Management of Safety in Construction & Maintenance Works

Case Study: Olympia Odos Motorway, Greece

"Holistic Safety Management Approach in Construction under Operation"

IRF

5th Webinar –Engineering Measures and Funding for Road Safety

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Contents

1. Greek Motorway Network

Hellastron network 2.145 km,
(7 concessions + 1 public under privatization)
out of which 55% constructed the last 10 years

Motorway	Total Network Length (km)
Attiki Odos	70
Rion-Antirrion Bridge	3,5
Egnatia Odos	887,2
Nea Odos Motorways	377,1
Moreas Motorway	205
Aegean Motorway	263,7
Olympia Odos Motorway	202,3
Central Greece Motorway	136,5
Total	**2.145,3**

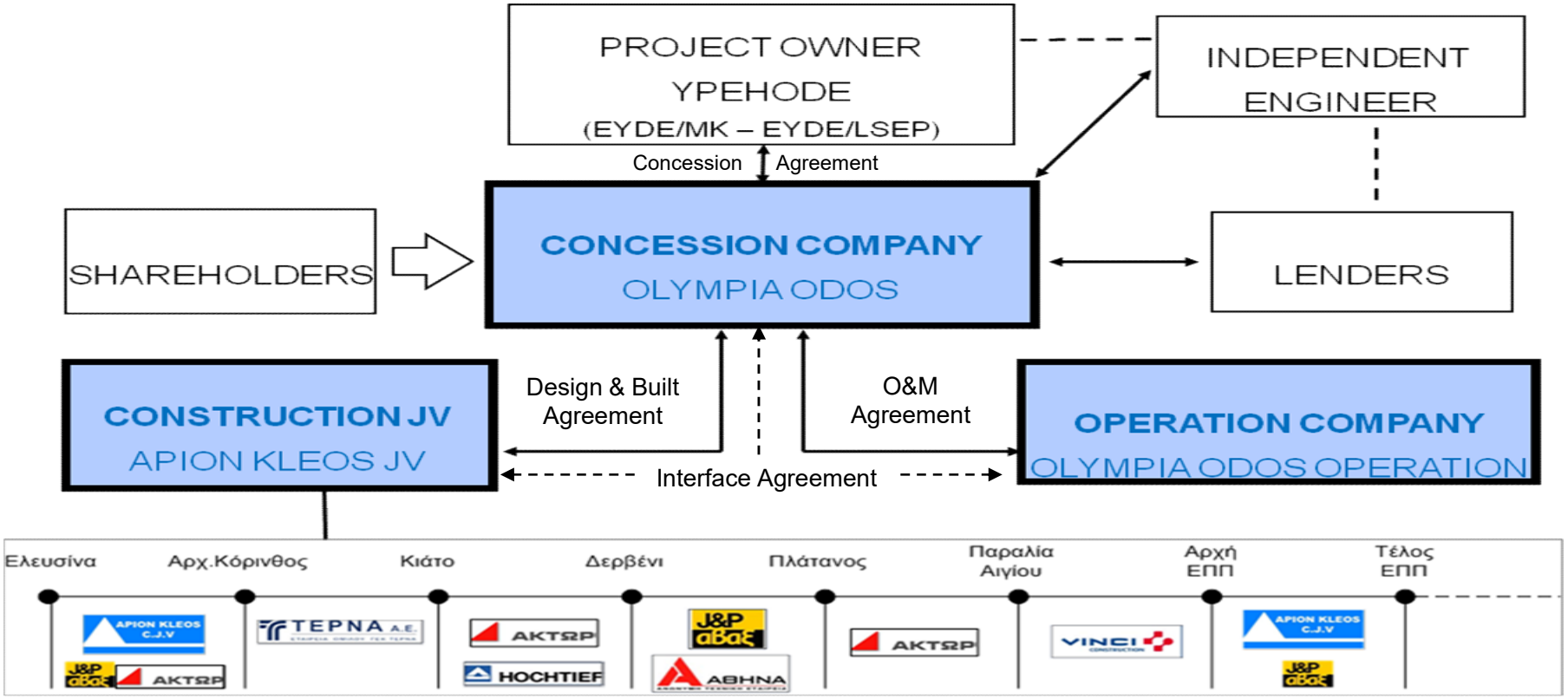
2. Olympia Odos, *general description*

- Strategic importance on reginal, national and international level
- Including Design, Build, Operation, Exploitation and Maintenance for 30 years
- 202 km of motorway in full development, including:
  - ✓ **82 km of Existing Sections:** *Elefsina-Korinthos & Patras By-Pass*
    - with *Upgrade & Heavy Maintenance works*
  - ✓ **120 km of New Sections:** *Korinthos-Patras (KoPa)*
    - *with extended works of gradual transformation/upgrade of an old road in operation into a modern new motorway*
- € 1.4 billion Construction Budget
- Financing: Bank loans, CNR funds, State & EU funds and Toll Revenue

→ In Operation since Concession Commencement (Aug.2008) including tolling in all sections (Existing and New under Construction)

→ Construction lasted during 2009-17 (w' works suspension during 2010-14)

2. Olympia Odos, *Contractual Framework*



2. Olympia Odos Operator, *Role & Activities, 24/7 service*

- ✓ **Traffic Management & Road Safety**
- ✓ **Managing Safety within extended Construction & Maintenance works in all sections**
- ✓ **Detection / Incident Management** in collaboration with Emergency Services
- ✓ **Routine Maintenance** (preventive & corrective)
- ✓ **Toll Collection**
- ✓ **Customer Service**

+

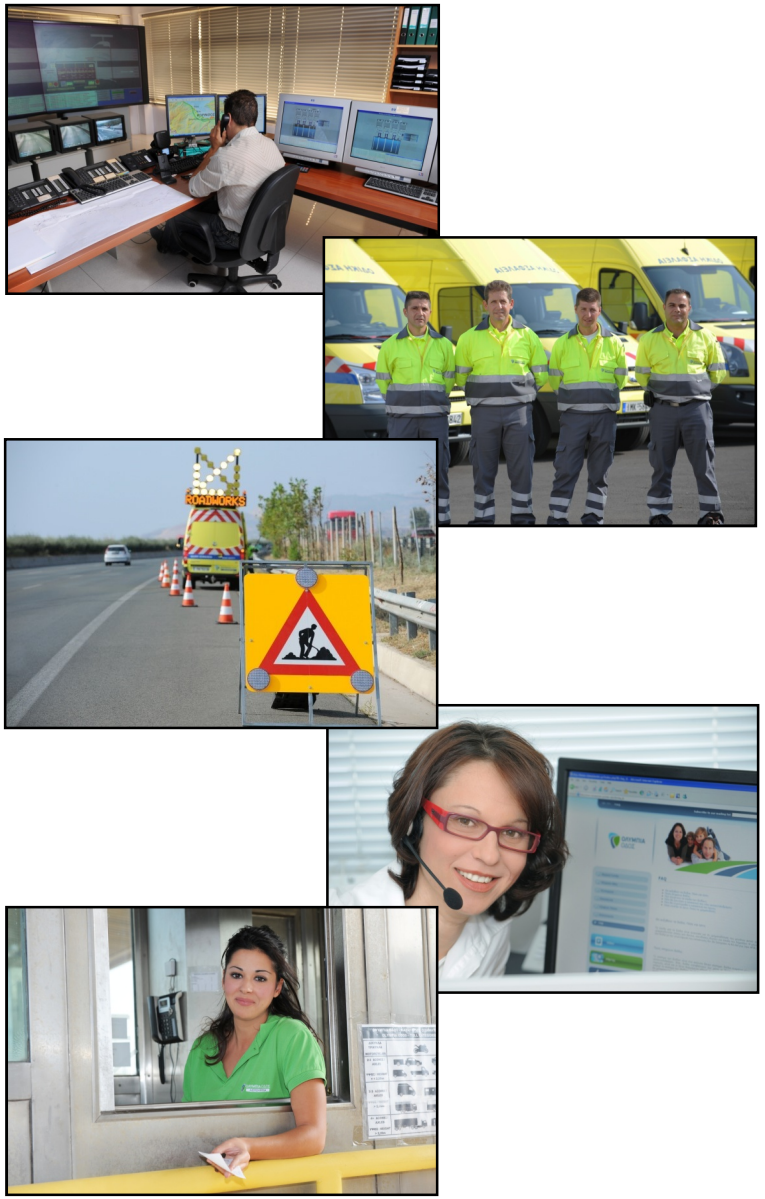
Design Review & Heavy Maintenance advices

in operational elements and especially on design of Traffic Arrangements for works

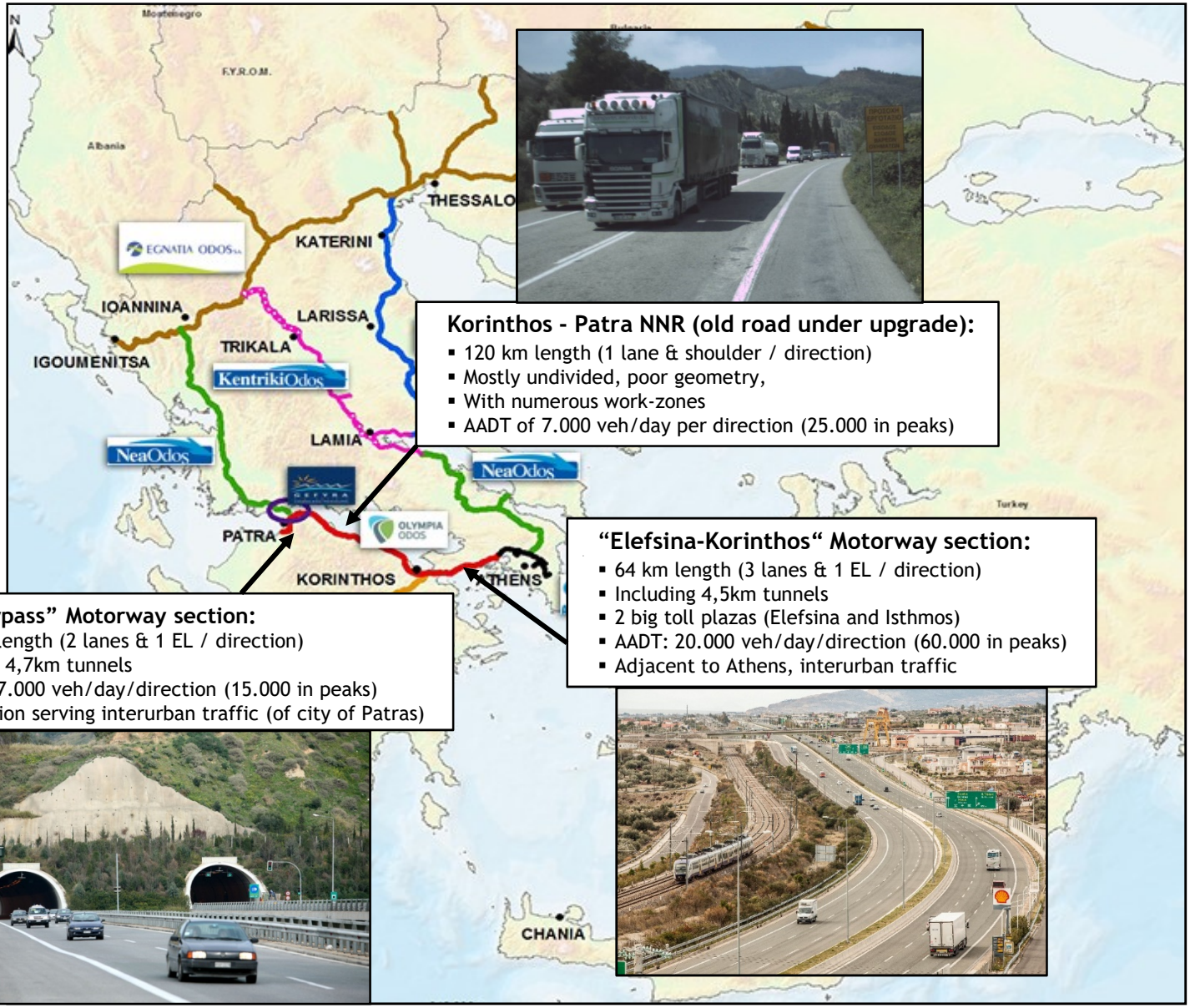
+

Daily Safety Management coordination

of all involved Constructors (for both Construction works in New Sections and Heavy Maintenance works in Existing Sections) and CNR crews



2. Olympia Odos, *three sub-sections of different character*

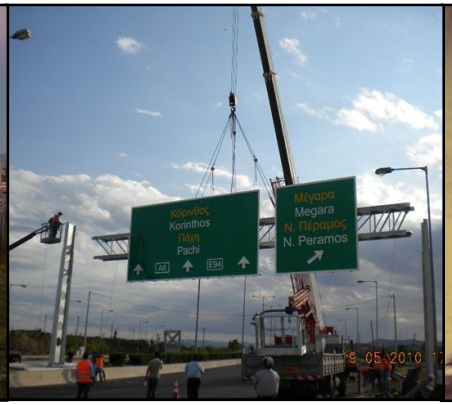


Korinthos - Patra NNR (old road under upgrade):
- 120 km length (1 lane & shoulder / direction)
- Mostly undivided, poor geometry,
- With numerous work-zones
- AADT of 7.000 veh/day per direction (25.000 in peaks)

"Elefsina-Korinthos" Motorway section:
- 64 km length (3 lanes & 1 EL / direction)
- Including 4,5km tunnels
- 2 big toll plazas (Elefsina and Isthmos)
- AADT: 20.000 veh/day/direction (60.000 in peaks)
- Adjacent to Athens, interurban traffic

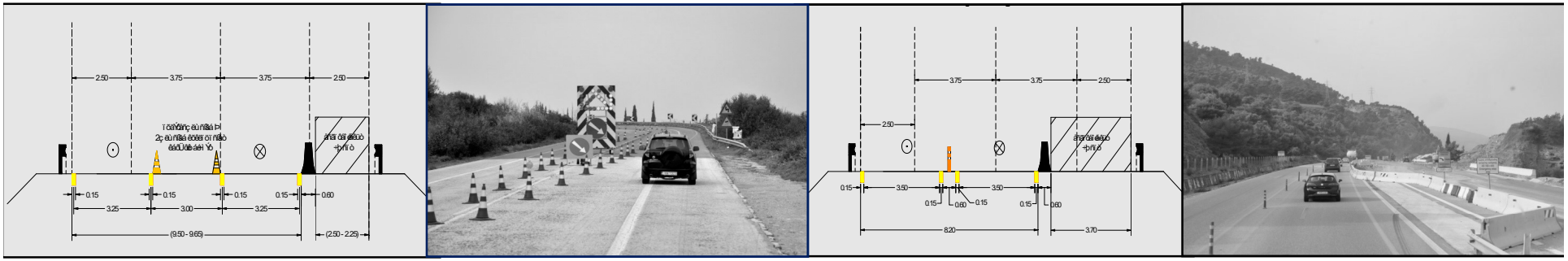
"Patra Bypass" Motorway section:
- 18.3 km length (2 lanes & 1 EL / direction)
- Including 4,7km tunnels
- AADT of 7.000 veh/day/direction (15.000 in peaks)
- Half section serving interurban traffic (of city of Patras)

2. Olympia Odos, *Existing Sections with extended Upgrade / Heavy Maintenance Works*



2. Olympia Odos, Construction Works in “Korinthos - Patras (KoPa)”

*Gradual transformation of an **Old Dangerous Road** to a **New Motorway** via **special** **Traffic Arrangements***



3. Particularity of KoPa, *Characteristics of Old Road*

- **Old Road** (constructed 1960-69) intended as a **high speed road / not a motorway**
- **Undivided carriageway, total width of 12 m**
- Mostly with **1 traffic lane and paved shoulder per direction**
- **Was joining Athens to Patra** passing near cities of the Northern Peloponnese
- **Higher traffic in eastern section (towards to Athens side)**
- With **important seasonal traffic variations** (tripled during peak days)
- With a **parallel road axis** (old road) of much worse characteristics, passing through inhabited areas
- Particularly **unfavourable history of road safety** (~35 to 40 fatalities per year…)

→ **Difficult old road requiring special measures and treatment**

3. Particularity of KoPa, *Immediate safety measures, 2008-09*

→ **The first "make-up" safety programme on existing road**
before starting construction works for new road

- Restoration of pre-existing damages and improvement of existing **safety barriers**
- Improvement of **anti-skid properties of the pavement**
- Local **pavement repairs**
- **Marking works**
- Improvement of visibility and increase of usable width of the road by **cleaning/trimming the plantation to the side of the road**
- Cleaning and replacement of worn **signs**
- Cleaning/change of **reflectors of safety barriers**
- **Road lighting repairs**
- Cleaning of shoulders from vegetation, dirt and waste and opening of water drain **gutters**
- Installation of **reflective studs at the edge of the road**
- Arrangement of **existing parking spaces** with marking, barriers and signs

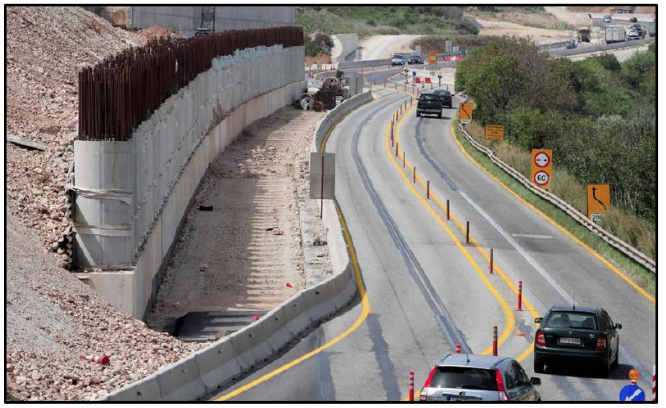
3. Particularity of KoPa, *design-construction challenges*

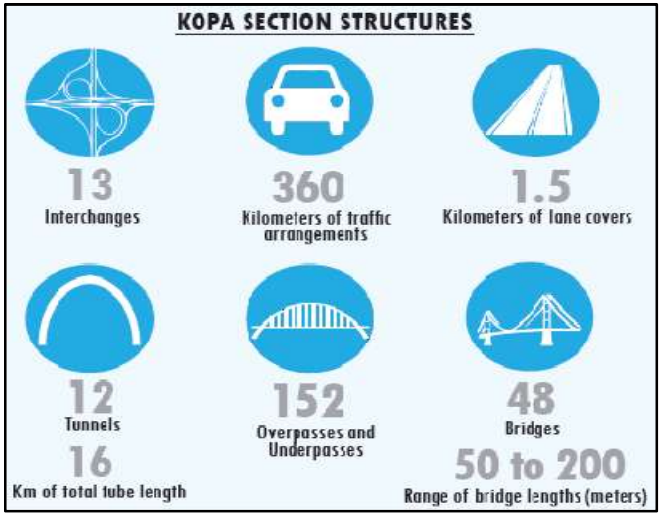
OLYMPIA ODOS OPERATION

- New **alignment on the existing road with upgraded standards and geometry**
  - except in specific locations due to geometry, landscape or geology (i.e. tunnels)

- Requiring **special construction interventions**
  - one-side or bilateral carriageway widening
  - X-crossings among old and new alignment
  - old structures demolitions/extensions (~30)
  - construction of new structures (~170)
- **In contact/interference with traffic** of the Old Road
- **Simultaneous construction of a new Railway Line running in parallel and very close to the road** (>10 points of interface)
- **Largescale utility relocation**
- Need for **necessary space for safe execution of construction works** next to traffic

→ <u>Managing Safety and Constructability</u> **required Design & Implementation of extensive and special Temporary Traffic Arrangements (TTAs)**





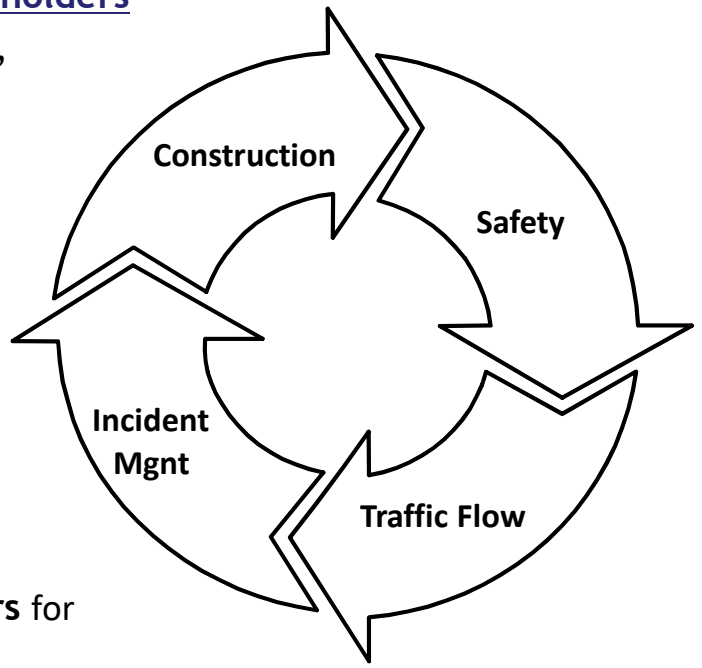
4. Temporary Traffic Arrangements (TTAs)

Holistic Safety Management Approach in Construction under Operation

OLYMPIA ODOS OPERATION

Extensive Design and approval procedure involving all stakeholders

- Accommodate multiple design parameters at the same time, sometimes conflicting each other
- Designs prepared by the Designers
- **Designs** reviewed and approved by
  - **Independent Safety Auditor expert**
  - **Independent Engineer**
  - **Operator**
  - **State Service**
  - Competent **Traffic Police** department
  - **Special Committee between all involved stakeholders** for dealing with special issues deviating from standard practice
- Issuance of **Police Decision** (Permission)



→ **Prompt and constant collaboration of all involved parties and Authorities**

Proper and Detailed Implementation Process

- **On site inspections** with all stakeholders and emergency services

(Traffic Police, Fire Brigade and Paramedics)

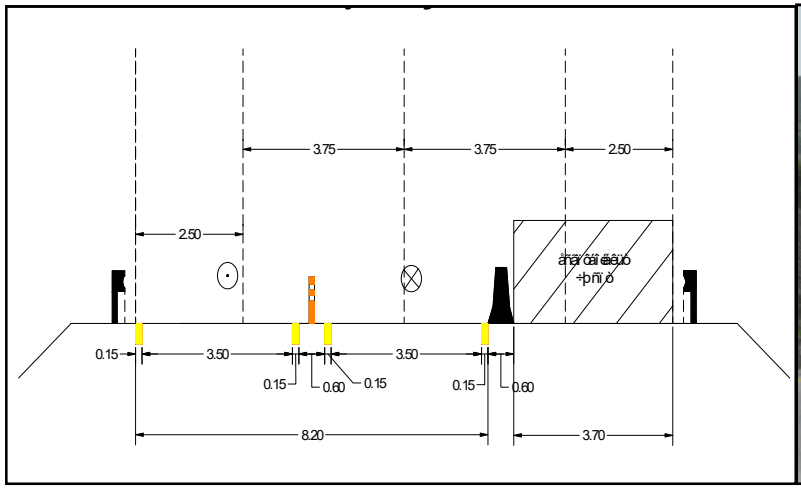
- Joint preparation of **emergency intervention plans**

Extensive Communication

- **Press Release** - **informative leaflets** for public

Continuous Monitoring, Improvements and Maintenance (including on duty mechanism for emergency)

4. Typical TTA of “1+1 Lanes”



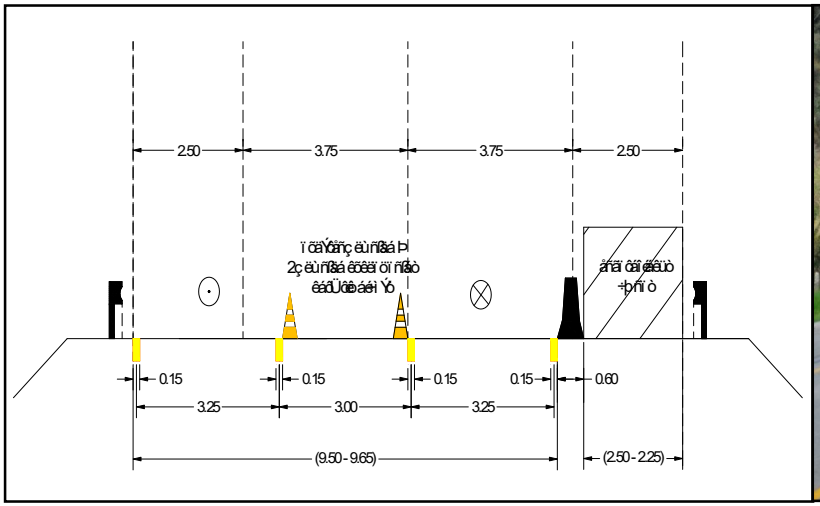
- **Applied in the western section,** w’ **lower traffic**

- Priority to **Safety and Construction**

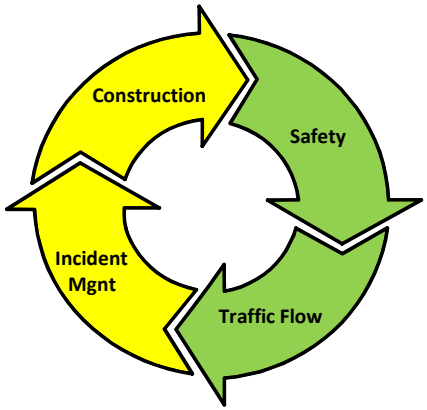
- **Work zone of 3.7 m width**
- **1 traffic lane per direction, separated by bollards**
  - with minimum total required width 8.2 m, i.e.:
    - 3.8 m for traffic / direction and
    - 0.6 m in the middle with **flexible bollards**

- **Incident management** with
  - **emergency lay-bys** (every ~500 m), ~30 m long, ~4 m wide and signing
  - 4-digit SOS phone number
  - **special side accesses** for the Emergency Services

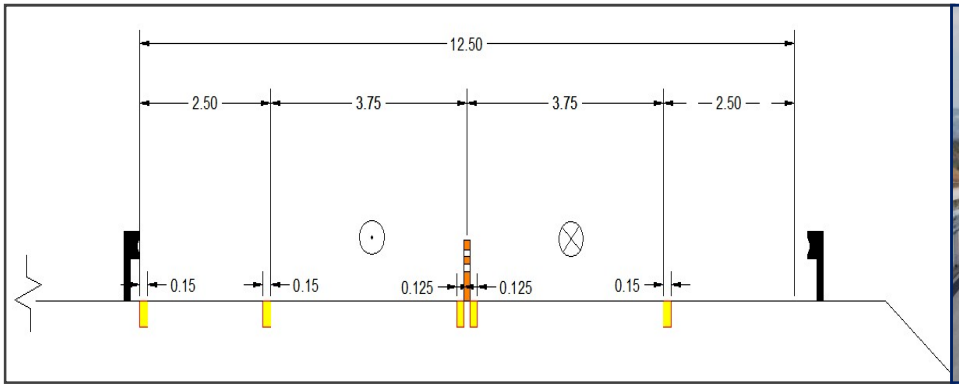
4. Typical TTA of “2+1/1+2 Lanes”



- **Applied in the eastern section,** w’ **higher traffic**
- Priority to **Safety and Traffic Flow**
- **Work zone of 2.5 m width**
- **3 lanes with portable separating means** (double row of cones) available to traffic:
  - on "low traffic " days, the edge lanes (3.25 m)
    i.e. cross section 1 + 1 with middle lane (3.0 m) as buffer zone
  - on "high traffic" days, also the middle lane in the direction of hight traffic, *i.e. cross section 2 + 1*
- **Incident management** with the use of middle (buffer) lane



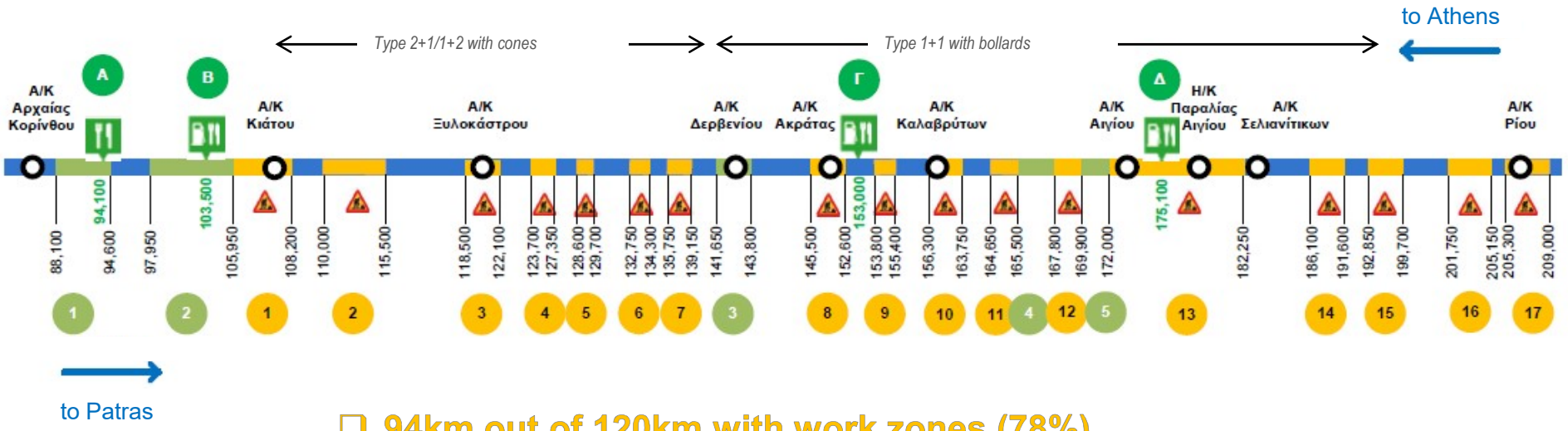
4. Typical TTA of “New Branch”



- **Applied where only one (new) branch (carriageway) of the new motorway is finished**, utilizing its whole width
- **Similar cross-section as the Old Road + bollards in the middle** to obstruct overpasses
- **1 traffic lane + EL per direction**
  - With total width of 12.5 m
    - 3.75 m for traffic / direction and 2.5 m EL

4. Deployment of multiple TTAs, *all along KoPa*

indicative conditions of 31/05/15

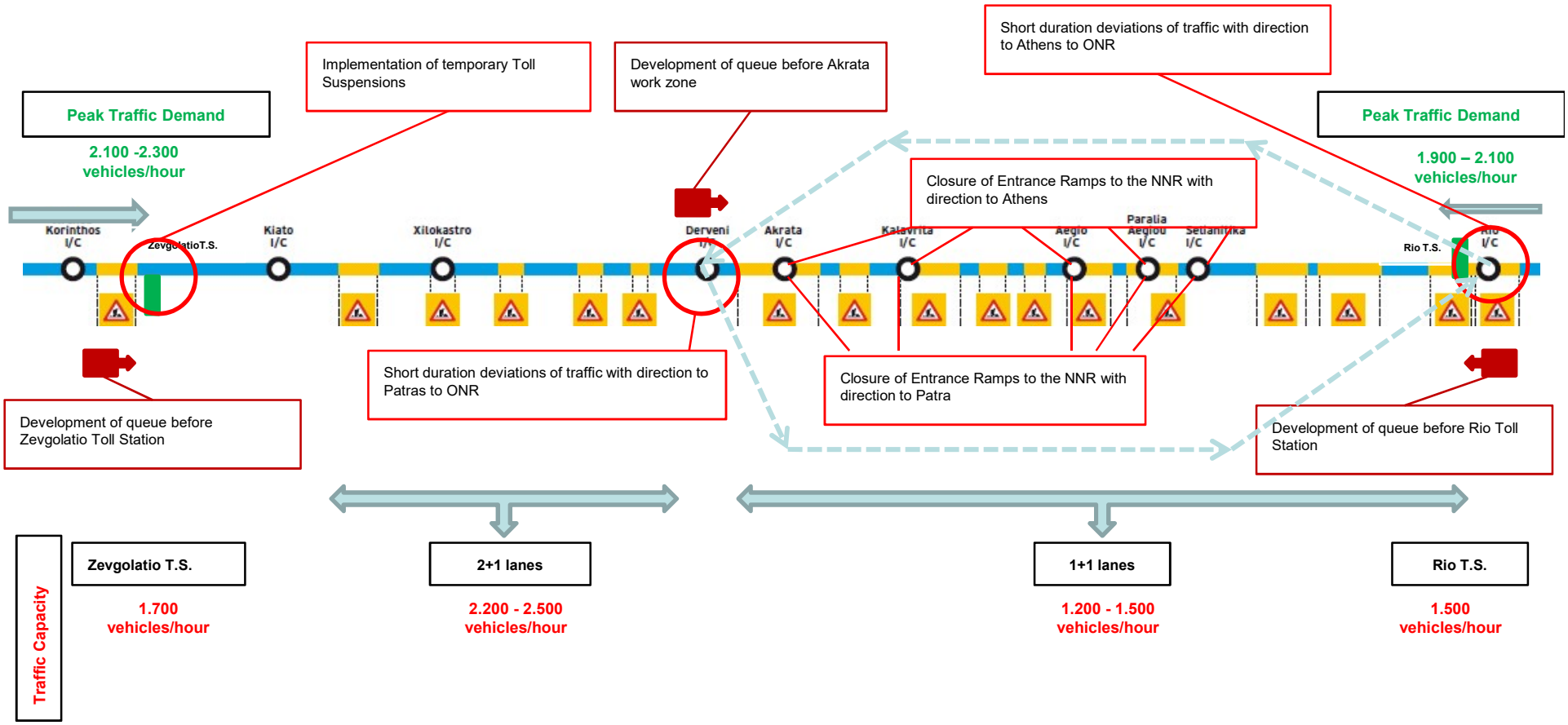


- ❑ **94km out of 120km with work zones (78%)**
  - ✓ 39km of TTAs (mainly 2+1/1+2 zones) in “Anc. Korinthos-Derveni” section (69%)
  - ✓ 55km of TTAs (mainly 1+1 zones) in “Derveni-Rio” section (85%), including intermediate relief sections of 1+2 in Akrata, Kalavryta and Aigio zones
- ❑ **21km of 5 new Sections in temporary use**

Use of the new branch **“2+1/1+2”** **“1+1”**

5. Access Management *for heavy traffic days* - *with Police*

Use of parallel Old National Road, provision of extra capacity



6. Special Safety Precautions for the Operator

A very difficult environment for the Operator to provide its services under very adverse and unorthodox conditions

- ✓ **Need for very strict procedures** and **follow up**
- ✓ Continuous and close **collaboration with Traffic Police** for strengthening the safety
- ✓ Need for **quick/ imediate detection** and **management incidents** in work-zones
- ✓ Ensure the **unobstructed operation not only of KoPa but also of the alternative route (out of the concession)** for use in cases of high traffic or incident
- ✓ Constant **monitoring, evaluation** and **management of eventual problems**

6. Special Safety Precautions for the Operator

Visibility red zones for personnel safety

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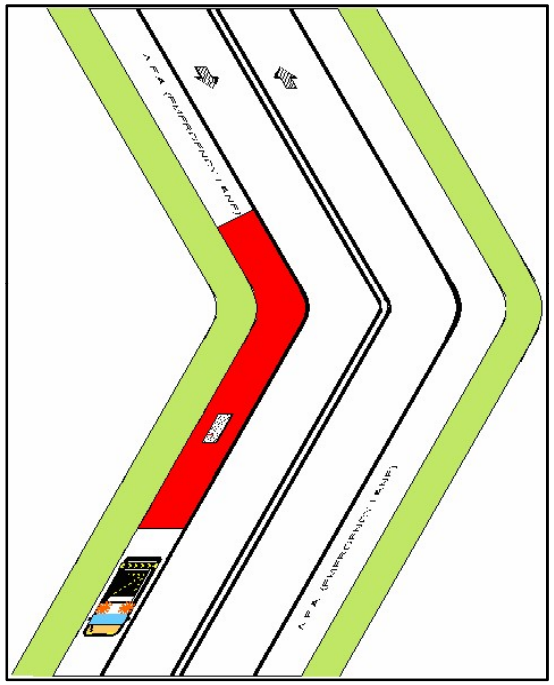
Visibility red zones for personnel safety

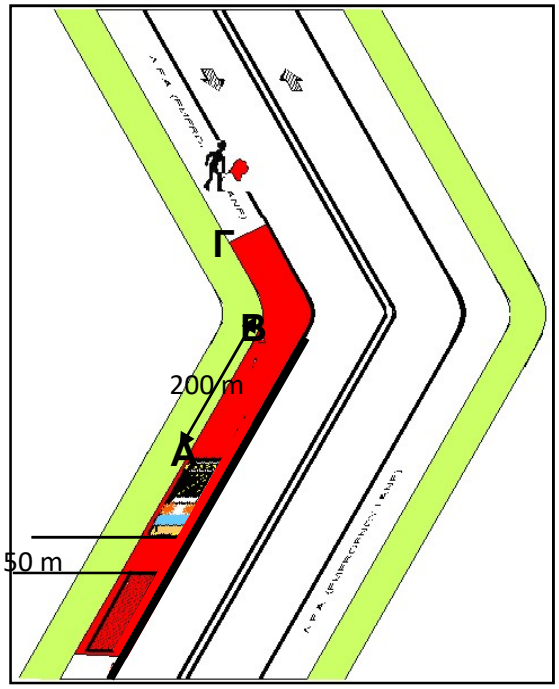
Special study for definition of road sections with limited visibility (<200m), so called as "red zones" (road ~20% of length)

- Manuals' basic guidelines (below sketches) for patrol stopping out of "red zones"

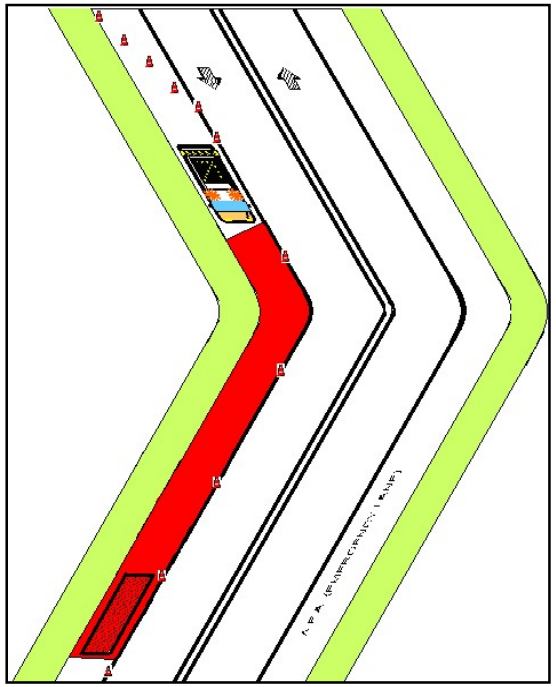
EL, minor and sudden within a "red zone"



EL, major and sudden within "red zone"



EL major and known within "red zone"



- Procedure for **additional safety measures** within "red zones"
  - In case of scheduled works, **prompt planning**
  - In case of mobile signing, **halting prior and immobile signing**
  - In case of incident, take proper measures, **inform TMC to assist** with other forces

6. Special Safety Precautions for the Operator

10 Non-Negotiable rules

1 I always observe without fail the Traffic Code and the driving rules

2 I always respect & follow the safety instructions & procedures

3 I always use the proper Personal Protection Equipment

4 I don't consume alcohol and I am careful with medication and fatigue

5 I move safely and carefully in toll stations

6 I always apply at least the typical temporary signing plans

7 I place and remove cones/signs with constant attention, alertness and prudence

8 I always take special measures in limited visibility zones and tunnels

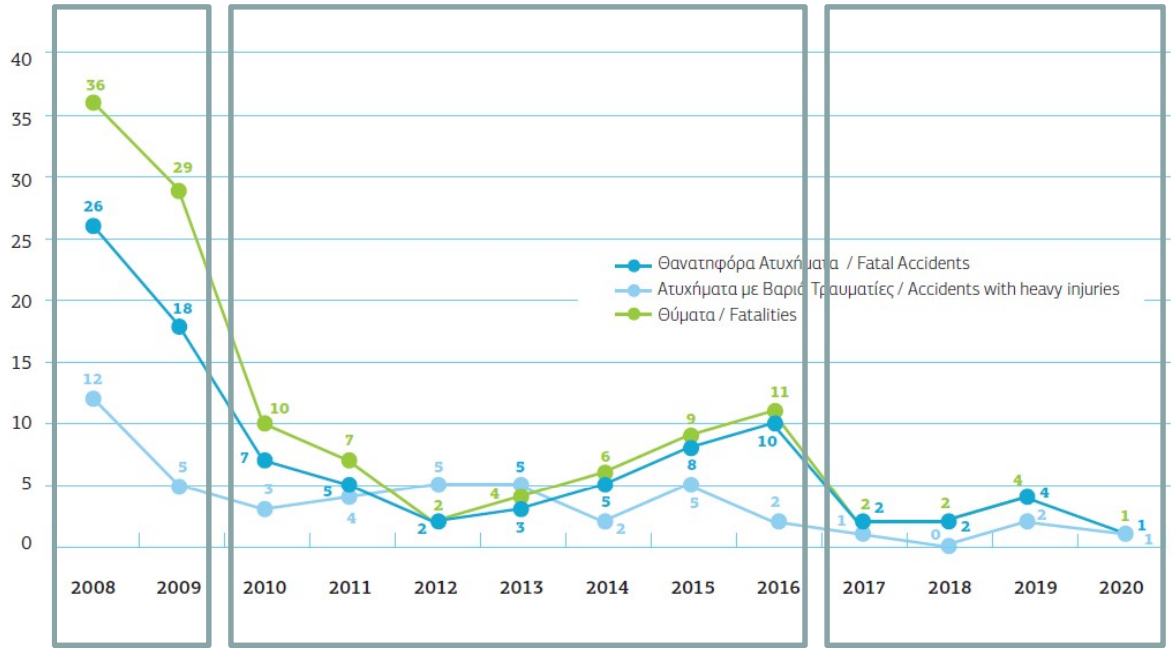
9 I don't cross the road vertically & I pay attention when reversing with a vehicle

10 Electricity kills, that is why I always take the necessary precautions

7. High Quality Result, *New "Korinthos – Patra" Motorway*

- **120 km** length (2 lanes & 1 EL / direction)
- **16km new tunnels** (5 groups)
- 3 bi-dir mainline toll plazas + 12 ramp plazas
- Reliable and Safe Connection of Athens to Patras

7. High Quality Result, *Road Safety Performance in Korinthos-Patra section*



Fatalities Index (Fatalities per 10^8 vehicle-kilometers travelled)

YEAR / ΕΤΟΣ	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Fatality Index/ Δείκτης Θανόντων	3,86	3,08	1,22	1,03	0,35	0,74	1,13	1,68	2,00	0,32	0,30	0,59	0,20
HELLASTRON							0.61	0.63	0.55	0.46	0.59	0.48	0.45

- **2008 - 2009 Development of Safety Improvement Measures**
  - 2008 Concession Commencement
  - 2009 First safety measures
- **2010 - 2016 Full Development of Traffic arrangement**
  - 2011 Works suspension
  - 2014 Reconstruction – Project Restarted
  - 2015 Capital Controls
  - 2016 Delivery of first motorway sections
- **2017 - 2020 Completion of Motorway**
  - 2017 Operation Completion
  - 2018-20 Fully Completed

The combination of:

- continuous safety services provided by the Operator and their subcontractors
- presence of traffic arrangements, imposing restrictions on reckless driving (speed, overtaking)

→ **Contributed to significant decrease of accidents and fatalities**

8. Conclusions (1/2)

Holistic Safety Management Approach in Construction under Operation

- ✓ Setting Necessary Contractual Provisions for optimum internal collaboration (i.e. Interface Agreement)
- ✓ Tracing/defining all involved Stakeholders
- ✓ Identification of Regulations
- ✓ Defining construction and operational needs and constraints
- ✓ Prepare appropriate design
- ✓ Take necessary approvals and liaise with Authorities
- ✓ Implement on site with Quality and High Standards
- ✓ Communicate to Users and Local Communities before Implementation
- ✓ Continuous follow up, monitoring and maintain the TTA's
- ✓ Upgrade/improvement where needed

8. Conclusions (2/2)

Operating in such adverse road conditions; Lessons learnt

- The presence of a mechanism providing **operation services contributed to the improvement of road safety**

- **During the time of recession** this contribution (of Operation) was even more valuable. Chances and indications of risk increase and **precautions became more necessary.**

- **Well prepared traffic arrangements ensured better management of traffic and provided safer environment for road users.** The great reduction of fatal accidents and fatalities achieved during the first 4 years of the Concession was the best evidence and obliged all involved parties to continue working together.

- The positive results in terms of road safety on Olympia Odos showed that **there are always ways to improve on existing infrastructure with interventions and low budget measures even before the needed heavy construction works.**

Key factors in all above were:

- Safety in priority
- Teamwork of all involved parties
- Preparation in advance with plans and procedures
- Constant monitoring

Thank you
for your attention!