

***"The way forward for the Eurocodes implementation in the Balkans"***

***10-11 October 2018, Tirana***

# **Process for the implementation of the Eurocodes in the national regulatory framework; guidance and best practices in Greece**

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**Chairman of CEN/TC250/SC1  
Chairman of the Greek Eurocodes  
Mirror Committee (ELOT/TE 67)**

## **Overview of the presentation**

- Recent environment/framework for the implementation of the EN Eurocodes
  - General environment/framework (Revision of the Eurocodes under Mandate M/515 : Phasing, various impacts,...)
  - Greek environment/framework (Financial and economic crisis under way, relevant impacts, priorities in standardisation,...)
- Brief historical review and last years' evolution in the field of standardisation and relevant regulatory activities
- Implementation in practice
- The foreseeable future and challenges

## General environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515

- The EN Eurocodes already implemented since some years in practically all CEN Member States (MS) and some affiliated and neighboring countries
- First conclusions from their application at national level, essentially expressed with the opportunity of the relevant systematic reviews launched by CEN
- Following the corrigenda and amendments already published, some improvements to be brought by completing and adapting the actual documents and in particular :
- Expressed willingness for achieving (more) ease of use and for reducing the number of national choices foreseen (NDPs). This aspect reflects also the tendency for more harmonisation, in view also of promoting universally the Eurocodes and the European Construction industry in general

## **General environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515**

The Structural Eurocodes to be developed under M/515 are deemed to cover at least :

- assessment, re-use and retrofitting of existing structures,
- strengthening of the requirements for robustness,
- improving the practical use for day-to-day calculations
- new Eurocode on structural glass
- incorporation of ISO Standards in the Eurocodes family, such as atmospheric icing of structures and actions from waves and currents on coastal structures

## General environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515

CEN is requested to provide:

- the development of new standards or new parts of existing standards (**vertical approach**)
- the incorporation of new performance requirements and design methods (**horizontal approach**)
- the introduction of a more user-friendly approach, in several existing standards (**horizontal approach**)
- A technical report on how to adapt the existing Eurocodes and the new Eurocode for structural glass to take into account the relevant impacts of future climate change.

## General environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515

- Revision of the current EN Eurocodes perceived and planned as an “evolution” , not a “revolution”
- Mandate established and financed within the FPA 2014-2020 rules. As a result (together with other practical management aspects) need for phasing of the whole contractual work:
  - Phase 1 (25 PTs) : Start Jan. 2015 - End June 2018
  - Phase 2 (22 PTs) : Start Jan. 2017 - End June 2020
  - Phase 3 (18 PTs) : Start Jan. 2018 - End June 2021
  - Phase 4 ( 8 PTs) : Start June 2018 - End June 2021
- Planned delivery of PT drafts : Starting Day (SD) + 16 months (First Draft), SD + 28 months (Second Draft), SD + 34 months (Final Draft)

## **General environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515 (cont'd)**

- Very tight time schedules and milestones (deadlines) to be achieved
- Informal commenting periods foreseen and favoured, in view of detecting major NSBs concerns, if any, as soon as possible and limiting/avoiding the risk of opposition at the time of formal voting
- As a result a lot of pressure is transferred to the National Eurocodes Mirror Committees who are invited to reviewing a significant number and volume of documents every few months.
- Another issue is the difficulty of NSBs for detecting and supporting available experts to be appointed in the numerous Working Groups

## Greek environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515

A flash-back in the history of (design) codes in Greece:

- 1945 : Code of Loading on structures
- 1945+ : German Codes (DIN) 1045, 1050, 1055, 1072 etc.  
(for concrete and steel structures, loading etc.)
- **1959 : Paraseismic Code**
- 1984 : “Additional clauses” (to the Paraseismic Code)
- **1989 : Code for RC structures & “New” Paraseismic Code**



## Greek environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515

A flash-back in the history of (design) codes in Greece (cont'd):

- **1996+ : ENV Eurocodes** (for steel, composite steel-concrete, masonry and timber structures)
- **2000 : Code for RC structures, Paraseismic code**
- 2003 : Guidelines for the Design of Road Works–Vol. Technical Works
- 2003 : Guidelines for the application of DIN-Fachberichte in Greece
- 2007 : Guidelines for the paraseismic design of bridges (& seismic isolation )
- **2010+ : EN Eurocodes**, Code for retrofitting of structures (NCCI)

## **Greek environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515**

Brief overview of the procedure for the implementation of EN-Eurocodes in Greece:

- The period 2011 – 2013 has practically been a “dormant” (non-active) period due to two unresolved problems :
  - lack of financing
  - incompatibility of publication of the corpus of the documents in the O.J. of Hellenic Republic, in case of mandatory application, without addressing the copyright issues

## Greek environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515

Brief overview of the procedure for the implementation of EN-Eurocodes in Greece (cont'd):

- The “Common Ministerial Decision” DIPAD/372/30-05-2014 (Official Government Gazette 1457 B/05-06-2014) has been issued rendering the **use of existing national regulatory documents non-mandatory** and **allowing the use of Eurocodes as an alternative option (which is in principle the preferred option and common practice in the case of Public Procurements)**. This document implies that:

## Greek environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515

- the Eurocodes in combination with the relevant National Annexes may be used as regulatory documents for the design of new and the assessment and redesign of existing structures, both for public and private (civil engineering) works;
- pre-existing National Codes/Regulations are no more mandatory;
- the Owner/Authority may choose the framework of regulatory documents for structural design between the two following options: either, the pre-existing regulatory documents, or, the Eurocodes together with their National Annexes;
- a selective use of clauses from both regulatory systems is prohibited.

## **Greek environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515**

Brief overview of the procedure for the implementation of EN-Eurocodes in Greece (cont'd):

- Since 2014 the Eurocodes Mirror Committee ELOT TE 67 “Structural Eurocodes” has been reactivated with Dr N. Malakatas as Chairman and Mrs Eug. Gardeli as Secretary. With the same of the BD of ELOT 11 WG have been established within TC 67 (reflecting the EN-Eurocodes). The Mirror Committee convenes as appropriate a number of times per year, in order to follow up the activities of CEN/TC 250, its CG and its SCs.

## **Greek environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515**

Brief overview of the procedure for the implementation of EN-Eurocodes in Greece (cont'd):

- The “main thrust” of TE 67, at least as far as comments and replies to questionnaires are concerned, comprise EN 1998 – which is quite understandable, due to the importance of that Eurocode for Greece – and EN 1993 to a lesser extent, as well as issues related to bridge design. In this very moment a “refreshing” of membership is planned, in order to increase Greece’s follow-up of the revision of the EN-Eurocodes under M/515. The revision of the climatic actions (snow, wind, thermal) NAs is also envisaged.

## **Greek environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515**

Brief overview of the procedure for the implementation of EN-Eurocodes in Greece (cont'd):

- Unfortunately during the last years there is practically no financing (estimated of the order of 20-30 K€/year, essentially for the participation of national delegates to meeting, as well as for secretarial /editorial activities, including translations whenever required)
- This situation may be partly explained by the fact that priority has been given by the Government to the revision of 440 Technical Specifications, linked to execution and product standards to be used in the framework CPR and new law (4412/2016) for Public Procurements

## **Greek environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515**

- Financial and economic crisis since 2009, still under way although signs of progressive recovery visible
- Direct impact : limitation or even lack of resources during a number of years
- Indirect impact : drastic shrinkage of design and consultancy contracts, as well as construction works, reflected on the need for use of codes/standards and on the priority for their revision. A side effect was the “expatriation” of the most competitive consulting firms and a significant number of engineers (at low cost conditions)



## Greek environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515

Within this context a positive message is given for the implementation of the EN-Eurocodes in practice thanks to the achievements of Greek consultant/engineering companies. Some representative cases performed by two of the most renown Greek design firms, DOMI S.A. and DENCO S.A., are presented in the following slides, not as publicity but just as **examples of good practice**. It is interesting to note that many of them concern works in countries other than Greece.

## **Memaliaj Bridge, Albania**

Road Bridge:  
prestressed box girder  
and steel-concrete  
composite deck,  
 $L=123\text{m}$ ,  $S_{\max}=76\text{m}$   
Complete design,  
construction consultancy  
by DOMI S.A.



## Fier-Tepelene, Albania

Road Bridges: various systems  
(prestressed or steel girders  
with in-situ concrete slab),  
 $L_{\max}=167\text{m}$ ,  $S_{\max}=40\text{m}$   
Complete design, construction  
consultancy by DOMI S.A.



## **Fier-Tepelene, Albania**



**Luftinja Bridge**



**Ali Pasha Bridge**



## Astmoor and Bridgewater Bridge, United Kingdom

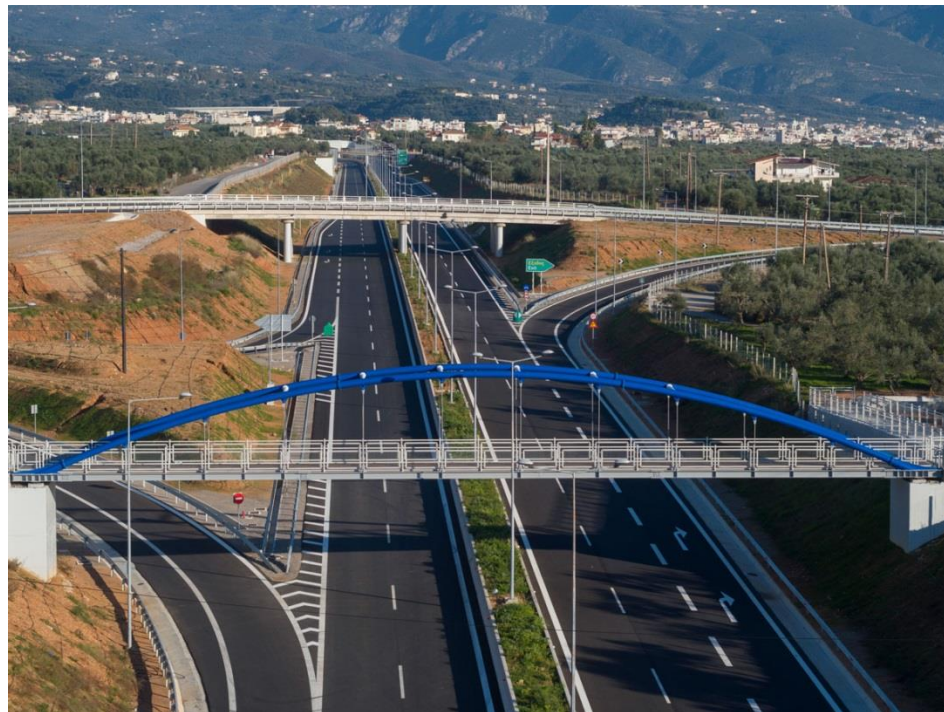
Road Bridge, Precast prestressed beams, r/c diaphragms and in-situ r/c deck slab composing a continuous deck with three branches,  $L=1018\text{m}$ ,  $S_{\max}=41\text{m}$   
Design check (Category-III) by DOMI S.A.



## Karelias Bridge, Greece

Pedestrian Bridge, Steel arch,  
 $L=45\text{m}$

Complete design, construction  
consultancy by DOMI S.A.



## **Drama-Paranesti, Greece**

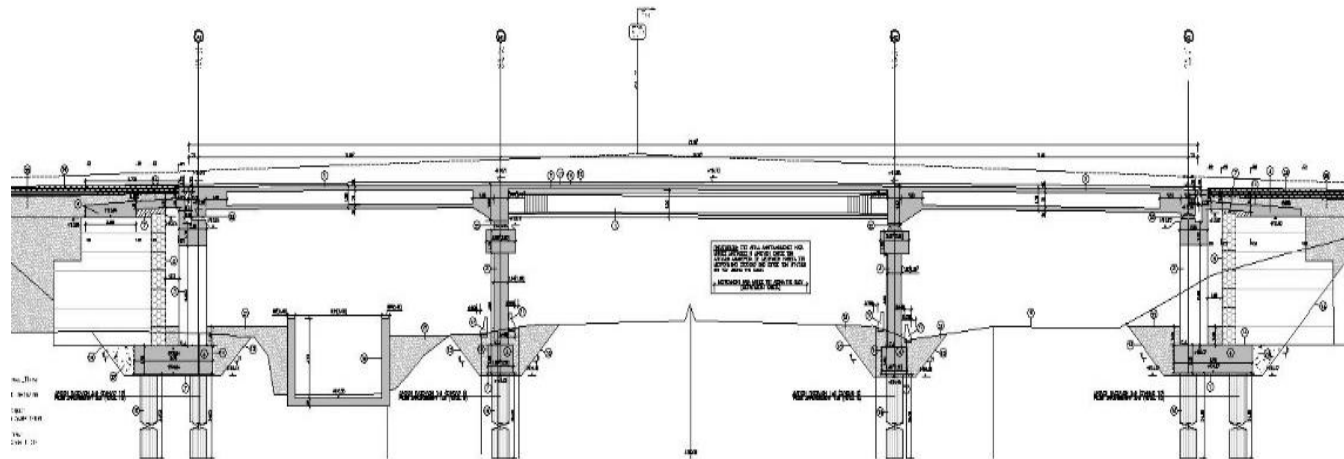
11 Railway Bridges, 2 Railway Tunnels, 3 Road Bridges,  
 $L_{\max}=100\text{m}$ ,  $S_{\max}=37\text{m}$  - Final design by DOMI S.A.

## **Kleidi-Evzoni, Greece**

8 Road Overpasses: reinforced concrete slab  $L_{\max}=83\text{m}$ ,  $S_{\max}=24.5\text{m}$   
- Final design by DOMI S.A.

## PATHE Motorway (Thebes, Ritsona, Atalanti), Greece

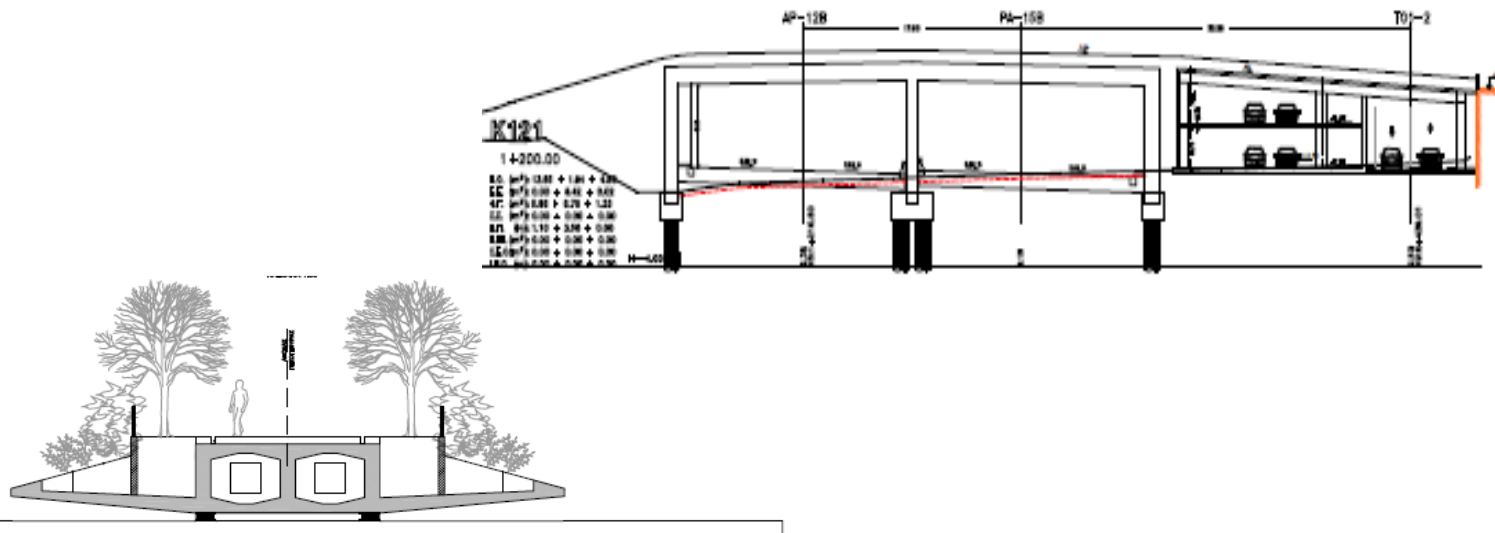
Final Design of 3 prestressed concrete overpasses of  $L_{\text{tot}}=70\text{m}$  (2018)  
by DENCO P.C.





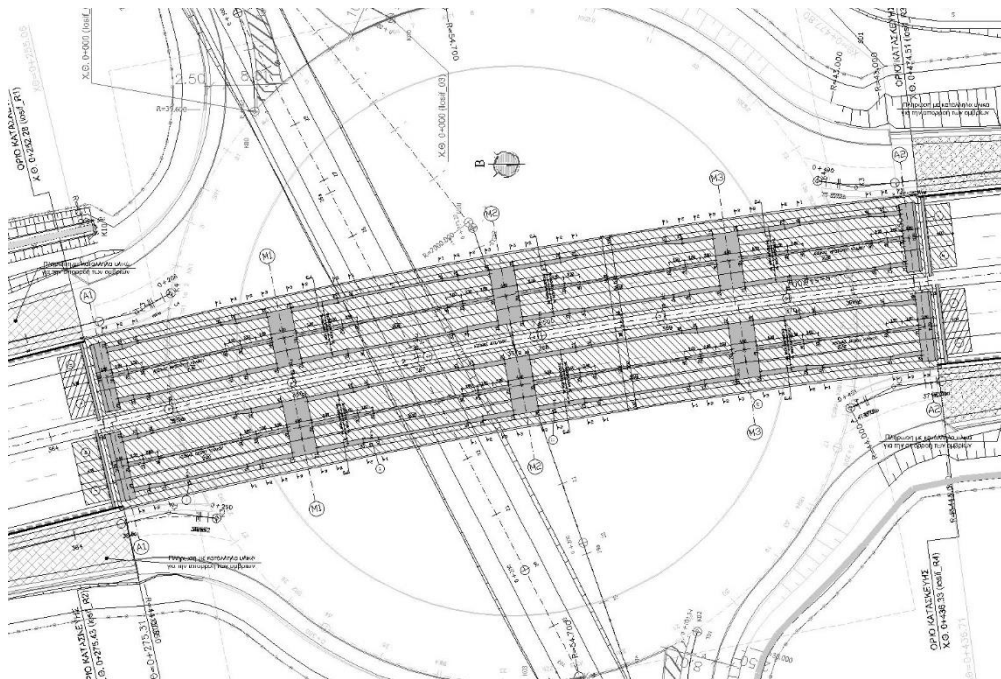
## Faliron Bay integrated redevelopment, Greece

Design of 2 cut & cover of  $L_{\text{tot}}=300\text{m}$ , alongside parkings, 2 pedestrian bridges and 4 bridges (2012) by DENCO P.C.



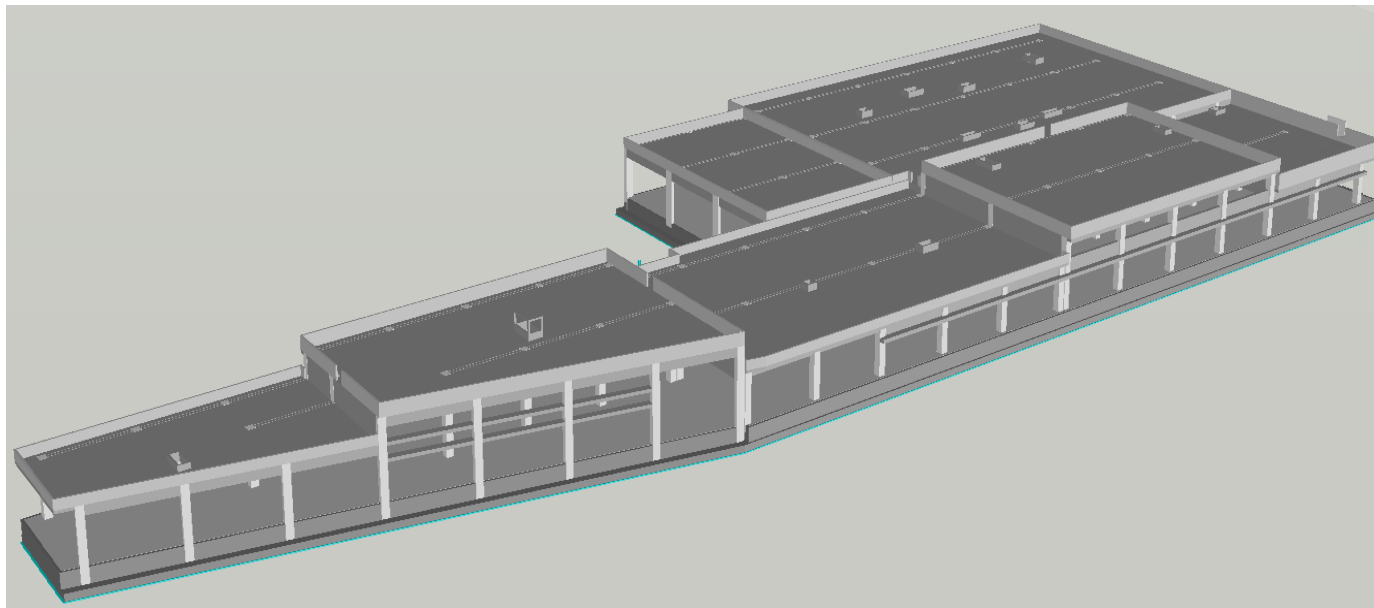
## Nicosia Ring-road, Cyprus

Final Design of 7 bridges  
with seismic isolation and  
17 over- and underpasses  
(2013-2018) by DENCO P.C.



## **Regional Aegean Airports, Greece**

Final Design of the new 8700m<sup>2</sup> terminal of Mytilini airport by DENCO PC



## **Baghdad, Iraq**

### **ELECTRICAL POWER STATION**

#### **– BESMAYA – PHASE 2:**

Structural Design of major equipment foundations (Gas Turbine - Generator Pedestals, Steam Turbine- Generator Pedestals, involving special vibration analyses) and other foundations and auxiliary structures for the new 1500MW (Units 3 & 4) combined cycle, gas-fired Power Plant, by DENCO P.C. (2016 - 2018)



## **Hassi R'mel, Algeria**

HASSI R'MEL I & II OCPP: Structural Design of major equipment foundation Pedestals, (involving special vibration analyses) and other foundations and auxiliary structures for the new 368MW (Units 1 & 2) and 590MW (Units 3, 4 & 5) open cycle, gas-fired Power Plant,  
by DENCO P.C. (2013 – 2016)



## **Shat al Basra, Iraq**

SHAT AL BASRA OCPP: Structural  
Design of equipment foundations,  
concrete buildings and tanks and  
steel buildings for the new 1250MW  
open cycle, LDO/gas-fired Power Plant  
and its First Extension (HFO storage  
and treatment),

by DENCO P.C. (2012 - 2015)





## Zarqa, Jordan

ZARQA PHASE III ADD-ON CCPP:  
Structural Design of major equipment  
foundations, concrete reservoirs  
and steel buildings for the new 143MW  
combined cycle add-on to Phase III  
of Zarqa Power Plant,

by DENCO P.C. (2013 – 2014)



## **Deir Ali, Syria**

DEIR ALI II CCPP: Structural Design  
of steel and concrete buildings and  
reservoirs for the new 701MW  
combined cycle, gas-fired Unit II  
at Deir Ali Power Plant,

by DENCO P.C. (2012 – 2014)





## **Ptolemais, Greece**

PTOLEMAIS V SES: Structural Design  
of concrete buildings, piperack &  
conveyors steel structures and  
Boiler Erection auxiliary structures,  
for the new 600MW (Unit 5)  
lignite-fired Power Plant in Ptolemais,

By DENCO P.C. (2014 – 2018)



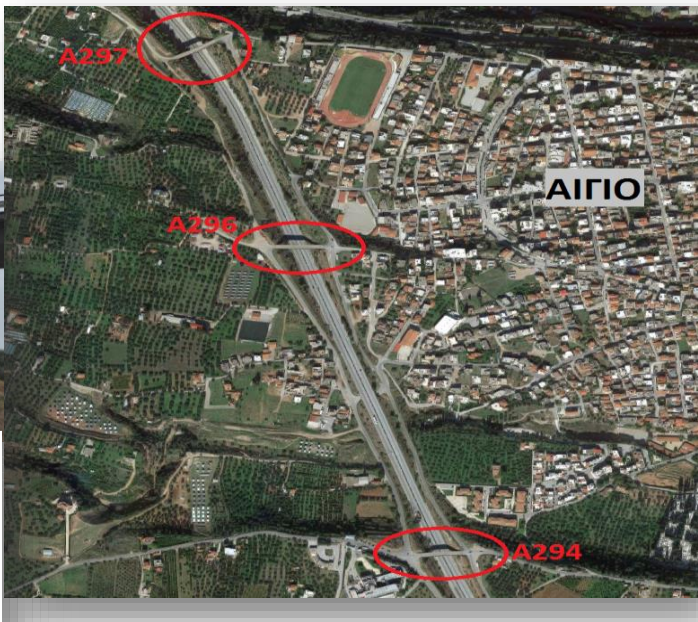
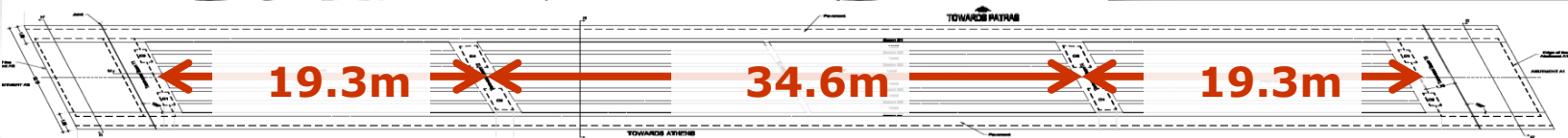
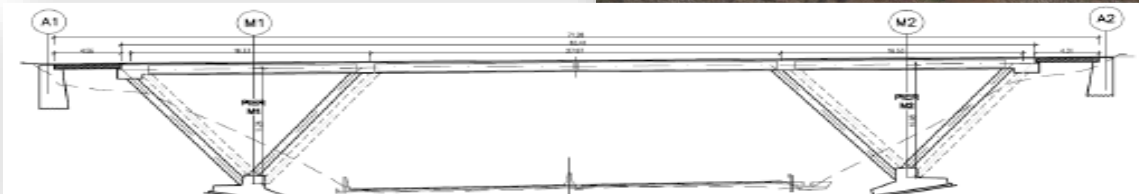
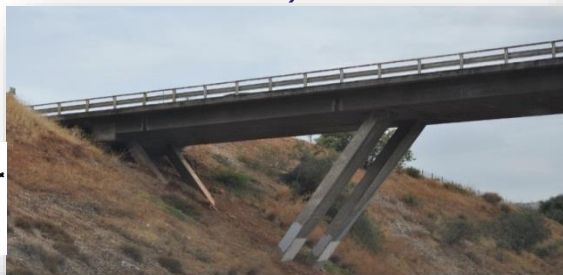
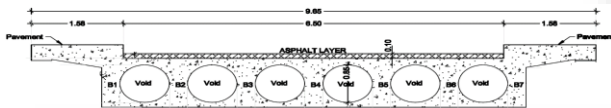
## Aigio Overpass Bridges (retrofitting)

Overpasses (1970) at Aigio region. Main deck consisted of 3 span  
voided-slab prestressed concrete supported on V-shaped columns  
(functioning as 1-bay frame in transverse direction).

Central span: 28,0~34,0m

Total width : 9,65 m

Deck height: 1,00~1,12m

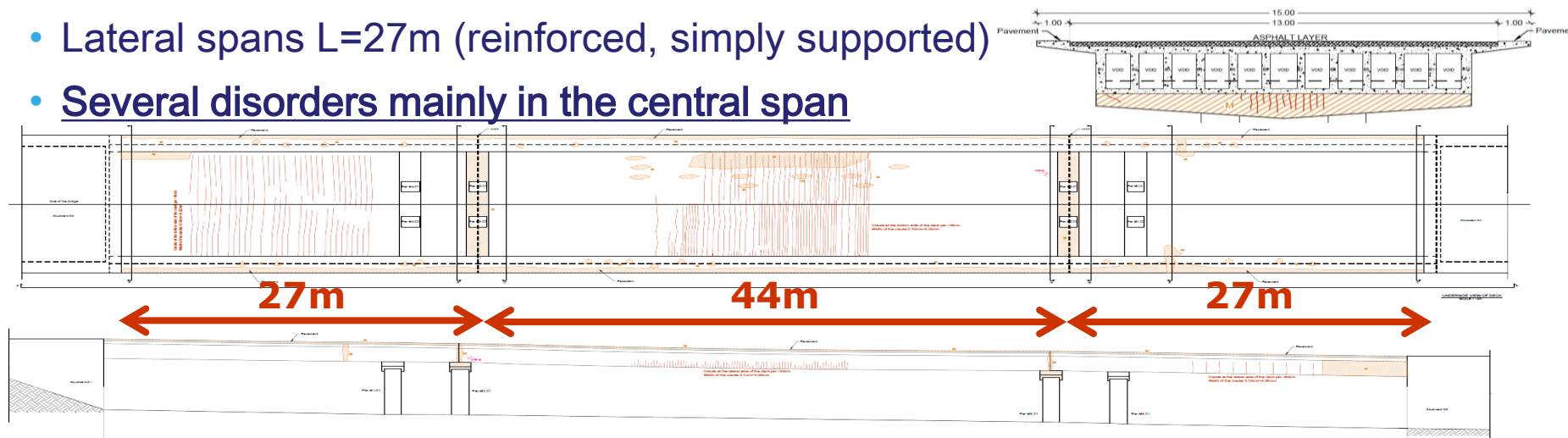


## Aigio Overpass Bridges (retrofitting)

- Retrofit of major bridges has been designed and constructed in order to fulfill:
  - The increased (x1.5) service loads.
  - The increased (x5.0) seismic demands.
- Optimization of the intervention method in order to
  - Achieve the specifications of the project
  - While the motorway remained partially operational
- **Application of the provisions of EN1998-3 for the first time on bridges**
  
- Contributors (gratefully acknowledged)
  - Structural Design: DENCO P.C.
  - Independent Engineer: SETEC TPI / SALFO S.A.
  - Contractor: AKTOR S.A. (APION KLEOS J.V.)

## Upgrading of Kamares Bridge, Greece

- Length 98m, width 15m, height 1.9m (voided concrete slab)
- Central span  $L=44\text{m}$  (prestressed, simply supported)
- Lateral spans  $L=27\text{m}$  (reinforced, simply supported)
- Several disorders mainly in the central span



## Upgrading of Kamares Bridge, Greece

- Phased construction without interruption of the traffic underneath the bridge – Total duration 1 year (ended March 2017)
- First application in Greece of monolithic connection between the steel-concrete composite and the reinforced concrete spans

Joint before the  
continuity is  
achieved





## Upgrading of Kamares Bridge, Greece

Bridge under construction



## Upgrading of Kamares Bridge, Greece

Bridge under construction



Design : DENCO P.C. - Design control : SETEC T.P.I. / SALFO S.A.  
Construction : AKTOR S.A. - Concessionaire : OLYMPIA ODOS S.A.



## **Upgrading of Kamares Bridge, Greece**

Bridge construction completed



## 3<sup>rd</sup> LNG Reservoir in Revythousa island, Greece

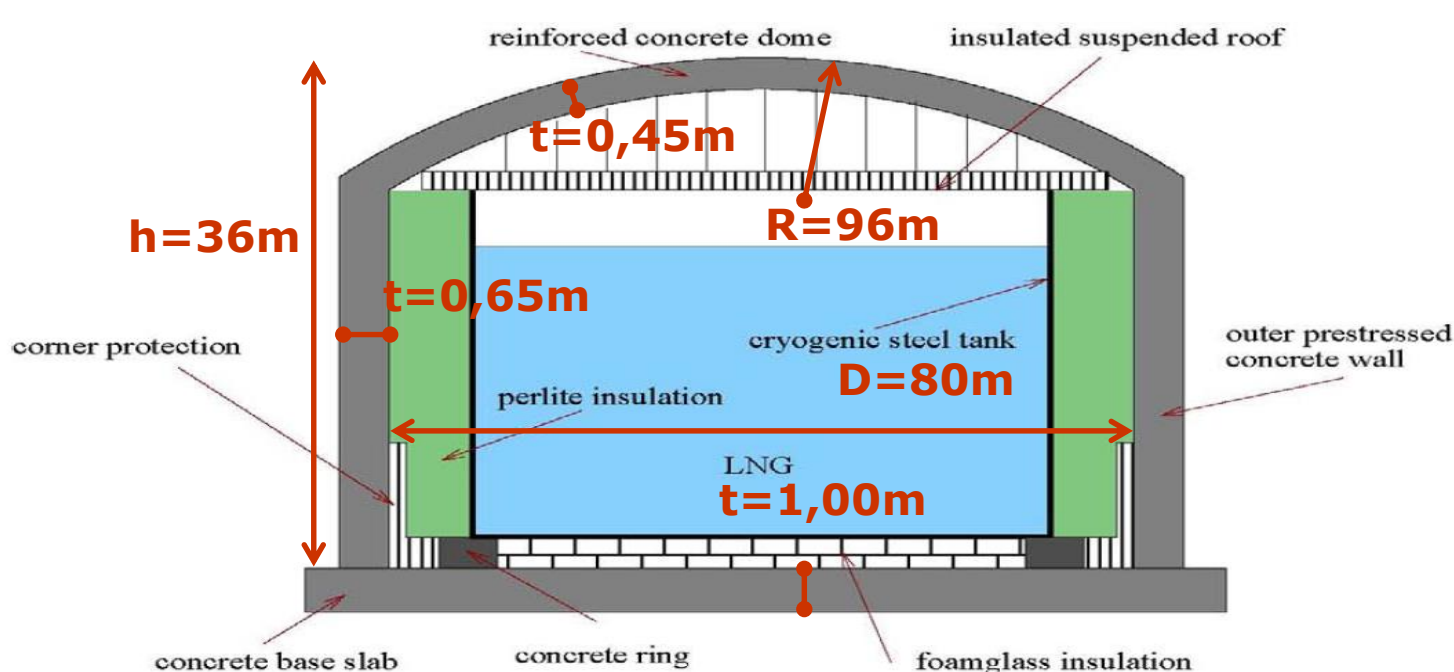
Final design of the seismic isolation for the 95000m<sup>3</sup> tank including foundation, outer shell and accompanying works by DENCO P.C. (2010-2018)

- Other contributions :  
J & P Avax S.A.- Whessoe Ltd
- Checker : ADK S.A.-Asprofos Engineering-C&M Engineering SA
- Constructor : J & P Avax S.A.
- Owner : DESFA S.A.



### 3<sup>rd</sup> LNG Reservoir in Revythousa island, Greece

Internal steel tank – External concrete tank (C40/50)



LNG :

$T=-167\text{ }^{\circ}\text{C}$

$p=29\text{ kPa}$

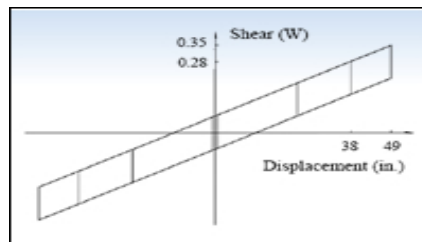
Free surface

## 3<sup>rd</sup> LNG Reservoir in Revythousa island, Greece

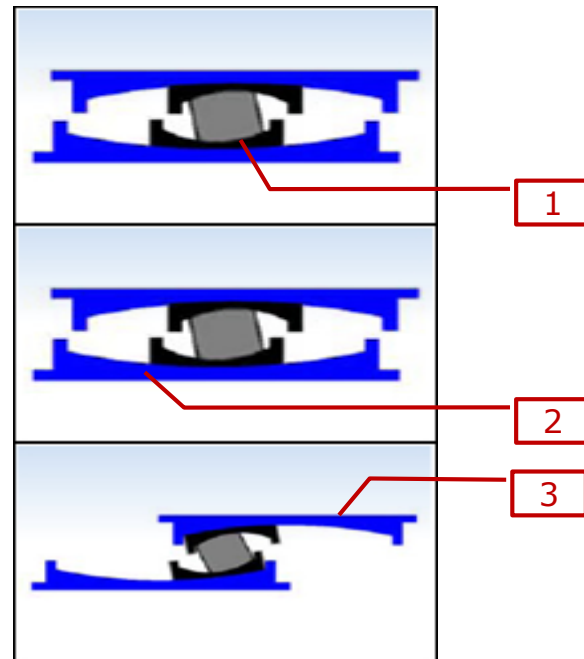
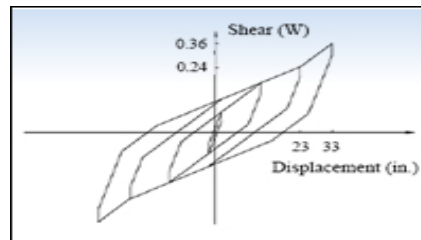
Seismic isolation : Triple friction pendulum bearings



Simple FPS



Triple FPS



- $R=2.5m$        $\mu=2.5\%\sim6\%$
- $T=2s \sim 2.4s$        $\zeta=10\% \sim 25\%$
- $D_{max} = \pm 400mm$        $A_{max} = 0.20g$



## 3<sup>rd</sup> LNG Reservoir in Revythousa island, Greece

Photos from the construction phase



## **Greek environment/framework of the further development (revision) of the EN Eurocodes under Mandate M/515 – The foreseeable (?) future**

Despite the moroseness of the international and European environment it is hoped that financial/economic conditions will be gradually improved. If the building sector is re-launched, it is expected that the application of Eurocodes will be spread, in combination with a set of other renewed regulations/codes related to e.g. diminishing energy consumption, improving fire protection etc.

A targeted readjustment of ELOT TE 67 together with some – even limited – financing is also expected to improving its efficiency.

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**Thank you for your attention!**

***Stay in touch***



***<http://eurocodes.jrc.ec.europa.eu/>***