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**FOT-Net
Field Operational Tests Networking and Implementation**



MINUTES NEAR CRASHES WORKSHOP

Brussels, 30 November 2010

Table of Contents

1. Introduction	3
2. Block 1 – Definition of near crashes	4
3. Block 2 – Measurement and detection of near crashes	5
4. Block 3 – The value of near crashes	6
5. Conclusions	6
6. Annexes	9

1. Introduction

Field Operational Tests and Naturalistic Driving Studies are interested in near crashes or incidents to identify situations that are potentially dangerous and could have led to an actual crash. However, projects struggle with finding a good operational definition of near crashes. If a FOT or ND study wants to analyse what happens when an incident takes place, it needs to know where to look in the huge data stream recorded continuously. In this workshop we will address the question of how we can define near crashes, how we can detect them and what the significance of near crashes is with regard to road safety.

The objectives of this workshop were:

- To share experiences with detecting near crashes
- To work towards a common definition of near crashes, to enhance comparability between projects
- To get a better understanding of the predictive value of near crashes

1.1. *Presentation by Niels Bos, SWOV, DaCoTA*

The DaCoTA project is broader than Naturalistic Driving Studies it is part of the European Road Safety Observatory. DaCoTA's WP6 is dedicated to ND. The previous project was called Safety-Net. DaCoTA is a monitoring project, not focusing only on research.

The study of near crashes is important. Statistics about near crashes give more data than those about fatalities. Therefore more accurate analyses are needed. It is important to understand how near crashes could have become real crashes. DaCoTA has given recommendations for large scale monitoring of near crash data. The future will bring more video analysis, giving the opportunity to analyse backwards video that were recorded earlier.

Are normal driving events necessary or not? Question is: should we record all situations or only triggered situations?

The relation between normal conditions and critical events is known, but the relation between near crashes and critical events is not.

1.2. *Presentation by Trent Victor, SAFER/CHALMERS, SeMiFOT, euroFOT*

SAFER is looking into the severity scale (Crash-Relevant-events). This topic will continue to be further discussed in a WG about Incidents and Event definition of FOT-Net 2. It is important to discuss injury risk and not only crash risk.

2. Block 1 – Definition of near crashes

This session of the workshop focused on:

- What are near crashes, how can they be defined?
- How are near crashes defined in FOT projects and ND studies?

2.1. Presentation by Oliver Carsten, ITS Leeds, FOT-Net

Oliver Carsten reminded of the discussions that took place at FOT-Net Third International Cooperation Workshop in Busan during which a round table was organised on incident and event definition. One of the conclusions was that: Incidents are needed because there are too few accidents to be analysed in FOTs.

Richard van der Horst reinforced this idea: we don't need accidents to improve safety. A lot can be learned only by observing the process rather than only the outcome (in this case crashes).

The distribution of accidents depends a lot on locations. It is important to ignore minor events (e.g. tire hitting the curve). Small events may change in relation with other factors (e.g. belt fastened or not). "Damage only" crashes need to be filtered (e.g. the case of bump in a parking).

Trent Victor stated that some near crashes without damage are more important and interesting than crashes that inflict damage, or even fatality crashes.

Some critical situations may not be recognised or reported. They should however be taken into account for algorithms, like for instance in case of distraction: systems in FOTs should be able to detect those situations.

Severity scale is of important: metrics should be discussed in FOT-Net. Pure time to collision may not work.

The intentions involved in a near crash situation are of importance. We should consider events by categories to study incidents and accidents (e.g. by overtaking). Those categories exist for accident causation, but accident causation data are rather difficult to use. Data coming from actors of an incident are difficult to use, especially if they are reported afterwards.

Walter Hagleitner highlighted that driver comments recording (audio input) is important for ND and FOTs. Crashes are not from an unlimited number of situations, the typology list is relatively short but it has to be linked to risk.

The participants agreed it would be relevant to look at:

- Non-relevant events as systems may decrease one risk and increase another. It would add value to define for the different types of systems, what situation they prevent.
- For automatic analysis, it should be known what share of accidents/incidents are missed.
- Background driving style should be analysed and considered.
- Impact of Environment conditions.

3. Block 2 – Measurement and detection of near crashes

This session focused on:

- What are the different techniques and equipments to measure near crashes? What are their (dis-)advantages, practically and technically?
- What kinds of near crashes can be detected (and how) and which ones go undetected?

Tsippy Lotan stated that some near-crashes are still not detected except if the driver mentions it and recognises it.

Carol Flanagan explained that triggers are important to detect near-crashes. She put forward three classes near-crash operational definition: environment –based, driver-based and device-based.

The audience commented that single vehicle events might not happen based on triggers: you need to use a complementary approach.

Trent Victor then presented the example of categorisation of conflicts and types of events and the different logging systems that SeMiFOT has reviewed. DriveCam for example is a commercial system which has recorded until now 12 millions events and 2 500 severe crashes. Map attributes can contribute to the results with matching of maps and accidents.

He also stressed that video capturing is important. Inner view and external views are both important. Gazes are the difference between a crash and a near crash. Video can help get rid of false alarms for data analysis.

Certain events do not predict crashes. An objective for NDS is to eliminate those bad performing indicators.

Even if the technology is not perfect, and the algorithms are not perfect (i.e. they trigger many false alarms), they will improve.

4. Block 3 – The value of near crashes

This session focused on:

- What is the predictive value of near crashes for actual crashes and road safety?
- What can we learn from more knowledge about near crashes?

There was a discussion on stationary camera: video techniques are still poor at giving reliable speed when the movement is farther than a couple of meters. Combining video and radar can be an approach.

Andrew Morris mentioned that accident data can be used to extrapolate to near-crashes.

Loughborough University presented the classification using genotype (contributing factors) and phenotype (observable effects). This model may be applied for near-crashes with the data coming from driving records.

The answer needs large data set with both near crashes and crashes.

A comparison was made with safety initiatives in airlines/aeronautics, with huge data bases of baseline. This baseline helps to understand near crashes, or near dangerous situations.

The question important is to understand the errors and how they come to make a system that can see it and acts as a co-pilot, indicating the mistakes when they are made.

5. Conclusions

Concerning the **definition of near crashes** it was found that:

- Existing definitions of NC are qualitative; we know qualitatively what a near crash is, for example from studies such as the 100 car study.
- Quantitative metrics are needed. Acknowledged need to distinguish between a qualitative near crash and a quantitative near crash.
- Categorisation is important which is linked to:
 - Situation, crash scenario or system
 - Frequency, severity, injury risk, avoidance success, related combined human errors
- There is a new behaviour-safety relationship to consider.

For an **operational definition of Near Crashes**, the following needs to be considered:

- Combination of Data triggers
- Video confirmation of triggered events
- Link near-crash to given crash scenario needs to be established and the classes of triggers:
 - Environment triggers: TTC, Deceleration

- Behaviour triggers: hard braking, hard steering
- Device triggers: warning algorithm
- Triggers however may need to be fine-tuned:
 - You could opt for no general set of triggers. The tuning is adapted to the scenario
 - You could look at non-near-crashes to tune your triggers.
 - Some triggers seem to mark the difference between crash and near-crash

In terms of **near-crashes detection and observation**, it was stressed the need to:

- Use Radar, CAN, video logging.
- Take into account possible bias due to experiment. Near Crashes observation can only give 50% of the data as other vehicles are not observed.

In what regards the **Data acquisition systems (DAS)**:

- The Study of False events is also relevant.
 - Thousands of events have been recorded by DriveCam (12 000 000 events). 2500 serious crashes were recorded.
 - The JARI study puts forward that the study of pre-crash phase is most informative
- In terms of System categories you can follow: Commercial NDS, Research NDS, FOT, Experimental.
- Market-ready logging systems are available such as DriveRecorder.co.uk.
- Events are not the main source. You need to enrich you data by using Map data, driver ID, questionnaires.
- Video is a must. It allows for:
 - Validation of crash related event
 - Validate scenarios
 - Driver state and gaze direction
 - Discard false alarm

Regarding **predictive value of near-crashes**:

- Relation between speed and TTA is one of the only one validate by accident data.
- Proportion of conflicts vs accidents is constant.
- Combination of sensors is relevant (radar and video).
- Detecting near-crashes is minimum requirement to understanding the near-crashes and getting insides into the safety process.

Participants recommended conducting **Large scale monitoring** but taking into consideration that:

- A higher level of instrumentation is needed. NC detection may be not feasible with simple devices.
- Additional cost for equipping a part of the vehicles with video is lower than with a separate research.
- For analysis of selected events, there will always be an interest.

- Accidents are not needed to improve safety. You can aim to Understand behaviour-safety relations.

Accident database and events:

- Rely on SAFETYNET and DREAM (Driver Reliability and Error Analysis).
- List of contributing factors exist from literature.
- Apply the accident causation theory to the incidents detected in the NDS.
- DREAMi is re-using the events detected in SeMiFOT to find out the links with accident database.

Next steps:

- FOT-Net will support the creation of WG with mission to dig in specific aspects to the FESTA methodology : WG on incident and event definition
- SeMiFOT2 WP1 on development of quantitative definition of crash relevant-event severity
- DaCoTA will issue recommendations and prepare the Implementation plan for a Large Scale ND study after DaCoTA (aim: all 27 EU countries, >20.000 vehicles in total)

6. Annexes

6.1. Annex 1 – Final agenda



Near Crashes FOT-Net, PROLOGUE and DaCoTA Workshop

When? 30 November 2010, 12:30-17:15

Where? ERTICO, Blue Tower, Av. Louise 326, Brussels

For whom? Experts interested and/or involved in Field Operational Tests and Naturalistic Driving Studies

www.fot-net.eu, www.cacota-project.eu, www.prologue-eu.eu/

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Final Agenda

11:30	Lunch (For those who want to join)	
12:30	WELCOME Aims / set-up / working procedures / time slots of the workshop	Chair: Maxime Flament, ERTICO - ITS Europe, FOT-Net
12:40	INTRODUCTION Why this workshop, why info about near crashes rather than actual (the three main questions of the workshop; the problems in finding straight answers to these questions?	Speakers: Niels Bos, SWOV, DaCoTA Trent Victor, SAFER/CHALMERS, SeMiFOT, euroFOT
13:00	BLOCK 1 What are near crashes, how can they be defined? How are near crashes defined in FOT projects and ND studies? A comparison between projects and discussion with panel and participants	Expert/moderator: Oliver Carsten, ITS Leeds, FOT-Net Panel: Josef Kroms, Univ of Chemnitz Richard van der Horst, TNO, PROLOGUE
14:00	Break	
14:20	BLOCK 2 What are the different techniques and equipments to measure near crashes? What are	Moderator: Tsippy Lotan, OR YAROK, PROLOGUE

	<p>their (dis-)advantages, practically and technically? What kinds of near crashes can be detected (and how) and which ones go undetected?</p> <p>A practical and technical presentation and discussion</p>	<p>Experts:</p> <p>Trent Victor, SAFER/CHALMERS, SeMiFOT, euroFOT</p> <p>Carol Flannagan, UMTRI</p> <p>Panel:</p> <p>Steven Reed, Univ of Loughborough, PROLOGUE, TeleFOT and DaCoTA</p>
15:30	Break	
15:50	<p>BLOCK 3</p> <p>What is the predictive value of near crashes for actual crashes and road safety? What can we learn from more knowledge about near crashes? Discussion with panel and participants</p>	<p>Moderator:</p> <p>Samantha Jamson, Univ of Leeds</p> <p>Expert:</p> <p>Aliaksei Laureshyn, Univ of Lund</p> <p>Panel:</p> <p>Andrew Morris, Univ of Loughborough, DaCoTA & PROLOGUE</p> <p>Atze Dijkstra, SWOV, Microsimulation expert</p>
17:00	Wrap-up and conclusions	Maxime Flament, ERTICO - ITS Europe, FOT-Net
17:15	Adjourn	
17:15	Drinks	
18:30		
19:30	Dinner	

6.2. Annex 2 – List of participants



Near Crashes FOT-Net, PROLOGUE and DaCoTA Workshop

When? 30 November 2010, 12:30-17:15

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For whom? Experts interested and/or involved in Field Operational Tests and Naturalistic Driving Studies

www.fot-net.eu, www.dacota-project.eu, www.prologue-eu.eu/

Participants List

Company Name	Last Name	First Name
ADAS_Management Consulting	Hagleitner	Walter
Chalmers University of Technology	Victor	Trent
Chemnitz University of Technology	Krems	Josef
DEKRA e.V.	Deiters	Oliver
DEKRA e.V.	Mazet	Anne-Charlotte
ERTICO - ITS Europe	Flament	Maxime
ERTICO - ITS Europe	Mure	Sébastien
ERTICO - ITS Europe	Silva	Irina
European Commission	Coulon Cantuer	Myriam
Fundación CIDAUT	Vega	María-Henar
Hasselt University	Daniels	Stijn
Institut für Kraftfahrzeuge (ika)	Benmimoun	Mohamed
INTRAS. Universitat de València	Tontsch	Anita
ITS, University of Leeds	Barnard	Yvonne
ITS, University of Leeds	Carsten	Oliver
ITS, University of Leeds	Jamson	Samantha
Loughborough University	Morris	Andrew
Lund University	Laureshyn	Aliaksei
OR YAROK	Lotan	Tsippy
RENAULT SAS	Mougammadoussane	Aurélie
Rijkswaterstaat	Alkim	Tom
Silicon Traffic Ltd.	Abramson	Yotam
SWOV	Bos	Niels
SWOV	Dijkstra	Atze
Technion - Israel Institute of Technology	Filin	Sagi
Test & Training International	Gatscha	Michael
TNO	van der Horst	Richard
TNO	Zwijnenberg	Han
TSRC - Loughborough University	Reed	Steve
UMTRI	Flannagan	Carol