Measures to Improve Road Infrastructure Safety

Klaus Machata, KFV – Austrian Road Safety Board

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>90% of crashes: human behaviour as causal factor - anything to worry for infrastructure providers?
Fatal single vehicle collision on a straight road section

2018, motorway, straight section, noon, prefect weather conditions, speed limit 100 kph, single vehicle crash, family, father (driver) killed, crash cause unknown …
Why bother? Trees do not jump on roads.
... and people do not jump off balconies.
The 4 principles of a 'Safe System'

1. Humans make mistakes*, crashes will always occur
2. Humans are fragile
3. **Shared responsibility** to prevent crashes resulting in **serious injury or death**
   - users
   - infrastructure & vehicle design, construction, maintenance
   - post crash care
4. **All parts of the system must be strengthened;** if one part fails, road users are still protected.

* Safe System expects people to act responsibly and to comply with safety-related traffic rules

Source: ITF
### Change of paradigm: Crash prevention → Injury prevention

**Traditional**

<table>
<thead>
<tr>
<th>What is the problem?</th>
<th>Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>What causes the problem?</td>
<td>Human factors</td>
</tr>
<tr>
<td>Responsibility?</td>
<td>Individual road users</td>
</tr>
<tr>
<td>Demand for road safety?</td>
<td>People don’t want safety</td>
</tr>
<tr>
<td>What is the appropriate goal?</td>
<td>“Optimum” number of fatalities and serious</td>
</tr>
</tbody>
</table>

**Safe System**

<table>
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<tr>
<th>What is the problem?</th>
<th>Fatalities and severe injuries</th>
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<tr>
<td>What causes the problem?</td>
<td>Humans make mistakes Humans are fragile</td>
</tr>
<tr>
<td>Responsibility?</td>
<td>Road users + system designers + …</td>
</tr>
<tr>
<td>Demand for road safety?</td>
<td>People do want safety</td>
</tr>
<tr>
<td>What is the appropriate goal?</td>
<td>Eliminate fatalities and serious injuries</td>
</tr>
</tbody>
</table>

**Think safe roads, not safer roads!**

Source: Matts-Ake Belin, Trafikverket (modified)
Road design of the past – any problem?
What does Safe System imply for infrastructure design & maintenance?

- **Forgivingness** of the road environment
- **Predictability** of road course (self-explaining, self-enforcing > adequate speed level): consistency and continuity of design
- **Homogeneity** of mass, speed and direction
- **Functionality** of roads: hierarchically structured road network

Source: SWOV, Sustainable Safety (NL, 2008)
Safe System in practice

Rural roads
Safe System in practice: Sweden (2+1)

Up to 80% less fatalities, FSI-rate for 2+1 roads is about the same as for motorways (excluding junctions) Anna Vadeby (VTI)

Source: Machata
Safe System in practice: Sweden (1+1)
Safe System in practice: Poland (1+1)

Source: Machata
Safe System in practice: Estonia (1+1)
Safe System in practice: Finland (2+2)

Source: Machata
Safe System in practice: The Netherlands

60 kph rural access road

1998-2002: +12,500 km

Source: SWOV
Safe System in practice: The Netherlands
80 kph rural distributor road

Source: SWOV
Safe System in practice: The Netherlands
100 kph rural distributor road

Source: SWOV
Safe System and Safe Speeds?

Source: Claes Tingvall, Trafikverket

Source: ETSC PIN Flash 36
Safe System in practice

Urban roads
Shares of vulnerable road user victims increasing!

Source: STATISTIK AUSTRIA, KFV
Design of urban road space

**Speed:** whatever ...

**Parking:** wherever ...

Design elements subdivide road space and *organise* traffic

The visual appearance of a road influences on the behaviour of road users!

Source: KFV
Urban thoroughfares should be designed for all users – not only for cars!

Urban
Longitudinal traffic is only one of several use types

Rural
Mostly longitudinal traffic

Source: KFV
Treatment of urban thoroughfares in practice

- Reduction of number of lanes
- Implementation of pedestrian crossings, central islands, road furniture…

Source: KFV
Approach to urban area

High-trunked trees, low bushes

“door effect”

Source: KFV
Approach to urban areas in practice

Source: KFV
Roundabouts: Thoroughfares and residential areas

Potential safety issues for bicyclists!
Roundabouts in practice
Crossing aids for pedestrians (1)

- Better visibility
- Better accessibility

Source: KFV
Crossing aids for pedestrians (2)

- Refuge islands
- Where possible: illumination

Source: KFV
Horizontal alignment

**Before:** curb-side parking both sides

**After:** angle parking on alternating sides

Source: KFV
Horizontal alignment measures in practice

Avoid straight lines ...

Source: KFV
30km/h sections & zones

- Make sure that 30km/h is a credible speed limit …
Change often requires a long a political process for decades…

Vienna, Encounter Zone Mariahilfer Straße
EU Directive on Infrastructure safety management (recast)

- TERN + “primary roads” + EU funded roads; Vision = application on all roads!

Network-wide Road Assessment
(proactive (“built-in” safety))

- Road Safety Impact Assessment
- Road Safety Audits
- Road Safety Inspections
- High Risk Site Management
- Safety Ranking and Management...
New infrastructure indicator in the Netherlands

Proactive safety work on provincial 80 kph roads using indicator ProMeV Light (in addition to reactive high-risk sites treatments):

1. Frequency of access roads to private property, fields, enterprises, …

2. Type of median, road markings or other separation of driving directions

3. Distance between obstacles (trees, ditches) and the edge of the road

+ AADT for prioritisation!

First results: need for action on 15% of the provincial road network

Source: SWOV, EIRA
Best Practice collections & guidelines

- SafetyCube: European Road Safety Decision Support System
  https://www.roadsafety-dss.eu

- ETSC PIN Publications
  https://etsc.eu/projects/pin/

- Several WHO Guidelines for VRU Safety
  http://www.who.int/roadsafety/publications/en/
  - Pedestrian Safety
  - Helmets
  - Speed Management
  - Data Systems

- PIARC Road Safety Guidelines
Thank you!

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