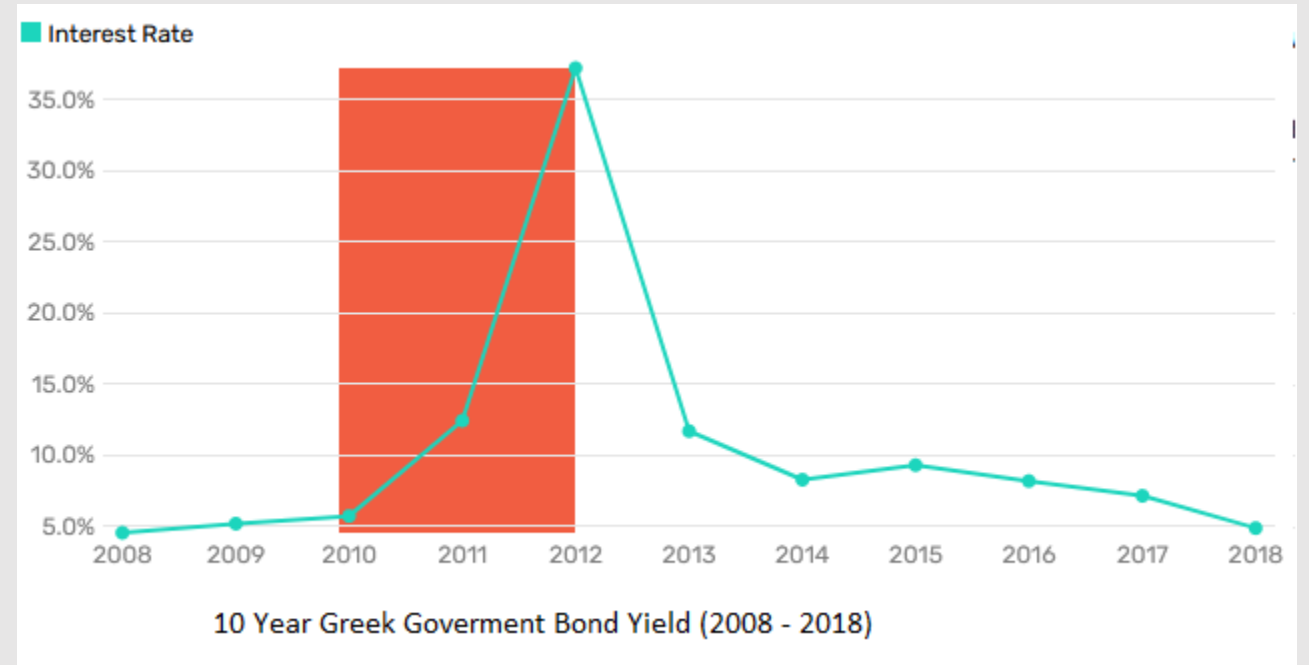
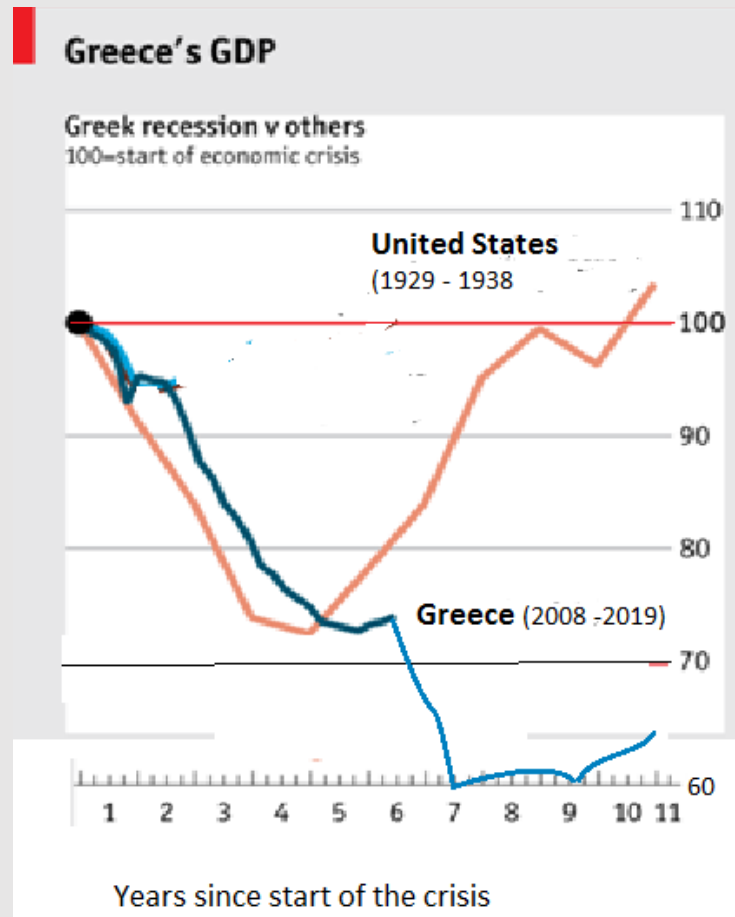


Tunnels in Greece hereafter - upcoming planned underground projects in Greece

Ioannis Bakogiannis

Since 2010 Greece suffered a tsunami of economical, fiscal and social crisis.



Even in these conditions, significant activity was observed in the implementation of tunnels and underground works

RECENT ACTIVITY FROM 2016 IN CONSTRUCTION OF UNDERGROUND WORKS

Type of Tunnels	Number of tunnels	Single tube total length (Km)
Road tunnels opened to traffic (2017)	29 (26 twin tube)	65.3
Twin Tube Railway tunnels opened to traffic (2018)	2	32.7
Twin Tube Railway tunnel excavation and final lining completed (2018)	1	9.6
Athens Metro Double track TBM Tunnel and Triple track NATM Tunnel (completed)	1	7.6
Thessaloniki Metro two single track tunnels (completed)	2	28.8
Hydraulic tunnels	2	5.7

What is provided next



1. Complete projects in progress

1.1. Section A of Line 4 of Athens metro. Contract signed in June 2021.

Cost 1.5b (VAT included). Currently It is the largest public work contract in Europe.

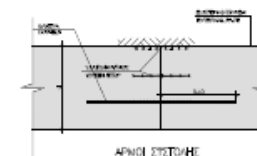
- The length of Section A is approximately 12.8 km
- 15 underground stations and 9 intermediate and/or terminal shafts.
- The main TBM tunnel of the entire Project shall be a **double track tunnel** (approximate inner diameter 8.5m, outer diameter of 9.5m).



TOM / SECTION 1-1
TYPICAL DOUBLE TRACK CROSS SECTION/TBM EXCAVATION
JULY 2005



ΤΥΠΙΚΗ ΔΙΑΤΟΜΗ ΣΤΑΘΙΑΣ ΔΙΠΛΗΣ ΤΡΟΧΙΑΣ/ΣΥΜΒΑΤΙΚΗ ΜΕΘΟΔΟΣ ΔΙΑΔΙΟΡΘΩΣΗΣ
DOUBLE TRACK TUNNEL TYPICAL CROSS SECTION/CONVENTIONAL METHOD



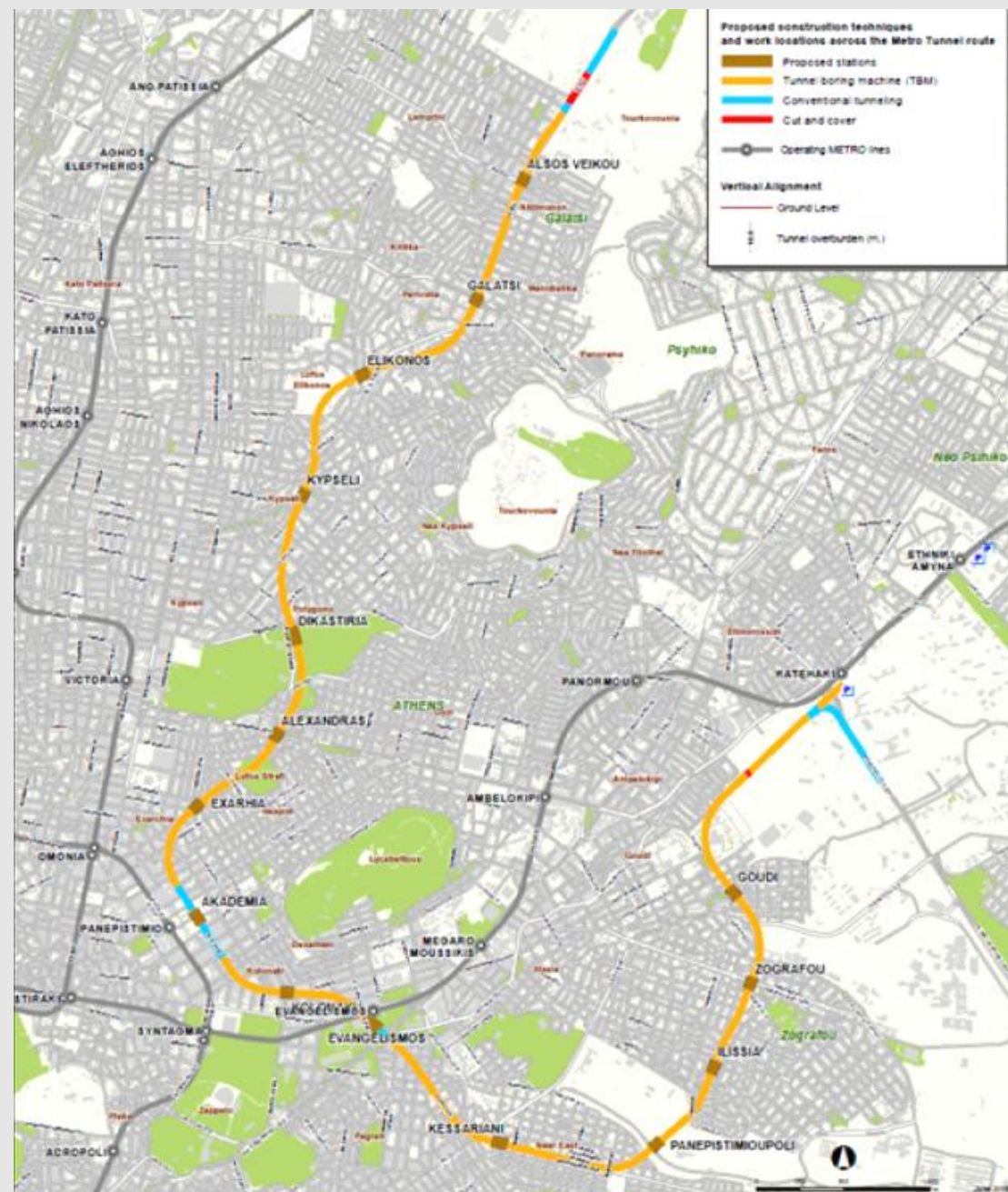
APPROXIMATE CONTRACTION JOINTS



TOMH / SECTION 3-3
TYPICAL TRACK TUNNEL TYPICAL CROSS SECTION/CONSTRUCTION METHOD

TUNNEL / SECTION 4-4
ΤΥΠΙΚΗ ΔΙΑΤΟΜΗ ΣΕΛΑΤΕΣ ΜΟΝΗΣ ΤΡΟΧΙΑΣ/ΕΥΡΕΤΑΤΗΝ ΝΕΦΩΣΕ ΔΙΑΜΟΡΦΗ
SINGLE TRACK TUNNEL TYPICAL CROSS SECTION/CONVENTIONAL METHOD
P.5/26 126

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1.2 Rail Underpass of Athens – 3 Gefires

- Four-track rail corridor, 2,36 km long, of which 1.91Km consists of a fully underground alignment,
- Public Contract value 70m



1.3 Motorway E65 twin tube road tunnels

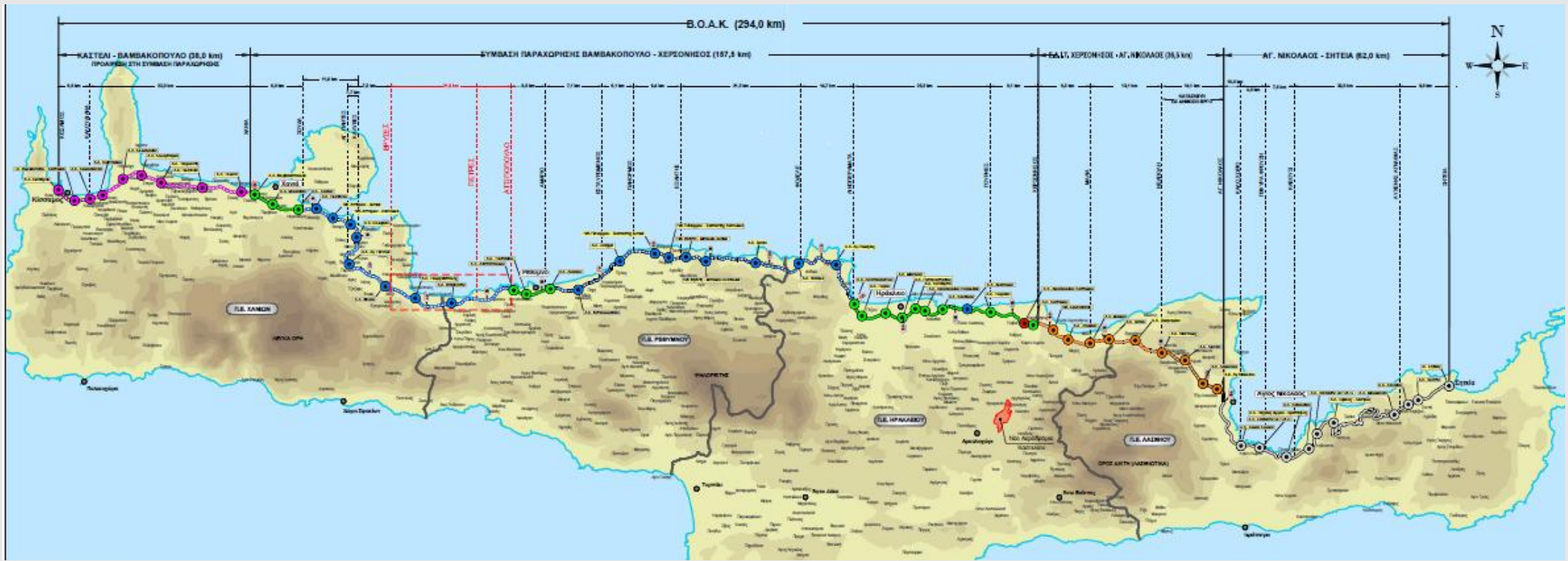
- Tunnel Othryos: tunnel 6 Km long (single tube)
- 2 tunnels with total length 1 Km (single tube)



2. Projects involving tunnels in contract award procedure

2.A Northern Road Axis of Creta Island: a concession contract and a PPP contract

Procedures for both contracts are in phase 2 (dialogue with candidates). Binding offers after environmental lisencc (early 2022)



Section Chania Heraclio 156Km
(concession contract) 1.5b cost
(design & construction)

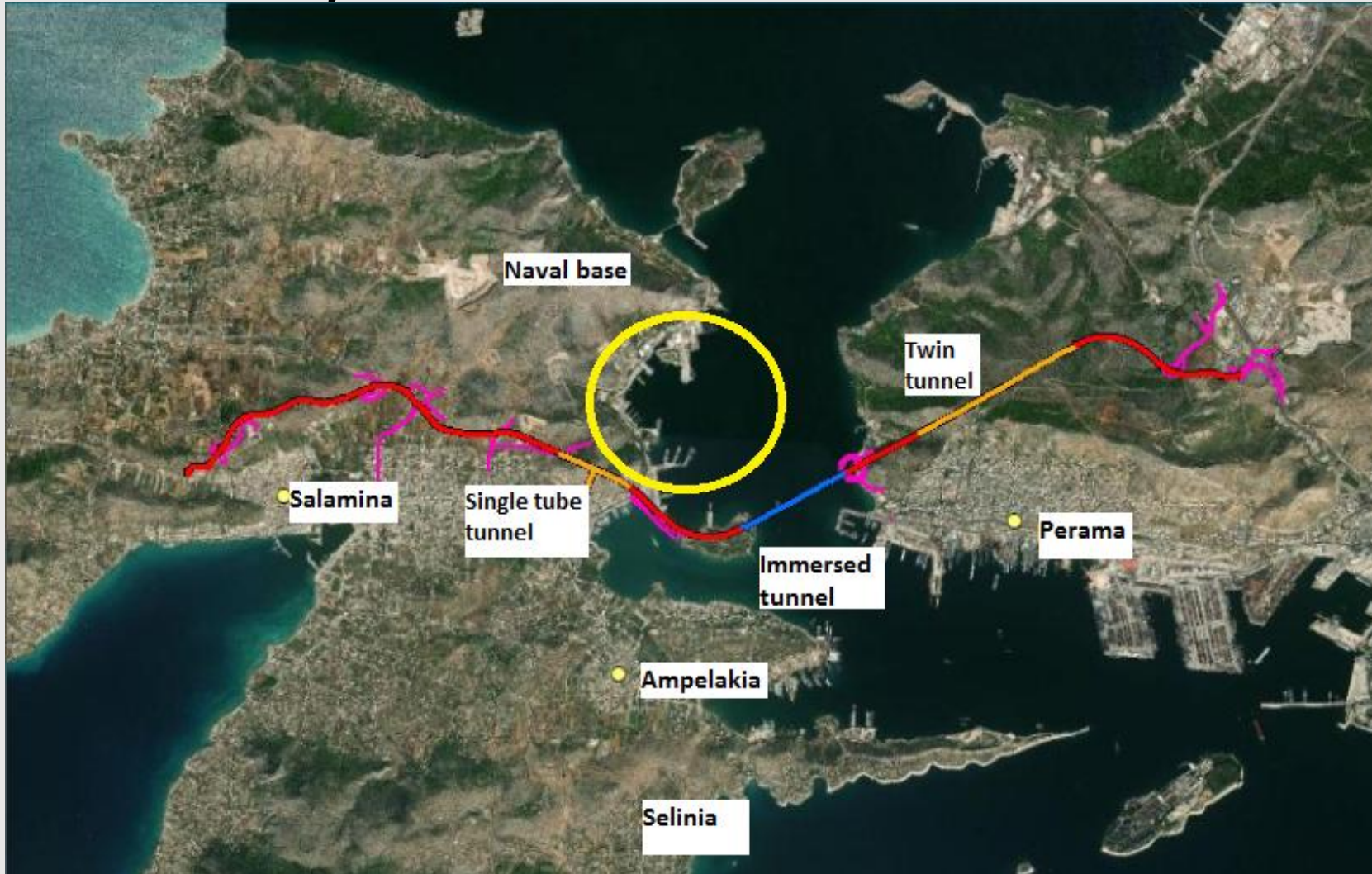
- 16 twin tube tunnels 31.5 Km long single tube
- 18 C&C (5 Km length)

Section Hersonisos Neapoli 23 Km
(PPP contract) 230m cost (design & construction)

- 3 twin tube tunnels 6,8 Km long single tube
- 1 C&C (0,25 Km length)

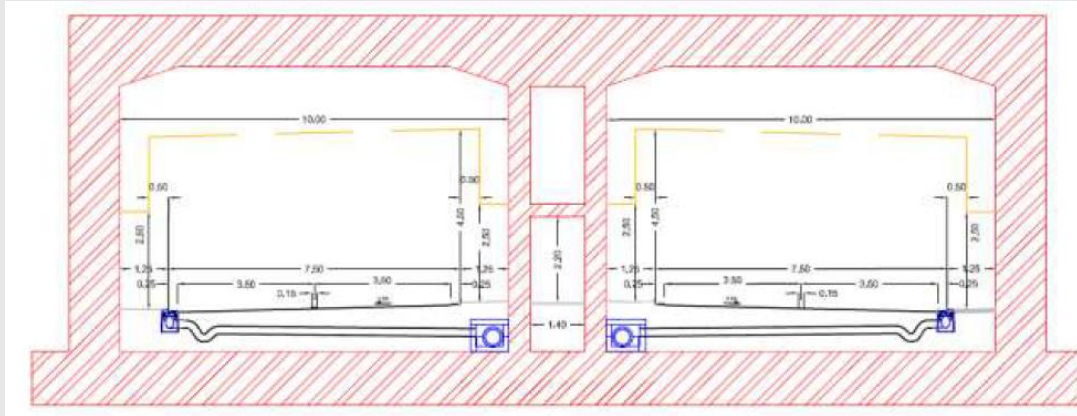


2.B Connection of Salamina Island with an undersea tunnel (concession contract)



Salamina undersea tunnel

- 1.1 Km long twin spaces plus central corridor immersed tunnel
- 2 conventional tunnels 4.5 Km long single tube
- 2 C&C 0.5 Km long



Procedure is in phase 2 (dialogue with candidates). Binding offers after environmental license (early 2022)



2.C Thessaloniki East Ring Road (Flyover) Project budget 370m

Total length 13 Km, 4 Km Flyover. 9 Interchanges, 8 Bridges, 3 Tunnels
Competitive dialogue for PPP contract in progress (bidding offers expected at the end of 2021)

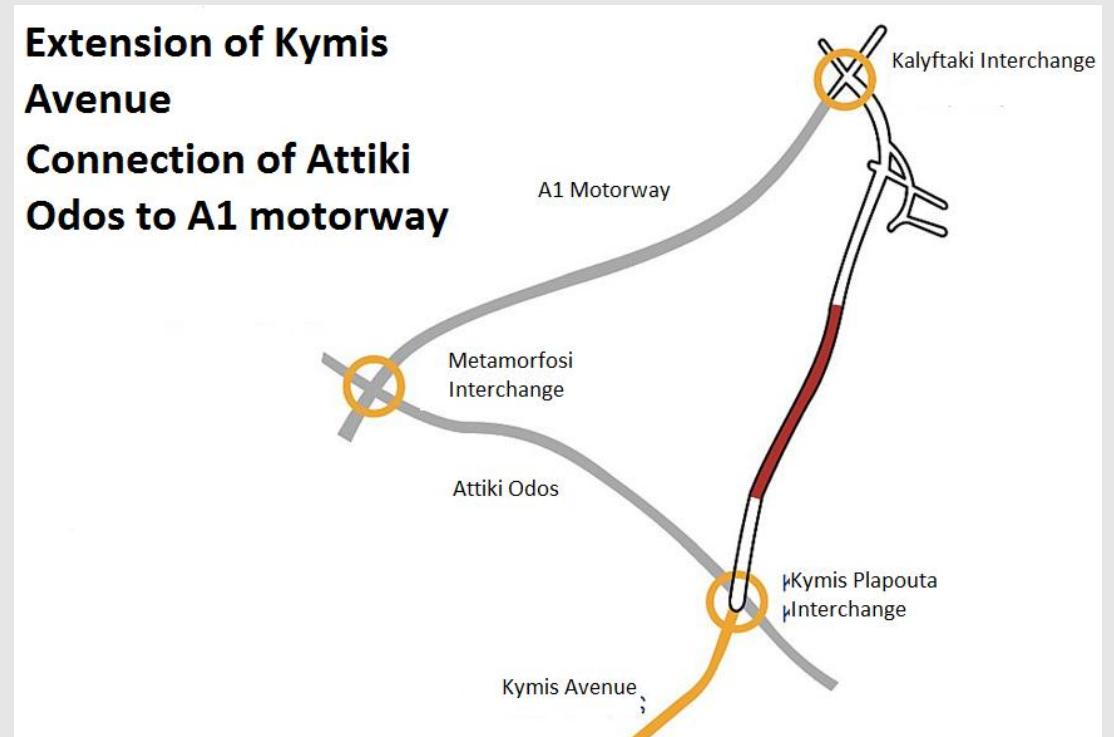


3. Scheduled projects

3.1 Extensions of Attiki Odos urban motorway

3.1.1 Connection of Attiki Odos to A1 motorway (Kymis avenue)

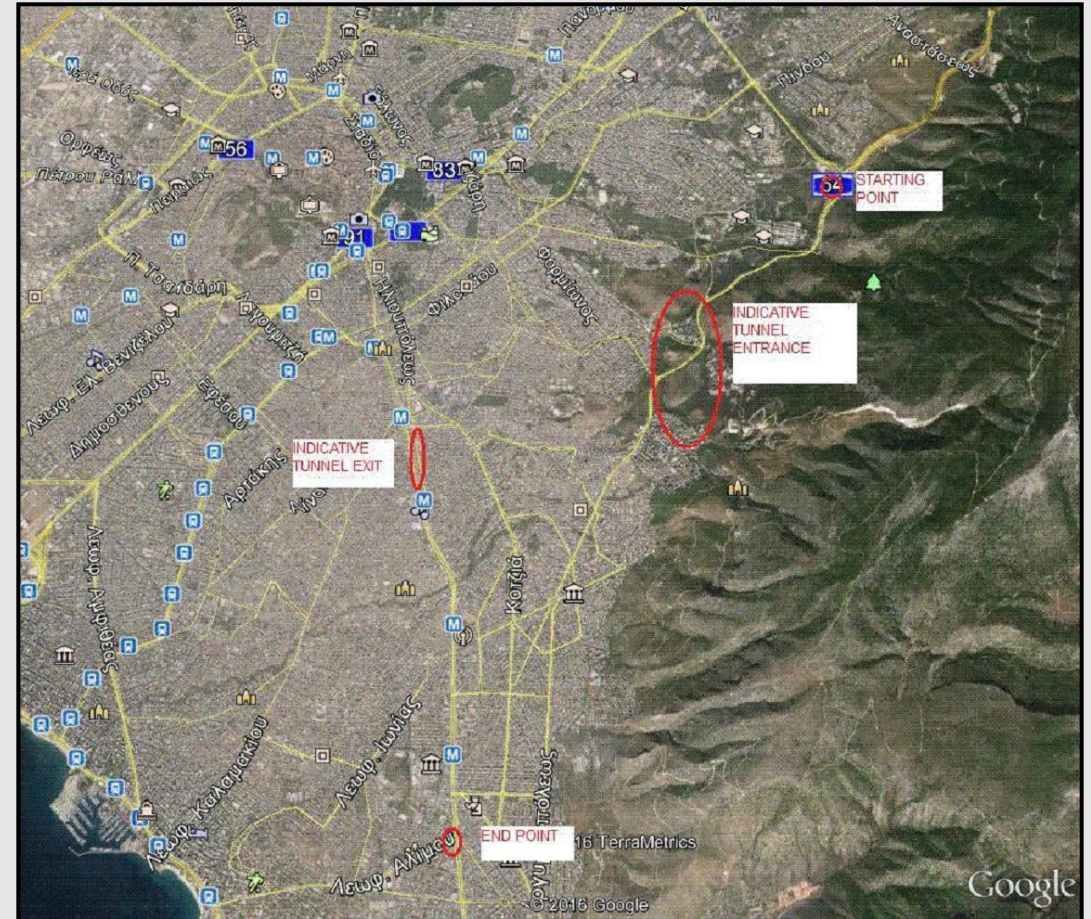
- The most mature project. Call for tenders early 2022 (design build public work contract). Project budget 400m
- Total length 3.8Km (1.26Km conventional tunnel in urban residential area, 1.16 Km C&C, 1.38 open road)
- Critical traffic project to decongest the only exit to the A1
- A modern traffic management system to avoid congestion



3.1.2 South extension of Ymittos Ring Road from connection with Attiki Odos to Vouliagmenis Avenue via an urban tunnel

a) construction of a 3 Km long urban road tunnel connecting existing YRR with Vouliagmenis Avenue,

It seems that the intention is to promote the contract as an innovation partnership once the relevant legal framework has been adopted



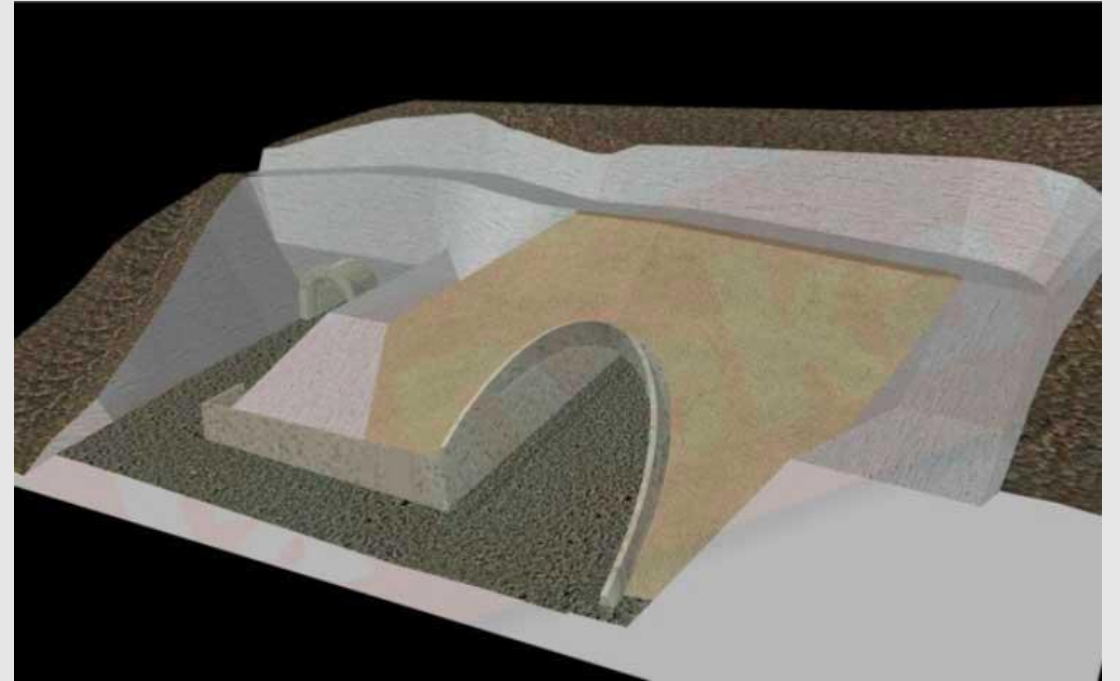
3.1.3 North extension of Ymittos Ring Road to Rafina port and north entrance of Athens airport and suburban railway access to the port of Rafina

- Twin bore Road tunnel 1.6Km
- Suburban railway tunnel in residential area ending at Rafina port 1.3 km
- Call for tender at the end of 2022.



3.2 Bidirectional regional road tunnels

- Kleisoura tunnel 1.36 Km long (1.4 Km escape tunnel). Mature project, call for tenders is expected very soon
- 2 Tunnels Brallos Amfissa 5 Km long. Funding alternatives are considered



3.3 Extensions of Athens metro double track tunnel

3.3.1 Extensions of Athens metro Line 2

- Ilion extension: 3 stations and 4 Km tunnel. Call for tender early 2022. Budget 350m
- Glyfada extension: 3 stations and 4.4 Km tunnel. Preparatory designs. Budget 300m

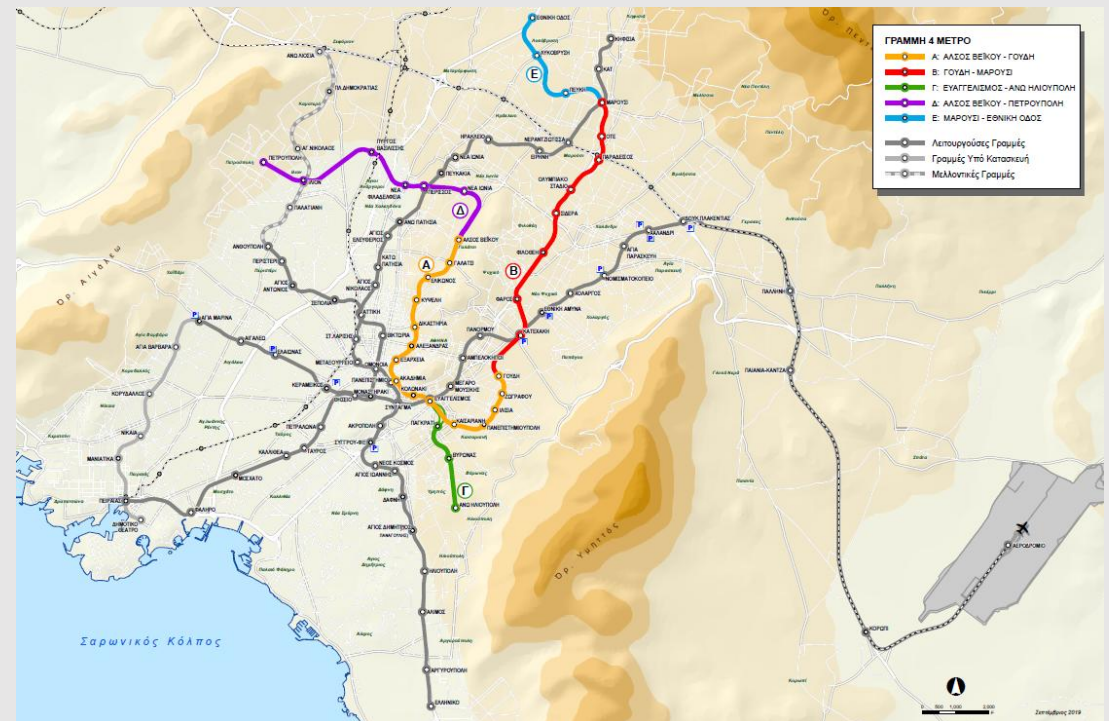
3.3.2 Extensions of Athens metro Line 1:

- Preparatory designs. Stavros Niarchos Foundation Cultural Center extension: 4 stations and 5 Km tunnel. Budget 450m

3.3.3 Extensions of Athens metro Line 4: Preparatory design

Total: 20 stations, 23 Km double track tunnel, Estimated budget 2.05bn

- Goudi – Marousi (red): 8 stations, 9 Km tunnel. Estimated budget 800m.
- Evagelismos Ano Helioupoli (green): 3 stations, 3.5 Km tunnel. Estimated budget 350m.
- Alsos Veikou Petroupoli (mauve) : 6 stations, 7 Km tunnel. Estimated budget 600m.
- Marousi A1 motorway (blue): 3 stations, 3.5 Km tunnel. Estimated budget 300m.



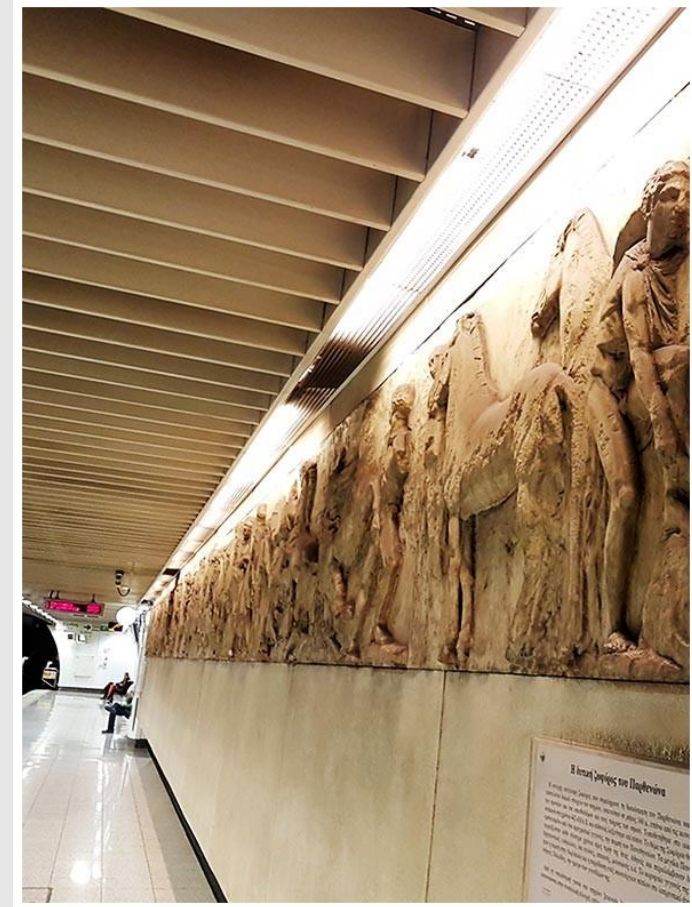
3.4 Extensions of Thessaloniki metro

- Two extensions in preparatory design. East extension to Pylaea and airport (4 stations) and west extension to Evosmos (8 stations round line).
- 11 km of Line (with two single track tunnels)



Specific issue for both metros: **Archaeological Work - Antiquities**

The Attiko Metro and the competent authorities of the Ministry of Culture have extensive experience in preserving and promoting antiquities. In some cases, however, the decision to retain on-site or transfer and relocate has become a major issue.



3.5 Connection of Rio rail station with Patras Port.

- 10.9 Km double track rail line of which 5.16 Km C&C.
- Project budget 516m
- In a first approach competitive dialogue will be adopted (first stage early 2022)



3.6. DEVELOPMENT OF METROPOLITAN POLE OF HELLINIKON – AG.KOSMAS: POSEIDONOS AVENUE UNDERPASS

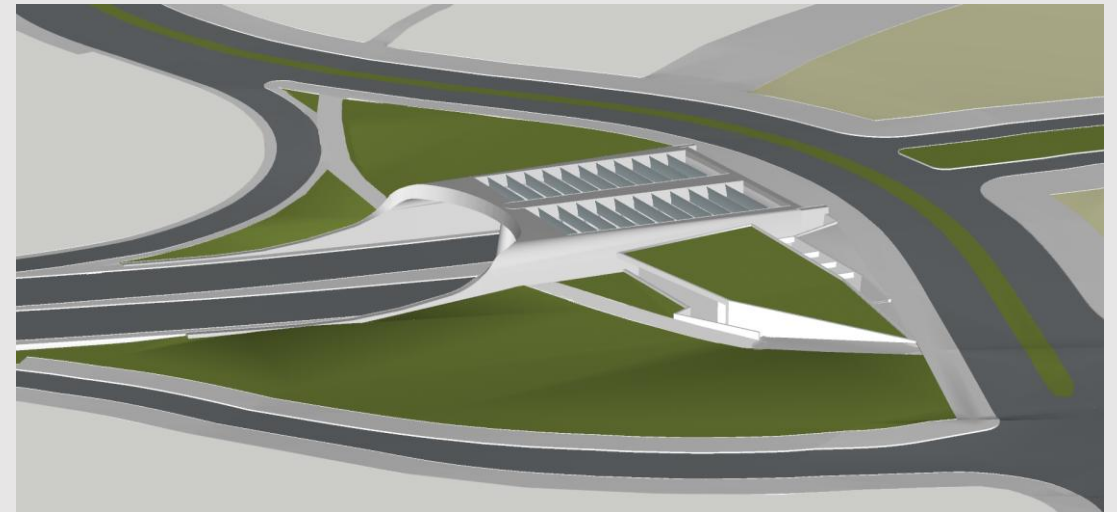
- the largest greenfield urban infrastructure development investment in Europe
- **6,200,000m²** of total land area

- **€8bln** total investment **€1.5bln** infrastructure project
- Metropolitan Park of 2,000,000 sq.m enhancement of the Coastal Front, both fully accessible to the public.

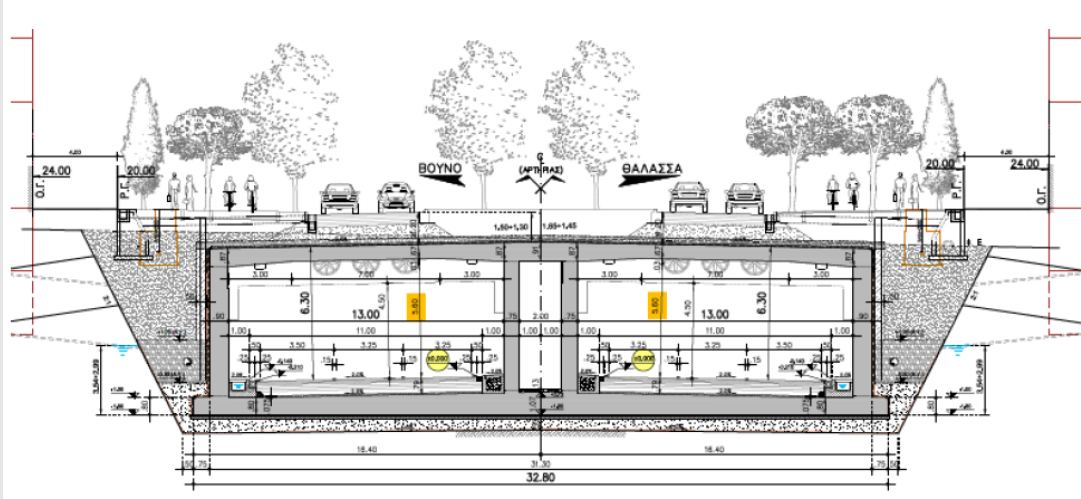


POSEIDONOS UNDERPASS : the unification of the land with Coastal front

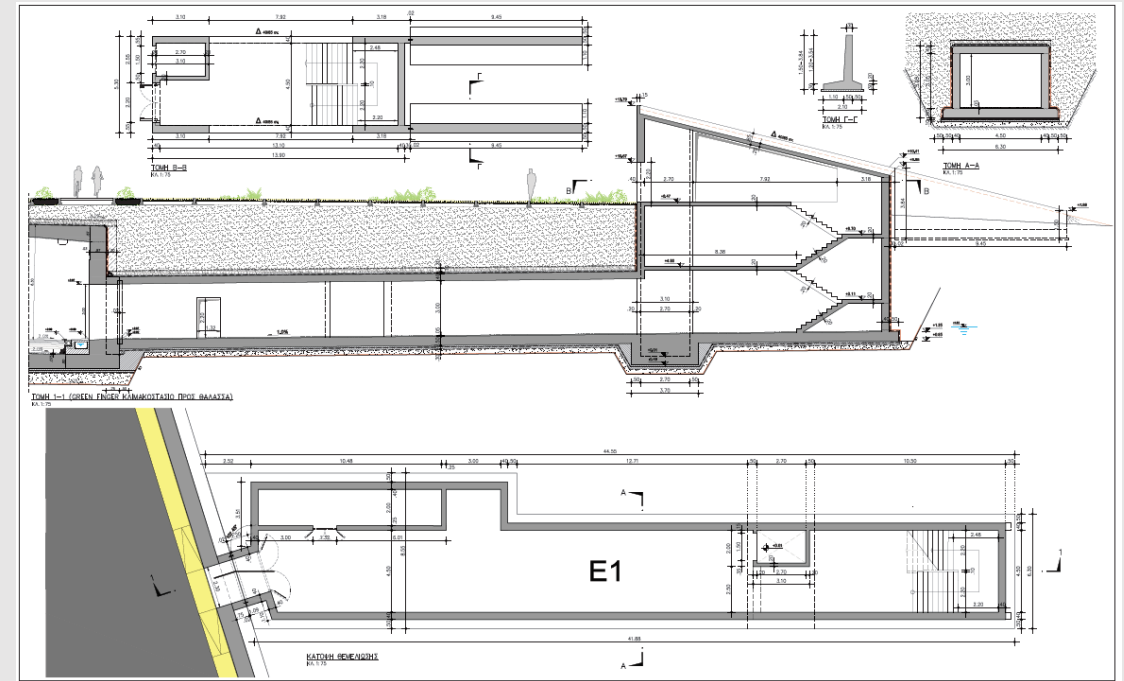
- Final design has been approved, project ready for call for bidding offers
- fully private project of public interest implemented by the investor
- Total length 1.34Km (1.14 C&C 0.2 access and exit ramps)
- 3 traffic lanes per direction (locally 4 and 5)



POSEIDONOS UNDERPASS the dominant cross section



- 4 emergency exits (2 per direction)



- Longitudinal ventilation for normal traffic. Semi-transversal ventilation for fire smoke extraction.
- Central corridor only for smoke extraction.

3.7 Connection of Lefkada Island with an undersea tunnel (PPP contract availability payments)

- Bidirectional immersed tunnel 0.7Km (shallow depth of seabed – small wave height → in situ concreting)
- 3Km bidirectional road in Avlemon lagoon



CONCLUSION - EPILOGUE

- Greek engineering community has incorporated significant experience in tunnels and underground works
- In the coming years, extensive activity is expected in the design and construction of important underground projects
- There is a strong tendency for leverage of private capital in the construction sector
- Purely public works contracts coming under pressure. The trend is the design risk be allocated to the contractor
- The institution of the independent engineer is constantly increasing application



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