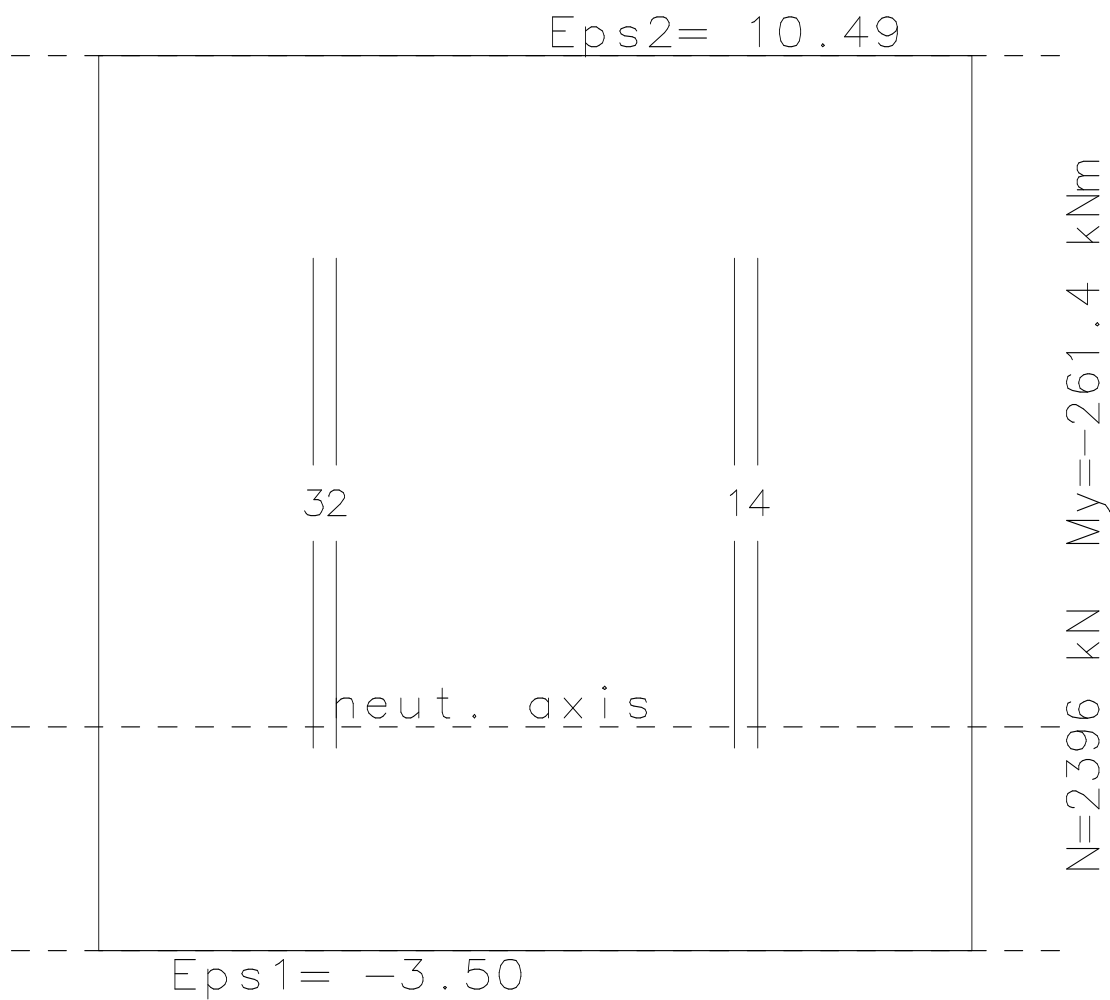


DoIn $p\beta s$

— = 0.1 (m)



Sec: 1 Poloha: 1 ZS: 5 As=196cm² MS vyuziti=1.01 >1 Nm1.00

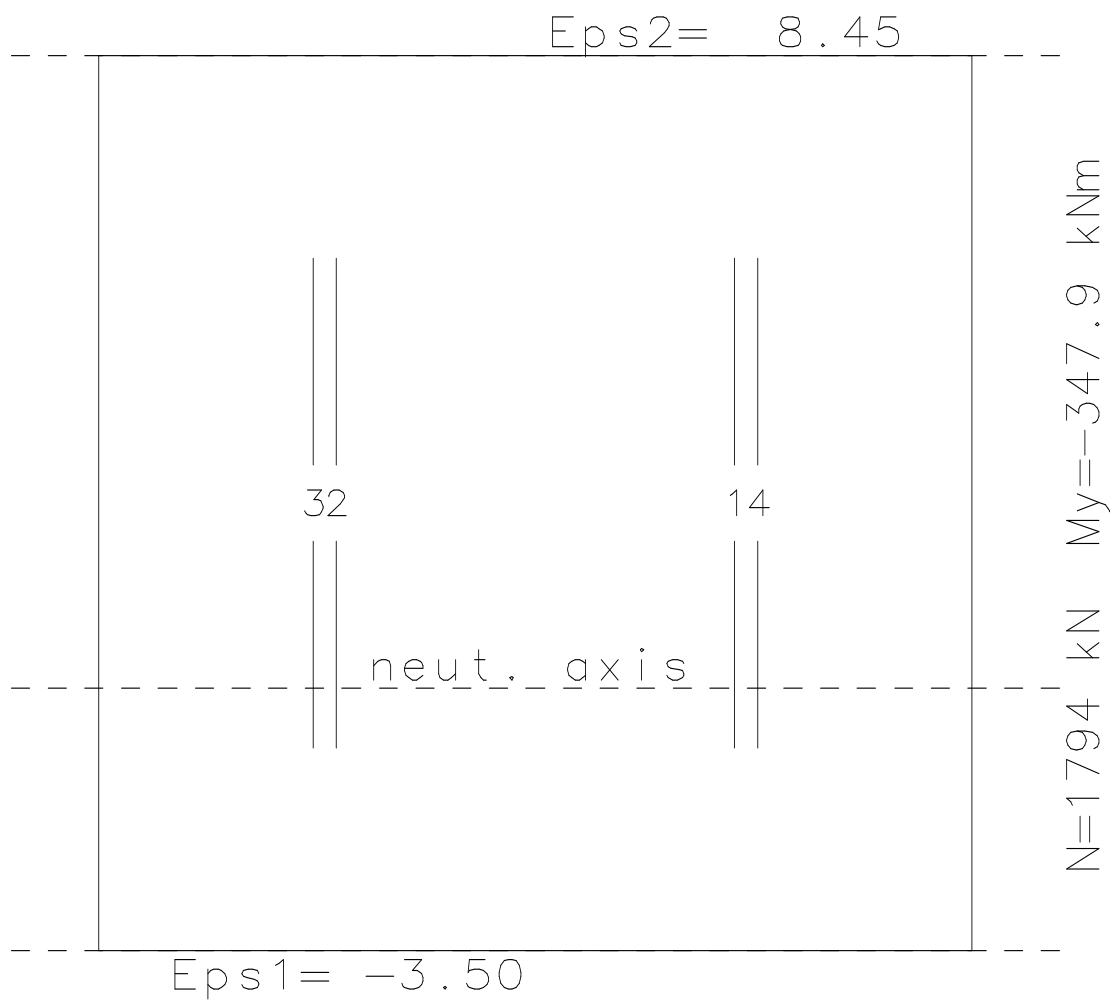


DoIn $p\beta s$

$\text{---} = 0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 6 As=196cm² MS vyuziti=1.01 >1 Nm1.00



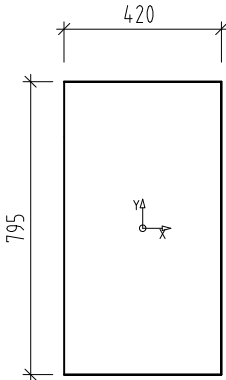
DoIn $p\beta s$

$\text{---} = 0.1 \text{ (m)}$

PŘÍČNÍK 3
Schéma

Průřezové charakteristiky

| | | |
|-----------------|------------|----------------|
| h | 0.795 | m |
| d | 0.420 | m |
| A | 0.33388595 | m ² |
| z _h | 0.397 | m |
| z _d | 0.397 | m |
| I _y | 0.01758388 | m ⁴ |
| i _y | 0.229 | m |
| Wy _h | 0.0442 | m ³ |
| Wy _d | 0.0442 | m ³ |



bez vzpěru
c 1

Materiály
beton
výztuž

C12/15
8xØ30

| MODEL 1 - Rámově spojený horní a dolní pás oblouku, zarámované svislice | |
|---|---|
| ZS | Zatížení |
| 1 | VLASTNÍ HMOTNOST |
| 2 | KONSTRUKCE VOZOVKY |
| 11 | zatížení pro norm zatížitelnost - rovnoměrné 2.5 |
| 23 | zatížení pro normální zatížitelnost - max M |
| 37 | zatížení pro normální zatížitelnost - max N |
| 63 | zatížení pro výhradní zatížitelnost - max M |
| 77 | zatížení pro výhradní zatížitelnost - max N |
| 41 | zatížení pro výjimečnou zatížitelnost - 9NV v polovině rozpětí |
| 42 | zatížení pro výjimečnou zatížitelnost - 9NV ve čtvrtině rozpětí |

1

$$\xi \cdot \gamma = 1.35 \cdot 0.85 = 1.1475$$
$$(M,N)_{Rd1} = 1.1475 \cdot (M,N)_{G1} + 1.35 \cdot \delta \cdot (M,N)_{q,b}$$
$$\delta \cdot (M,N)_{q,b} = \frac{(M,N)_{Rd1} - 1.1475 \cdot (M,N)_{G1}}{1.35}$$

2

$$\gamma = 1.35, \psi = 0.75$$
$$(M,N)_{Rd1} = 1.35 \cdot (M,N)_{G1} + 1.35 \cdot 0.75 \cdot \delta \cdot (M,N)_{q,b}$$
$$\delta \cdot (M,N)_{q,b} = \frac{(M,N)_{Rd1} - 1.35 \cdot (M,N)_{G1}}{1.35 \cdot 0.75}$$

Únosnost průřezu

Vn_M

| M kNm |
|----------|
| -170.1 |
| -36.8 |
| -40.4 |
| -87.6 |
| -240.7 |
| -37.8 |
| -240.7 |
| -18.1 |
| -26.7 |

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| -3.85 | 3.85 |
| -0.83 | 0.83 |
| -0.91 | 0.91 |
| -1.98 | 1.98 |
| -5.44 | 5.44 |
| -0.85 | 0.85 |
| -5.44 | 5.44 |
| -0.41 | 0.41 |
| -0.60 | 0.60 |

Vr_M

| |
|--------|
| -679.8 |
|--------|

| | |
|--------|-------|
| -15.37 | 15.37 |
|--------|-------|

Ve_1/2

| |
|--------|
| -679.8 |
|--------|

| | |
|--------|-------|
| -15.37 | 15.37 |
|--------|-------|

Ve_1/4

| | |
|--------|-------|
| -15.37 | 15.37 |
|--------|-------|

Zbývá na zatížení vozidly

1

$$\delta \cdot (M,N)_{q,b}$$

Vn_M

| M |
|--------|
| -327.6 |

| δ | 3NV | Va | N | M |
|-----|-----|----|---|------|
| 1.2 | | | | 2.13 |

Zatížitelnost normální Vn 28.4 t

Vr_M

| |
|--------|
| -327.6 |
|--------|

| | | | | |
|------|-----|-----|--|------|
| 1.25 | 6NV | Vrw | | 6.93 |
|------|-----|-----|--|------|

Zatížitelnost výhradní Vr 69.3 t

Ve_1/2

| |
|--------|
| -327.6 |
|--------|

| | | | | |
|------|-----|-----|--|-------|
| 1.05 | 9NV | Vew | | 17.26 |
|------|-----|-----|--|-------|

Zatížitelnost výjimečná Ve 172.6 t

Ve_1/4

| |
|--------|
| -327.6 |
|--------|

| | | | | |
|------|-----|-----|--|-------|
| 1.05 | 9NV | Vew | | 11.70 |
|------|-----|-----|--|-------|

Zatížitelnost výjimečná Ve 117.0 t

Zbývá na zatížení vozidly

2

$$\delta \cdot (M,N)_{q,b}$$

Vn_M

| M |
|--------|
| -395.5 |

| δ | 3NV | Va | N | M |
|-----|-----|----|---|------|
| 1.2 | | | | 2.57 |

Zatížitelnost normální Vn 34.3 t

Vr_M

| |
|--------|
| -395.5 |
|--------|

| | | | | |
|------|-----|-----|--|------|
| 1.25 | 6NV | Vrw | | 8.37 |
|------|-----|-----|--|------|

Zatížitelnost výhradní Vr 83.7 t

Ve_1/2

| |
|--------|
| -395.5 |
|--------|

| | | | | |
|------|-----|-----|--|-------|
| 1.05 | 9NV | Vew | | 20.83 |
|------|-----|-----|--|-------|

Zatížitelnost výjimečná Ve 208.3 t

Ve_1/4

| |
|--------|
| -395.5 |
|--------|

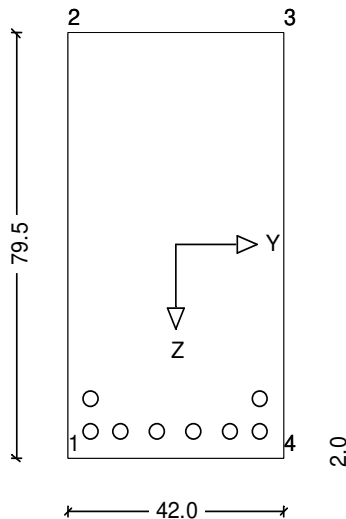
| | | | | |
|------|-----|-----|--|-------|
| 1.05 | 9NV | Vew | | 14.12 |
|------|-----|-----|--|-------|

Zatížitelnost výjimečná Ve 141.2 t



Obloukový most

Soubor: Příčník3 fy 280.zwv



Bereich: Příčník 3, Querschnitt: PŘ3

RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Příčník 3

Soubor: ZWAX.ZWA

Protokol zadání

* Mezní stav únosnosti pro ohyb s normálovou silou CSN EN 1992-1-1

Počítá se s průřezem netto tlačené zóny betonu

| Materiál - č. | Pevnost (N/mm ²) | E-Modul (N/mm ²) | Dov.přetvoření (o/oo) | |
|---------------|------------------------------|------------------------------|-----------------------|-------|
| | | | hrana | střed |
| Beton | $f_{c.d} = 8.0$ | $E_c = 27100.$ | tlak | -3.50 |
| Výztuž 2 | $f_{y.d} = 243.5$ | $E_s = 200000.$ | tah | -2.00 |
| Předp.kabel 3 | $f_{p.d} = 1304.3$ | $E_p = 195000.$ | | 10.00 |
| | | | | 1.22 |

Průřez: PŘ3

Výpočet jako netlačený prvek.

Počítá se vzdálenost vnější tahové výztuže od okraje

Polygonální dílčí průřez 1
Beton (=materiál 1)

Souřadnice

| y (m) | z (m) | Bod |
|--------|--------|-----|
| -0.210 | 0.400 | 1 |
| -0.210 | -0.395 | 2 |
| 0.210 | -0.395 | 3 |
| 0.210 | 0.400 | 4 |



Bodová, úseková, kruhová výztuž

| Č. Druh | Sada | Č.-mat. | Průřez | | As | Bod 1 | | Bod 2 | | zrca- dlit |
|---------|------|---------|--------|-----|-----|--------|--------|--------|--------|---------------|
| | | | min | max | | y1 (m) | z1 (m) | y2 (m) | z2 (m) | |
| 1 Bod | 1 | 2 | 6.5 | 6.5 | cm2 | 0.165 | 0.350 | | | na z |
| 3 Bod | 1 | 2 | 6.5 | 6.5 | cm2 | 0.105 | 0.350 | | | na z |
| 5 Bod | 1 | 2 | 6.5 | 6.5 | cm2 | 0.035 | 0.350 | | | na z |
| 7 Bod | 1 | 2 | 6.5 | 6.5 | cm2 | 0.165 | 0.290 | | | na z |

Poloha: PŘ3 - 770

| ZS | NS (kN) | MSy (kNm) | MSz (kNm) |
|----|---------|-----------|-----------|
| 1 | 0.0 | 453.0 | 0.0 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Příčnick 3

Výsledek

Průřez: PŘ3 Poloha: PŘ3 - 770

Průř. charakteristiky - brutto $I_1 = 0.017586 \text{ m}^4$ $y_s = 0.0000 \text{ m}$
 $A = 0.3339 \text{ m}^2$ $\alpha = 0.00$ $I_2 = 0.004908 \text{ m}^4$ $z_s = 0.0025 \text{ m}$

Výztuž (S=Sada M=Materiál)

| As | min.As | | max.As | stáv.As | | Souřadnice (m) | | | | Eps.0 | |
|------|--------|---|--------|---------|-------|----------------|----------------------------|-------|----|-------|------|
| Č. | S | M | (cm2) | (cm2) | (cm2) | cm2/m | y1 | z1 | y2 | z2 | o/oo |
| 1 | 1 | 2 | 6.51 | 6.51 | 6.51 | | 0.165 | 0.350 | | | |
| 2 | 1 | 2 | 6.51 | 6.51 | 6.51 | | -0.165 | 0.350 | | | |
| 3 | 1 | 2 | 6.51 | 6.51 | 6.51 | | 0.105 | 0.350 | | | |
| 4 | 1 | 2 | 6.51 | 6.51 | 6.51 | | -0.105 | 0.350 | | | |
| 5 | 1 | 2 | 6.51 | 6.51 | 6.51 | | 0.035 | 0.350 | | | |
| 6 | 1 | 2 | 6.51 | 6.51 | 6.51 | | -0.035 | 0.350 | | | |
| 7 | 1 | 2 | 6.51 | 6.51 | 6.51 | | 0.165 | 0.290 | | | |
| 8 | 1 | 2 | 6.51 | 6.51 | 6.51 | | -0.165 | 0.290 | | | |
| Suma | | | 52.08 | 52.09 | 52.08 | | nutná.As/Abrutto = 1.560 ‰ | | | | |

Návrh na MSÚ As = 52.1 cm²

ZS Vnitřní účinky na MSÚ Přetvoření (o/oo) Beta Gama Využití
N (kN) My (kNm) Mz (kNm) Eps.1 Eps.2 Eps.s (°)

1 0. 680. 0. -3.500 2.469 2.09 0.0 1.000 0.666

ZS ----Tlaková výslednice----- ----Tahová výslednice----- Rameno
(kN) y (m) z (m) A (m²) (kN) y (m) z (m) A (m²) (m)

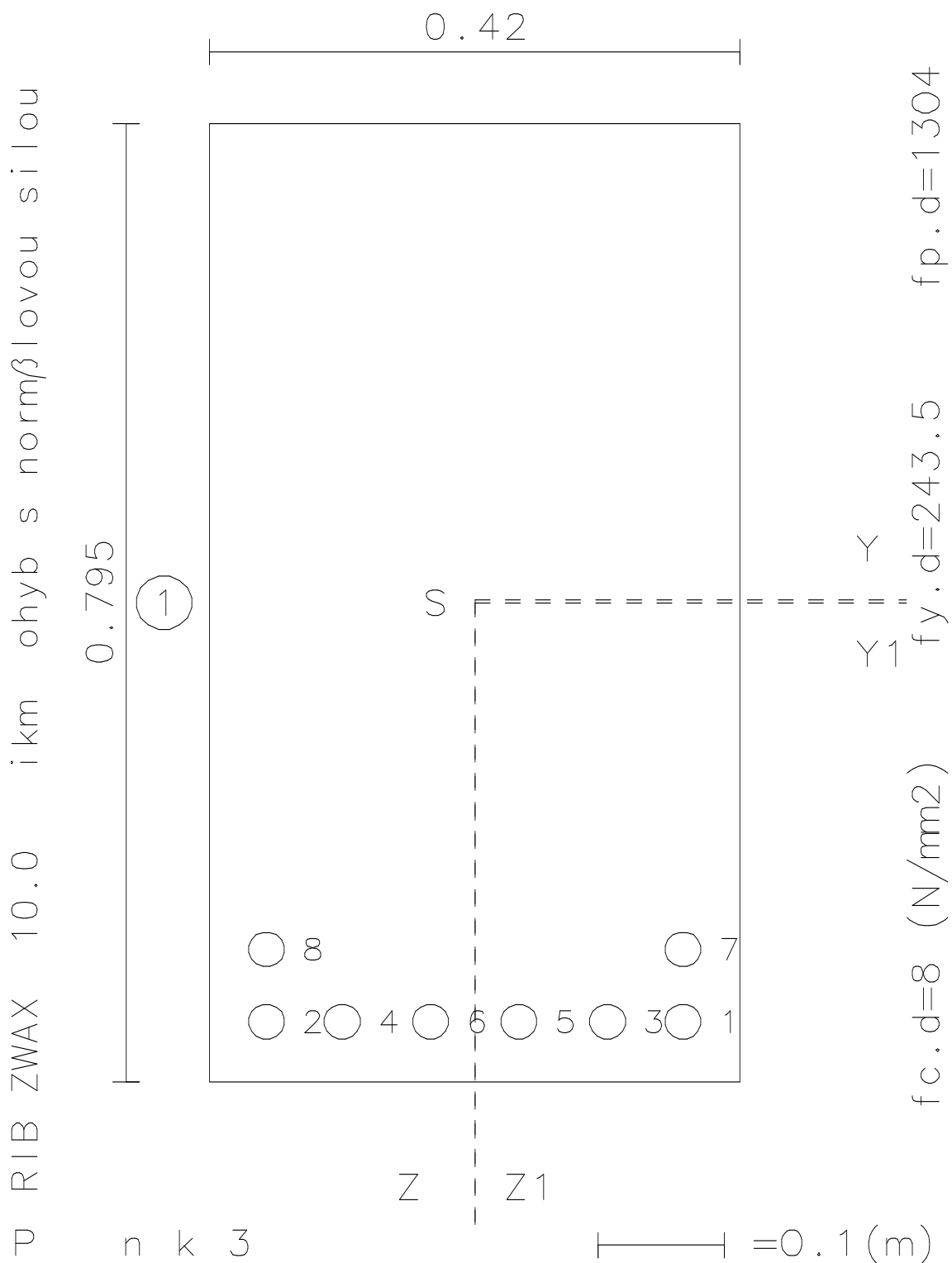
1 -1268. 0.000 -0.201 0.1958 1268. 0.000 0.335 0.00521 0.5361

Výztuž Eps.0 y z ZS Eps.s Sigma
Č. (cm²) (o/oo) (m) (m) (o/oo) N/mm²

| | | | | | | | |
|---|-----|--|--------|-------|---|-------|-----|
| 1 | 6.5 | | 0.165 | 0.350 | 1 | 2.093 | 243 |
| 2 | 6.5 | | -0.165 | 0.350 | 1 | 2.093 | 243 |
| 3 | 6.5 | | 0.105 | 0.350 | 1 | 2.093 | 243 |
| 4 | 6.5 | | -0.105 | 0.350 | 1 | 2.093 | 243 |
| 5 | 6.5 | | 0.035 | 0.350 | 1 | 2.093 | 243 |
| 6 | 6.5 | | -0.035 | 0.350 | 1 | 2.093 | 243 |
| 7 | 6.5 | | 0.165 | 0.290 | 1 | 1.643 | 243 |
| 8 | 6.5 | | -0.165 | 0.290 | 1 | 1.643 | 243 |

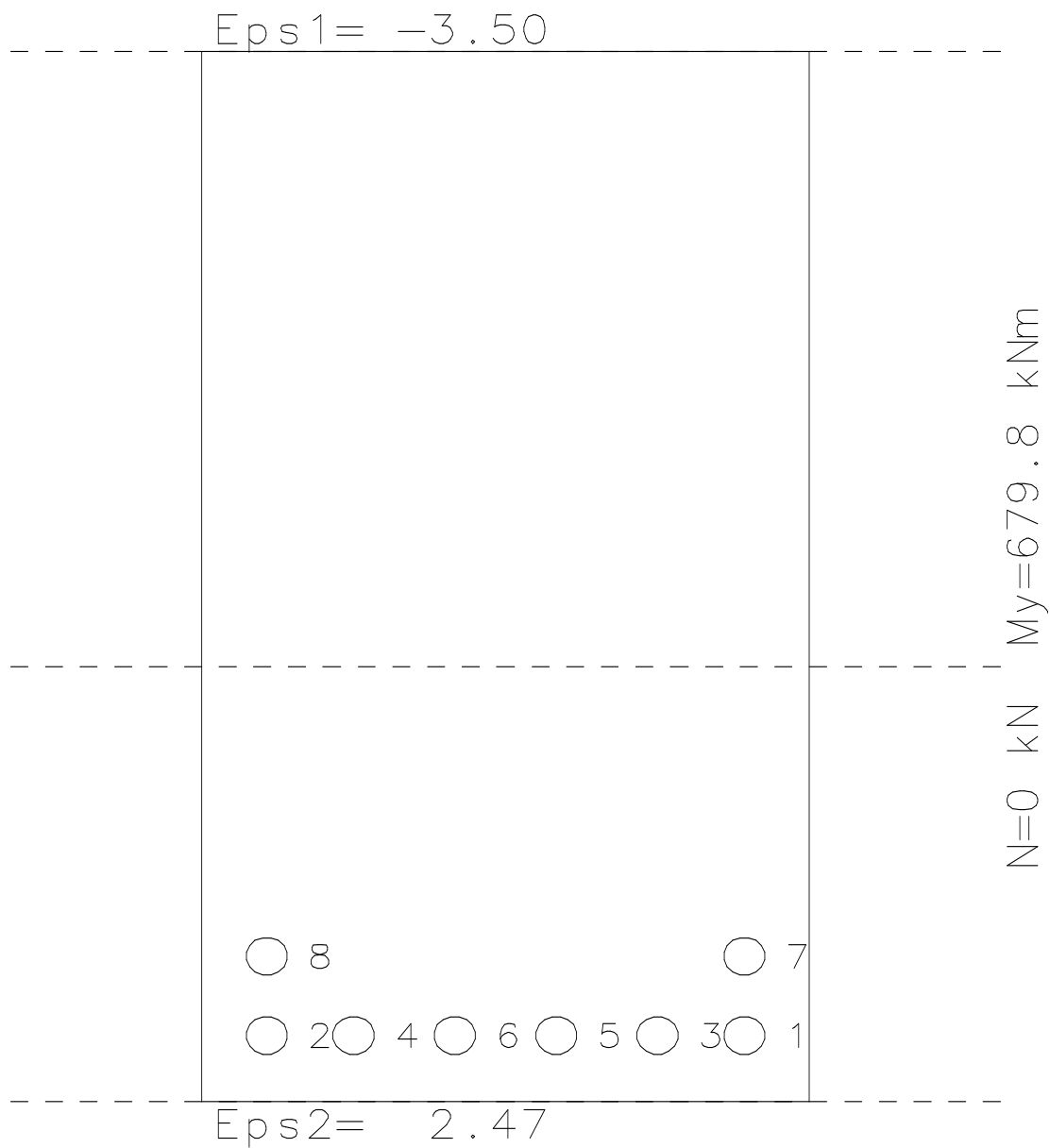


Výsledková grafika





Sec: 1 Poloha: 1 ZS: 1 As=52.08cm² MS vyuziti=1.01 >1 Nm.666



P n k 3

— = 0.1 (m)

Deska
Schéma

Průřezové charakteristiky

| | | |
|----------------------------|------------|----------------|
| h | 0.150 | m |
| d | 1.000 | m |
| A | 0.15 | m ² |
| z _h | 0.075 | m |
| z _d | 0.075 | m |
| I _y | 0.00028125 | m ⁴ |
| i _y | 0.043 | m |
| W _{y_h} | 0.0038 | m ³ |
| W _{y_d} | 0.0038 | m ³ |

bez vzpěru
c

1

Materiály
beton
výztuž

C12/15
pr. 12 a 120mm

MODEL 1 - Rámově spojený horní a dolní pás oblouku, zarámované svislice

| ZS | | uzel | FXX | MXX |
|----|---|---------------|------|--------|
| ZS | Zatížení | | kN/m | kNm/m |
| 1 | VLASTNÍ HMOTNOST | [Výsledek] 1 | 2187 | 155.32 |
| 2 | KONSTRUKCE VOZOVKY | [Výsledek] 2 | 2187 | 20.23 |
| 11 | zatížení pro norm. zatížitelnost - rovnoměrné 2.5 | [Výsledek] 11 | 2187 | 18.81 |
| 13 | zatížení pro normální zatížitelnost - max M | [Výsledek] 13 | 2187 | 32.95 |
| 22 | zatížení pro normální zatížitelnost - max N | [Výsledek] 22 | 2187 | 17.87 |
| 53 | zatížení pro výhradní zatížitelnost - max M | [Výsledek] 53 | 2187 | 16.76 |
| 62 | zatížení pro výhradní zatížitelnost - max N | [Výsledek] 62 | 2187 | 14.51 |
| 41 | zatížení pro výjimečnou zatížitelnost - 9NV v polovině rozpětí | [Výsledek] 41 | 2187 | 5.19 |
| 42 | zatížení pro výjimečnou zatížitelnost - 9NV ve čtvrtině rozpětí | [Výsledek] 42 | 2187 | 8.58 |

| betonová deska | |
|-----------------------------|-----------------------------|
| σ _c ^h | σ _c ^d |
| MPa | MPa |

e=M/F h/6

| N |
|-------|
| kN/m |
| 155.3 |
| 20.2 |
| 18.8 |
| 33.0 |
| 17.9 |
| 16.8 |
| 14.5 |
| 5.2 |
| 8.6 |

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| 1.04 | 1.04 |
| 0.13 | 0.13 |
| 0.13 | 0.13 |
| 0.22 | 0.22 |
| 0.12 | 0.12 |
| 0.11 | 0.11 |
| 0.10 | 0.10 |
| 0.03 | 0.03 |
| 0.06 | 0.06 |

Únosnost průřezu

| N _{rd} |
|-----------------|
| kN/m |
| Vn_M 414.8 |
| Vn_N 414.8 |
| Vr_M 414.8 |
| Vr_N 414.8 |
| Ve_1/2 414.8 |
| Ve_1/4 414.8 |

| σ ^h | σ ^d |
|----------------|----------------|
| MPa | MPa |
| 2.77 | 2.77 |
| 2.77 | 2.77 |
| 2.77 | 2.77 |
| 2.77 | 2.77 |
| 2.77 | 2.77 |
| 2.77 | 2.77 |

1

$$\xi \cdot \gamma = 1.35 \cdot 0.85 = 1.1475$$
$$(M, N)_{Rd1} = 1.1475 \cdot (M, N)_{G1} + 1.35 \cdot \delta \cdot (M, N)_{q,b}$$
$$\delta \cdot (M, N)_{q,b} = \frac{(M, N)_{Rd1} - 1.1475 \cdot (M, N)_{G1}}{1.35}$$

2

$$\gamma = 1.35, \psi = 0.75$$
$$(M, N)_{Rd1} = 1.35 \cdot (M, N)_{G1} + 1.35 \cdot 0.75 \cdot \delta \cdot (M, N)_{q,b}$$
$$\delta \cdot (M, N)_{q,b} = \frac{(M, N)_{Rd1} - 1.35 \cdot (M, N)_{G1}}{1.35 \cdot 0.75}$$

Zbývá na zatížení vozidly

1

$$\delta \cdot (M, N)_{q,b}$$

| N |
|--------------|
| Vn_M 158.0 |
| Vn_N 158.0 |
| Vr_M 158.0 |
| Vr_N 158.0 |
| Ve_1/2 158.0 |
| Ve_1/4 158.0 |

| δ | | | N |
|------|-----|-----|-------|
| 1.2 | 3NV | Va | 2.54 |
| 1.2 | 3NV | Va | 3.59 |
| 1.25 | 6NV | Vrw | 7.54 |
| 1.25 | 6NV | Vrw | 8.71 |
| 1.05 | 9NV | Vew | 28.98 |
| 1.05 | 9NV | Vew | 17.54 |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 33.9 | t |
| Zatížitelnost normální Vn | 47.9 | t |
| Zatížitelnost výhradní Vr | 75.4 | t |
| Zatížitelnost výhradní Vr | 87.1 | t |
| Zatížitelnost výjimečná Ve | 289.8 | t |
| Zatížitelnost výjimečná Ve | 175.4 | t |

Zbývá na zatížení vozidly

2

$$\delta \cdot (M, N)_{q,b}$$

| N |
|--------------|
| Vn_M 175.6 |
| Vn_N 175.6 |
| Vr_M 175.6 |
| Vr_N 175.6 |
| Ve_1/2 175.6 |
| Ve_1/4 175.6 |

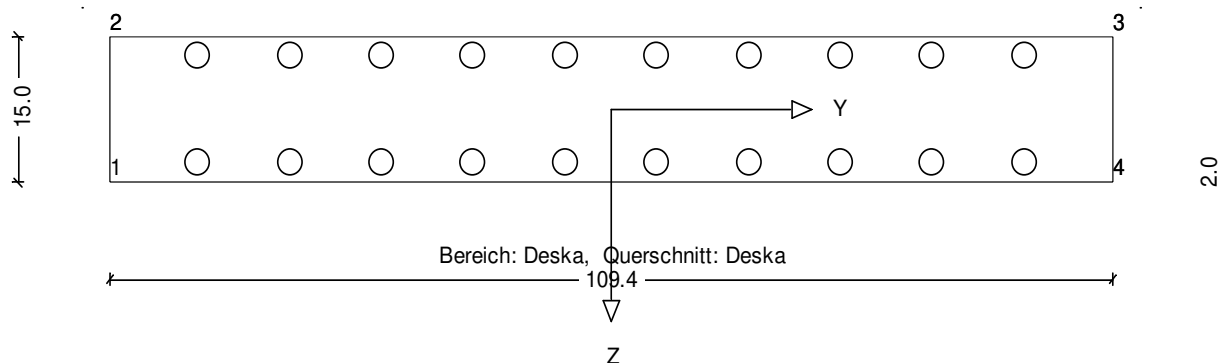
| δ | | | N |
|------|-----|-----|-------|
| 1.2 | 3NV | Va | 2.83 |
| 1.2 | 3NV | Va | 3.99 |
| 1.25 | 6NV | Vrw | 8.38 |
| 1.25 | 6NV | Vrw | 9.68 |
| 1.05 | 9NV | Vew | 32.20 |
| 1.05 | 9NV | Vew | 19.48 |

| | | |
|----------------------------|-------|---|
| Zatížitelnost normální Vn | 37.7 | t |
| Zatížitelnost normální Vn | 53.2 | t |
| Zatížitelnost výhradní Vr | 83.8 | t |
| Zatížitelnost výhradní Vr | 96.8 | t |
| Zatížitelnost výjimečná Ve | 322.0 | t |
| Zatížitelnost výjimečná Ve | 194.8 | t |



Obloukový most

Soubor: Deska.zwv



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Deska

Soubor: ZWAX.ZWA

Protokol zadání

* Mezní stav únosnosti pro ohyb s normálovou silou CSN EN 1992-1-1

Počítá se s průřezem netto tlačené zóny betonu

| Materiál - č. | Pevnost (N/mm ²) | E-Modul (N/mm ²) | Dov. přetvoření (o/oo) | |
|---------------|------------------------------|------------------------------|------------------------|-------------|
| | | | hrana | střed |
| Beton | $f_{c,d} = 6.4$ | $E_c = 27100.$ | tlak | -3.50 -2.00 |
| Výztuž 2 | $f_{y,d} = 230.4$ | $E_s = 200000.$ | tah | 10.00 1.15 |
| Předp.kabel 3 | $f_{p,d} = 1304.3$ | $E_p = 195000.$ | | |

Průřez: Deska

Výpočet jako netlačený prvek.

Počítá se vzdálenost vnější tahové výztuže od okraje

Polygonální dílčí průřez 1
Beton (=materiál 1)

Souřadnice

| y (m) | z (m) | Bod |
|--------|--------|-----|
| -0.547 | 0.075 | 1 |
| -0.547 | -0.075 | 2 |
| 0.547 | -0.075 | 3 |
| 0.547 | 0.075 | 4 |



Bodová, úseková, kruhová výztuž

| Č. Druh | Sada | Č.-mat. | Průřez | | As | Bod 1 | | Bod 2 | | zrca- dlit |
|---------|------|---------|--------|-----|-----|--------|--------|--------|--------|---------------|
| | | | min | max | | y1 (m) | z1 (m) | y2 (m) | z2 (m) | |
| 1 Bod | 1 | 2 | 0.9 | 0.9 | cm2 | 0.050 | -0.055 | | | na z |
| 3 Bod | 1 | 2 | 0.9 | 0.9 | cm2 | 0.150 | -0.055 | | | na z |
| 5 Bod | 1 | 2 | 0.9 | 0.9 | cm2 | 0.250 | -0.055 | | | na z |
| 7 Bod | 1 | 2 | 0.9 | 0.9 | cm2 | 0.350 | -0.055 | | | na z |
| 9 Bod | 1 | 2 | 0.9 | 0.9 | cm2 | 0.450 | -0.055 | | | na z |
| 11 Bod | 1 | 2 | 0.9 | 0.9 | cm2 | 0.050 | 0.055 | | | na z |
| 13 Bod | 1 | 2 | 0.9 | 0.9 | cm2 | 0.150 | 0.055 | | | na z |
| 15 Bod | 1 | 2 | 0.9 | 0.9 | cm2 | 0.250 | 0.055 | | | na z |
| 17 Bod | 1 | 2 | 0.9 | 0.9 | cm2 | 0.350 | 0.055 | | | na z |
| 19 Bod | 1 | 2 | 0.9 | 0.9 | cm2 | 0.450 | 0.055 | | | na z |

Poloha: Deska

| ZS | N (kN) | M1 (kNm) | M2 (kNm) | | |
|----|--------|----------|----------|-----|-----|
| 1 | 370.0 | 0.0 | 0.0 | 0.0 | 0.0 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Deska

| ZS | N (kN) | M1 (kNm) | M2 (kNm) |
|----|--------|----------|----------|
| 2 | 0.0 | -10.0 | 0.0 |

Výsledek

Průřez: Deska Poloha: Deska

Průř. charakteristiky - brutto $I_1 = 0.000308 \text{ m}^4$ $y_s = 0.0000 \text{ m}$
 $A = 0.1641 \text{ m}^2$ $\text{Alfa} = 0.00$ $I_2 = 0.016367 \text{ m}^4$ $z_s = 0.0000 \text{ m}$

Výztuž (S=Sada M=Materiál)

| As | min.As | max.As | stáv.As | Souřadnice (m) | | | Eps.0 |
|------|--------|--------------------|--------------------|--------------------|--------------------|----------------------------|-------|
| Č. | S M | (cm ²) | (cm ²) | (cm ²) | cm ² /m | y1 z1 y2 z2 | o/oo |
| 1 | 1 2 | 0.90 | 0.90 | 0.90 | | 0.050 -0.055 | |
| 2 | 1 2 | 0.90 | 0.90 | 0.90 | | -0.050 -0.055 | |
| 3 | 1 2 | 0.90 | 0.90 | 0.90 | | 0.150 -0.055 | |
| 4 | 1 2 | 0.90 | 0.90 | 0.90 | | -0.150 -0.055 | |
| 5 | 1 2 | 0.90 | 0.90 | 0.90 | | 0.250 -0.055 | |
| 6 | 1 2 | 0.90 | 0.90 | 0.90 | | -0.250 -0.055 | |
| 7 | 1 2 | 0.90 | 0.90 | 0.90 | | 0.350 -0.055 | |
| 8 | 1 2 | 0.90 | 0.90 | 0.90 | | -0.350 -0.055 | |
| 9 | 1 2 | 0.90 | 0.90 | 0.90 | | 0.450 -0.055 | |
| 10 | 1 2 | 0.90 | 0.90 | 0.90 | | -0.450 -0.055 | |
| 11 | 1 2 | 0.90 | 0.90 | 0.90 | | 0.050 0.055 | |
| 12 | 1 2 | 0.90 | 0.90 | 0.90 | | -0.050 0.055 | |
| 13 | 1 2 | 0.90 | 0.90 | 0.90 | | 0.150 0.055 | |
| 14 | 1 2 | 0.90 | 0.90 | 0.90 | | -0.150 0.055 | |
| 15 | 1 2 | 0.90 | 0.90 | 0.90 | | 0.250 0.055 | |
| 16 | 1 2 | 0.90 | 0.90 | 0.90 | | -0.250 0.055 | |
| 17 | 1 2 | 0.90 | 0.90 | 0.90 | | 0.350 0.055 | |
| 18 | 1 2 | 0.90 | 0.90 | 0.90 | | -0.350 0.055 | |
| 19 | 1 2 | 0.90 | 0.90 | 0.90 | | 0.450 0.055 | |
| 20 | 1 2 | 0.90 | 0.90 | 0.90 | | -0.450 0.055 | |
| Suma | | 18.00 | 18.02 | 18.00 | | nutná.As/Abrutto = 1.097 % | |

Návrh na MSÚ As = 18.0 cm²

| ZS | Vnitřní účinky na MSÚ | | | Přetvoření (o/oo) | | | Beta | Gama | Využití |
|----|-----------------------|----------|----------|-------------------|--------|-------|-------|-------|---------|
| | N (kN) | My (kNm) | Mz (kNm) | Eps.1 | Eps.2 | Eps.s | (°) | | |
| 1 | 415. | 0. | 0. | 1.152 | 1.152 | 1.15 | 0.0 | 1.000 | 0.892 |
| 2 | 0. | -24. | 0. | -2.372 | 11.903 | 10.00 | 180.0 | 1.000 | 0.415 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

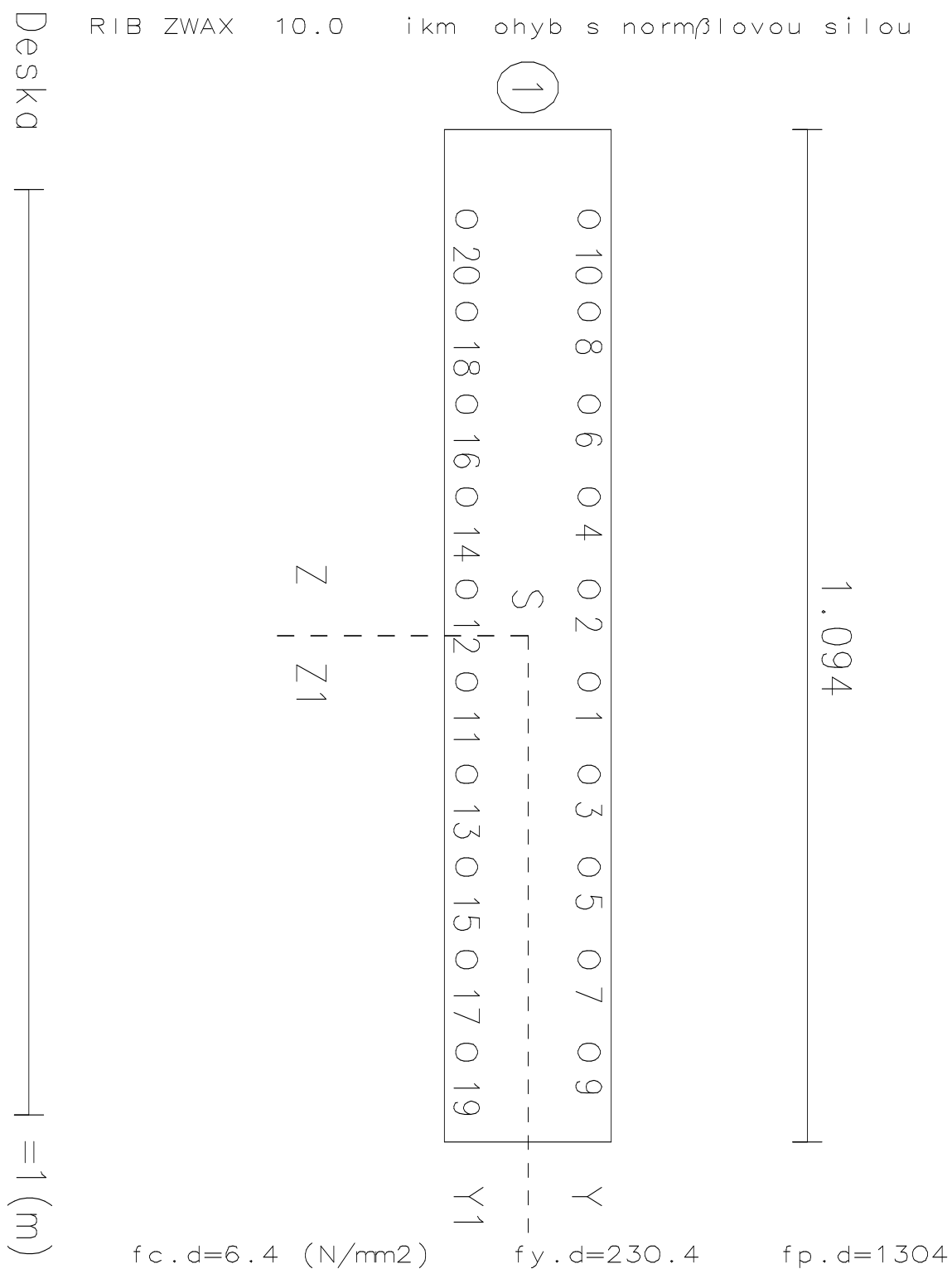
Deska

| ZS | ----Tlaková výslednice----- | | | | -----Tahová výslednice----- | | | | Rameno (m) |
|----|-----------------------------|-------|-------|--------|-----------------------------|-------|--------|---------|---------------|
| | (kN) | y (m) | z (m) | A (m2) | (kN) | y (m) | z (m) | A (m2) | |
| 1 | | | | | 415. | 0.000 | 0.000 | 0.00180 | |
| 2 | -207. | 0.000 | 0.061 | 0.0273 | 207. | 0.000 | -0.055 | 0.00090 | 0.1163 |

| Výztuž Č. | Eps.0 (o/oo) | y (m) | z (m) | ZS | Eps.s (o/oo) | Sigma N/mm2 |
|--------------|-----------------|----------|----------|----|-----------------|----------------|
| 1 | 0.9 | 0.050 | -0.055 | 1 | 1.152 | 230 |
| 2 | 0.9 | -0.050 | -0.055 | 1 | 1.152 | 230 |
| 3 | 0.9 | 0.150 | -0.055 | 1 | 1.152 | 230 |
| 4 | 0.9 | -0.150 | -0.055 | 1 | 1.152 | 230 |
| 5 | 0.9 | 0.250 | -0.055 | 1 | 1.152 | 230 |
| 6 | 0.9 | -0.250 | -0.055 | 1 | 1.152 | 230 |
| 7 | 0.9 | 0.350 | -0.055 | 1 | 1.152 | 230 |
| 8 | 0.9 | -0.350 | -0.055 | 1 | 1.152 | 230 |
| 9 | 0.9 | 0.450 | -0.055 | 1 | 1.152 | 230 |
| 10 | 0.9 | -0.450 | -0.055 | 1 | 1.152 | 230 |
| 11 | 0.9 | 0.050 | 0.055 | 1 | 1.152 | 230 |
| 12 | 0.9 | -0.050 | 0.055 | 1 | 1.152 | 230 |
| 13 | 0.9 | 0.150 | 0.055 | 1 | 1.152 | 230 |
| 14 | 0.9 | -0.150 | 0.055 | 1 | 1.152 | 230 |
| 15 | 0.9 | 0.250 | 0.055 | 1 | 1.152 | 230 |
| 16 | 0.9 | -0.250 | 0.055 | 1 | 1.152 | 230 |
| 17 | 0.9 | 0.350 | 0.055 | 1 | 1.152 | 230 |
| 18 | 0.9 | -0.350 | 0.055 | 1 | 1.152 | 230 |
| 19 | 0.9 | 0.450 | 0.055 | 1 | 1.152 | 230 |
| 20 | 0.9 | -0.450 | 0.055 | 1 | 1.152 | 230 |
| 1 | 0.9 | 0.050 | -0.055 | 2 | 10.000 | 230 |
| 2 | 0.9 | -0.050 | -0.055 | 2 | 10.000 | 230 |
| 3 | 0.9 | 0.150 | -0.055 | 2 | 10.000 | 230 |
| 4 | 0.9 | -0.150 | -0.055 | 2 | 10.000 | 230 |
| 5 | 0.9 | 0.250 | -0.055 | 2 | 10.000 | 230 |
| 6 | 0.9 | -0.250 | -0.055 | 2 | 10.000 | 230 |
| 7 | 0.9 | 0.350 | -0.055 | 2 | 10.000 | 230 |
| 8 | 0.9 | -0.350 | -0.055 | 2 | 10.000 | 230 |
| 9 | 0.9 | 0.450 | -0.055 | 2 | 10.000 | 230 |
| 10 | 0.9 | -0.450 | -0.055 | 2 | 10.000 | 230 |
| 11 | 0.9 | 0.050 | 0.055 | 2 | -0.468 | -94 |
| 12 | 0.9 | -0.050 | 0.055 | 2 | -0.468 | -94 |
| 13 | 0.9 | 0.150 | 0.055 | 2 | -0.468 | -94 |
| 14 | 0.9 | -0.150 | 0.055 | 2 | -0.468 | -94 |
| 15 | 0.9 | 0.250 | 0.055 | 2 | -0.468 | -94 |
| 16 | 0.9 | -0.250 | 0.055 | 2 | -0.468 | -94 |
| 17 | 0.9 | 0.350 | 0.055 | 2 | -0.468 | -94 |
| 18 | 0.9 | -0.350 | 0.055 | 2 | -0.468 | -94 |
| 19 | 0.9 | 0.450 | 0.055 | 2 | -0.468 | -94 |
| 20 | 0.9 | -0.450 | 0.055 | 2 | -0.468 | -94 |



Výsledková grafika





Eps1= 1.15

01008 06 04 02 01 03 05 07 09

0 20 0 18 0 16 0 14 0 12 0 11 0 13 0 15 0 17 0 19

$$\epsilon_{ps2} = 1.15$$
$$N = 414.8 \text{ kN} \quad M_y = 0 \text{ kNm}$$

Desk $\vdash 1(m)$



Sec: 1 Poloha: 1 ZS: 2 As=18cm2 MS vyuziti=1.01 >1 Nm.415

Eps2=11.90

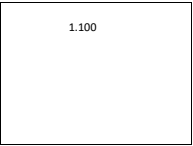
| | | | | | | | | | | | | | | | | | | | |
|---------------------------------|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|
| 0 | 10 | 0 | 8 | 0 | 6 | 0 | 4 | 0 | 2 | 0 | 1 | 0 | 3 | 0 | 5 | 0 | 7 | 0 | 9 |
| $n_{\text{eul}}^{\text{axi's}}$ | | | | | | | | | | | | | | | | | | | |
| 0 | 20 | 0 | 18 | 0 | 16 | 0 | 14 | 0 | 12 | 0 | 11 | 0 | 13 | 0 | 15 | 0 | 17 | 0 | 19 |

$$\text{Eps1} = -2.37$$

$$N=0 \quad \text{kN} \quad M_y=-24.1 \quad \text{kNm}$$

Desk $\vdash 1(m)$

PODÉLNÍK 3
Schéma



Materiály
beton C12/15
výztuž 5xØ15

Bez vzpěru
c 1

| MODEL 1 - Rámově spojený horní a dolní pás oblouku, zarámované svíslíce | | | | | | | | | |
|---|---|--------------------------|-------|------|------|--------|-------|---------|-------|
| | | | prut | | | | | | |
| | | | prvek | uzel | FX | My | FXX | MXX | FXX |
| | | | | | kN | kNm | kN/m | kNm/m | kNm/m |
| ZS | Zatížení | | | | | | | | |
| 1 | VLASTNÍ HMOTNOST | [Výsledek_normalni.xlsm] | 1 | 434 | 2658 | 52.27 | -5.05 | 147.95 | -0.92 |
| 2 | KONSTRUKCE VOZOVKY | [Výsledek_normalni.xlsm] | 2 | 434 | 2658 | 6.97 | -1.06 | 19.81 | -0.19 |
| 11 | zatížení pro norm zatížitelnost - rovnoměrné 2.5 | [Výsledek_normalni.xlsm] | 11 | 434 | 2658 | 6.54 | -1.14 | 18.64 | -0.20 |
| 34 | zatížení pro norm zatížitelnost - max M | [Výsledek_normalni.xlsm] | 34 | 434 | 2658 | 14.83 | -7.31 | 43.73 | -1.28 |
| 36 | zatížení pro norm zatížitelnost - max N | [Výsledek_normalni.xlsm] | 36 | 434 | 2658 | 16.42 | -9.74 | 46.38 | -1.42 |
| 74 | zatížení pro výhradní zatížitelnost - max M | [Výsledek_vyhradni.xlsm] | 74 | 434 | 2658 | 7.24 | -3.50 | 21.21 | -0.66 |
| 76 | zatížení pro výhradní zatížitelnost - max N | [Výsledek_vyhradni.xlsm] | 76 | 434 | 2658 | 8.15 | -4.80 | 22.99 | -0.75 |
| 41 | zatížení pro výjimečnou zatížitelnost - 9NV v polovině | [Výsledek_vyhradni.xlsm] | 41 | 434 | 2658 | 3.46 | -1.04 | 9.83 | -0.18 |
| 42 | zatížení pro výjimečnou zatížitelnost - 9NV ve čtvrtině | [Výsledek_vyhradni.xlsm] | 42 | 434 | 2658 | 2.60 | -0.90 | 7.60 | -0.16 |
| 51 | smršť | [Výsledek_normalni.xlsm] | 51 | 434 | 2658 | -43.24 | 2.26 | -133.01 | 0.20 |

| N | M |
|-------|-------|
| kN | kNm |
| 328.3 | -20.4 |
| 41.9 | -3.5 |
| 38.7 | -3.6 |
| 41.1 | -20.9 |
| 41.6 | -24.5 |
| 23.1 | -9.8 |
| 23.7 | -11.8 |
| 17.1 | -2.9 |
| 12.1 | -2.5 |
| 181.1 | 74.4 |
| Nrd | Mrd |
| kN | kNm |

| | | |
|--------|-------|--------|
| Vn_M | 704.0 | -113.2 |
| Vn_N | 688.9 | -119.8 |
| Vr_M | 626.6 | -113.3 |
| Vr_N | 631.7 | -130.2 |
| Ve_1/2 | 691.7 | -72.3 |
| Ve_1/4 | 614.2 | -66.3 |

1

$$\xi \cdot \gamma = 1.35 \cdot 0.85 = 1.1475$$
$$(M, N)_{\text{tot}} = 1.1475 \cdot (M, N)_{\text{ci}} + 1.35 \cdot \delta \cdot (M, N)_{\text{ed}}$$
$$\delta \cdot (M, N)_{\text{ed}} = \frac{(M, N)_{\text{tot}} - 1.1475 \cdot (M, N)_{\text{ci}}}{1.35}$$

2

$$\gamma = 1.35, \mu = 0.75$$
$$(M, N)_{\text{tot}} = 1.35 \cdot (M, N)_{\text{ci}} + 1.35 \cdot 0.75 \cdot \delta \cdot (M, N)_{\text{ed}}$$
$$\delta \cdot (M, N)_{\text{ed}} = \frac{(M, N)_{\text{tot}} - 1.35 \cdot (M, N)_{\text{ci}}}{1.35 \cdot 0.75}$$

Zatížení průřezu

Zbývá na zatížení vozidly

1

$$\delta \cdot (M, N)_{\text{ed}}$$

| | N | M |
|--------|-------|-------|
| Vn_M | 206.8 | -63.5 |
| Vn_N | 195.6 | -68.4 |
| Vr_M | 149.5 | -63.5 |
| Vr_N | 153.2 | -76.1 |
| Ve_1/2 | 197.7 | -33.2 |
| Ve_1/4 | 140.2 | -28.8 |

| | | | | N | M | | | |
|--|------|-----|-----|-------|-------|----------------------------|-------|---|
| | δ | | | | | | | |
| | 1.2 | 3NV | Va | 2.16 | 2.16 | Zatížitelnost normální Vn | 28.8 | t |
| | 1.2 | 3NV | Va | 2.16 | 2.16 | Zatížitelnost normální Vn | 28.8 | t |
| | 1.25 | 6NV | Vrw | 5.57 | 5.57 | Zatížitelnost výhradní Vr | 55.7 | t |
| | 1.25 | 6NV | Vrw | 5.57 | 5.57 | Zatížitelnost výhradní Vr | 55.7 | t |
| | 1.05 | 9NV | Vew | 11.00 | 11.00 | Zatížitelnost výjimečná Ve | 110.0 | t |
| | 1.05 | 9NV | Vew | 11.00 | 11.00 | Zatížitelnost výjimečná Ve | 110.0 | t |

Zbývá na zatížení vozidly

2

$$\delta \cdot (M, N)_{\text{ed}}$$

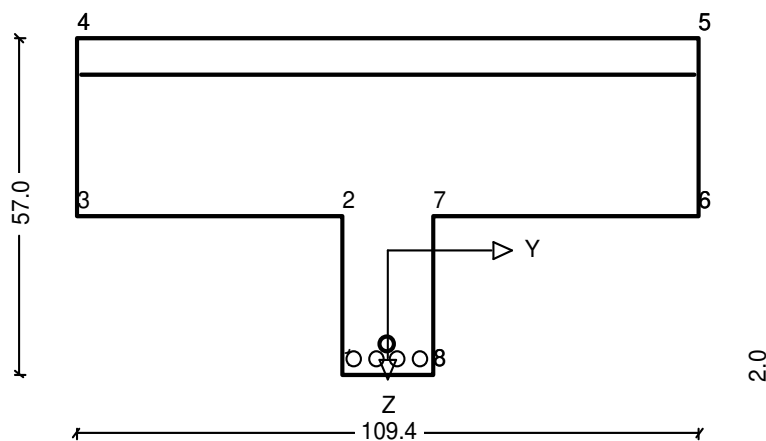
| | N | M |
|--------|-------|-------|
| Vn_M | 201.7 | -79.9 |
| Vn_N | 186.7 | -86.4 |
| Vr_M | 125.3 | -79.9 |
| Vr_N | 130.3 | -96.7 |
| Ve_1/2 | 189.5 | -39.5 |
| Ve_1/4 | 112.9 | -33.6 |

| | | | | N | M | | | |
|--|------|-----|-----|-------|-------|----------------------------|-------|---|
| | δ | | | | | | | |
| | 1.2 | 3NV | Va | 2.11 | 2.72 | Zatížitelnost normální Vn | 28.1 | t |
| | 1.2 | 3NV | Va | 1.94 | 2.56 | Zatížitelnost normální Vn | 25.8 | t |
| | 1.25 | 6NV | Vrw | 4.33 | 6.50 | Zatížitelnost výhradní Vr | 43.3 | t |
| | 1.25 | 6NV | Vrw | 4.39 | 6.57 | Zatížitelnost výhradní Vr | 43.9 | t |
| | 1.05 | 9NV | Vew | 10.55 | 13.08 | Zatížitelnost výjimečná Ve | 105.5 | t |
| | 1.05 | 9NV | Vew | 8.86 | 12.84 | Zatížitelnost výjimečná Ve | 88.6 | t |



Obloukový most

Soubor: Podélník 3 se zesílenou deskou v2.zwv



Bereich: Krajní podélník 403, 434, Querschnitt: POD 3

RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Krajní podélník 403, 434

Soubor: ZWAX.ZWA

Protokol zadání

* Mezní stav únosnosti pro ohyb s normálovou silou CSN EN 1992-1-1

Počítá se s průřezem netto tlačené zóny betonu

| Materiál - č. | Pevnost (N/mm ²) | E-Modul (N/mm ²) | Dov. přetvoření (o/oo) | |
|---------------|------------------------------|------------------------------|------------------------|-------------|
| | | | hrana | střed |
| Beton | $f_{c,d} = 8.0$ | $E_c = 27100.$ | tlak | -3.50 -2.00 |
| Výztuž 2 | $f_{y,d} = 243.5$ | $E_s = 200000.$ | tah | 10.00 1.22 |
| Předp.kabel 3 | $f_{p,d} = 1304.3$ | $E_p = 200000.$ | | |

Průřez: POD 3

Výpočet jako netlačený prvek.

Počítá se vzdálenost vnější tahové výztuže od okraje

Vnitřní účinky jsou vztaženy na počátek souř. systému

Polygonální dílčí průřez 1
Beton (=materiál 1)

Souřadnice

| y (m) | z (m) | Bod |
|--------|--------|-----|
| -0.080 | 0.210 | 1 |
| -0.080 | -0.060 | 2 |
| -0.547 | -0.060 | 3 |



| | | |
|--------|--------|---|
| -0.547 | -0.360 | 4 |
| 0.547 | -0.360 | 5 |
| 0.547 | -0.060 | 6 |
| 0.080 | -0.060 | 7 |
| 0.080 | 0.210 | 8 |

Bodová, úseková, kruhová výztuž

| Č. Druh | Sada | Č.-mat. | Průřez | | As | Bod 1 | | Bod 2 | | zrca- dlit |
|---------|------|---------|--------|------|-------|--------|--------|--------|--------|---------------|
| | | | min | max | | y1 (m) | z1 (m) | y2 (m) | z2 (m) | |
| 1 Bod | 1 | 2 | 1.6 | 1.7 | cm2 | 0.060 | 0.185 | | | na z |
| 3 Bod | 1 | 2 | 1.6 | 1.6 | cm2 | 0.020 | 0.185 | | | na z |
| 5 Úsek | 1 | 2 | 0.0 | 45.3 | cm2/m | -0.540 | -0.300 | 0.540 | -0.300 | |
| 6 Bod | 1 | 2 | 1.6 | 1.7 | cm2 | 0.000 | 0.160 | | | |

Poloha: POD3

| ZS | NS (kN) | MSy (kNm) | MSz (kNm) |
|----|---------|-----------|-----------|
| 1 | 705.0 | -126.0 | 0.0 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Krajní podélník 403, 434

| ZS | NS (kN) | MSy (kNm) | MSz (kNm) |
|----|---------|-----------|-----------|
| 2 | 647.0 | -138.0 | 0.0 |

Výsledek

Průřez: POD 3 Poloha: POD3

Průř. charakteristiky - brutto $I_1 = 0.005825 \text{ m}^4$ $y_s = 0.0000 \text{ m}$
 $A = 0.3714 \text{ m}^2$ $\text{Alfa} = 0.00$ $I_2 = 0.032826 \text{ m}^4$ $z_s = -0.1768 \text{ m}$

Výztuž (S=Sada M=Materiál)

| As | min.As | | max.As | nutná As | | Souřadnice (m) | | | | Eps.0 | | |
|------|--------|---|--------|----------|-------|----------------|-------------------------------|--------|-------|--------|------|--|
| Č. | S | M | (cm2) | (cm2) | (cm2) | cm2/m | y1 | z1 | y2 | z2 | o/oo | |
| 1 | 1 | 2 | 1.65 | 1.65 | 1.65 | | 0.060 | 0.185 | | | | |
| 2 | 1 | 2 | 1.65 | 1.65 | 1.65 | | -0.060 | 0.185 | | | | |
| 3 | 1 | 2 | 1.58 | 1.58 | 1.58 | | 0.020 | 0.185 | | | | |
| 4 | 1 | 2 | 1.58 | 1.58 | 1.58 | | -0.020 | 0.185 | | | | |
| 5 | 1 | 2 | 0.00 | 48.88 | 21.75 | 20.1 | -0.540 | -0.300 | 0.540 | -0.300 | | |
| 6 | 1 | 2 | 1.65 | 1.65 | 1.65 | | 0.000 | 0.160 | | | | |
| Suma | | | 8.11 | 57.00 | 29.86 | | stávající.As/Abutto = 0.804 % | | | | | |

Návrh na MSÚ As = 29.9 cm²

| ZS | Vnitřní účinky na MSÚ | | | Přetvoření (o/oo) | | | Beta | Gama | Využití |
|----|-----------------------|----------|----------|-------------------|-------|-------|-------|-------|---------|
| | N (kN) | My (kNm) | Mz (kNm) | Eps.1 | Eps.2 | Eps.s | (°) | | |
| 1 | 709. | -127. | 0. | 0.999 | 3.005 | 2.79 | 180.0 | 1.000 | 0.995 |
| 2 | 647. | -138. | 0. | 0.260 | 9.052 | 8.13 | 180.0 | 1.000 | 1.000 |

| ZS | ----Tlaková výslednice----- | | | | -----Tahová výslednice----- | | | | Rameno |
|----|-----------------------------|-------|-------|---------------------|-----------------------------|-------|--------|---------------------|--------|
| | (kN) | y (m) | z (m) | A (m ²) | (kN) | y (m) | z (m) | A (m ²) | (m) |
| 1 | | | | | 709. | 0.000 | -0.179 | 0.00299 | |
| 2 | | | | | 647. | 0.000 | -0.213 | 0.00299 | |

| Výztuž | Eps.0 | y | z | ZS | Eps.s | Sigma |
|--------|-------|--------|-------|----|--------|-------|
| Č. | (cm2) | (o/oo) | (m) | | (o/oo) | N/mm2 |
| 1 | 1.7 | 0.060 | 0.185 | 1 | 1.087 | 217 |
| 2 | 1.7 | -0.060 | 0.185 | 1 | 1.087 | 217 |
| 3 | 1.6 | 0.020 | 0.185 | 1 | 1.087 | 217 |
| 4 | 1.6 | -0.020 | 0.185 | 1 | 1.087 | 217 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

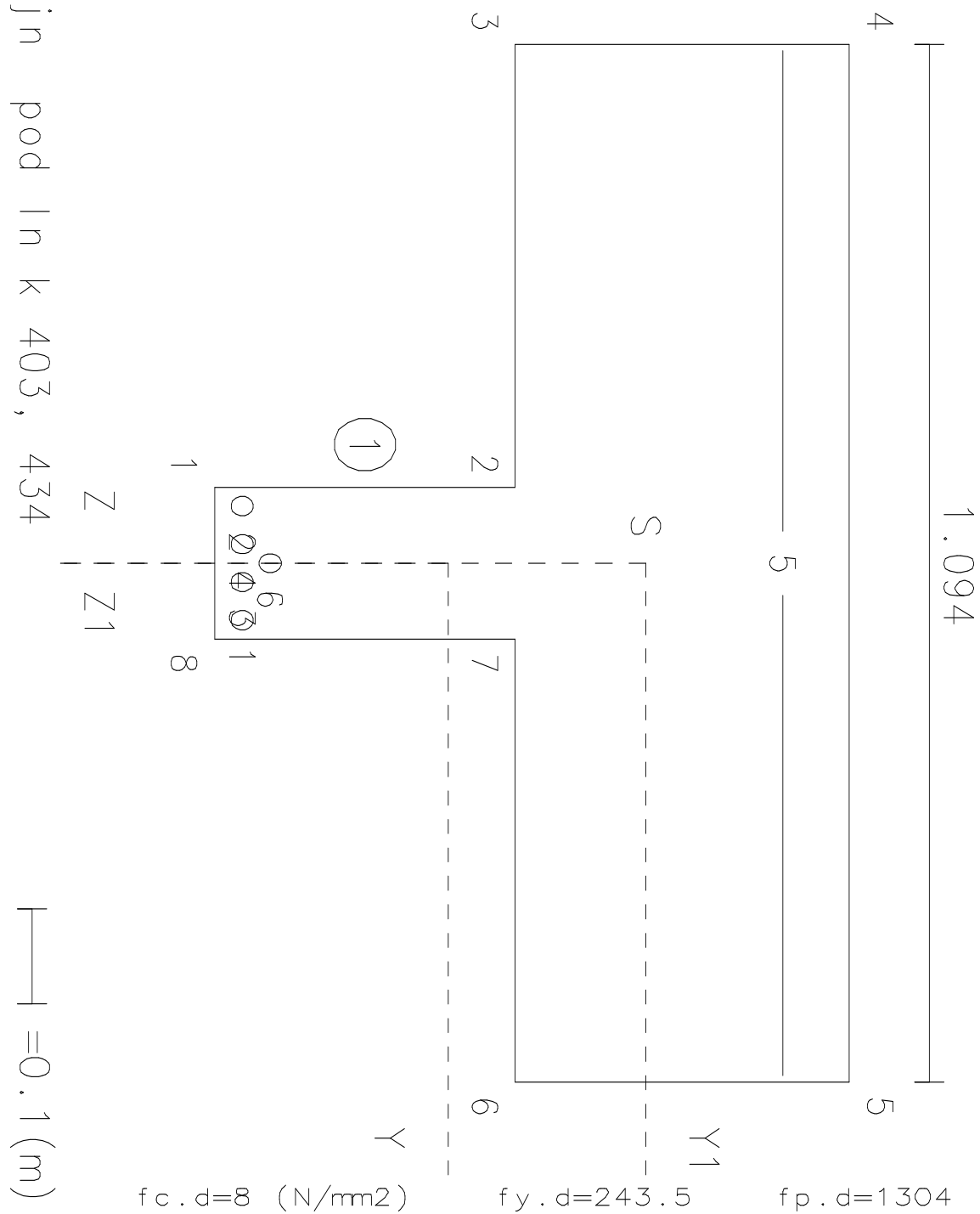
Krajní podélník 403, 434

| Výztuž Č. | Eps.0 (cm2) | Eps.0 (o/oo) | y (m) | z (m) | ZS | Eps.s (o/oo) | Sigma N/mm2 |
|--------------|----------------|-----------------|----------|----------|----|-----------------|----------------|
| 5 | 21.8 | | -0.540 | -0.300 | 1 | 2.794 | 243 |
| 6 | 1.7 | | 0.000 | 0.160 | 1 | 1.175 | 235 |
| 1 | 1.7 | | 0.060 | 0.185 | 2 | 0.645 | 129 |
| 2 | 1.7 | | -0.060 | 0.185 | 2 | 0.645 | 129 |
| 3 | 1.6 | | 0.020 | 0.185 | 2 | 0.645 | 129 |
| 4 | 1.6 | | -0.020 | 0.185 | 2 | 0.645 | 129 |
| 5 | 21.8 | | -0.540 | -0.300 | 2 | 8.127 | 243 |
| 6 | 1.7 | | 0.000 | 0.160 | 2 | 1.031 | 206 |



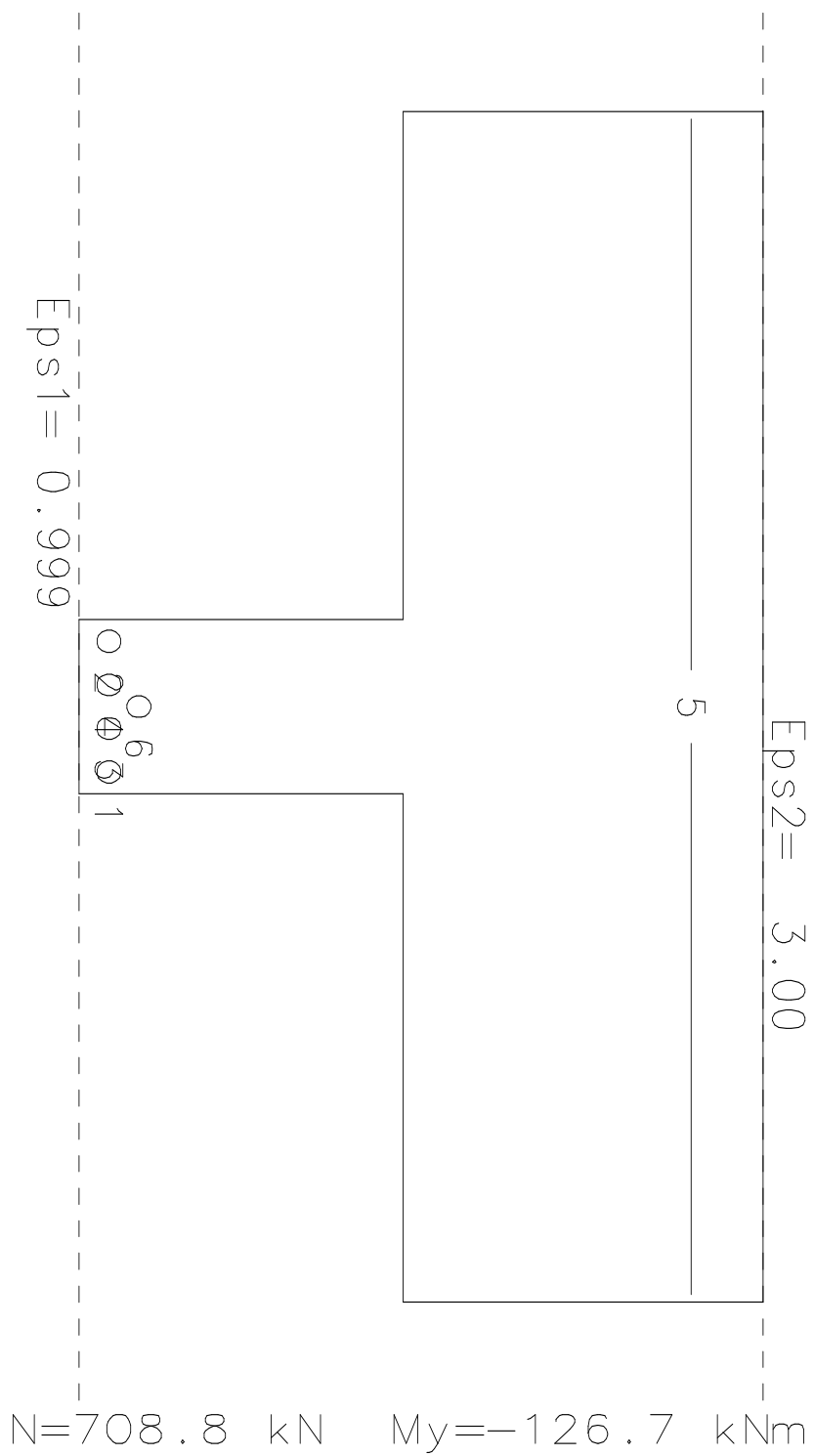
Výsledková grafika

Krajn RIB ZWAX 10.0 ikm ohyb s normálovou silou





Sec: 1 Poloha: 1 ZS: 1 $A_s=29.86\text{cm}^2$ MS vyuziti=1.01 >1 Nm.995



Krajn podln k 403, 434

$l=0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 2 $A_s=29.86\text{cm}^2$ MS využití=1.01 >1 Nm1.00

$E_{ps2}= 9.05$

5

Ø 6
Ø 1

$E_{ps1}= 0.260$

$N=647 \text{ kN}$ $M_y=-138 \text{ kNm}$

Krajn podln k 403, 434

$\ell=0.1 \text{ (m)}$

PODÉLNÍK 4
Schéma

1.1

| Materiály beton výztuž | | C12/15 5xØ15 | | | | | | | | | |
|---|---|--------------------------|----|---------------|------|----------|-----------|-------------|--------------|-------------|--------------|
| MODEL 1 - Rámcové spojený horní a dolní pás oblouku, zarámované svíslce | | | ZS | prut prvek | uzel | FX kN | My kNm | FXX kN/m | MXX kNm/m | FXY kN/m | MYX kNm/m |
| ZS | Zatížení | | | | | | | | | | |
| 1 | VLASTNÍ HMOTNOST | [Výsledky_normalni.xlsx] | 1 | 509 | 2168 | 90.90 | -16.70 | 151.74 | -1.22 | 66.41 | -0.98 |
| 2 | KONSTRUKCE VOZOVKY | [Výsledky_normalni.xlsx] | 2 | 509 | 2168 | 11.87 | -2.46 | 20.05 | -0.17 | 8.23 | -0.15 |
| 11 | zatížení pro norm zatížitelnost - rovnoměrné 2.5 | [Výsledky_normalni.xlsx] | 11 | 509 | 2168 | 11.03 | -2.31 | 18.69 | -0.16 | 7.60 | -0.14 |
| 13 | zatížení pro norm zatížitelnost - max M | [Výsledky_normalni.xlsx] | 13 | 509 | 2168 | 18.83 | -8.50 | 31.34 | -0.62 | -6.74 | -0.52 |
| 22 | zatížení pro norm zatížitelnost - max N | [Výsledky_normalni.xlsx] | 22 | 509 | 2168 | 10.35 | -1.25 | 17.07 | -0.10 | 9.76 | -0.08 |
| 53 | zatížení pro výhradní zatížitelnost - max M | [Výsledky_vyhradni.xlsx] | 53 | 509 | 2168 | 9.72 | -4.73 | 16.15 | -0.35 | -2.86 | -0.30 |
| 62 | zatížení pro výhradní zatížitelnost - max N | [Výsledky_vyhradni.xlsx] | 62 | 509 | 2168 | 8.29 | -1.61 | 13.55 | -0.13 | 4.87 | -0.10 |
| 41 | zatížení pro výjimečnou zatížitelnost - 9Nv v polovině | [Výsledky_vyhradni.xlsx] | 41 | 509 | 2168 | 3.06 | -0.16 | 5.11 | -0.01 | 4.34 | -0.01 |
| 42 | zatížení pro výjimečnou zatížitelnost - 9Nv ve čtvrtině | [Výsledky_vyhradni.xlsx] | 42 | 509 | 2168 | 4.95 | -1.09 | 8.36 | -0.08 | 2.94 | -0.07 |
| 51 | smršť | [Výsledky_normalni.xlsx] | 51 | 509 | 2168 | -65.38 | -5.50 | -112.18 | -0.65 | 241.69 | 0.07 |

$$\begin{array}{l}
 1 \\
 \hline
 \xi, \gamma = 1.35 - 0.85 = 1.1475 \\
 (M, N)_{Bd1} = 1.1475 \cdot (M, N)_{G1} + 1.35 \cdot \delta \cdot (M, N)_{\phi, \delta} \\
 \delta \cdot (M, N)_{\phi, \delta} = \frac{(M, N)_{Bd1} - 1.1475 \cdot (M, N)_{G1}}{1.35} \\
 \hline
 2 \\
 \hline
 \gamma = 1.35, \psi = 0.75 \\
 (M, N)_{Bd1} = 1.35 \cdot (M, N)_{G1} + 1.35 \cdot 0.75 \cdot \delta \cdot (M, N)_{\phi, \delta} \\
 \delta \cdot (M, N)_{\phi, \delta} = \frac{(M, N)_{Bd1} - 1.35 \cdot (M, N)_{G1}}{1.35 \cdot 0.75}
 \end{array}$$

Zatížení průřezu

Zbývá na zatížení vozidly

$$\mathcal{S} \cdot (M, N)_{qb}$$

Zbývá na zatížení vozidly

$$\delta \cdot (M, N)_{q,b}$$

Bez vzpěru

c

| N kN | M kNm |
|-----------|------------|
| 330.9 | -43.8 |
| 43.0 | -6.1 |
| 39.9 | -5.7 |
| 45.9 | -17.7 |
| 39.9 | -3.9 |
| 24.3 | -9.5 |
| 28.5 | -4.2 |
| 13.4 | -0.7 |
| 16.8 | -2.8 |
| 135.4 | 60.0 |
| Nrd kN | Mrd kNm |

| | | |
|--------|-------|--------|
| Vn_M | 729.3 | -139.3 |
| Vn_N | 708.2 | -91.0 |
| Vr_M | 657.8 | -146.2 |
| Vr_N | 697.3 | -97.0 |
| Ve_1/2 | 638.6 | -68.6 |
| Ve_1/4 | 690.9 | -100.6 |

| | N | M |
|--------|-------|-------|
| Vn_M | 222.5 | -60.8 |
| Vn_N | 206.8 | -25.0 |
| Vr_M | 169.5 | -65.9 |
| Vr_N | 198.7 | -29.5 |
| Ve_1/2 | 155.3 | -8.4 |
| Ve_1/4 | 194.0 | -32.1 |

| δ | | | N | M | | | |
|----------|-----|-----|-------|-------|-------------------------|----|---------|
| 1.2 | 3Nv | Va | 2.16 | 2.16 | Zatížitelnost normální | Vn | 28.8 t |
| 1.2 | 3Nv | Va | 2.16 | 2.16 | Zatížitelnost normální | Vn | 28.8 t |
| 1.25 | 6Nv | Vrw | 5.57 | 5.57 | Zatížitelnost výhradní | Vr | 55.7 t |
| 1.25 | 6Nv | Vrw | 5.57 | 5.57 | Zatížitelnost výhradní | Vr | 55.7 t |
| 1.05 | 9Nv | Vew | 11.00 | 11.00 | Zatížitelnost vyjimečná | Ve | 110.0 t |
| 1.05 | 9Nv | Vew | 11.00 | 11.00 | Zatížitelnost vyjimečná | Ve | 110.0 t |

| | N | M |
|--------|-------|-------|
| Vn_M | 221.9 | -71.1 |
| Vn_N | 201.0 | -23.4 |
| Vr_M | 151.2 | -77.9 |
| Vr_N | 190.2 | -29.3 |
| Ve_1/2 | 132.2 | -1.2 |
| Ve_1/4 | 184.0 | -32.8 |

| δ | | | N | M | | |
|----------|-----|-----|-------|-------|----------------------------|---------|
| 1.2 | 3Nv | Va | 2.15 | 2.53 | Zatížitelnost normální Vn | 28.7 t |
| 1.2 | 3Nv | Va | 2.10 | 2.02 | Zatížitelnost normální Vn | 26.9 t |
| 1.25 | 6Nv | Vrw | 4.97 | 6.58 | Zatížitelnost vyhradní Vr | 49.7 t |
| 1.25 | 6Nv | Vrw | 5.33 | 5.54 | Zatížitelnost vyhradní Vr | 53.3 t |
| 1.05 | 9Nv | Vew | 9.37 | 1.55 | Zatížitelnost vyjimečná Ve | 15.5 t |
| 1.05 | 9Nv | Vew | 10.43 | 11.24 | Zatížitelnost vyjimečná Ve | 104.3 t |

PODÉLNÍK 4
Schéma

1.1

| Materiály | | C12/15 | | 5xØ15 | | prut | | | | | | | | | | | |
|---|---|--------------------------|----|-------|------|-------|------|--------|--------|---------|-------|--------|-------|--|--|--|--|
| beton | | | | | | | | | | | | | | | | | |
| výztuž | | | | | | | | | | | | | | | | | |
| MODEL 1 - Rámově spojený horní a dolní pás oblouku, zarámované svíslíce | | | | | | | | | | | | | | | | | |
| ZS | Zatížení | | | | | prvek | uzel | FX | My | FXX | MXX | FXX | MXX | | | | |
| 1 | VLASTNÍ HMOTNOST | [Výsledky_normalni.xlsm] | 1 | 516 | 2301 | | | 99.64 | -13.58 | 169.61 | -0.98 | 94.76 | -0.81 | | | | |
| 2 | KONSTRUKCE VOZOVKY | [Výsledky_normalni.xlsm] | 2 | 516 | 2301 | | | 13.16 | -2.16 | 22.47 | -0.15 | 11.90 | -0.13 | | | | |
| 11 | zatížení pro norm zatížitelnost - rovnoměrné 2.5 | [Výsledky_normalni.xlsm] | 11 | 516 | 2301 | | | 12.21 | -2.01 | 20.89 | -0.14 | 11.10 | -0.12 | | | | |
| 16 | zatížení pro norm zatížitelnost - max M | [Výsledky_normalni.xlsm] | 16 | 516 | 2301 | | | 22.74 | -11.95 | 40.11 | -0.87 | -9.97 | -1.01 | | | | |
| 26 | zatížení pro norm zatížitelnost - max N | [Výsledky_normalni.xlsm] | 26 | 516 | 2301 | | | 12.74 | -1.17 | 21.09 | -0.09 | 12.93 | -0.08 | | | | |
| 56 | zatížení pro výhradní zatížitelnost - max M | [Výsledky_vyhradni.xlsm] | 56 | 516 | 2301 | | | 12.93 | -7.33 | 22.66 | -0.54 | -5.22 | -0.67 | | | | |
| 66 | zatížení pro výhradní zatížitelnost - max N | [Výsledky_vyhradni.xlsm] | 66 | 516 | 2301 | | | 11.42 | -3.84 | 19.20 | -0.28 | 4.92 | -0.39 | | | | |
| 41 | zatížení pro výjimečnou zatížitelnost - 9NV v polovině | [Výsledky_vyhradni.xlsm] | 41 | 516 | 2301 | | | 3.70 | 0.11 | 6.20 | 0.01 | 6.33 | 0.00 | | | | |
| 42 | zatížení pro výjimečnou zatížitelnost - 9NV ve čtvrtině | [Výsledky_vyhradni.xlsm] | 42 | 516 | 2301 | | | 5.63 | -1.19 | 9.67 | -0.08 | 3.05 | -0.07 | | | | |
| 51 | smršť | [Výsledky_normalni.xlsm] | 51 | 516 | 2301 | | | -72.77 | -1.64 | -123.93 | -0.38 | 297.46 | 0.17 | | | | |

1

$$\xi \cdot \gamma = 1.35 \cdot 0.85 = 1.1475$$
$$(M, N)_{\text{tot}} = 1.1475 \cdot (M, N)_{\text{ci}} + 1.35 \cdot \delta \cdot (M, N)_{\text{q}, \delta}$$
$$\delta \cdot (M, N)_{\text{q}, \delta} = \frac{(M, N)_{\text{tot}} - 1.1475 \cdot (M, N)_{\text{ci}}}{1.35}$$

2

$$\gamma = 1.35, \mu = 0.75$$
$$(M, N)_{\text{tot}} = 1.35 \cdot (M, N)_{\text{ci}} + 1.35 \cdot 0.75 \cdot \delta \cdot (M, N)_{\text{q}, \delta}$$
$$\delta \cdot (M, N)_{\text{q}, \delta} = \frac{(M, N)_{\text{tot}} - 1.35 \cdot (M, N)_{\text{ci}}}{1.35 \cdot 0.75}$$

Zatížení průřezu

| Bez vzpěru | | 1 | |
|------------|-------|--------|--|
| c | | | |
| N | M | | |
| kN | kNm | | |
| 390.4 | -40.0 | | |
| 51.0 | -5.8 | | |
| 47.4 | -5.4 | | |
| 55.9 | -24.2 | | |
| 50.2 | -4.3 | | |
| 32.1 | -14.4 | | |
| 37.9 | -8.2 | | |
| 17.5 | -0.4 | | |
| 19.6 | -3.1 | | |
| 118.1 | 67.3 | | |
| Nrd | Mrd | | |
| kN | kNm | | |
| Vn_M | 868.0 | -156.0 | |
| Vn_N | 847.9 | -86.3 | |
| Vr_M | 808.4 | -187.5 | |
| Vr_N | 863.1 | -129.3 | |
| Ve_1/2 | 779.2 | -58.4 | |
| Ve_1/4 | 812.5 | -100.5 | |

Zbývá na zatížení vozidly

1

$$\delta \cdot (M, N)_{\text{q}, \delta}$$

| | N | M |
|--------|-------|--------|
| Vn_M | 267.7 | -76.7 |
| Vn_N | 252.9 | -25.1 |
| Vr_M | 223.6 | -100.0 |
| Vr_N | 264.2 | -56.9 |
| Ve_1/2 | 202.0 | -4.4 |
| Ve_1/4 | 226.6 | -35.5 |

| | | δ | | | | N | | M | | | |
|------|-----|-----|-------|-------|----------------------------|-------|---|---|--|--|--|
| 1.2 | 3NV | Va | 2.16 | 2.16 | Zatížitelnost normální Vn | 28.8 | t | | | | |
| 1.2 | 3NV | Va | 2.16 | 2.16 | Zatížitelnost normální Vn | 28.8 | t | | | | |
| 1.25 | 6NV | Vrw | 5.57 | 5.57 | Zatížitelnost výhradní Vr | 55.7 | t | | | | |
| 1.25 | 6NV | Vrw | 5.57 | 5.57 | Zatížitelnost výhradní Vr | 55.7 | t | | | | |
| 1.05 | 9NV | Vew | 11.00 | 11.00 | Zatížitelnost výjimečná Ve | 110.0 | t | | | | |
| 1.05 | 9NV | Vew | 11.00 | 11.00 | Zatížitelnost výjimečná Ve | 110.0 | t | | | | |

Zbývá na zatížení vozidly

2

$$\delta \cdot (M, N)_{\text{q}, \delta}$$

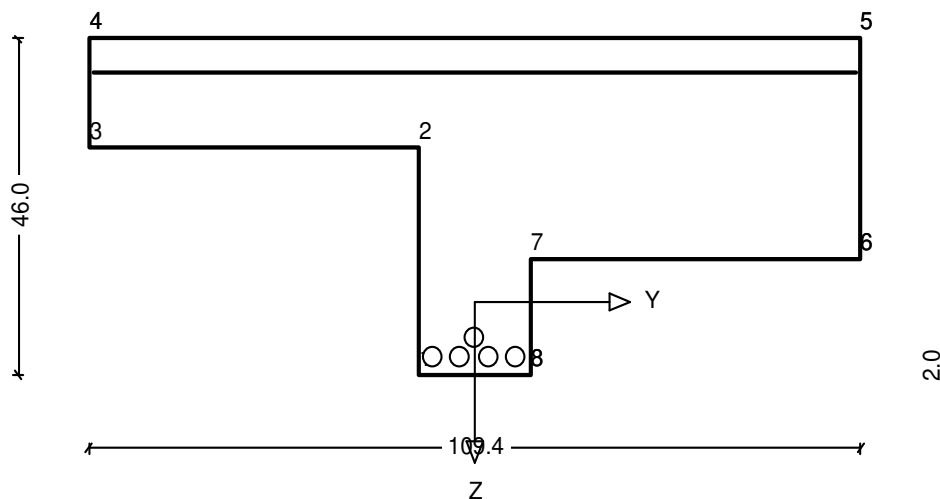
| | N | M |
|--------|-------|--------|
| Vn_M | 268.7 | -93.1 |
| Vn_N | 248.9 | -24.3 |
| Vr_M | 209.8 | -124.2 |
| Vr_N | 263.9 | -66.7 |
| Ve_1/2 | 181.0 | 3.3 |
| Ve_1/4 | 213.9 | -38.2 |

| | | δ | | | | N | | M | | | |
|------|-----|-----|-------|-------|----------------------------|-------|---|---|--|--|--|
| 1.2 | 3NV | Va | 2.17 | 2.62 | Zatížitelnost normální Vn | 28.9 | t | | | | |
| 1.2 | 3NV | Va | 2.13 | 2.09 | Zatížitelnost normální Vn | 27.9 | t | | | | |
| 1.25 | 6NV | Vrw | 5.23 | 6.92 | Zatížitelnost výhradní Vr | 52.3 | t | | | | |
| 1.25 | 6NV | Vrw | 5.57 | 6.53 | Zatížitelnost výhradní Vr | 55.7 | t | | | | |
| 1.05 | 9NV | Vew | 9.86 | -8.35 | Zatížitelnost výjimečná Ve | -83.5 | t | | | | |
| 1.05 | 9NV | Vew | 10.38 | 11.83 | Zatížitelnost výjimečná Ve | 103.8 | t | | | | |



Obloukový most

Soubor: Podélník 4 se zesílenou deskou v2.zwv



Bereich: Krajní podélník 509_516, Querschnitt: POD 4

RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Krajní podélník 509_516

Soubor: ZWAX.ZWA

Protokol zadání

* Mezní stav únosnosti pro ohyb s normálovou silou CSN EN 1992-1-1

Počítá se s průřezem netto tlačené zóny betonu

| Materiál - č. | Pevnost (N/mm ²) | E-Modul (N/mm ²) | Dov. přetvoření (o/oo) | |
|---------------|------------------------------|------------------------------|------------------------|-------------|
| | | | hrana | střed |
| Beton | $f_{c,d} = 8.0$ | $E_c = 27100.$ | tlak | -3.50 -2.00 |
| Výztuž 2 | $f_{y,d} = 243.5$ | $E_s = 200000.$ | tah | 10.00 1.22 |
| Předp.kabel 3 | $f_{p,d} = 1304.3$ | $E_p = 200000.$ | | |

Průřez: POD 4

Výpočet jako netlačený prvek.

Počítá se vzdálenost vnější tahové výztuže od okraje

Vnitřní účinky jsou vztaženy na těžiště průřezu brutto

Polygonální dílčí průřez 1
Beton (=materiál 1)

Souřadnice

| y (m) | z (m) | Bod |
|--------|--------|-----|
| -0.080 | 0.100 | 1 |
| -0.080 | -0.210 | 2 |
| -0.547 | -0.210 | 3 |
| -0.547 | -0.360 | 4 |



| | | |
|-------|--------|---|
| 0.547 | -0.360 | 5 |
| 0.547 | -0.060 | 6 |
| 0.080 | -0.060 | 7 |
| 0.080 | 0.100 | 8 |

Bodová, úseková, kruhová výztuž

| Č. | Druh | Sada | Č.-mat. | Průřez | | As | Bod 1 | | Bod 2 | | zrca- dlit |
|----|------|------|---------|--------|------|-------|--------|--------|--------|--------|---------------|
| | | | | min | max | | y1 (m) | z1 (m) | y2 (m) | z2 (m) | |
| 1 | Bod | 1 | 2 | 1.6 | 1.7 | cm2 | 0.060 | 0.075 | | | na z |
| 3 | Bod | 1 | 2 | 1.6 | 1.6 | cm2 | 0.020 | 0.075 | | | na z |
| 5 | Bod | 1 | 2 | 1.6 | 1.7 | cm2 | 0.000 | 0.050 | | | |
| 6 | Úsek | 1 | 2 | 20.0 | 55.0 | cm2/m | -0.540 | -0.315 | 0.540 | -0.315 | |

Poloha: POD 4

| ZS | NS (kN) | MSy (kNm) | MSz (kNm) |
|----|---------|-----------|-----------|
| 1 | 868.0 | -156.0 | 0.0 |
| 2 | 808.0 | -187.5 | 0.0 |



RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Krajní podélník 509_516

| ZS | NS (kN) | MSy (kNm) | MSz (kNm) |
|----|---------|-----------|-----------|
| 3 | 987.0 | -88.0 | 0.0 |

Výsledek**Průřez: POD 4 Poloha: POD 4**

Průř. charakteristiky - brutto I1 = 0.003214 m4 ys = 0.0774 m
 A = 0.2837 m2 Alfa = 4.63 I2 = 0.023060 m4 zs = -0.2078 m

Výztuž (S=Sada M=Materiál)

| As | min.As | | max.As | nutná As | | Souřadnice (m) | | | | Eps.0 | | |
|------|--------|---|--------|----------|-------|----------------|--------------------------------|--------|-------|--------|------|--|
| Č. | S | M | (cm2) | (cm2) | (cm2) | cm2/m | y1 | z1 | y2 | z2 | o/oo | |
| 1 | 1 | 2 | 1.65 | 1.65 | 1.65 | | 0.060 | 0.075 | | | | |
| 2 | 1 | 2 | 1.65 | 1.65 | 1.65 | | -0.060 | 0.075 | | | | |
| 3 | 1 | 2 | 1.58 | 1.58 | 1.58 | | 0.020 | 0.075 | | | | |
| 4 | 1 | 2 | 1.58 | 1.58 | 1.58 | | -0.020 | 0.075 | | | | |
| 5 | 1 | 2 | 1.65 | 1.65 | 1.65 | | 0.000 | 0.050 | | | | |
| 6 | 1 | 2 | 21.60 | 59.40 | 48.74 | 45.1 | -0.540 | -0.315 | 0.540 | -0.315 | | |
| Suma | | | 29.71 | 67.51 | 56.86 | | stávající.As/Abrutto = 2.004 % | | | | | |

Návrh na MSÚ As = 56.9 cm2

| ZS | Vnitřní účinky na MSÚ | | | Přetvoření (o/oo) | | | Beta | Gama | Využití |
|----|-----------------------|----------|----------|-------------------|--------|-------|-------|-------|---------|
| | N (kN) | My (kNm) | Mz (kNm) | Eps.1 | Eps.2 | Eps.s | (°) | | |
| 1 | 893. | -161. | 0. | -1.919 | 10.726 | 10.00 | 212.7 | 1.000 | 0.972 |
| 2 | 808. | -187. | 0. | -2.517 | 10.796 | 10.00 | 209.9 | 1.000 | 1.000 |
| 3 | 1080. | -96. | 0. | -1.665 | 10.584 | 10.00 | 220.0 | 1.000 | 0.914 |

| ZS | ----Tlaková výslednice----- | | | | -----Tahová výslednice----- | | | | Rameno |
|----|-----------------------------|--------|--------|--------|-----------------------------|-------|--------|---------|--------|
| | (kN) | y (m) | z (m) | A (m2) | (kN) | y (m) | z (m) | A (m2) | (m) |
| 1 | -203. | -0.122 | 0.003 | 0.0241 | 1097. | 0.040 | -0.315 | 0.00480 | 0.3577 |
| 2 | -299. | -0.078 | 0.022 | 0.0286 | 1107. | 0.036 | -0.315 | 0.00484 | 0.3556 |
| 3 | -63. | -0.420 | -0.193 | 0.0149 | 1144. | 0.050 | -0.291 | 0.00534 | 0.4798 |



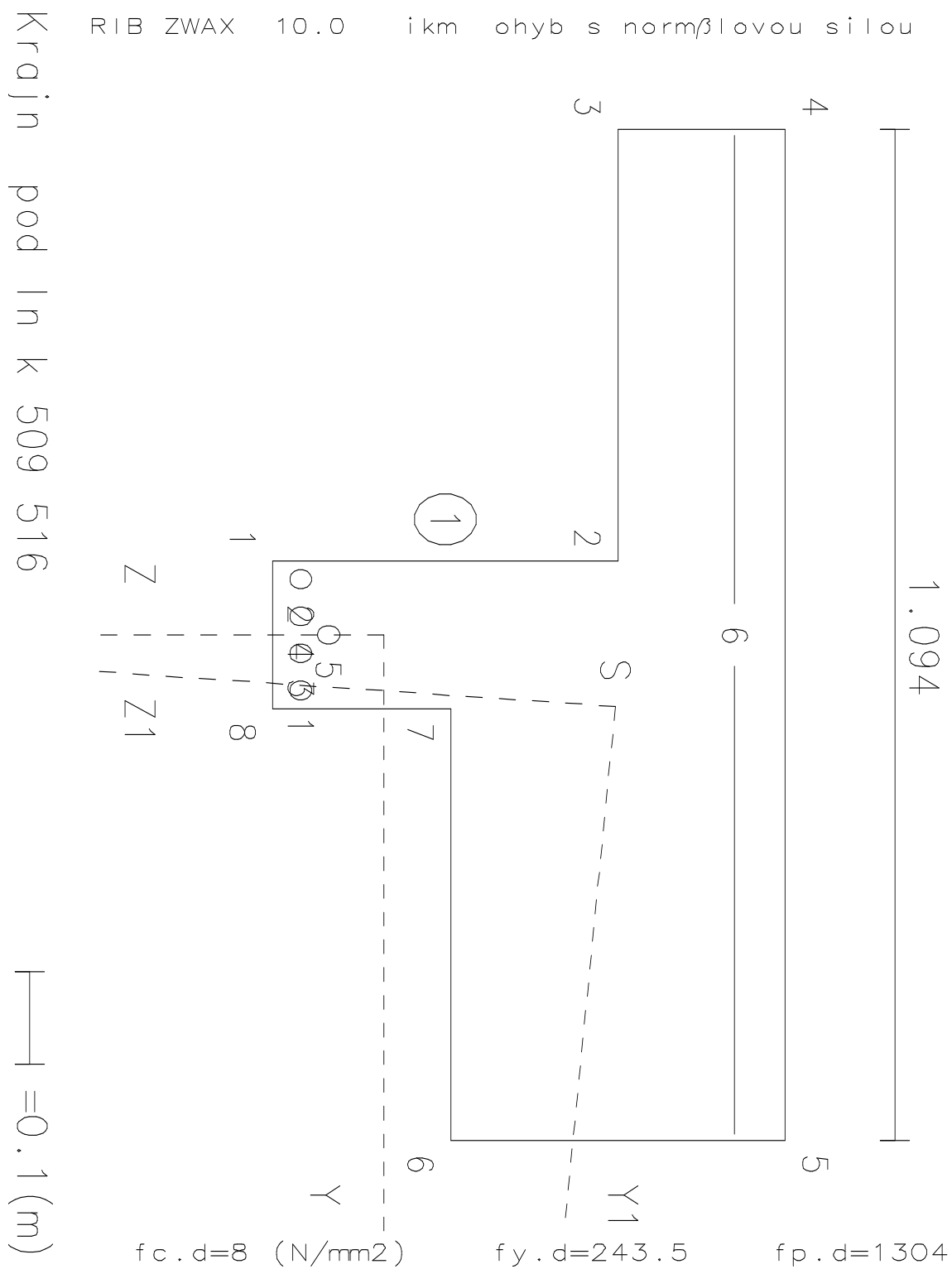
RIB ZWAX 10.0 Šikmý ohyb s normálovou silou

Krajní podélník 509_516

| Výztuž Č. | Eps.0 (o/oo) | y (m) | z (m) | ZS | Eps.s (o/oo) | Sigma N/mm2 |
|--------------|-----------------|----------|----------|----|-----------------|----------------|
| 1 | 1.7 | 0.060 | 0.075 | 1 | -0.235 | -47 |
| 2 | 1.7 | -0.060 | 0.075 | 1 | -1.364 | -243 |
| 3 | 1.6 | 0.020 | 0.075 | 1 | -0.611 | -122 |
| 4 | 1.6 | -0.020 | 0.075 | 1 | -0.988 | -198 |
| 5 | 1.7 | 0.000 | 0.050 | 1 | -0.433 | -87 |
| 6 | 48.7 | -0.540 | -0.315 | 1 | -0.164 | -33 |
| | | 0.540 | -0.315 | 1 | 10.000 | 243 |
| 1 | 1.7 | 0.060 | 0.075 | 2 | -0.806 | -161 |
| 2 | 1.7 | -0.060 | 0.075 | 2 | -1.925 | -243 |
| 3 | 1.6 | 0.020 | 0.075 | 2 | -1.179 | -236 |
| 4 | 1.6 | -0.020 | 0.075 | 2 | -1.552 | -243 |
| 5 | 1.7 | 0.000 | 0.050 | 2 | -0.959 | -192 |
| 6 | 48.7 | -0.540 | -0.315 | 2 | -0.066 | -13 |
| | | 0.540 | -0.315 | 2 | 10.000 | 243 |
| 1 | 1.7 | 0.060 | 0.075 | 3 | 0.907 | 181 |
| 2 | 1.7 | -0.060 | 0.075 | 3 | -0.248 | -50 |
| 3 | 1.6 | 0.020 | 0.075 | 3 | 0.522 | 104 |
| 4 | 1.6 | -0.020 | 0.075 | 3 | 0.137 | 27 |
| 5 | 1.7 | 0.000 | 0.050 | 3 | 0.616 | 123 |
| 6 | 48.7 | -0.540 | -0.315 | 3 | -0.393 | -79 |
| | | 0.540 | -0.315 | 3 | 10.000 | 243 |



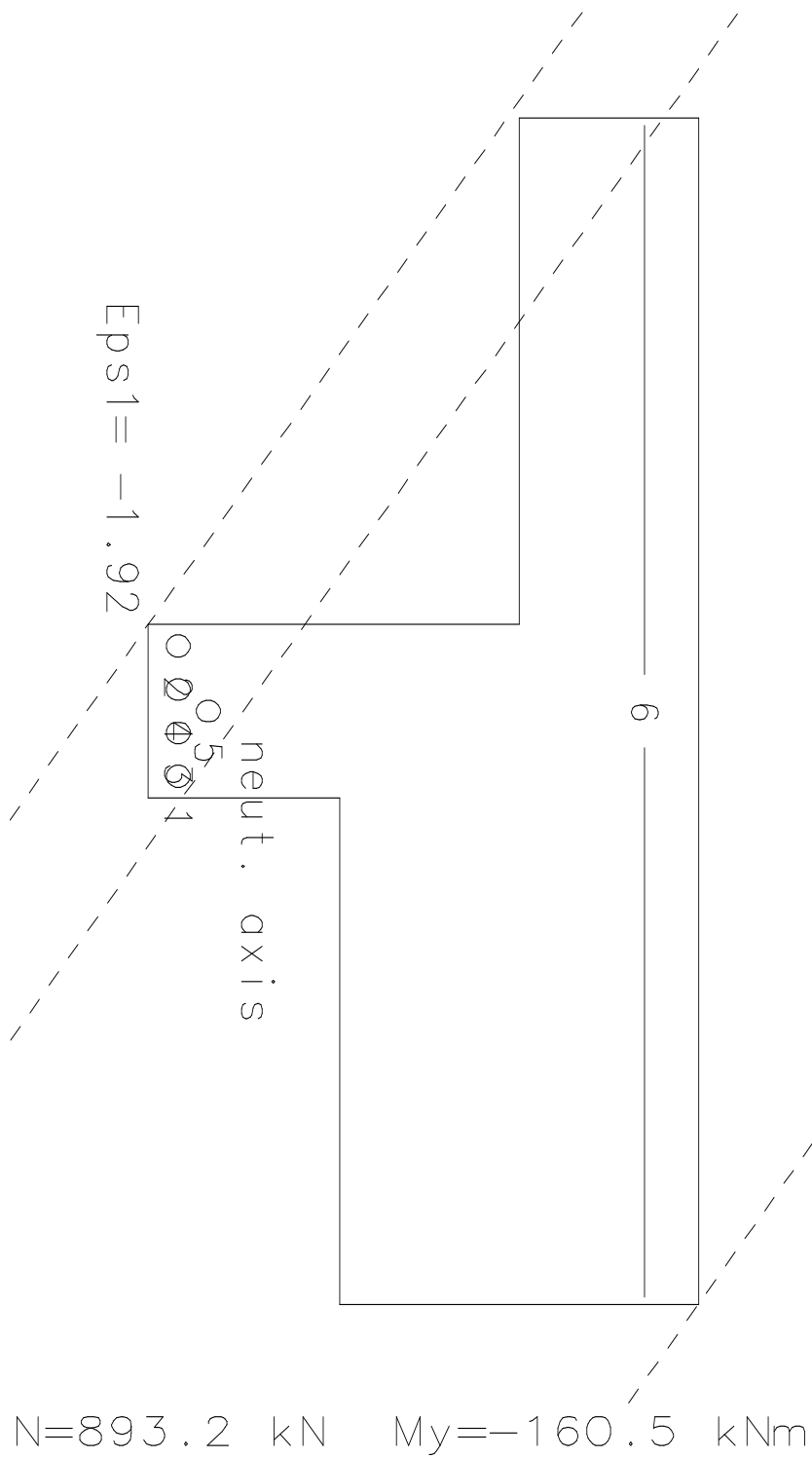
Výsledková grafika





Sec: 1 Poloha: 1 ZS: 1 $A_s=56.86\text{cm}^2$ MS vyuziti=1.01 >1 Nm.972

$$\epsilon_{ps2} = 10.73$$



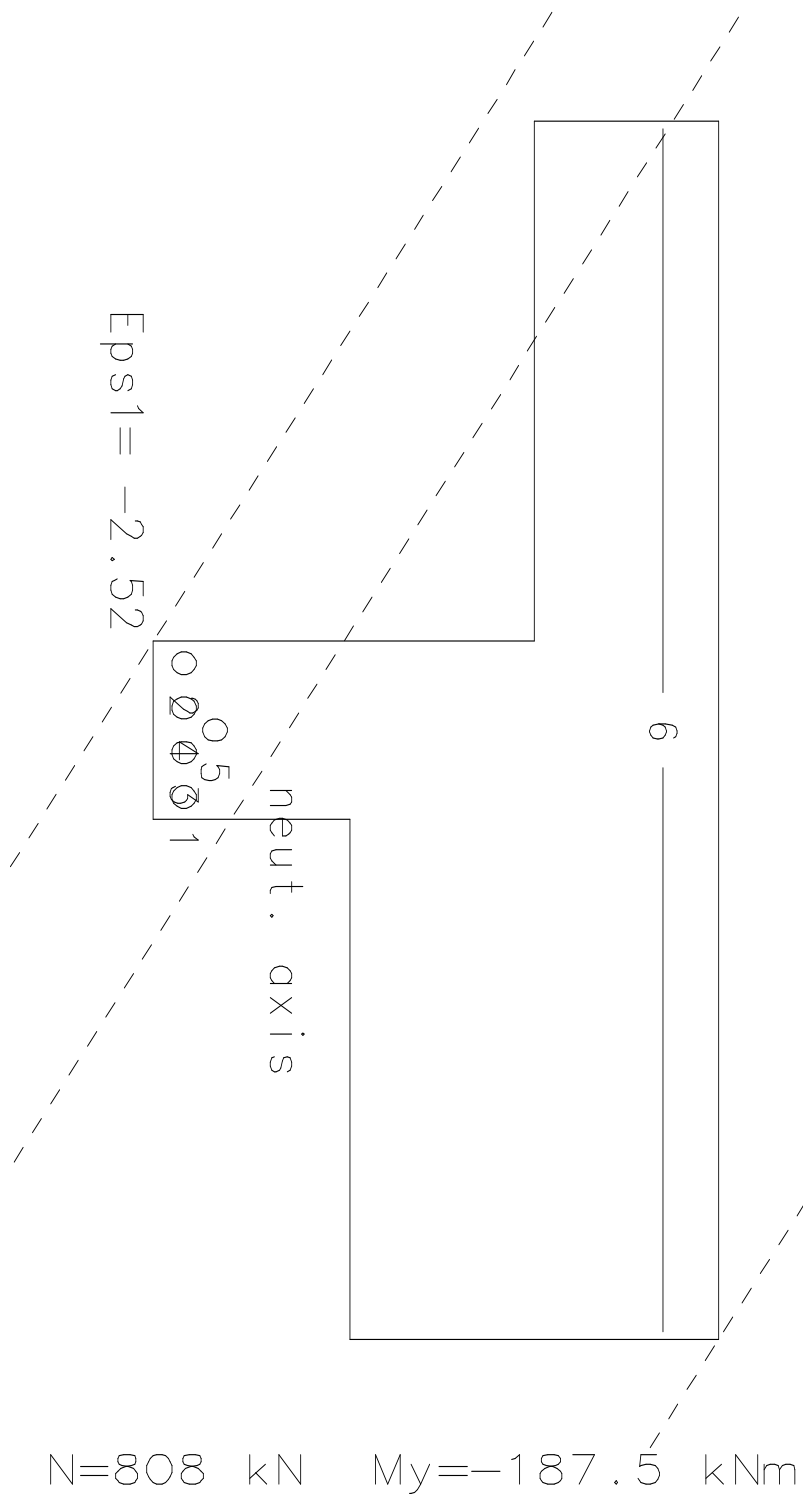
Krajn pod ln k 509 516

$H = 0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 2 $A_s=56.86\text{cm}^2$ MS vyuziti=1.01 > 1 Nm1.00

$$\epsilon_{s2} = 10.80$$



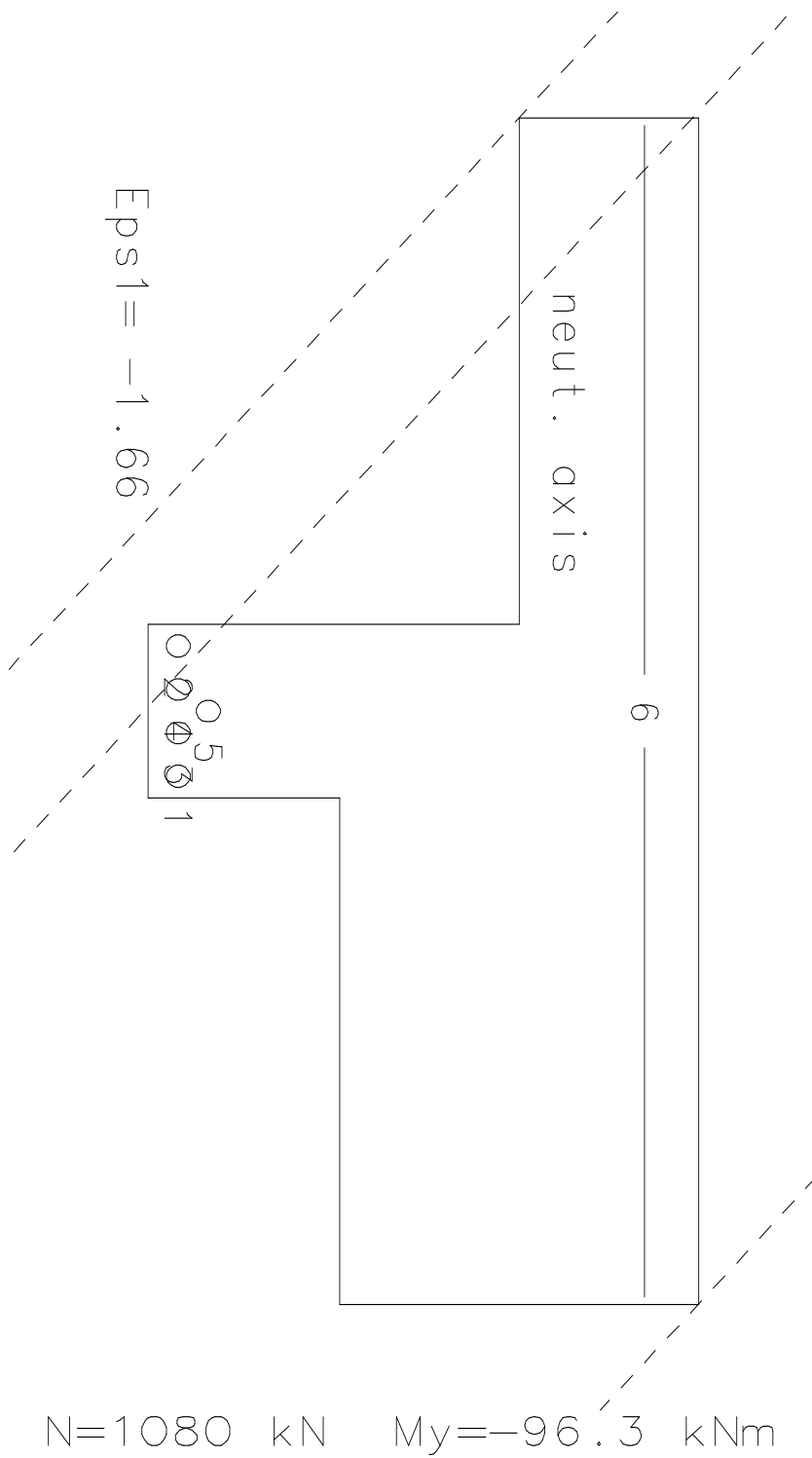
Krajn pod ln k 509 516

$l = 0.1 \text{ (m)}$



Sec: 1 Poloha: 1 ZS: 3 $A_s=56.86\text{cm}^2$ MS vyuziti=1.01 > 1 Nm.914

$$\epsilon_{ps2} = 10.58$$



Krajn podln k 509 516

$H = 0.1 \text{ (m)}$

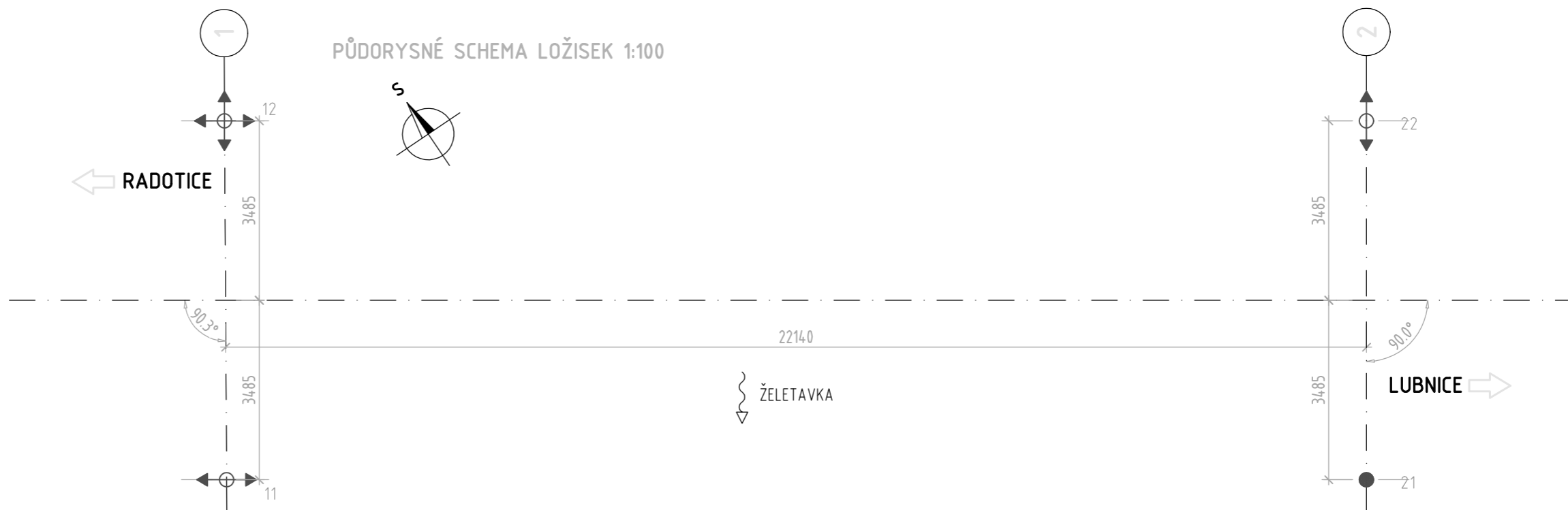
R Reakce

D

C

B

A



D

C

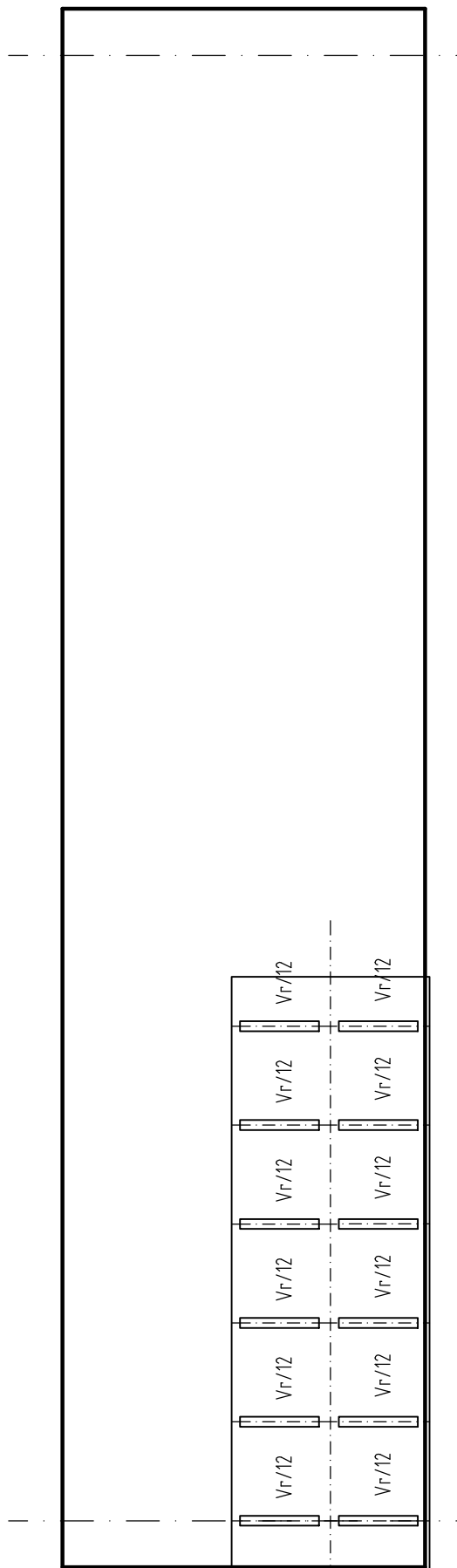
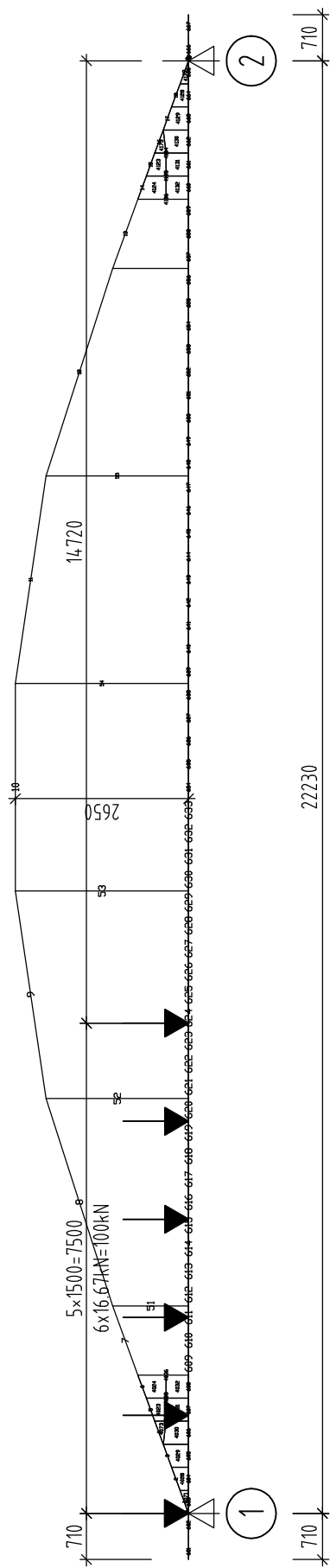
B

A

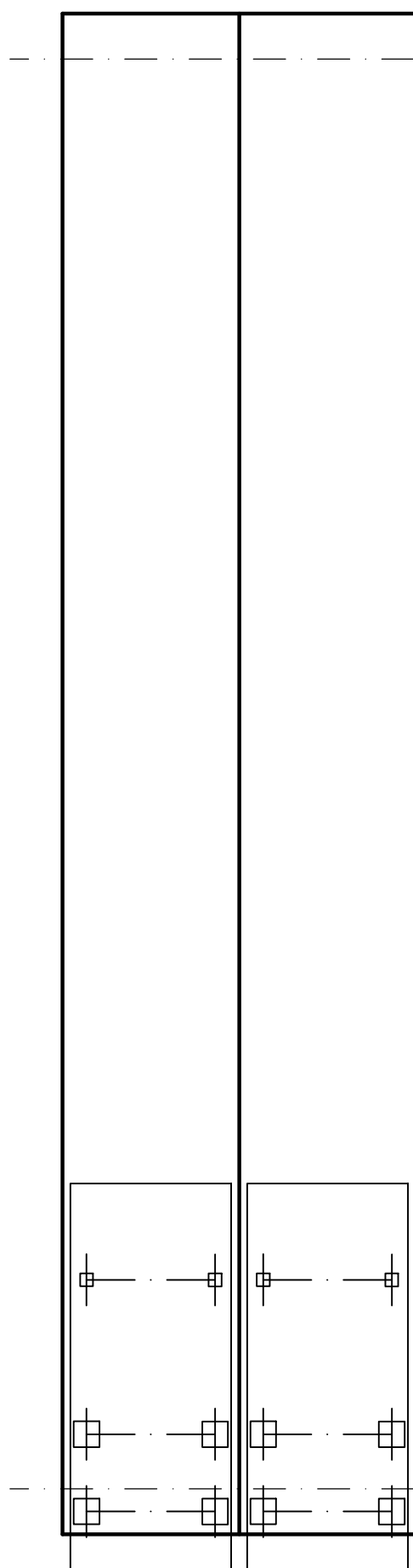
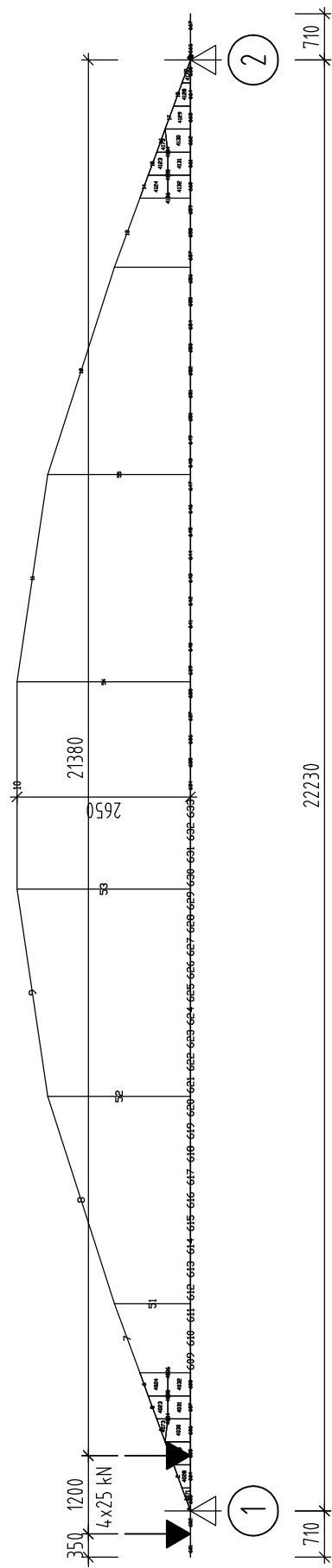
TABULKA LOŽISEK

| ULOŽENÍ | ČÍSLO LOŽISKA | PODPOROVÉ REAKCE A DEFORMACE, HODNOTY ZATÍŽENÍ PRO MEZNÍ STAV ÚNOSNOSTI | | | | | | | | | | | | | NAVRHOVANÁ LOŽISKA - ELASTOMEROVÁ | | | | | POZNÁMKA |
|---------|---------------|---|------|-----|------|------|-------|------|---------------|-------|-----|------|------------------|-------|-----------------------------------|-------------|-----|------------|---------------------|-----------------|
| | | SÍLY [kN] | | | | | | | POSUNUTÍ [mm] | | | | POOTOČENÍ [mRAD] | | TYP | ROZMĚR [mm] | | POSUN [mm] | STAVEBNÍ VÝŠKA [mm] | |
| | | Hx | | Hy | | V | | | Δx | | Δy | | φx | φy | | a | b | | | |
| | | max | min | max | min | max | stálé | min | max | min | max | min | max | min | | | | | | |
| 1 | 11 | 0 | 0 | 194 | -182 | 1614 | 865 | 1156 | 14,9 | -14,8 | 0,0 | 0,0 | 0,12 | 0,04 | 1 | 250 | 400 | 20,3 | 41 | podélně posuvné |
| | 12 | 0 | 0 | 0 | 0 | 1614 | 865 | 1156 | 14,9 | -14,9 | 5,2 | -3,6 | -0,06 | -0,10 | 1 | 250 | 400 | 20,3 | 41 | všesměrné |
| 2 | 21 | 138 | -297 | 194 | -182 | 1614 | 866 | 1156 | 0,0 | 0,0 | 0,0 | 0,0 | 0,06 | 0,04 | 1 | 250 | 400 | 14,7 | 41 | pevné |
| | 22 | 138 | -297 | 0 | 0 | 1614 | 866 | 1156 | 0,0 | 0,0 | 0,0 | 0,0 | -0,04 | -0,06 | 1 | 250 | 400 | 14,7 | 41 | příčně posuvné |

VÝHRADNÍ ZATÍŽITELNOST
6NV – ŠESTINÁPRAVOVÉ VOZIDLO – 55t



NORMÁLNÍ ZATÍŽITELNOST



- Zatížení brzdnými a rozjezdovými silami

LM1

$$Q_{lk} = 0,6 \alpha_{Q1} (2 Q_{1k}) + 0,10 \alpha_{Q1} q_{1k} w_l L$$
$$180 \alpha_{Q1} \text{ (kN)} \leq Q_{lk} \leq 900 \text{ (kN)},$$

- brzdná síla $Q_{lk} = 0,6 \cdot 280 + 0,1 \cdot 2,5 \cdot 3,0 \cdot 23,64 = 175,5 \text{ kN}$

Zatížení PH větrem

1 Zatížení větrem

ČSN EN 1991-1-4

Výpočet maximálního dynamického tlaku větru

1 Větrová oblast

základní rychlost větru

| | |
|-----------|----------|
| | III |
| $v_{b,0}$ | 27.5 m/s |

2 Výška objektu

| | |
|-----|-------|
| z | 8.0 m |
|-----|-------|

3 Kategorie terénu

parametr drsnosti terénu

| | |
|-------|-----|
| | III |
| z_0 | 0.3 |

parametr drsnosti terénu pro kat. ter. II

| | |
|------------|------|
| $z_{0,II}$ | 0.05 |
|------------|------|

minimální výška

| | |
|-----------|-------|
| z_{min} | 5.0 m |
|-----------|-------|

maximální výška

| | |
|-----------|---------|
| z_{max} | 200.0 m |
|-----------|---------|

4 Maximální dynamický tlak

$$q_p(z) = [1 + 7 \cdot I_v(z)] \cdot \frac{1}{2} \cdot \rho \cdot v_m^2(z) = c_e(z) \cdot q_b$$

| | | |
|-------|------------------------|------------------------|
| q_p | 740.4 N/m ² | 0.74 kN/m ² |
|-------|------------------------|------------------------|

součinitel expozice

$$c_e = \frac{q_p(z)}{q_b}$$

| | |
|------------|-------|
| $c_{e(z)}$ | 1.566 |
|------------|-------|

referenční dyn. tlak větru

$$q_b = \frac{1}{2} \cdot \rho \cdot v_b^2(z)$$

| | | |
|-------|------------------------|------------------------|
| q_b | 472.7 N/m ² | 0.47 kN/m ² |
|-------|------------------------|------------------------|

měrná hmotnost vzduchu

| | |
|--------|------------------------|
| ρ | 1.25 kg/m ³ |
|--------|------------------------|

střední rychlost větru

$$v_m(z) = c_r(z) \cdot c_o(z) \cdot v_b$$

| | |
|----------|-----------|
| $v_m(z)$ | 19.45 m/s |
|----------|-----------|

součinitel drsnosti terénu

$$c_r(z) = k_r \cdot \ln\left(\frac{z}{z_0}\right) \quad \text{pro} \quad z_{min} \leq z \leq z_{max} \quad \text{§ 1}$$
$$c_r(z) = c_r(z_{min}) \quad \text{pro} \quad z \leq z_{min}$$

| | |
|----------|-------|
| $c_r(z)$ | 0.707 |
|----------|-------|

součinitel terénu

$$k_r = 0.19 \cdot \left(\frac{z_0}{z_{0,II}}\right)^{0.07}$$

| | |
|-------|-------|
| k_r | 0.215 |
|-------|-------|

součinitel orografie

| | |
|----------|---|
| $c_o(z)$ | 1 |
|----------|---|

intenzita turbulence větru

$$I_v(z) = \frac{\sigma_v}{v_m(z)} = \frac{k_t}{c_o(z) \cdot \ln(z/z_0)} \quad \text{pro} \quad z_{min} \leq z \leq z_{max}$$

| | | | |
|----------|-------|----|---|
| $I_v(z)$ | 0.305 | kl | 1 |
|----------|-------|----|---|

$$I_v(z) = I_v(z_{min}) \quad \text{pro} \quad z \leq z_{min}$$

Zatížení mostu větrem

Obecná metoda

samostatný most

$$b/d_{tot} = 10.3/2.24 = 4.6$$

Rovnoměrné zatížení na kraj mostu

$$F_w = C_{fx,0} \times q_p(z) \times A_{ref,x} = 1.3 \times 0.74 \times (1.05 + 0.14 + 0.6) = 1.72 \text{ kN/m}$$

most+zatížení dopravou

$$b/d_{tot} = 10.3/(0.9 + 0.14 + 3.0) = 2.55$$

Rovnoměrné zatížení na kraj mostu

$$F_w = C_{fx,0} \times q_p(z) \times A_{ref,x} = 1.8 \times 0.74 \times (1.05 + 0.14 + 2) = 4.29 \text{ kN/m}$$

Zjednodušená metoda

samostatný most

$$b/d_{tot} = 10.3/2.24 = 4.6$$

$$F_w = \frac{1}{2} \times \rho \times v_b^2 \times C \times A_{ref,x} = \frac{1}{2} \times 1.25 \times 27.5^2 \times 3.6 \times (1.05 + 0.14 + 0.6) = 3046 \text{ N/m} = 3.05 \text{ kN/m}$$

most+zatížení dopravou

$$b/d_{tot} = 10.3/(0.9 + 0.14 + 3.0) = 2.55$$

$$F_w = \frac{1}{2} \times \rho \times v_b^2 \times C \times A_{ref,x} = \frac{1}{2} \times 1.25 \times 23^2 \times 3.6 \times (0.9 + 0.14 + 2) = 3797 \text{ N/m} = 3.80 \text{ kN/m}$$

Zatížení teplotou

ČSN EN 1991-1-5

rovnoměrná teplota

typ mostu 3 4.5 4.5

| | | | | | | | |
|------------|-----|----|----|--------------|-------------|-------|----|
| T_{\max} | 37 | °C | => | $T_{e,\max}$ | $37+4.5 =$ | 41.5 | °C |
| T_{\min} | -29 | °C | => | $T_{e,\min}$ | $-29+4.5 =$ | -24.5 | °C |

pro $T_0 = 10$ °C

$\Delta T_{N,\text{con}} = T_{e,\min} - T_0 = -24.5 - 10 = -34.5$ °C

$\Delta T_{N,\text{exp}} = T_{e,\max} - T_0 = 41.5 - 10 = 31.5$ °C

$\Delta T_N = 66$ °C

nerovnoměrná teplota

teplotní spád

$\Delta T = 10$ °C

| | | |
|----------|----------|---|
| délka NK | 23.64 | m |
| alfa | 1.20E-05 | |

| | | |
|----------|-------|----|
| delta L- | -9.79 | mm |
| delta L+ | 8.94 | mm |

Výpočet smršťování

$$f_{ck} = 25 \text{ MPa}$$

$$RH_0 = 100 \%$$

$$RH = 80 \%$$

$$\beta_{RH} = 1,55 \left[1 - \left(\frac{RH}{RH_0} \right)^3 \right] \quad \beta_{RH} = 0.756$$

základní poměrné přetvoření od smršťování vysycháním:

$$\varepsilon_{cd,0} = 0,85 \left[(220 + 110 \cdot \alpha_{ds1}) \cdot \exp \left(-\alpha_{ds2} \cdot \frac{f_{cm}}{f_{cm0}} \right) \right] \cdot 10^{-6} \cdot \beta_{RH}$$

$$f_{cm0} = 10 \text{ MPa}$$

součinitelé závislé na druhu cementu

$$\alpha_{ds1} = 4 \quad (N)$$

$$\alpha_{ds2} = 0.12 \quad (N)$$

$$\varepsilon_{cd,0} = 0.000286 \quad -$$

konec ošetřování betonu:

$$t_s = 1 \text{ dnů}$$

stáří betonu v uvažovaném okamžiku

$$t = 36500 \text{ dnů}$$

$$\beta_{ds}(t; t_s) = \frac{(t - t_s)}{(t - t_s) + 0,04 \sqrt{h_0^3}} \quad \beta_{ds}(t; t_s) = 1.00$$

součinitel závislý na náhradní tloušťce h_0 :

náhradní rozměr prvku:

$$h_0 = 2 \cdot A_c / u = 127 \text{ mm}$$

$$k_h = 0.75 \quad -$$

poměrné smršťování vysycháním:

$$\varepsilon_{cd(t)} = \beta_{ds}(t; t_s) \cdot k_h \cdot \varepsilon_{cd,0} = 0.000214 \quad -$$

poměrné autogenní smršťování:

pro 100 let:

$$\beta_{as}(t) = 1 - \exp(-0,2 \cdot t^{0,5}) = 0.8$$

$$\varepsilon_{ca, \infty} = 2,5 \cdot (f_{ck} - 10) \cdot 10^{-6} = 0.000038$$

$$\varepsilon_{ca(t)} = \beta_{as}(t) \cdot \varepsilon_{ca, \infty} = 0.000030$$

celkové poměrné smršťování:

$$\varepsilon_{cs} = \varepsilon_{cs} + \varepsilon_{ca} = 0.000243$$

odpovídající změna teploty konstrukce

$$\Delta t = \frac{\varepsilon_{cs}}{\alpha} \quad \Delta t = -20.28 \quad ^\circ\text{C}$$

ložisko 11

Zatížení
doprav
ou

| | Koeficienty kombinací | | |
|---------------------------------|-----------------------|-----------|------------|
| Zatěžovací stavy | | | |
| (kombinace) | g_{sup} | g_{inf} | γ_o |
| | | | |
| | | | |
| | | | |
| VLASTNI HMOTNOST | 1.35 | 1 | 0 |
| KONSTRUKCE VOZOVKY | 1.35 | 1 | 0 |
| KONSTRUKCE RIMS | 1.35 | 1 | 0 |
| DOTVAROVANI A SMRSTOVANI BETONU | 1.5 | 1.5 | 0.6 |
| | | | |
| VN - MAX R | 1.35 | 1.35 | 0.75 |
| VR - MAX R | 1.35 | 1.35 | 0.75 |
| VE - MAX R | 1.35 | 1.35 | 0 |
| ROVNOMERNE OTEPLENI | 1.5 | 1.5 | 0.6 |
| ROVNOMERNE OCHLAZENI | 1.5 | 1.5 | 0.6 |
| VRATNÉ SÍLY V LOŽISCÍCH | 1.5 | 1.5 | 0.6 |
| BRZDNE A ROZJEZDOVE SÍLY | 1.35 | 1.35 | 0 |
| | | | |
| VITR NEZATIZENY | 1.5 | 1.5 | 0.6 |
| VITR AUTO | 1.5 | 1.5 | 0.6 |
| | | | |

max Q

min Q

max G

min G

max Q zatížení dopravou

min Q zatížení dopravou

max Q teplota

min Q teplota

max Q vítr

min Q vítr

| | Ložiskové síly pro základní kombinaci EN 1990 |
|-------|---|
| 1.1 | Max Ved |
| 1.2 | Min Ved |
| 1.2.1 | Vg |
| 1.3 | Max Hx |
| 1.4 | Min Hx |
| 1.5 | Max Hy |
| 1.6 | Min Hy |
| | Pohyby pro základní kombinaci |
| 2.1 | max vx |
| 2.2 | min vx |
| 2.3 | max vy |
| 2.4 | min vy |
| 2.5 | max φx |
| 2.6 | min φx |
| 2.7 | max φy |
| 2.8 | min φy |

| Charakteristické hodnoty | | | | | | |
|--------------------------|------|--------|-------|-------|--------|--------|
| V | Hx | Hy | v_x | v_y | φx | φy |
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] |
| | | | | | | |
| | | | | | | |
| 691.86 | 0.00 | 0.20 | -0.81 | 0.00 | 0.023 | 0.058 |
| 90.16 | 0.00 | 0.00 | -0.10 | 0.00 | 0.005 | 0.007 |
| 83.45 | 0.00 | 0.00 | -0.10 | 0.00 | 0.005 | 0.007 |
| 0.00 | 0.00 | 0.00 | 1.13 | 0.00 | 0.010 | -0.007 |
| | | | | | | |
| | | | | | | |
| 285.05 | 0.00 | 8.29 | 0.00 | 0.00 | 0.039 | 0.002 |
| 134.40 | 0.00 | -20.58 | -0.09 | 0.00 | 0.018 | 0.014 |
| 335.81 | 0.00 | 6.44 | -0.26 | 0.00 | 0.028 | 0.033 |
| 0.00 | 0.00 | 0.00 | -8.87 | 0.00 | -0.001 | -0.130 |
| 0.00 | 0.00 | 0.00 | 9.71 | 0.00 | 0.001 | 0.142 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.000 |
| -0.06 | 0.00 | 0.47 | 0.03 | 0.00 | 0.000 | 0.000 |
| | | | | | | |
| | | | | | | |
| 8.04 | 0.00 | -29.82 | -0.02 | 0.00 | 0.000 | 0.001 |
| 0.26 | 0.00 | -36.50 | -0.01 | 0.00 | 0.000 | 0.000 |
| | | | | | | |

| | | | | | | |
|--------|------|--------|-------|------|-------|-------|
| 335.81 | 0.00 | 8.29 | 9.71 | 0.00 | 0.039 | 0.142 |
| 134.34 | 0.00 | -20.58 | -0.26 | 0.00 | 0.018 | 0.002 |

| | | | | | | |
|--------|------|--------|-------|------|--------|--------|
| 865.47 | 0.00 | 0.20 | 0.13 | 0.00 | 0.043 | 0.073 |
| 865.47 | 0.00 | 0.19 | -1.01 | 0.00 | 0.033 | 0.066 |
| 335.81 | 0.00 | 8.76 | 0.03 | 0.00 | 0.039 | 0.033 |
| 134.34 | 0.00 | -20.58 | -0.26 | 0.00 | 0.018 | 0.002 |
| 0.00 | 0.00 | 0.00 | 9.71 | 0.00 | 0.001 | 0.142 |
| 0.00 | 0.00 | 0.00 | -8.87 | 0.00 | -0.001 | -0.130 |
| 8.29 | 0.00 | 66.32 | 0.03 | 0.00 | 0.00 | 0.00 |
| -8.29 | 0.00 | -66.32 | -0.03 | 0.00 | 0.00 | 0.00 |

| V | Hx | Hy | v_x | v_y | φx | φy |
|---------|------|--------|-------|-------|-------|--------|
| 1209.58 | | | | | | |
| 991.52 | | | | | | |
| 865.47 | 0.00 | 0.19 | 0.13 | 0.00 | 0.043 | 0.066 |
| | 0.00 | | | | | |
| | 0.00 | | | | | |
| | | 75.27 | | | | |
| | | -86.71 | | | | |
| | | | 9.90 | | | |
| | | | -9.03 | | | |
| | | | | 0.00 | | |
| | | | | 0.00 | | |
| | | | | | 0.084 | |
| | | | | | 0.061 | |
| | | | | | | 0.242 |
| | | | | | | -0.063 |

| Mezní stav únosnosti | | | | | | |
|----------------------|------|--------|--------|-------|--------|--------|
| V | Hx | Hy | v_x | v_y | φx | φy |
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] |
| | | | | | | |
| | | | | | | |
| 934.01 | 0.00 | 0.26 | -1.09 | 0.00 | 0.032 | 0.079 |
| 121.72 | 0.00 | 0.00 | -0.14 | 0.00 | 0.006 | 0.010 |
| 112.66 | 0.00 | 0.00 | -0.13 | 0.00 | 0.007 | 0.009 |
| 0.00 | 0.00 | 0.00 | 1.70 | 0.00 | 0.015 | -0.010 |
| | | | | | | |
| | | | | | | |
| 384.81 | 0.00 | 11.20 | 0.00 | 0.00 | 0.053 | 0.003 |
| 181.44 | 0.00 | -27.78 | -0.12 | 0.00 | 0.025 | 0.019 |
| 453.34 | 0.00 | 8.69 | -0.35 | 0.00 | 0.038 | 0.044 |
| 0.00 | 0.00 | 0.00 | -13.30 | 0.00 | -0.002 | -0.195 |
| 0.00 | 0.00 | 0.00 | 14.57 | 0.00 | 0.002 | 0.213 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.000 |
| -0.08 | 0.00 | 0.63 | 0.04 | 0.00 | 0.000 | 0.000 |
| | | | | | | |
| | | | | | | |
| 12.06 | 0.00 | -44.73 | -0.02 | 0.00 | 0.000 | 0.001 |
| 0.39 | 0.00 | -54.75 | -0.02 | 0.00 | 0.000 | 0.000 |
| | | | | | | |

| | | | | | | |
|--------|------|--------|-------|------|-------|-------|
| 453.34 | 0.00 | 11.20 | 14.57 | 0.00 | 0.053 | 0.213 |
| 181.36 | 0.00 | -27.78 | -0.35 | 0.00 | 0.025 | 0.003 |

| | | | | | | |
|---------|------|--------|--------|------|--------|--------|
| 1168.39 | 0.00 | 0.26 | 0.34 | 0.00 | 0.060 | 0.098 |
| 1168.39 | 0.00 | 0.26 | -1.36 | 0.00 | 0.045 | 0.088 |
| 453.34 | 0.00 | 11.82 | 0.04 | 0.00 | 0.053 | 0.044 |
| 181.36 | 0.00 | -27.78 | -0.35 | 0.00 | 0.025 | 0.003 |
| 0.00 | 0.00 | 0.00 | 14.57 | 0.00 | 0.002 | 0.213 |
| 0.00 | 0.00 | 0.00 | -13.30 | 0.00 | -0.002 | -0.195 |
| 12.44 | 0.00 | 99.48 | 0.04 | 0.00 | 0.00 | 0.00 |
| -12.44 | 0.00 | -99.48 | -0.04 | 0.00 | 0.00 | 0.00 |

| V | Hx | Hy | v_x | v_y | φx | φy |
|---------|------|---------|--------|-------|-------|--------|
| 1634.18 | 0.00 | 12.09 | 9.16 | 0.02 | 0.116 | 0.271 |
| 1155.95 | 0.00 | -27.52 | -1.71 | 0.00 | 0.070 | 0.091 |
| 865.47 | 0.00 | 0.89 | -1.32 | 0.00 | 0.060 | 0.087 |
| | 0.00 | | | | | |
| | 0.00 | | | | | |
| | | 108.14 | | | | |
| | | -120.06 | | | | |
| | | | 14.95 | | | |
| | | | -14.78 | | | |
| | | | | 0.02 | | |
| | | | | -0.02 | | |
| | | | | | 0.116 | |
| | | | | | 0.042 | |
| | | | | | | 0.327 |
| | | | | | | -0.108 |

| V | Hx | Hy | v_x | v_y | φx | φy |
|------|------|------|-------|-------|--------|--------|
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] |

| | | | | | | |
|--------|------|--------|-------|------|----------|----------|
| 288.61 | 0.00 | 8.40 | 0.00 | 0.00 | 0.0397 | 0.0024 |
| 136.08 | 0.00 | -20.84 | -0.09 | 0.00 | 0.0187 | 0.0145 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 0.00 | 0.00 | 0.00 | -7.98 | 0.00 | -0.00113 | -0.11684 |
| 0.00 | 0.00 | 0.00 | 8.74 | 0.00 | 0.00123 | 0.12797 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| | | | | | | |
| | | | | | | |
| 7.23 | 0.00 | -26.84 | -0.01 | 0.00 | -0.00027 | 0.00067 |
| 0.23 | 0.00 | -32.85 | -0.01 | 0.00 | 0.00021 | 0.00021 |
| | | | | | | |

| | | | | | | |
|--------|------|--------|-------|------|------|------|
| 288.61 | 0.00 | 8.40 | 0.00 | 0.00 | 0.04 | 0.01 |
| 0.00 | 0.00 | -20.84 | -0.09 | 0.00 | 0.00 | 0.00 |

| | | | | | | |
|--------|------|--------|-------|-------|----------|----------|
| 288.61 | 0.00 | 8.40 | 0.00 | 0.00 | 0.0397 | 0.0145 |
| 0.00 | 0.00 | -20.84 | -0.09 | 0.00 | 0 | 0 |
| 0.00 | 0.00 | 0.00 | 8.74 | 0.00 | 0.00123 | 0.12797 |
| 0.00 | 0.00 | 0.00 | -7.98 | 0.00 | -0.00113 | -0.11684 |
| 12.44 | 0.00 | 0.00 | 0.03 | 0.02 | 0.00123 | 0.00127 |
| -12.44 | 0.00 | 0.00 | -0.03 | -0.02 | -0.00123 | -0.00127 |

| | | | | |
|--------------------------|---------------------------------|----------------|----------------|-----------------------|
| Zatížení doprav ou | ložisko 12 | | | |
| | | | | Koeficienty kombinací |
| | Zatěžovací stavy (kombinace) | | | |
| | | γ_{sup} | γ_{inf} | ψ_0 |
| | | | | |
| | | | | |
| | VLASTNI HMOTNOST | 1.35 | 1 | 0 |
| | KONSTRUKCE VOZOVKY | 1.35 | 1 | 0 |
| | KONSTRUKCE RIMS | 1.35 | 1 | 0 |
| | DOTVAROVANI A SMRSTOVANI BETONU | 1.5 | 1.5 | 0.6 |
| | VN - MAX R | 1.35 | 1.35 | 0.75 |
| | VR - MAX R | 1.35 | 1.35 | 0.75 |
| | VE - MAX R | 1.35 | 1.35 | 0 |
| | | | | |
| | ROVNOMERNE OTEPLENI | 1.5 | 1.5 | 0.6 |
| | ROVNOMERNE OCHLAZENI | 1.5 | 1.5 | 0.6 |
| | VRATNE SILY V LOZISCICH | 1.5 | 1.5 | 0.6 |
| | BRZDNE A ROZJEZDOVE SILY | 1.35 | 1.35 | 0 |
| | | | | |
| | VITR NEZATIZENY | 1.5 | 1.5 | 0.6 |
| | VITR AUTO | 1.5 | 1.5 | 0.6 |

max Q
min Q

max G
min G
max Q zatížení dopravou
min Q zatížení dopravou
max Q teplota
min Q teplota
max Q vítr
min Q vítr

| | | |
|-------|---|--|
| | Ložiskové síly pro základní kombinaci EN 1990 | |
| 1.1 | Max Ved | |
| 1.2 | Min Ved | |
| 1.2.1 | Vg | |
| 1.3 | Max Hx | |
| 1.4 | Min Hx | |
| 1.5 | Max Hy | |
| 1.6 | Min Hy | |
| | Pohyby pro základní kombinaci | |
| 2.1 | max vx | |
| 2.2 | min vx | |
| 2.3 | max vy | |
| 2.4 | min vy | |
| 2.5 | max φx | |
| 2.6 | min φx | |
| 2.7 | max φy | |
| 2.8 | min φy | |

| Charakteristické hodnoty | | | | | | |
|--------------------------|------|------|----------------|----------------|--------|--------|
| V | Hx | Hy | V _x | V _y | φx | φy |
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] |
| | | | | | | |
| 691.85 | 0.00 | 0.00 | -0.81 | 0.18 | -0.023 | 0.058 |
| 90.16 | 0.00 | 0.00 | -0.10 | 0.03 | -0.005 | 0.007 |
| 83.45 | 0.00 | 0.00 | -0.10 | 0.03 | -0.005 | 0.007 |
| 0.00 | 0.00 | 0.00 | 1.13 | 0.34 | -0.010 | -0.007 |
| | | | | | | |
| 284.80 | 0.00 | 0.00 | -0.03 | 0.14 | -0.039 | 0.003 |
| 320.99 | 0.00 | 0.00 | -0.17 | 0.10 | -0.021 | 0.030 |
| 335.62 | 0.00 | 0.00 | -0.28 | 0.14 | -0.028 | 0.033 |
| | | | | | | |
| 0.00 | 0.00 | 0.00 | -8.87 | -2.59 | 0.001 | -0.130 |
| 0.00 | 0.00 | 0.00 | 9.71 | 2.83 | -0.001 | 0.142 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.000 |
| -0.07 | 0.00 | 0.00 | 0.03 | 0.00 | 0.000 | 0.000 |
| | | | | | | |
| -8.04 | 0.00 | 0.00 | 0.01 | 0.01 | -0.001 | -0.001 |
| -0.26 | 0.00 | 0.00 | 0.01 | 0.01 | 0.000 | 0.000 |

| | | | | | | |
|--------|------|------|-------|------|--------|-------|
| 335.62 | 0.00 | 0.00 | 9.71 | 2.83 | 0.001 | 0.142 |
| 284.72 | 0.00 | 0.00 | -0.28 | 0.10 | -0.039 | 0.002 |

| | | | | | | |
|--------|------|------|-------|-------|--------|--------|
| 865.47 | 0.00 | 0.00 | 0.13 | 0.58 | -0.033 | 0.073 |
| 865.47 | 0.00 | 0.00 | -1.01 | 0.24 | -0.043 | 0.066 |
| 335.62 | 0.00 | 0.00 | 0.00 | 0.14 | -0.021 | 0.033 |
| 284.72 | 0.00 | 0.00 | -0.28 | 0.10 | -0.039 | 0.002 |
| 0.00 | 0.00 | 0.00 | 9.71 | 2.83 | 0.001 | 0.142 |
| 0.00 | 0.00 | 0.00 | -8.87 | -2.59 | -0.001 | -0.130 |
| 8.29 | 0.00 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 |
| -8.29 | 0.00 | 0.00 | -0.02 | -0.01 | 0.00 | 0.00 |

| V | Hx | Hy | V _x | V _y | φx | φy |
|---------|------|------|----------------|----------------|--------|--------|
| 1209.38 | | | | | | |
| 1141.90 | | | | | | |
| 865.47 | 0.00 | 0.00 | 0.13 | 0.58 | -0.043 | 0.066 |
| | 0.00 | | | | | |
| | 0.00 | | | | | |
| | | 0.00 | | | | |
| | | 0.00 | | | | |
| | | | 9.86 | | | |
| | | | -9.04 | | | |
| | | | | 3.57 | | |
| | | | | -1.92 | | |
| | | | | | -0.062 | |
| | | | | | -0.085 | |
| | | | | | | 0.242 |
| | | | | | | -0.063 |

| Mezní stav únosnosti | | | | | | |
|----------------------|------|------|----------------|----------------|--------|--------|
| V | Hx | Hy | V _x | V _y | φx | φy |
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] |
| | | | | | | |
| 934.00 | 0.00 | 0.00 | -1.09 | 0.25 | -0.032 | 0.079 |
| 121.72 | 0.00 | 0.00 | -0.14 | 0.04 | -0.006 | 0.010 |
| 112.66 | 0.00 | 0.00 | -0.13 | 0.04 | -0.007 | 0.009 |
| 0.00 | 0.00 | 0.00 | 1.70 | 0.51 | -0.015 | -0.010 |
| | | | | | | |
| 384.48 | 0.00 | 0.00 | -0.04 | 0.19 | -0.053 | 0.004 |
| 433.33 | 0.00 | 0.00 | -0.23 | 0.13 | -0.028 | 0.041 |
| 453.08 | 0.00 | 0.00 | -0.38 | 0.19 | -0.038 | 0.044 |
| | | | | | | |
| 0.00 | 0.00 | 0.00 | -13.30 | -3.88 | 0.002 | -0.195 |
| 0.00 | 0.00 | 0.00 | 14.57 | 4.25 | -0.002 | 0.213 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.000 | 0.000 |
| -0.10 | 0.00 | 0.00 | 0.04 | 0.00 | 0.000 | 0.000 |
| | | | | | | |
| -12.06 | 0.00 | 0.00 | 0.02 | 0.01 | -0.001 | -0.001 |
| -0.39 | 0.00 | 0.00 | 0.01 | 0.01 | 0.000 | 0.000 |

| | | | | | | |
|--------|------|------|-------|------|--------|-------|
| 453.08 | 0.00 | 0.00 | 14.57 | 4.25 | 0.002 | 0.213 |
| 384.38 | 0.00 | 0.00 | -0.38 | 0.13 | -0.053 | 0.003 |

| | | | | | | |
|---------|------|------|--------|-------|--------|--------|
| 1168.38 | 0.00 | 0.00 | 0.34 | 0.83 | -0.045 | 0.098 |
| 1168.38 | 0.00 | 0.00 | -1.36 | 0.33 | -0.060 | 0.088 |
| 453.08 | 0.00 | 0.00 | 0.00 | 0.19 | -0.028 | 0.044 |
| 384.38 | 0.00 | 0.00 | -0.38 | 0.13 | -0.053 | 0.003 |
| 0.00 | 0.00 | 0.00 | 14.57 | 4.25 | 0.002 | 0.213 |
| 0.00 | 0.00 | 0.00 | -13.30 | -3.88 | -0.002 | -0.195 |
| 12.44 | 0.00 | 0.00 | 0.03 | 0.02 | 0.00 | 0.00 |
| -12.44 | 0.00 | 0.00 | -0.03 | -0.02 | 0.00 | 0.00 |

| V | Hx | Hy | V _x | V _y | φx | φy |
|---------|------|------|----------------|----------------|--------|--------|
| 1633.91 | 0.00 | 0.00 | 9.12 | 3.59 | -0.070 | 0.272 |
| 1155.94 | 0.00 | 0.00 | -1.74 | 0.46 | -0.113 | 0.091 |
| 865.47 | 0.00 | 0.00 | -1.32 | 0.33 | -0.060 | 0.087 |
| | 0.00 | | | | | |
| | 0.00 | | | | | |
| | | 0.00 | | | | |
| | | 0.00 | | | | |
| | | | 14.95 | | | |
| | | | -14.87 | | | |
| | | | | 5.25 | | |
| | | | | -3.57 | | |
| | | | | | -0.057 | |
| | | | | | -0.100 | |
| | | | | | | 0.272 |
| | | | | | | -0.108 |

| V | Hx | Hy | V _x | V _y | φx | φy |
|------|------|------|----------------|----------------|--------|--------|
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] |

| | | | | | | |
|--------|------|------|-------|-------|----------|----------|
| 288.36 | 0.00 | 0.00 | -0.03 | 0.14 | -0.03966 | 0.00265 |
| 325.00 | 0.00 | 0.00 | -0.17 | 0.10 | -0.02081 | 0.0308 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 0.00 | 0.00 | 0.00 | -7.98 | -2.33 | 0.00113 | -0.11684 |
| 0.00 | 0.00 | 0.00 | 8.74 | 2.55 | -0.00123 | 0.12797 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| | | | | | | |
| -7.23 | 0.00 | 0.00 | 0.01 | 0.01 | -0.0006 | -0.00062 |
| -0.23 | 0.00 | 0.00 | 0.01 | 0.01 | -0.00014 | -0.00014 |

| | | | | | | |
|--------|------|------|-------|------|-------|------|
| 325.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.00 | 0.03 |
| 0.00 | 0.00 | 0.00 | -0.17 | 0.00 | -0.04 | 0.00 |

| | | | | | | |
|--------|------|------|-------|-------|----------|----------|
| 325.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0 | 0.0308 |
| 0.00 | 0.00 | 0.00 | -0.17 | 0.00 | -0.03966 | 0 |
| 0.00 | 0.00 | 0.00 | 8.74 | 2.55 | 0.00113 | 0.12797 |
| 0.00 | 0.00 | 0.00 | -7.98 | -2.33 | -0.00123 | -0.11684 |
| 12.44 | 0.00 | 0.00 | 0.03 | 0.02 | 0.00123 | 0.00127 |
| -12.44 | 0.00 | 0.00 | -0.03 | -0.02 | -0.00123 | -0.00127 |

Zatížení dopravy

ou

| | | | | |
|---------------------------------|--|-----------------------|----------------|----------|
| ložisko 21 | | Koeficienty kombinací | | |
| Zatěžovací stavy | | | | |
| (kombinace) | | γ_{sup} | γ_{inf} | ψ_0 |
| | | | | |
| VLASTNI HMOTNOST | | 1.35 | 1 | 0 |
| KONSTRUKCE VOZOVKY | | 1.35 | 1 | 0 |
| KONSTRUKCE RIMS | | 1.35 | 1 | 0 |
| DOTVAROVANI A SMRSTOVANI BETONU | | 1.5 | 1.5 | 0.6 |
| VN - MAX R | | 1.35 | 1.35 | 0.75 |
| VR - MAX R | | 1.35 | 1.35 | 0.75 |
| VE - MAX R | | 1.35 | 1.35 | 0 |
| | | | | |
| ROVNOMERNE OTEPLENI | | 1.5 | 1.5 | 0.6 |
| ROVNOMERNE OCHLAZENI | | 1.5 | 1.5 | 0.6 |
| VRATNÉ SÍLY V LOŽISCÍCH | | 1.5 | 1.5 | 0.6 |
| BRZDNE A ROZJEZDOVE SÍLY | | 1.35 | 1.35 | 0 |
| | | | | |
| VITR NEZATIZENY | | 1.5 | 1.5 | 0.6 |
| VITR AUTO | | 1.5 | 1.5 | 0.6 |

max Q

min Q

max G

min G

max Q zatížení dopravou

min Q zatížení dopravou

max Q teplota

min Q teplota

max Q vítr

min Q vítr

| | |
|---|---------|
| Ložiskové síly pro základní kombinaci EN 1990 | |
| 1.1 | Max Ved |
| 1.2 | Min Ved |
| 1.2.1 | Vg |
| 1.3 | Max Hx |
| 1.4 | Min Hx |
| 1.5 | Max Hy |
| 1.6 | Min Hy |
| Pohyby pro základní kombinaci | |
| 2.1 | max vx |
| 2.2 | min vx |
| 2.3 | max vy |
| 2.4 | min vy |
| 2.5 | max φx |
| 2.6 | min φx |
| 2.7 | max φy |
| 2.8 | min φy |

| | | | | | | | |
|--------------------------|--------|--------|------|------|--------|--------|--|
| Charakteristické hodnoty | | | | | | | |
| V | Hx | Hy | Vx | Vy | φx | φy | |
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] | |
| | | | | | | | |
| 691.90 | -37.86 | -0.20 | 0.00 | 0.00 | 0.023 | -0.058 | |
| 90.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.005 | -0.007 | |
| 83.45 | 0.00 | 0.00 | 0.00 | 0.00 | 0.005 | -0.007 | |
| 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.010 | 0.007 | |
| | | | | | | | |
| 2.15 | -26.64 | -8.29 | 0.00 | 0.00 | 0.001 | 0.000 | |
| 28.40 | 66.09 | 20.58 | 0.00 | 0.00 | 0.001 | 0.000 | |
| 114.19 | -20.67 | -6.44 | 0.00 | 0.00 | 0.003 | -0.004 | |
| | | | | | | | |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.001 | 0.130 | |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.001 | -0.142 | |
| 0.00 | -46.60 | 0.00 | 0.00 | 0.00 | 0.000 | 0.000 | |
| 0.06 | -89.30 | -0.47 | 0.00 | 0.00 | 0.000 | 0.001 | |
| | | | | | | | |
| 7.59 | -47.88 | -59.63 | 0.00 | 0.00 | 0.000 | -0.001 | |
| -0.03 | -30.81 | -55.69 | 0.00 | 0.00 | 0.000 | 0.000 | |

| | | | | | | |
|--------|---------|-------|------|------|-------|--------|
| 114.19 | 66.09 | 20.58 | 0.00 | 0.00 | 0.003 | 0.130 |
| 2.15 | -115.93 | -8.76 | 0.00 | 0.00 | 0.001 | -0.004 |

| | | | | | | |
|--------|---------|---------|------|------|-------|--------|
| 865.51 | -37.85 | -0.19 | 0.00 | 0.00 | 0.043 | -0.066 |
| 865.51 | -37.86 | -0.20 | 0.00 | 0.00 | 0.033 | -0.073 |
| 114.25 | 66.09 | 20.58 | 0.00 | 0.00 | 0.003 | 0.001 |
| 2.15 | -115.93 | -8.76 | 0.00 | 0.00 | 0.001 | -0.004 |
| 0.00 | 46.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 |
| 0.00 | -46.60 | 0.00 | 0.00 | 0.00 | 0.00 | -0.14 |
| 7.56 | 78.69 | 115.32 | 0.00 | 0.00 | 0.00 | 0.00 |
| -7.56 | -78.69 | -115.32 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | |
|--------|---------|---------|------|------|-------|--------|
| V | Hx | Hy | Vx | Vy | φx | φy |
| 987.32 | | | | | | |
| 860.11 | | | | | | |
| 865.51 | -37.85 | -0.19 | 0.00 | 0.00 | 0.043 | -0.066 |
| | 153.53 | | | | | |
| | -279.08 | | | | | |
| | | 135.71 | | | | |
| | | -124.27 | | | | |
| | | | 0.00 | | | |
| | | | 0.00 | | | |
| | | | | 0.00 | | |
| | | | | 0.00 | | |
| | | | | | 0.048 | |
| | | | | | 0.043 | |
| | | | | | | 0.066 |
| | | | | | | -0.213 |

| | | | | | | | |
|----------------------|---------|--------|------|------|--------|--------|--|
| Mezní stav únosnosti | | | | | | | |
| V | Hx | Hy | Vx | Vy | φx | φy | |
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] | |
| | | | | | | | |
| 934.07 | -51.11 | -0.26 | 0.00 | 0.00 | 0.032 | -0.079 | |
| 121.72 | 0.00 | 0.00 | 0.00 | 0.00 | 0.006 | -0.010 | |
| 112.66 | 0.00 | 0.00 | 0.00 | 0.00 | 0.007 | -0.009 | |
| 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.015 | 0.010 | |
| | | | | | | | |
| 2.91 | -35.96 | -11.20 | 0.00 | 0.00 | 0.001 | 0.000 | |
| 38.34 | 89.22 | 27.78 | 0.00 | 0.00 | 0.001 | 0.000 | |
| 154.15 | -27.90 | -8.69 | 0.00 | 0.00 | 0.004 | -0.006 | |
| | | | | | | | |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.002 | 0.195 | |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.002 | -0.213 | |
| 0.00 | -69.90 | 0.00 | 0.00 | 0.00 | 0.000 | 0.000 | |
| 0.08 | -120.55 | -0.63 | 0.00 | 0.00 | 0.000 | 0.001 | |
| | | | | | | | |
| 11.39 | -71.82 | -89.45 | 0.00 | 0.00 | 0.000 | -0.001 | |
| -0.04 | -46.21 | -83.53 | 0.00 | 0.00 | 0.001 | 0.000 | |

| | | | | | | |
|--------|---------|--------|------|------|-------|--------|
| 154.15 | 89.22 | 27.78 | 0.00 | 0.00 | 0.004 | 0.195 |
| 2.91 | -156.51 | -11.82 | 0.00 | 0.00 | 0.001 | -0.006 |

| | | | | | | |
|---------|---------|---------|------|------|-------|--------|
| 1168.44 | -51.10 | -0.26 | 0.00 | 0.00 | 0.060 | -0.088 |
| 1168.44 | -51.11 | -0.26 | 0.00 | 0.00 | 0.045 | -0.098 |
| 154.23 | 89.22 | 27.78 | 0.00 | 0.00 | 0.004 | 0.001 |
| 2.91 | -156.51 | -11.82 | 0.00 | 0.00 | 0.001 | -0.006 |
| 0.00 | 69.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.19 |
| 0.00 | -69.90 | 0.00 | 0.00 | 0.00 | 0.00 | -0.21 |
| 11.34 | 118.03 | 172.98 | 0.00 | 0.00 | 0.00 | 0.00 |
| -11.34 | -118.03 | -172.98 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | |
|---------|---------|---------|------|-------|-------|--------|
| V | Hx | Hy | Vx | Vy | φx | φy |
| 1335.12 | 80.07 | 27.52 | 0.03 | 0.02 | 0.066 | 0.032 |
| 1156.00 | -207.62 | -12.09 | 0.00 | 0.00 | 0.046 | -0.103 |
| 865.51 | -171.66 | -0.89 | 0.00 | 0.00 | 0.060 | -0.087 |
| | 175.79 | | | | | |
| | -249.56 | | | | | |
| | | 193.56 | | | | |
| | | -181.64 | | | | |
| | | | 0.00 | | | |
| | | | 0.00 | | | |
| | | | | 0.02 | | |
| | | | | -0.02 | | |
| | | | | | 0.065 | |
| | | | | | 0.042 | |
| | | | | | | 0.108 |
| | | | | | | -0.313 |

| | | | | | | |
|------|------|------|------|------|--------|--------|
| V | Hx | Hy | Vx | Vy | φx | φy |
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] |

| | | | | | | |
|-------|--------|--------|------|------|----------|----------|
| 2.18 | -26.97 | -8.40 | 0.00 | 0.00 | 0.0011 | 0.00028 |
| 28.75 | 66.92 | 20.84 | 0.00 | 0.00 | 0.00096 | -0.00026 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.00112 | 0.11684 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00122 | -0.12796 |
| 0.00 | -41.94 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| | | | | | | |
| 6.83 | -43.09 | -53.67 | 0.00 | 0.00 | -7.7E-05 | -0.00047 |
| -0.03 | -27.73 | -50.12 | 0.00 | 0.00 | 0.00033 | -8.2E-05 |

| | | | | | | |
|-------|--------|-------|------|------|------|------|
| 28.75 | 66.92 | 20.84 | 0.00 | 0.00 | 0.00 | 0.00 |
| 0.00 | -26.97 | -8.40 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | |
|--------|--------|-------|-------|-------|----------|----------|
| 28.75 | 66.92 | 20.84 | 0.00 | 0.00 | 0.0011 | 0.00028 |
| 0.00 | -26.97 | -8.40 | 0.00 | 0.00 | 0 | -0.00026 |
| 0.00 | 41.94 | 0.00 | 0.00 | 0.00 | 0.00122 | 0.11684 |
| 0.00 | -41.94 | 0.00 | 0.00 | 0.00 | -0.00112 | -0.12796 |
| 12.44 | 0.00 | 0.00 | 0.03 | 0.02 | 0.00123 | 0.00127 |
| -12.44 | 0.00 | 0.00 | -0.03 | -0.02 | -0.00123 | -0.00127 |

| | | | | |
|---------------------------------|--|-----------------------|----------------|----------|
| ložisko 22 | | Koeficienty kombinací | | |
| Zatěžovací stavy | | | | |
| (kombinace) | | γ_{sup} | γ_{inf} | ψ_0 |
| | | | | |
| VLASTNI HMOTNOST | | 1.35 | 1 | 0 |
| KONSTRUKCE VOZOVKY | | 1.35 | 1 | 0 |
| KONSTRUKCE RIMS | | 1.35 | 1 | 0 |
| DOTVAROVANI A SMRSTOVANI BETONU | | 1.5 | 1.5 | 0.6 |
| VN - MAX R | | 1.35 | 1.35 | 0.75 |
| VR - MAX R | | 1.35 | 1.35 | 0.75 |
| VE - MAX R | | 1.35 | 1.35 | 0 |
| ROVNOMERNE OTEPLENI | | 1.5 | 1.5 | 0.6 |
| ROVNOMERNE OCHLAZENI | | 1.5 | 1.5 | 0.6 |
| VRATNÉ SILY V LOŽISCICH | | 1.5 | 1.5 | 0.6 |
| BRZDNE A ROZJEZDOVE SILY | | 1.35 | 1.35 | 0 |
| VITR NEZATIZENY | | 1.5 | 1.5 | 0.6 |
| VITR AUTO | | 1.5 | 1.5 | 0.6 |

Zatížení dopravou

max Q

min Q

max G

min G

max Q zatížení dopravou

min Q zatížení dopravou

max Q teplota

min Q teplota

max Q vítr

min Q vítr

- 1.1
- 1.2
- 1.2.1
- 1.3
- 1.4
- 1.5
- 1.6
- 2.1
- 2.2
- 2.3
- 2.4
- 2.5
- 2.6
- 2.7
- 2.8

| | |
|---|--|
| Ložiskové síly pro základní kombinaci EN 1990 | |
| Max Ved | |
| Min Ved | |
| Vg | |
| Max Hx | |
| Min Hx | |
| Max Hy | |
| Min Hy | |
| Pohyby pro základní kombinaci | |
| max vx | |
| min vx | |
| max vy | |
| min vy | |
| max φx | |
| min φx | |
| max φy | |
| min φy | |

| | | | | | | |
|--------------------------|--------|------|-------|-------|-------------|-------------|
| Charakteristické hodnoty | | | | | | |
| V | Hx | Hy | v_x | v_y | φ_x | φ_y |
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] |
| 691.91 | -36.60 | 0.00 | 0.00 | 0.18 | -0.023 | -0.058 |
| 90.16 | 0.00 | 0.00 | 0.00 | 0.03 | -0.005 | -0.007 |
| 83.45 | 0.00 | 0.00 | 0.00 | 0.03 | -0.005 | -0.007 |
| 0.00 | -0.01 | 0.00 | 0.00 | 0.34 | -0.010 | 0.007 |
| 2.40 | 26.64 | 0.00 | 0.00 | 0.01 | -0.001 | 0.000 |
| 64.42 | -66.09 | 0.00 | 0.00 | 0.01 | -0.001 | 0.000 |
| 114.38 | 20.67 | 0.00 | 0.00 | 0.03 | -0.003 | -0.004 |
| 0.00 | 0.00 | 0.00 | 0.00 | -2.59 | 0.001 | 0.130 |
| 0.00 | 0.00 | 0.00 | 0.00 | 2.83 | -0.001 | -0.142 |
| 0.00 | -46.60 | 0.00 | 0.00 | 0.00 | 0.000 | 0.000 |
| 0.07 | -86.31 | 0.00 | 0.00 | -0.01 | 0.000 | 0.001 |
| -7.59 | 47.88 | 0.00 | 0.00 | 0.01 | -0.001 | 0.000 |
| 0.03 | 30.81 | 0.00 | 0.00 | 0.01 | 0.000 | 0.000 |

| | | | | | | |
|--------|---------|------|------|------|--------|--------|
| 114.38 | 47.88 | 0.00 | 0.00 | 2.83 | 0.001 | 0.130 |
| 2.40 | -152.40 | 0.00 | 0.00 | 0.00 | -0.003 | -0.004 |

| | | | | | | |
|--------|---------|------|------|-------|--------|--------|
| 865.52 | -36.60 | 0.00 | 0.00 | 0.58 | -0.033 | -0.066 |
| 865.52 | -36.61 | 0.00 | 0.00 | 0.24 | -0.043 | -0.073 |
| 114.45 | 26.64 | 0.00 | 0.00 | 0.03 | -0.001 | 0.001 |
| 2.40 | -152.40 | 0.00 | 0.00 | 0.00 | -0.003 | -0.004 |
| 0.00 | 46.60 | 0.00 | 0.00 | 2.83 | 0.001 | 0.130 |
| 0.00 | -46.60 | 0.00 | 0.00 | -2.59 | -0.001 | -0.142 |
| 7.56 | 78.69 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 |
| -7.56 | -78.69 | 0.00 | 0.00 | -0.03 | 0.00 | 0.00 |

| | | | | | | |
|--------|---------|------|-------|-------|-------------|-------------|
| V | Hx | Hy | v_x | v_y | φ_x | φ_y |
| 987.54 | | | | | | |
| 860.36 | | | | | | |
| 865.52 | -36.61 | 0.00 | 0.00 | 0.58 | -0.043 | -0.066 |
| | 115.32 | | | | | |
| | -314.30 | | | | | |
| | | 0.00 | | | | |
| | | 0.00 | | | | |
| | | | 0.00 | | | |
| | | | 0.00 | | | |
| | | | | 3.47 | | |
| | | | | -2.03 | | |
| | | | | | -0.042 | |
| | | | | | -0.048 | |
| | | | | | | 0.065 |
| | | | | | | -0.213 |

| | | | | | | |
|----------------------|---------|------|-------|-------|-------------|-------------|
| Mezní stav únosnosti | | | | | | |
| V | Hx | Hy | v_x | v_y | φ_x | φ_y |
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] |
| 934.07 | -49.41 | 0.00 | 0.00 | 0.25 | -0.032 | -0.079 |
| 121.72 | 0.00 | 0.00 | 0.00 | 0.04 | -0.006 | -0.010 |
| 112.66 | 0.00 | 0.00 | 0.00 | 0.04 | -0.007 | -0.009 |
| 0.00 | -0.01 | 0.00 | 0.00 | 0.51 | -0.015 | 0.010 |
| 3.24 | 35.96 | 0.00 | 0.00 | 0.01 | -0.001 | 0.000 |
| 86.96 | -89.22 | 0.00 | 0.00 | 0.01 | -0.001 | 0.000 |
| 154.41 | 27.90 | 0.00 | 0.00 | 0.04 | -0.003 | -0.006 |
| 0.00 | 0.00 | 0.00 | 0.00 | -3.88 | 0.002 | 0.195 |
| 0.00 | 0.00 | 0.00 | 0.00 | 4.25 | -0.002 | -0.213 |
| 0.00 | -69.90 | 0.00 | 0.00 | 0.00 | 0.000 | 0.000 |
| 0.10 | -116.52 | 0.00 | 0.00 | -0.01 | 0.000 | 0.001 |
| -11.39 | 71.82 | 0.00 | 0.00 | 0.02 | -0.001 | 0.001 |
| 0.04 | 46.21 | 0.00 | 0.00 | 0.02 | 0.000 | 0.000 |

| | | | | | | |
|--------|---------|------|------|------|--------|--------|
| 154.41 | 71.82 | 0.00 | 0.00 | 4.25 | 0.002 | 0.195 |
| 3.24 | -205.74 | 0.00 | 0.00 | 0.00 | -0.003 | -0.006 |

| | | | | | | |
|---------|---------|------|------|-------|--------|--------|
| 1168.45 | -49.41 | 0.00 | 0.00 | 0.83 | -0.045 | -0.088 |
| 1168.45 | -49.42 | 0.00 | 0.00 | 0.33 | -0.060 | -0.098 |
| 154.51 | 35.96 | 0.00 | 0.00 | 0.04 | -0.001 | 0.001 |
| 3.24 | -205.74 | 0.00 | 0.00 | 0.00 | -0.003 | -0.006 |
| 0.00 | 69.90 | 0.00 | 0.00 | 4.25 | 0.002 | 0.195 |
| 0.00 | -69.90 | 0.00 | 0.00 | -3.88 | -0.002 | -0.213 |
| 11.34 | 118.03 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 |
| -11.34 | -118.03 | 0.00 | 0.00 | -0.04 | 0.00 | 0.00 |

| | | | | | | |
|---------|---------|------|-------|-------|-------------|-------------|
| V | Hx | Hy | v_x | v_y | φ_x | φ_y |
| 1335.41 | 28.49 | 0.00 | 0.03 | 3.45 | -0.044 | 0.031 |
| 1156.01 | -255.16 | 0.00 | 0.00 | 0.32 | -0.064 | -0.104 |
| 865.52 | -165.93 | 0.00 | 0.00 | 0.32 | -0.060 | -0.087 |
| | 137.53 | | | | | |
| | -297.10 | | | | | |
| | | 0.00 | | | | |
| | | 0.00 | | | | |
| | | | 0.00 | | | |
| | | | 0.00 | | | |
| | | | | 5.11 | | |
| | | | | -3.57 | | |
| | | | | | -0.042 | |
| | | | | | -0.065 | |
| | | | | | | 0.108 |
| | | | | | | -0.313 |

| | | | | | | |
|------|------|------|-------|-------|-------------|-------------|
| V | Hx | Hy | v_x | v_y | φ_x | φ_y |
| [kN] | [kN] | [kN] | [mm] | [mm] | [mrad] | [mrad] |

| | | | | | | |
|-------|--------|------|------|-------|----------|----------|
| 2.43 | 26.97 | 0.00 | 0.00 | 0.01 | -0.00099 | -0.00024 |
| 65.22 | -66.92 | 0.00 | 0.00 | 0.01 | -0.00089 | -0.00017 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 0.00 | 0.00 | 0.00 | 0.00 | -2.33 | 0.00112 | 0.11684 |
| 0.00 | 0.00 | 0.00 | 0.00 | 2.55 | -0.00122 | -0.12796 |
| 0.00 | -41.94 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| -6.83 | 43.09 | 0.00 | 0.00 | 0.01 | -0.00067 | 0.00038 |
| 0.03 | 27.73 | 0.00 | 0.00 | 0.01 | -0.00019 | -5.4E-06 |

| | | | | | | |
|-------|--------|------|------|------|------|------|
| 65.22 | 26.97 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| 0.00 | -66.92 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | |
|--------|--------|------|-------|-------|----------|----------|
| 65.22 | 26.97 | 0.00 | 0.00 | 0.01 | 0 | 0 |
| 0.00 | -66.92 | 0.00 | 0.00 | 0.00 | -0.00099 | -0.00024 |
| 0.00 | 41.94 | 0.00 | 0.00 | 2.55 | 0.00112 | 0.11684 |
| 0.00 | -41.94 | 0.00 | 0.00 | -2.33 | -0.00122 | -0.12796 |
| 12.44 | 0.00 | 0.00 | 0.03 | 0.02 | 0.00123 | 0.00127 |
| -12.44 | 0.00 | 0.00 | -0.03 | -0.02 | -0.00123 | -0.00127 |

Objekt SO 201
Umístění Podpěra 1
Číslo ložiska 11

1. Data :

| Zatížení : | Zatížení Mezní stav únosnosti (MSÚ) | | | | | |
|---------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
| | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
| $F_{z,d}$ | 1614 | 865 | 1156 | 0 | 0 | 0 |
| $F_{x,d}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $F_{y,d}$ | 46 | 46 | 46 | 0 | 0 | 0 |
| $F_{xy,d}$ | 46 | 46 | 46 | 0 | 0 | 0 |
| $\Phi_{x,d}$ | ± 0.0001 | ± 0.0001 | ± 0.0001 | ± 0.0000 | ± 0.0000 | ± 0.0000 |
| $\Phi_{y,d}$ | ± 0.0000 | ± 0.0000 | ± 0.0000 | ± 0.0000 | ± 0.0000 | ± 0.0000 |
| $\Phi_{xy,d}$ | ± 0.0001 | ± 0.0001 | ± 0.0001 | ± 0.0000 | ± 0.0000 | ± 0.0000 |
| $v_{x,d}$ | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 |
| $v_{y,d}$ | ± 14.9 | ± 14.9 | ± 14.9 | ± 0.0 | ± 0.0 | ± 0.0 |
| $v_{xy,d}$ | ± 14.9 | ± 14.9 | ± 14.9 | ± 0.0 | ± 0.0 | ± 0.0 |

$F_{z,d}$ Svislé zatížení
 $F_{x,d}$ Vodorovné síly v podélném směru [kN] (vratná síla)
 $F_{y,d}$ Vodorovné síly v příčném směru [kN] (vratná síla)
 $F_{xy,d}$ Celková Horizontální síla
 $\Phi_{x,d}$ Pootočení podélné (podle osy Y) [rad]
 $\Phi_{y,d}$ Pootočení příčné (podle osy X) [rad]
 $\Phi_{xy,d}$ Celkové pootočení
 $v_{x,d}$ Posunutí v podélném směru [mm]
 $v_{y,d}$ Posunutí v příčném směru [mm]
 $v_{xy,d}$ Celkové posunutí

2. Rozměry Elastomeru

Kratší strana a = 250 mm
 Delší strana b = 400 mm
 Stavební výška d = 41 mm
 Čistá výška elastomeru T = 29 mm
 Typ : Typ 1 Typ B dle EN1337-3
 Počet vrstev elastomeru n = 3
 Tloušťka vrstvy elastomeru t = 8 mm
 Plocha A = 100000 mm²
 Tloušťka výztužného plechu = 3 mm
 Tloušťka krajního plechu = 0 mm
 Krytí = 2 x 2,5 mm

3. Elastomer

3.1 Vratné síly

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
|---|------|--------|------|-----|-----|-----|
| $F_{x,d} = G \cdot A \cdot v_{x,d} / T$ | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 |
| $F_{y,d} = G \cdot A \cdot v_{y,d} / T$ | 46.4 | 46.4 | 46.4 | 0.0 | 0.0 | 0.0 |

G = Modul pružnosti ve smyku G dle EN 1337-3 (0.9 N/mm²)

3.2 Kontrola rozměrů elatomeru

Tvarový součinitel pro pravoúhlý / kruhový blok

$$S = 9.35 \quad S = \frac{a' \cdot b'}{2 \cdot (a' + b') \cdot t} \quad / \quad S = \frac{D'}{4 \cdot t}$$

Účinná šířka, délka, plocha ložiska

$$a' = 242 \text{ mm} \quad a' \cong (a - 8) \quad / \quad D' \cong D - 8$$

$$b' = 392 \text{ mm} \quad b' \cong (b - 8)$$

$$A' = 94864 \text{ mm}^2 \quad A' = a' \cdot b' \quad / \quad A' = \frac{D'^2 \cdot \pi}{4}$$

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
|----------|-------|--------|-------|-------|-------|-------|
| A_r | 91238 | 91238 | 91238 | 94864 | 94864 | 94864 |

Redukovaná účinná půdorysná plocha

$$A_r = A' \cdot \left(1 - \frac{v_{x,d}}{a'} - \frac{v_{y,d}}{b'} \right) \quad / \quad A_r = A' \cdot \left(1 - \frac{v_{xy,d}}{D'} \right)$$

Návrhové tlakové přetvoření

$$\varepsilon_{c,d} = \frac{1,5 \cdot F_{z,d}}{G_d \cdot A_r \cdot S}$$

Návrhové smykové přetvoření

$$\varepsilon_{q,d} = \frac{v_{xy,d}}{n \cdot t} \leq 1,0$$

Návrhové přetvoření vyvozené pootočením

$$\varepsilon_{\alpha,d} = \frac{(\Theta_{x,d} \cdot a'^2 + \Theta_{y,d} \cdot b'^2)}{2 \cdot n \cdot t^2} \quad / \quad \varepsilon_{\alpha,d} = \frac{\Theta_{xy,d} \cdot D'^2}{2 \cdot n \cdot t^2}$$

Suma přetvoření: $\varepsilon_{c,d} + \varepsilon_{q,d} + \varepsilon_{\alpha,d} <$

7.0 dle EN1337-3

Omezení pootočení pro pravoúhlý / kruhový blok

$$v_{z,d} = \left(\frac{1}{5 \cdot G_d \cdot S^2} + \frac{1}{E_b} \right) \cdot \frac{n \cdot t \cdot F_{z,d}}{A'} \geq v_{z,derf} = \frac{d' \cdot \Theta_{x,d} + b' \cdot \Theta_{y,d}}{3} \quad / \quad \frac{D' \cdot \Theta_{xy,d}}{3}$$

Tloušťka výztužného plechu

$$2 \leq t_s \geq \frac{1,3 \cdot F_{z,d} \cdot 2 \cdot t \cdot \gamma_m}{A_r \cdot f_y}$$

| | |
|--------------|--|
| $f_y =$ | 355 N/mm ² |
| $t_s =$ | 3 mm (Tloušťka výztužného plechu) |
| $\gamma_m =$ | 1.00 |
| $G_d =$ | 0.9 N/mm ² |
| $E_b =$ | 2000 N/mm ² (Objemový modul přetvárnosti) |

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|---------------------------------|--------|--------|--------|------|------|------|-------|
| Posouzení smykového přetvoření | | | | | | | |
| $\varepsilon_{c,d}$ | 3.15 | 1.69 | 2.26 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{q,d}$ | 0.62 | 0.62 | 0.62 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{\alpha,d}$ | - 0.03 | - 0.03 | - 0.03 | 0.00 | 0.00 | 0.00 | |
| $\Sigma \varepsilon$ | 3.74 | 2.28 | 2.85 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{q,d} / 1,0$ | 0.62 | 0.62 | 0.62 | 0.00 | 0.00 | 0.00 | -> OK |
| $\Sigma \varepsilon$ / Podmínka | 0.53 | 0.33 | 0.41 | 0.00 | 0.00 | 0.00 | -> OK |
| Posouzení stability | | | | | | | |
| $v_{z,d}$ | 1.24 | 0.67 | 0.89 | 0.22 | 0.22 | 0.22 | |
| $v_{z,derf}$ | - 0.01 | - 0.01 | - 0.01 | 0.00 | 0.00 | 0.00 | |
| $v_{z,d} - v_{z,derf}$ | 1.26 | 0.68 | 0.90 | 0.22 | 0.22 | 0.22 | -> OK |
| Ověření tloušťky | | | | | | | |
| t_{serf} | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | -> OK |

Stabilita proti vybočení:

$$F_{z,d} < \frac{2 \cdot a' \cdot G \cdot S \cdot A_r}{3 \cdot T}$$

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|----------------------------------|------|--------|------|------|------|------|-------|
| $2 \cdot a' \cdot G \cdot \dots$ | 4272 | 4272 | 4272 | 4442 | 4442 | 4442 | |
| $F_{z,d}$ | 1614 | 865 | 1156 | 0 | 0 | 0 | -> OK |

3.3 Posun Elastomer - ocel

Aby se horizontální síly mezi elastomerem a deskou přenesly třením, musí být splněny následující podmínky.

$$F_{xy,d} < \left(0,1 + \frac{1,5 \cdot 0,2}{\frac{F_z}{A_r}} \right) \cdot F_{z,d}$$

pravá strana rovnice menší než 0,3•Fz

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|-------------------|-------|--------|-------|-----|-----|-----|-------|
| Fz•(0,1+..) | 188.8 | 113.9 | 143.0 | 0.0 | 0.0 | 0.0 | |
| F _{xy,d} | 46.4 | 46.4 | 46.4 | 0.0 | 0.0 | 0.0 | -> OK |

minimální tlak 3N/mm² za stálého zatížení

$$p_{El \min} = F_{Zg \text{ ULS}} / A_r = 865475 / 91238 =$$

$$9.5 \quad \text{N/mm}^2 > 3$$

-> žádné protiskluzové opatření

3.4 Posun Elastomer-Beton

Aby se horizontální síly mezi elastomerem a deskou přenesly třením, musí být splněny následující podmínky.

$$F_{xy,d} < \left(0,1 + \frac{1,5 \cdot 0,4}{\frac{F_z}{A_r}} \right) \cdot F_{z,d}$$

pravá strana rovnice menší než 0,6•Fz

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|-------------------|-------|--------|-------|-----|-----|-----|-------|
| Fz•(0,1+..) | 216.2 | 141.3 | 170.3 | 0.0 | 0.0 | 0.0 | |
| F _{xy,d} | 46.4 | 46.4 | 46.4 | 0.0 | 0.0 | 0.0 | -> OK |

minimální tlak 3N/mm² za stálého zatížení

$$p_{El \min} = F_{Zg \text{ ULS}} / A_r = 865475 / 91238 =$$

$$9.5 \quad \text{N/mm}^2 > 3$$

-> žádné protiskluzové opatření

Objekt SO 201
Umístění Podpěra 1
Číslo ložiska 12

1. Data :

| Zatížení : | Zatížení Mezní stav únosnosti (MSÚ) | | | | | |
|---------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
| | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
| $F_{z,d}$ | 1614 | 865 | 1156 | 0 | 0 | 0 |
| $F_{x,d}$ | 16 | 16 | 16 | 0 | 0 | 0 |
| $F_{y,d}$ | 46 | 46 | 46 | 0 | 0 | 0 |
| $F_{xy,d}$ | 49 | 49 | 49 | 0 | 0 | 0 |
| $\Phi_{x,d}$ | ± 0.0001 | ± 0.0001 | ± 0.0001 | ± 0.0000 | ± 0.0000 | ± 0.0000 |
| $\Phi_{y,d}$ | ± 0.0001 | ± 0.0001 | ± 0.0001 | ± 0.0000 | ± 0.0000 | ± 0.0000 |
| $\Phi_{xy,d}$ | ± 0.0001 | ± 0.0001 | ± 0.0001 | ± 0.0000 | ± 0.0000 | ± 0.0000 |
| $v_{x,d}$ | ± 5.2 | ± 5.2 | ± 5.2 | ± 0.0 | ± 0.0 | ± 0.0 |
| $v_{y,d}$ | ± 14.9 | ± 14.9 | ± 14.9 | ± 0.0 | ± 0.0 | ± 0.0 |
| $v_{xy,d}$ | ± 15.8 | ± 15.8 | ± 15.8 | ± 0.0 | ± 0.0 | ± 0.0 |

$F_{z,d}$ Svislé zatížení
 $F_{x,d}$ Vodorovné síly v podélném směru [kN] (vratná síla)
 $F_{y,d}$ Vodorovné síly v příčném směru [kN] (vratná síla)
 $F_{xy,d}$ Celková Horizontální síla
 $\Phi_{x,d}$ Pootočení podélné (podle osy Y) [rad]
 $\Phi_{y,d}$ Pootočení příčné (podle osy X) [rad]
 $\Phi_{xy,d}$ Celkové pootočení
 $v_{x,d}$ Posunutí v podélném směru [mm]
 $v_{y,d}$ Posunutí v příčném směru [mm]
 $v_{xy,d}$ Celkové posunutí

2. Rozměry Elastomeru

Kratší strana a = 250 mm
 Delší strana b = 400 mm
 Stavební výška d = 41 mm
 Čistá výška elastomeru T = 29 mm
 Typ : Typ 1 Typ B dle EN1337-3
 Počet vrstev elastomeru n = 3
 Tloušťka vrstvy elastomeru t = 8 mm
 Plocha A = 100000 mm²
 Tloušťka výztužného plechu = 3 mm
 Tloušťka krajního plechu = 0 mm
 Krytí = 2 x 2,5 mm

3. Elastomer

3.1 Vratné síly

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
|---|------|--------|------|-----|-----|-----|
| $F_{x,d} = G \cdot A \cdot v_{x,d} / T$ | 16.3 | 16.3 | 16.3 | 0.0 | 0.0 | 0.0 |
| $F_{y,d} = G \cdot A \cdot v_{y,d} / T$ | 46.3 | 46.3 | 46.3 | 0.0 | 0.0 | 0.0 |

G = Modul pružnosti ve smyku G dle EN 1337-3 (0.9 N/mm²)

3.2 Kontrola rozměrů elatomeru

Tvarový součinitel pro pravoúhlý / kruhový blok

$$S = 9.35 \quad S = \frac{a' \cdot b'}{2 \cdot (a' + b') \cdot t} \quad / \quad S = \frac{D'}{4 \cdot t}$$

Účinná šířka, délka, plocha ložiska

$$a' = 242 \text{ mm} \quad a' \cong (a - 8) \quad / \quad D' \cong D - 8$$

$$b' = 392 \text{ mm} \quad b' \cong (b - 8)$$

$$A' = 94864 \text{ mm}^2 \quad A' = a' \cdot b' \quad / \quad A' = \frac{D'^2 \cdot \pi}{4}$$

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
|----------|-------|--------|-------|-------|-------|-------|
| A_r | 89198 | 89198 | 89198 | 94864 | 94864 | 94864 |

Redukovaná účinná půdorysná plocha

$$A_r = A' \cdot \left(1 - \frac{v_{x,d}}{a'} - \frac{v_{y,d}}{b'} \right) \quad / \quad A_r = A' \cdot \left(1 - \frac{v_{xy,d}}{D'} \right)$$

Návrhové tlakové přetvoření

$$\varepsilon_{c,d} = \frac{1,5 \cdot F_{z,d}}{G_d \cdot A_r \cdot S}$$

Návrhové smykové přetvoření

$$\varepsilon_{q,d} = \frac{v_{xy,d}}{n \cdot t} \leq 1,0$$

Návrhové přetvoření vyvozené pootočením

$$\varepsilon_{\alpha,d} = \frac{(\Theta_{x,d} \cdot a'^2 + \Theta_{y,d} \cdot b'^2)}{2 \cdot n \cdot t^2} \quad / \quad \varepsilon_{\alpha,d} = \frac{\Theta_{xy,d} \cdot D'^2}{2 \cdot n \cdot t^2}$$

Suma přetvoření: $\varepsilon_{c,d} + \varepsilon_{q,d} + \varepsilon_{\alpha,d} <$

7.0 dle EN1337-3

Omezení pootočení pro pravoúhlý / kruhový blok

$$v_{z,d} = \left(\frac{1}{5 \cdot G_d \cdot S^2} + \frac{1}{E_b} \right) \cdot \frac{n \cdot t \cdot F_{z,d}}{A'} \geq v_{z,derf} = \frac{d' \cdot \Theta_{x,d} + b' \cdot \Theta_{y,d}}{3} \quad / \quad \frac{D' \cdot \Theta_{xy,d}}{3}$$

Tloušťka výztužného plechu

$$2 \leq t_s \geq \frac{1,3 \cdot F_{z,d} \cdot 2 \cdot t \cdot \gamma_m}{A_r \cdot f_y}$$

| | |
|--------------|--|
| $f_y =$ | 355 N/mm ² |
| $t_s =$ | 3 mm (Tloušťka výztužného plechu) |
| $\gamma_m =$ | 1.00 |
| $G_d =$ | 0.9 N/mm ² |
| $E_b =$ | 2000 N/mm ² (Objemový modul přetvárnosti) |

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|---------------------------------|------|--------|------|------|------|------|-------|
| Posouzení smykového přetvoření | | | | | | | |
| $\varepsilon_{c,d}$ | 3.23 | 1.73 | 2.31 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{q,d}$ | 0.66 | 0.66 | 0.66 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{\alpha,d}$ | 0.05 | 0.05 | 0.05 | 0.00 | 0.00 | 0.00 | |
| $\Sigma \varepsilon$ | 3.93 | 2.44 | 3.02 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{q,d} / 1,0$ | 0.66 | 0.66 | 0.66 | 0.00 | 0.00 | 0.00 | -> OK |
| $\Sigma \varepsilon$ / Podmínka | 0.56 | 0.35 | 0.43 | 0.00 | 0.00 | 0.00 | -> OK |
| Posouzení stability | | | | | | | |
| $v_{z,d}$ | 1.24 | 0.67 | 0.89 | 0.22 | 0.22 | 0.22 | |
| $v_{z,derf}$ | 0.02 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | |
| $v_{z,d} - v_{z,derf}$ | 1.22 | 0.65 | 0.87 | 0.22 | 0.22 | 0.22 | -> OK |
| Ověření tloušťky | | | | | | | |
| t_{serf} | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | -> OK |

Stabilita proti vybočení:

$$F_{z,d} < \frac{2 \cdot a' \cdot G \cdot S \cdot A_r}{3 \cdot T}$$

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|----------------------------------|------|--------|------|------|------|------|-------|
| $2 \cdot a' \cdot G \cdot \dots$ | 4177 | 4177 | 4177 | 4442 | 4442 | 4442 | |
| $F_{z,d}$ | 1614 | 865 | 1156 | 0 | 0 | 0 | -> OK |

3.3 Posun Elastomer - ocel

Aby se horizontální síly mezi elastomerem a deskou přenesly třením, musí být splněny následující podmínky.

$$F_{xy,d} < \left(0,1 + \frac{1,5 \cdot 0,2}{\frac{F_z}{A_r}} \right) \cdot F_{z,d}$$

pravá strana rovnice menší než 0,3•Fz

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|-------------------|-------|--------|-------|-----|-----|-----|-------|
| Fz•(0,1+..) | 188.2 | 113.3 | 142.4 | 0.0 | 0.0 | 0.0 | |
| F _{xy,d} | 49.1 | 49.1 | 49.1 | 0.0 | 0.0 | 0.0 | -> OK |

minimální tlak 3N/mm² za stálého zatížení

$$p_{El \min} = F_{Zg \text{ ULS}} / A_r = 865469 / 89198 =$$

$$9.7 \quad \text{N/mm}^2 > 3$$

-> žádné protiskluzové opatření

3.4 Posun Elastomer-Beton

Aby se horizontální síly mezi elastomerem a deskou přenesly třením, musí být splněny následující podmínky.

$$F_{xy,d} < \left(0,1 + \frac{1,5 \cdot 0,4}{\frac{F_z}{A_r}} \right) \cdot F_{z,d}$$

pravá strana rovnice menší než 0,6•Fz

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|-------------------|-------|--------|-------|-----|-----|-----|-------|
| Fz•(0,1+..) | 214.9 | 140.1 | 169.1 | 0.0 | 0.0 | 0.0 | |
| F _{xy,d} | 49.1 | 49.1 | 49.1 | 0.0 | 0.0 | 0.0 | -> OK |

minimální tlak 3N/mm² za stálého zatížení

$$p_{El \min} = F_{Zg \text{ ULS}} / A_r = 865469 / 89198 =$$

$$9.7 \quad \text{N/mm}^2 > 3$$

-> žádné protiskluzové opatření

1. Data :

| Zatížení : | Zatížení Mezní stav únosnosti (MSÚ) | | | | | |
|---------------|-------------------------------------|--------------|--------------|--------------|--------------|--------------|
| | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
| $F_{z,d}$ | 1614 | 866 | 1156 | 0 | 0 | 0 |
| $F_{x,d}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $F_{y,d}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $F_{xy,d}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $\Phi_{x,d}$ | ± 0.0001 | ± 0.0001 | ± 0.0001 | ± 0.0000 | ± 0.0000 | ± 0.0000 |
| $\Phi_{y,d}$ | ± 0.0000 | ± 0.0000 | ± 0.0000 | ± 0.0000 | ± 0.0000 | ± 0.0000 |
| $\Phi_{xy,d}$ | ± 0.0001 | ± 0.0001 | ± 0.0001 | ± 0.0000 | ± 0.0000 | ± 0.0000 |
| $v_{x,d}$ | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 |
| $v_{y,d}$ | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 |
| $v_{xy,d}$ | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 |

$F_{z,d}$ Svislé zatížení
 $F_{x,d}$ Vodorovné síly v podélném směru [kN] (vratná síla)
 $F_{y,d}$ Vodorovné síly v příčném směru [kN] (vratná síla)
 $F_{xy,d}$ Celková Horizontální síla
 $\Phi_{x,d}$ Pootočení podélné (podle osy Y) [rad]
 $\Phi_{y,d}$ Pootočení příčné (podle osy X) [rad]
 $\Phi_{xy,d}$ Celkové pootočení
 $v_{x,d}$ Posunutí v podélném směru [mm]
 $v_{y,d}$ Posunutí v příčném směru [mm]
 $v_{xy,d}$ Celkové posunutí

2. Rozměry Elastomeru

Kratší strana a = 250 mm
 Delší strana b = 400 mm
 Stavební výška d = 41 mm
 Čistá výška elastomeru T = 29 mm
 Typ : Typ 1 Typ B dle EN1337-3
 Počet vrstev elastomeru n = 3
 Tloušťka vrstvy elastomeru t = 8 mm
 Plocha A = 100000 mm²
 Tloušťka výztužného plechu = 3 mm
 Tloušťka krajního plechu = 0 mm
 Krytí = 2 x 2,5 mm

3. Elastomer

3.1 Vratné síly

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
|---|------|--------|------|-----|-----|-----|
| $F_{x,d} = G \cdot A \cdot v_{x,d} / T$ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| $F_{y,d} = G \cdot A \cdot v_{y,d} / T$ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

G = Modul pružnosti ve smyku G dle EN 1337-3 (0.9 N/mm²)

3.2 Kontrola rozměrů elatomeru

Tvarový součinitel pro pravoúhlý / kruhový blok

$$S = 9.35 \quad S = \frac{a' \cdot b'}{2 \cdot (a' + b') \cdot t} \quad / \quad S = \frac{D'}{4 \cdot t}$$

Účinná šířka, délka, plocha ložiska

$$a' = 242 \text{ mm} \quad a' \cong (a - 8) \quad / \quad D' \cong D - 8$$

$$b' = 392 \text{ mm} \quad b' \cong (b - 8)$$

$$A' = 94864 \text{ mm}^2 \quad A' = a' \cdot b' \quad / \quad A' = \frac{D'^2 \cdot \pi}{4}$$

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
|----------|-------|--------|-------|-------|-------|-------|
| A_r | 94864 | 94864 | 94864 | 94864 | 94864 | 94864 |

Redukovaná účinná půdorysná plocha

$$A_r = A' \cdot \left(1 - \frac{v_{x,d}}{a'} - \frac{v_{y,d}}{b'} \right) \quad / \quad A_r = A' \cdot \left(1 - \frac{v_{xy,d}}{D'} \right)$$

Návrhové tlakové přetvoření

$$\varepsilon_{c,d} = \frac{1,5 \cdot F_{z,d}}{G_d \cdot A_r \cdot S}$$

Návrhové smykové přetvoření

$$\varepsilon_{q,d} = \frac{v_{xy,d}}{n \cdot t} \leq 1,0$$

Návrhové přetvoření vyvozené pootočením

$$\varepsilon_{\alpha,d} = \frac{(\Theta_{x,d} \cdot a'^2 + \Theta_{y,d} \cdot b'^2)}{2 \cdot n \cdot t^2} \quad / \quad \varepsilon_{\alpha,d} = \frac{\Theta_{xy,d} \cdot D'^2}{2 \cdot n \cdot t^2}$$

Suma přetvoření: $\varepsilon_{c,d} + \varepsilon_{q,d} + \varepsilon_{\alpha,d} <$

7.0 dle EN1337-3

Omezení pootočení pro pravoúhlý / kruhový blok

$$v_{z,d} = \left(\frac{1}{5 \cdot G_d \cdot S^2} + \frac{1}{E_b} \right) \cdot \frac{n \cdot t \cdot F_{z,d}}{A'} \geq v_{z,derf} = \frac{d' \cdot \Theta_{x,d} + b' \cdot \Theta_{y,d}}{3} \quad / \quad \frac{D' \cdot \Theta_{xy,d}}{3}$$

Tloušťka výztužného plechu

$$2 \leq t_s \geq \frac{1,3 \cdot F_{z,d} \cdot 2 \cdot t \cdot \gamma_m}{A_r \cdot f_y}$$

| | |
|--------------|--|
| $f_y =$ | 355 N/mm ² |
| $t_s =$ | 3 mm (Tloušťka výztužného plechu) |
| $\gamma_m =$ | 1.00 |
| $G_d =$ | 0.9 N/mm ² |
| $E_b =$ | 2000 N/mm ² (Objemový modul přetvárnosti) |

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|---------------------------------|--------|--------|--------|------|------|------|-------|
| Posouzení smykového přetvoření | | | | | | | |
| $\varepsilon_{c,d}$ | 3.03 | 1.63 | 2.17 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{q,d}$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{\alpha,d}$ | - 0.03 | - 0.03 | - 0.03 | 0.00 | 0.00 | 0.00 | |
| $\Sigma \varepsilon$ | 3.01 | 1.60 | 2.14 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{q,d} / 1,0$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -> OK |
| $\Sigma \varepsilon$ / Podmínka | 0.43 | 0.23 | 0.31 | 0.00 | 0.00 | 0.00 | -> OK |
| Posouzení stability | | | | | | | |
| $v_{z,d}$ | 1.24 | 0.67 | 0.89 | 0.22 | 0.22 | 0.22 | |
| $v_{z,derf}$ | - 0.01 | - 0.01 | - 0.01 | 0.00 | 0.00 | 0.00 | |
| $v_{z,d} - v_{z,derf}$ | 1.25 | 0.68 | 0.90 | 0.22 | 0.22 | 0.22 | -> OK |
| Ověření tloušťky | | | | | | | |
| t_{serf} | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | -> OK |

Stabilita proti vybočení:

$$F_{z,d} < \frac{2 \cdot a' \cdot G \cdot S \cdot A_r}{3 \cdot T}$$

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|----------------------------------|------|--------|------|------|------|------|-------|
| $2 \cdot a' \cdot G \cdot \dots$ | 4442 | 4442 | 4442 | 4442 | 4442 | 4442 | |
| $F_{z,d}$ | 1614 | 866 | 1156 | 0 | 0 | 0 | -> OK |

3.3 Posun Elastomer - ocel

Aby se horizontální síly mezi elastomerem a deskou přenesly třením, musí být splněny následující podmínky.

$$F_{xy,d} < \left(0,1 + \frac{1,5 \cdot 0,2}{\frac{F_z}{A_r}} \right) \cdot F_{z,d}$$

pravá strana rovnice menší než 0,3•Fz

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|-------------------|-------|--------|-------|-----|-----|-----|-------|
| Fz•(0,1+..) | 189.9 | 115.0 | 144.1 | 0.0 | 0.0 | 0.0 | |
| F _{xy,d} | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -> OK |

minimální tlak 3N/mm² za stálého zatížení

$$p_{El \min} = F_{Zg \text{ ULS}} / A_r = 865514 / 94864 =$$

$$9.1 \quad \text{N/mm}^2 > 3$$

-> žádné protiskluzové opatření

3.4 Posun Elastomer-Beton

Aby se horizontální síly mezi elastomerem a deskou přenesly třením, musí být splněny následující podmínky.

$$F_{xy,d} < \left(0,1 + \frac{1,5 \cdot 0,4}{\frac{F_z}{A_r}} \right) \cdot F_{z,d}$$

pravá strana rovnice menší než 0,6•Fz

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|-------------------|-------|--------|-------|-----|-----|-----|-------|
| Fz•(0,1+..) | 218.3 | 143.5 | 172.5 | 0.0 | 0.0 | 0.0 | |
| F _{xy,d} | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -> OK |

minimální tlak 3N/mm² za stálého zatížení

$$p_{El \min} = F_{Zg \text{ ULS}} / A_r = 865514 / 94864 =$$

$$9.1 \quad \text{N/mm}^2 > 3$$

-> žádné protiskluzové opatření

Objekt SO 201
Umístění Podpěra 2
Číslo ložiska 22

1. Data :

| Zatížení : | Zatížení Mezní stav únosnosti (MSÚ) | | | | | |
|---------------|-------------------------------------|---------|---------|---------|---------|---------|
| | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
| $F_{z,d}$ | 1614 | 866 | 1156 | 0 | 0 | 0 |
| $F_{x,d}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $F_{y,d}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $F_{xy,d}$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $\Phi_{x,d}$ | ±0.0000 | ±0.0000 | ±0.0000 | ±0.0000 | ±0.0000 | ±0.0000 |
| $\Phi_{y,d}$ | ±0.0001 | ±0.0001 | ±0.0001 | ±0.0000 | ±0.0000 | ±0.0000 |
| $\Phi_{xy,d}$ | ±0.0001 | ±0.0001 | ±0.0001 | ±0.0000 | ±0.0000 | ±0.0000 |
| $v_{x,d}$ | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 |
| $v_{y,d}$ | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 |
| $v_{xy,d}$ | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 | ± 0.0 |

$F_{z,d}$ Svislé zatížení
 $F_{x,d}$ Vodorovné síly v podélném směru [kN] (vratná síla)
 $F_{y,d}$ Vodorovné síly v příčném směru [kN] (vratná síla)
 $F_{xy,d}$ Celková Horizontální síla
 $\Phi_{x,d}$ Pootočení podélné (podle osy Y) [rad]
 $\Phi_{y,d}$ Pootočení příčné (podle osy X) [rad]
 $\Phi_{xy,d}$ Celkové pootočení
 $v_{x,d}$ Posunutí v podélném směru [mm]
 $v_{y,d}$ Posunutí v příčném směru [mm]
 $v_{xy,d}$ Celkové posunutí

2. Rozměry Elastomeru

Kratší strana a = 250 mm
 Delší strana b = 400 mm
 Stavební výška d = 41 mm
 Čistá výška elastomeru T = 29 mm
 Typ : Typ 1 Typ B dle EN1337-3
 Počet vrstev elastomeru n = 3
 Tloušťka vrstvy elastomeru t = 8 mm
 Plocha A = 100000 mm²
 Tloušťka výztužného plechu = 3 mm
 Tloušťka krajního plechu = 0 mm
 Krytí = 2 x 2,5 mm

3. Elastomer

3.1 Vratné síly

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
|-------------------------------------|------|--------|------|-----|-----|-----|
| $F_{x,d}=G \cdot A \cdot v_{x,d}/T$ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| $F_{y,d}=G \cdot A \cdot v_{y,d}/T$ | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

G = Modul pružnosti ve smyku G dle EN 1337-3 (0.9 N/mm²)

3.2 Kontrola rozměrů elatomeru

Tvarový součinitel pro pravoúhlý / kruhový blok

$$S = 9.35 \quad S = \frac{a' \cdot b'}{2 \cdot (a' + b') \cdot t} \quad / \quad S = \frac{D'}{4 \cdot t}$$

Účinná šířka, délka, plocha ložiska

$$a' = 242 \text{ mm} \quad a' \cong (a - 8) \quad / \quad D' \cong D - 8$$

$$b' = 392 \text{ mm} \quad b' \cong (b - 8)$$

$$A' = 94864 \text{ mm}^2 \quad A' = a' \cdot b' \quad / \quad A' = \frac{D'^2 \cdot \pi}{4}$$

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 |
|----------|-------|--------|-------|-------|-------|-------|
| A_r | 94864 | 94864 | 94864 | 94864 | 94864 | 94864 |

Redukovaná účinná půdorysná plocha

$$A_r = A' \cdot \left(1 - \frac{v_{x,d}}{a'} - \frac{v_{y,d}}{b'} \right) \quad / \quad A_r = A' \cdot \left(1 - \frac{v_{xy,d}}{D'} \right)$$

Návrhové tlakové přetvoření

$$\varepsilon_{c,d} = \frac{1,5 \cdot F_{z,d}}{G_d \cdot A_r \cdot S}$$

Návrhové smykové přetvoření

$$\varepsilon_{q,d} = \frac{v_{xy,d}}{n \cdot t} \leq 1,0$$

Návrhové přetvoření vyvozené pootočením

$$\varepsilon_{\alpha,d} = \frac{(\Theta_{x,d} \cdot a'^2 + \Theta_{y,d} \cdot b'^2)}{2 \cdot n \cdot t^2} \quad / \quad \varepsilon_{\alpha,d} = \frac{\Theta_{xy,d} \cdot D'^2}{2 \cdot n \cdot t^2}$$

Suma přetvoření: $\varepsilon_{c,d} + \varepsilon_{q,d} + \varepsilon_{\alpha,d} <$

7.0 dle EN1337-3

Omezení pootočení pro pravoúhlý / kruhový blok

$$v_{z,d} = \left(\frac{1}{5 \cdot G_d \cdot S^2} + \frac{1}{E_b} \right) \cdot \frac{n \cdot t \cdot F_{z,d}}{A'} \geq v_{z,derf} = \frac{d' \cdot \Theta_{x,d} + b' \cdot \Theta_{y,d}}{3} \quad / \quad \frac{D' \cdot \Theta_{xy,d}}{3}$$

Tloušťka výztužného plechu

$$2 \leq t_s \geq \frac{1,3 \cdot F_{z,d} \cdot 2 \cdot t \cdot \gamma_m}{A_r \cdot f_y}$$

| | |
|--------------|--|
| $f_y =$ | 355 N/mm ² |
| $t_s =$ | 3 mm (Tloušťka výztužného plechu) |
| $\gamma_m =$ | 1.00 |
| $G_d =$ | 0.9 N/mm ² |
| $E_b =$ | 2000 N/mm ² (Objemový modul přetvárnosti) |

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|---------------------------------|------|--------|------|------|------|------|-------|
| Posouzení smykového přetvoření | | | | | | | |
| $\varepsilon_{c,d}$ | 3.03 | 1.63 | 2.17 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{q,d}$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{\alpha,d}$ | 0.03 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | |
| $\Sigma \varepsilon$ | 3.06 | 1.66 | 2.20 | 0.00 | 0.00 | 0.00 | |
| $\varepsilon_{q,d} / 1,0$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -> OK |
| $\Sigma \varepsilon$ / Podmínka | 0.44 | 0.24 | 0.31 | 0.00 | 0.00 | 0.00 | -> OK |
| Posouzení stability | | | | | | | |
| $v_{z,d}$ | 1.24 | 0.67 | 0.89 | 0.22 | 0.22 | 0.22 | |
| $v_{z,derf}$ | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | |
| $v_{z,d} - v_{z,derf}$ | 1.23 | 0.65 | 0.88 | 0.22 | 0.22 | 0.22 | -> OK |
| Ověření tloušťky | | | | | | | |
| t_{serf} | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | -> OK |

Stabilita proti vybočení:

$$F_{z,d} < \frac{2 \cdot a' \cdot G \cdot S \cdot A_r}{3 \cdot T}$$

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|----------------------------------|------|--------|------|------|------|------|-------|
| $2 \cdot a' \cdot G \cdot \dots$ | 4442 | 4442 | 4442 | 4442 | 4442 | 4442 | |
| $F_{z,d}$ | 1614 | 866 | 1156 | 0 | 0 | 0 | -> OK |

3.3 Posun Elastomer - ocel

Aby se horizontální síly mezi elastomerem a deskou přenesly třením, musí být splněny následující podmínky.

$$F_{xy,d} < \left(0,1 + \frac{1,5 \cdot 0,2}{\frac{F_z}{A_r}} \right) \cdot F_{z,d}$$

pravá strana rovnice menší než 0,3•Fz

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|-------------------|-------|--------|-------|-----|-----|-----|-------|
| Fz•(0,1+..) | 189.9 | 115.0 | 144.1 | 0.0 | 0.0 | 0.0 | |
| F _{xy,d} | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -> OK |

minimální tlak 3N/mm² za stálého zatížení

$$p_{El \min} = F_{Zg \text{ ULS}} / A_r = 865520 / 94864 =$$

$$9.1 \quad \text{N/mm}^2 > 3$$

-> žádné protiskluzové opatření

3.4 Posun Elastomer-Beton

Aby se horizontální síly mezi elastomerem a deskou přenesly třením, musí být splněny následující podmínky.

$$F_{xy,d} < \left(0,1 + \frac{1,5 \cdot 0,4}{\frac{F_z}{A_r}} \right) \cdot F_{z,d}$$

pravá strana rovnice menší než 0,6•Fz

| Zatížení | Vmax | Vstálé | Vmin | V1 | V2 | V3 | |
|-------------------|-------|--------|-------|-----|-----|-----|-------|
| Fz•(0,1+..) | 218.3 | 143.5 | 172.5 | 0.0 | 0.0 | 0.0 | |
| F _{xy,d} | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -> OK |

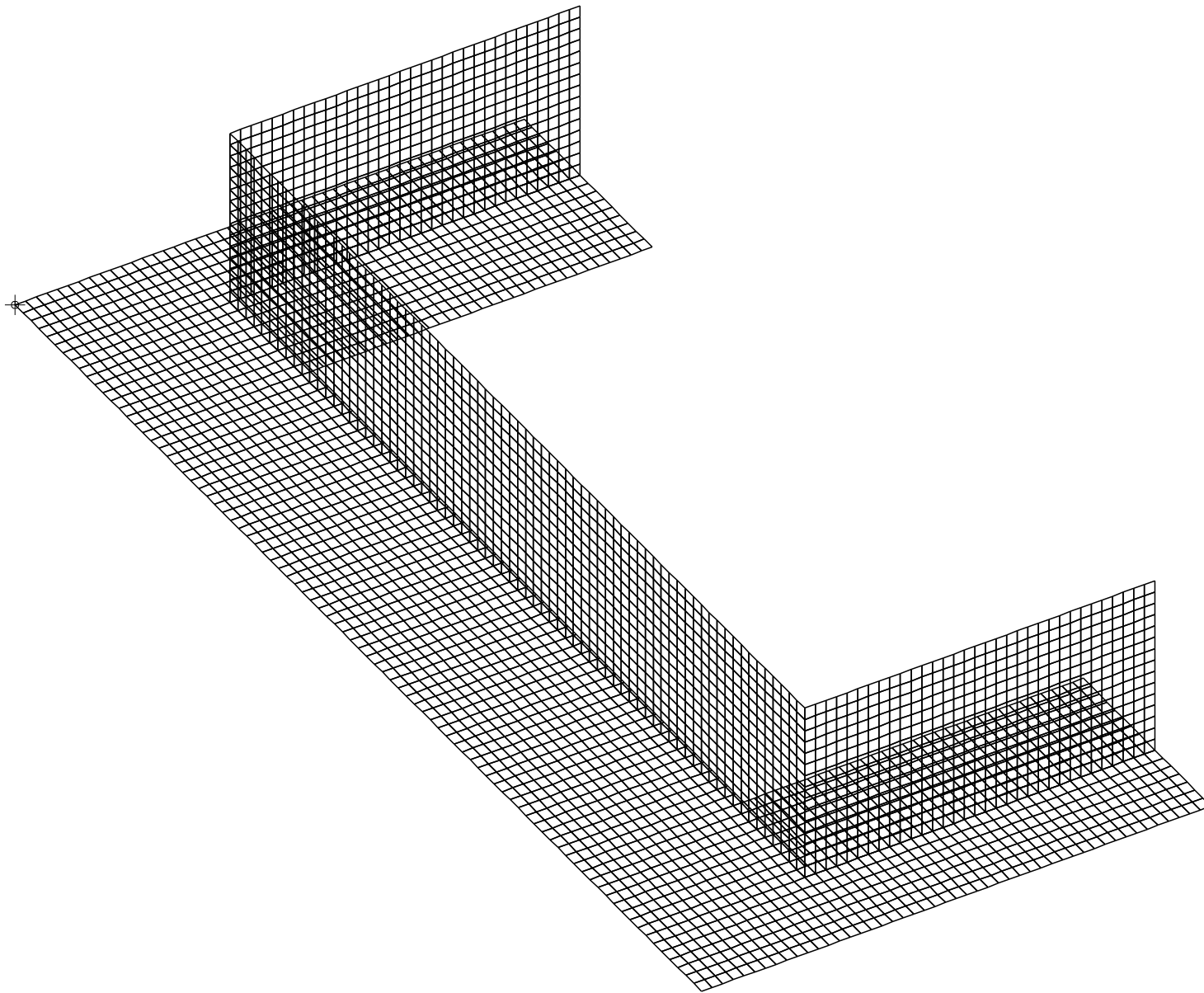
minimální tlak 3N/mm² za stálého zatížení

$$p_{El \min} = F_{Zg \text{ ULS}} / A_r = 865520 / 94864 =$$

$$9.1 \quad \text{N/mm}^2 > 3$$

-> žádné protiskluzové opatření

S Spodní stavba



↑ Z
Y
X
SCALE REDUCTION
X 1.000
Y 1.000
Z 1.000
SCALE LENGTH
27.58128

GEOMETRY

Backovice obl most - ulozny prah

DATE
JAN 30, 1912
TIME
13:38:34

ICES STRUOL
VERSION MAN-MBB

TRANSCONSULT
HRAD. KRALOVE

\$ *****
STRUDL 'GEOM' 'Backovice obl most - ulozny prah'
\$ *****

UNITS MET KNEW DEG CENTIG SEC JOU MASSOFF
DUMP MESSAGE

\$ *****
\$ ULOZNY PRAH
\$ *****

NEWSET 201 'ULOZNY PRAH'
TYPE SHELL

JOINT COORDINATES
1 0.000 0.000 0.000
49 0.000 4.800 0.000

4215 8.600 0.000 0.000
4263 8.600 4.800 0.000

VARY JOINT FROM 1 TO 49 BY 1 TO 4215 BY 49

ELEMENT INCIDENCES
1 1 2 51 50
48 48 49 98 97
4081 4166 4167 4216 4215
VARY ELEMENTS FROM 1 TO 48 BY 1 TO 4081 BY 48

SET 301 ELEM == GRID FROM 834 TO 864 BY 1 TO 3282 BY 48
DEL ELEM 301 SET
SET 301 JOINT == GRID FROM 851 TO 882 BY 1 TO 3399 BY 49
DEL JOINT 301 SET

ELEMENT PROPERTIES
201 SET TYPE 'FQSE' THICK 0.350

\$ *****
\$ ZAVERNA ZIDKA
\$ *****

NEWSET 202 'ZAVERNA ZIDKA'
TYPE SHELL

JOINT COORDINATES
5001 0.700 1.500 1.500
5016 0.700 1.500 0.000

6153 7.900 1.500 1.500
6168 7.900 1.500 0.000

VARY JOINT FROM 5001 TO 5016 BY 1 TO 6153 BY 16

ELEMENT INCIDENCES
5001 5001 5002 5018 5017
5015 5015 5016 5032 5031
6066 6137 6138 6154 6153

VARY ELEMENTS FROM 5001 TO 5015 BY 1 TO 6066 BY 15

ELEMENT PROPERTIES
5001 TO 6066 BY 15 TYPE 'FQSE' THICK 0.480
5002 TO 6067 BY 15 TYPE 'FQSE' THICK 0.480
5003 TO 6068 BY 15 TYPE 'FQSE' THICK 0.480
5004 TO 6069 BY 15 TYPE 'FQSE' THICK 0.480
5005 TO 6070 BY 15 TYPE 'FQSE' THICK 0.480
5006 TO 6071 BY 15 TYPE 'FQSE' THICK 0.480
5007 TO 6072 BY 15 TYPE 'FQSE' THICK 0.480
5008 TO 6073 BY 15 TYPE 'FQSE' THICK 0.480
5009 TO 6074 BY 15 TYPE 'FQSE' THICK 0.480
5010 TO 6075 BY 15 TYPE 'FQSE' THICK 0.480
5011 TO 6076 BY 15 TYPE 'FQSE' THICK 0.600
5012 TO 6077 BY 15 TYPE 'FQSE' THICK 0.600
5013 TO 6078 BY 15 TYPE 'FQSE' THICK 0.600

5014 TO 6079 BY 15 TYPE 'FQSE' THICK 0.600
5015 TO 6080 BY 15 TYPE 'FQSE' THICK 0.600

\$*****

\$ KRIDLO_L

\$*****

NEWSET 203 'KRIDLO_L'
TYPE SHELL

JOINT COORDINATES

8001 0.700 1.500 1.500
8016 0.700 1.500 0.000

8529 0.700 4.800 1.500
8544 0.700 4.800 0.000

VARY JOINT FROM 8001 TO 8016 BY 1 TO 8529 BY 16

ELEMENT INCIDENCES

8001 8001 8002 8018 8017
8015 8015 8016 8032 8031
8481 8513 8514 8530 8529

VARY ELEMENTS FROM 8001 TO 8015 BY 1 TO 8481 BY 15

ELEMENT PROPERTIES

8001 TO 8481 BY 15 TYPE 'FQSE' THICK 1.000
8002 TO 8482 BY 15 TYPE 'FQSE' THICK 1.000
8003 TO 8483 BY 15 TYPE 'FQSE' THICK 1.000
8004 TO 8484 BY 15 TYPE 'FQSE' THICK 1.000
8005 TO 8485 BY 15 TYPE 'FQSE' THICK 1.000
8006 TO 8486 BY 15 TYPE 'FQSE' THICK 1.000
8007 TO 8487 BY 15 TYPE 'FQSE' THICK 1.000
8008 TO 8488 BY 15 TYPE 'FQSE' THICK 1.000
8009 TO 8489 BY 15 TYPE 'FQSE' THICK 1.000
8010 TO 8490 BY 15 TYPE 'FQSE' THICK 1.000
8011 TO 8491 BY 15 TYPE 'FQSE' THICK 1.000
8012 TO 8492 BY 15 TYPE 'FQSE' THICK 1.000
8013 TO 8493 BY 15 TYPE 'FQSE' THICK 1.000
8014 TO 8494 BY 15 TYPE 'FQSE' THICK 1.000
8015 TO 8495 BY 15 TYPE 'FQSE' THICK 1.000

\$*****

\$ KRIDLO_P

\$*****

NEWSET 204 'KRIDLO_P'
TYPE SHELL

JOINT COORDINATES

9001 7.900 1.500 1.500
9016 7.900 1.500 0.000

9529 7.900 4.800 1.500
9544 7.900 4.800 0.000

VARY JOINT FROM 9001 TO 9016 BY 1 TO 9529 BY 16

ELEMENT INCIDENCES

9001 9001 9002 9018 9017
9015 9015 9016 9032 9031
9481 9513 9514 9530 9529

VARY ELEMENTS FROM 9001 TO 9015 BY 1 TO 9481 BY 15

ELEMENT PROPERTIES

9001 TO 9481 BY 15 TYPE 'FQSE' THICK 1.000
9002 TO 9482 BY 15 TYPE 'FQSE' THICK 1.000
9003 TO 9483 BY 15 TYPE 'FQSE' THICK 1.000
9004 TO 9484 BY 15 TYPE 'FQSE' THICK 1.000
9005 TO 9485 BY 15 TYPE 'FQSE' THICK 1.000
9006 TO 9486 BY 15 TYPE 'FQSE' THICK 1.000
9007 TO 9487 BY 15 TYPE 'FQSE' THICK 1.000
9008 TO 9488 BY 15 TYPE 'FQSE' THICK 1.000

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9009 TO 9489 BY 15 TYPE 'FQSE' THICK 1.000
9010 TO 9490 BY 15 TYPE 'FQSE' THICK 1.000
9011 TO 9491 BY 15 TYPE 'FQSE' THICK 1.000
9012 TO 9492 BY 15 TYPE 'FQSE' THICK 1.000
9013 TO 9493 BY 15 TYPE 'FQSE' THICK 1.000
9014 TO 9494 BY 15 TYPE 'FQSE' THICK 1.000
9015 TO 9495 BY 15 TYPE 'FQSE' THICK 1.000

$ *****
$ KONSTANTY
$ *****
CONSTANTS

$ ----- BETON C25/30 -----
CTE 0.000012 201 SET 202 SET 203 SET 204 SET
DENSITY 25. 201 SET 202 SET 203 SET 204 SET
POISSON 0.15 201 SET 202 SET 203 SET 204 SET
E 31000000 201 SET 202 SET 203 SET 204 SET

$ *****
$ SPOJENI CASTI MODELU
$ *****

COMPRESS JOINTS
REPLACE JOINTS WITHIN TOLERANCE 0.01
COMPRESS JOINTS

$ *****
$ PODEPRENI
$ *****
$ SET 110 TITLE 'PODEPRENI'
$ SET 110 JOINTS == ADJACENT TO ELEMENTS 201 SET
JOINT 201 SET STATUS SUPP
JOINT 201 SET REL MOM X Y Z
JOINT 201 SET REL KFX 60000.0 KFY 60000.0 KFZ 2500.0

$ *****
$ ***** ZATEZOVACI STAVY *****
$ *****

LOADING 1 'VLASTNI HMOTNOST'
ELEM LOADS
GENER DEAD LOAD GRA DIR -Z FOR ALL

$ reakce lozisek
NEWSET 211 TITLE 'L21' $ 0.54 m2
SET 211 ELEM == GRID 244 TO 252 BY 1 TO 484 BY 48

NEWSET 212 TITLE 'L22' $ 0.54 m2
SET 212 ELEM == GRID 3604 TO 3612 BY 1 TO 3844 BY 48

LOADING 2 'REAKCE LOZISEK STALE '
ELEM LOADS
$ reakce lozisek 1198+1198=3396
211 SET SURFACE FORCE GLOBAL UNIFORM PZ -2211
212 SET SURFACE FORCE GLOBAL UNIFORM PZ -2211

$ reakce lozisek 83+83=166 37 stale + vratna sila 46.3
211 SET SURFACE FORCE GLOBAL UNIFORM PY -153.7
212 SET SURFACE FORCE GLOBAL UNIFORM PY -153.7

LOADING 3 'ZEMNI TLAK NA ZAVERNOU ZIDKU'
ELEM LOADS
$ zemni tlak
5001 TO 6066 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -0.500
5002 TO 6067 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -1.500
5003 TO 6068 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -2.500
5004 TO 6069 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -3.500
5005 TO 6070 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -4.500
5006 TO 6071 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -5.500
5007 TO 6072 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -6.500
5008 TO 6073 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -7.500
5009 TO 6074 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -8.500
5010 TO 6075 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -9.500
5011 TO 6076 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -10.500
5012 TO 6077 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -11.500
5013 TO 6078 BY 15 SURFACE FORCE GLOBAL UNIFORM PY -12.500

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| | | | | | | | | | | |
|------|----|------|----|----|---------|-------|--------|---------|----|---------|
| 5014 | TO | 6079 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -13.500 |
| 5015 | TO | 6080 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -14.500 |

LOADING 4 'ZEMNI TLAK NA KRIDL01'

ELEM LOADS

\$ zemni tlak

| | | | | | | | | | | |
|------|----|------|----|----|---------|-------|--------|---------|----|---------|
| 8001 | TO | 8481 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -0.500 |
| 8002 | TO | 8482 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -1.500 |
| 8003 | TO | 8483 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -2.500 |
| 8004 | TO | 8484 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -3.500 |
| 8005 | TO | 8485 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -4.500 |
| 8006 | TO | 8486 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -5.500 |
| 8007 | TO | 8487 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -6.500 |
| 8008 | TO | 8488 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -7.500 |
| 8009 | TO | 8489 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -8.500 |
| 8010 | TO | 8490 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -9.500 |
| 8011 | TO | 8491 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10.500 |
| 8012 | TO | 8492 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -11.500 |
| 8013 | TO | 8493 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -12.500 |
| 8014 | TO | 8494 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -13.500 |
| 8015 | TO | 8495 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -14.500 |

LOADING 5 'BRZDNA SILA NA ZAVERNOU ZIDKU'

\$ brzdna sila 2x (3/4*280 na 3 m) =420kN

NEWSET 213 TITLE 'M'

SET 213 ELEM == GRID 5091 TO 5976 BY 15

ELEM LOADS

\$ brzdna sila

213 SET SURFACE FORCE GLOBAL UNIFORM PY -700.0

LOADING 6 'ZEMNI TLAK NA ZAVERNOU ZIDKU OD VOZIDEL'

ELEM LOADS

\$ zemni tlak

| | | | | | | | | | | |
|------|----|------|----|----|---------|-------|--------|---------|----|-----|
| 5001 | TO | 6066 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5002 | TO | 6067 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5003 | TO | 6068 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5004 | TO | 6069 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5005 | TO | 6070 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5006 | TO | 6071 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5007 | TO | 6072 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5008 | TO | 6073 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5009 | TO | 6074 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5010 | TO | 6075 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5011 | TO | 6076 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5012 | TO | 6077 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5013 | TO | 6078 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5014 | TO | 6079 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |
| 5015 | TO | 6080 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PY | -10 |

LOADING 7 'ZEMNI TLAK NA KRIDL01 OD VOZIDEL'

ELEM LOADS

\$ zemni tlak

| | | | | | | | | | | |
|------|----|------|----|----|---------|-------|--------|---------|----|-----|
| 8001 | TO | 8481 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8002 | TO | 8482 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8003 | TO | 8483 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8004 | TO | 8484 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8005 | TO | 8485 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8006 | TO | 8486 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8007 | TO | 8487 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8008 | TO | 8488 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8009 | TO | 8489 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8010 | TO | 8490 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8011 | TO | 8491 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8012 | TO | 8492 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8013 | TO | 8493 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8014 | TO | 8494 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |
| 8015 | TO | 8495 | BY | 15 | SURFACE | FORCE | GLOBAL | UNIFORM | PX | -10 |

LOADING COMBINATION 11 COMBINE 1 1.00 2 1.00 3 1.00 4 1.00 5 1.00 6 1.00 7 1.00

LOADING COMBINATION 12 COMBINE 1 1.35 2 1.35 3 1.35 4 1.35 5 1.35 6 1.35 7 1.35

\$ *****
\$ ***** STATICKA ANALYZA *****
\$ *****

CONSISTENCY CHECK

STIFFNESS ANALYSIS

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$ *****
$ ***** IZOLINIE (priprava pro vykreslovani) *****
$ *****

SURFACE 'UP'          LOCAL P1 1 P2 50 P 2

SURFACE 'ZZ'          LOCAL P1 359 P2 408 P 5015

SURFACE 'KRIDL01'     LOCAL P1 8530 P2 8514 P 8529

$ PREPARE ITEM NEWSET 501 'UP' JOINT ADJACENT TO ELEMENTS 201 SET LOADS ACTIVE
$ PREPARE JOINT STRESSES AVERAGE TO REFERENCE SYSTEM 'UP'

$ PREPARE ITEM NEWSET 501 'ZZ' JOINT ADJACENT TO ELEMENTS 202 SET LOADS ACTIVE
$ PREPARE JOINT STRESSES AVERAGE TO REFERENCE SYSTEM 'ZZ'

PREPARE ITEM NEWSET 501 'K1' JOINT ADJACENT TO ELEMENTS 203 SET LOADS ACTIVE
PREPARE JOINT STRESSES AVERAGE TO REFERENCE SYSTEM 'KRIDL01'

$ *****
$          VYSLEDKY
$ *****

$ ----- REAKCE A POSUNY -----
LIST REA
LIST DISPLACEMENT
LIST FORCES
LIST SECTION FORCES
LIST JOINT SECTION FORCES

$LIST JOINT STRESSES 801 SET
$LIST JOINT STRESSES 802 SET

$ *****
$          TASK
$ *****
PLOT DEVICE PLOTTER

$ ***** PUDORYS = ULOZNY PRAH *****
$ PLOT FORMAT PROJ AXO X 0. 1. Y 90. 1. Z 0. 0.

$ ***** BOKORYS = ZAVERNA ZIDKA *****
$ PLOT FORMAT PROJ AXO X 0. 1. Y 0. 0. Z 90. 1.

$ ***** 3D *****
PLOT FORMAT PROJ AXO X -45. 1. Y 20. 1. Z 90. 1.

PLOT FORMAT SIGN JOINT OFF
PLOT FORMAT SIGN MEM OFF

PLOT GEOMETRY

PLOT FORMAT SIGN JOINT
PLOT FORMAT SIGN MEM

$ ***** NARYS = KRIDL0 1 *****
PLOT FORMAT PROJ AXO X 0. 0. Y 0. -1. Z 90. 1.

$ ***** SILY MOMENTY DESCE *****
PLOT GEOMETRY SET 501

PLOT GEOMETRY SET 501 AND CONTOURS SECTION FORCES MXX SET 501 LOADING '11' LEVEL 10
PLOT GEOMETRY SET 501 AND CONTOURS SECTION FORCES MYX SET 501 LOADING '11' LEVEL 10

PLOT OUTLINE SET 501 AND CONTOURS SECTION FORCES MXX SET 501 LOADING '11' LEVEL 10
PLOT OUTLINE SET 501 AND CONTOURS SECTION FORCES MYX SET 501 LOADING '11' LEVEL 10

PLOT GEOMETRY SET 501 AND CONTOURS SECTION FORCES MXX SET 501 LOADING '12' LEVEL 10
PLOT GEOMETRY SET 501 AND CONTOURS SECTION FORCES MYX SET 501 LOADING '12' LEVEL 10

PLOT OUTLINE SET 501 AND CONTOURS SECTION FORCES MXX SET 501 LOADING '12' LEVEL 10
PLOT OUTLINE SET 501 AND CONTOURS SECTION FORCES MYX SET 501 LOADING '12' LEVEL 10

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PLOT END

```
$ *****
$      VYPIS MODELU
$ *****

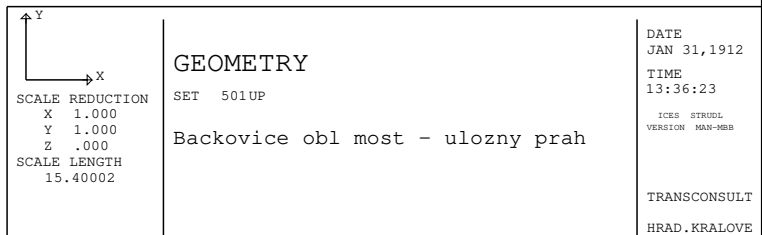
$ PRINT DATA
$ PRINT STRUCTURAL DATA
$ PRINT LOADING DATA

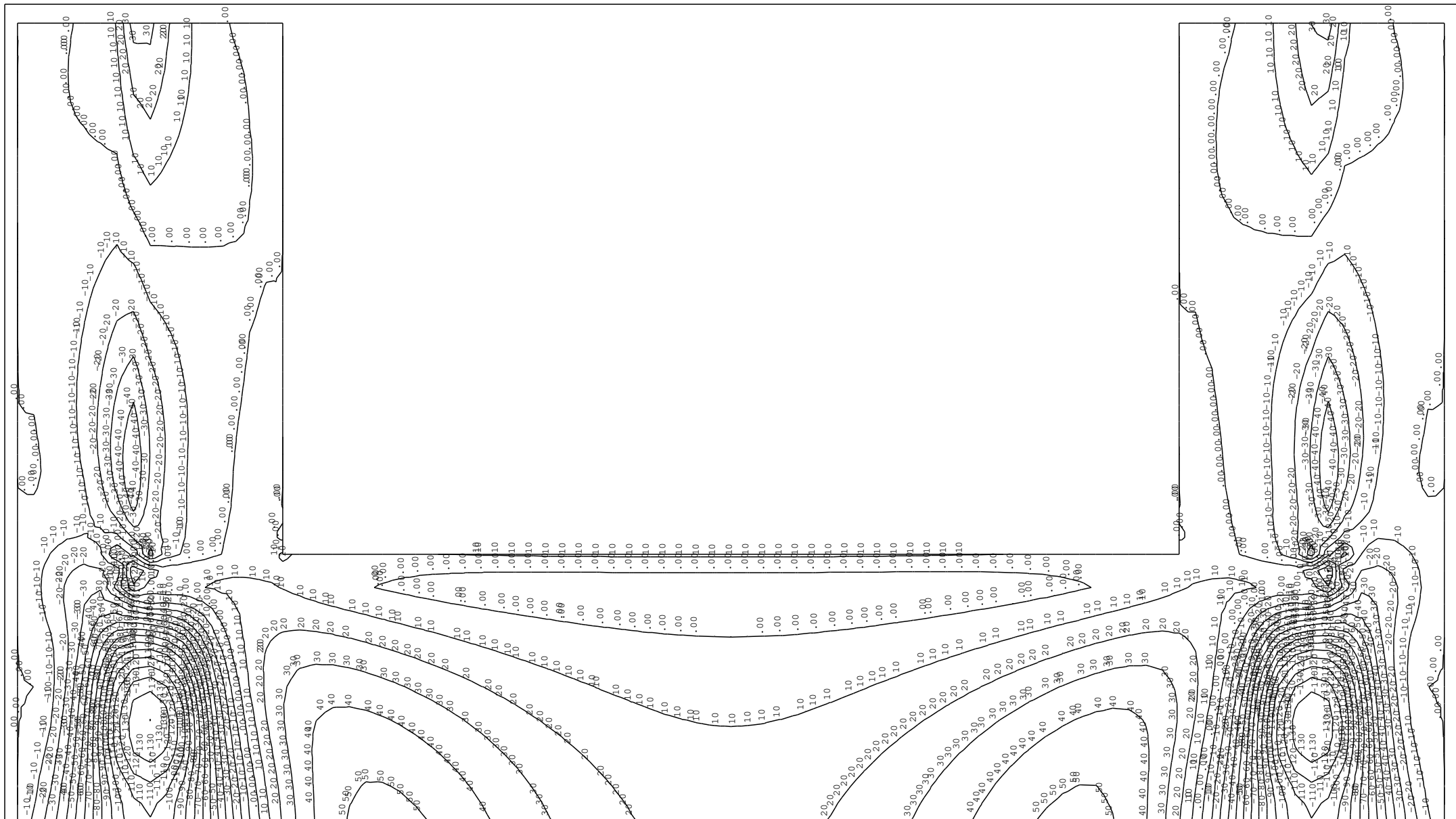
$ PRINT JOINT COORDINATES
$ PRINT ELEM DATA
$ PRINT ELEM INCIDENCES
$ PRINT MEM INCIDENCES
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FINISH

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$ *****
$      str 1 backovice_up.st
$ *****
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| 76 | 97 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 75 | 96 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 74 | 95 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 73 | 94 | 67 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 72 | 93 | 68 | 67 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 71 | 92 | 69 | 68 | 67 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 70 | 91 | 70 | 69 | 68 | 67 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 69 | 90 | 71 | 70 | 69 | 68 | 67 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 68 | 89 | 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 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42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 59 | 80 | 81 | 80 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 58 | 79 | 82 | 81 | 80 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 57 | 78 | 83 | 82 | 81 | 80 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 56 | 77 | 84 | 83 | 82 | 81 | 80 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 55 | 76 | 85 | 84 | 83 | 82 | 81 | 80 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65 | 64 | 63 | 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|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|--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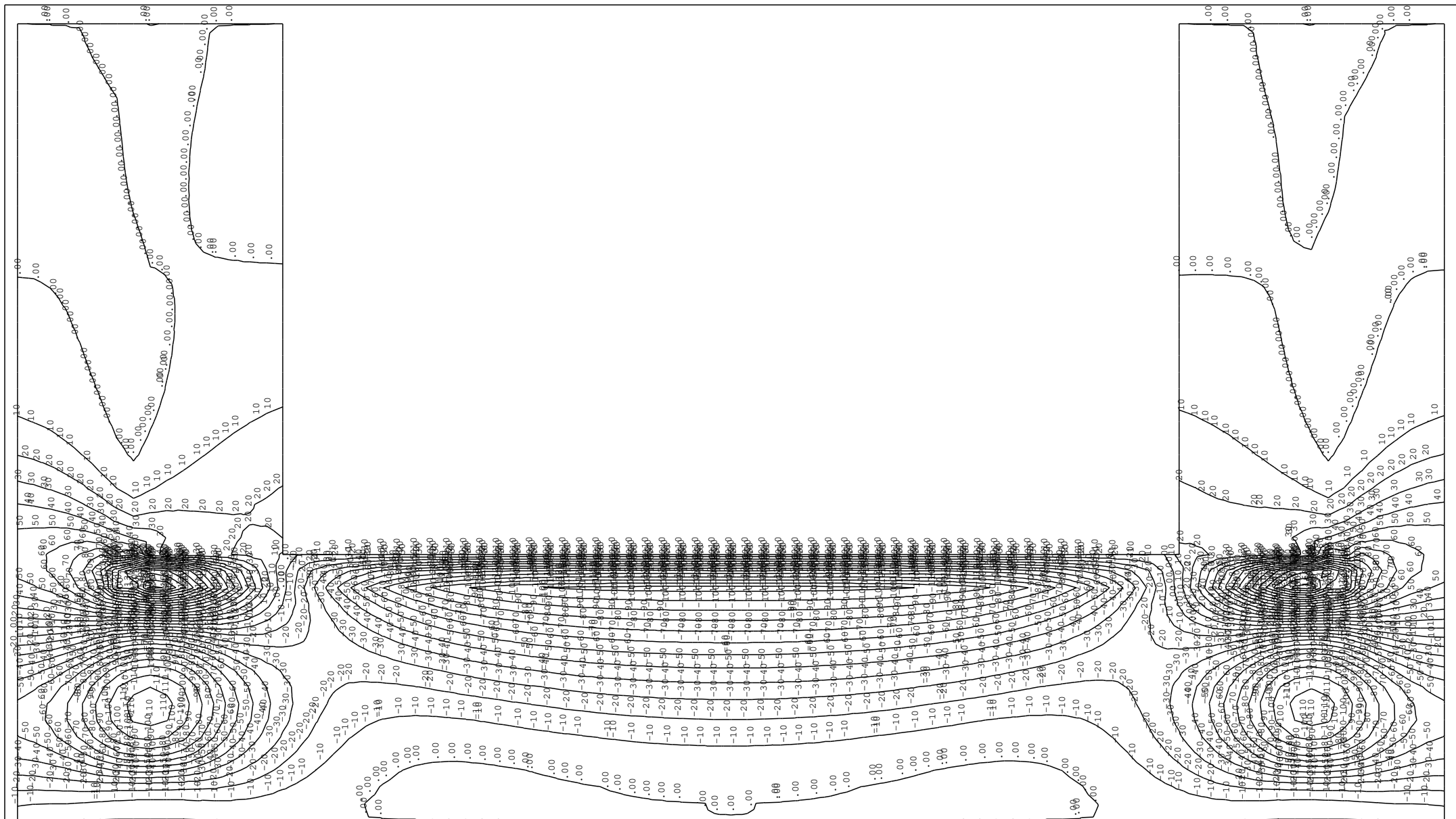
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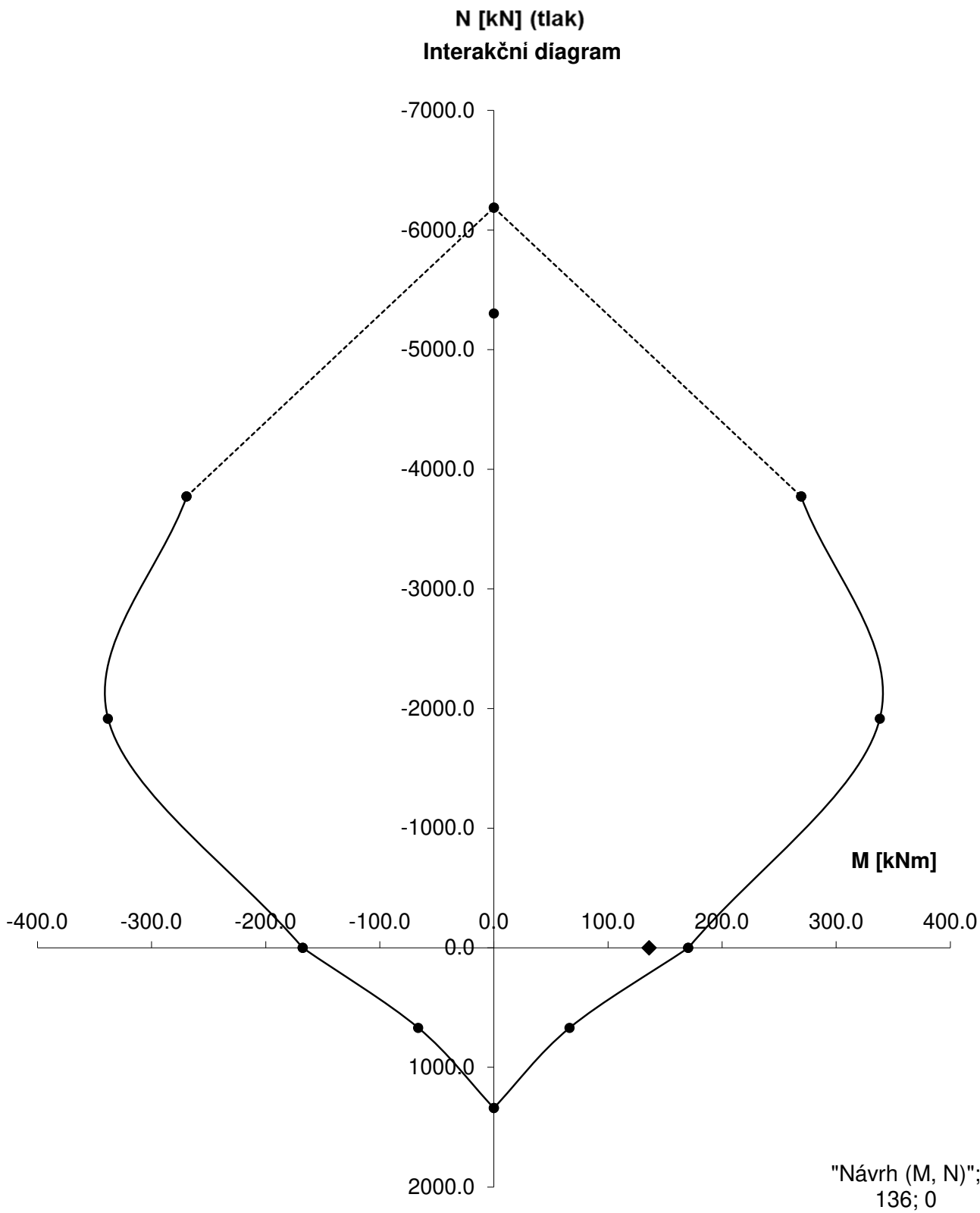


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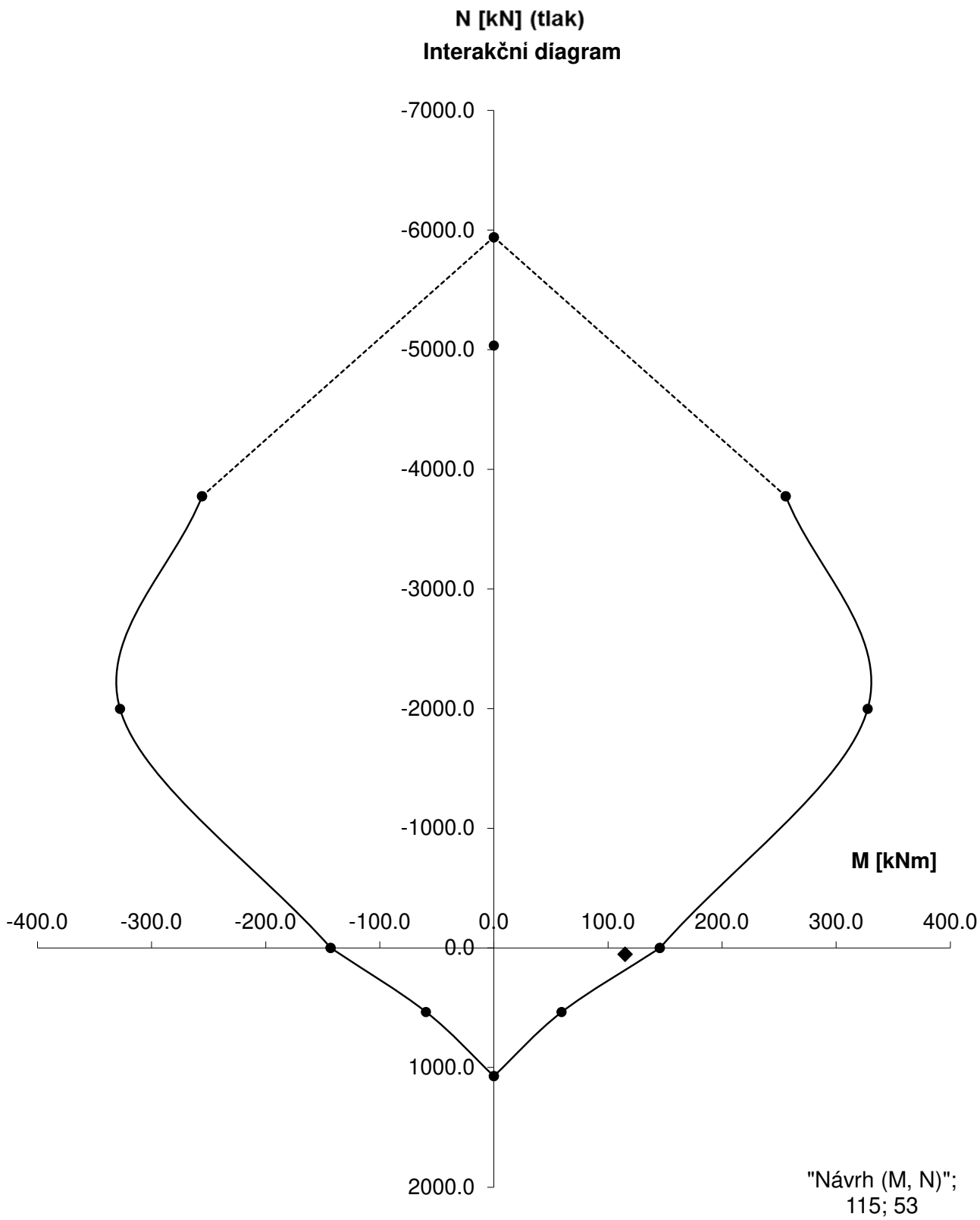
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| Rozměr prvku | | | Vyztužení | | Průřez 1 | |
|--|------------|----------|--|---|---------------|-------------------------|
| b= | 1 m | | As2 | 14 | Počet | 10 |
| h= | 0.35 m | | As1 | 14 | As2= | 1539.38 mm ² |
| | | | | | As1= | 1539.38 mm ² |
| Charakteristiky betonu | | | Charakteristiky výztuže As1 | | Krytí výztuže | |
| Beton | C 25/30 | | Výztuž | B 500 B | R | |
| f _{ck} = | 25 MPa | | f _{yk} = | 500 MPa | | c min = |
| f _{ctm} = | 2.6 MPa | | f _{tk} = | 550 MPa | | φ třmínku = |
| E _{cm} = | 31000 MPa | | E _s = | 200000 MPa | | c = cmin + Δh + |
| τ _{rk} = | 0.45 MPa | | průměry | 8-36 mm | | d1 = c + φ/2 |
| α= | 1 | | Povrch | žebírkový | | d2 = c + φ/2 |
| γ _c = | 1.5 | | γ _s = | 1.15 | | d = h - d1 |
| f _{cd} = α _{cc} * f _{ck} / γ _c | 14.2 MPa | | f _{yd} = f _{yk} / γ _s | 434.78 MPa | | d' = h - d2 |
| ε _{cd} = f _{cd} / E | 0.0035 | | ε _{yd} = f _{yd} / E | 0.00217 | | |
| α _{cc} | 0.85 | | | | | |
| Schema | | | | | | |
| | | | | | | |
| Doplňující parametry | | | | | | |
| σ _s | 434.78 MPa | | Fs1 = As1 * f _{yd} | 669.29 KN | | |
| ξ _{lim} | 0.617 | | Fs2 = As2 * f _{yd} | 669.29 KN | | |
| ξ _{lim2} | 2.639 | | ΔFs = Fs2 - Fs1 | 0.0000 KN | | |
| ρ | 0.00879648 | | ξ _{lim2} * d2 = | 0.2006 [1] | | |
| z1 | 0.099 m | | ξ _{lim2} * d1 = | 0.2006 [1] | | |
| z2 | 0.099 m | | ξ _{lim} * d = | 0.1690 [1] | | |
| zs | 0.198 m | | ξ _{lim} * d' = | 0.1690 [1] | | |
| Bod grafu | | | | | | |
| | Mrd [KNm] | Nrd [KN] | Mrd [KNm] | | | |
| 0 | 0.0 | -6187.5 | | | | |
| 1 | 269.3 | -3773.2 | | d > ξ _{lim2} * d2 | PRAVDA | |
| 2 | 338.1 | -1914.7 | | ξ _{lim} * d >= ξ _{lim2} * d2 | ##### | |
| 3 | 170.3 | 0.0 | | | | |
| 4 | 66.3 | 669.3 | | | | |
| 5 | 0.0 | 1338.6 | | | | |
| 4' | -66.3 | 669.3 | | | | |
| 3' | -167.6 | 0.0 | | | | |
| 2' | -338.1 | -1914.7 | | ξ _{lim} * d' >= ξ _{lim2} * d1 | ##### | |
| 1' | -269.3 | -3773.2 | | | | |
| 0 | 0.0 | -6187.5 | | | | |
| 0' | 0.0 | -5303.4 | | | | |
| | 136 | 0 | | | | |



| VÝPOČET OMEZENÍ NAPĚTÍ ŽB PRŮŘEZU | | | | Průřez 1 |
|--|---------------------------|--|------------|---|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | <u>uzel</u> 400 |
| b= | 1 m | ϕ [mm] | Počet | $A_{s2} =$ |
| h= | 0.35 m | 14 | 10 | 1539 mm ² |
| 323 | | A_{s1} | 14 | 10 |
| | | | | $A_{s1} =$ |
| | | | | 1539 mm ² |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | <u>Krytí výztuže</u> |
| Beton | C 25/30 | Výztuž | B 500 B | R |
| $f_{ck} =$ | 25 MPa | $f_{yk} =$ | 500 MPa | |
| $f_{ctm} =$ | 2.6 MPa | $f_{tk} =$ | 550 MPa | |
| $E_{cm} =$ | 31000 MPa | $E_s =$ | 200000 MPa | |
| $\tau_{rk} =$ | 0.45 MPa | průměry | 8-36 mm | |
| $\alpha =$ | 1 | Povrch | žebírkový | |
| $\gamma_c =$ | 1.5 | $\gamma_s =$ | 1.15 | |
| $f_{cd} = \alpha_{cc} \cdot f_{ck} / \gamma_c$ | 14.2 Mpa | $f_{yd} = f_{yk} / \gamma_s$ | 434.78 Mpa | |
| $\varepsilon_{cd} = f_{cd} / E$ | 0.0035 | $\varepsilon_{yd} = f_{yd} / E$ | 0.00217 | |
| $\alpha_{cc} =$ | 0.85 | | | |
| <u>Schema</u> | | | | |
| | | | | |
| $\alpha_e = E_s / E_{cm}$ | 6.45 | | | |
| x= | 95.18 mm | $x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2 b A_{s1} d + A_{s2} d_2}{\alpha_e (A_{s1} + A_{s2})^2}} \right]$ | | |
| $I_{ir} =$ | 0.00060866 m ⁴ | $I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d - x)^2 + A_{s2} (x - d_2)^2 \right]$ | | |
| <u>Charakteristická kombinace</u> | | | | |
| $M_{MSP} =$ | 100.96 kNm | | | |
| $\sigma_c =$ | -15.79 MPa | $\sigma_c = -\frac{M_k}{I_{ir}} x$ | <= | $ \sigma_c \leq 0,6 f_{ck}$ 15.00 MPa NEVYHOVUJE |
| $\sigma_s =$ | 191.37 MPa | $\sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d - x)$ | <= | $\sigma_s \leq 0,8 f_{yk}$ 400 MPa ==> VYHOVUJE |

| Rozměr prvku | | | Vyztužení | | Průřez 1 | |
|--|------------|----------|--|---|---------------|-----------------------------|
| b= | 1 m | | As2 | 14 | Počet | 8 |
| h= | 0.35 m | | As1 | 14 | As2= | 1231.51 mm ² |
| | | | | | As1= | 1231.51 mm ² |
| Charakteristiky betonu | | | Charakteristiky výztuže As1 | | Krytí výztuže | |
| Beton | C 25/30 | | Výztuž | B 500 B | R | |
| f _{ck} = | 25 MPa | | f _{yk} = | 500 MPa | | c min = |
| f _{ctm} = | 2.6 MPa | | f _{tk} = | 550 MPa | | φ třmínku = |
| E _{cm} = | 31000 MPa | | E _s = | 200000 MPa | | c = c _{min} + Δh + |
| τ _{rk} = | 0.45 MPa | | průměry | 8-36 mm | | d1 = c + φ/2 |
| α= | 1 | | Povrch | žebírkový | | d2 = c + φ/2 |
| γ _c = | 1.5 | | γ _s = | 1.15 | | d = h - d1 |
| f _{cd} = α _{cc} * f _{ck} / γ _c | 14.2 MPa | | f _{yd} = f _{yk} / γ _s | 434.78 MPa | | d' = h - d2 |
| ε _{cd} = f _{cd} / E | 0.0035 | | ε _{yd} = f _{yd} / E | 0.00217 | | |
| α _{cc} | 0.85 | | | | | |
| Schema | | | | | | |
| | | | | | | |
| Doplňující parametry | | | | | | |
| σ _s | 434.78 MPa | | Fs1 = As1 * f _{yd} | 535.43 KN | | |
| ξ _{lim} | 0.617 | | Fs2 = As2 * f _{yd} | 535.43 KN | | |
| ξ _{lim2} | 2.639 | | ΔFs = Fs2 - Fs1 | 0.0000 KN | | |
| ρ | 0.00703718 | | ξ _{lim2} * d2 = | 0.1689 [1] | | |
| z1 | 0.111 m | | ξ _{lim2} * d1 = | 0.1689 [1] | | |
| z2 | 0.111 m | | ξ _{lim} * d = | 0.1764 [1] | | |
| zs | 0.222 m | | ξ _{lim} * d' = | 0.1764 [1] | | |
| Bod grafu | | | | | | |
| | Mrd [KNm] | Nrd [KN] | Mrd [KNm] | | | |
| 0 | 0.0 | -5941.2 | | | | |
| 1 | 255.8 | -3775.2 | | d > ξ _{lim2} * d2 | PRAVDA | |
| 2 | 327.6 | -1998.5 | | ξ _{lim} * d >= ξ _{lim2} * d2 | PRAVDA | |
| 3 | 145.4 | 0.0 | | | | |
| 4 | 59.4 | 535.4 | | | | |
| 5 | 0.0 | 1070.9 | | | | |
| 4' | -59.4 | 535.4 | | | | |
| 3' | -143.0 | 0.0 | | | | |
| 2' | -327.6 | -1998.5 | | ξ _{lim} * d' >= ξ _{lim2} * d1 | PRAVDA | |
| 1' | -255.8 | -3775.2 | | | | |
| 0 | 0.0 | -5941.2 | | | | |
| 0' | 0.0 | -5035.7 | | | | |
| | 115 | 53 | | | | |



| VÝPOČET OMEZENÍ NAPĚTÍ ŽB PRŮŘEZU | | | | Průřez 1 | |
|---|-----------|---|------------|----------------------|---|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | <u>Počet</u> | |
| b= | 1 m | A_{s2} | 14 | $A_{s2}=$ | uzel 400 1232 mm ² |
| h= | 0.35 m | A_{s1} | 14 | $A_{s1}=$ | 1232 mm ² |
| 323 | | | | | |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | <u>Krytí výztuže</u> | |
| Beton C 25/30 | | Výztuž B 500 B | | R | |
| $f_{ck}=$ | 25 MPa | $f_{yk}=$ | 500 MPa | | |
| $f_{ctm}=$ | 2.6 MPa | $f_{tk}=$ | 550 MPa | | |
| $E_{cm}=$ | 31000 MPa | $E_s=$ | 200000 MPa | | |
| $\tau_{rk}=$ | 0.45 MPa | průměry | 8-36 mm | | |
| $\alpha=$ | 1 | Povrch | žebírkový | | |
| $\gamma_c=$ | 1.5 | $\gamma_s=$ | 1.15 | | |
| $f_{cd}=\alpha_{cc} \cdot f_{ck} / \gamma_c$ | 14.2 Mpa | $f_{yd}=f_{yk} / \gamma_s$ | 434.78 Mpa | | |
| $\varepsilon_{cd}=f_{cd} / E$ | 0.0035 | $\varepsilon_{yd}=f_{yd} / E$ | 0.00217 | | |
| α_{cc} | 0.85 | | | | |
| <u>Schema</u> | | | | | |
| | | | | | |
| $\alpha_e = E_s / E_{cm} = 6.45$ | | | | | |
| $x = 88.58 \text{ mm}$ | | | | | |
| $I_{ir} = 0.00054615 \text{ m}^4$ | | | | | |
| $I_{ir} = \frac{1}{3} b x^3 + \alpha_e [A_{s1} (d - x)^2 + A_{s2} (x - d_s)^2]$ | | | | | |
| <u>Charakteristická kombinace</u> | | | | | |
| $M_{MSP} = 85.19 \text{ kNm}$ | | | | | |
| $\sigma_c = -13.82 \text{ MPa}$ | | | | | |
| $\sigma_c = -\frac{M_k}{I_{ir}} x$ | | | | | |
| $ \sigma_c \leq 0,6 f_{ck}$ | | | | | |
| $\leq 15.00 \text{ MPa}$ | | | | | |
| ==> VYHOVUJE | | | | | |
| $\sigma_s = 198.66 \text{ MPa}$ | | | | | |
| $\sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d - x)$ | | | | | |
| $\sigma_s \leq 0,8 f_{yk}$ | | | | | |
| $\leq 400 \text{ MPa}$ | | | | | |
| ==> VYHOVUJE | | | | | |

Geometrie průřezu

| | | |
|-------|------|---|
| b_w | 1 | m |
| h | 0.37 | m |

Průběh vnitřních sil V_{ED} , N_{ED}

| | | |
|------------|-------|----|
| V_{ED} | 650.0 | kN |
| $V_{ED,0}$ | 650.0 | kN |
| N_{ED} | 0 | kN |
| L_{ED} | 0.75 | m |

Vlastnosti betonu:

C 25/30

| | | |
|--|-------|-----|
| f_{ck} | 25 | MPa |
| f_{ctm} | 2.6 | MPa |
| E_{cm} | 31 | GPa |
| τ_{rk} | 3 | MPa |
| α_{cc} | 0.85 | |
| γ_c | 1.5 | |
| $f_{cd} = \alpha_{cc} \cdot f_{ck} / \gamma_c$ | 14.17 | MPa |
| $v = 0.6 \cdot (1 - (f_{ck} / 250))$ | 0.54 | MPa |

Vlastnosti výztuže

B 500 B

| | | |
|------------|--------|-----|
| f_{ywk} | 500 | MPa |
| γ_s | 1.15 | |
| f_{ywd} | 434.78 | MPa |

Krytí výztuže betonem

| | | |
|---------------------------|----|----|
| c_{nom} | 45 | mm |
| ϕ_{tr} | 12 | mm |
| $c = c_{nom} + \phi_{tr}$ | 57 | mm |

Podélná výztuž

| | | |
|----------|---------|-----------------|
| d_{s1} | 14 | mm |
| počet | 10 | ks |
| A_{s1} | 1539.36 | mm ² |

Účinná výška průřezu

| | | |
|------------------------|-------|----|
| $d_1 = c + d_{s1} / 2$ | 64 | mm |
| $d = h - d_1$ | 0.306 | m |

Návrhová smyková únosnost nevytluženého betonového průřezu

| | |
|---------------|----------|
| k | 1.8 |
| ρ_1 | 0.005 |
| σ_{cp} | 0.00 MPa |
| v_{min} | 0.43 MPa |
| k_1 | 0.15 |
| $V_{Rd,c}$ | 154.4 kN |
| $V_{Rd,cm}$ | 130.2 kN |
| $V_{Rd,c}$ | 154.4 kN |

Posouzení

| | | |
|----------|---|------------|
| V_{ED} | > | $V_{Rd,c}$ |
| 650 kN | | 154.4 kN |

Nevyhovuje - nutný návrh smykové výztuže

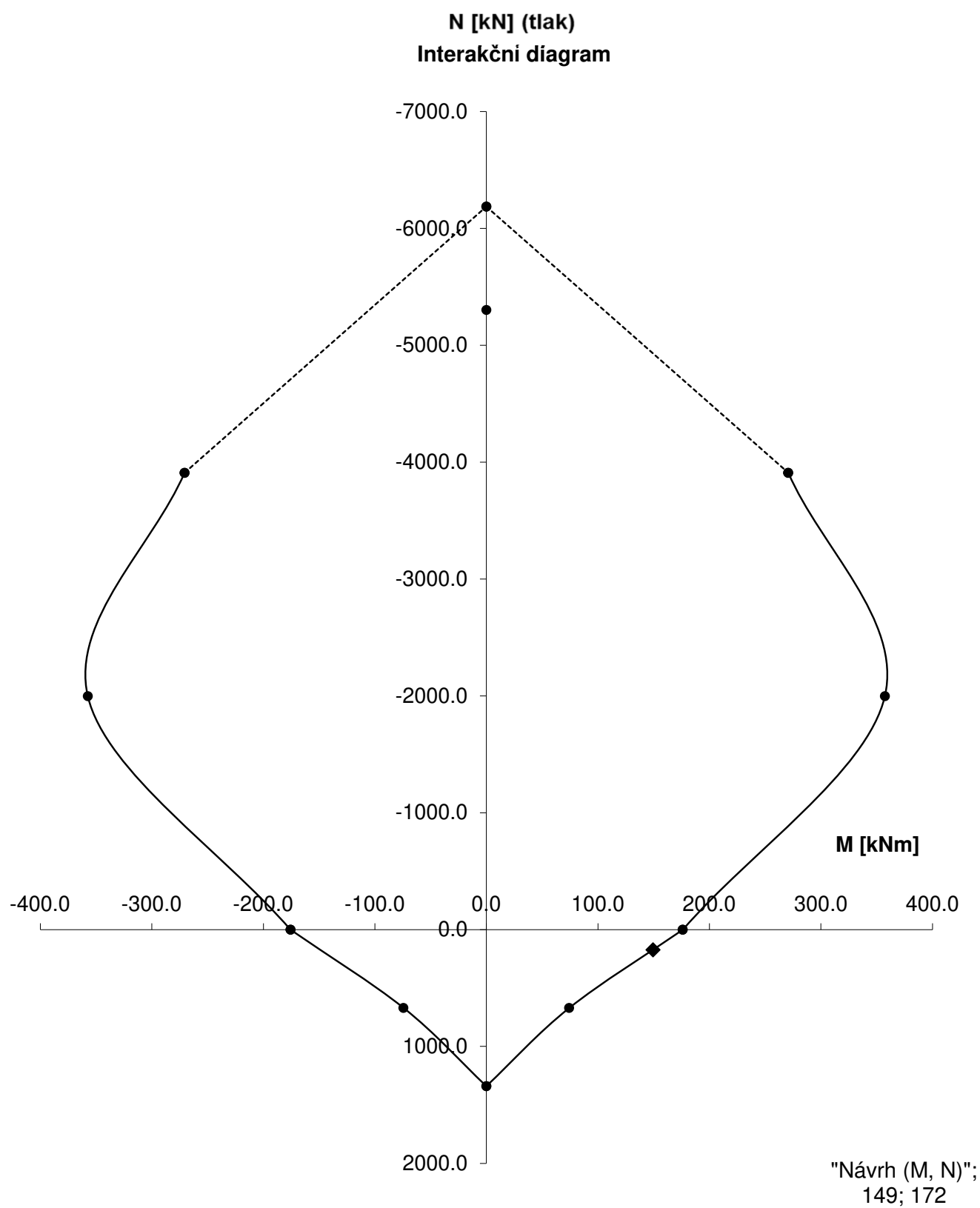
Návrh smykové výztuže

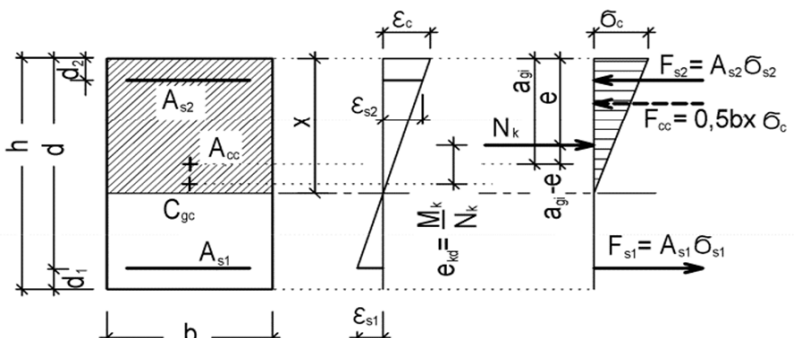
| | | | | |
|---------------|------------|--------|----------|----------|
| $\cot \Phi$ | 2.5 | Φ | 21.80 ° | |
| $V_{Rd,max}=$ | 726.49 kN | > | V_{ED} | 650.0 kN |
| $\cot \Phi$ | 1 | Φ | 45.00 ° | |
| $V_{Rd,max}=$ | 1053.41 kN | > | V_{ED} | 650.0 kN |

Třmínky, spony

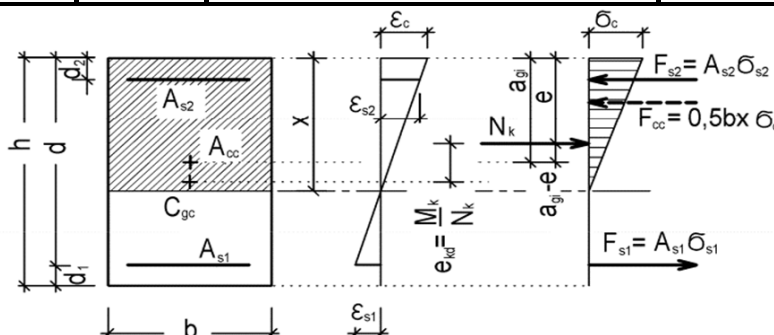
| | | | |
|------------------|------------------------|-----------|----------------------|
| β | 100% | | |
| $\rho_{w,st}$ | 0.00217 | | |
| ϕ_{sw} | 12 mm | | |
| n | 5 ks | | $s_{t,max}$ |
| s_{st} | 200 mm | < | 229.5 mm |
| $A_{sw,st}$ | 565.49 mm ² | | |
| z | 0.2754 m | | |
| $\rho_{w,min}$ | 0.00080 | | |
| $\rho_{w,st}$ | 0.00283 | > | 0.00217 |
| s | < | 706.86 mm | |
| $V_{rd,st}$ | 846.39 kN | | |
| Posouzení | | | |
| V_{rd} | 726.49 | > | $V_{ed,0}$ 650.00 kN |

| Průřez 2 | | | |
|--|------------|--|--|
| Rozměr prvku | | Vyztužení | |
| b= | 1 m | As2 | 14 |
| h= | 0.35 m | As1 | 14 |
| | | Počet | 10 |
| | | As2= | 1539.38 mm ² |
| | | As1= | 1539.38 mm ² |
| Charakteristiky betonu | | Charakteristiky výztuže As1 | |
| Beton | C 25/30 | Výztuž | B 500 B |
| f _{ck} = | 25 MPa | f _{yk} = | 500 MPa |
| f _{ctm} = | 2.6 MPa | f _{tk} = | 550 MPa |
| E _{cm} = | 31000 MPa | E _s = | 200000 MPa |
| τ _{rk} = | 0.45 MPa | průměry | 8-36 mm |
| α= | 1 | Povrch | žebírkový |
| γ _c = | 1.5 | γ _s = | 1.15 |
| f _{cd} =α _{cc} * f _{ck} /γ _c | 14.2 Mpa | f _{yd} =f _{yk} /γ _s | 434.78 Mpa |
| ε _{cd} =f _{cd} /E | 0.0035 | ε _{yd} =f _{yd} /E | 0.00217 |
| α _{cc} | 0.85 | | |
| | | Krytí výztuže | |
| | | c min = | 45 mm |
| | | φ třmínku = | 12 mm |
| | | c = cmin + Δh + | 57 mm |
| | | d1 = c + φ/2 | 64 mm |
| | | d2 = c + φ/2 | 64 mm |
| | | d = h - d1 | 0.286 m |
| | | d' = h - d2 | 0.286 m |
| Schema | | | |
| | | | |
| Doplňující parametry | | | |
| σ _s | 434.78 Mpa | Fs1=As1*f _{yd} | 669.29 KN |
| ξ _{lim} | 0.617 | Fs2=As2*f _{yd} | 669.29 KN |
| ξ _{lim2} | 2.639 | ΔFs=Fs2-Fs1 | 0.0000 KN |
| ρ | 0.00879648 | ξ _{lim2} *d2= | 0.1689 [1] |
| z1 | 0.111 m | ξ _{lim2} *d1= | 0.1689 [1] |
| z2 | 0.111 m | ξ _{lim} *d= | 0.1764 [1] |
| zs | 0.222 m | ξ _{lim} *d'= | 0.1764 [1] |
| Bod grafu | | | |
| | Mrd[KNm] | Nrd[KN] | Mrd[KNm] |
| 0 | 0.0 | -6187.5 | |
| 1 | 270.6 | -3909.1 | d > ξ _{lim2} *d2 PRAVDA |
| 2 | 357.3 | -1998.5 | ξ _{lim} *d >= ξ _{lim2} *d2 PRAVDA |
| 3 | 176.1 | 0.0 | |
| 4 | 74.3 | 669.3 | |
| 5 | 0.0 | 1338.6 | |
| 4' | -74.3 | 669.3 | |
| 3' | -175.6 | 0.0 | |
| 2' | -357.3 | -1998.5 | ξ _{lim} *d' >= ξ _{lim2} *d1 PRAVDA |
| 1' | -270.6 | -3909.1 | |
| 0 | 0.0 | -6187.5 | |
| 0' | 0.0 | -5303.4 | |
| | 149 | 172 | |



| VÝPOČET OMEZENÍ NAPĚTÍ ŽB PRŮŘEZU | | | | Průřez 2 |
|---|---------------------------|--|------------|---|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | uzel 407 |
| b= | 1 m | ϕ [mm] | 14 | $A_{s2} =$ |
| h= | 0.35 m | | 10 | $A_{s1} =$ |
| 323 | | | | 1539 mm ² |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | <u>Krytí výztuže</u> |
| Beton | C 25/30 | Výztuž | B 500 B | |
| $f_{ck} =$ | 25 MPa | $f_{yk} =$ | 500 MPa | $c_{min} =$ |
| $f_{ctm} =$ | 2.6 MPa | $f_{tk} =$ | 550 MPa | ϕ třmínku = |
| $E_{cm} =$ | 31000 MPa | $E_s =$ | 200000 MPa | $c = c_{min} + \Delta h =$ |
| $\tau_{rk} =$ | 0.45 MPa | průměry | 8-36 mm | $d_1 = c + \phi/2$ |
| $\alpha =$ | 1 | Povrch | žebírkový | $d_2 = c + \phi/2$ |
| $\gamma_c =$ | 1.5 | $\gamma_s =$ | 1.15 | $d = h - d_1$ |
| $f_{cd} = \alpha_{cc} \cdot f_{ck} / \gamma_c$ | 14.2 Mpa | $f_{yd} = f_{yk} / \gamma_s$ | 434.78 Mpa | 0.286 m |
| $\varepsilon_{cd} = f_{cd} / E$ | 0.0035 | $\varepsilon_{yd} = f_{yd} / E$ | 0.00217 | |
| α_{cc} | 0.85 | | | |
| <u>Schema</u> | | | | |
|  | | | | |
| $\alpha_e = E_s / E_{cm}$ | 6.45 | | | |
| $x =$ | 95.18 mm | $x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2 b A_{s1} d + A_{s2} d_2}{\alpha_e (A_{s1} + A_{s2})^2}} \right]$ | | |
| $I_{ir} =$ | 0.00065871 m ⁴ | $I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d - x)^2 + A_{s2} (x - d_2)^2 \right]$ | | |
| <u>Charakteristická kombinace</u> | | | | |
| M_{MSP} | 110.69 kNm | | | |
| $\sigma_c =$ | -15.99 MPa | $\sigma_c = -\frac{M_k}{I_{ir}} x$ | <= | $ \sigma_c \leq 0,6 f_{ck}$ 15.00 MPa NEVYHOVUJE |
| $\sigma_s =$ | 206.88 MPa | $\sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d - x)$ | <= | $\sigma_s \leq 0,8 f_{yk}$ 400 MPa ==> VYHOVUJE |

| | | | | | | |
|--|--|--|--|--------------------------|---------------------------------------|------------------|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | ϕ [mm] | Počet | uzel: <u>400</u> |
| b= | <div><div>1</div><div>m</div></div> | A _{s1} | <div><div>14</div><div>10</div></div> | A _{s1} = | 1539 mm ² | |
| h= | <div><div>0.35</div><div>m</div></div> | | | | | |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | <u>Krytí výztuže</u> | | |
| Beton | <div>C 25/30<div></div></div> | Výztuž | <div>B 500 B<div></div></div> | R | | |
| f _{ck} = | 25 MPa | f _{yk} = | 500 MPa | c min = | <div><div>45</div><div>mm</div></div> | |
| f _{ctm} = | 2.6 MPa | f _{tk} = | 550 MPa | φ třmínku = | <div><div>12</div><div>mm</div></div> | |
| E _{cm} = | 31000 MPa | E _s = | <div><div>200000</div><div>MPa</div></div> | c = c min + Δh + | 57 mm | |
| τ _{rk} = | 0.45 MPa | průměry | 8-36 mm | d ₁ = c + φ/2 | 64 mm | |
| α= | <div><div>1</div></div> | Povrch | žebírkový | d = h - d ₁ | 0.286 m | |
| γ _c = | <div><div>1.5</div></div> | γ _s = | <div><div>1.15</div></div> | | | |
| f _{cd} = α _{cc} * f _{ck} / γ _c | 14.2 Mpa | f _{yd} = f _{yk} / γ _s | 434.78 Mpa | | | |
| ε _{cd} = f _{cd} / E | <div><div>0.0035</div></div> | ε _{yd} = f _{yd} / E | 0.00217 | | | |
| α _{cc} | <div><div>0.85</div></div> | | | | | |

Schema


$$\alpha_e = E_s / E_{cm} = 6.45$$

$$A_c = 0.35 \text{ m}^2$$

$$I_c = 0.003572917 \text{ m}^4$$

Kvazistálá kombinace

$$M = 132.83 \text{ kNm}$$

$$A_i = 0.359932 \text{ m}^2$$

$$a_s = 0.111 \text{ m}$$

$$t_i = 0.003063 \text{ m}$$

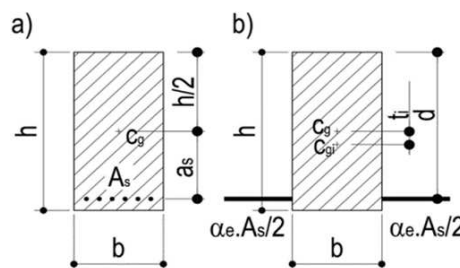
$$A_i = A_c + A_s \cdot \alpha_e$$

$$t_i = \frac{\alpha_e \cdot A_s \cdot a_s}{A_i}$$

Moment setrvačnosti plně působícího ideálního průřezu:

$$I_{ci} = 0.003692 \text{ m}^4$$

$$I_{ci} = I_c + A_c \cdot t_i^2 + \alpha_e A_s (a_s - t_i)^2$$



Obr. 1 a) Železobetonový, b) ideální plně působící průřez

Posouzení omezení napětí v tažených vláknech betonu

$$\sigma_{ct} = 6.19 \text{ MPa}$$

$$\sigma_{ct} = \frac{M_{E\psi 2} \cdot (h/2 - t_i)}{I_{ci}}$$

$$> f_{ctm} = 2.6 \text{ MPa}$$

 od kvazistálé kombinace vzniknou v betonu ohybové trhliny \Rightarrow průřez porušený trhlinou

Posouzení šířky trhlin

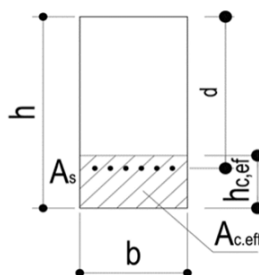
$$w_k = s_{r,max} (\epsilon_{sm} - \epsilon_{cm})$$

$$k_1 = 0.8$$

$$k_2 = 0.5$$

$$k_3 = 3.4$$

$$k_4 = 0.425$$



Posouzení betonových prvků dle EuroCode 2

$k_t =$

0.4

0.4 - dlouhodobá

0.6 - krátkodobá

| | | | | | |
|------------------|---------|----------------|--|------------|---------|
| $h_{c,ef} =$ | 0.095 | m | $h_{c,ef} = \min\{2,5 \cdot (h-d); (h-x)/3; h/2\}$ | $> d$ | 0.064 |
| d | | | $h_{c,ef}$ | $2,5(h-d)$ | 0.160 m |
| $A_{c,ef} =$ | 0.095 | m ² | | $(h-x)/3$ | 0.095 m |
| $\rho_{c,eff} =$ | 0.01627 | | | $h/2$ | 0.175 m |

$$f_{ct,eff} = f_{ctm} = 2.6 \text{ MPa}$$

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{\sigma_s - k_t \frac{f_{ct,eff}}{\rho_{p,eff}} (1 + \alpha_e \cdot \rho_{p,eff})}{E_s} \geq 0,6 \frac{\sigma_s}{E_s}$$

$$\varepsilon_{sm} - \varepsilon_{cm} = 0.001281 \quad \geq \quad 0.000981 \quad \Rightarrow \text{VYHOVUJE}$$

Výpočet napětí σ_s

$$x = 66.09 \text{ mm} \quad x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2b}{\alpha_e} \frac{A_{s1}d + A_{s2}d_2}{(A_{s1} + A_{s2})^2}} \right]$$

$$I_{ir} = 0.00057652 \text{ m}^4 \quad I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d-x)^2 + A_{s2} (x-d_2)^2 \right]$$

$$\sigma_s = 326.89 \text{ MPa} \quad \sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d-x)$$

Šířka trhliny

$$w_k = s_{r,max} (\varepsilon_{sm} - \varepsilon_{cm})$$

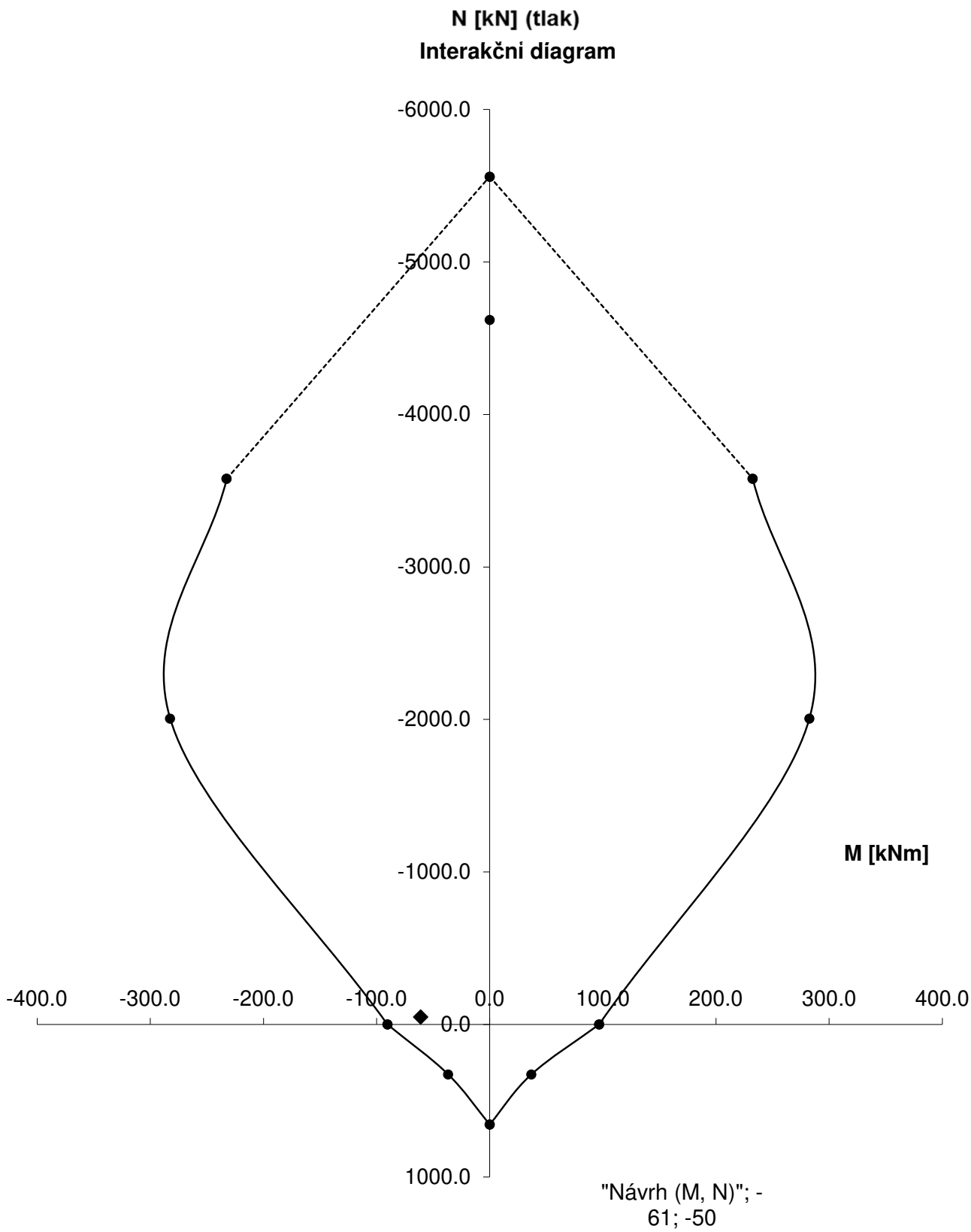
dle (EN 1991-1-1 čl. 7.3.4)

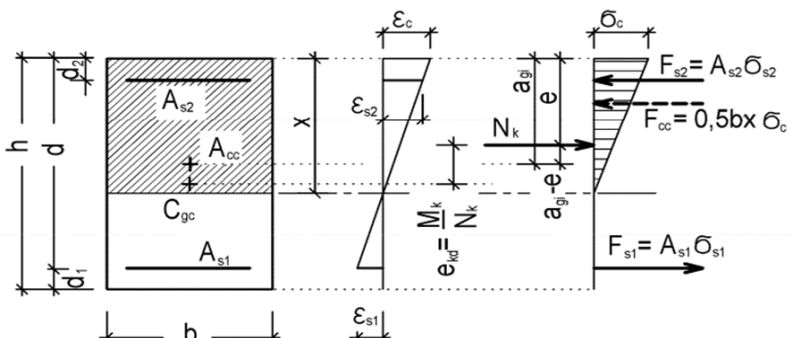
maximální vzdálenost trhlin

$$s_{r,max} = 146.47 \text{ mm} \quad s_{r,max} = k_3 c + k_1 k_2 k_4 \phi / \rho_{p,eff}$$

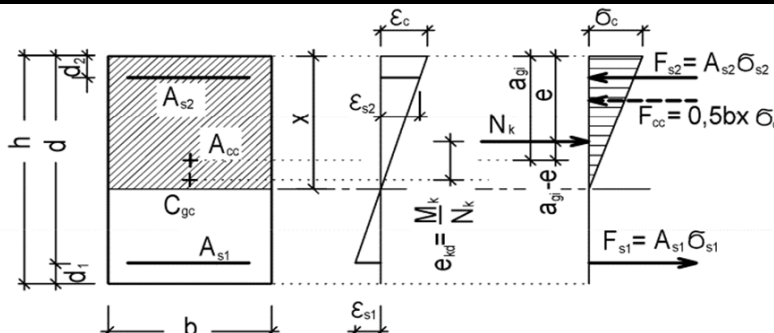
$$w_k = 0.188 \text{ mm} \quad < \quad w_{lim} \quad \boxed{0.3} \text{ mm} \quad \Rightarrow \text{VYHOVUJE}$$

| Průřez 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|------------|----------------|------------|-------------------------|-----------|------------------|-------|-------------------------|-----------|-------------------|-------|-------------|-----------|---|------------|------------------------|------------|----|---|--|------------|----|---------|----------------------|------------|----|---------|-----------------------|------------|----|-------|-------|--|----|--|--|--|----|--------|---------|--|----|--------|---------|--|---|-----|---------|--|----|--|---------|--|--|------------|------------|--|
| Rozměr prvku <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> b= 1 m h= 0.35 m </div> <div style="width: 45%;"> Vyztužení <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> As2 As1 </div> <div style="width: 45%;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> ϕ [mm] 12 </div> <div style="width: 45%;"> Počet 6.67 </div> </div> </div> </div> </div> </div> | | <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> As2= 754.36 mm² As1= 754.36 mm² </div> <div style="width: 45%;"> uzal: 2123 </div> </div> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Charakteristiky betonu Beton C 25/30 f _{ck} = 25 MPa f _{ctm} = 2.6 MPa E _{cm} = 31000 MPa τ _{rk} = 0.45 MPa α= 1 γ _c = 1.5 f _{cd} =α _{cc} * f _{ck} /γ _c = 14.2 Mpa ε _{cd} =f _{cd} /E = 0.0035 α _{cc} = 0.85 | | Charakteristiky výztuže As1 Výztuž B 500 B R f _{yk} = 500 MPa f _{tk} = 550 MPa E _s = 200000 MPa průměry 8-36 mm Povrch žebírkový γ _s = 1.15 f _{yd} =f _{yk} /γ _s = 434.78 Mpa ε _{yd} =f _{yd} /E = 0.00217 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Krytí výztuže c min = 45 mm φ třmínku = 12 mm c = cmin + Δh = 57 mm d1 = c + φ/2 = 63 mm d2 = c + φ/2 = 63 mm d = h - d1 = 0.287 m d' = h - d2 = 0.287 m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Schema | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Doplňující parametry <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">σ_s</td> <td style="width: 20%;">434.78 Mpa</td> <td style="width: 20%;">Fs1=As1*f_{yd}</td> <td style="width: 20%;">327.98 KN</td> </tr> <tr> <td>ξ_{lim}</td> <td>0.617</td> <td>Fs2=As2*f_{yd}</td> <td>327.98 KN</td> </tr> <tr> <td>ξ_{lim2}</td> <td>2.639</td> <td>ΔFs=Fs2-Fs1</td> <td>0.0000 KN</td> </tr> <tr> <td>ρ</td> <td>0.00431063</td> <td>ξ_{lim2}*d2=</td> <td>0.1663 [1]</td> </tr> <tr> <td>z1</td> <td>0.112 m</td> <td>ξ_{lim2}*d1=</td> <td>0.1663 [1]</td> </tr> <tr> <td>z2</td> <td>0.112 m</td> <td>ξ_{lim}*d=</td> <td>0.1770 [1]</td> </tr> <tr> <td>zs</td> <td>0.224 m</td> <td>ξ_{lim}*d'=</td> <td>0.1770 [1]</td> </tr> </table> | | | | σ _s | 434.78 Mpa | Fs1=As1*f _{yd} | 327.98 KN | ξ _{lim} | 0.617 | Fs2=As2*f _{yd} | 327.98 KN | ξ _{lim2} | 2.639 | ΔFs=Fs2-Fs1 | 0.0000 KN | ρ | 0.00431063 | ξ _{lim2} *d2= | 0.1663 [1] | z1 | 0.112 m | ξ _{lim2} *d1= | 0.1663 [1] | z2 | 0.112 m | ξ _{lim} *d= | 0.1770 [1] | zs | 0.224 m | ξ _{lim} *d'= | 0.1770 [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| σ _s | 434.78 Mpa | Fs1=As1*f _{yd} | 327.98 KN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ξ _{lim} | 0.617 | Fs2=As2*f _{yd} | 327.98 KN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ξ _{lim2} | 2.639 | ΔFs=Fs2-Fs1 | 0.0000 KN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ρ | 0.00431063 | ξ _{lim2} *d2= | 0.1663 [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| z1 | 0.112 m | ξ _{lim2} *d1= | 0.1663 [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| z2 | 0.112 m | ξ _{lim} *d= | 0.1770 [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| zs | 0.224 m | ξ _{lim} *d'= | 0.1770 [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bod grafu <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Mrd[KNm]</th> <th>Nrd[KN]</th> <th>Mrd[KNm]</th> </tr> </thead> <tbody> <tr><td>0</td><td>0.0</td><td>-5559.5</td><td></td></tr> <tr><td>1</td><td>232.5</td><td>-3579.1</td><td></td></tr> <tr><td>2</td><td>282.4</td><td>-2005.5</td><td></td></tr> <tr><td>3</td><td>96.7</td><td>0.0</td><td></td></tr> <tr><td>4</td><td>36.7</td><td>328.0</td><td></td></tr> <tr><td>5</td><td>0.0</td><td>656.0</td><td></td></tr> <tr><td>4'</td><td>-36.7</td><td>328.0</td><td></td></tr> <tr><td>3'</td><td>-90.3</td><td>0.0</td><td></td></tr> <tr><td>2'</td><td>-282.4</td><td>-2005.5</td><td></td></tr> <tr><td>1'</td><td>-232.5</td><td>-3579.1</td><td></td></tr> <tr><td>0</td><td>0.0</td><td>-5559.5</td><td></td></tr> <tr><td>0'</td><td>0.0</td><td>-4620.8</td><td></td></tr> <tr><td></td><td>-61</td><td>-50</td><td></td></tr> </tbody> </table> <div style="margin-top: 20px;"> <div style="display: flex; justify-content: space-between;"> <div> d > ξ_{lim2}*d2 ξ_{lim}*d >= ξ_{lim2}*d2 </div> <div> PRAVDA PRAVDA </div> </div> <div style="margin-top: 20px;"> <div style="display: flex; justify-content: space-between;"> <div>ξ_{lim}*d' >= ξ_{lim2}*d1</div> <div>PRAVDA</div> </div> </div> </div> | | | | | Mrd[KNm] | Nrd[KN] | Mrd[KNm] | 0 | 0.0 | -5559.5 | | 1 | 232.5 | -3579.1 | | 2 | 282.4 | -2005.5 | | 3 | 96.7 | 0.0 | | 4 | 36.7 | 328.0 | | 5 | 0.0 | 656.0 | | 4' | -36.7 | 328.0 | | 3' | -90.3 | 0.0 | | 2' | -282.4 | -2005.5 | | 1' | -232.5 | -3579.1 | | 0 | 0.0 | -5559.5 | | 0' | 0.0 | -4620.8 | | | -61 | -50 | |
| | Mrd[KNm] | Nrd[KN] | Mrd[KNm] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0.0 | -5559.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 232.5 | -3579.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 282.4 | -2005.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 96.7 | 0.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 36.7 | 328.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 0.0 | 656.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4' | -36.7 | 328.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3' | -90.3 | 0.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2' | -282.4 | -2005.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1' | -232.5 | -3579.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0.0 | -5559.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0' | 0.0 | -4620.8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | -61 | -50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



| VÝPOČET OMEZENÍ NAPĚTÍ ŽB PRŮŘEZU | | | | Průřez 3 |
|---|---------------------------|--|------------|---|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | <u>uzel</u> 2123 |
| b= | 1 m | A_{s2} | 12 6.67 | $A_{s2}= 754 \text{ mm}^2$ |
| h= | 0.35 m | A_{s1} | 12 6.67 | $A_{s1}= 754 \text{ mm}^2$ |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | <u>Krytí výztuže</u> |
| Beton | C 25/30 | Výztuž | B 500 B R | |
| $f_{ck}=$ | 25 MPa | $f_{yk}=$ | 500 MPa | $c \text{ min} =$ |
| $f_{ctm}=$ | 2.6 MPa | $f_{tk}=$ | 550 MPa | $\phi \text{ třmínku} =$ |
| $E_{cm}=$ | 31000 MPa | $E_s=$ | 200000 MPa | $c = c \text{ min} + \Delta h =$ |
| $\tau_{rk}=$ | 0.45 MPa | průměry | 8-36 mm | $d_1 = c + \phi / 2$ |
| $\alpha =$ | 1 | Povrch | žebírkový | $d_2 = c + \phi / 2$ |
| $\gamma_c =$ | 1.5 | $\gamma_s =$ | 1.15 | $d = h - d_1$ |
| $f_{cd} = \alpha_{cc} \cdot f_{ck} / \gamma_c$ | 14.2 Mpa | $f_{yd} = f_{yk} / \gamma_s$ | 434.78 Mpa | 0.287 m |
| $\varepsilon_{cd} = f_{cd} / E$ | 0.0035 | $\varepsilon_{yd} = f_{yd} / E$ | 0.00217 | |
| α_{cc} | 0.85 | | | |
| <u>Schema</u> | | | | |
|  | | | | |
| $\alpha_e = E_s / E_{cm}$ | 6.45 | | | |
| $x =$ | 74.69 mm | $x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2 b A_{s1} d + A_{s2} d_2}{\alpha_e (A_{s1} + A_{s2})^2}} \right]$ | | |
| $I_{ir} =$ | 0.00035894 m ⁴ | $I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d - x)^2 + A_{s2} (x - d_2)^2 \right]$ | | |
| <u>Charakteristická kombinace</u> | | | | |
| M_{MSP} | 45.93 kNm | | | |
| $\sigma_c =$ | -9.56 MPa | $\sigma_c = -\frac{M_k}{I_{ir}} x$ | <= | $ \sigma_c \leq 0,6 f_{ck}$ 15.00 MPa ==> VYHOVUJE |
| $\sigma_s =$ | 175.25 MPa | $\sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d - x)$ | <= | $\sigma_s \leq 0,8 f_{yk}$ 400 MPa ==> VYHOVUJE |

| | | | | | |
|--|-----------|---|-------------|----------------------|---|
| Rozměr prvku | | Vyztužení | ϕ [mm] | Počet | uzel: 2123 |
| b= | 1 m | A_{s1} | 12 | 6.67 | $A_{s1}= 754 \text{ mm}^2$ |
| h= | 0.35 m | | | | |
| Charakteristiky betonu | | Charakteristiky výztuže As1, As2 | | Krytí výztuže | |
| Beton | C 25/30 | Výztuž | B 500 B | R | |
| $f_{ck}=$ | 25 MPa | $f_{yk}=$ | 500 MPa | | $c_{\min} = 45 \text{ mm}$ |
| $f_{ctm}=$ | 2.6 MPa | $f_{tk}=$ | 550 MPa | | $\phi \text{ třmínku} = 12 \text{ mm}$ |
| $E_{cm}=$ | 31000 MPa | $E_s=$ | 200000 MPa | | $c = c_{\min} + \Delta h = 57 \text{ mm}$ |
| $\tau_{rk}=$ | 0.45 MPa | průměry | 8-36 mm | | $d_1 = c + \phi/2 = 63 \text{ mm}$ |
| $\alpha=$ | 1 | Povrch | žebírkový | | $d = h - d_1 = 0.287 \text{ m}$ |
| $\gamma_c=$ | 1.5 | $\gamma_s=$ | 1.15 | | |
| $f_{cd} = \alpha_{cc} \cdot f_{ck} / \gamma_c$ | 14.2 Mpa | $f_{yd} = f_{yk} / \gamma_s$ | 434.78 Mpa | | |
| $\epsilon_{cd} = f_{cd} / E$ | 0.0035 | $\epsilon_{yd} = f_{yd} / E$ | 0.00217 | | |
| α_{cc} | 0.85 | | | | |

Schema


$$\alpha_e = E_s / E_{cm} = 6.45$$

$$A_c = 0.35 \text{ m}^2$$

$$I_c = 0.003572917 \text{ m}^4$$

Kvazistálá kombinace

$$M = 62 \text{ kNm}$$

$$A_i = 0.354867 \text{ m}^2$$

$$a_s = 0.112 \text{ m}$$

$$t_i = 0.001536 \text{ m}$$

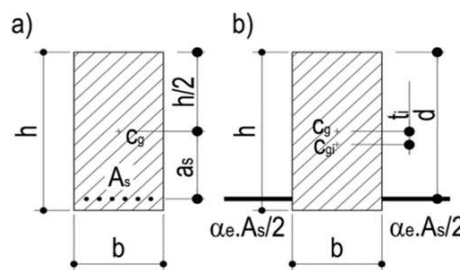
$$A_i = A_c + A_s \cdot \alpha_e$$

$$t_i = \frac{\alpha_e \cdot A_s \cdot a_s}{A_i}$$

Moment setrvačnosti plně působícího ideálního průřezu:

$$I_{ci} = 0.003633 \text{ m}^4$$

$$I_{ci} = I_c + A_c \cdot t_i^2 + \alpha_e A_s (a_s - t_i)^2$$



Obr. 1 a) Železobetonový, b) ideální plně působící průřez

Posouzení omezení napětí v tažených vláknech betonu

$$\sigma_{ct} = 2.96 \text{ MPa}$$

$$\sigma_{ct} = \frac{M_{E\psi 2} \cdot (h/2 - t_i)}{I_{ci}}$$

$$> f_{ctm} = 2.6 \text{ MPa}$$

od kvazistálé kombinace vzniknou v betonu ohybové trhliny => průřez porušený trhlinou

Posouzení šířky trhlín

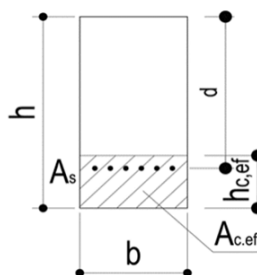
$$w_k = s_{r,max} (\epsilon_{sm} - \epsilon_{cm})$$

$$k_1 = 0.8$$

$$k_2 = 0.5$$

$$k_3 = 3.4$$

$$k_4 = 0.425$$



Posouzení betonových prvků dle EuroCode 2

$k_t =$

0.4

0.4 - dlouhodobá

0.6 - krátkodobá

| | | | | |
|------------------|----------------------|--|------------|---------|
| $h_{c,ef} =$ | 0.101 m | $h_{c,ef} = \min\{2,5 \cdot (h-d); (h-x)/3; h/2\}$ | $> d$ | 0.063 |
| d | | $h_{c,ef}$ | $2,5(h-d)$ | 0.158 m |
| $A_{c,ef} =$ | 0.101 m ² | | $(h-x)/3$ | 0.101 m |
| $\rho_{c,eff} =$ | 0.00750 | | $h/2$ | 0.175 m |

$f_{ct,eff} = f_{ctm} = 2.6 \text{ MPa}$

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{\sigma_s - k_t \frac{f_{ct,eff}}{\rho_{p,eff}} (1 + \alpha_e \cdot \rho_{p,eff})}{E_s} \geq 0,6 \frac{\sigma_s}{E_s}$$

$\varepsilon_{sm} - \varepsilon_{cm} = 0.000910 \quad \geq \quad 0.000910 \quad \Rightarrow \text{VYHOVUJE}$

Výpočet napětí σ_s

$x = 48.21 \text{ mm} \quad x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2b}{\alpha_e} \frac{A_{s1}d + A_{s2}d_2}{(A_{s1} + A_{s2})^2}} \right]$

$I_{ir} = 0.00031486 \text{ m}^4 \quad I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d-x)^2 + A_{s2} (x-d_2)^2 \right]$

$\sigma_s = 303.36 \text{ MPa} \quad \sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d-x)$

Šířka trhliny

dle (EN 1991-1-1 čl. 7.3.4) $w_k = s_{r,max} (\varepsilon_{sm} - \varepsilon_{cm})$

maximální vzdálenost trhlin

$s_{r,max} = 272.19 \text{ mm} \quad s_{r,max} = k_3 c + k_1 k_2 k_4 \phi / \rho_{p,eff}$

$w_k = 0.248 \text{ mm} \quad < \quad w_{lim} \quad \boxed{0.3} \text{ mm} \quad \Rightarrow \text{VYHOVUJE}$

Posouzení uloženého bloku oblast dle ČSN 1992-1

| | | | | | | |
|---|------|--------|--------|---|-------|----|
| beton | | C25/30 | | | | |
| fck | | 25 | | | | |
| fck cube | | 30 | | | | |
| alfacc | | 1 | | | | |
| Fcd | | 16.667 | MPa | | | |
| plocha ložiska | | | | | | |
| b1 | | 0.440 | m | | | |
| d1 | | 0.500 | m | | | |
| Ac0 | | 0.220 | m2 | | | |
| roznášecí plocha | | | | | | |
| b2 | | 0.600 | m | < | 1.32 | m |
| d2 | | 0.900 | m | < | 1.5 | m |
| Ac1 | | 0.540 | m2 | | | |
| výška uloženého bloku | h | 0.46 | mm | | | |
| Reakce ložiska | Fed | 1614 | kN | < | Frdu | |
| $F_{Rdu} = A_{c0} \cdot f_{cd} \cdot \sqrt{A_{c1} / A_{c0}} \leq 3,0 \cdot f_{cd} \cdot A_{c0}$ | | | | | | |
| soustředná síla na mezi únosnosti | Frdu | 5744.6 | kN | < | 11000 | kN |
| | Fed | < | Frdu | | | |
| | 1614 | < | 5744.6 | | | |

Vyztužení uloženého bloku

| | | | | | | |
|-----------------------------------|----------------|-------|-----|--------|---------|------------|
| Napětí pod ložiskem | σ_x | 7.34 | MPa | | | |
| směr X | a2/a1 | 0.73 | | | z grafu | |
| Největší tahové napětí | max σ_z | 1.10 | MPa | graf B | 0.15 | σ_x |
| Vzdálenost napětí od čela nosníku | x1 | 0.28 | m | graf A | 0.47 | a |
| Výsledná tahová síla | H _z | 96.84 | kN | graf D | 0.06 | H |
| směr Y | a2/a1 | 0.56 | | | z grafu | |
| Největší tahové napětí | max σ_y | 1.47 | MPa | graf B | 0.2 | σ_x |
| Vzdálenost napětí od čela nosníku | y1 | 0.38 | m | graf A | 0.42 | a |
| Výsledná tahová síla | H _y | 161.4 | kN | graf D | 0.1 | H |

Výztuž potřebná pro zachycení tahů (výztuž 10505)

| | | | | | | |
|---|----------|-----------|------------|----|------|-----|
| x | As min | 0.0003468 | m2 | | 3.47 | cm2 |
| y | | 0.0005781 | m2 | | 5.78 | cm2 |
| | Navrhuji | 6 | mřížky R10 | As | 4.71 | cm2 |
| | Navrhuji | 8 | mřížky R10 | As | 6.28 | cm2 |

Příčná tahová síla dle ČSN EN 1992-1

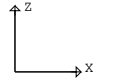
Fs 17.54347826 kN

Výztuž potřebná pro zachycení tahů (výztuž 10505)

As min 0.0000404 m2 0.40 cm2

500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000

L



SCALE REDUCTION
X 1.000
Y .000
Z 1.000
SCALE LENGTH
12.89304

GEOMETRY

SET 501ZZ

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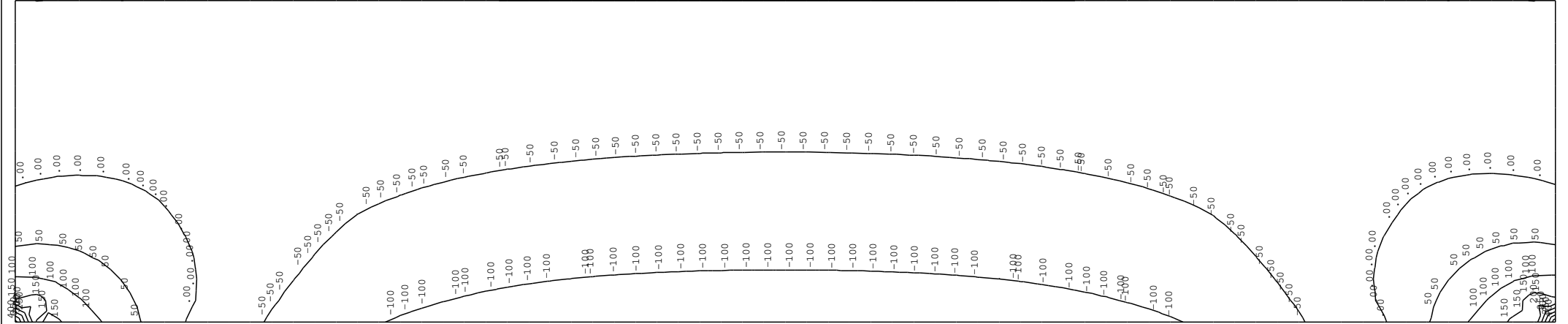
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JAN 30, 1912

TIME
09:52:00

ICES STRUOL
VERSION MAN-MBB

TRANSCONSULT

HRAD. KRALOVE



SCALE REDUCTION
X 1.000
Y .000
Z 1.000
LEVEL SIZE
50.00000
EXPONENT
0

SECTION FORCE M-YY

SET 501ZZ
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Backovice obl most - ulozny prah

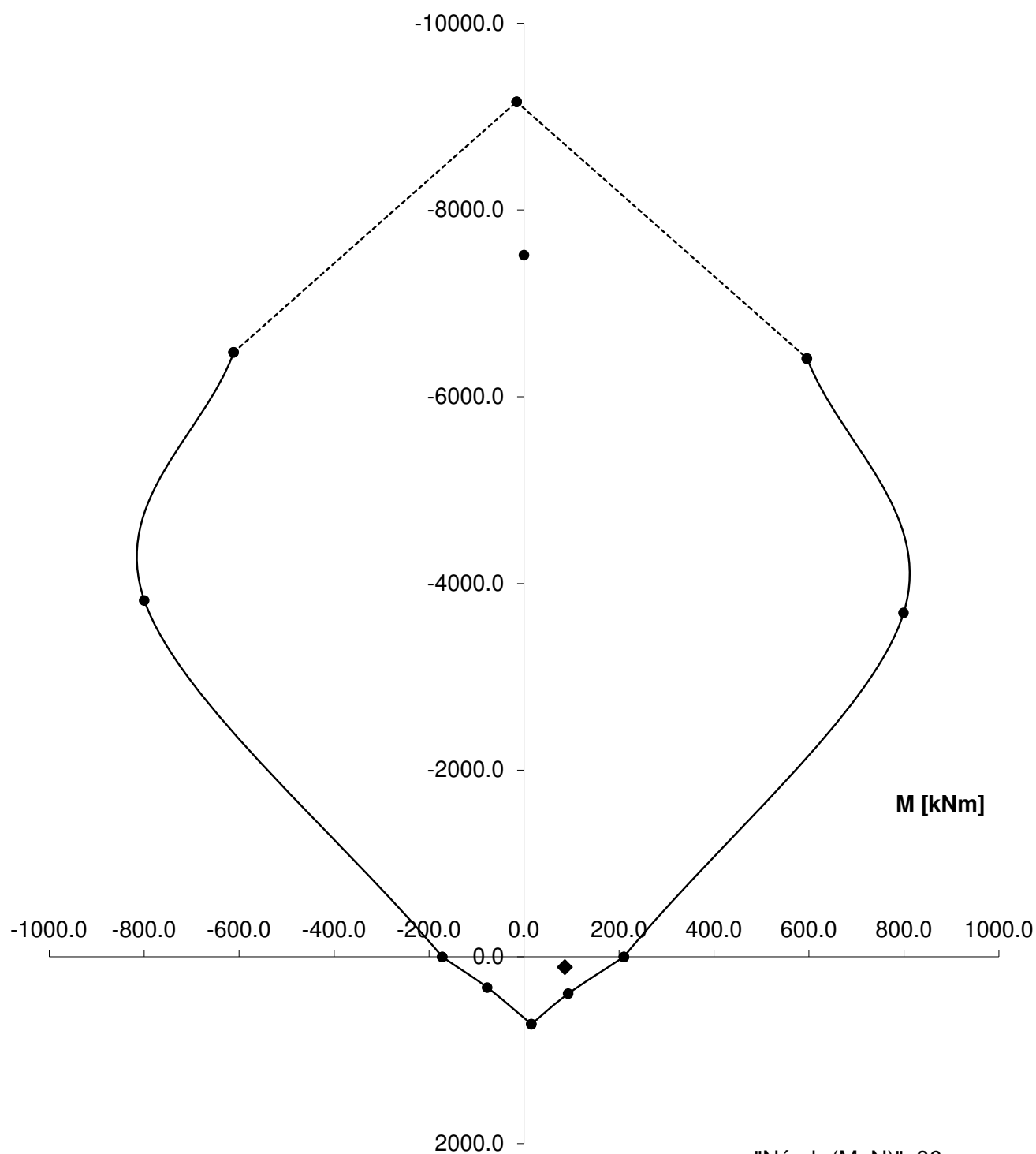
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TITLE NOT GIVEN

DATE
JAN 30,1912
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09:52:11
ICES STRUCL
VERSION MAN-MBB

TRANSCONSULT
HRAD.KRALOVE

| Průřez <u>1</u> | | | | | | | |
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| Rozměr prvku <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="margin-left: 10px;">m</div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="margin-left: 10px;">m</div> </div> </div> </div> | | Vyztužení <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="margin-left: 10px;">mm</div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="margin-left: 10px;">mm</div> </div> </div> </div> | | <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> </div> | | Průřez 1 uzel: 5540 <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> </div> | |
| Charakteristiky betonu Beton C 25/30 <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; 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| Schema | | | | | | | |
| Doplňující parametry <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> </div> </div></div></div></div> | | | | | | | |
| Bod grafu <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div style="width: 45%;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> <div style="display: flex; align-items: center;"> <div style="width: 60px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="width: 100px; border-bottom: 1px solid black; margin-bottom: 5px;"></div> </div> </div> </div> </div></div></div></div></div> | | | | | | | |

N [kN] (tlak)
Interakční diagram

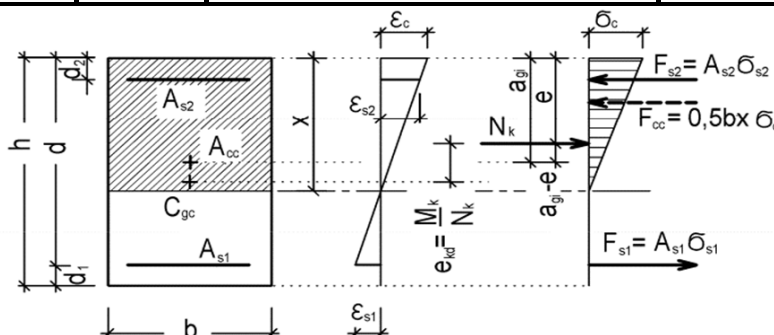


"Návrh (M, N)"; 86;
108

| VÝPOČET OMEZENÍ NAPĚTÍ ŽB PRŮŘEZU | | | | | Průřez 1 | |
|-----------------------------------|---------------|--|------------|------------------------------|-----------|-----------|
| Rozměr prvku | | Vyztužení | | φ [mm] | Počet | uzel 5540 |
| b= | 1 m | As2 | 12 | 6.67 | As2= | 754 mm² |
| h= | 0.6 m | As1 | 12 | 8 | As1= | 905 mm² |
| 323 | | | | | | |
| Charakteristiky betonu | | Charakteristiky výztuže As1, As2 | | Krytí výztuže | | |
| Beton | C 25/30 | Výztuž | B 500 B | R | | |
| fck= | 25 MPa | fyk= | 500 MPa | c min = 45 mm | | |
| fctm= | 2.6 MPa | ftk= | 550 MPa | φ třmínku = 12 mm | | |
| Ecm= | 31000 MPa | Es= | 200000 MPa | c = c min + Δh+ 57 mm | | |
| τrk= | 0.45 MPa | průměry | 8-36 mm | d1=c+φ/2 63 mm | | |
| α= | 1 | Povrch | žebírkový | d2=c+φ/2 63 mm | | |
| γc= | 1.5 | γs= | 1.15 | d = h-d1 0.537 m | | |
| fcd=αcc * fck/γc | 14.2 Mpa | fyd = fyk/γs | 434.78 Mpa | | | |
| εcd=fcd/E | 0.0035 | εyd=fyd/E | 0.00217 | | | |
| αcc | 0.85 | | | | | |
| Schema | | | | | | |
| | | | | | | |
| αe=Es/Ecm | 6.45 | | | | | |
| x= | 90.74 mm | $x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2 b A_{s1} d + A_{s2} d^2}{\alpha_e (A_{s1} + A_{s2})^2}} \right]$ | | | | |
| Iir = | 0.00141527 m⁴ | $I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d - x)^2 + A_{s2} (x - d)^2 \right]$ | | | | |
| Charakteristická kombinace | | | | | | |
| MMSP | 62.96 kNm | | | | | |
| σc= | -4.04 MPa | $\sigma_c = -\frac{M_k}{I_{ir}} x$ | <= | $ \sigma_c \leq 0,6 f_{ck}$ | 15.00 MPa | |
| ==> VYHOVUJE | | | | | | |
| σs= | 128.09 MPa | $\sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d - x)$ | <= | $\sigma_s \leq 0,8 f_{yk}$ | 400 MPa | |
| ==> VYHOVUJE | | | | | | |

| | | | | | | |
|--|---------------------------------------|---|--------------------------------------|-------------------|------------------------|---------------------------------------|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | ϕ [mm] | Počet | uzel: 5540 |
| b= | <div><div>1</div><div>m</div></div> | A _{s1} | <div><div>12</div><div>8</div></div> | A _{s1} = | 905 mm ² | |
| h= | <div><div>0.6</div><div>m</div></div> | | | | | |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | | <u>Krytí výztuže</u> | |
| Beton | <div>C 25/30</div> | Výztuž | <div>B 500 B</div> | R | | |
| f _{ck} = | 25 MPa | f _{yk} = | 500 MPa | | c min = | <div><div>45</div><div>mm</div></div> |
| f _{ctm} = | 2.6 MPa | f _{tk} = | 550 MPa | | φ třmínku = | <div><div>12</div><div>mm</div></div> |
| E _{cm} = | 31000 MPa | E _s = | <div>200000</div> MPa | | c = c min + Δh + | 57 mm |
| τ _{rk} = | 0.45 MPa | průměry | 8-36 mm | | d ₁ =c+φ/2 | 63 mm |
| α= | <div>1</div> | Povrch | žebírkový | | d = h - d ₁ | 0.537 m |
| γ _c = | <div>1.5</div> | γ _s = | <div>1.15</div> | | | |
| f _{cd} =α _{cc} * f _{ck} /γ _c | 14.2 Mpa | f _{yd} = f _{yk} /γ _s | 434.78 Mpa | | | |
| ε _{cd} =f _{cd} /E | <div>0.0035</div> | ε _{yd} =f _{yd} /E | 0.00217 | | | |
| α _{cc} | <div>0.85</div> | | | | | |

Schema



$$\alpha_e = E_s / E_{cm} = 6.45$$

$$A_c = 0.6 \text{ m}^2$$

$$I_c = 0.018 \text{ m}^4$$

Kvazistálá kombinace

$$M = 75.56 \text{ kNm}$$

$$A_i = 0.605837 \text{ m}^2$$

$$a_s = 0.237 \text{ m}$$

$$t_i = 0.002284 \text{ m}$$

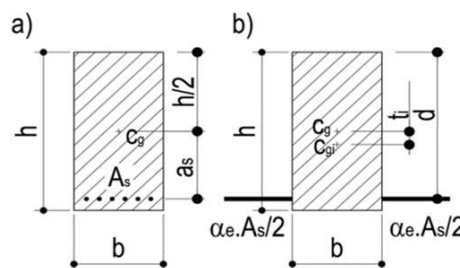
$$A_i = A_c + A_s \cdot \alpha_e$$

$$t_i = \frac{\alpha_e \cdot A_s \cdot a_s}{A_i}$$

Moment setrvačnosti plně působícího ideálního průřezu:

$$I_{ci} = 0.018325 \text{ m}^4$$

$$I_{ci} = I_c + A_c \cdot t_i^2 + \alpha_e A_s (a_s - t_i)^2$$



Obr. 1 a) Železobetonový, b) ideální plně působící průřez

Posouzení omezení napětí v tažených vláknech betonu

$$\sigma_{ct} = 1.23 \text{ MPa}$$

$$\sigma_{ct} = \frac{M_{E\psi 2} \cdot (h/2 - t_i)}{I_{ci}}$$

$$> f_{ctm} = 2.6 \text{ MPa}$$

od kvazistálé kombinace vzniknou v betonu ohybové trhliny => průřez porušený trhlinou

Posouzení šířky trhlin

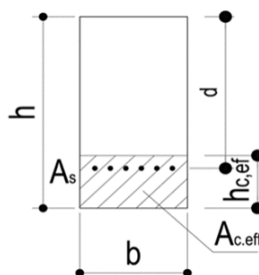
$$w_k = s_{r,max} (\epsilon_{sm} - \epsilon_{cm})$$

$$k_1 = 0.8$$

$$k_2 = 0.5$$

$$k_3 = 3.4$$

$$k_4 = 0.425$$



Posouzení betonových prvků dle EuroCode 2

$k_t =$

0.4

0.4 - dlouhodobá

0.6 - krátkodobá

| | | | | | |
|------------------|---------|----------------|--|------------|---------|
| $h_{c,ef} =$ | 0.158 | m | $h_{c,ef} = \min\{2,5 \cdot (h-d); (h-x)/3; h/2\}$ | $> d$ | 0.063 |
| d | | | $ h_{c,ef}$ | $2,5(h-d)$ | 0.158 m |
| $A_{c,ef} =$ | 0.158 | m ² | | $(h-x)/3$ | 0.175 m |
| $\rho_{c,eff} =$ | 0.00574 | | | $h/2$ | 0.300 m |

$f_{ct,eff} = f_{ctm} = 2.6 \text{ MPa}$

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{\sigma_s - k_t \frac{f_{ct,eff}}{\rho_{p,eff}} (1 + \alpha_e \cdot \rho_{p,eff})}{E_s} \geq 0,6 \frac{\sigma_s}{E_s}$$

$\varepsilon_{sm} - \varepsilon_{cm} = 0.000489 \quad \geq \quad 0.000489 \quad \Rightarrow \text{VYHOVUJE}$

Výpočet napětí σ_s

$x = 73.56 \text{ mm} \quad x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2b}{\alpha_e} \frac{A_{s1}d + A_{s2}d_2}{(A_{s1} + A_{s2})^2}} \right]$

$I_{ir} = 0.00138639 \text{ m}^4 \quad I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d-x)^2 + A_{s2} (x-d_2)^2 \right]$

$\sigma_s = 162.95 \text{ MPa} \quad \sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d-x)$

Šířka trhliny

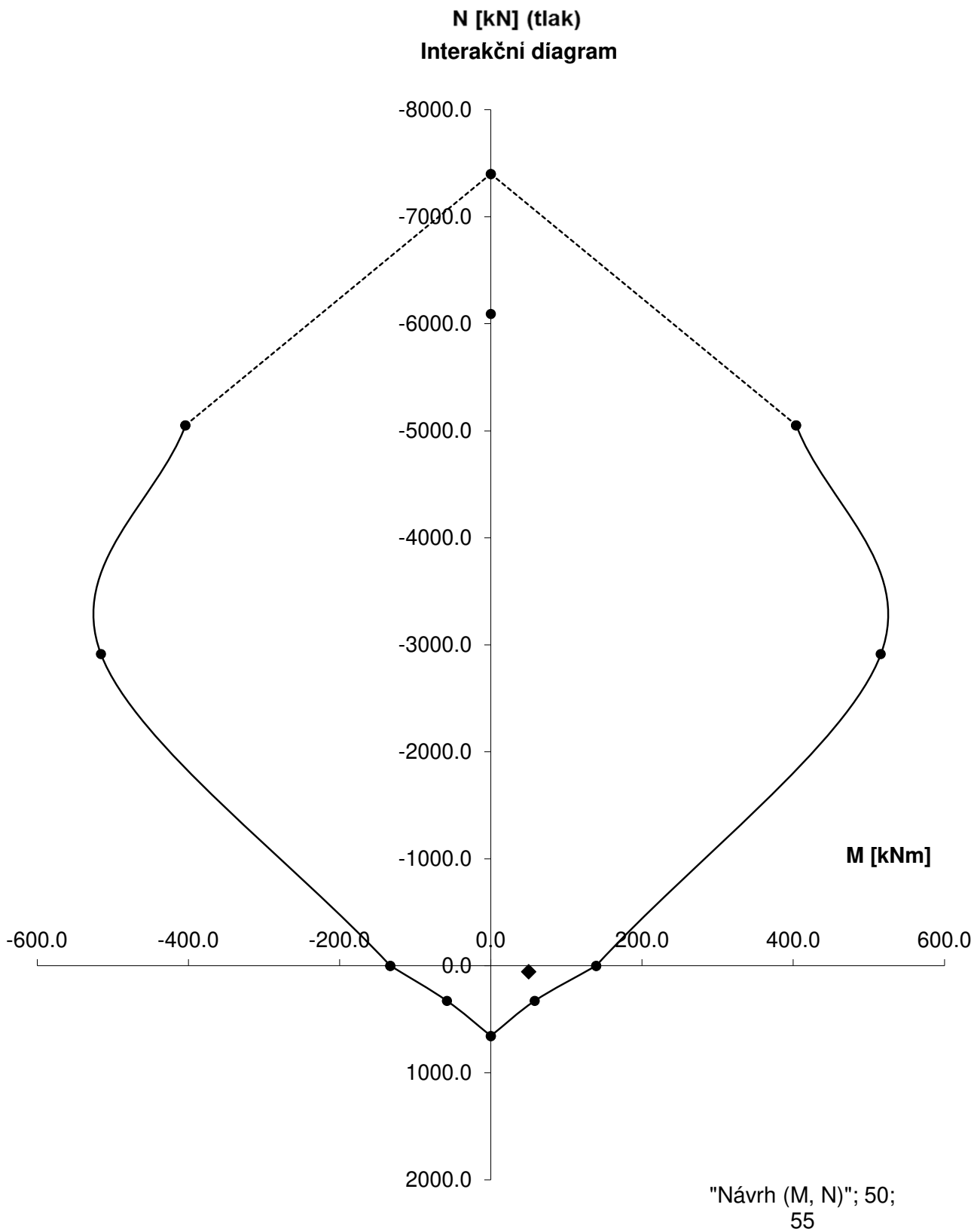
dle (EN 1991-1-1 čl. 7.3.4) $w_k = s_{r,max} (\varepsilon_{sm} - \varepsilon_{cm})$

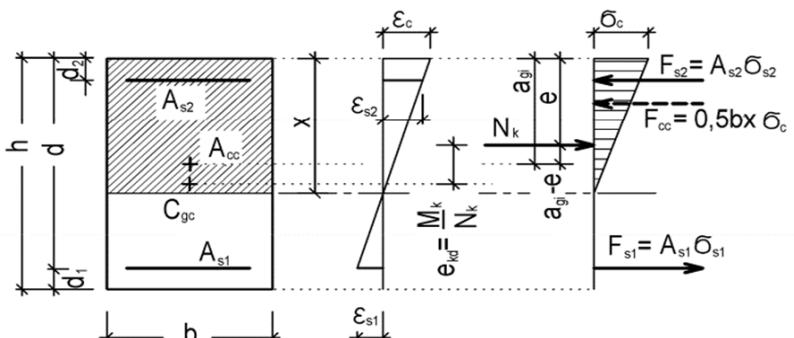
maximální vzdálenost trhlin

$s_{r,max} = 355.27 \text{ mm} \quad s_{r,max} = k_3 c + k_1 k_2 k_4 \phi / \rho_{p,eff}$

$w_k = 0.174 \text{ mm} \quad < \quad w_{lim} \quad \boxed{0.3} \text{ mm} \quad \Rightarrow \text{VYHOVUJE}$

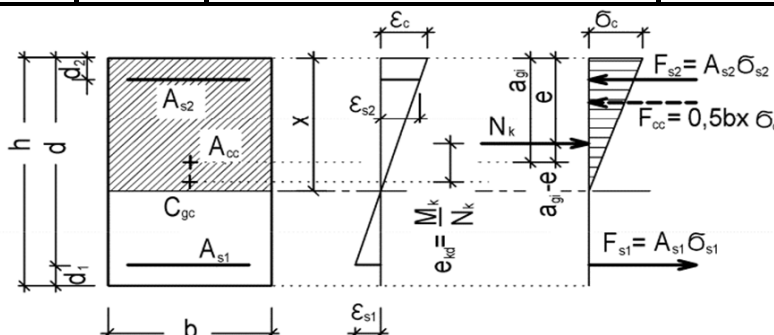
| Průřez 22 | | | |
|--|------------|------------------------------------|---|
| Rozměr prvku | | Vyztužení | |
| b= | 1 m | ϕ [mm] | Počet |
| h= | 0.48 m | As2 | 12 6.67 |
| | | As1 | 12 6.67 |
| | | As2= | 754.36 mm ² |
| | | As1= | 754.36 mm ² |
| Charakteristiky betonu | | Charakteristiky výztuže As1 | |
| Beton | C 25/30 ▼ | Výztuž | B 500 B ▼ R |
| f_{ck} = | 25 MPa | f_{yk} = | 500 MPa |
| f_{ctm} = | 2.6 MPa | f_{tk} = | 550 MPa |
| E_{cm} = | 31000 MPa | E_s = | 200000 MPa |
| τ_{rk} = | 0.45 MPa | průměry | 8-36 mm |
| α = | 1 | Povrch | žebírkový |
| γ_c = | 1.5 | γ_s = | 1.15 |
| $f_{cd} = \alpha_{cc} * f_{ck} / \gamma_c$ | 14.2 Mpa | $f_{yd} = f_{yk} / \gamma_s$ | 434.78 Mpa |
| $\epsilon_{cd} = f_{cd} / E$ | 0.0035 | $\epsilon_{yd} = f_{yd} / E$ | 0.00217 |
| α_{cc} | 0.85 | | |
| | | Krytí výztuže | |
| | | c min = | 45 mm |
| | | ϕ třmínku = | 12 mm |
| | | c = cmin + Δh + | 57 mm |
| | | d1 = c + ϕ / 2 | 63 mm |
| | | d2 = c + ϕ / 2 | 63 mm |
| | | d = h - d1 | 0.417 m |
| | | d' = h - d2 | 0.417 m |
| Schema | | | |
| | | | |
| Doplňující parametry | | | |
| σ_s | 434.78 Mpa | Fs1 = As1 * f_{yd} | 327.98 KN |
| ξ_{lim} | 0.617 | Fs2 = As2 * f_{yd} | 327.98 KN |
| ξ_{lim2} | 2.639 | $\Delta F_s = F_{s2} - F_{s1}$ | 0.0000 KN |
| ρ | 0.00314317 | $\xi_{lim2} * d2 =$ | 0.1663 [1] |
| z1 | 0.177 m | $\xi_{lim2} * d1 =$ | 0.1663 [1] |
| z2 | 0.177 m | $\xi_{lim} * d =$ | 0.2572 [1] |
| zs | 0.354 m | $\xi_{lim} * d' =$ | 0.2572 [1] |
| Bod grafu | | | |
| | Mrd [KNm] | Nrd [KN] | Mrd [KNm] |
| 0 | 0.0 | -7400.3 | |
| 1 | 403.8 | -5051.8 | d > $\xi_{lim2} * d2$ PRAVDA |
| 2 | 515.6 | -2913.9 | $\xi_{lim} * d > \xi_{lim2} * d2$ PRAVDA |
| 3 | 139.4 | 0.0 | |
| 4 | 58.1 | 328.0 | |
| 5 | 0.0 | 656.0 | |
| 4' | -58.1 | 328.0 | |
| 3' | -133.0 | 0.0 | |
| 2' | -515.6 | -2913.9 | $\xi_{lim} * d' > \xi_{lim2} * d1$ PRAVDA |
| 1' | -403.8 | -5051.8 | |
| 0 | 0.0 | -7400.3 | |
| 0' | 0.0 | -6093.4 | |
| | 50 | 55 | |



| VÝPOČET OMEZENÍ NAPĚTÍ ŽB PRŮŘEZU | | | | Průřez 22 |
|---|---------------------------|--|------------|---|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | <u>uzel</u> 5536 |
| b= | 1 m | ϕ [mm] | 12 | $A_{s2}=$ 754 mm ² |
| h= | 0.48 m | | 6.67 | $A_{s1}=$ 754 mm ² |
| 323 | | | | |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | <u>Krytí výztuže</u> |
| Beton | C 25/30 | Výztuž | B 500 B | R |
| $f_{ck}=$ | 25 MPa | $f_{yk}=$ | 500 MPa | |
| $f_{ctm}=$ | 2.6 MPa | $f_{tk}=$ | 550 MPa | |
| $E_{cm}=$ | 31000 MPa | $E_s=$ | 200000 MPa | |
| $\tau_{rk}=$ | 0.45 MPa | průměry | 8-36 mm | |
| $\alpha=$ | 1 | Povrch | žebírkový | |
| $\gamma_c=$ | 1.5 | $\gamma_s=$ | 1.15 | |
| $f_{cd}=\alpha_{cc} \cdot f_{ck} / \gamma_c$ | 14.2 Mpa | $f_{yd}=f_{yk} / \gamma_s$ | 434.78 Mpa | |
| $\varepsilon_{cd}=f_{cd} / E$ | 0.0035 | $\varepsilon_{yd}=f_{yd} / E$ | 0.00217 | |
| α_{cc} | 0.85 | | | |
| <u>Schema</u> | | | | |
|  | | | | |
| $\alpha_e=E_s/E_{cm}$ | 6.45 | | | |
| x= | 80.44 mm | $x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2 b A_{s1} d + A_{s2} d_2}{\alpha_e (A_{s1} + A_{s2})^2}} \right]$ | | |
| $I_{ir} =$ | 0.00072627 m ⁴ | $I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d - x)^2 + A_{s2} (x - d_2)^2 \right]$ | | |
| <u>Charakteristická kombinace</u> | | | | |
| M_{MSP} | 37.04 kNm | | | |
| $\sigma_c=$ | -4.10 MPa | $\sigma_c = -\frac{M_k}{I_{ir}} x$ | <= | $ \sigma_c \leq 0,6 f_{ck}$ 15.00 MPa ==> VYHOVUJE |
| $\sigma_s=$ | 110.73 MPa | $\sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d - x)$ | <= | $\sigma_s \leq 0,8 f_{yk}$ 400 MPa ==> VYHOVUJE |

| | | | | | |
|--|-----------|--|-------------|------------------------|---------------------------|
| Rozměr prvku | | Vyztužení | ϕ [mm] | Počet | uzel: 5536 |
| b= | 1 m | A_{s1} | 12 | 6.67 | $A_{s1}=754 \text{ mm}^2$ |
| h= | 0.48 m | | | | |
| Charakteristiky betonu | | Charakteristiky výztuže A_{s1}, A_{s2} | | Krytí výztuže | |
| Beton | C 25/30 | Výztuž | B 500 B | R | |
| $f_{ck}=$ | 25 MPa | $f_{yk}=$ | 500 MPa | $c_{\min}=$ | 45 mm |
| $f_{ctm}=$ | 2.6 MPa | $f_{tk}=$ | 550 MPa | ϕ třmínku = | 12 mm |
| $E_{cm}=$ | 31000 MPa | $E_s=$ | 200000 MPa | $c=c_{\min}+\Delta h+$ | 57 mm |
| $\tau_{rk}=$ | 0.45 MPa | průměry | 8-36 mm | $d_1=c+\phi/2$ | 63 mm |
| $\alpha=$ | 1 | Povrch | žebírkový | $d=h-d_1$ | 0.417 m |
| $\gamma_c=$ | 1.5 | $\gamma_s=$ | 1.15 | | |
| $f_{cd}=\alpha_{cc} \cdot f_{ck}/\gamma_c$ | 14.2 Mpa | $f_{yd}=f_{yk}/\gamma_s$ | 434.78 Mpa | | |
| $\epsilon_{cd}=f_{cd}/E$ | 0.0035 | $\epsilon_{yd}=f_{yd}/E$ | 0.00217 | | |
| α_{cc} | 0.85 | | | | |

Schema



$$\alpha_e = E_s/E_{cm} = 6.45$$

$$A_c = 0.48 \text{ m}^2$$

$$I_c = 0.009216 \text{ m}^4$$

Kvazistálá kombinace

$$M = 44.44 \text{ kNm}$$

$$A_i = 0.484867 \text{ m}^2$$

$$a_s = 0.177 \text{ m}$$

$$t_i = 0.001777 \text{ m}$$

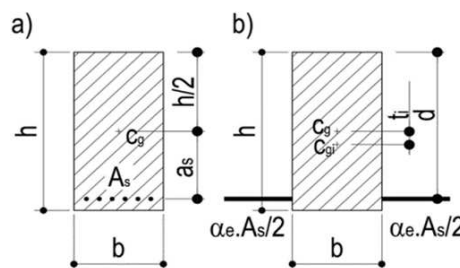
$$A_i = A_c + A_s \cdot \alpha_e$$

$$t_i = \frac{\alpha_e \cdot A_s \cdot a_s}{A_i}$$

Moment setrvačnosti plně působícího ideálního průřezu:

$$I_{ci} = 0.009367 \text{ m}^4$$

$$I_{ci} = I_c + A_c \cdot t_i^2 + \alpha_e A_s (a_s - t_i)^2$$



Obr. 1 a) Železobetonový, b) ideální plně působící průřez

Posouzení omezení napětí v tažených vláknech betonu

$$\sigma_{ct} = 1.13 \text{ MPa}$$

$$\sigma_{ct} = \frac{M_{E\psi 2} \cdot (h/2 - t_i)}{I_{ci}}$$

$$> f_{ctm} = 2.6 \text{ MPa}$$

od kvazistálé kombinace vzniknou v betonu ohybové trhliny \Rightarrow průřez porušený trhlinou

Posouzení šířky trhlin

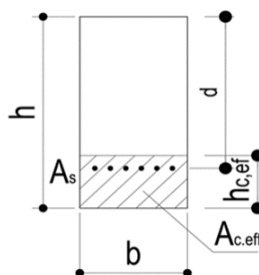
$$w_k = s_{r,max} (\epsilon_{sm} - \epsilon_{cm})$$

$$k_1 = 0.8$$

$$k_2 = 0.5$$

$$k_3 = 3.4$$

$$k_4 = 0.425$$



Posouzení betonových prvků dle EuroCode 2

$k_t =$

0.4

0.4 - dlouhodobá

0.6 - krátkodobá

| | | | | | |
|------------------|---------|----------------|--|------------|---------|
| $h_{c,ef} =$ | 0.140 | m | $h_{c,ef} = \min\{2,5 \cdot (h-d); (h-x)/3; h/2\}$ | $> d$ | 0.063 |
| d | | | $h_{c,ef}$ | $2,5(h-d)$ | 0.158 m |
| $A_{c,ef} =$ | 0.140 | m ² | | $(h-x)/3$ | 0.140 m |
| $\rho_{c,eff} =$ | 0.00538 | | | $h/2$ | 0.240 m |

$f_{ct,eff} = f_{ctm} = 2.6 \text{ MPa}$

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{\sigma_s - k_t \frac{f_{ct,eff}}{\rho_{p,eff}} (1 + \alpha_e \cdot \rho_{p,eff})}{E_s} \geq 0,6 \frac{\sigma_s}{E_s}$$

$\varepsilon_{sm} - \varepsilon_{cm} = 0.000445 \quad \geq \quad 0.000445 \quad \Rightarrow \text{VYHOVUJE}$

Výpočet napětí σ_s

$x = 59.03 \text{ mm} \quad x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2b}{\alpha_e} \frac{A_{s1}d + A_{s2}d_2}{(A_{s1} + A_{s2})^2}} \right]$

$I_{ir} = 0.00069221 \text{ m}^4 \quad I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d-x)^2 + A_{s2} (x-d_2)^2 \right]$

$\sigma_s = 148.28 \text{ MPa} \quad \sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d-x)$

Šířka trhliny

dle (EN 1991-1-1 čl. 7.3.4) $w_k = s_{r,max} (\varepsilon_{sm} - \varepsilon_{cm})$

maximální vzdálenost trhlin

$s_{r,max} = 379.63 \text{ mm} \quad s_{r,max} = k_3 c + k_1 k_2 k_4 \phi / \rho_{p,eff}$

$w_k = 0.169 \text{ mm} \quad < \quad w_{lim} \quad \boxed{0.3} \text{ mm} \quad \Rightarrow \text{VYHOVUJE}$

Geometrie průřezu

| | | |
|-------|------|---|
| b_w | 1 | m |
| h | 0.48 | m |

Průběh vnitřních sil V_{ED} , N_{ED}

| | | |
|------------|-------|----|
| V_{ED} | 100.0 | kN |
| $V_{ED,0}$ | 100.0 | kN |
| N_{ED} | 0 | kN |
| L_{ED} | 0.75 | m |

Vlastnosti betonu:

C 25/30 ▼

| | | |
|--|-------|-----|
| f_{ck} | 25 | MPa |
| f_{ctm} | 2.6 | MPa |
| E_{cm} | 31 | Gpa |
| τ_{rk} | 3 | MPa |
| α_{cc} | 0.85 | |
| γ_c | 1.5 | |
| $f_{cd} = \alpha_{cc} \cdot f_{ck} / \gamma_c$ | 14.17 | MPa |
| $v = 0.6 \cdot (1 - (f_{ck} / 250))$ | 0.54 | MPa |

Vlastnosti výztuže

B 500 B ▼

| | | |
|------------|--------|-----|
| f_{ywk} | 500 | MPa |
| γ_s | 1.15 | |
| f_{ywd} | 434.78 | MPa |

Krytí výztuže betonem

| | | |
|---------------------------|----|----|
| c_{nom} | 45 | mm |
| ϕ_{tr} | 12 | mm |
| $c = c_{nom} + \phi_{tr}$ | 57 | mm |

Podélná výztuž

| | | |
|----------|--------|-----------------|
| d_{s1} | 12 | mm |
| počet | 6.67 | ks |
| A_{s1} | 754.35 | mm ² |

Účinná výška průřezu

| | | |
|------------------------|-------|----|
| $d_1 = c + d_{s1} / 2$ | 63 | mm |
| $d = h - d_1$ | 0.417 | m |

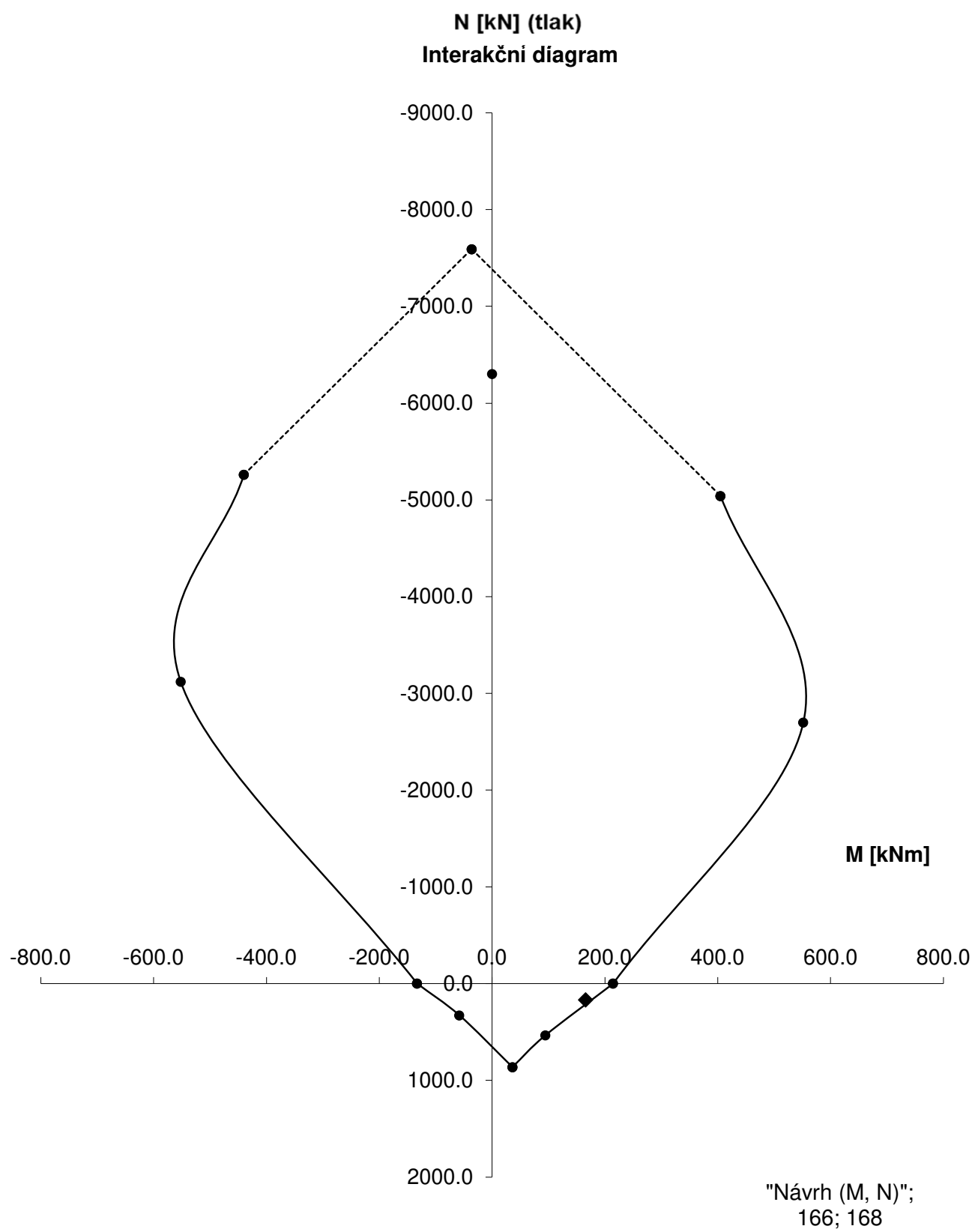
Návrhová smyková únosnost nevztláčeného betonového průřezu

| | |
|---------------|----------|
| k | 1.7 |
| ρ_1 | 0.002 |
| σ_{cp} | 0.00 MPa |
| v_{min} | 0.39 MPa |
| k_1 | 0.15 |
| $V_{Rd,c}$ | 140.1 kN |
| $V_{Rd,cm}$ | 160.7 kN |
| $V_{Rd,c}$ | 160.7 kN |

Posouzení

| | | |
|---------------------------------------|---|------------|
| V_{ED} | < | $V_{Rd,c}$ |
| 100 kN | | 160.6 kN |
| Vyhovuje - smyková výztuž konstrukčně | | |

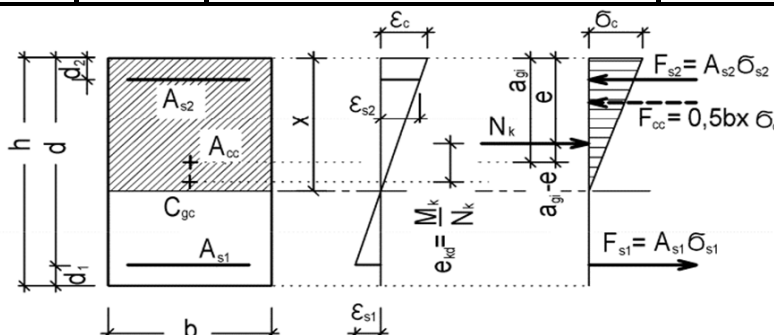
| Průřez 3 | | | | | | | | | |
|--|--|--|--|---|--|--|--|---|--|
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| VÝPOČET OMEZENÍ NAPĚTÍ ŽB PRŮŘEZU | | | | Průřez 3 |
|---|---------------------------|--|------------|---|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | uzel 5001 |
| b= | 1 m | ϕ [mm] | Počet | |
| h= | 0.48 m | A _{s2} | 12 6.67 | A _{s2} = 754 mm ² |
| 323 | | A _{s1} | 14 8 | A _{s1} = 1232 mm ² |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | <u>Krytí výztuže</u> |
| Beton | C 25/30 | Výztuž | B 500 B | R |
| f _{ck} = | 25 MPa | f _{yk} = | 500 MPa | |
| f _{ctm} = | 2.6 MPa | f _{tk} = | 550 MPa | |
| E _{cm} = | 31000 MPa | E _s = | 200000 MPa | |
| τ _{rk} = | 0.45 MPa | průměry | 8-36 mm | |
| α= | 1 | Povrch | žebírkový | |
| γ _c = | 1.5 | γ _s = | 1.15 | |
| f _{cd} =α _{cc} ·f _{ck} /γ _c | 14.2 Mpa | f _{yd} =f _{yk} /γ _s | 434.78 Mpa | |
| ε _{cd} =f _{cd} /E | 0.0035 | ε _{yd} =f _{yd} /E | 0.00217 | |
| α _{cc} | 0.85 | | | |
| <u>Schema</u> | | | | |
| | | | | |
| α _e =E _s /E _{cm} | 6.45 | | | |
| x= | 98.85 mm | $x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2 b A_{s1} d + A_{s2} d^2}{\alpha_e (A_{s1} + A_{s2})^2}} \right]$ | | |
| I _{ir} = | 0.00112740 m ⁴ | $I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d - x)^2 + A_{s2} (x - d_2)^2 \right]$ | | |
| <u>Charakteristická kombinace</u> | | | | |
| M _{MSP} | 122.96 kNm | | | |
| σ _c = | -10.78 MPa | $\sigma_c = -\frac{M_k}{I_{ir}} x$ | <= | $ \sigma_c \leq 0,6 f_{ck}$ 15.00 MPa ==> VYHOVUJE |
| σ _s = | 223.16 MPa | $\sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d - x)$ | <= | $\sigma_s \leq 0,8 f_{yk}$ 400 MPa ==> VYHOVUJE |

| | | | | | | |
|--|--|--|--------------------------------------|----------------------|----------------------------|---------------------------------------|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | ϕ [mm] | Počet | uzel: <u>5001</u> |
| b= | <div><div>1</div><div>m</div></div> | A _{s1} | <div><div>14</div><div>8</div></div> | A _{s1} = | 1232 mm ² | |
| h= | <div><div>0.48</div><div>m</div></div> | | | | | |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | <u>Krytí výztuže</u> | | |
| Beton | <div>C 25/30<div></div></div> | Výztuž | <div>B 500 B<div></div></div> | R | | |
| f _{ck} = | 25 MPa | f _{yk} = | 500 MPa | | c min = | <div><div>45</div><div>mm</div></div> |
| f _{ctm} = | 2.6 MPa | f _{tk} = | 550 MPa | | ϕ třmínku = | <div><div>12</div><div>mm</div></div> |
| E _{cm} = | 31000 MPa | E _s = | <div>200000</div> MPa | | c = c min + Δh + | 57 mm |
| τ _{rk} = | 0.45 MPa | průměry | 8-36 | mm | d ₁ = c + ϕ / 2 | 64 mm |
| α = | <div>1</div> | Povrch | žebírkový | | d = h - d ₁ | 0.416 m |
| γ _c = | <div>1.5</div> | γ _s = | <div>1.15</div> | | | |
| f _{cd} = α _{cc} * f _{ck} / γ _c | 14.2 Mpa | f _{yd} = f _{yk} / γ _s | 434.78 Mpa | | | |
| ε _{cd} = f _{cd} / E | <div>0.0035</div> | ε _{yd} = f _{yd} / E | 0.00217 | | | |
| α _{cc} | <div>0.85</div> | | | | | |

Schema



$$\alpha_e = E_s / E_{cm} = 6.45$$

$$A_c = 0.48 \text{ m}^2$$

$$I_c = 0.009216 \text{ m}^4$$

Kvazistálá kombinace

$$M = 147.56 \text{ kNm}$$

$$A_i = 0.487945 \text{ m}^2$$

$$a_s = 0.176 \text{ m}$$

$$t_i = 0.002866 \text{ m}$$

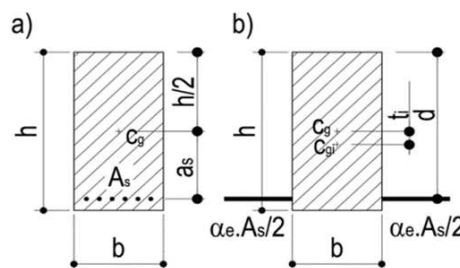
$$A_i = A_c + A_s \cdot \alpha_e$$

$$t_i = \frac{\alpha_e \cdot A_s \cdot a_s}{A_i}$$

Moment setrvačnosti plně působícího ideálního průřezu:

$$I_{ci} = 0.009458 \text{ m}^4$$

$$I_{ci} = I_c + A_c \cdot t_i^2 + \alpha_e A_s (a_s - t_i)^2$$



Obr. 1 a) Železobetonový, b) ideální plně působící průřez

Posouzení omezení napětí v tažených vláknech betonu

$$\sigma_{ct} = 3.70 \text{ MPa}$$

$$\sigma_{ct} = \frac{M_{E\psi 2} \cdot (h/2 - t_i)}{I_{ci}}$$

$$> f_{ctm} = 2.6 \text{ MPa}$$

od kvazistálé kombinace vzniknou v betonu ohybové trhliny \Rightarrow průřez porušený trhlinou

Posouzení šířky trhlin

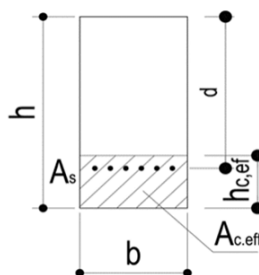
$$w_k = s_{r,max} (\epsilon_{sm} - \epsilon_{cm})$$

$$k_1 = 0.8$$

$$k_2 = 0.5$$

$$k_3 = 3.4$$

$$k_4 = 0.425$$



Posouzení betonových prvků dle EuroCode 2

$k_t =$

0.4

0.4 - dlouhodobá

0.6 - krátkodobá

| | | | | | |
|------------------|---------|----------------|--|------------|---------|
| $h_{c,ef} =$ | 0.135 | m | $h_{c,ef} = \min\{2,5 \cdot (h-d); (h-x)/3; h/2\}$ | $> d$ | 0.064 |
| d | | | $ h_{c,ef}$ | $2,5(h-d)$ | 0.160 m |
| $A_{c,ef} =$ | 0.135 | m ² | | $(h-x)/3$ | 0.135 m |
| $\rho_{c,eff} =$ | 0.00909 | | | $h/2$ | 0.240 m |

$f_{ct,eff} = f_{ctm} = 2.6 \text{ MPa}$

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{\sigma_s - k_t \frac{f_{ct,eff}}{\rho_{p,eff}} (1 + \alpha_e \cdot \rho_{p,eff})}{E_s} \geq 0,6 \frac{\sigma_s}{E_s}$$

$\varepsilon_{sm} - \varepsilon_{cm} = 0.000925 \quad \geq \quad 0.000918 \quad \Rightarrow \text{VYHOVUJE}$

Výpočet napětí σ_s

$x = 73.75 \text{ mm} \quad x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2b}{\alpha_e} \frac{A_{s1}d + A_{s2}d_2}{(A_{s1} + A_{s2})^2}} \right]$

$I_{ir} = 0.00106437 \text{ m}^4 \quad I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d-x)^2 + A_{s2} (x-d_2)^2 \right]$

$\sigma_s = 306.11 \text{ MPa} \quad \sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d-x)$

Šířka trhliny

dle (EN 1991-1-1 čl. 7.3.4) $w_k = s_{r,max} (\varepsilon_{sm} - \varepsilon_{cm})$

maximální vzdálenost trhlin

$s_{r,max} = 261.86 \text{ mm} \quad s_{r,max} = k_3 c + k_1 k_2 k_4 \phi / \rho_{p,eff}$

$w_k = 0.242 \text{ mm} \quad < \quad w_{lim} \quad \boxed{0.3} \text{ mm} \quad \Rightarrow \text{VYHOVUJE}$

Geometrie průřezu

| | | |
|-------|-----|---|
| b_w | 1 | m |
| h | 0.6 | m |

Průběh vnitřních sil V_{ED} , N_{ED}

| | | |
|------------|-------|----|
| V_{ED} | 873.0 | kN |
| $V_{ED,0}$ | 873.0 | kN |
| N_{ED} | 0 | kN |
| L_{ED} | 0.75 | m |

Vlastnosti betonu:

C 25/30

| | | |
|--|-------|-----|
| f_{ck} | 25 | MPa |
| f_{ctm} | 2.6 | MPa |
| E_{cm} | 31 | GPa |
| τ_{rk} | 3 | MPa |
| α_{cc} | 0.85 | |
| γ_c | 1.5 | |
| $f_{cd} = \alpha_{cc} \cdot f_{ck} / \gamma_c$ | 14.17 | MPa |
| $v = 0.6 \cdot (1 - (f_{ck} / 250))$ | 0.54 | MPa |

Vlastnosti výztuže

B 500 B

| | | |
|------------|--------|-----|
| f_{ywk} | 500 | MPa |
| γ_s | 1.15 | |
| f_{ywd} | 434.78 | MPa |

Krytí výztuže betonem

| | | |
|---------------------------|----|----|
| c_{nom} | 45 | mm |
| ϕ_{tr} | 12 | mm |
| $c = c_{nom} + \phi_{tr}$ | 57 | mm |

Podélná výztuž

| | | |
|----------|---------|-----------------|
| d_{s1} | 14 | mm |
| počet | 8 | ks |
| A_{s1} | 1231.49 | mm ² |

Účinná výška průřezu

| | | |
|------------------------|-------|----|
| $d_1 = c + d_{s1} / 2$ | 64 | mm |
| $d = h - d_1$ | 0.536 | m |

Návrhová smyková únosnost nevytluženého betonového průřezu

| | |
|---------------|----------|
| k | 1.6 |
| ρ_1 | 0.002 |
| σ_{cp} | 0.00 MPa |
| v_{min} | 0.36 MPa |
| k_1 | 0.15 |
| $V_{Rd,c}$ | 185.6 kN |
| $V_{Rd,cm}$ | 191.8 kN |
| $V_{Rd,c}$ | 191.8 kN |

Posouzení

| | | |
|----------|---|------------|
| V_{ED} | > | $V_{Rd,c}$ |
| 873 kN | | 191.7 kN |

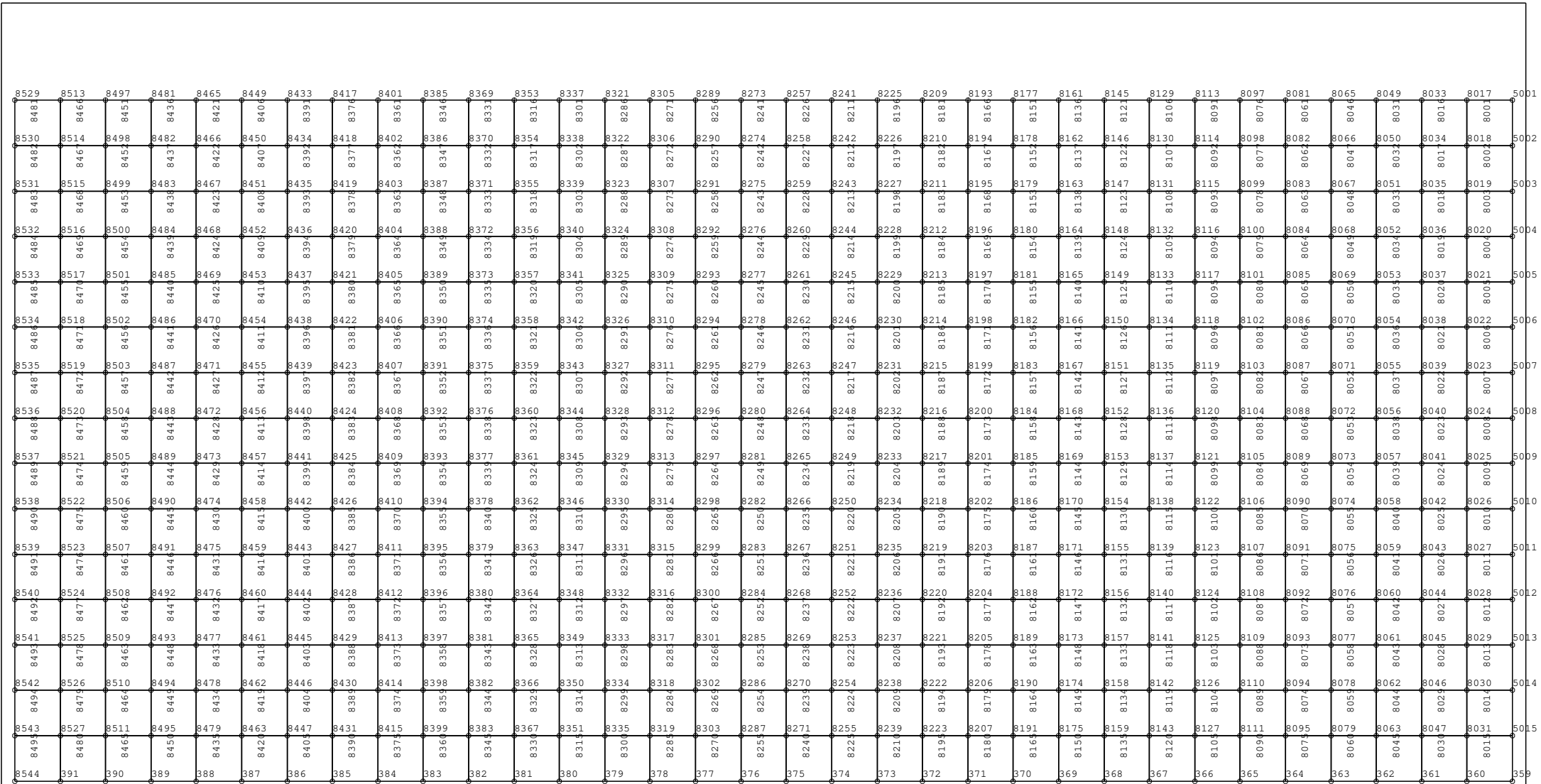
Nevyhovuje - nutný návrh smykové výztuže

Návrh smykové výztuže

| | | | |
|----------------|---------|--------|-------------------|
| $\cot \Phi$ | 2.5 | Φ | 21.80 ° |
| $V_{Rd,max} =$ | 1272.54 | > | V_{ED} 873.0 kN |
| $\cot \Phi$ | 1 | Φ | 45.00 ° |
| $V_{Rd,max} =$ | 1845.18 | > | V_{ED} 873.0 kN |

Tříminky, spony

| | | | |
|------------------|------------------------|-----------|----------------------|
| β | 100% | | |
| $\rho_{w,st}$ | 0.00166 | | |
| ϕ_{sw} | 10 mm | | |
| n | 5 ks | | $s_{t,max}$ |
| s_{st} | 200 mm | < | 402 mm |
| $A_{sw,st}$ | 392.70 mm ² | | |
| z | 0.4824 m | | |
| $\rho_{w,min}$ | 0.00080 | | |
| $\rho_{w,st}$ | 0.00196 | > | 0.00166 |
| s | < | 490.87 mm | |
| $V_{rd,st}$ | 1029.55 kN | | |
| Posouzení | | | |
| V_{rd} | 1029.55 | > | $V_{ed,0}$ 873.00 kN |



L

SCALE REDUCTION
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Y 1.000
Z 1.000
SCALE LENGTH
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GEOMETRY

SET 501K1

Backovice obl most - ulozny prah

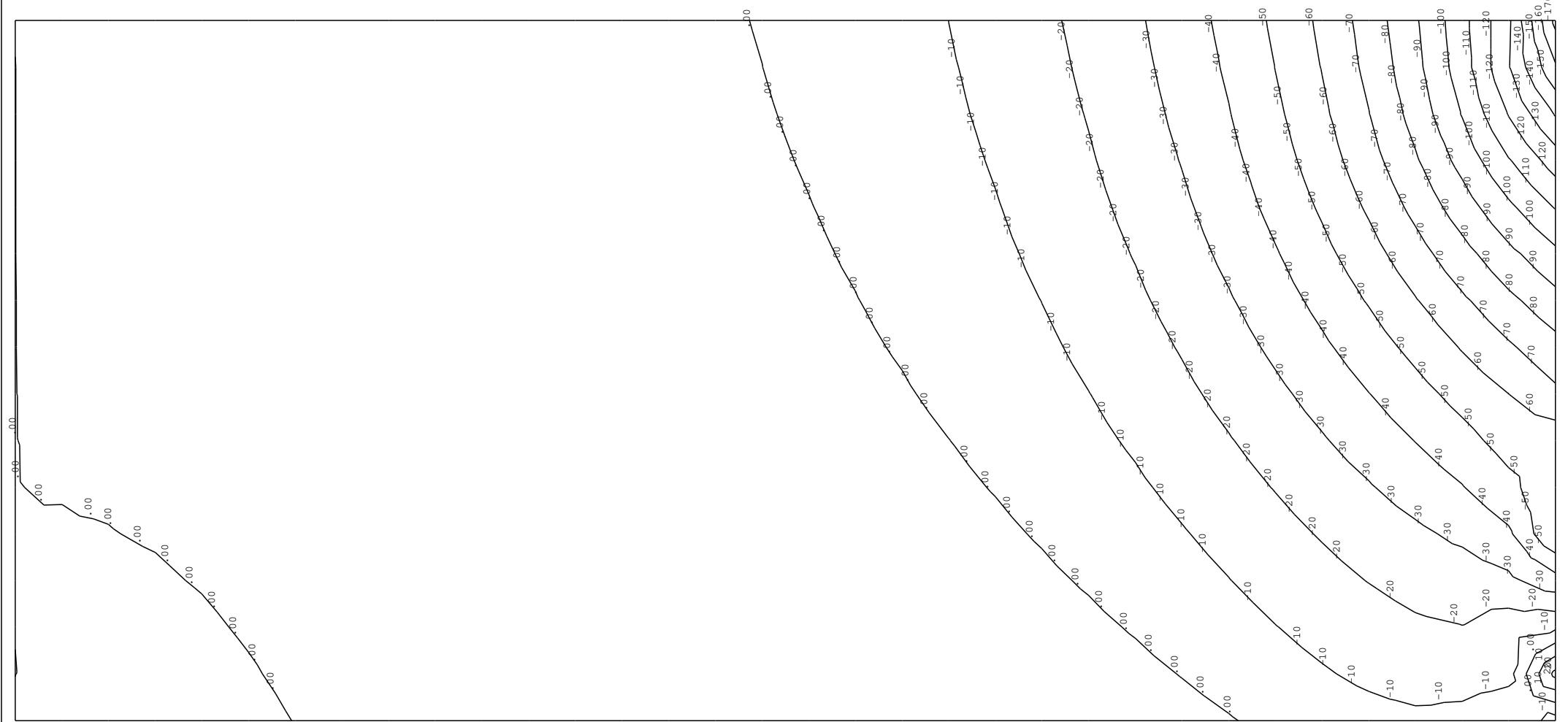
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JAN 30, 1912

TIME
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ICES STRUOL
VERSION MAN-MBB

TRANSCONSULT

HRAD. KRALOVE



← y

↑ z

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SECTION FORCE

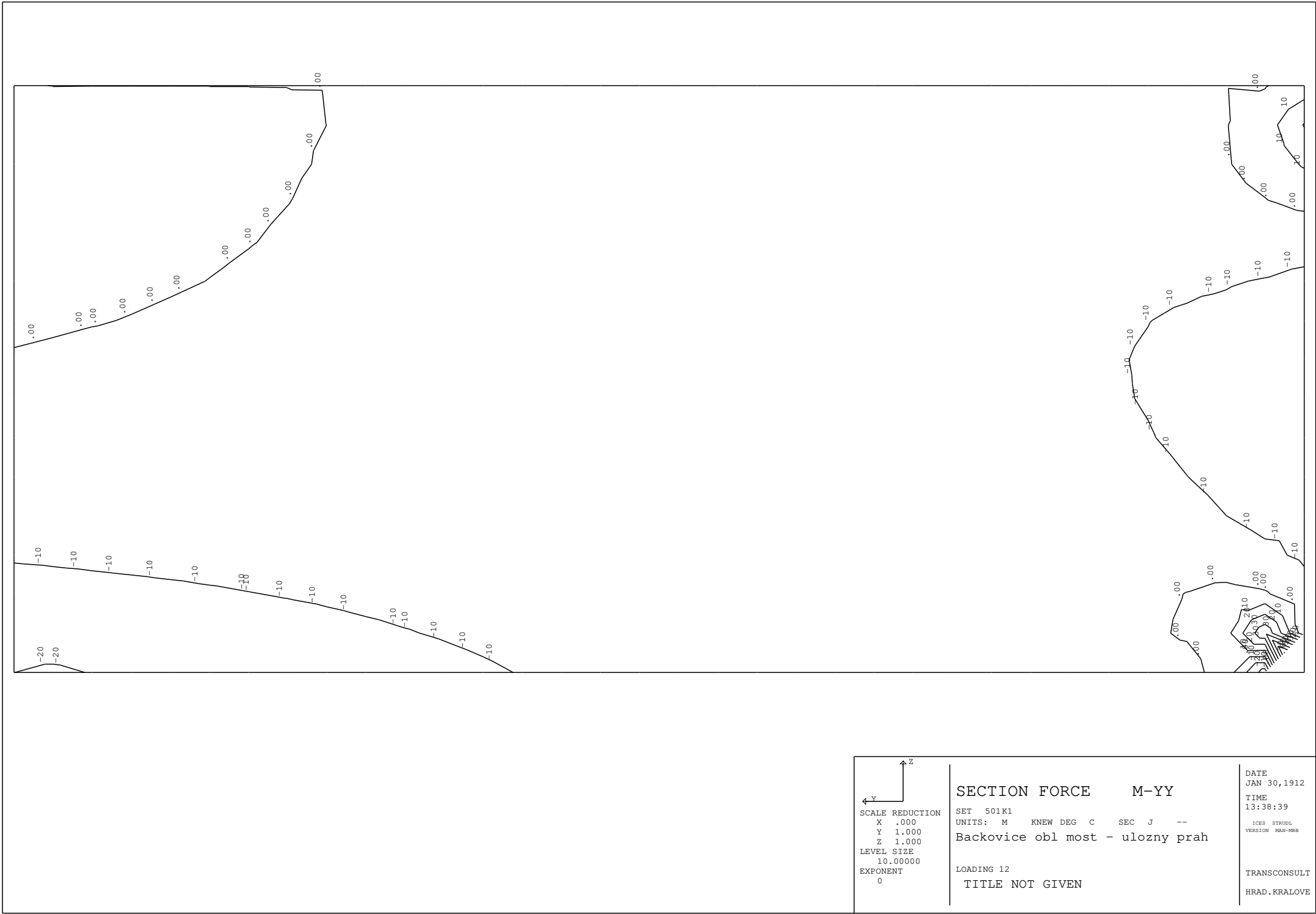
M-XX

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Backovice obl most - ulozny prah

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JAN 30,1912
TIME
13:38:37
ICES STRUOL
VERSION MAN-MBB

TRANSCONSULT
HRAD.KRALOVE



SCALE REDUCTION

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Y 1.000

Z 1.000

LEVEL SIZE

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EXPONENT

0

SECTION FORCE

M-YY

SET 501K1

UNITS: M KNEW DEG C SEC J --

Backovice obl most - ulozny prah

LOADING 12

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DATE

JAN 30,1912

TIME

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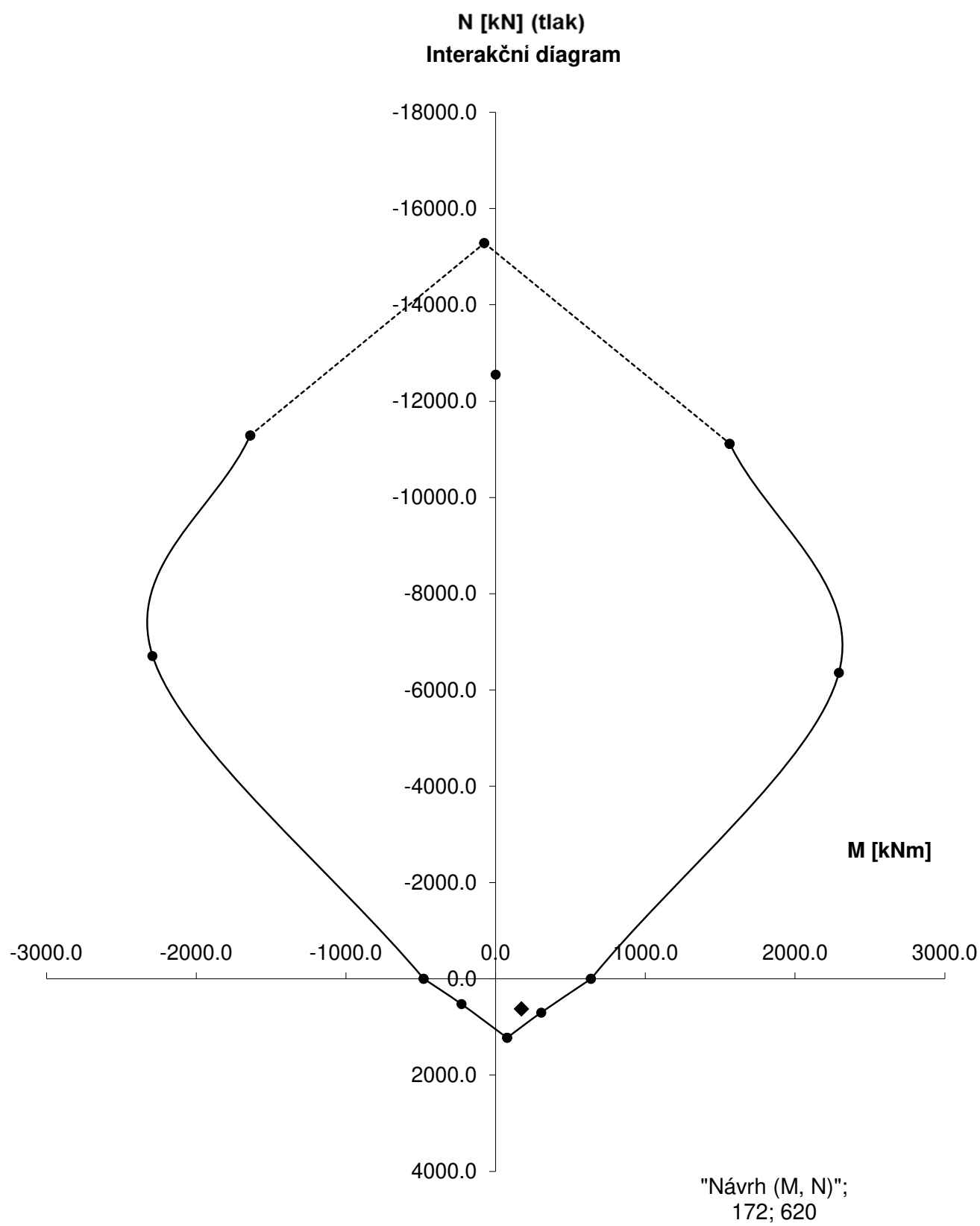
ICES STRUOL

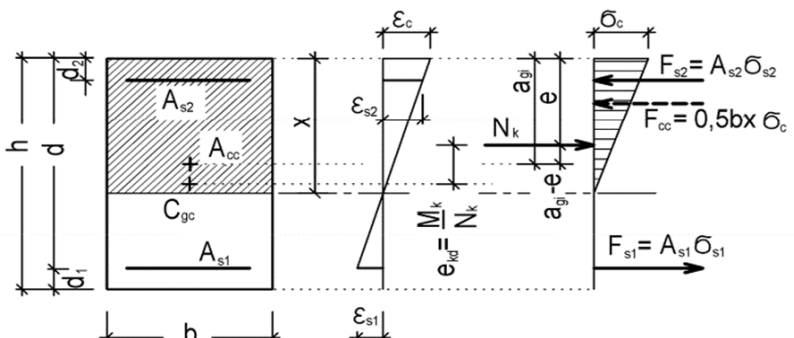
VERSION MAN-MBB

TRANSCONSULT

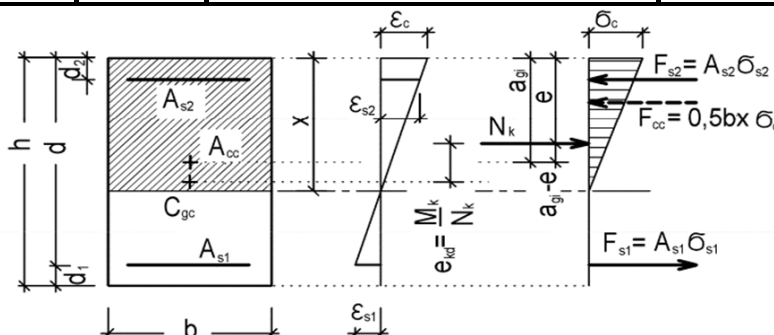
HRAD.KRALOVE

| Průřez 1 | | | |
|--|------------|--|--|
| Rozměr prvku | | Vyztužení | |
| b= | 1 m | As2 | 16 |
| h= | 1 m | As1 | 16 |
| | | Počet | 6 |
| | | As2= | 1206.37 mm ² |
| | | As1= | 1608.50 mm ² |
| Charakteristiky betonu | | Charakteristiky výztuže As1 | |
| Beton | C 25/30 | Výztuž | B 500 B |
| f _{ck} = | 25 MPa | f _{yk} = | 500 MPa |
| f _{ctm} = | 2.6 MPa | f _{tk} = | 550 MPa |
| E _{cm} = | 31000 MPa | E _s = | 200000 MPa |
| τ _{rk} = | 0.45 MPa | průměry | 8-36 mm |
| α= | 1 | Povrch | žebírkový |
| γ _c = | 1.5 | γ _s = | 1.15 |
| f _{cd} =α _{cc} * f _{ck} /γ _c | 14.2 MPa | f _{yd} =f _{yk} /γ _s | 434.78 MPa |
| ε _{cd} =f _{cd} /E | 0.0035 | ε _{yd} =f _{yd} /E | 0.00217 |
| α _{cc} | 0.85 | | |
| | | Krytí výztuže | |
| | | c min = | 45 mm |
| | | φ třmínku = | 12 mm |
| | | c = c _{min} + Δh + | 57 mm |
| | | d1 = c + φ/2 | 65 mm |
| | | d2 = c + φ/2 | 65 mm |
| | | d = h - d1 | 0.935 m |
| | | d' = h - d2 | 0.935 m |
| Schema | | | |
| | | | |
| Doplňující parametry | | | |
| σ _s | 434.78 MPa | Fs1=As1*f _{yd} | 699.34 KN |
| ξ _{lim} | 0.617 | Fs2=As2*f _{yd} | 524.51 KN |
| ξ _{lim2} | 2.639 | ΔFs=Fs2-Fs1 | -174.8358 KN |
| ρ | 0.00281487 | ξ _{lim2} *d2= | 0.1716 [1] |
| z1 | 0.435 m | ξ _{lim2} *d1= | 0.1716 [1] |
| z2 | 0.435 m | ξ _{lim} *d= | 0.5768 [1] |
| zs | 0.87 m | ξ _{lim} *d'= | 0.5768 [1] |
| Bod grafu | | | |
| | Mrd[KNm] | Nrd[KN] | Mrd[KNm] |
| 0 | -76.1 | -15285.9 | |
| 1 | 1562.7 | -11116.2 | d>ξ _{lim2} *d2 PRAVDA |
| 2 | 2291.8 | -6358.7 | ξ _{lim} *d>=ξ _{lim2} *d2 PRAVDA |
| 3 | 636.9 | 0.0 | |
| 4 | 304.2 | 699.3 | |
| 5 | 76.1 | 1223.9 | |
| 4' | -228.2 | 524.5 | |
| 3' | -480.7 | 0.0 | |
| 2' | -2291.8 | -6708.4 | ξ _{lim} *d'>=ξ _{lim2} *d1 PRAVDA |
| 1' | -1638.8 | -11291.0 | |
| 0 | -76.1 | -15285.9 | |
| 0' | 0.0 | -12551.9 | |
| | 172 | 620 | |



| VÝPOČET OMEZENÍ NAPĚTÍ ŽB PRŮŘEZU | | | | Průřez 1 |
|---|---------------------------|--|------------|---|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | <u>uzel 5001</u> |
| b= | 1 m | ϕ [mm] | Počet | |
| h= | 1 m | A _{s2} | 6 | A _{s2} = |
| 323 | | A _{s1} | 8 | A _{s1} = |
| | | | | 1206 mm ² |
| | | | | 1608 mm ² |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | <u>Krytí výztuže</u> |
| Beton | C 25/30 | Výztuž | B 500 B | R |
| f _{ck} = | 25 MPa | f _{yk} = | 500 MPa | |
| f _{ctm} = | 2.6 MPa | f _{tk} = | 550 MPa | |
| E _{cm} = | 31000 MPa | E _s = | 200000 MPa | |
| τ _{rk} = | 0.45 MPa | průměry | 8-36 mm | |
| α= | 1 | Povrch | žebírkový | |
| γ _c = | 1.5 | γ _s = | 1.15 | |
| f _{cd} =α _{cc} ·f _{ck} /γ _c | 14.2 Mpa | f _{yd} =f _{yk} /γ _s | 434.78 Mpa | |
| ε _{cd} =f _{cd} /E | 0.0035 | ε _{yd} =f _{yd} /E | 0.00217 | |
| α _{cc} | 0.85 | | | |
| <u>Schema</u> | | | | |
|  | | | | |
| α _e =E _s /E _{cm} | 6.45 | | | |
| x= | 125.88 mm | $x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2 b A_{s1} d + A_{s2} d_2}{\alpha_e (A_{s1} + A_{s2})^2}} \right]$ | | |
| I _{ir} = | 0.00748757 m ⁴ | $I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d - x)^2 + A_{s2} (x - d_2)^2 \right]$ | | |
| <u>Charakteristická kombinace</u> | | | | |
| M _{MSP} | 122.96 kNm | | | |
| σ _c = | -2.07 MPa | $\sigma_c = -\frac{M_k}{I_{ir}} x$ | <= | $ \sigma_c \leq 0,6 f_{ck}$ 15.00 MPa ==> VYHOVUJE |
| σ _s = | 85.73 MPa | $\sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d - x)$ | <= | $\sigma_s \leq 0,8 f_{yk}$ 400 MPa ==> VYHOVUJE |

| | | | | | | |
|--|-------------------------------------|--|-------------------------------------|------------------------------------|----------------------------|---------------------------------------|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | ϕ [mm] | Počet | uzel: 5001 |
| b= | <div><div>1</div><div>m</div></div> | A _{s1} | <div><div>16</div><div></div></div> | <div><div>8</div><div></div></div> | A _{s1} = | 1608 mm ² |
| h= | <div><div>1</div><div>m</div></div> | | | | | |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | | <u>Krytí výztuže</u> | |
| Beton | <div>C 25/30</div> | Výztuž | <div>B 500 B</div> | R | | |
| f _{ck} = | 25 MPa | f _{yk} = | 500 MPa | | c min = | <div><div>45</div><div>mm</div></div> |
| f _{ctm} = | 2.6 MPa | f _{tk} = | 550 MPa | | φ třmínku = | <div><div>12</div><div>mm</div></div> |
| E _{cm} = | 31000 MPa | E _s = | <div>200000</div> MPa | | c = c min + Δh + | 57 mm |
| τ _{rk} = | 0.45 MPa | průměry | 8-36 mm | | d ₁ = c + φ / 2 | 65 mm |
| α = | <div>1</div> | Povrch | žebírkový | | d = h - d ₁ | 0.935 m |
| γ _c = | <div>1.5</div> | γ _s = | <div>1.15</div> | | | |
| f _{cd} = α _{cc} * f _{ck} / γ _c | 14.2 Mpa | f _{yd} = f _{yk} / γ _s | 434.78 Mpa | | | |
| ε _{cd} = f _{cd} / E | <div>0.0035</div> | ε _{yd} = f _{yd} / E | 0.00217 | | | |
| α _{cc} | <div>0.85</div> | | | | | |

Schema


$$\alpha_e = E_s/E_{cm} = 6.45$$

$$A_c = 1 \text{ m}^2$$

$$I_c = 0.083333333 \text{ m}^4$$

Kvazistálá kombinace

$$M = 147.56 \text{ kNm}$$

$$A_i = 1.010377 \text{ m}^2$$

$$a_s = 0.435 \text{ m}$$

$$t_i = 0.004468 \text{ m}$$

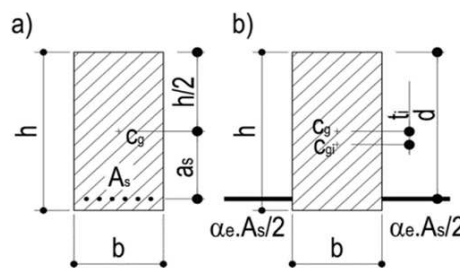
$$A_i = A_c + A_s \cdot \alpha_e$$

$$t_i = \frac{\alpha_e \cdot A_s \cdot a_s}{A_i}$$

Moment setrvačnosti plně působícího ideálního průřezu:

$$I_{ci} = 0.085277 \text{ m}^4$$

$$I_{ci} = I_c + A_c \cdot t_i^2 + \alpha_e A_s (a_s - t_i)^2$$



Obr. 1 a) Železobetonový, b) ideální plně působící průřez

Posouzení omezení napětí v tažených vláknech betonu

$$\sigma_{ct} = 0.86 \text{ MPa} \quad \sigma_{ct} = \frac{M_{E\psi 2} \cdot (h/2 - t_i)}{I_{ci}} > f_{ctm} = 2.6 \text{ MPa}$$

 od kvazistálé kombinace vzniknou v betonu ohybové trhliny \Rightarrow průřez porušený trhlinou

Posouzení šířky trhlin

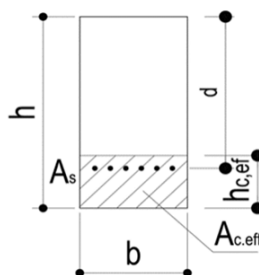
$$w_k = s_{r,max} (\epsilon_{sm} - \epsilon_{cm})$$

$$k_1 = 0.8$$

$$k_2 = 0.5$$

$$k_3 = 3.4$$

$$k_4 = 0.425$$



Posouzení betonových prvků dle EuroCode 2

$k_t =$

0.4

0.4 - dlouhodobá

0.6 - krátkodobá

| | | | | | |
|------------------|---------|----------------|--|------------|---------|
| $h_{c,ef} =$ | 0.163 | m | $h_{c,ef} = \min\{2,5 \cdot (h-d); (h-x)/3; h/2\}$ | $> d$ | 0.065 |
| d | | | $ h_{c,ef}$ | $2,5(h-d)$ | 0.163 m |
| $A_{c,ef} =$ | 0.163 | m ² | | $(h-x)/3$ | 0.290 m |
| $\rho_{c,eff} =$ | 0.00990 | | | $h/2$ | 0.500 m |

$$f_{ct,eff} = f_{ctm} = 2.6 \text{ MPa}$$

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{\sigma_s - k_t \frac{f_{ct,eff}}{\rho_{p,eff}} (1 + \alpha_e \cdot \rho_{p,eff})}{E_s} \geq 0,6 \frac{\sigma_s}{E_s}$$

$$\varepsilon_{sm} - \varepsilon_{cm} = 0.000309 \quad \geq \quad 0.000309 \quad \Rightarrow \text{VYHOVUJE}$$

Výpočet napětí σ_s

$$x = 129.31 \text{ mm} \quad x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2b}{\alpha_e} \frac{A_{s1}d + A_{s2}d_2}{(A_{s1} + A_{s2})^2}} \right]$$

$$I_{ir} = 0.00745709 \text{ m}^4 \quad I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d-x)^2 + A_{s2} (x-d_2)^2 \right]$$

$$\sigma_s = 102.85 \text{ MPa} \quad \sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d-x)$$

Šířka trhliny

dle (EN 1991-1-1 čl. 7.3.4)

$$w_k = s_{r,max} (\varepsilon_{sm} - \varepsilon_{cm})$$

maximální vzdálenost trhlin

$$s_{r,max} = 274.94 \text{ mm} \quad s_{r,max} = k_3 c + k_1 k_2 k_4 \phi / \rho_{p,eff}$$

$$w_k = 0.085 \text{ mm} \quad < \quad w_{lim} \quad \boxed{0.3} \text{ mm} \quad \Rightarrow \text{VYHOVUJE}$$

Geometrie průřezu

| | | |
|-------|---|---|
| b_w | 1 | m |
| h | 1 | m |

Průběh vnitřních sil V_{ED} , N_{ED}

| | | |
|------------|--------|----|
| V_{ED} | 1142.0 | kN |
| $V_{ED,0}$ | 1142.0 | kN |
| N_{ED} | 0 | kN |
| L_{ED} | 0.75 | m |

Vlastnosti betonu:

C 25/30 ▼

| | | |
|--|-------|-----|
| f_{ck} | 25 | MPa |
| f_{ctm} | 2.6 | MPa |
| E_{cm} | 31 | GPa |
| τ_{rk} | 3 | MPa |
| α_{cc} | 0.85 | |
| γ_c | 1.5 | |
| $f_{cd} = \alpha_{cc} \cdot f_{ck} / \gamma_c$ | 14.17 | MPa |
| $v = 0.6 \cdot (1 - (f_{ck} / 250))$ | 0.54 | MPa |

Vlastnosti výztuže

B 500 B ▼

| | | |
|------------|--------|-----|
| f_{ywk} | 500 | MPa |
| γ_s | 1.15 | |
| f_{ywd} | 434.78 | MPa |

Krytí výztuže betonem

| | | |
|---------------------------|----|----|
| c_{nom} | 45 | mm |
| ϕ_{tr} | 12 | mm |
| $c = c_{nom} + \phi_{tr}$ | 57 | mm |

Podélná výztuž

| | | |
|----------|---------|-----------------|
| d_{s1} | 16 | mm |
| počet | 8 | ks |
| A_{s1} | 1608.48 | mm ² |

Účinná výška průřezu

| | | |
|------------------------|-------|----|
| $d_1 = c + d_{s1} / 2$ | 65 | mm |
| $d = h - d_1$ | 0.935 | m |

Návrhová smyková únosnost nevytluženého betonového průřezu

| | |
|---------------|----------|
| k | 1.5 |
| ρ_1 | 0.002 |
| σ_{cp} | 0.00 MPa |
| v_{min} | 0.31 MPa |
| k_1 | 0.15 |
| $V_{Rd,c}$ | 266.9 kN |
| $V_{Rd,cm}$ | 289.4 kN |
| $V_{Rd,c}$ | 289.4 kN |

Posouzení

| | | |
|----------|---|------------|
| V_{ED} | > | $V_{Rd,c}$ |
| 1142 kN | | 289.3 kN |

Nevyhovuje - nutný návrh smykové výztuže**Návrh smykové výztuže**

| | | | |
|----------------|---------|--------|--------------------|
| $\cot \Phi$ | 2.5 | Φ | 21.80 ° |
| $V_{Rd,max} =$ | 2219.82 | > | V_{ED} 1142.0 kN |
| $\cot \Phi$ | 1 | Φ | 45.00 ° |
| $V_{Rd,max} =$ | 3218.74 | > | V_{ED} 1142.0 kN |

Třmínky, spony

| | | | |
|------------------|------------------------|-----------|-----------------------|
| β | 100% | | |
| $\rho_{w,st}$ | 0.00125 | | |
| ϕ_{sw} | 10 mm | | |
| n | 4 ks | | $s_{t,max}$ |
| s_{st} | 250 mm | < | 600 mm |
| $A_{sw,st}$ | 314.16 mm ² | | |
| z | 0.8415 m | | |
| $\rho_{w,min}$ | 0.00080 | | |
| $\rho_{w,st}$ | 0.00126 | > | 0.00125 |
| s | < | 392.70 mm | |
| $V_{rd,st}$ | 1149.41 kN | | |
| Posouzení | | | |
| V_{rd} | 1149.41 | > | $V_{ed,0}$ 1142.00 kN |

Geometrie průřezu

| | | |
|-------|---|---|
| b_w | 1 | m |
| h | 1 | m |

Průběh vnitřních sil V_{ED} , N_{ED}

| | | |
|------------|--------|----|
| V_{ED} | 1126.0 | kN |
| $V_{ED,0}$ | 1126.0 | kN |
| N_{ED} | 0 | kN |
| L_{ED} | 0.75 | m |

Vlastnosti betonu:

C 25/30

| | | |
|--|-------|-----|
| f_{ck} | 25 | MPa |
| f_{ctm} | 2.6 | MPa |
| E_{cm} | 31 | GPa |
| τ_{rk} | 3 | MPa |
| α_{cc} | 0.85 | |
| γ_c | 1.5 | |
| $f_{cd} = \alpha_{cc} \cdot f_{ck} / \gamma_c$ | 14.17 | MPa |
| $v = 0.6 \cdot (1 - (f_{ck} / 250))$ | 0.54 | MPa |

Vlastnosti výztuže

B 500 B

| | | |
|------------|--------|-----|
| f_{yk} | 500 | MPa |
| γ_s | 1.15 | |
| f_{ywd} | 434.78 | MPa |

Krytí výztuže betonem

| | | |
|---------------------------|----|----|
| c_{nom} | 45 | mm |
| ϕ_{tr} | 12 | mm |
| $c = c_{nom} + \phi_{tr}$ | 57 | mm |

Podélná výztuž

| | | |
|----------|---------|-----------------|
| d_{s1} | 14 | mm |
| počet | 8 | ks |
| A_{s1} | 1231.49 | mm ² |

Účinná výška průřezu

| | | |
|------------------------|-------|----|
| $d_1 = c + d_{s1} / 2$ | 64 | mm |
| $d = h - d_1$ | 0.936 | m |

Návrhová smyková únosnost nevytluženého betonového průřezu

| | |
|---------------|----------|
| k | 1.5 |
| ρ_1 | 0.001 |
| σ_{cp} | 0.00 MPa |
| v_{min} | 0.31 MPa |
| k_1 | 0.15 |
| $V_{Rd,c}$ | 244.3 kN |
| $V_{Rd,cm}$ | 289.6 kN |
| $V_{Rd,c}$ | 289.6 kN |

Posouzení

| | | |
|----------|---|------------|
| V_{ED} | > | $V_{Rd,c}$ |
| 1126 kN | | 289.6 kN |

Nevyhovuje - nutný návrh smykové výztuže

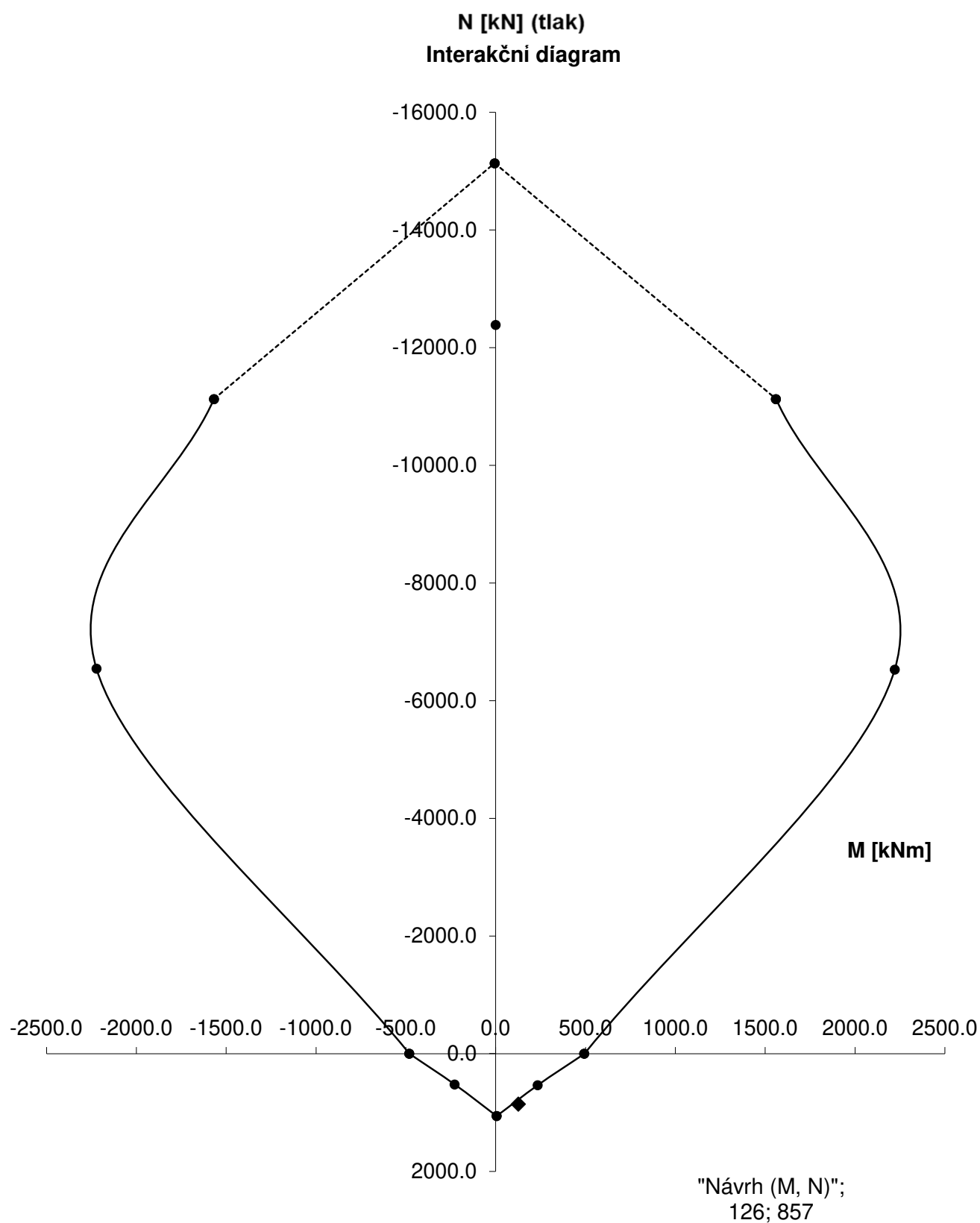
Návrh smykové výztuže

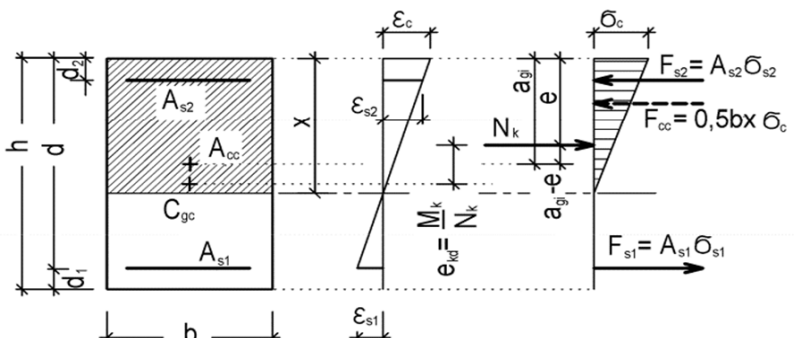
| | | | |
|----------------|------------|--------|--------------------|
| $\cot \Phi$ | 2.5 | Φ | 21.80 ° |
| $V_{Rd,max} =$ | 2222.19 kN | > | V_{ED} 1126.0 kN |
| $\cot \Phi$ | 1 | Φ | 45.00 ° |
| $V_{Rd,max} =$ | 3222.18 kN | > | V_{ED} 1126.0 kN |

Třmínky, spony

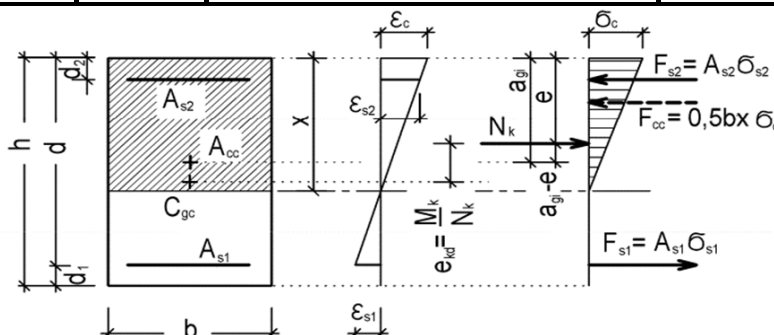
| | | | | |
|------------------|------------------------|-----------|------------|-------------|
| β | 100% | | | |
| $\rho_{w,st}$ | 0.00123 | | | |
| ϕ_{sw} | 10 mm | | | |
| n | 4 ks | | | $s_{t,max}$ |
| s_{st} | 250 mm | < | | 600 mm |
| $A_{sw,st}$ | 314.16 mm ² | | | |
| z | 0.8424 m | | | |
| $\rho_{w,min}$ | 0.00080 | | | |
| $\rho_{w,st}$ | 0.00126 | > | | 0.00123 |
| s | < | 392.70 mm | | |
| $V_{rd,st}$ | 1150.64 kN | | | |
| Posouzení | | | | |
| V_{rd} | 1150.64 | > | $V_{ed,0}$ | 1126.00 kN |

| Průřez 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|------------|--|-------------|-------------|------------|-------------------------|-----------|-------------|-------|-------------------------|-----------|--------------|--------|--------------------------------|-------------|--------|------------|---------------------|------------|----|---------|---------------------|------------|----|---------|-------------------|------------|----|---------|--------------------|------------|----|--------|-------|--|----|--------|-----|--|----|---------|---------|--|----|---------|----------|--|---|------|----------|--|----|-----|----------|--|--|-----|-----|--|
| Rozměr prvku b= 1 m h= 1 m | | Vyztužení <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">ϕ [mm]</td> <td style="width: 30%; text-align: center;">Počet</td> <td style="width: 40%;"></td> </tr> <tr> <td>As2</td> <td style="border: 1px solid black; text-align: center;">16</td> <td style="border: 1px solid black; text-align: center;">6</td> </tr> <tr> <td>As1</td> <td style="border: 1px solid black; text-align: center;">14</td> <td style="border: 1px solid black; text-align: center;">8</td> </tr> </table> | | ϕ [mm] | Počet | | As2 | 16 | 6 | As1 | 14 | 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ϕ [mm] | Počet | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| As2 | 16 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| As1 | 14 | 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | As2= 1206.37 mm ² As1= 1231.51 mm ² | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Charakteristiky betonu Beton C 25/30 f_{ck} = 25 MPa f_{ctm} = 2.6 MPa E_{cm} = 31000 MPa τ_{rk} = 0.45 MPa α = 1 γ_c = 1.5 $f_{cd} = \alpha_{cc} * f_{ck} / \gamma_c$ = 14.2 Mpa $\epsilon_{cd} = f_{cd} / E$ = 0.0035 α_{cc} = 0.85 | | Charakteristiky výztuže As1 Výztuž B 500 B R f_{yk} = 500 MPa f_{tk} = 550 MPa E_s = 200000 MPa průměry 8-36 mm Povrch žebírkový γ_s = 1.15 $f_{yd} = f_{yk} / \gamma_s$ = 434.78 Mpa $\epsilon_{yd} = f_{yd} / E$ = 0.00217 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Krytí výztuže c_{min} = 45 mm ϕ třmínku = 12 mm $c = c_{min} + \Delta h$ = 57 mm $d1 = c + \phi / 2$ = 64 mm $d2 = c + \phi / 2$ = 65 mm $d = h - d1$ = 0.936 m $d' = h - d2$ = 0.935 m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Schema | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Doplňující parametry <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">σ_s</td> <td style="width: 30%;">434.78 Mpa</td> <td style="width: 20%;">Fs1=As1*f_{yd}</td> <td style="width: 20%;">535.43 KN</td> </tr> <tr> <td>ξ_{lim}</td> <td>0.617</td> <td>Fs2=As2*f_{yd}</td> <td>524.51 KN</td> </tr> <tr> <td>ξ_{lim2}</td> <td>2.639</td> <td>$\Delta F_s = F_{s2} - F_{s1}$</td> <td>-10.9272 KN</td> </tr> <tr> <td>ρ</td> <td>0.00243788</td> <td>$\xi_{lim2} * d2 =$</td> <td>0.1716 [1]</td> </tr> <tr> <td>z1</td> <td>0.436 m</td> <td>$\xi_{lim2} * d1 =$</td> <td>0.1689 [1]</td> </tr> <tr> <td>z2</td> <td>0.435 m</td> <td>$\xi_{lim} * d =$</td> <td>0.5774 [1]</td> </tr> <tr> <td>zs</td> <td>0.871 m</td> <td>$\xi_{lim} * d' =$</td> <td>0.5768 [1]</td> </tr> </table> | | | | σ_s | 434.78 Mpa | Fs1=As1*f _{yd} | 535.43 KN | ξ_{lim} | 0.617 | Fs2=As2*f _{yd} | 524.51 KN | ξ_{lim2} | 2.639 | $\Delta F_s = F_{s2} - F_{s1}$ | -10.9272 KN | ρ | 0.00243788 | $\xi_{lim2} * d2 =$ | 0.1716 [1] | z1 | 0.436 m | $\xi_{lim2} * d1 =$ | 0.1689 [1] | z2 | 0.435 m | $\xi_{lim} * d =$ | 0.5774 [1] | zs | 0.871 m | $\xi_{lim} * d' =$ | 0.5768 [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| σ_s | 434.78 Mpa | Fs1=As1*f _{yd} | 535.43 KN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ξ_{lim} | 0.617 | Fs2=As2*f _{yd} | 524.51 KN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ξ_{lim2} | 2.639 | $\Delta F_s = F_{s2} - F_{s1}$ | -10.9272 KN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ρ | 0.00243788 | $\xi_{lim2} * d2 =$ | 0.1716 [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| z1 | 0.436 m | $\xi_{lim2} * d1 =$ | 0.1689 [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| z2 | 0.435 m | $\xi_{lim} * d =$ | 0.5774 [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| zs | 0.871 m | $\xi_{lim} * d' =$ | 0.5768 [1] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bod grafu <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>Mrd [KNm]</th> <th>Nrd [KN]</th> <th>Mrd [KNm]</th> </tr> </thead> <tbody> <tr><td>0</td><td>-5.3</td><td>-15135.2</td><td></td></tr> <tr><td>1</td><td>1559.9</td><td>-11127.5</td><td></td></tr> <tr><td>2</td><td>2221.3</td><td>-6529.6</td><td></td></tr> <tr><td>3</td><td style="border: 1px solid black;">493.7</td><td style="border: 1px solid black;">0.0</td><td></td></tr> <tr><td>4</td><td>233.4</td><td>535.4</td><td></td></tr> <tr><td>5</td><td>5.3</td><td>1059.9</td><td></td></tr> <tr><td>4'</td><td>-228.2</td><td>524.5</td><td></td></tr> <tr><td>3'</td><td style="border: 1px solid black;">-480.7</td><td style="border: 1px solid black;">0.0</td><td></td></tr> <tr><td>2'</td><td>-2221.1</td><td>-6544.5</td><td></td></tr> <tr><td>1'</td><td>-1568.0</td><td>-11127.1</td><td></td></tr> <tr><td>0</td><td>-5.3</td><td>-15135.2</td><td></td></tr> <tr><td>0'</td><td style="border: 1px solid black;">0.0</td><td style="border: 1px solid black;">-12387.9</td><td></td></tr> <tr><td></td><td style="border: 1px solid black;">126</td><td style="border: 1px solid black;">857</td><td></td></tr> </tbody> </table> <div style="margin-top: 20px;"> $d > \xi_{lim2} * d2$ PRAVDA $\xi_{lim} * d > \xi_{lim2} * d2$ PRAVDA $\xi_{lim} * d' > \xi_{lim2} * d1$ PRAVDA </div> | | | | | Mrd [KNm] | Nrd [KN] | Mrd [KNm] | 0 | -5.3 | -15135.2 | | 1 | 1559.9 | -11127.5 | | 2 | 2221.3 | -6529.6 | | 3 | 493.7 | 0.0 | | 4 | 233.4 | 535.4 | | 5 | 5.3 | 1059.9 | | 4' | -228.2 | 524.5 | | 3' | -480.7 | 0.0 | | 2' | -2221.1 | -6544.5 | | 1' | -1568.0 | -11127.1 | | 0 | -5.3 | -15135.2 | | 0' | 0.0 | -12387.9 | | | 126 | 857 | |
| | Mrd [KNm] | Nrd [KN] | Mrd [KNm] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | -5.3 | -15135.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1559.9 | -11127.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 2221.3 | -6529.6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 493.7 | 0.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 233.4 | 535.4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 5.3 | 1059.9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4' | -228.2 | 524.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3' | -480.7 | 0.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2' | -2221.1 | -6544.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1' | -1568.0 | -11127.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | -5.3 | -15135.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0' | 0.0 | -12387.9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 126 | 857 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



| VÝPOČET OMEZENÍ NAPĚTÍ ŽB PRŮŘEZU | | | | Průřez 2 |
|---|-----------|--|------------|----------------------|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | uzel 359 |
| b= | 1 m | ϕ [mm] | Počet | |
| h= | 1 m | A _{s2} | 6 | A _{s2} = |
| 323 | | A _{s1} | 8 | A _{s1} = |
| | | | | 1206 mm ² |
| | | | | 1232 mm ² |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | <u>Krytí výztuže</u> |
| Beton C 25/30 | | Výztuž B 500 B | | R |
| f _{ck} = | 25 MPa | f _{yk} = | 500 MPa | |
| f _{ctm} = | 2.6 MPa | f _{tk} = | 550 MPa | |
| E _{cm} = | 31000 MPa | E _s = | 200000 MPa | |
| τ _{rk} = | 0.45 MPa | průměry | 8-36 mm | |
| α= | 1 | Povrch | žebírkový | |
| γ _c = | 1.5 | γ _s = | 1.15 | |
| f _{cd} =α _{cc} ·f _{ck} /γ _c | 14.2 Mpa | f _{yd} =f _{yk} /γ _s | 434.78 Mpa | |
| ε _{cd} =f _{cd} /E | 0.0035 | ε _{yd} =f _{yd} /E | 0.00217 | |
| α _{cc} | 0.85 | | | |
| <u>Schema</u> | | | | |
|  | | | | |
| α _e =E _s /E _{cm} 6.45 | | | | |
| x= 111.29 mm $x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2 b A_{s1} d + A_{s2} d_2}{\alpha_e (A_{s1} + A_{s2})^2}} \right]$ | | | | |
| I _{ir} = 0.00588004 m ⁴ $I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d - x)^2 + A_{s2} (x - d_2)^2 \right]$ | | | | |
| <u>Charakteristická kombinace</u> | | | | |
| M _{MSP} 93.33 kNm | | | | |
| $ \sigma_c \leq 0,6 f_{ck}$ | | | | |
| σ _c = | -1.77 MPa | $\sigma_c = -\frac{M_k}{I_{ir}} x$ | | ≤ 15.00 MPa |
| ==> VYHOVUJE | | | | |
| $\sigma_s \leq 0,8 f_{yk}$ | | | | |
| σ _s = | 84.46 MPa | $\sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d - x)$ | | ≤ 400 MPa |
| ==> VYHOVUJE | | | | |

| | | | | | | |
|--|-------------------------------------|--|--------------------------------------|----------------------|----------------------------|---------------------------------------|
| <u>Rozměr prvku</u> | | <u>Vyztužení</u> | | ϕ [mm] | Počet | uzel: <u>359</u> |
| b= | <div><div>1</div><div>m</div></div> | A _{s1} | <div><div>14</div><div>8</div></div> | A _{s1} = | 1232 mm ² | |
| h= | <div><div>1</div><div>m</div></div> | | | | | |
| <u>Charakteristiky betonu</u> | | <u>Charakteristiky výztuže As1, As2</u> | | <u>Krytí výztuže</u> | | |
| Beton | <div>C 25/30<div></div></div> | Výztuž | <div>B 500 B<div></div></div> | R | | |
| f _{ck} = | 25 MPa | f _{yk} = | 500 MPa | | c min = | <div><div>45</div><div>mm</div></div> |
| f _{ctm} = | 2.6 MPa | f _{tk} = | 550 MPa | | ϕ třmínku = | <div><div>12</div><div>mm</div></div> |
| E _{cm} = | 31000 MPa | E _s = | <div>200000</div> MPa | | c = c min + Δh + | 57 mm |
| τ _{rk} = | 0.45 MPa | průměry | 8-36 mm | | d ₁ = c + ϕ / 2 | 64 mm |
| α = | <div>1</div> | Povrch | žebírkový | | d = h - d ₁ | 0.936 m |
| γ _c = | <div>1.5</div> | γ _s = | <div>1.15</div> | | | |
| f _{cd} = α _{cc} * f _{ck} / γ _c | 14.2 Mpa | f _{yd} = f _{yk} / γ _s | 434.78 Mpa | | | |
| ε _{cd} = f _{cd} / E | <div>0.0035</div> | ε _{yd} = f _{yd} / E | 0.00217 | | | |
| α _{cc} | <div>0.85</div> | | | | | |

Schema


$$\alpha_e = E_s/E_{cm} = 6.45$$

$$A_c = 1 \text{ m}^2$$

$$I_c = 0.083333333 \text{ m}^4$$

Kvazistálá kombinace

$$M = 112.00 \text{ kNm}$$

$$A_i = 1.007945 \text{ m}^2$$

$$a_s = 0.436 \text{ m}$$

$$t_i = 0.003437 \text{ m}$$

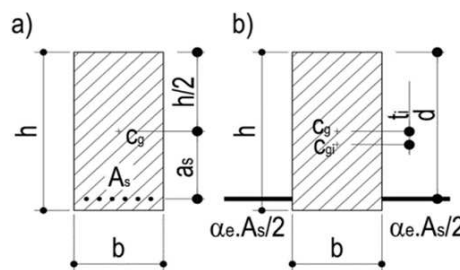
$$A_i = A_c + A_s \cdot \alpha_e$$

$$t_i = \frac{\alpha_e \cdot A_s \cdot a_s}{A_i}$$

Moment setrvačnosti plně působícího ideálního průřezu:

$$I_{ci} = 0.084832 \text{ m}^4$$

$$I_{ci} = I_c + A_c \cdot t_i^2 + \alpha_e A_s (a_s - t_i)^2$$



Obr. 1 a) Železobetonový, b) ideální plně působící průřez

Posouzení omezení napětí v tažených vláknech betonu

$$\sigma_{ct} = 0.66 \text{ MPa}$$

$$\sigma_{ct} = \frac{M_{E\psi 2} \cdot (h/2 - t_i)}{I_{ci}}$$

$$> f_{ctm} = 2.6 \text{ MPa}$$

od kvazistálé kombinace vzniknou v betonu ohybové trhliny => průřez porušený trhlinou

Posouzení šířky trhlín

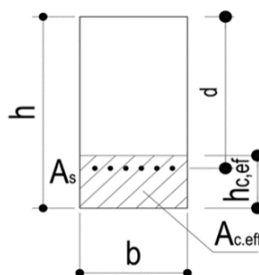
$$w_k = s_{r,max} (\epsilon_{sm} - \epsilon_{cm})$$

$$k_1 = 0.8$$

$$k_2 = 0.5$$

$$k_3 = 3.4$$

$$k_4 = 0.425$$



Posouzení betonových prvků dle EuroCode 2

$k_t =$

0.4

0.4 - dlouhodobá

0.6 - krátkodobá

| | | | | | |
|------------------|---------|----------------|--|------------|---------|
| $h_{c,ef} =$ | 0.160 | m | $h_{c,ef} = \min\{2,5 \cdot (h-d); (h-x)/3; h/2\}$ | $> d$ | 0.064 |
| d | | | $h_{c,ef}$ | $2,5(h-d)$ | 0.160 m |
| $A_{c,ef} =$ | 0.160 | m ² | | $(h-x)/3$ | 0.295 m |
| $\rho_{c,eff} =$ | 0.00770 | | | $h/2$ | 0.500 m |

$f_{ct,eff} = f_{ctm} = 2.6 \text{ MPa}$

$$\varepsilon_{sm} - \varepsilon_{cm} = \frac{\sigma_s - k_t \frac{f_{ct,eff}}{\rho_{p,eff}} (1 + \alpha_e \cdot \rho_{p,eff})}{E_s} \geq 0,6 \frac{\sigma_s}{E_s}$$

$\varepsilon_{sm} - \varepsilon_{cm} = 0.000304 \quad \geq \quad 0.000304 \quad \Rightarrow \text{VYHOVUJE}$

Výpočet napětí σ_s

$x = 114.27 \text{ mm} \quad x = \frac{\alpha_e}{b} (A_{s1} + A_{s2}) \left[-1 + \sqrt{1 + \frac{2 b A_{s1} d + A_{s2} d^2}{\alpha_e (A_{s1} + A_{s2})^2}} \right]$

$I_{ir} = 0.00586229 \text{ m}^4 \quad I_{ir} = \frac{1}{3} b x^3 + \alpha_e \left[A_{s1} (d-x)^2 + A_{s2} (x-d_2)^2 \right]$

$\sigma_s = 101.29 \text{ MPa} \quad \sigma_s = \alpha_e \frac{M_k}{I_{ir}} (d-x)$

Šířka trhliny

dle (EN 1991-1-1 čl. 7.3.4) $w_k = s_{r,max} (\varepsilon_{sm} - \varepsilon_{cm})$

maximální vzdálenost trhlin

$s_{r,max} = 309.37 \text{ mm} \quad s_{r,max} = k_3 c + k_1 k_2 k_4 \phi / \rho_{p,eff}$

$w_k = 0.094 \text{ mm} \quad < \quad w_{lim} \quad \boxed{0.3} \text{ mm} \quad \Rightarrow \text{VYHOVUJE}$