InDeV: In-Depth understanding of accident causation for Vulnerable road users

HORIZON 2020 - the Framework Programme for Research and Innovation

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Preliminary Exploitation Plan

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Document information

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1 Background and purpose of InDeV

The main objective of the InDeV project is to contribute to the improvement of VRUs’ safety in Europe, by developing an integrated methodology (compiled in a toolbox) for understanding accident causes for VRUs and a framework for good practice for a comprehensive assessment of socio-economic costs related to road-accidents involving VRUs.

The tool-box for in-depth analysis of accident causation for Vulnerable Road Users (VRU) is based on a combined use of accident databases, in-depth accident investigations, surrogate safety indicators, self-reported accidents and naturalistic behavioural data. The tool-box will help to link accident causation factors to VRUs’ accident risk, and provide a solid basis for developing preventive countermeasures and a better input for socio-economic cost calculations of VRU accidents. The proposed approach is to reveal the causational factors by focusing on the process of accident development, thus overcoming the main weakness of the traditional accident data-based approach that might find correlations between various factors and accident frequency, but not show the causation chains. It will also employ, to a larger extent, observation of critical traffic events that are similar in process to real accidents, but are relatively more frequent and easier to collect in sufficient quantities. Thus, InDeV aims to further validate the use of surrogate safety indicators as a reliable substitute for crash data by comparing the results with findings from crash statistics and in-depth data from different countries. The tools developed in the project will be close to market-readiness and will be useful in any traffic context, i.e. will not be country-specific.

The InDeV project includes the following steps: i) review of methods and identification of the critical sites and road user groups; ii) development of technical tools for automated behaviour data collection; iii) observation studies at the selected sites; iv) analysis of the socio-economical costs; v) compilation of the project results and development of the safety analyst toolbox. The project has a clear focus on VRUs and the course of events in accidents they get injured in. It will provide solid knowledge, help to avoid a skewed view on the problem of VRUs’ safety, and facilitate the proposed tailor-made countermeasures for these groups. Moreover, with the use of surrogate safety indicators, there will be no need to wait for accidents to happen in order to learn how to prevent them from happening.
2 Exploitable results

2.1 Products

2.1.1 VRU safety analysis handbook

The final outcome of the InDeV research work is a handbook on the analysis of the VRU safety problems. The handbook is primarily aimed for practitioners in road safety work – traffic engineers at municipalities and road administrations, as well as traffic consultants. The book provides guidelines on how to choose the right method to study a particular problem, step-by-step instructions on how to design and perform the study and present and interpret the results.

The handbook contains also an extended list of recommended literature that can be used to deepen the knowledge in the subject and in this way it can be a useful starting point even for researchers new to the field.

The book will be available in electronic and “hard” versions. Currently we consider possibilities for making an on-line interactive version (similar to e.g. www.tiltaksksatalog.no) and also coordinating it with the handbook on VRU safety measures produced by SafetyCUBE project.

2.2 Methodologies

2.2.1 Integral methodology for VRU safety analysis

InDeV develops an integrated approach to the analysis VRU safety problems. The project examines the possibilities for combining data from different available sources (such as registered accident data, in-depth accident data, naturalistic driving data, self-reported accidents and real world observations) and also use the different methods to “triangulate” the safety problems of the VRU.

2.2.2 Surrogate safety measures for VRU safety analysis

One of the main contribution of InDeV is further development and validation of the surrogate safety method in context of VRU. Due to lack and poor quality of the accident data, the use of non-accident-based indicators of safety is highly motivated. The existing techniques and indicators are often “car-oriented” and InDeV will develop proper adjustments so that they can be used for VRUs. InDeV also performs an extended validation study to make sure that the suggested indicators are proper representatives of VRU’s actual risks for injuries in traffic.

2.2.3 Video processing algorithms

To support automated collection of the microscopic traffic data necessary for surrogate safety analysis, InDeV develops algorithms for video processing that can extract the necessary data from video recordings. The ultimate problem of complete autonomous tracking of all objects in video will not probably solved in InDeV, but some important steps forward in development of the technology are expected.

2.2.4 Mobile app for detection of dangerous traffic situations

Another novel approach tested in InDeV is development of a mobile app that would automatically detect involvement of a cyclist/pedestrian in a dangerous traffic situation. Again, the problem of being able to detect any type of fall/collision/etc. running stably on any model of a telephone is not realistic to achieve within the project timeframe. However, some important knowledge and
experience will be accumulated and documented which will contribute to development of such solution in the future.

2.3 Tools

2.3.1 Watchdog software RUBA

The watchdog software RUBA is an efficient tool for detection of potentially relevant traffic situations in video recordings. RUBA provides a set of detectors and possibility to build logical combinations of the detectors. A detector “raises a flag” when a certain activity takes place in a pre-defined area of the camera view, for example motion in a certain direction that indicates a passage of individual road users (motor vehicles, cyclists, pedestrians). Combination of the detectors allows to find situations of simultaneous arrivals and possible interactions. The main purpose of the watchdog is to remove the irrelevant parts of the video recordings when no interactions occur.

2.3.2 Semi-automated software T-Analyst

T-Analyst is a semi-automated tool for managing of large amounts of events detected in video recordings. The program allows to manually extract trajectories of the individual road users and calculate a number of safety-related indicators (Time-to-Collision, Time Advantage, Delta-V, etc.). Within InDeV project, T-Analyst is further enhanced with respect to implementation of the safety indicators identified as relevant for VRU-safety studies. Tools for seamless transfer of the detections provided by RUBA into T-Analyst for further processing are also developed.

2.3.3 Mobile app for accident self-reporting

A mobile application is developed in InDeV that is used to collect data from the road users about traffic accidents and incidents they are involved in. The study participants are asked regularly if they had any incidents during the last month (or any other time interval chosen) and, if positive, they receive a detailed questionnaire asking about the details.

Beside the application (client), server infrastructure is developed to collect the data from individual participants and store it in a central database.

2.4 Summary of the results

Table 1 presents the summary of the exploitable results of InDeV.
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3 Exploitation of results by InDeV partners

3.1 Lund University, Sweden (LU)
LU will exploit the results from InDeV by integrating the further developed evaluation methods in its coming research and dissemination activities, as well as in teaching activities, both on undergraduate and postgraduate level, as well as through training of professionals.

3.2 Ålborg University, Denmark (AAU)
AAU will incorporate the results (findings, methodology and technology) of InDev into both its education in Traffic Planning and Safety and its education in Vision, Graphics and Interactive Systems. Moreover, since the topic of InDev fits very nicely with current research activities at AAU, they will naturally be included directly in ongoing research and exploited further.

3.3 The Federal Highway Research Institute, Germany (BASt)
BASt will exploit the results from the InDeV project by integrating the developed evaluation methods in its coming research activities. BASt will seek to develop options to integrate the findings regarding socio-economic assessment into the German assessment framework for the evaluation of road safety measures. The improved accident cost rates will be used especially for cost benefit analysis concerning VRUs.

3.4 Hasselt University, Belgium (HU)
HU will exploit the results from InDeV by integrating the further developed evaluation methods in its coming research and dissemination activities, as well as in teaching activities both on undergraduate and postgraduate level, as well as through training of professionals.

3.5 Netherlands Organisation for Applied Scientific Research, Netherlands (TNO)
TNO will use the knowledge acquired from InDeV to help cities and municipalities to answer questions on traffic environment design, increasing VRU traffic safety in a more efficient and effective way. Moreover, TNO will extend on this knowledge and promote the use of it by others in their large (international) network of municipalities and VRU organizations of interest.

3.6 Warsaw University of Technology, Poland (WUT)
WUT will make use of InDeV results in efforts to improve the road safety situation in Poland in collaboration with the Polish National Road Safety Council. The results will also be used in other related research projects and in teaching.

3.7 Traffic Engineering, Spain (INTRA)
INTRA will employ the results from InDeV to help cities and municipalities to solve their traffic safety problems, by increasing VRUs’ safety in a more efficient way.

3.8 Polytechnique Montréal, Canada (PM)
PM will use the InDeV results in its coming research activities, as well as in teaching activities, both on undergraduate and postgraduate level.
4 Analysis of the external stakeholders

4.1 Research community

The researchers within road safety, city planning and urban mobility as well as in the area of computer vision will have clearly interest in the outcomes of the InDeV project.

How to reach?

The research community will be reached through the channels such as publications in scientific journals, presentations at conferences, workshops, communication within researchers’ networks (ICTCT\(^1\), NTSA\(^2\), LinkedIn and ResearchGate, etc) as well as through informal personal communication.

4.2 Traffic engineers and consultancies

The main objective of InDeV is to provide functional tools and knowledge for the traffic practitioners that they could introduce in daily road safety work. Turning research results into everyday practice is not possible unless the practitioners receive information in an attractive, understandable and persuasive way as well as the new work routines get supported with efficient and user-friendly technical tools.

How to reach?

During the project time InDeV partners co-operate intensively with the local municipalities when it comes to selection of the study site, obtaining the necessary permissions and background data, sharing the early results, etc. A number of target-group workshops are planned to get practitioners actively involved in development of VRU safety handbook structure. The project final event will have a separate session devoted to communication with the practitioners, too.

Partners also consider providing of educational courses for practitioners both when it comes to the theoretical and practical knowledge generated by InDeV and in using the technical tools developed in the project. Many of the project partners are universities and have extended experience in organising and managing supplementary courses for practitioners.

4.3 Policymakers

The preliminary InDeV results show that the problem of VRU safety is under-estimated and is not given proper attention on a higher decision-making level. However, there is quite substantial interest of the policy-makers to promote sustainable transport modes (which includes cycling and walking) and better information is demanded.

How to reach?

The decision makers are usually quite difficult to reach (and particularly make them change opinions) through regular educational channels. One of the strong advantages of InDeV is that it will generate a substantial amount of very illustrative videos, for example showing how certain intersection designs promote unsafe behaviour and what type of situations it can result into. From out earlier experience, such demos are very persuasive and are very good arguments in discussion about road safety.

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2 NTSA – Nordic Traffic Safety Academy, [www.tft.lth.se/ntsa](http://www.tft.lth.se/ntsa)
4.4 Technical companies

Most of the technical tools developed in InDeV have commercial potential, but will be developed only as prototypes. These includes:

- Equipment for filming;
- Video-processing software;
- Other software for data analysis and presentation;
- Mobile app infrastructure.

It is a long step from having a working prototype to a stably functioning and user-friendly tool that can be sold commercially. Therefore, it is highly desirable that external commercial companies take over the developments of InDeV and turn them into marketable products. This will contribute to a wider use of the knowledge and methods developed in InDeV by practitioners (and researchers) and also remove the burden of the technical support from the InDeV’s team.

How to reach?

Most often, companies with high technical development skills have very limited knowledge on traffic and thus have difficulties understanding the actual needs and challenges within a “narrow” subject such as VRU safety analysis. Personal communication is the most efficient way to explain that. InDeV has already been in contact with several companies providing, for example, traffic counts and willing to extend their product line with more “intelligent” solutions. Besides cultivating further these contacts, InDeV plans to create a short promotion video directed towards the potential investors explaining in a simple way the existence of a market niche for intelligent safety analysis, who are the potential customers and what are their expectations.

4.5 Educational bodies

It is highly important that the newly educated traffic practitioners receive the most recent knowledge on the subject.

How to reach?

InDeV will contact the educational bodies active within road safety area in each partner country and inform them about the VRU-safety handbook as well as the possibility to contribute with educational materials or provide lectures. Since many of the researchers are also university teachers, this information will also be spread at other research-related occasions, for example at conferences, workshops, etc.
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