



SIKA AT WORK

Kallidromo Tunnel

CONCRETE PRODUCTION: Sika® Plastiment®, Sika® ViscoCrete®,
Sika-Aer® Fine, Sika® Separol®, SikaTard®,
Sikament®, Sika® Sigunit®

BUILDING TRUST



KALLIDROMO TUNNEL



PROJECT DESCRIPTION

The project involves the construction of the New Double High Speed Railway Line Tithorea – Lianokladi – Domokos which replaces the mountainous part of the existing single line, 122 km long, with a New Double High Speed Railway Line, 106 km long.

The new alignment has been designed for speeds of 160-200 kph, starts from Tithorea Railway Station, moves east crossing the Kallidromo mountain with a twin tunnel, 9,038 m long each, follows a flat course through the Sperchios river valley and ends up at Lianokladi Railway Station. Then, it crosses the Othris Mountain with a twin tunnel, 6,380 m long each, follows a flat route through the dried-up lake of Xiniada and goes up to the mountainous area of Domokos until Domokos Railway Station.

The project aims at the following:

- reducing the journey time in the Athens - Thessaloniki line down to 3.5 hours after the completion of the projects
- restoring discontinuities in the Trans-European Networks, part of which is the PATHE/P railway axis, which includes the present Project.

In addition, the savings from the use of electricity and not petroleum will be significant as the cost will drop by 70% and this will reduce significantly the environmental footprint.

Technical characteristics:

Section length: 106 km

Design Speed: 160-200 kph,

- 4 single track tunnels (per branch) with a total length of 30,837.00 m (Kallidromo and Othris Tunnels)
- 12 double track tunnels with a total length of 4,499.61 m
- 18 double track Cut & Cover with a total length of 2,374.75 m
- 6 single track Cut & Cover with a total length of 1,708.00 m
- 49 railway bridges with a total length of 6,086.88 m
- 32 grade separated crossings with a total length of 2,764.50 m
- 2 new railway stations at Molos and Agios Stefanos and two new stops at Aggies and Thavmakos.

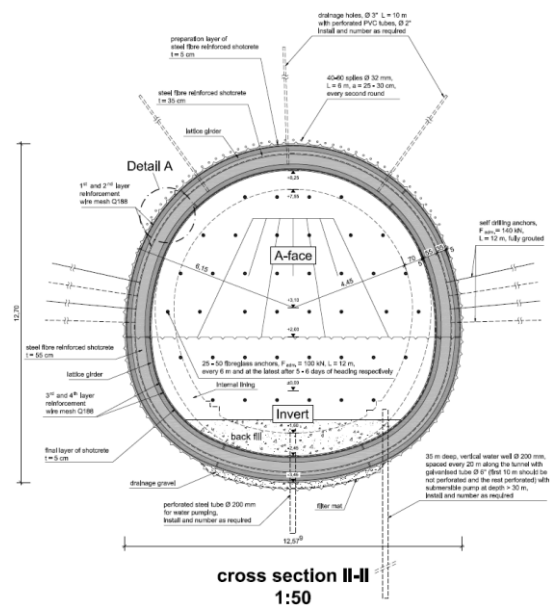
PROJECT DEMANDS

The project includes the two larger twin rail tunnels in the country (and in the Balkans), the Kallidromo tunnel with 9km length and the Othris tunnel with 6km length. Undoubtedly, the opening of the Kallidromo Tunnel was the most challenging task of the project, due to the topography and the soil morphology.

The twin Kallidromo tunnel is a part of the New High Speed Railway Track from Tithorea to Lianokladi, beginning from the RR Station of Tithorea. Each direction of the tunnel has a length of 9,025 m, effective operational area of 58 m², design speed of 250 Km/h, longitudinal inclination 6‰ and a general trend from South to North. The Kallidromo tunnel crosses three major geological formations: clay, limestone and serpentines.

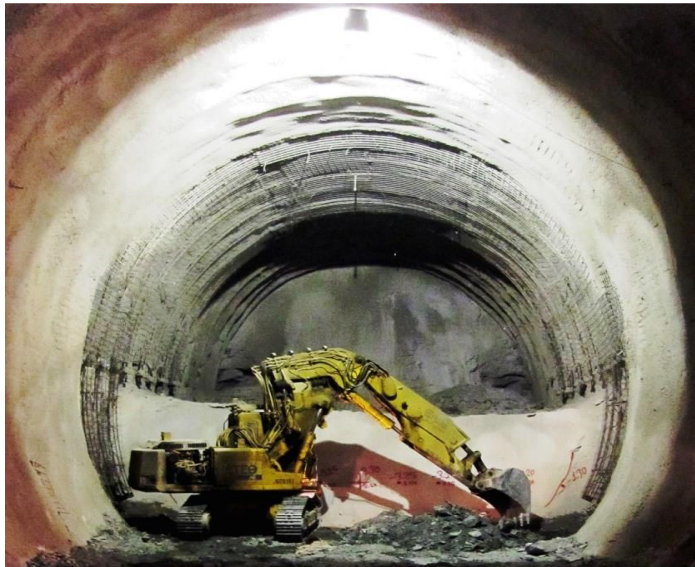
A major challenge was the opening in the clayey part (about 4,000m long), for which the method of "Double Support" was selected, modified based on the original design of the tunnel, on the observation of the soil conditions on site and on the behavior of already constructed parts of the tunnel.

Based on the modified method, the drilling was performed in 2 phases: Heading (Phase-A) and Bench-Invert (Phase-B). The distance between the two phases is < 20m.



SIKA SOLUTION

For this project, Sika has supplied a wide range of materials for Concrete and Shotcrete production. Besides that, Sika was a strong partner with continuous on site presence, already from the design phase. Especially regarding the construction of the twin tunnels, the selected method required large amounts of sprayed concrete and in large application thicknesses (up to 30cm per layer mainly, while in many cases shotcrete was as thick as 80cm and in many cases even 1m!). This demand both contributed to increased wear of equipment and secondly to increased manufacturing costs. The only way to address the problem was to optimize the shotcrete mixture, which was carried out using Sika products.



Therefore, with the use of Sika admixtures, it was possible to produce shotcrete mixes, category C30 / 37 with cement content <math><430\text{kg} / \text{m}^3</math> (extremely low for such demanding requirements), without loss of quality and strength. Also there was a demand for a stabilized shotcrete mix for 6 hours, which was made possible using SikaTard® hydration stabilizer technology. For all these requirements, Sika supplied specific demand superplasticizers and performed mix designs aiming at the optimization of the finally used mix in its fully equipped Concrete Laboratory in Sika Hellas premises. All tests were performed using aggregates and cement from site. In addition, our Sika project manager was always present when needed, actively supporting, with on-site optimization tests during construction.

In all shotcrete mix designs, Sigunit® shotcrete accelerators were used, not only for the specially stabilized, but for all shotcrete types.



SIKA PRODUCTS IN VOLUME:

- **Concrete & Shotcrete production:**

Superplasticizers: Sika® ViscoCrete®: **2,757 tns**

Retarders: Sika® Plastiment®: **1.2 tns**

Cement hydration stabilizer: SikaTard®-930: **200 tns**

Shotcrete accelerators: Sika® Sigunit®: **2,500 tns**

Air entrainer: Sika-Aer® Fine: **155 tns**

Demoulding agent: Sika® Separol®: **7,2 tns**

Waterproofing admixture: Sika®-1+: **3 tns**

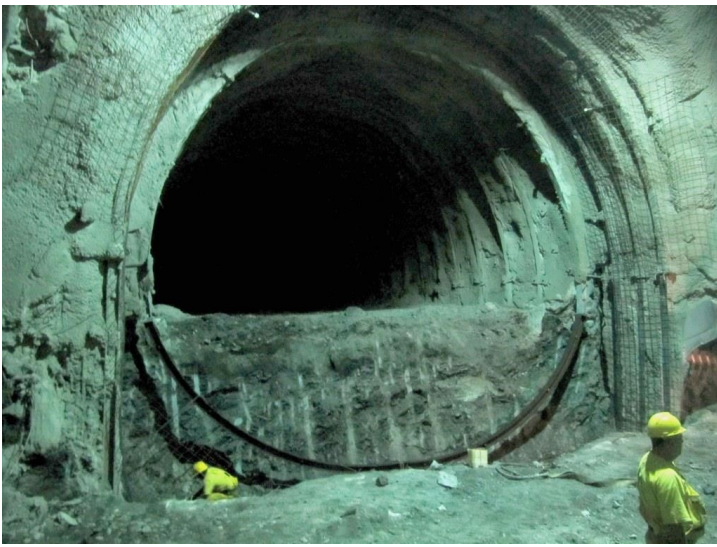
Also many anchoring, repair and waterproofing products were used.

PROJECT PARTICIPANTS:

Owner: **OSE PROJECTS S.A.**

Construction: **J/V AKTOR S.A. – TERNA S.A. – J&P-AVAX S.A.**





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