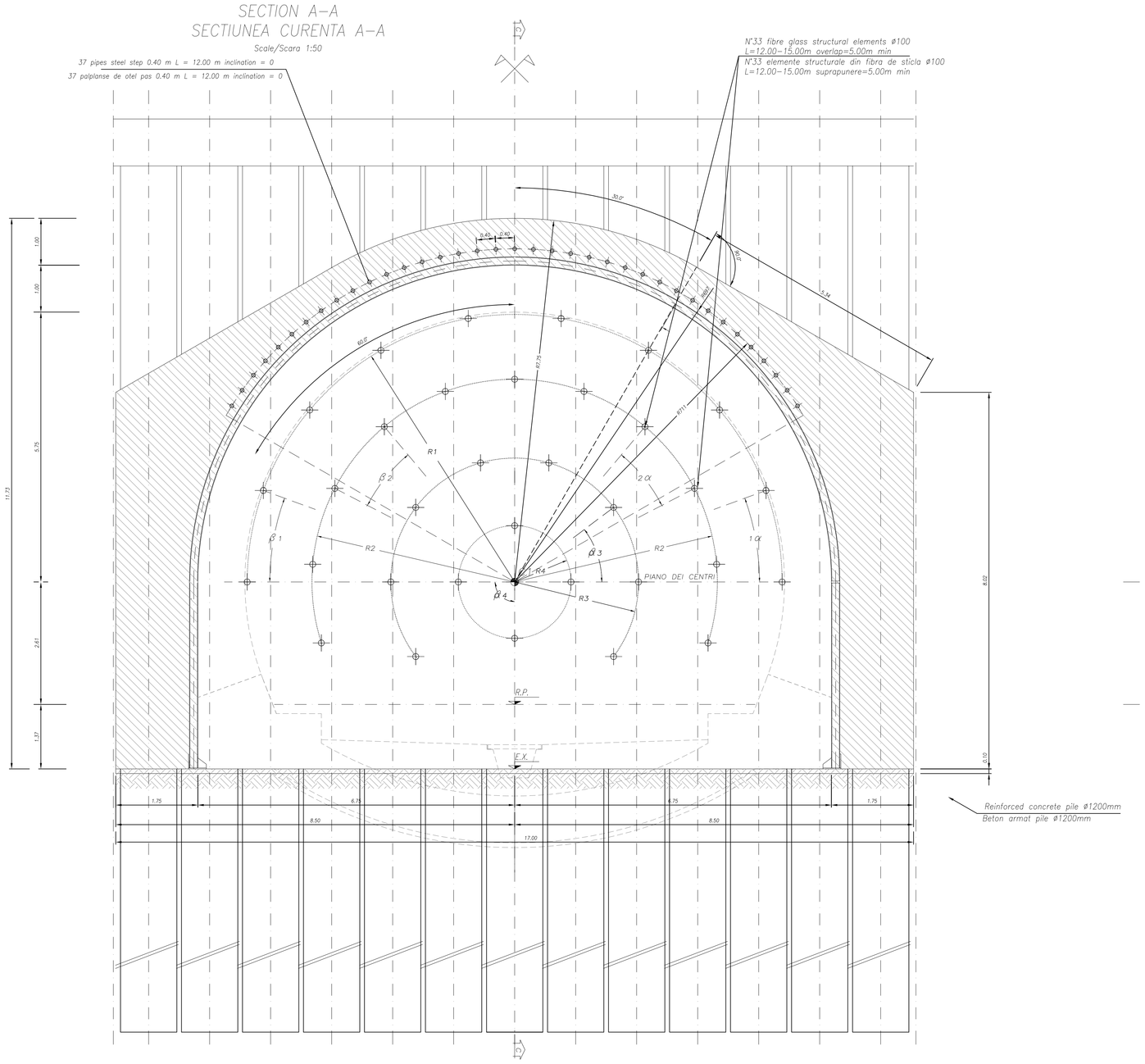
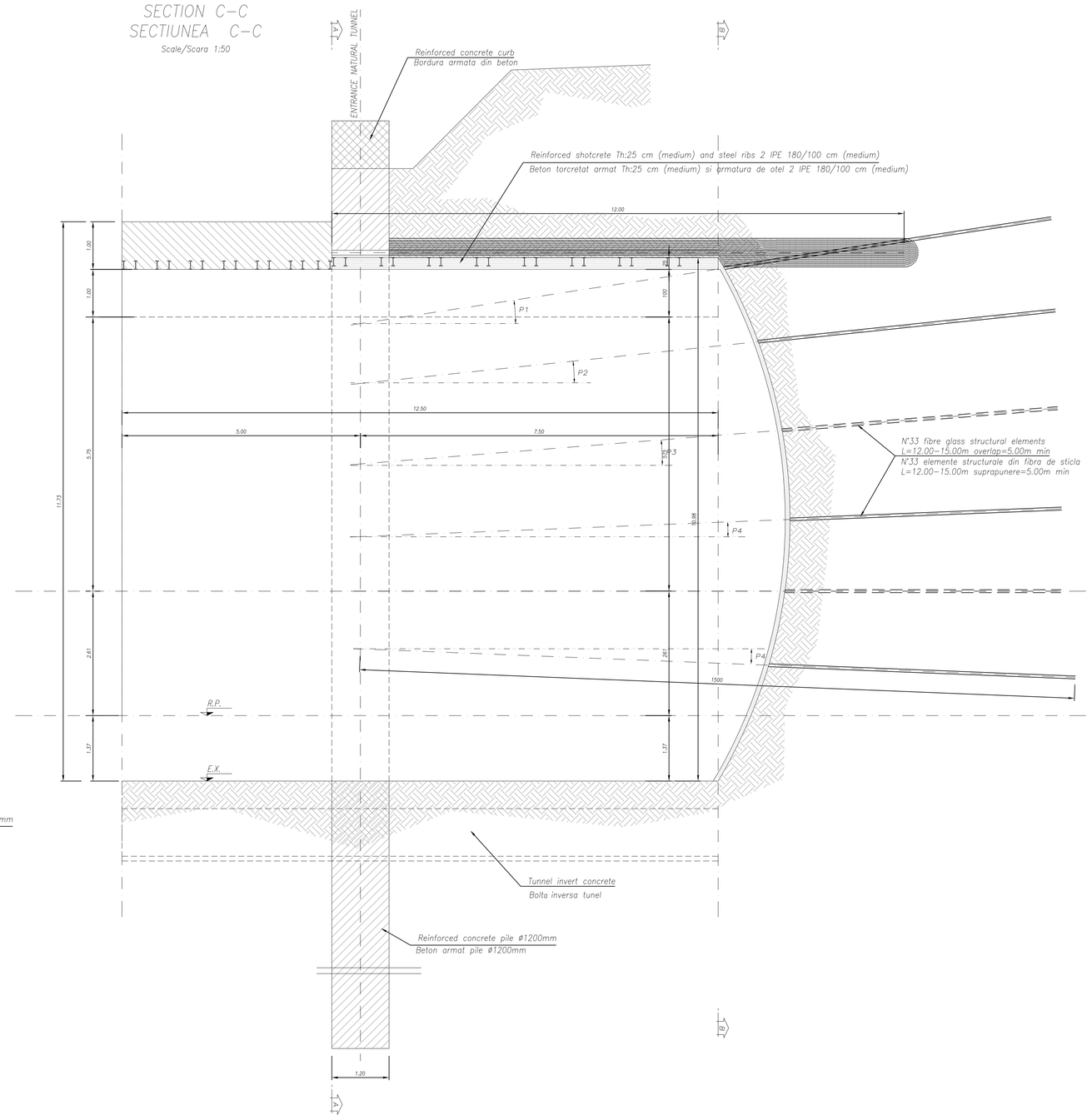
## SECTION A–A
## SECTIUNEA CURENTA A–A

Scale/Scara 1:50




## SECTION C–C
## SECTIUNEA C–C

Scale/Scara 1:50




| TUNNEL FACE CONSOLIDATION LAYOUT OF FIBERGLASS BARS | | | | | |
|---|---|---|---|---|---|
| CIRCUMFERENCE | RADIUS (m.) | NUMBER | ANGLE (g) | RADIAL INCL. | LENGHT (m.) |
| R.1 | 5.70 | 10 | α1=22.2222 | P1=13.50% | 15.00 |
| R.2 | 4.32 | 11 | α2=25.0000 | P2=10.50% | 15.00 |
| R.3 | 2.64 | 8 | α3=41.1111 | P3=8.00% | 15.00 |
| R.4 | 1.20 | 4 | α4=100.0000 | P4=4.00% | 15.00 |

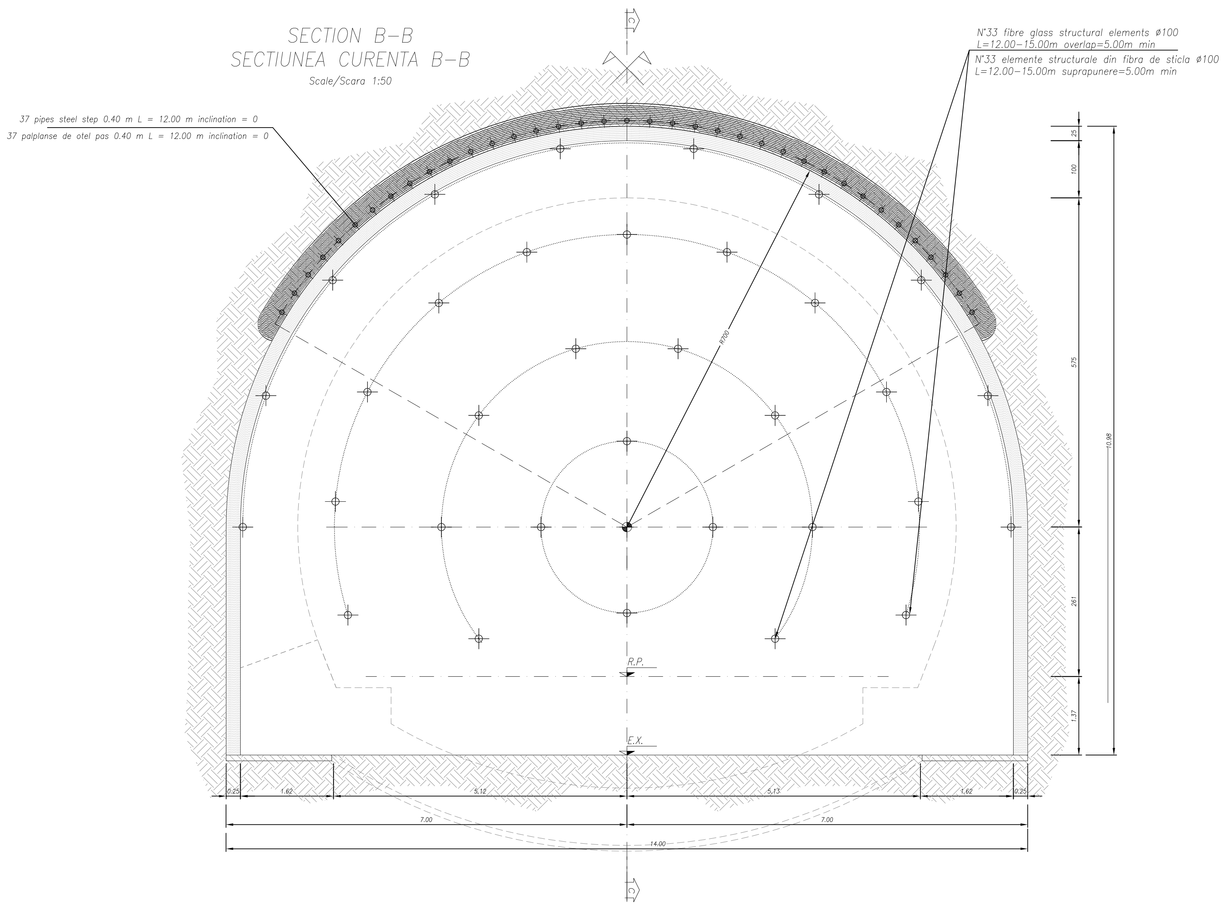
NOTE: Type, number and arrangement of preconsolidamenti may be varied, on recommendation of the designer, depending on the actual behavior of cable deformativo, detected in terms of convergence of cable and extrusion of the front.

CONSOLIDATION OF PIPES STEEL DISPOSITION AROUND THE EXCAVATION BOUNDARY
DISPOSITIA A PALPLANSE DE OTEL JURUL EXCAVARE

–N. 37 pipes steel step 0.40 m L = 12.00 m inclination = 0
–N. 37 palplanse de otel pas 0.40 m L = 12.00 m inclination = 0

## SECTION B–B
## SECTIUNEA CURENTA B–B

Scale/Scara 1:50




### TABELUL DE MATERIALE

*Beton torcretat*
*C20/25*
- *Rezistenta medie la compresiune dupa 48h > 1.3N/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%*
  *Elongatie (Agt)k > 7.5%, fractile 10%*
- *Sudabil;*
- *Beton de acoperire: c=4cm ±20%.*

*Nervurile din otel*
- *Nervurile de otel constau in doua sectiuni cuplate IPE180 in S275 otel si coabe de otel rigidizate cu toleranta de 1.0m Placi de otel S275 unghiuri de otel pentru atasarea lanturilor.*

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

*Conducta PVC de drenaj*
- *pentru apa insita 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*
- *Continutul > 60% sticla*

*diametrul exten al conductei din fibra de sticla ø60;*
*Imbinarea (eventual): mai bine fara sudura; daca imbinarile sunt pregnte trebuiesc realizate pentru lipirea cu rasini epoxidice si racordat cu manson de otel;*
*fibre plate: 40 th.×8mm 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 Pt, 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 > 5.0 MPa*

### MATERIAL TABLE

*Shotcrete*
*C20/25*
- *Average compressive strength after 48h > 1.3N/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 IPE180 in S275 steel and stiffening brackets step 1.0m tolerance. Steel plates S275 and steel angles 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*
- *Geotextile: polypropylene nonwoven 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.×8mm 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 Pt, 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 > 5.0 MPa*

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 FINANŢAT 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 | C.Gambelli | | |
| Verificat Checked | Tunel Expert Tunnel Expert | C. Gambelli | | |
| Întocmit Elaborated | Proiectant Designer | C.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.
Sectiune 1 Brasov - Sighisoara

Rehabilitation of the railway line Braşov - 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 : **MURENI TUNNEL**
**ENTRANCE VANATORI SIDE**
**Starting framework: excavation and consolidation sections**
**Inceputul cadrului: sectiuni de excavatie si consolidare**

| Codificare / Codification System | Scara / Scale | LOT | Nr. / No |
|---|---|---|---|
| E A 5 1 0 1 C 1 6 B B G A 1 1 0 0 0 0 1 0 | varlat / various | | - |