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Refinement of the Reference Geological Model and Design Solutions for the Construction of the "*A12 - Tor dè Cenci*" Motorway

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RIASSUNTO

Perfezionamento del Modello Geologico di Riferimento e Soluzioni Progettuali per la Realizzazione dell'Autostrada "A12 – Tor dè Cenci"

Lo studio geologico, propedeutico alla progettazione, e geotecnico del collegamento autostradale tra l'autostrada A12 "Roma-Civitavecchia" e l'autostrada Roma (Tor dé Cenci) – Latina, curati dalla Direzione Centrale Progettazione dell'ANAS, ha visto un approfondimento del quadro conoscitivo corrispondente all'avanzamento del livello progettuale. Ciò è stato determinato grazie alla realizzazione di indagini geognostiche e geofisiche mirate, appositamente programmate in corrispondenza dei tratti di maggior criticità geologica e/o progettuale, che hanno permesso una ricostruzione particolarmente dettagliata del modello geologico di riferimento, soprattutto in corrispondenza delle opere d'arte principali. Il modello geologico così ricostruito ha permesso di orientare le scelte progettuali ottimali da adottare, con particolare riferimento ai tratti in cui il corpo stradale si sviluppa in rilevato ed alle diverse tipologie di fondazione adottate per le opere d'arte.

KEY WORDS: *Great road infrastructures, Geological Reference Model, Design solutions.*

The road construction of considerable size and importance, requires the definition of a particularly detailed reference geological model. Its reliability level must be deepened in relation to different outcropping lithofacies and their geometric relationship, as well as their geotechnical behavior. This is a fundamental issue in order to carry out a correct evaluation of design problems related to the local geological contest.

The current example concerns preliminary and final designs of the motorway linking the A12 "*Roma-Civitavecchia*" road with the motorway "*Roma (Tor de 'Cenci) – Latina*", planed by the "*Ufficio Centrale di progettazione ANAS*", on behalf of the "*Autostrade del Lazio SpA*" (ADL).

The intervention, extending for about 16 km, is composed of 4 viaducts, denominated "Viaduct Interconnection" (approximately 2715.50 m), "Viaduct Tevere" (1424.86 m long), "Viaduct Colombo" (of 448.48 m) and "Viaduct Frasso" (336.20 m long) and one artificial tunnel called " *Quartaccio*", about 225 m long.

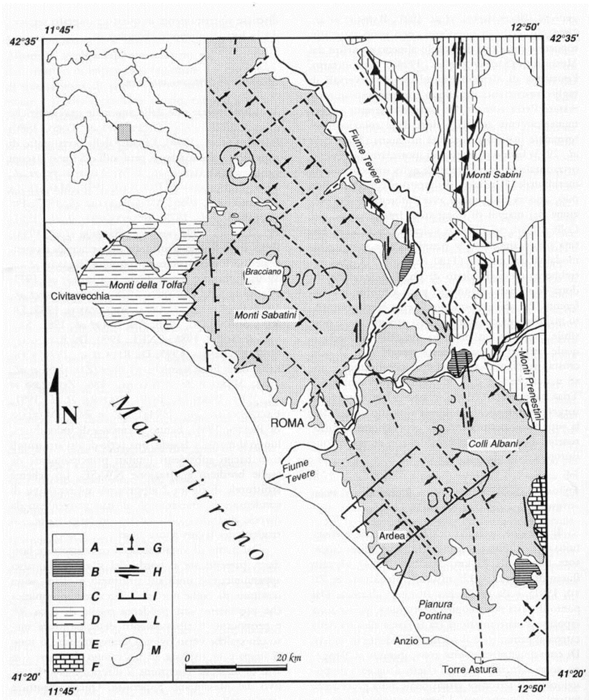

Fig. 1 – Simplified tectonic map of the Lazio region. Legend: A) sedimentary deposits of cycles "*neoautoctoni*" and coastal deposits (Messinian-Pleistocene), B) travertine deposits (Quaternary), C) volcanic deposits (Pliocene-Pleistocene), D) unit of "Monti della Tolfa" (Sup.Cretaceous-Eocene), E) series silico-clastic-limestone-marl "sabine" (Sup Triassic.-Miocene); F) carbonate series of "Monti Lepini" (Sup. Cretaceous); G) edge faults, mainly buried, of subsiding basins with predominantly normal movement; the arrow indicates the depressed part, H) faults with predominantly strike-slip movement, I) faults with mostly normal movement; dashes indicate the depressed part; L) the main sources of thrust; M) rims of craters and calderas (after Faccenna et al.,1995).

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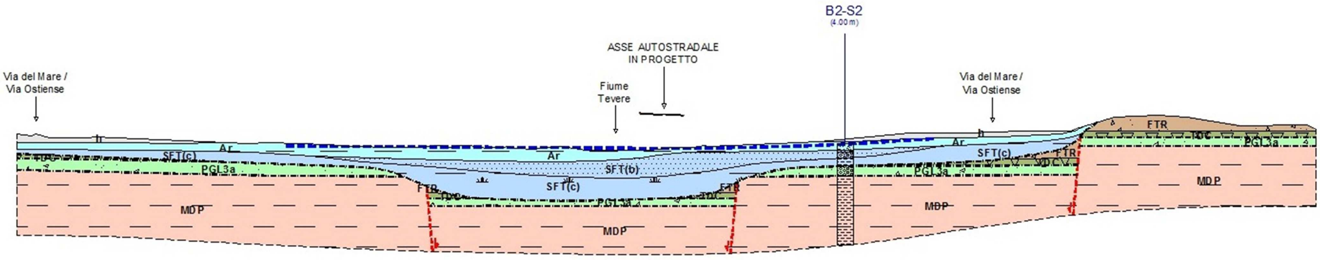

Fig. 2 – Geologic section n.358 – *h*: anthropic deposits; *Ar*: recent floods; *SFT*: 'Sintema del Fiume Tevere', b) subordinate silty sands, c) organic clays and peat horizons with plant remains; *FTR*: 'Formazione del Fosso del Torrino'; *TDC*: 'Unità di Tor de Cenci'; *PGL*: 'Formazione di Ponte Galeria', 3a) 'Membro della Pisana'- conglomeratic-sandy lithofacies; *MDP*: Formazione di Monte delle Piche.

The road corridor is located in a complex geological setting in which depositional and erosional phases overlap in different genetic environments. In this context, the sedimentary pre-volcanic bedrock consists of units with facies at first marine then transitional and finally continental (Conato V. et alii, 1980; Funiciello R. at alii, 1978; Funiciello R. et alii, 2008).

The oldest unit, as identified in the studied region, is represented by the formation of "*Monte delle Piche*", a marine clayey deposit on which recent pyroclastic and alluvial sediments have settled. These soils have been subject to tectonic movements, characterized by faults with Apenninic (NW-SE) and Antiapeninic (NE-SW) directions, as well as N-S oriented. The first system lowered the substrate according to a staircase system (*Fig.1*) (De Rita et alii, 1989).

The reference geological model was progressively refined. During the preliminary design, by means of a great amount of geognostic data (no 65 boreholes, no 27 static penetration tests, no 2 wells and other no 31 boreholes coming from pre-existing investigations), a preliminary model was prepared. Afterwards during the final project, by means of further investigation specifically programmed on the basis of project requirements, the cognitive framework was properly integrated.

At the end of the new site-investigation phase, a reference geological model, congruent with that previously established, is therefore achieved.

With reference to each viaduct, this model was enriched by a more detailed layout of tectonic and stratigraphic properties of foundation soils (*Fig.2*).

The study of the geotechnical properties of the foundation soils of viaducts, constituted by fluvial-marsh terrains with a high content of organic matter, highlighted their high deformability and compressibility. Consequently, in order to reduce potential failures of significant magnitude (also consolidation settlements), different interventions were suggested.

The study of the geometry body road aimed the reduction of the overload transmitted to the soil, lowering the project level and the height of the traits in embankment, compatibly with the other constraints.

In the same time and perspective, some of the highest embankments (for example in approach to the viaducts) have been made of lighter material in a different way for each area.

In order to lighten the body road will be insert, according to the traits, both metal pipes ARMCO type, and adopting the sintered polystyrene foam (EPS) preformed in blocks and still realizing the embankment with expanded clay. To the aim of improve the resistance of the laying surface, a geogrid reinforcement will be positioned below the reclamation.

The foundational solutions adopted for the main viaducts are different according to the local context: direct compensated foundations, deep foundations on diaphragms, deep foundations on large diameter piles, deep foundations on precast beaten piles (*Fig.3*).

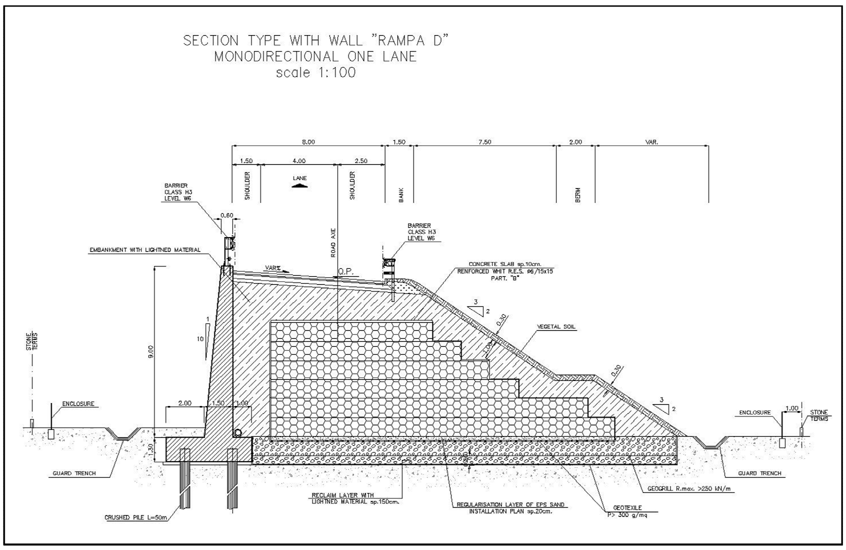

Fig. 3 – Examples of sections used.

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