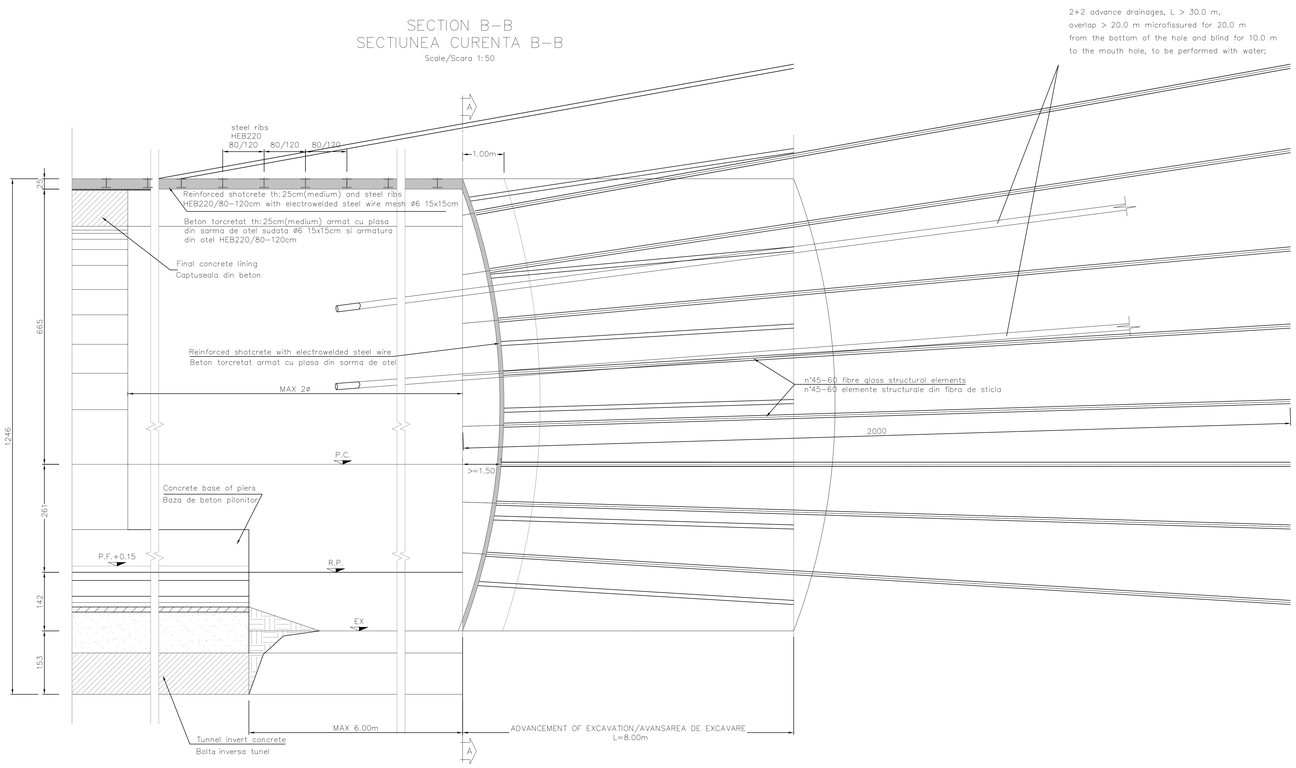
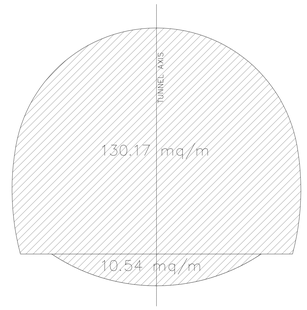
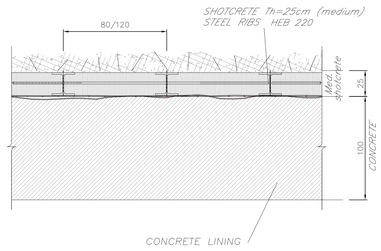
SECTION B–B
SECTIUNEA CURENTA B–B
Scale/Scara 1:50



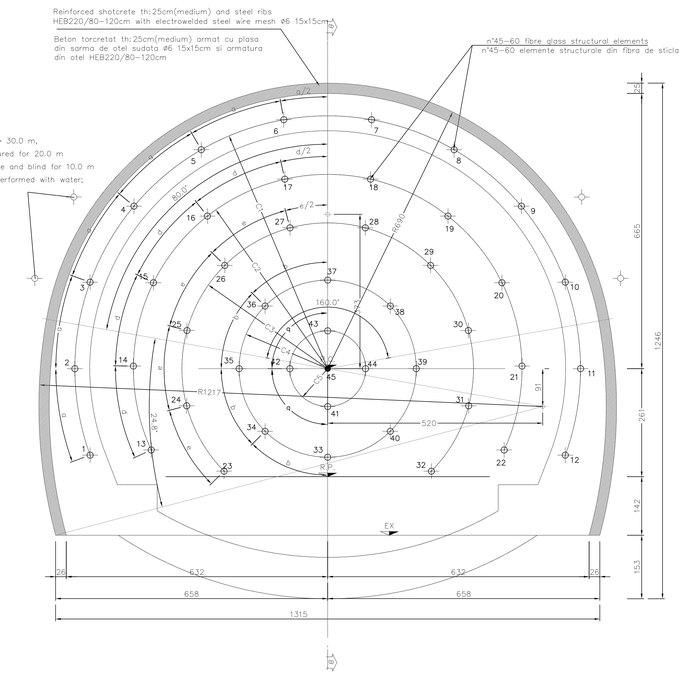
EXCAVATION VOLUME
total volume= 140.71 mc/m



SHOTCRETE DETAIL
BETON TORCRETAT DETALIU
Scale/Scara 1:20



SECTION A–A
SECTIUNEA CURENTA A–A
Scale/Scara 1:50



TABELUL DE MATERIALE

Beton torcretat
C20/25
- *Rezistenta medie la compresiune dupa 48h > 13N/mm²;*
- *Betonul torcretat trebuie armat sudat cu plasa de sarma ø6 15x15cm in B450C otel sau fibre de otel cu continut scazut de carbon.*
  Consumul de energie > 500 jouli (De la testul de perforare efectuat pe placi din beton armat).
  Fata tunelului va fi armat numai cu fibre.

Consolidarea cu otel
- *B450C controlat de catre unitate:*
  fynom = 450 N/mm2
  ftnom = 540 N/mm2
  fyk > fynom, fractile 5%
  ftk > ftnom, fractile 5%
  1.15 ≤ (ft/fy)k ≤ 1.35 fractile 10%
  (fy/fynom)k ≤ 1.25, fractile 10%
  Elongation (Agt)k > 7.5%, fractile 10%
- *Sudabil;*
- *Beton de acoperire: c=4cm ±20%.*

Nervurile din otel
- *Nervurile de otel constau in doua sectiuni cuplate HEB 220 in S275 otel si/ cadre de otel rigidizate cu toleranta de 0.8/1.2m - placi de otel S275 unghiuri de otel 60x60x10 pentru ptasarea lanturilor.*

Conducta PVC microracoata
- *la baza hidroizolatiei ø125mm, Th.>3mm (vezi DIN 1187)*

Conducta PVC de drenaj
- *pentru apa irosita ø125mm, Th.>3mm (vezi DIN 1187)*

Hidroizolatia
- *Geotextil: polipropilena din material netesut in fir continuu P>400g/mq*
- *PVC: Membrana termoplastic PVC rezistenta la apa Th.>2mm. Rezistenta la rupere >=15 N/mm²*

Elemente structurale din fibra de sticla
Consolidarea cu elemente structurale din fibra de sticla ø60/40 si valve amestec. din ciment intarit (1valv/1.00m):
- *Densitate > 19 KN/mc;*
- *Rezistenta la rupere> 1000 MPa*
- *Rezistenta la forfecare > 200MPa*
- *Modulul de elasticitate > 40000 MPa*
- *Continuitul > 60% sticla*
  diametrul exten ol conductei din fibra de sticla ø60;
  Imbinarea (eventual): mai bine fara sudura; daca imbinarile sunt prezente trebuiesc realizate pentru lipirea cu rasini epoxidice si racordat cu manson de otel;
  Bare plate: 40 th.=6mm conenctat la limita a 20mm din conducta PVC; aderenta ridicata o obtinem cu qart din nisip

Amestecuri in ciment expansiv
- *Compozitie tipica:*
  apa 1000 lt
  Ciment: 42.5 PL 1340 kg
  Bentonite: 40 kg
  Sodium silicate: 10 kg
  Aluminum paste: 1.5 kg
- *Cerinte minime:*
  raportul liber de expansiune > 50%
  presiunea confirmata de expansiune > 1.5 MPa
  Semi-confined expantion pressure > 1.0 MPa
  rezistenta minima la rupere (at 48 hours) and confined expantion > 3.0 MPa

MATERIAL TABLE

Shotcrete
C20/25
- *Average compressive strength after 48h > 13N/mm²;*
- *The shotcrete must be reinforced with electrowelded wire mesh ø6 15x15cm in B450C steel or steel fibers with low carbon content.*
  Energy Consumption> 500 joules (From punching tests performed on fiber-reinforced concrete plates).
  The tunnel face will be armed only with fiber.

Reinforcing steel
- *B450C controlled by establishment:*
  fynom = 450 N/mm2
  ftnom = 540 N/mm2
  fyk > fynom, fractile 5%
  ftk > ftnom, fractile 5%
  1.15 ≤ (ft/fy)k ≤ 1.35 fractile 10%
  (fy/fynom)k ≤ 1.25, fractile 10%
  Elongation (Agt)k > 7.5%, fractile 10%
- *Weldable;*
- *Concrete cover: c=4cm ±20%.*

Steel ribs
- *Steel ribs consisting of two coupled sections HEB 220 in S275 steel and stiffening brackets step 0.8/1.2m tolerance. Steel plates S275 and steel angles 60x60x10 for attaching chains.*

Microfissured PVC Pipeline
- *at base of waterproofing ø125mm, Th.>3mm (see DIN 1187)*

Drainage PVC Pipeline
- *for waste water, ø125mm, Th.>3mm (see DIN 1187)*

Waterproofing
- *Geotextil: polypropylene nonwowen fabric in continuos wire P>400g/mq*
- *PVC: thermoplastic PVC waterproof membrane, Th.>2mm. Tensile strength >=15 N/mm²*

Fibre Glass Structural Elements
- *Consolidation with fibre glass structural elements ø60/40 and valves hardened cement mixtures (1valv/1.00m):*
  Density >= 19 KN/m;
  Tensile strength >= 1000 MPa;
  Shear strength >= 200 MPa;
  Modulus of elasticity >= 40'000 MPa;
  Glass content >= 60%;
  External diameter to fibre glass pipes ø60;
  Joint (eventual): better seamless bars; if joint are present must be made for bonding with epoxy resins and screwing with steel sleeve;
  Flat bars: 40 th.=6mm connected to the boudary of a 20mm PVC pipe; high adherence achieved with qartz sand

Expansive cement mixtures
- *Typical composition:*
  Water: 1000 lt
  Cement: 42.5 PL 1340 kg
  Bentonite: 40 kg
  Sodium silicate: 10 kg
  Aluminum paste: 1.5 kg
- *Minimum requirements:*
  Free expantion ratio > 50%
  Confined expantion pressure > 1.5 MPa
  Semi-confined expantion pressure > 1.0 MPa
  Minimum compressive strength (at 48 hours) and confined expantion > 3.0 MPa

FAZA DE CONSTRUCTIE

Faza 1: implementare de pre-consolidare la fata tunelului cu elemente structurale de fibra de sticla

Faza 2: efectuarea excavatiei

Faza 3: stabilirea nervurilor de otel si betonul torcretat

Faza 4: cast in place of tunnel invert, baza stalpilor si umplerea cu beton

FAZA5: si coroana tunelului

CONSTRUCTION PHASES

PHASE 1: implementing pre-consolidation with structural fibreglass elements to the tunnel face

PHASE 2: perform excavation

PHASE 3: laying steel ribs and shotcrete

PHASE 4: cast in place of tunnel invert, base of piers and concrete filling

PHASE 5: cast in place of piers and tunnel crown

SPECIFICALTIILE DE PROIECTARE

numarul elementelor structurale si lungimea lor de suprapunere va varia depinzand de comportamentul monitorizat de deformare (intre nr 45÷60, suprapunand 10÷12m).

DESIGN SPECIFICATIONS

the number of structural elements and their length of overlap will vary depending on the geotechnical parameters measured during construction (between n°45÷60, overlap 10÷12m).

FIBRE GLASS STRUCTURAL ELEMENT LAYOUT

CIRC.	RADIUS (m.)	NUMBER	LENGHT	OVERL. m.	RADIAL INCLIN.	ANGLE
C1	6.11	12	>=20.00	>=12.00	17.00%	α=22.2 g
C2	4.70	10	>=20.00	>=12.00	13.00%	δ=28.3 g
C3	3.52	10	>=20.00	>=12.00	9.50%	ε=33.2 g
C4	2.14	8	>=20.00	>=12.00	5.50%	β=50.0 g
C5	0.91	4	>=20.00	>=12.00	2.50%	Φ=100.0 g
C6	0.00	1	>=20.00	>=12.00	0.00%	/

ELEMENT N° 45/60

LEGEND
RP = REFERENCE PLANE
EX = EXCAVATIONS PLANE
PC = CENTERS PLANE

Indice Index	Data Date	Modificare Modification/Revision	Proiectant Designer	Aprobat Consultant Approved Consultant	Aprobat CFR Approved CFR
D					
C					
B					
A					

GUVERNUL ROMANIEI / ROMANIAN GOVERNMENT
PROIECT FINANTAT DE UNIUNEA EUROPEANĂ / EUROPEAN UNION FINANCED PROJECT

C.N.C.F. "C.F.R." - S.A.

CLIENT / CLIENT

ITALFERR GRUPPO FERROVIE DELLO STATO Joint Venture leader
Scott Wilson
OBERMEYER PLANEN + BERATEN GmbH
TECNIC Consulting Engineers

CONSULTANT / CONSULTANT

			Data Date	Semnătură Signature
Aprobat Approved	Şef proiect Project manager	R. Liuzza		
Aprobat Approved	Coordonator Secţiune 1 Section 1 Coordinator	G.Gambelli		
Verificat Checked	Tunel Expert Tunnel Expert	C. Gambelli		
Întocmit Elaborated	Proiectant Designer	G.Gambelli		

SUBCONSULTANT / SUBCONSULTANT

Aprobat Approved	Responsabil Subconsultant Subconsultant Responsible				
Întocmit Elaborated	Proiectant Designer				

Reabilitarea liniei de cale ferata Braşov - Simeria, parte componentă a coridorului IV Pan European, pentru circulaţia trenurilor cu viteza maximă de 160 km/h. Secţiunea 1 Brasov - Sighisoara

Rehabilitation of the railway line Brasov - Simeria, component Part of the IV Pan-European Corridor, for the trains circulation with maximum speed of 160 km/h. Section 1 Brasov - Sighisoara

Proiect/Project 2004/RO/16/P/PA/003

Faza / Phase: P.Th. / T.D.

Denumire desen / Drawing Title : **ARCHITA 2 TUNNEL**
NATURAL TUNNEL
Section type "B3" with and without niches - Excavation and consolidation sections
Sectiunea tip "B3" cu si fara nise - Sectiuni de excavatie si consolidare

Codificare / Codification System

Scara / Scale	LOT	Nr. / No.
variat / various		

E A 5 1 | 0 1 | C | 1 4 | B B | G N | 0 4 | 0 | 0 | 0 0 6 | 0