Striving for Safer Infrastructure for all Road Users in the Danube Area

How to perform network-wide road safety assessments: reactive and proactive approaches

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Presentation Outline

1. Methods to assess road safety (5)
   I. Reactive
   II. Proactive

2. Network-wide road safety assessment: concept and challenges (1)

3. Combination of reactive and proactive safety assessment for the network-level (2)
Methods to Assess Road Safety

- **Crash occurrence:** Identification of high-risk sections across a network based on the analysis of crash records – *reactive approach*

- **“In-built” safety assessment:** Consideration of roadway design characteristics to assess road safety – *proactive approach*

- **Network-wide safety assessment:** Consideration of the in-built safety of an entire road network – *large scale proactive approach*
Methods to Assess Road Safety
Crash occurrence

- **Macroscopic** (variables recorded by the police) or **microscopic** (variables collected by hospitals, insurance companies, etc.) crash data is analyzed to identify high-risk locations.

- Depending on other data sources (e.g., traffic volume, crash severity levels) various safety performance metrics may be chosen, such as: crash density, crash rates, crash costs, potential for crash reduction, etc.

- Crash data needs to be of good quality, reliable, and accurate, otherwise the analysis may be **falsie** or **inconclusive**.
Shortcomings of the reactive approach

- Crashes may not be the best proxy to assess road infrastructure safety; local human factors, behaviour, enforcement, vehicle fleet characteristics, etc., play a role in the overall safety of the road.

- Not applicable when the number of crashes is small or when the crash data is erroneous/incomplete (e.g., mistaken crash location or injury severity level).

- Not applicable for new roads.

- Major road network improvements generally not examined.
Methods to Assess Road Safety In-built safety assessment

Various proactive methodologies have been developed internationally:

- Road Safety Audits (RSA) or Road Inspections (RSI)
- Models that predict the expected average crash frequency at the examined locations, as a function of traffic volume and road infrastructure characteristics (e.g., number of lanes):
  - AASHTO Highway Safety Manual Safety Performance Functions and Crash Modification Factors
  - PRACT models
  - Stand-alone multivariate crash prediction models
- iRAP Star Rating Protocol (used worldwide)
- Methodologies that related a set of parameters to a risk rating system (e.g., National Swedish methodology)
Need for Network-wide Safety Assessment

- While detailed proactive approaches (RSIs, crash prediction models) are the most effective ways to identify hazardous locations and improve road safety, they are time- and resource-consuming, this is why they are applied to small sections or parts of a network.

- Network-wide safety assessment evaluate the broader road network and can identify in a less costly way, (large) sections of the network that are in urgent need of improvement.

- This way, road safety-related resources are allocated more effectively.
Developing a Network-wide Safety Assessment methodology – Challenges

- Identification of appropriate road characteristics, i.e., a set of parameters, that affect network-level safety, for example:
  - barrier presence and safe roadside are important
  - the presence of an uncovered barrier end does not affect network-level safety, although it’s important for the specific site

- Identification of a scientifically sound relationship between the set of parameters and safety outcomes

- Achieve a balance between accuracy and level of detail, without being overly data-intensive and costly to use.
Need for Network-level Safety Assessment: Pro- or Re-active?

A general rule is that proactive approaches help saving lives as actions are taken in advance of crashes.

- **Proactive approaches** that consider the geometric, operational, and traffic characteristics are applicable for:
  - New roads
  - Roads where no sufficient and/or reliable/accurate crash data are available

- **Combination** of proactive and reactive approaches: Expansion of the network-level safety assessment framework to focus on locations with high crash concentration.
Combined reactive and proactive assessment framework

1. Reactive Assessment
   Identification of high-risk sites based on crash occurrence

2. Proactive Assessment
   Network-wide, "in-built" safety assessment, related to road infrastructure problems

   Road Safety Inspection
   Problem identification in identified high-risk sites

   Periodic road safety inspection
   Maintenance-related

3. Intervention selection

4. Interventions / Risk assessment

➢ In case of conflicting results, which approach should be prioritized?
➢ Authorities tend to rely on crashes to justify road safety fund allocation (more socially and politically acceptable).
➢ Proactive approach should be preferred when reactive analysis results are not statistically significant or are unreliable.
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