MSE
SMWALL SYSTEM

SMWALL system for mechanically stabilized earth

SMWALL

Somma srl is specialized in design and installation of soil reinforced structures, both facing sloping with grassing or vertical wall with concrete panels .

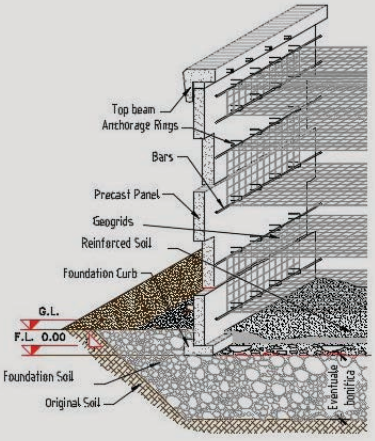
The firm boasts a great and consolidate experience in designing and realization of works in Italy and abroad such as retaining walls, bridge abutments, bank protections, soundproof turned-green dunes, protective barriers for military works and every possible application of the SM wall. The SM Wall are an innovative process for the construction of reinforced soil structures. The soil reinforcement technique, consisting in the insertion of armatures comprising both metallic and polymeric bands, deployed in horizontal layers within the ground and anchored to the external retaining wall, either vertical or slanted, is well known in the geotechnical engineering field and several systems based on this principle have been developed.

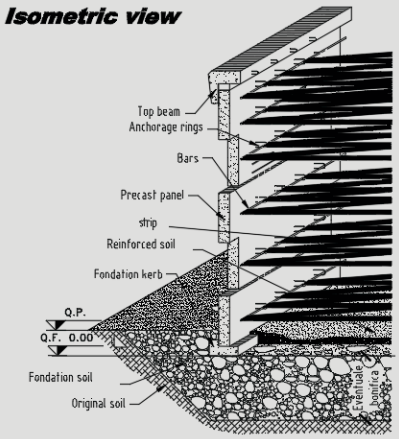
SMWALL

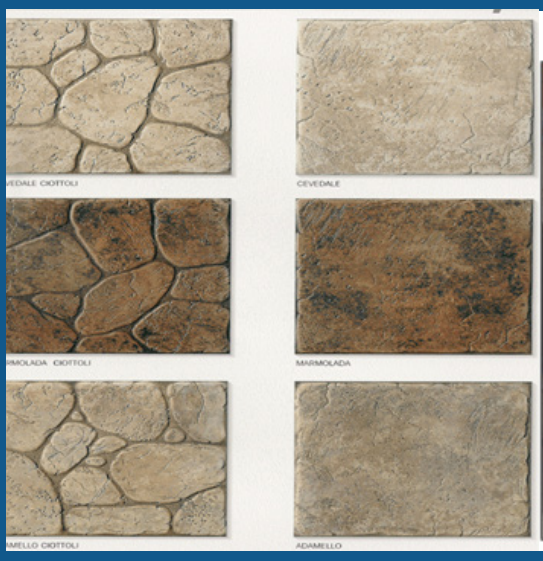
The system of geogrids allow for the within-ground reinforcement to be more uniform, and give that reinforcement a more effective action. This is due to the presence of transverse lines, running parallel to the retaining wall, wich noticeably improve the anchorage carateristics. The system use also polymeric reinforcing strip. The soil reinforcement system is totally composed of prefabricated elements, quick and easy to install, that together with fill-in soil of specific characteristics forms the structure. The system can be used in several fields of application such as:

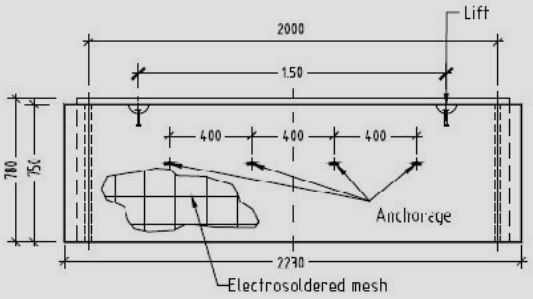
- Support walls
- Support walls
- Architectural barriers
- Motorway platforms
- Settling of slopes
- Settling of slopes
- Industrial works
- Railway platforms

Of course the functioning principle of the main body as well as the following installation instructions remain valid for every application, varying case by case the environmental conditions and consequently the accessory works. Also, from the building point of view, the system is easier and quicker to carry out. The external containment wall can also reproduce several architectural motifs playing with the decorative elements and using its components as a mosaic.

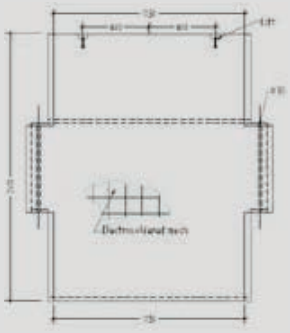




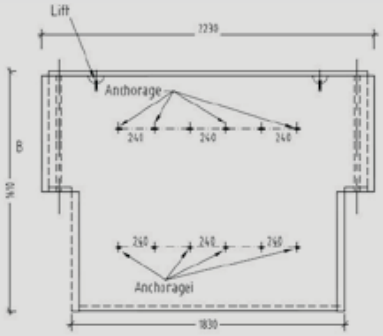




>>> Base Panel



>>> Top Panel



>>> Standard Panel

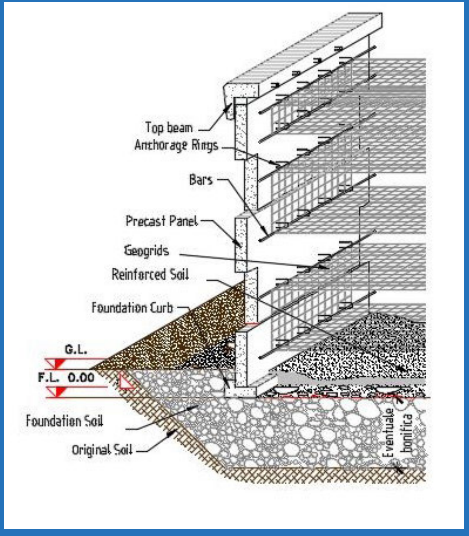
The constituent parts of the system are showed in the axonometric detail attached and listed here below:

Prefabricated panels in reinforced concrete

These are concrete prefabricated panels lightly reinforced (electrosoldered mesh of variable φ 6-10 mm) having a costant depth of 14 cm. They are basically distinguished in three topologies :

- the base panel of maximum dimension 2 x 0.8 m
- the standard panel of dimension 2 x 1.6 m
- the top panel of variable dimensions according to the profile of the project but never larger than 2 x 2.4 m
  The weights is then controlled within 1.2 – 1.8 tons, allowing easy transportation.

>>> Axonometric view

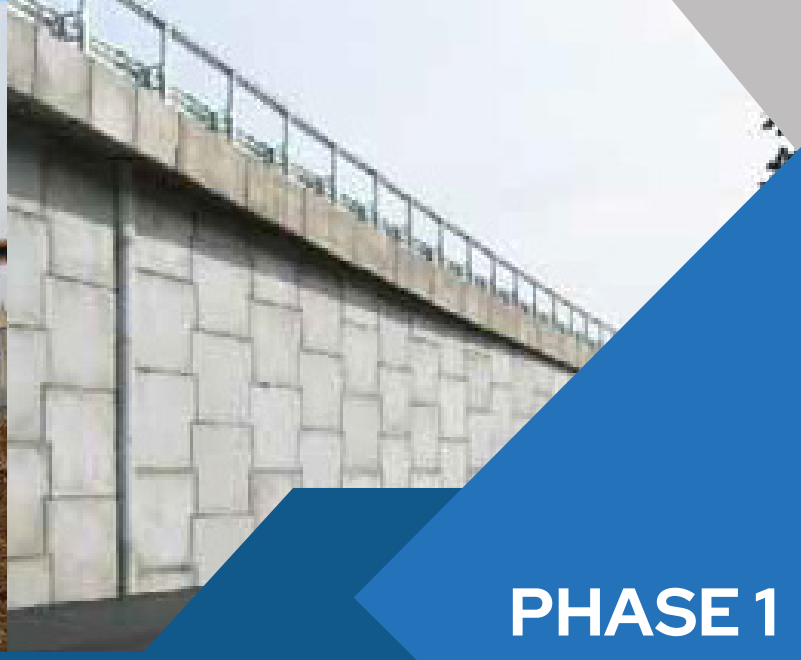


Steel anchorage points

They are composed of two separate elements. The anchorage rings in stainless steel, wich are united to the prefabricated panels at the moment of casting and are thus delivered to the building site already assembled and ready to be installed, and the anchorage bars which are steel rods coated by an elastic-polymer having the double function of protecting the bar itself and to improve the grip of the anchorage to the armature.

The armatures

These are composed of geogrids in composite polymers of high resistence and elastic module, of different classes in such a way that can be optimised within the same project. They are delivered to the building site in 50-100 m long rolls, already of the width of the project and easily identifiable. Each armature binds one panel making their laying down work quick and safe. The system is completed by accessories specified in the following phases, the foundation kerb to be laid down and top kerb, wich is prefabricated as well, plus of course all those additional works specifically required by the project susch as hydraulic gutters, draining foundations, pillow beams for bridges shoulders, etc. The speed of the system resides essentially in the repetitiveness of the actions described below, wich consequently maximize the productivity of a team and of the equipment used for the ground movement, once a steady working rhythm has been reached, that is after the first square meters have been laid down. The reinforcing strip are high tenacity polyester fiber tendons enceased in a polyethylene sheath coating wich increases the durability of fiber tendons from physical and chemical damages.



PHASE 1

PHASE 1: Preparation of the laying floor, tracing and casting of the foundation kerb.

Once the working area has been identified, the digging until foundation level (min. 40 cm below the terrain level) is carried out and possibly the reclamation of the soil underneath, according to the project specifications.

Although one of the main advantages of the system is that ground failures tend to happen mainly during the scheduled phases of the construction (90% ca. depending on the site geologic characteristics), in some specific cases geotechnical procedures may be deemed necessary to reduce the absolute value of these failures and to gua- rantee specific hydraulic proper-ties.

There follows the tracing of the altitude plan of the site by means of topographic measurements. This must be as precise as possi-ble because, although another notable advantage of the system is that it can accept relevant differential ground failures (of a magnitude of roughly 1%), it is better to maintain this margin to absorb possible unhomogeneity of the site.

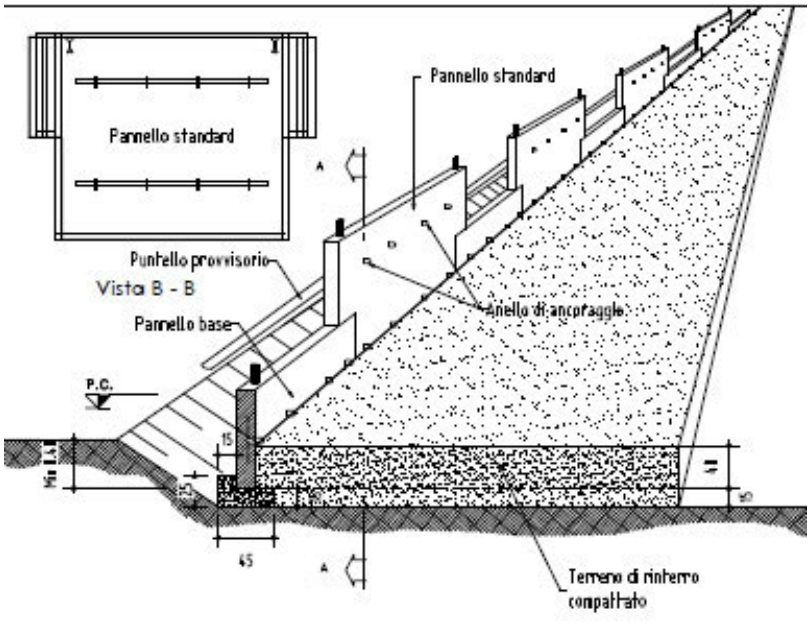
PHASE 2: Lying down of the base panels.

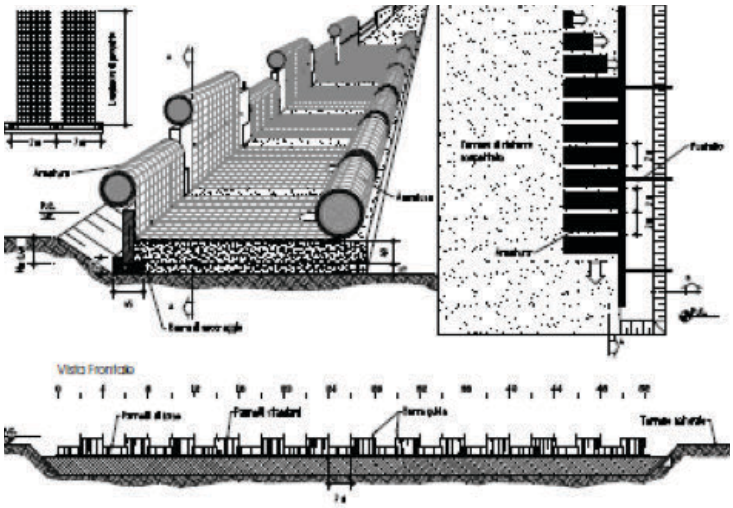
The SM system panels have grooved sides to ensure a good interconnection between the panels themselves and to avoid the escaping of the finer parts of the fill- in soil without the use of filtering geo- textures.

The lying down begins with rectangu- lar shaped base panels to be placed with an axial spacing of two meters. The panels are provided with holes on their sides to better identify the reference point. Guiding bars, inserted in.

Those holes after the lying down, allow to lineup correctly successive panels, keeping their positioning easy.

PHASE 2





PHASE 3

PHASE 3: Lying down of the standard panels and the first fill-in soil layer.

The “T” shaped standard panels, constituting the majority of the used panels, are installed between the base panels lowering them from above, over the guiding bars which hold them until they are anchored to the armatures. The movement of the panels can be done by the same excavator used for the laying down of the fillin ground, the movement height being limited to a single row of panels (the building work takes place from within the struc- ture standing on the filledin ground during its on-going construction). For the first two/three row of panels it is suggested to support them from outside the structure. This helps main- taining the desired verticality of the structure in the successive phases. An error in the first rows of panels, in fact, is obviously amplified as the structure grows, this won’t endanger its stability, but has negative repercussions on the finished work aesthetic. The installation proceeds then with the laying down and solidification of the fillIn soil, working in parallel to the wall with 20 cm layers until the level of the first anchorage rings is reached (40 cm from the external side of the foundation kerb).

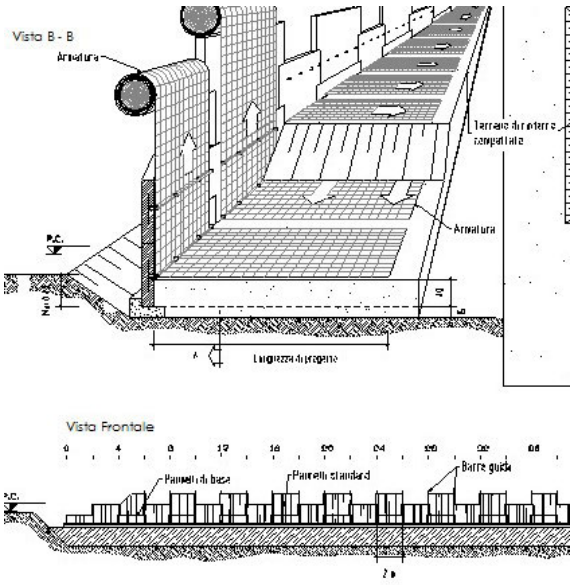
The ground has to be carefully compacted, using a large drum compactor, in the part behind the reinforced massif and a small plate compacting machine for the 2 m strip behind the wall.

PHASE 4: Laying down of the first bed of armatures and the second fill-in soil layer.

The armatures are, as previously mentioned, of different re-sistances, easily identified by their coloured elements and by the dimension of the lines composing the mesh. The strongest armatures must always be laid-down first, the lower layers of the structure being the most stressed. Once the length of the project has been traced (distance between the containment wall and the end of the armatures), rolls are placed in the inside part of the structure to be built (one roll for each panel) and unrolled toward the anchorage points, holding the back end firmly in place by pegging it to the ground. When the anchorage points are reached, the armature is stretched manually, before inserting the anchorage rings in its mesh (during this operation it will necessary to cut some of the mesh transversal lines).

The anchorage bar is then inserted through the rings and the geogrid is thus fixed. The remaining part of the armature roll is temporarily kept on the panel. The installation proceeds then with the laying down and solidification of the fill-in soil, working parallel to the wall in 20 cm layers until the upper level of the first base panels is reached (40 cm). The ground must be carefully compacted as previously described.

PHASE 4



PHASE 5

PHASE 5: Laying down of the second row of standard panels and of relative fill-in soil layer.

The “T” shaped standard panels are placed between the panels previously installed, lowering then from above over the new guide bars. On the resting surface between the panels is placed a horizontal joint made of a layer of neoprene to di-stribute the contact pressures and avoid localized overtensions. Easy to apply, close-cells, expanded polythene foam is used instead to seal the vertical joints and to avoid concrete contact in case of great differential ground failures.

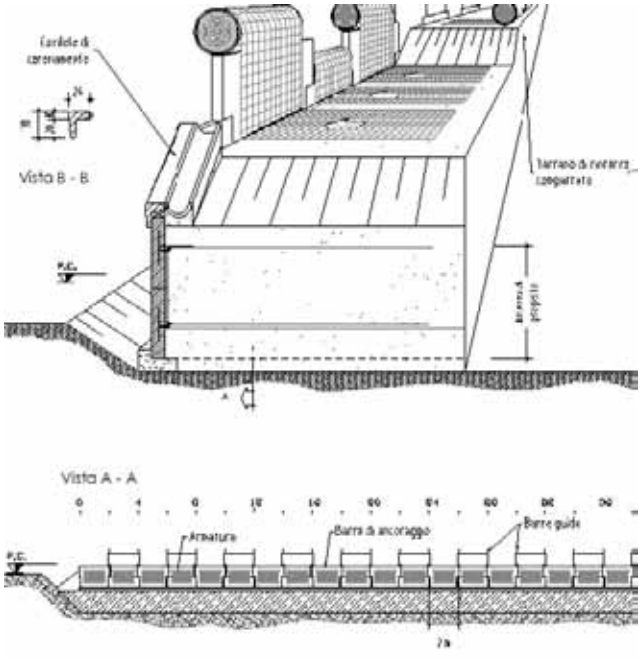
The installation proceeds then with the laying down and solidification of the fill-in soil, working parallel to the wall in 20 cm layers until the upper level of the first base panels is reached (40 cm). The ground must be carefully compacted as previously

PHASE 6: Laying down of the sec-ond bed of armatures and of the above fill-in soil layer.

The armatures, being now close to the containment wall, are fixed to the new row of anchorage points with the proce-dure previously explained. Subsequently they are unrolled toward the back of the massif where, after manually prestretching them, they are again pegged to the ground. It is now possible to cut the armature and use the roll again in the successive phases. The operation of cutting to length the armature can actually be done before the beginning of the laying-down. In this way, although a sub-phase is created, requiring additional work and temporary stocking of several elements, it is easier to move the armatures and to check the quality of their installation (control of their length and resistance according to the project documentation).

The installation proceeds then with the laying down and solidification of the fill-in soil, working parallel to the wall in 20 cm layers until the upper level of the first base panels is reached (40 cm). The ground must be carefully compacted as previously described.

PHASE 6



REFERENCE LIST

Project: Protection of the promenade of the city of Boumerdes (Algeria)

Description: The structure consists of a wall of scarp in support of the seafront road, 790 m long and having the varying heights between 6 m and 2.2 m with two accesses to the beach. Because the wall facing the sea is subjected to severe environmental conditions. This has been made with careful choice of materials and has made particular attention to the hydraulic system.

Surface: 2.790 m2 of reinforced soil in vertical facing with concrete panels and architectural finishes.

Enterprice: SAPTA – Entreprise Publique Economique, Algers

Place: Boumerdes – Algeria

Project: Algiers Highway – Costantine, Interchange Setif East (Algeria)

Description: Two bridge abutments comprehensive of long wing walls for the construction of road overpass. The walls have a maximum height of 6.2 m for the sections of the abutments, and 7.5 m for the sections of the wing walls. The overpass has a width of 26 m and lights of 30 m. The deck is made of prestressed concrete beams that rest on two pillow beams. The wing walls have different lengths. Varying from 115 m to 50 m.

Surface: 1.280 m2 of reinfor-ced soil in vertical facing with concrete panels and architectural finishes.

Enterprice: SAPTA – Entrepri-se Publique Economique, Algers.

Place: Setif – Algeria

REFERENCE LIST

Project: Eco-environmental Residential Construction (Italy)

Description: Earth reinforced walls with grassing with three main bearings for the recovery and expansion of areas used as garden of a private villa.

Surface: 500 m2 of reinforced soil in inclined facing with grassing.

Enterprise: RA.ME S.r.l. - Rome

Place: Campagnano Romano – Italy

Project: South Tangential of Verona, new lay-bys (Italy)

Description: The structures in question are constituted by four walls of scarp for the realization of the same number bys without modification of the im- pression of the road embankment and of the expropriations. The walls have variable heights from 1.40 to 4.00 m and have a linear development of about 392 m, varying for different works from 90 m to 103.5 m.

Surface: 1.200 m2 of reinforced soil in vertical facing with concrete panels.

Enterprise: THIENE Costruzioni S.r.l. - Longare (VI).

Place: Verona – Italy

REFERENCE LIST

Project: FS Line Empoli - Siena, bank protection of the river Elsa (Italy)

Description: The project involves the bank protection of the right bank of the Elsa. This protection extends longitudinally along a stretch of about 500 me-ters. The defense of the bank is made of reinforced earth retaining structures with inclined facing and filled with dry material to maximum height of 6 m and about 4 m wide at the top with a bank of 4 m at the base of the ultima-tely escarpment made with ground lined with geocells of 2:3 slope.

Surface: 2.500 m2 of reinforced soil with hanging inclined filled with dry material and special anti-erosion textile.

Enterprise: COESTRA S.p.A. - Florence

Place: Val d'Elsa (FI) – Italy

Project: A22 of Brennero, new lay-bys (Italy)

Description: scarp Walls in inclined facing with grassing for the widening of the road without changing the footprint of the existing embankment and expropriations. The walls have heights varying between 2 and 4 m.

Surface: 1.000 m2 of reinforced soil in inclined facing with grassing.

Enterprise: COESTRA S.p.A. - Florence

Place: Brennero and Mezzocorona – Italy

REFERENCE LIST

Project: S.S.77 “Val di Chienti”, Lotto Sfercia - La Maddalena (Italy)

Description: Project Executive variant S.S. 77 “Val di Chienti,” reinforced earth retaining walls. The works extend along the whole track and include: Junction Sfercia, walls of the ramps L and K and bridge abutment of the roundabout at high altitu-de, variable heights from 2 to 7 m. Retaining walls both in westbound carriageway and in eastbound carriageway, located between the progressive pk 1+053.00 - pk 1 +240.00, heights varying from 5 m to to 9 m. Passers abutment of the Chienti II, Chienti III, Chienti IV and Polverina viaducts, heights varying from 4 m to about 6 m under the abutment, and up to 9 m about at the back of the walls paregravier of them.

Surface: 7.000 m2 of reinforced soil with vertical facing using concrete panels.

Enterprise: COESTRA S.p.A. - Florence

Place: Sfercia (AN) – Italy

Project: Link road between Highway exit Noventa di Piave and SS14 locations Calvecchia of San Dona di Piave, “flyover via Gondulmera (Italy)

Description: The structures under consideration consist of retaining walls for the overpass bridge abutments and embankments of the ramps, with a height equal to 5.40 m below the bridge abutments, to decrease up to 1.60 m along the wing walls of the same.

Surface: 500 m2 of reinforced soil in vertical facing with concrete panels.

Enterprise: THIENE Costruzioni S.r.l. - Longare (VI)

Place: Calvecchia of San Donà di Piave (VI) – Italy

REFERENCE LIST

Project: Accomodation of the Intersection of S.P. N.31/43 Valdichiampo and S.P. N.33 Montorsina (Italy)

Description: Reinforced soil retaining wall to bring in height the ramp to Montecchio, reducing the space at the bottom of the same access ramp to the bridge over the river Chiampo to allow the un-derlying viability that branches off from the roundabout junction to Arzignano. The structure in question is constituted by a wall in rein-forced earth having a height varying from 1.2 to 8.60 m approxima-tely and a total length of 140 m.

Surface: 1.100 m2 of reinforced soil with vertical facing using concre-te panels.

Enterprise: THIENE Costruzioni S.r.l. - Longare (VI).

Place: Montorso Vicentino (VI) – Italy

Project: Works lot road Mirto - Longobucco - Sila, I ° excerpt, Longo-bucco - Destro (Italy)

Description: N° 11 reinforced earth bridge abutments inclusive of wing walls, which have different lengths (ViaductSullacca, Viaduct Manche Canine, Viaduct Gaul, viaducts Ortiano1 and 2 and Viaduct Puntadura) with maximum heights of 12 meters for a total of 4.200 m2. Current scarp walls, having different lengths and heights ran-ging from 7 to 3 meters, for a total of approximately 10,000 m2. Outer facing in smooth concrete panels.

Surface: 14.200 m2 of reinforced soil with vertical facing using concrete panels.

Enterprise: SO.GE.MI. Ingegneria s.r.l. Costruzioni Generali

Place: Longobucco (KR) – Italy

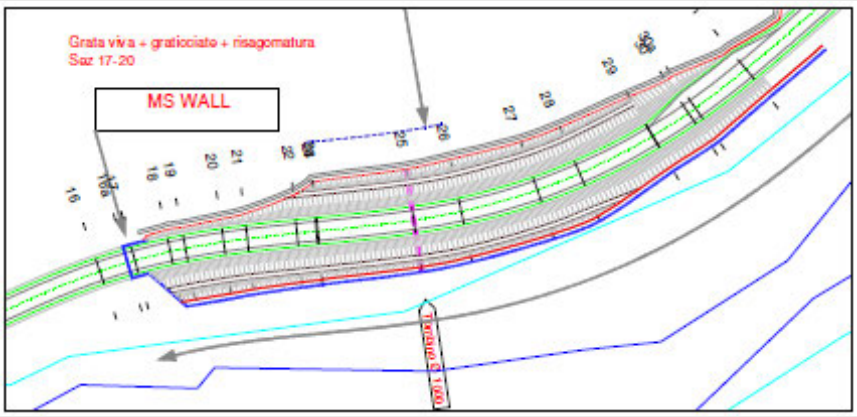
Project: FS Line Verona – Brennero, Section Matterello – Stella di Man – Trento South. Realization of the service road alongside (Italy)

Description: Scarp walls in inclined facing with grassing for the con- struction of service road alongside the railway line without chan- ging the footprint of the existing embankment and expropriations. The walls have heights varying between 2 and 6 m.

Surface: 14.000 m2 of reinforced soil in inclined facing with grassing.

Enterprise: COESTRA S.p.A. - Florence

Place: Trento – Italy



Project: Urbanization Via di Selva Nera, Rome (Italy)

Description: Scrap walls to two banks of which the higher in inclined facing with grassing and lower in vertical facing with concrete panels for slope stabilization and simultaneous enlargement of the residential areas.

Surface: 1.200 m2 of reinforced soil with vertical facing using concrete panels and 1.000 m2 of reinforced soil in inclined facing with grassing.

Enterprise: CE.SA.I S.r.l. - Roma.

Place: Rome – Italy

REFERENCE LIST

Project: Highway Passing of Mestre, Dolo (Italy)

Description: Reinforced earth retaining walls of the access ramps to the Spinea viaduct. The peculiarity of this project consists of the soil in relief executed with soils stabilized with lime (CaO or Ca(OH)2) having a pH residue order of about 10 - 11 and the outer facing is in architectural panels. It's the first production of its kind in Italy.

Surface: 5.035 m2 of reinforced soil with ver- tical facing using architectonical concrete panels.

Enterprise: MANTOVANI S.p.A. – Mestre (VE)

Place: Mestre – Italy

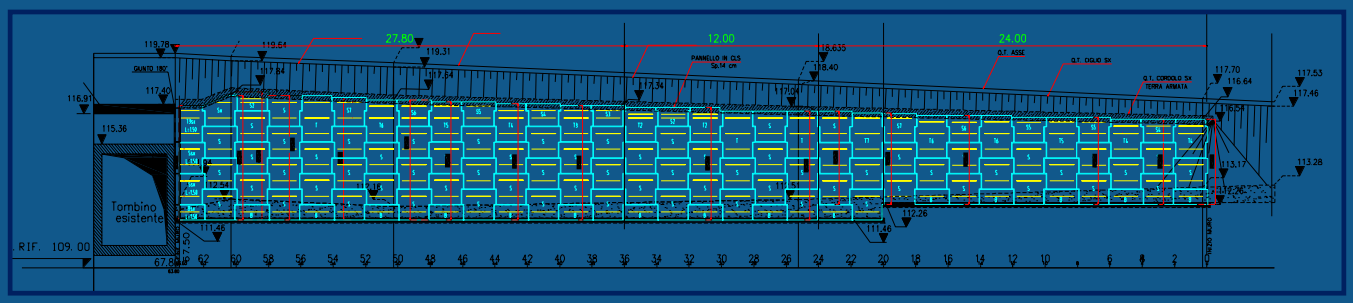
Project: Highway G.R.A. - Adaptation to three lanes to the progressive 18+800

Description: The project involves the constructiona structure consisting of a scarp wall of a vertical facing concrete panels and finishes architectural matrix

Surface: 1.750 m2 of reinforced soil with vertical facing using concrete panels**.**

Enterprise: COSTRUZIONI CONGLOMERATI ED AFFINI - S.r.l. -Rome

Place: Castel Giubileo, Rome – Italy



Project: Reconstruction of the bridge over the Po river SS 9 “Emilia”

Description: The construction of a retaining wall in vertical facing reinforced soil with “scratched” architectural concrete panels. The peculiarity of the project consists in the use of perforated panels suitable for the insertion of the planters for grassing. The maximum height of 4 m of the wall is approxi-mately.

Surface: 170 m2 of reinforced soil with vertical facing using concrete panels.

Place: Piacenza (Italy)

Project: Athens Highway - Kalamata (Greece).

Description: The construction of two reinforced earth retaining walls to facing vertical with “scratched” architectural concre-te panels. The maximum height of the wall is about 8 m.

Surface: 12.000 m2 of reinforced soil with vertical facing using concrete panels.

Enterprise: PROBETON-ERGOTECHNIKI – Gerakas (Greece)

Place: Athene – Greece

REFERENCE LIST

Project: Italy - Requalification of SP46 Rho - Monza

Description: Requalification of SP46 Rho-Monza with motorway characteristics, from the end of the Milan North North (artificial tunnel) to the bridge over the Milano-Varese railway line (included), corresponding to the sections 1 and 2 of the "Preliminary design of the road system adduction to the existing A8/A52 motorway system – Rho-Monza"

Surface: 500 m2 of reinforced soil with vertical facing using concrete panels.

Enterprise: GLF Grandi Lavori Fincosit - SpA- Collini Lavori SpA– ICG srl

Place: MILANO - ITALY.

Project: Implementation of the variant to srt 429 of Val D'Elsa, Section Empoli Castelfiorentino, Lotti IV-V-VI

Description: The project involves the construction of various struc-tures along the route of the variant. Scarp walls are both inclined facing with grassing, both vertical facing concrete panels. Walls for counter, inclined facing with a grassing for the protection and modeling of the sections in tren- ches.

Surface: 2500 sqm of reinforced soil with vertical facing using con-crete panels and 21.315 m2 of reinforced soil in inclined facing with grassing.

Enterprise: Metropolitan city of Florence

Place: Castelfiorentino – Italy.

Project: Maxi-Lot n°2 of the Road System of Marche – Umbria and internal penetration area.

Description: Design end realization of reinforced soil in inclined facing with grassing. Max-Lot 2 of “Quadrilatero Marche- Um-bria” road network is a complex project involving performance using the general contracting formula of works to upgrade the Perugia-Ancona direct route along the Fossato di Vico-Cancelli and Albacina-Valtreara Tunnel-Serra San Quirico sections of the national road “SS-76” (Lot 1.1 – Sub- Lots 1.1.1, 1.1.2, 1.1.3) and Pianello-Valfabbrica section of the national road “SS-318” (Lot 1.2), as well as modernisation of the “Pedemontana delle Marche” national road, along the route between Fabriano and Muccia/Sfercia (Lots 2.1 and 2.2). The overall value of works amounts to EUR 745 million, of which approximately EUR 500 million still to be performed to date.

Surface: 3.000 m2

Enterprise: ASTALDI SPA

Place: UMBRIA - ITALY - 2016

Project: Highway Lioni-Grottaminarda

Description: The project involves construction work on the hi-ghway Lioni-Grottaminarda, more specifically the section of about 20 km that connects Sant’Angelo dei Lombardi and Grottaminarda (AV). The infrastructure is part of the most complex project of connecting the A3 Salerno-Reggio Calabria (exit Con-tursi) with the A16 Napoli-Bari (exit Grottaminarda) with the aim of creating an axis Apennine cross linking “Tirreno- Adriatico”, o drain the basins towards the industrial areas and to strengthen the internal communication lines in the province of Avellino.

Surface: 2500 m2 of reinforced soil in inclined facing with grassing.

Enterprise: Motedil 2000 srl

Place: Avellino – Italy.

REFERENCE LIST

Project: Construction of the new road of the for-mer S.S. 106 for Cutro to SS.109 in Lenze contrada

Description: Design and realization of MSE WALL and reinforced soil slopes.

Surface: 1.000 m2

Enterprise: CROTON SCAVI COSTRUZIONI GENERALI SPA

Project: Construction of the by-pass Road in Nardò (Lecce)

Description: Design and realization of MSE WALL . The project involves the construction of a retaining wall and two bridge abutments in reinforced earth –SM system . The retaining wall facing is vertical and made of concrete panels with stones cladding.

Surface: 2.000 m2.

Enterprise: DIELLE SRL Under realization

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