
Video-based accidents, conflicts, and road user behaviour: a step forward in traffic safety research
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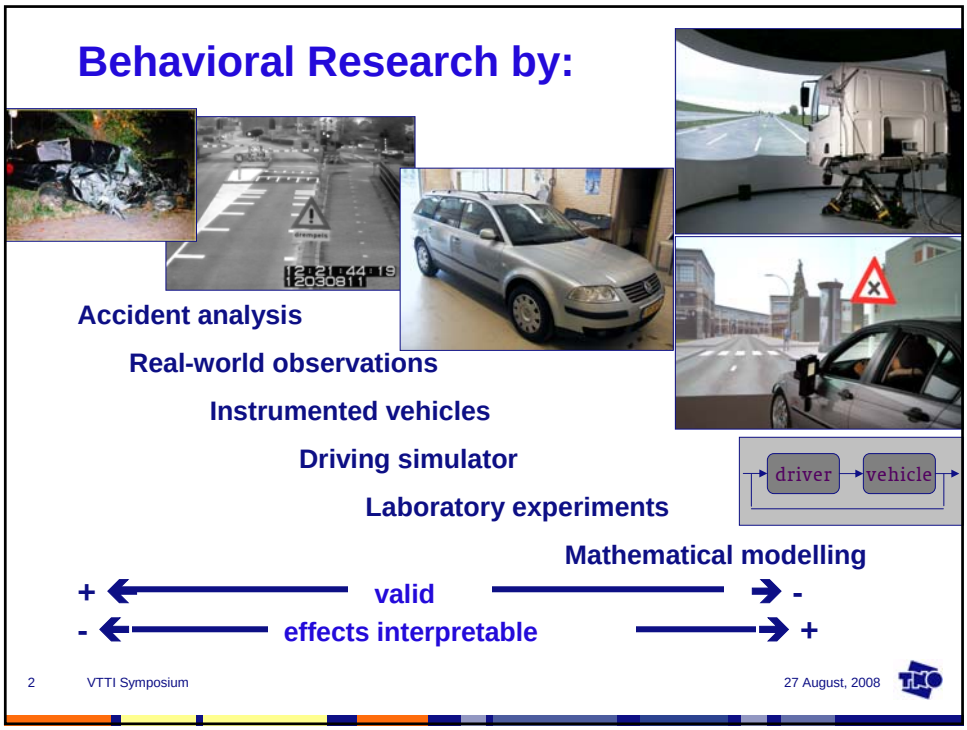
TNO | Knowledge for business
VTTI Symposium

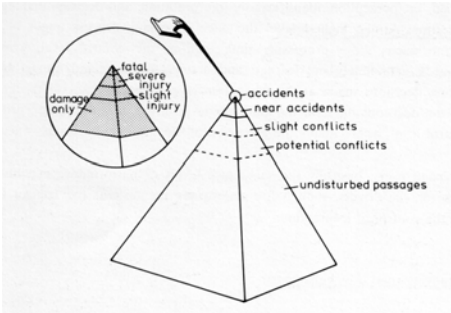

Behavioral Research by:
Accident analysis
Real-world observations
Instrumented vehicles
Driving simulator
Laboratory experiments
Mathematical modelling
driver
vehicle
+ valid -
- effects interpretable +
2 VTTI Symposium 27 August, 2008

Introduction
Traffic Safety Assessment

- Traffic Accidents
  - limited reflection of traffic (un)safety
- Police reports
  - limited sample of all accidents
  - limited for behavioral research purposes ?
  - Subjective interviews?
- Accident Analyses
  - many methods
  - validated?

- Traffic Safety Assessment
  - Do the thing right
  - Do the right thing

Introduction (2)
Traffic Safety Assessment



Project Outline (1)
The elements

TNO Automotive

- **In-depth studies**
- **Relational databases**

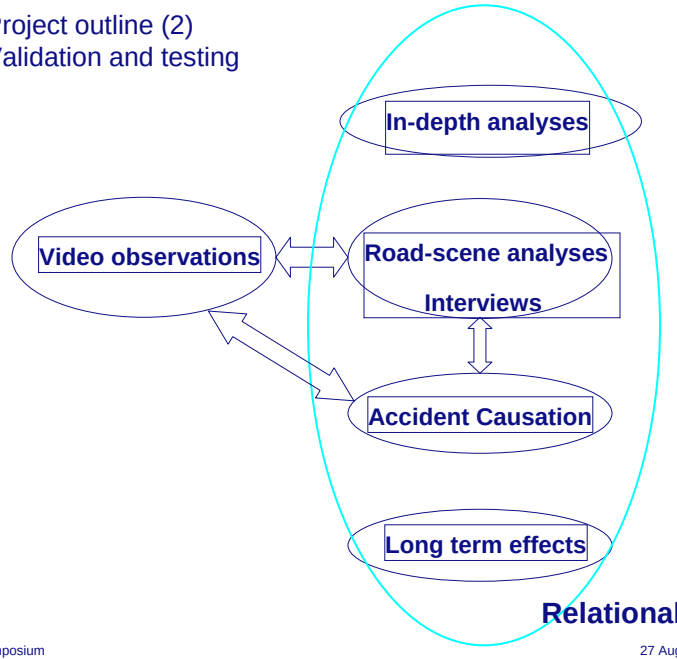
TNO Prevention & Health

- **Monitoring of injured**
- **relation between causation and long term effects** (quality of life, re-integration, participation in society)
- **Measure to determine limitations**

TNO Human Factors

- **Video observations (behavior, conflicts, accidents)**
- **Road-scene analyses**
- **Interviews**

Project outline (2)
Validation and testing



Long-term video observations

- Observation of 4 blackspots in 2-yr period
  - Pijnacker (T-junction) + Delft (3 signalized intersections)
- Rough data: 8 years of video material
- Selection: Collisions (# police-reported?) *whole period*
  Incidents *when observed*
  Conflicts (analyses ala 'DOCTOR' method) *one day*
- Methodology to determine driver behavior in the pre-crash phase
- Insight in the chain of elements of human behavior that either is resulting in, or avoiding an accident

Traffic observations

T-junction - Pijnacker

Video recordings

- At each location 1 or 2 CCD cameras
- PC + 3 hard discs (750 Gb) (> 2 weeks, 2 cameras)
- Separate jpeg pictures in a time-directory structure (date, hour, min, 60x 12.5 fields)
- Motion detection on the spot + specific areas excluded)

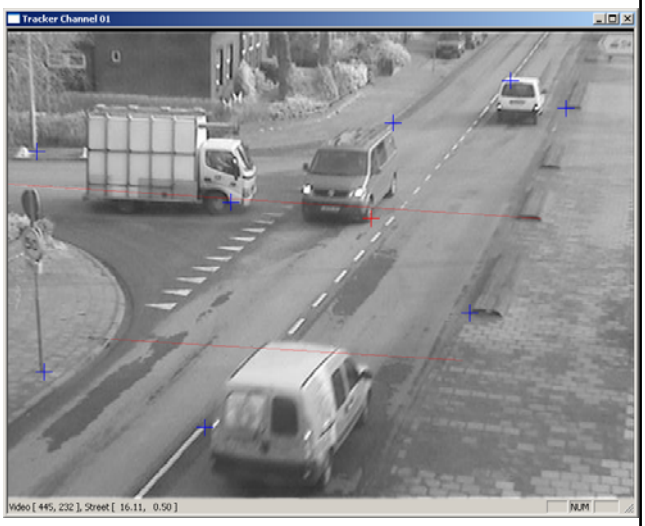
Video analysis

- Manual selection of collisions by specially developed fast Windows viewer (at high speed still good interpretable images)
- Windows application for quantitative analysis (semi-automatic), (basically the same as 26 years ago) of collisions and conflicts (speed, distance, TTC, PET, etc.)
- Still urgent need for automated procedure!!

Pijnacker P1 T-junction

4 collisions
1 rear-end C-C
1 right-angle C-C
1 'right-angle' C-B (injury)
1 single-bicyclist B

- Left turn from minor road
- Crossing bicyclists
- Interaction



Delft D1

7 collisions
- 4 left-turn –opposing
  - C-C minor road
- 2 rear end C-C
- 1 right-angle C- Moped

- Left turn from minor roads
- Left turn from below into wrong carriageway

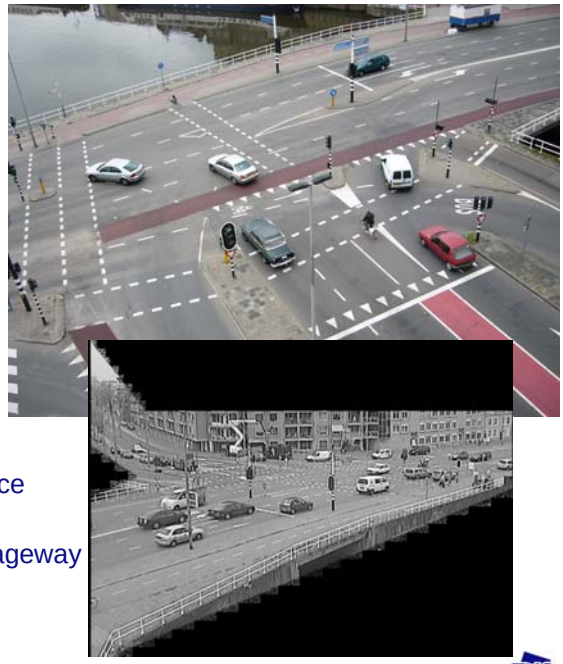
Delft D2

1 collision
- 1 single-vehicle C

- Frequently U-turns -> conflicts (C-B-P-tram)
- Difficult path choice

(straight-on -> right turn)
Left turn -> wrong carriageway
-> Tram/bus lane

Delft D3



4 collisions
- 2 rear-end C-C
- 1 single-vehicle C
- 1 single-scootmobiel

- Conflicts BU-B/P
- Many Bs own path-choice
- C straight-on -> left-turn
- Left-turn -> wrong carriageway

Delft D1 Left-turn opposing minor road

Pijnacker T-junction rear-end + conflict C-C

Pijnacker Right-angle C-C

Pijnacker Car-Bicycle collision

Analysis

- VIDARTS (VIDeo-based Analysis of Road Traffic Scenes)
- collisions and conflicts

Transformation from video to street
Semi-automatic procedure
-> V, DIST, TTC, TTCmin, PET, etc.

- DOCTOR (Dutch Objective Conflict Technique for Operation and Research)

Overall severity (scale 1-5)
- probability of collision (TTC or PET)
- extent of consequences if collision had occurred

Conclusions (1)

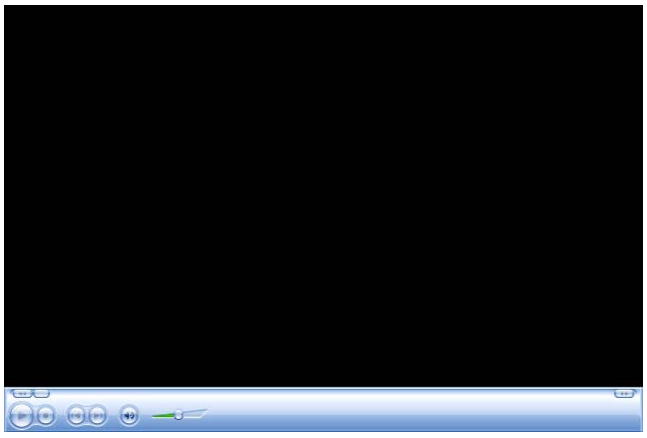
- Traffic conflicts and analysing deviant behaviour together with road scene analyses give good insight in potential traffic safety problems at intersections. Good resemblance with results analysis of collisions from video.
- Remarkably, frequently, another road user (in)directly involved in pre-crash process
- Observing and scoring conflicts according to DOCTOR method from video feasible
- Time-related measures such as TTC and PET promising surrogate safety measures for predicting accident risks by microscopic traffic simulation models (EU proposal SIMPAC)

Conclusions (2)

- We do not have to wait for accidents for improving road environment and traffic management
- Systematic observation of behaviour already gives you lots of clues for improving road safety at intersections
- Video observations rich source of information for natural traffic behaviour of road users (interactions mutually or in relation with road environment), in future additional to integral approach? -> Naturalistic driving studies (also on-site)

Example C-C conflict D1

Example collision D2



Example conflict C-Tram D2

Pijnacker: Example conflict B-C conflict