

FEATURE OF TECHNICAL SERVICE

Subject

Detailed and Executive design of artificial tunnels, roadways, hydraulic works, environmental mitigations and minor works in Ca of Maxilotto 2 - Completion works of the Perugia-Ancona route: SS.318 «Valfabbrica» section of Pianello-Valfabbrica, SS.76 «Val d'Esino» sections of Fossato di Vico-Cancelli and Albacina-Serra San Quirico and «Pedemontana delle Marche» section of Fabriano-Muccia-Sfercia.

Carried out by

SGAI srl di E. Forlani & C.

Client

Dirpa 2 Scarl

Service length

2015 – 2019

Value of works

€ 316'071'173,03

Category values

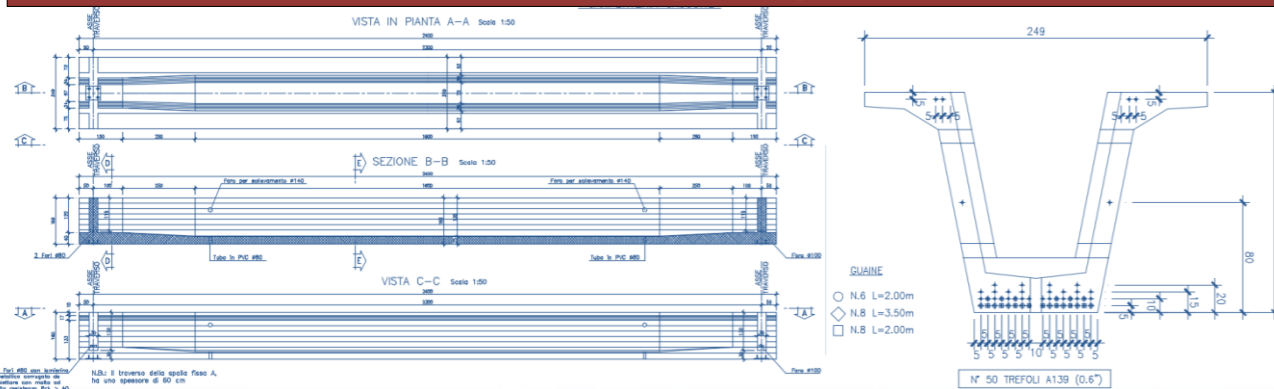
V.03	€ 21'852'549,29	D.05	€ 21'540'329,00
S.04	€ 19'774'412,48	P.01	€ 19'774'412,48
S.05	€ 25'122'888,20		

Viaduct DEL RANCO - Design issues and their resolution

As part of the Executive Project of sub-lot 1.2 of the S.S. 318 on the Pianello-Valfabbrica - Maxilotto 2 section - on the North and South carriageways, the construction of the viaduct called Del Ranco is planned. The viaduct has a length of 253m on the south carriageway and 251m on the north ones, with spans simply placed on the piers and abutments. The first 8 spans of the viaduct have a length of 25m of span and are made with **prefabricated beams in reinforced-prestressed concrete** of the box type and reinforced concrete slab cast on site. During the executive variant design phase, the span of the last span of the two viaducts, on the Ancona side, was increased to 50m by providing a mixed steel-concrete structure, so that it was possible to overcome of the existing road SS. 318-Valfabbrica.

From a construction point of view, a continuous slab deck was planned thanks to the use of continuity bars and buffer joints to connect the reinforced concrete and steel-concrete decks to each other (**kinematic chain**). In this way it was possible to provide expansion joints only at the two abutments. In particular, by using elasto-plastic insulators with transversal constraint on the piles and on the mobile abutment, it is possible to transfer the longitudinal actions on the fixed abutment only, where support devices with longitudinal and transversal constraint have been placed. The verification of the viaduct was performed on the basis of the **global 3D modeling** of the work thanks to the aid of the **SAP2000** calculation program.

Viaduct DEL RANCO – Carpentry of precast beams



Viaduct SERRA SAN QUIRICO NORTH – Design issues and their resolution

As part of the Executive Project of sub-lot 1.1.B of the S.S. 76 on the Albacina-Serra San Quirico section - Maxilotto 2 - the construction of the viaduct called Serra San Quirico is planned on the north carriageway. The work extends for about **751m** in length alongside the Ancona - Perugia railway line and the existing SS.76 (future south carriageway of the infrastructure), crossing the Esino river. The viaduct is made up of 17 spans, 10 of which with mixed steel-concrete section deck with variable span from a minimum of 44m to a maximum of 70m, while the remaining 7 spans reinforced-prestressed decks with a span of 25m. The overall width of the deck is 12.55m, which is supported by a system consisting of two beams with a height of 3m, cross-beams with a reticular structure, bracing and a collaborating slab, by shear connectors, with a thickness of 6+26cm. The substructures reach a maximum height of about 16m from the ground level.

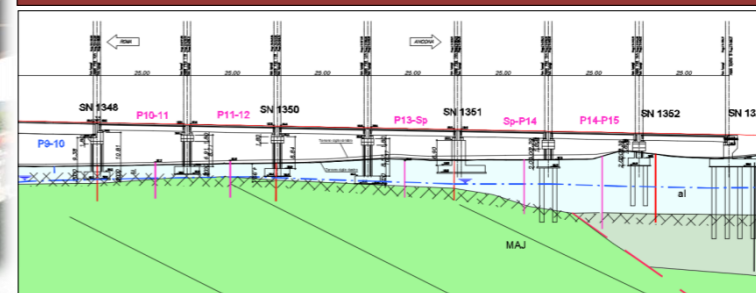
The verification of the viaduct was performed on the basis of a first simplified modeling (model A), in which the loads, once the partition coefficients were calculated, were applied to the single multi-span beam modeled thanks to the aid of the **Midas Civil** calculation program. Subsequently, the modeling was refined and validated by drafting the **global three-dimensional model** (model B), so that the effects of the planimetric curvature of the viaduct could also be taken into account.

In the second modeling, the curves relating to the **rheological phenomena of concrete** and the permanent loads were automatically considered. In addition, the different load configurations were studied during the construction phases of the work. In Phase 1, the only reagent section of the metal structures was considered, considering the weight of the metal structure and of the concrete slab during the casting phase. In Phase 2, the entire mixed section was considered reagent, introducing the mobile loads due to traffic, the thermal and viscous effects of shrinkage. The sismical analysis was, however, carried out separately taking into account the constraint system, consisting of multidirectional supports and seismic isolators.

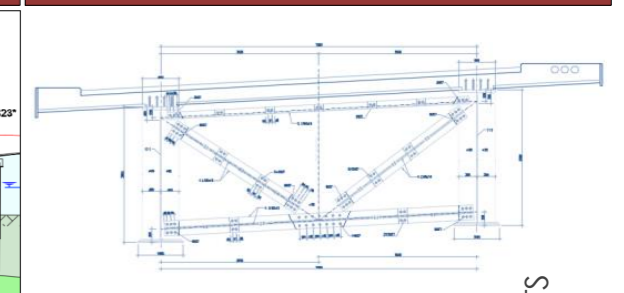
Aerial view of viaduct SERRA SAN QUIRICO NORTH during the execution works and deck launch



Excerpt geological profile of the precast section



Typological section of the steel section



FEM 3D modeling of the viaduct

