FIFTH UNITED NATIONS GLOBAL ROAD SAFETY WEEK

6-12 May 2019

Save Lives
#SpeakUp

Economic analysis of road infrastructure safety projects

- EIB CBA –

Anastasios Dragomanovits

Transportation Engineer, Research Associate

Together with:
Julia Roussou, Dimitrios Nikolaou, George Yannis

The Assignment

- **Objective**:
  Develop a methodology for the assessment of the economic feasibility of road safety schemes, to be applied in the Greece Road Rehabilitation and Safety Project by Egnatia Odos SA

- **Duration**:
  3 months (December 2018 – March 2019)

- **Carried out for**:
  European Investment Bank (EIB) / European Investment Advisory Hub (EIAH)

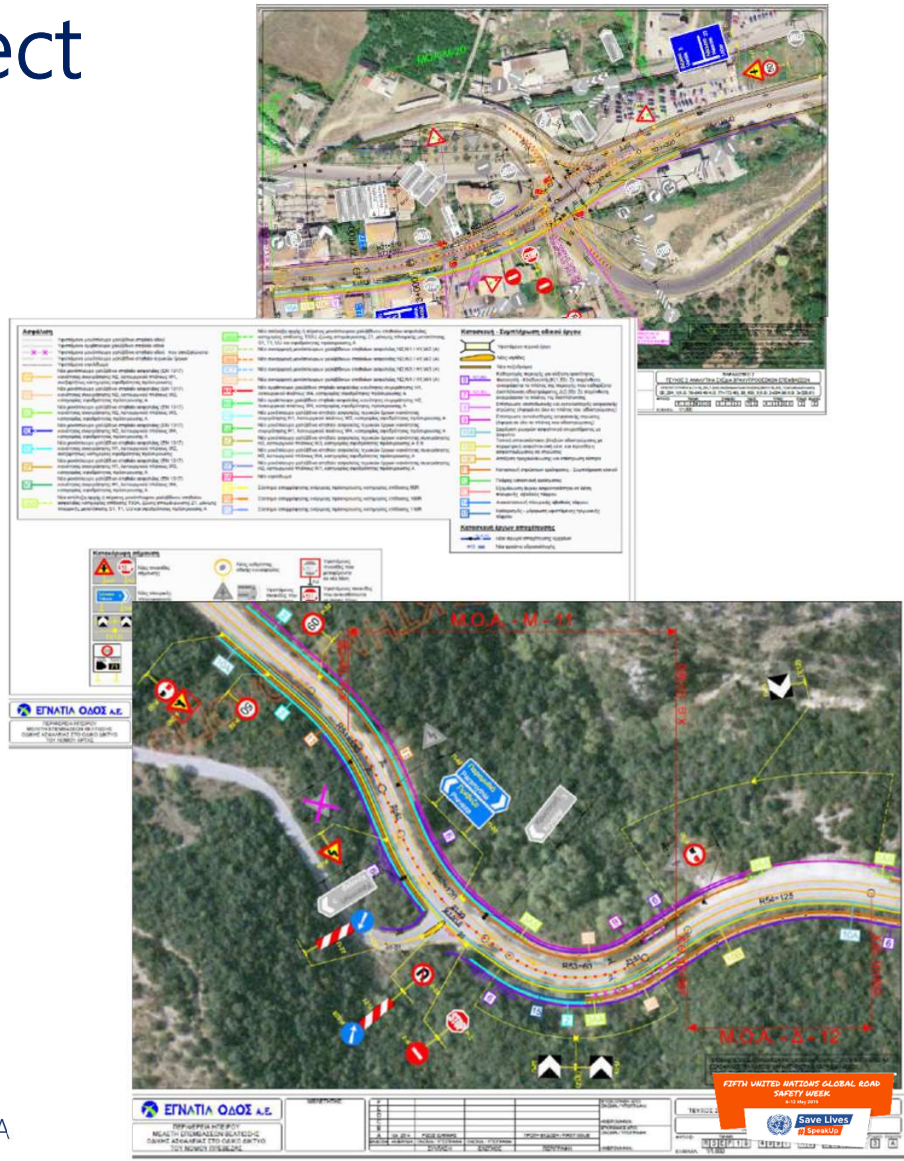
- **With the cooperation of**:
  Egnatia Odos S.A.

European Investment Bank The EU bank

ΕΓΝΑΤΙΑ ΟΔΟΣ Α.Ε.

Egnatia Odos Road Safety Project

- 15.000km of roads outside built-up areas examined, covering the national & regional network of Greece (not including motorways).
- Over 7.000 hazardous locations identified, spread over 2.500 km on 80 roads.
- Hazardous locations categorized as:
  - Proven (HL-PR)
  - Testimony (HL-T)
  - Potential (HL-P)
- 60 Road Safety Interventions Design Studies (RSIS) completed (2012-2015).
- Total project cost estimated at 470m€.



Road Safety Interventions

- Construction of road markings (delineation)
- Installation of traffic signs, including speed limit signage
- Construction of new asphalt pavement
- Construction of anti-skid asphalt course
- Installation of roadside delineator posts
- Installation of centerline roadway deflectors
- Installation of transversal rumble strips (for speed reduction at intersection approaches)
- Installation of safety barriers
- Installation of side roadway deflectors
- Improvement of roadside conditions (e.g. reconstruction of shoulders, removal of vegetation, removal of roadside obstacles)
- Installation of road lighting

Data sources

- **Crash data**

  National Road Accident Database of ELSTAT (2013 – 2017), maintained by NTUA

- **Traffic data**

  Local traffic counts in Imathia and Viotia, combined with AADT estimations from the National Traffic Model for Greece, by the Ministry of Infrastructure & Transport

- **Road geometry and existing equipment**

  RSIS of Egnatia Odos S.A., complemented by data collected during site inspections

- **Suggested interventions**

  RSIS of Egnatia Odos S.A.

Pilot site inspections

- 103 sites inspected (out of 255)
  61 in Viotia and 42 in Imathia: representative of all site categories
- General findings:
  - Selection of hazardous sites is appropriate.
  - Suggested road safety interventions are generally appropriate. Minor updates required.
  - Suggested measures are indeed road safety improvements, with only very few exceptions of maintenance activities.
- Specific findings:
  - 27 of 126 schemes in Imathia inside built-up areas, in contrast to project guidelines. These were excluded from the analysis.
  - New asphalt course already constructed in 9 sites
  - Minor improvements required in suggested signage and road restraint systems in a few sites.

Accident Prediction Models (APM)

- Based on the HSM predictive method (AASHTO, 2010), calibrated for Viotia and Imathia sites using local crash data.

- Separate APMs for roadway segments:

$$N_{spf} = (AADT) \times (L) \times (365) \times (10^{-6}) \times e^{(-0,312)}$$

and intersections:

Three-leg intersections with minor-road stop control:

$$N_{spf} = exp\,[-9,86 + 0,79 \times ln(AADT_{maj}) + 0,49 \times ln(AADT_{min})]$$

Four-leg intersections with minor-road stop control:

$$N_{spf} = exp\,[-8,56 + 0,60 \times ln(AADT_{maj}) + 0,61 \times ln(AADT_{min})]$$

- Crash Modification Factors (CMFs) used to account for differences between the base conditions of the model and local conditions of each examined site.

Safety performance function (full APM)

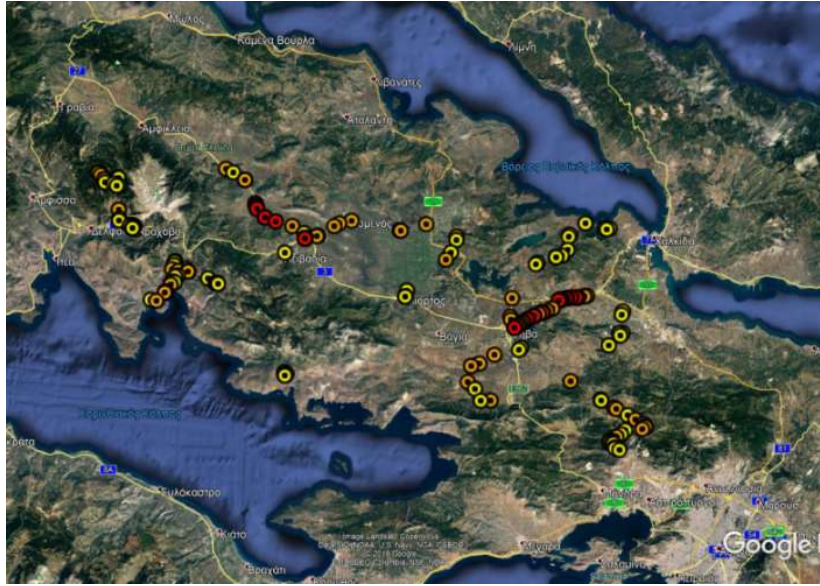
SPF (base APM) x CMFs x C

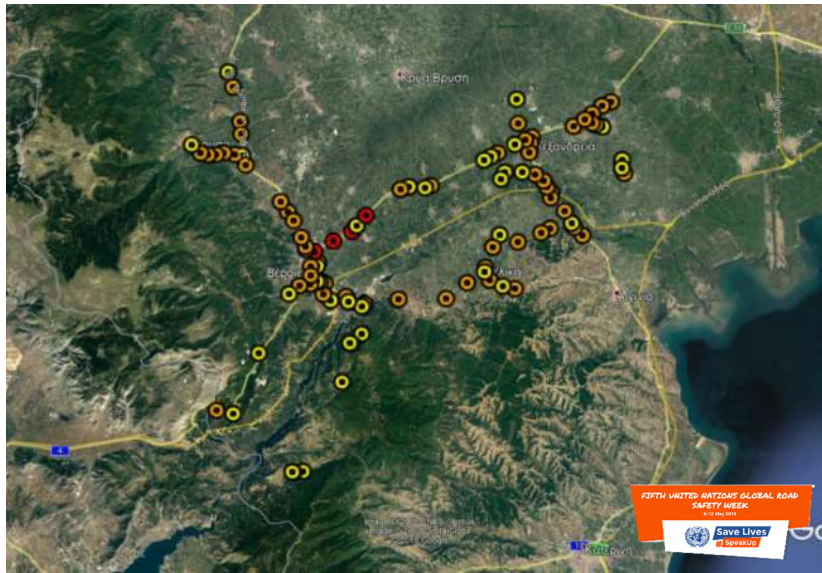
Accident Prediction Models

- Step 1
  APMs applied to predict accidents for each hazardous location for base year.
- Step 2
  Prediction results compared to actual police recorded accidents for model calibration
- Step 3
  Calibrated APMs used to estimate the number of accidents without the project ("Business-As-Usual" scenario).
- Step 4
  Calibrated APMs used to estimate the number of accidents with the project.
- Step 5
  The difference between step 4 and step 3 number of accidents represents the road safety benefit of the examined interventions.

Results

- Approximately 40% reduction in injury accidents
- Casualty reductions, from 2017 to 2035 in Viotia and Imathia (as a total) – depending on scenario:
  - approximately 21 fatalities
  - approximately 25 serious injuries
  - approximately 139 slight injuries
- Economic Rate of Return (ERR) – depending on scenario:
  - Viotia: 20% to 27%
  - Imathia: 13% to 19%
  - Whole Project (preliminary estimation): 12% to 19%



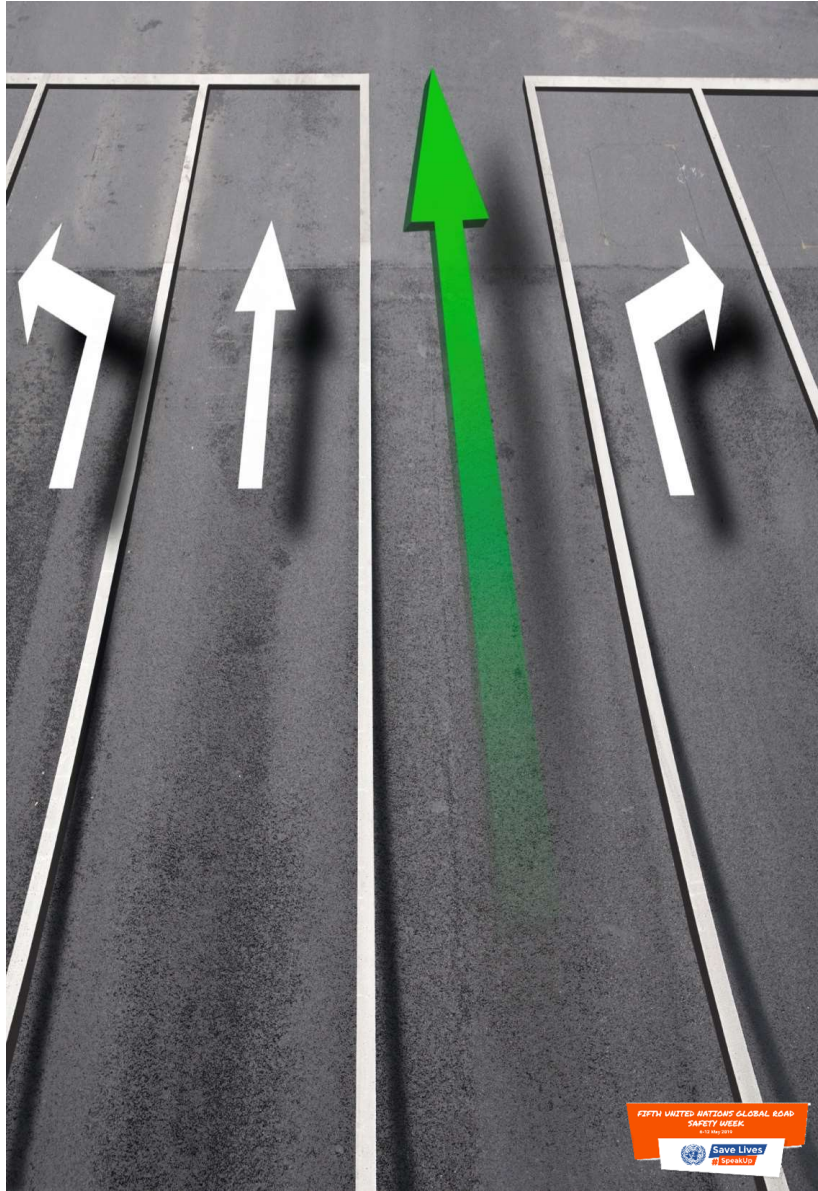


Scientific and Social Impact

- The methodology can be effectively utilized for the economic evaluation of road safety schemes even with limited data availability.
- It has been demonstrated that road infrastructure safety projects exhibit very high ERR, due to the low construction costs combined with the high valuation of road safety benefits (2,15M€ per fatality).
- Therefore, targeted low cost safety interventions in hazardous locations are a particularly cost effective measure for road safety improvement.

Future Challenges

- Road Authorities and Operators should be encouraged to use APMs as a decision making tool, to quantitatively justify road safety funds.
- The availability of high quality data (crash, traffic & road infrastructure) can further improve the reliability and accuracy of economic assessment tools.
- Effective identification of hazardous locations and selection of appropriate treatments requires a combination of quantitative tools and solid engineering judgment.



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