Road safety in the Netherlands: Safety vision, developments, testing safety levels of existing roads

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senior researcher
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• Background
• Overview of Safety vision: Sustainable Safety
• Policy developments
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• Implementation and other developments
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Background

- Inhabitants: 16.5 million
- Surface: 33,883 km²
- Total road network length: 135,000 km
- 7.0 million cars
- 16 million bicycles
- 0.5 million mopeds
Road fatalities

Our safety performance over the years...

International top position
Sustainable safety vision

The human is the measure of things (i.e. are physically vulnerable, make mistakes etc.) and prevention instead of cure
Advancing Sustainable Safety

www.sustainablesafety.nl
Aims of Advancing Sustainable Safety

1. Elimination of (serious) crash conditions
2. Severity reduction, if a crash cannot be prevented
Integration in a systematic way of:

- **Infrastructure**
  - Tuned to road users' capabilities and limitations

- **Vehicle**
  - Simplify driving task
  - Provide protection

- **Road User**
  - Well instructed and informed
  - Controlled where necessary
Characteristics of sustainable safety

- a road environment with an infrastructure adapted to the limitations of the road user
- vehicles equipped with technology to simplify the driving task and provided with the features that protect vulnerable and other users; and
- road users that are well informed and adequately educated
# Sustainable Safety in a nutshell

## Sustainable safety principles

- **Functionality** of roads
- **Homogeneity** of masses and/or speed and direction
- **Predictability** of road course and road user behaviour by a recognisable road design
- **Forgivingness** of the environment and of road users
- **State awareness** by the road user
Basis: **FUNCTIONALITY**

- Functional categorization of roads:
  - Flow function
  - Access function
- Ideally, roads only have one of these functions (monofunctionality)
Functional road categorization

- Through roads
  - Traffic should flow

- Distributor roads
  - Flow function on road sections
  - Exchange of traffic at intersections

- Access roads
  - Residence and exchange of traffic is central
The road network, classification
Road classification

Flow function

Distributor function

Access function
The road network (1)

Category 1: roads with through function for rapid movement of through traffic
The road network (2)

Category 2: distributor roads for the distribution and collection of traffic between different districts and residential areas
The road network (3)

Category 3: roads with an access function providing access to property whilst ensuring the safety of the street as a meeting place: within zone 30 and zone 60
Casualty risk on various road types

### Risks of casualties on various types of road

<table>
<thead>
<tr>
<th>Type of Road</th>
<th>Within Built-up Areas</th>
<th>Outside Built-up Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resd. access street</td>
<td>0.15</td>
<td>0.51</td>
</tr>
<tr>
<td>Collector</td>
<td>0.73</td>
<td>0.25</td>
</tr>
<tr>
<td>Arterial</td>
<td>1.27</td>
<td>0.08</td>
</tr>
<tr>
<td>Rural road</td>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td>Rural arterial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTCT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freeway</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Max. Speed km/h    | 30 | 50 | 50/70 | 80 | 80 | 100 | 100/120 |

* ctct = Closed To Certain Traffic
National Transport Policy

- Mobility as prerequisite for economic growth
  - 1960-2000 mobility up tenfold
  - 2000-2020 further 40% increase
- Policy aimed at maintaining congestion levels, reliable and predictable travel times
- Policy leans on two pillars
  - more efficient utilisation
  - building new roads
- New road safety strategy
- New planning procedures
Utilisation of existing road space

• Short term focus aimed improving reliability, average speed and safety
• Optimising the available road capacity (peak hour lanes, extending weaving sections, entry/exit lanes etc)
• Improving traffic management (average speed management, signal co-ordination underlying network etc)
• Spreading demand
• Area wide traffic management (especially around unique events)
Road safety strategy
(Strategic plan 2008-2020)

• Three cornerstones (collaboration; integrated approach and sustainable safety)
• Focus areas
  – Pedestrians and cyclists
  – Single vehicle accidents
  – Children and the elderly
  – Novice drivers
  – Moped/scooter/motorcyclists
  – Driving under influence
  – Speeding
  – 50 km- en 80 km/h roads
  – Freight transport
New guidelines
Marking system for recognisability
Turbo roundabouts

- Dubbele toe- en afritten bieden hoge capaciteit
- Lage snelheden door kleine diameter
- Geen snijconflicten door spiraalbelijning
- Op de rotonde maximaal twee rijstroken die doorlopen

Overrijdbaar verhoogde rijstrookscheiding voorkomt bochtafsnijden met hoge snelheid
2+1 roads

- Low design compliance rural distributors, high traffic volumes and poor safety
- Potential for full upgrade to dual carriageway, budget limitations and phased solution preferred, i.e. 2+1
- CROW WG and guideline developed (based on German and Swedish principles)
- 2+1 similar capacity but higher comfort
Other guidelines

• Road Safety Manual
  – Understanding safety (theory, trends etc); making traffic safer (spatial planning; infrastructure, vehicle safety etc) and dangerous behaviour (incl. remedial measures)

• Road categorisation (revised version)
  – Separate publications for urban and rural roads
  – Case studies to help road authority address problems related to multifunctional use, space constraints etc
  – Setting of speed limits
Implementation of infrastructure related measures

- Categorisation plans (90%)
- 70% urban road 30km/h, 70% with speed reduction measures
- Nearly 60% rural road 60km/h, 45% with some form of measures
- Most intersections and urban distributors have assigned control.
- Many urban distributors still have dual function (access/traffic, grey road problem)
- 40% of rural network with marking system
- Roundabouts increased from 1442 to 3451 (1998-2005)
- Peak hour lanes extensively implemented (42 by 2011)
Other developments

• European directive on road safety management
  – Compulsory since 2011
  – Mandatory RSIA, RSA, RSI and NSM
  – 600 fatalities and 7000 serious injury saved annually in EU

• Quality assurance
  – Compromises (especially affecting safety) need to be visible
  – provides integrated procedures for planning, design and operation of road infrastructure
  – RWS has taken lead (code of practice, Road safety Management system, EU directive)
Conclusions

- Sustainable safety is a way of life and has been widely implemented with great and continuing success.
- Redesign of urban and rural roads, traffic calming, intersection control, especially roundabouts have resulted in significant reductions in traffic fatalities.
- Congestion increasing and building no longer only viable option, optimal utilisation is the new motto.
- New challenges to provide similar or better road safety levels, quality assurance increasingly important.
Testing safety levels
### Indicators for the 3 principles per road category

<table>
<thead>
<tr>
<th>Road sections</th>
<th>Intersections</th>
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<tbody>
<tr>
<td>1. Speed limit (H&amp;P)</td>
<td>1. Intersection type (H&amp;P&amp;F)</td>
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<tr>
<td>2. Median/physical separation (H&amp;F)</td>
<td>2. Type of priority (H&amp;P)</td>
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<td>3. Alignment marking (P)</td>
<td>3. Traffic lights (H&amp;P)</td>
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<tr>
<td>4. Obstacle-free zone / barrier (P&amp;F)</td>
<td>4. Speed reduction (H&amp;P)</td>
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<td>5. Accesses (H&amp;P)</td>
<td>5. Signposting (P)</td>
</tr>
<tr>
<td>6. Emergency lanes (P&amp;F)</td>
<td>(Simplified version of 20 indicators)</td>
</tr>
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<td>7. Breaking down lots (H&amp;P)</td>
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<td>8. Parking lots (H&amp;P)</td>
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<td>9. Bus and/or tram stops (H&amp;P)</td>
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<td>12. Mopeds (H&amp;P)</td>
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<td>13. other ‘Slow traffic’ (H&amp;P)</td>
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**Homogeneity (H) & Predictability (P) & Forgivingness (F)**
Sustainable Safe Test

Road characteristics

Indicators

Principles:
- Functionality
- Homogeneity
- Forgivingness
- Predictability

Requirements

Score = xx%

Sustainable Safe

October 2013
# Road Protection Score (RPS)

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**Homogeneity (H) & Predictability (P) & Forgivingness (F)**

**Road sections**
- Speed limit (H&F)
- Median/physical separation (H&F)
- Alignment marking (P)
- Obstacle-free zone / barrier (F)
- Accesses (H)
- Emergency lanes (P&F)
- Breaking down lots (H&P)
- Parking lots (H&P)
- Bus and/or tram stops (H&P)
- Road surface (P)
- Bicycles (H&P)
- Mopeds (H&P)
- other ‘Slow traffic’ (H&P)
- Speed reduction (H&P)
- Signposting (P)

**Intersections**
- Intersection type (H&P&F)
- Type of priority (H&P)
- Traffic lights (H&P)
- Speed reduction (H&P)
- Signposting (P)
Road Protection Score (RPS)

Road characteristics

Indicators

Principles:
- Functionality
- Homogeneity
- Forgivingness
- Predictability

Requirements

score = 1-4 RPS stars
RPS pilot (2005) in the Dutch province of Zuid-Holland
Road category: Access road (60 km/h)

N468 Province Zuid-Holland

Score = 50% Sustainable Safe
• no speed reduction
• wrong alignment marking
• obstacles

RPS = 3 stars
• rigid obstacles at < 3 meter (waterway)
Road category: Access road (60 km/h)

- No speed reduction
- No roadside marking
- Single axis marking
- Speed limit: 60 km/h
- Accesses
- No obstacle-free zone
- Black asphalt pavement

N468 Province Zuid-Holland
RPS pilot (2007) in the Dutch province of Utrecht
Road category: Distributor (80 km/h)

Score = 70% Sustainable Safe
- no physical separator
- obstacle-free zone
- wrong alignment marking

RPS = 2 stars
- no physical separator
- rigid obstacle at < 3 meter (waterway)
Road category: Distributor (80 km/h)

- Cycle track
- No emergency lanes or bus stops
- No accesses
- Single axis marking
- Speed limit: 80 km/h
- Black asphalt pavement
- Roadside marking
- Obstacle-free zone < 3 m

N204 Province Utrecht

October 2013
Road category: Distributor (80 km/h)
Improved design
Road category: Distributor (80 km/h)

Score = 90% Sustainable Safe
• no physical separator
• alignment marking
• obstacle-free zone

N210 Province Utrecht

RPS = 3 stars
• no physical separator
• rigid obstacle at < 3 meter (waterway)
Intersection between Distributors (80 km/h)

N204-N210 Province Utrecht
Intersection between Distributors (80 km/h)

- **RPS**: 4 stars
- **Intersection type**: Low speed roundabout

- **Score**: 100% Sustainable Safe
- **Intersection type**: Roundabout, bicycle crossing without priority
Comparison between: Safety Tests

<table>
<thead>
<tr>
<th>Principles</th>
<th>Sustainable Safety Test</th>
<th>RPS (EuroRAP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functionality</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Homogeneity</td>
<td>✓ ✓</td>
<td>✓ (no VRU!)</td>
</tr>
<tr>
<td>Forgivingness</td>
<td>✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>Predictability</td>
<td>✓</td>
<td>X</td>
</tr>
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