FEATURE OF TECHNICAL SERVICE

Subject	Maxilotto 1 Highway A3 «Salerno-Reggio Calabria» - Adjustment and modernization work on the type 1A section of the CNR/80 on SA-RC motorway between km 53+800 (interchange of Sicignano included) and km 82+330 (interchange of Athena Lucana excluded), section Sicignano, Petina, Auletta, Pertosa, Polla and d Atena Lucana.
Carried out by	SGAI srl of E. Forlani & C.
Client	Cooperativa Muratori & Cementisti - CMC of Ravenna soc.coop
Service length	2003 - 2013
Value of works	€ 529'009'393,97
Categories value	V.03: € 216'883'927,37 S.03: € 62'108'209,99 S.04: € 48'957'588,99 S.05: € 166'090'875,64 IA.03: € 14'897'815,42 IA.04: € 6'384'778,04 IB.08: € 11'046'585,52 D.02: € 867'441,60 D.04: € 867'441,60 P.01: € 904'729,80

Tunnels – Computational aspects - Simulation, results and verifications

The analyses were carried out simulating the structure with numerical model and finite tridimensional elements, resolved with calculation code SAP 2000 (*C.S.i. Computer & Structures, Inc.: "SAP2000 Integrated Software for Structural Analysis and Design" Ver. 8.2. Berkeley, California (USA). 2002*; In the verification sections of the typological section of tunnel portal, for the numerical model of the single-dimensional finite and finished elements, SAP 2000 was used to solve the hyperstatic problem given by the pre-covering, resting on the lateral bases, anchored along the piers and the flanks of bolts and confined in deformations by the reactions of the surrounding cluster.

Tunnels - Design issues and their resolution

The Esecutive Project foreseen the expansion of 3 natural tunnels. As a result of the numerous critical issues faced and resolved for the various works, the various papers and design solutions adopted for the Castelluccio tunnel are reported here: planimetry, elevations, profiles, sections, construction details and calculation models executed.
The Castelluccio tunnel crosses a ridge, entirely modeled on the calcareous rocks, which separates the Tanagro valley from that of its tributary creek Petroso, which settled on a fault. The cluster affected by the enlargement excavation is formed by calcareous layers which, to different degrees, are fractured both due to the mesostructural conditions and to the effects of the excavation of the existing tunnel. In the South entrance, to overcome the debris accumulation, cores of micropiles in the cap were necessary. The remaining parts of excavation in enlargement are made with ribs in double section (center distance 1.50 m), projected concrete with a maximum thickness of 30 cm and diffuse radial bolting with punctual anchor bolts subsequently cemented.

Some results of the simulation - TECHNICAL REPORT AND CALCULATION OF THE CASTELLUCCIO TUNNEL (Section V Class)

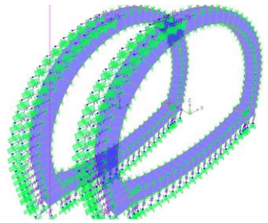
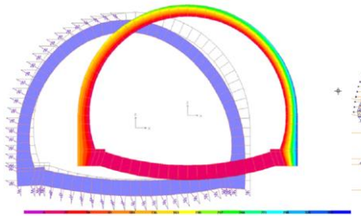


FIG. 1



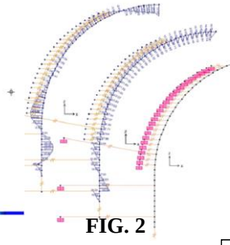


FIG. 2

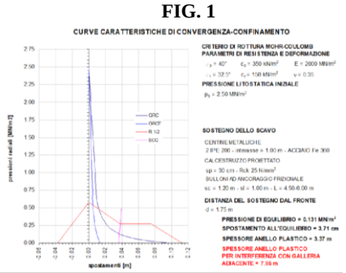


FIG. 3

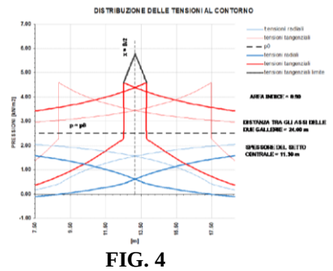
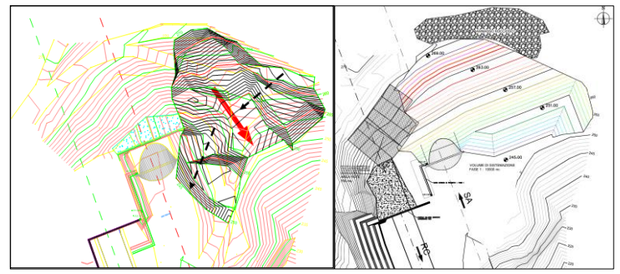


FIG. 4

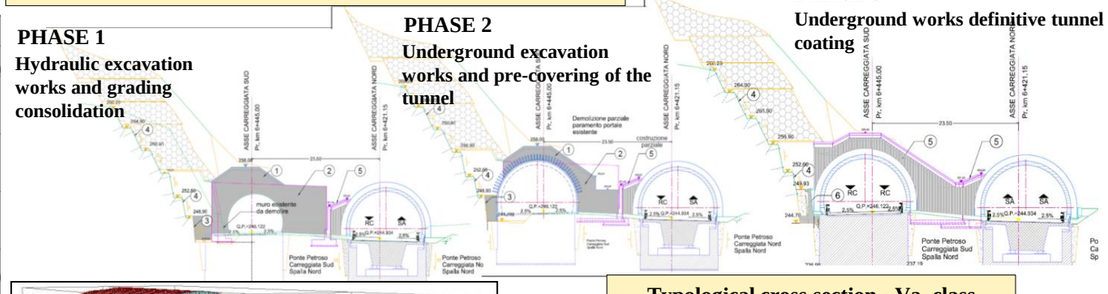
FIG.1: Numerical model in static and seismic conditions Section Class V - definitive coating sizing verification - Results: Deformed and pressure distribution- seismic condition
FIG.2: Static diagram - Diagram of shear and bending stress of section at the portal - verification of pre-covering dimensioning
FIG.3: Characteristic curves
FIG.4: Adjacent tunnel interaction

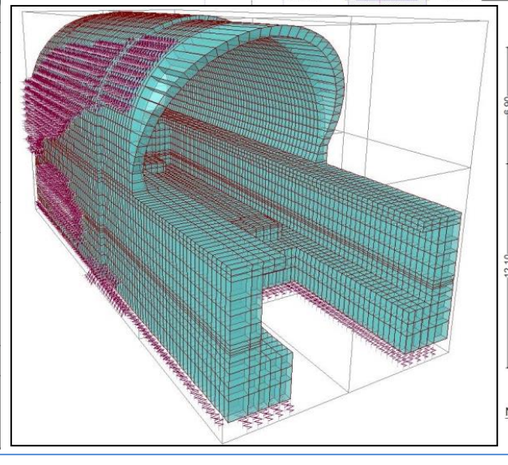
Resolutions of landslide movement - South portal



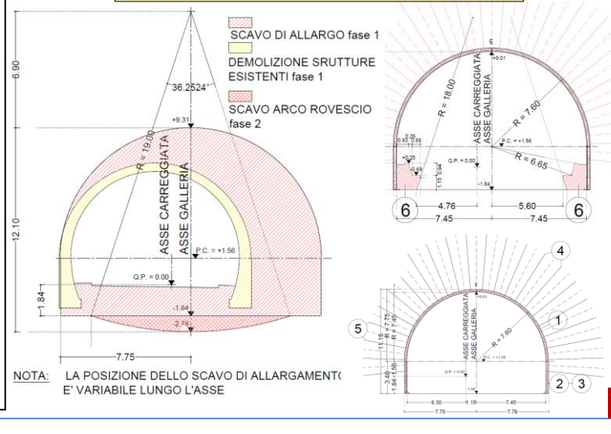
Surveyed area in landslide - restoring works

FASISTIC SECTIONS 6+445.00 Portal South

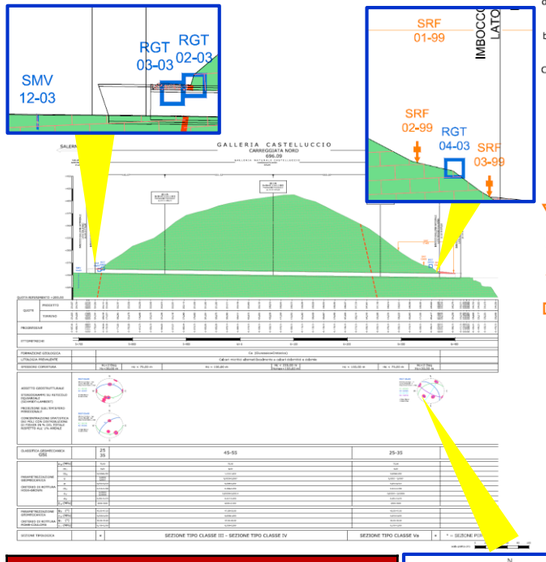


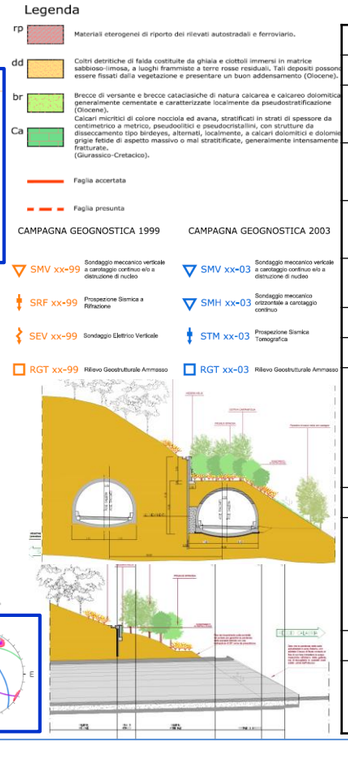


Typological cross section - Va. class



Geomechanical profile - CASTELLUCCIO tunnel - North carriageway





Geomechanical Class

The traits encountered are attributable to the III, IV, V geomechanical class.

STRUCTURAL ELEMENTS AND MATERIALS	
ARTIFICAL LIMB	1
Lightened concrete + 50x50 cm of crowning curb in reinforced concrete	
SUPERFICIAL LAYER FOR PORTAL'S REGULARIZATION	2
Projected concrete minimum thickness 5 cm reinforced with double electrowelded mesh 6/15x15 cm	
PROTECTION LAYER OF TRENCH WALL	3
Projected concrete minimum thickness 15 cm	
CORTICAL PROTECTION ON THE WALLS	4
Double torsion wire mesh panels with heavy galvanizing reinforced by steel bars or cables in strands and anchored to the ground by bolts Φ20 mm L = 2.00 m, with injection mortar in holes 40 mm, arranged in quantities equal to 1/6 m²	
CARRIAGEWAYS SEPARATION WALL	5
Reinforced concrete wall with front formwork panel in pre-fabricated reinforced concrete with face surface obtained from polyurethane elastomer matrix type "Reckli " Indus 2/108 B or equivalent type	
SUSTAIN WALL	6
Reinforced concrete wall with front formwork panel in prefabricated reinforced concrete covered with natural stone	

TUNNELS AND MAJOR UNDERGROUND STRUCTURES