An overview on the effect of weather and traffic conditions on road safety

George Yannis, Professor, Akis Theofilatos, PhD Candidate
National Technical University of Athens
www.nrso.ntua.gr/geyannis
Introduction

• Road safety is a complex scientific field with high need for multi-parameter, multi-level and multi-disciplinary analysis.

• Very often we look where the data are and not where the problem is.

• Traffic and weather parameters play a major role on road safety, however their combined effect has not been examined properly so far.

• The objective of this presentation is to provide an overview on the effect of weather and traffic conditions on road safety and identify future challenges.
• Dominance of a **macroscopic** approach especially in early studies.

• The majority of studies have considered the effect on AADT (Annual Average **Daily Traffic**).

• **Speed** is explored mainly at macroscopic level.

• Less attention is devoted to the other traffic parameters such as traffic **density** and occupancy.

• **Short-term variations** in traffic parameters are rarely explored.
Traffic parameters (2)

- Quite a few **contradictory** findings exist.

- A number of studies indicate a **positive** linear relationship between flow and accident absolute figures.

- A **U-shaped** curve seems to describe the relationship between flow and accident rates.

- Increase in **speed limits** has been found to mostly have a straightforward increase in the number of accidents.

- Traffic **congestion** was estimated by using proxies and led to inconsistent effects on safety.
The effect of weather conditions

- Much research has been conducted.

- The most commonly considered parameter is precipitation (rainfall, rainfall intensity, snowfall).

- The lagged-effect of precipitation is also examined (time passed since last precipitation).

- Other weather parameters such as low visibility, temperature, wind etc. have not received so much attention.

- Data are usually aggregated daily, monthly or even annually.
The effect of precipitation (1)

- The **type of aggregation** is very important as it may lead to different effects of precipitation on road accidents (Eisenberg, 2004):

  - Increased *monthly* precipitation is associated with reduced fatal traffic crashes.
  - *Daily* data indicate a positive linear relationship

- Generally, a **positive linear relationship** between rainfall and accidents exists.

- Research results on the precipitation impact on accident **severity** are not converging.
• Other important findings from literature suggest that:

  ✓ Risk rises rapidly when the time since last precipitation increases (lagged-effect).

  ✓ “Drivers are able to compensate for wet road conditions, but that reduced visibility during rainfall results in increased travel risk.” (Andrey & Yagar, 1993, p. 468).

  ✓ Studies in Mediterranean countries showed a negative relationship between adverse weather and accidents (Karlaftis and Yannis, 2010, etc.)
The effect of snow

- Some studies indicate that snowfall has a negative relationship with accidents (Fridstrøm et al., 1995).

- On the other hand, Andreescu and Frost (1998), found that the number of accidents increased dramatically with increased snowfalls.

- Eisenberg and Warner (2005), stated that snowy weather resulted in less fatal crashes than non-fatal and property damage crashes.

- In the same study, it is also stated that there were more fatalities in the first snowy day of the year than other snowy days.
The effect of fog, wind and temperature

- Al-Ghamdi (2007), found that fog-related crashes have remarkably higher injury and fatality rates.

- Very few studies have examined the effect of wind. They mostly found no correlation, except for Baker and Reynolds (1992) who found an increase in overturning accidents involving high trucks.

- Contradictory results concerning the effect of air temperature and need further research.
Exploitation of microscopic (real-time) data

- There is need for an aggregation level under the daily level both for traffic and weather data (Eisenberg, 2004)

- Weather and traffic parameters need to be explored quantitatively prior to an accident that has occurred.

- Today, short term disaggregate data (e.g. five minutes before the accident) are becoming more and more available, mainly on motorways.

- Microscopic traffic and weather data enable the exploration of the combined effect of weather and traffic parameters measured quantitatively prior to an accident.
Concluding remarks

- Traffic characteristics were found to have **mixed effects** on safety.

- **Precipitation** is the most commonly considered weather parameter. It generally increases accident frequency but its effect on severity is not clear.

- The effect of the other weather parameters needs further research and consideration.

- Application of **short-term traffic and weather data** can produce more straightforward results, allowing for the identification of their combined effect on traffic accidents.
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