**CEDR Transnational Road Research Programme**
**Call 2013: Programme name**

funded by
Belgium-Flanders, Denmark, Finland,
Norway, UK and Netherlands

# PRIMA – Pro-Active Incident Management

# Inception report

Deliverable No 1.1
July 2014

# CEDR Call 2013: Traffic Management
# PRIMA
# Pro-Active Incident Management

## Inception report

Due date of deliverable: 31/07/2014
Actual submission date: 31/07/2014

Start date of project: 15/05/2014 End date of project: 31/05/2016

**Author(s) of this deliverable**:
Philippe Nitsche, AIT, Austria
Isabela Mocanu, AIT, Austria
Lex Van Rooij, TNO, The Netherlands
Christopher Kettell, TRL, United Kingdom
Johan Olstam, VTI, Sweden

PEB Project Manager: Erik De Bisschop, Belgium

Version: 1.0

# Table of contents

# 1 Introduction

The aim of the CEDR programme is to realise the benefit of implementing innovation in traffic management solutions for National Road Administrations (NRAs). In this context, PRIMA targets the enhancement of current state-of-the-art Traffic Incident Management (TIM) techniques by introducing the idea of Pro-Active Incident Management with the following essential features: Anticipate, Prepare, Respond, and Monitor - anticipate that something may happen, be prepared to respond efficiently when the situation requires it, and monitor developments to minimize secondary effects.

The project work will build upon previous regulations, specifications and assessment studies regarding TIM. The **objectives** can be summarized as follows:

1. Provide clear guidance and recommendations for handling incidents and monitoring management performance and benefits, based on the assessment of risks and costs
2. Assess the technical, economical and organisational feasibility of innovative incident management based on novel technologies
3. Provide implementable solutions to facilitate proactive incident management for high-level road networks, at a transnational level.

This project will deliver practical and cost-efficient procedures on TIM by involving conventional as well as novel and innovative techniques. PRIMA focuses on TIM for the high-level road networks, i.e. motorways and primary roads. Secondary roads will be taken into account during the execution of this project, however this will be limited to incidents requiring the diversion of traffic onto non-primary roads and incidents on secondary roads and the impact on primary roads.

Relevant stakeholders play an important role in the research activities and will be involved from the project start. In the longer term, the project outcomes will lead to

- more efficient and automated strategies and cross-border activities for handling traffic incidents,
- reduced response and clearance time,
- increased responder safety,
- optimal integration of innovative and novel methods in existing and conventional environments and
- fewer incidents due to preventative and proactive practices.

The scope limitations are defined as follows:

- No development of traffic management software or applications
- No assessment of incident detection technologies
- No guidelines for low level networks (e.g. urban or tertiary roads)

This report summarizes decisions and discussion points addressed at the inception meeting and the planning of WP1, which was performed in the first month of the PRIMA project. The document includes an enhanced description of work including an updated timetable (see Section 2), the results of the risk analysis (Section 3), as well as a collaboration plan with other projects within the programme (Section 4). The report is concluded with final remarks concerning project collaboration and relevant issues that need to be taken into account in PRIMA.

# 2 Description of work

This section describes the activities to be done in PRIMA by elaborating on the description of work given in the original proposal. After giving an overview of the methodology, each work package is explained in detail.

## *2.1 Overview of methodology*

The approach proposed in PRIMA is to build upon the current best practice, by looking at the backbone of traffic incident management (TIM) and the TIM cycle, (see Figure 1, CEDR, 2011) and finding solutions for improvement, especially concerning the right balance of risks, costs, transnational benefits and utilization of novel technologies.


Figure 1: TIM Cycle

The methodology is depicted in Figure 2, showing also the connections between work packages and tasks.

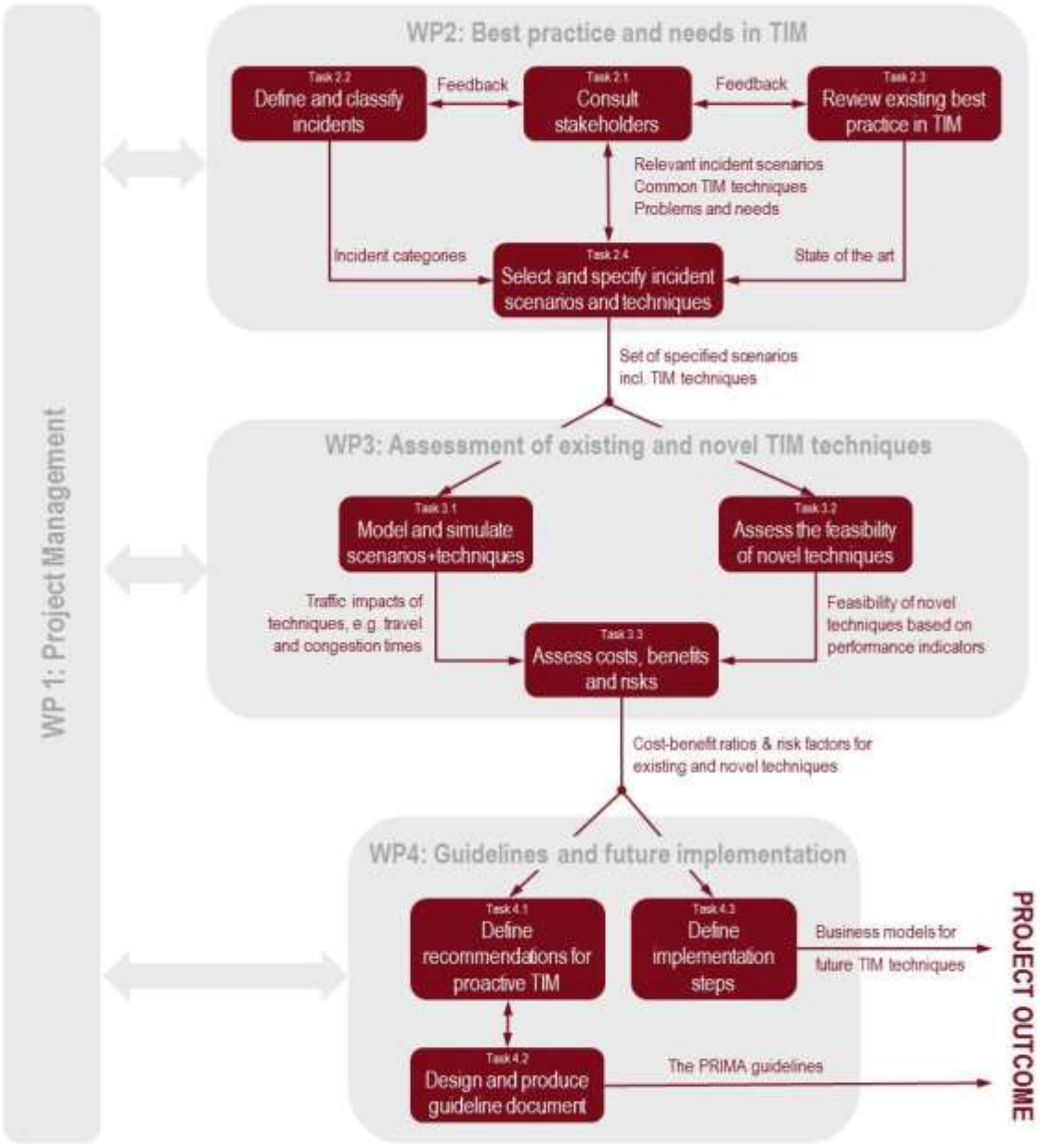



Figure 2 PRIMA Methodology

## *2.2 Work breakdown structure*

Figure 3 depicts the work breakdown structure in a simple chart.

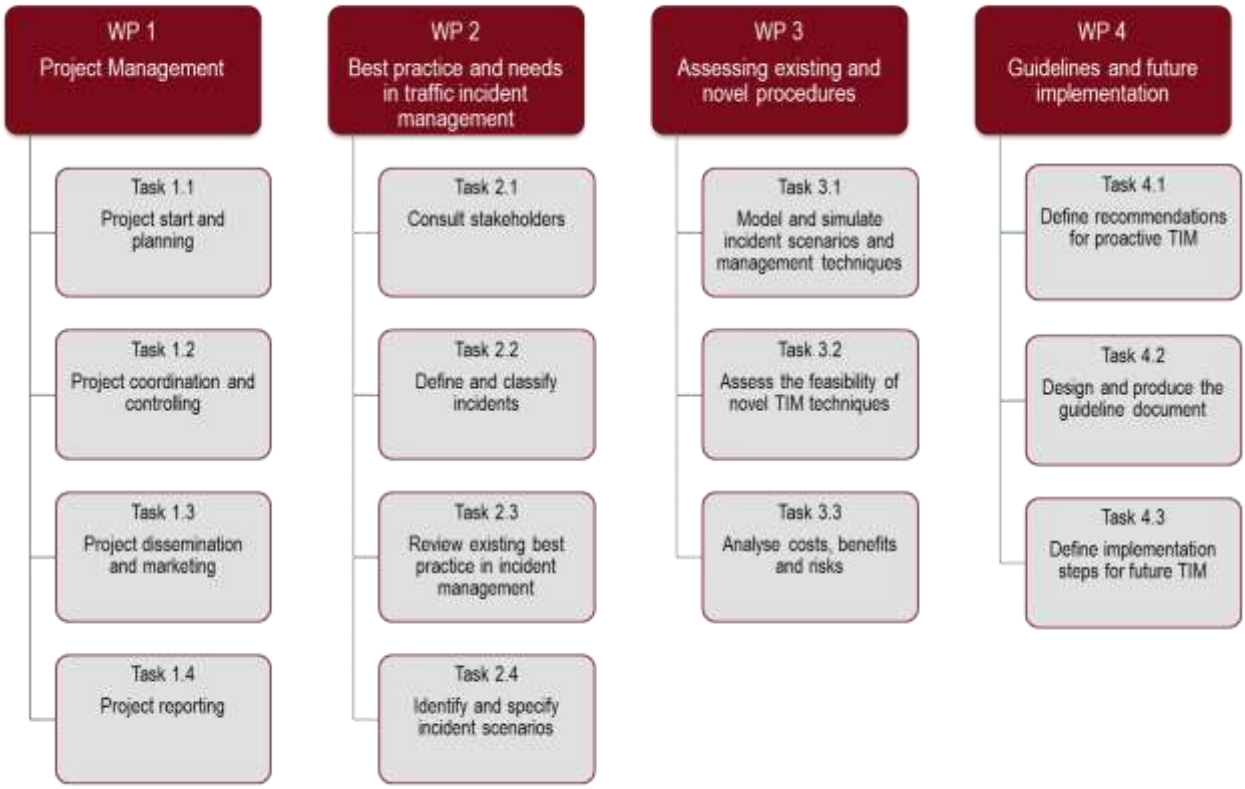
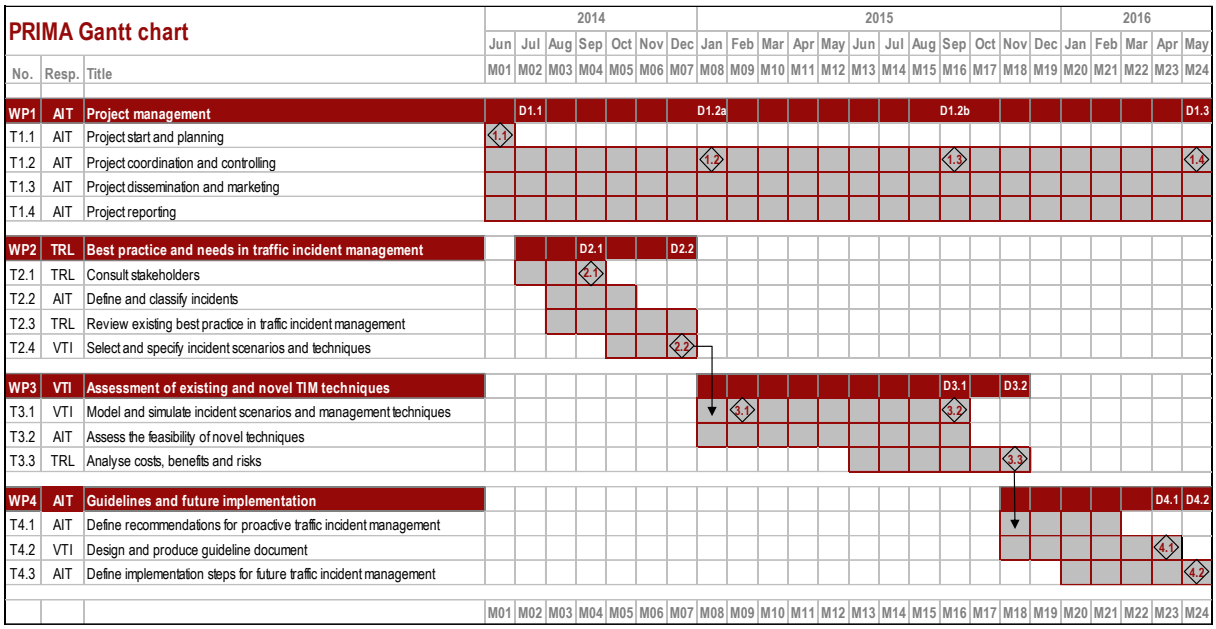



Figure 3: Work breakdown structure

## *2.3 Gantt chart*

The time plan is given in Figure 4. The project duration is 2 years from June 2014 to May 2016.




| No. | Milestone | Deadline |
|---|---|---|
| 1.1 | Inception meeting held | M01 |
| 1.2 | First interim meeting held | M08 |
| 1.3 | Second interim meeting held | M16 |
| 1.4 | Final meeting held, project ready for closure | M24 |
| 2.1 | Stakeholder needs obtained | M04 |
| 2.2 | Relevant incident scenarios specified | M07 |
| 3.1 | Specification of traffic model scenarios completed | M09 |
| 3.2 | Traffic analysis of incident scenarios completed | M16 |
| 3.3 | Cost-benefit and risk analysis completed | M18 |
| 4.1 | Guidelines developed | M23 |
| 4.2 | Implementation steps defined | M24 |

| No. | Deliverable | Deadline |
|---|---|---|
| D1.1 | Inception report (DoW) | M02 |
| D1.2a | Progress report 1 | M08 |
| D1.2b | Progress report 2 | M16 |
| D1.3 | Final project report | M24 |
| D2.1 | Summary of stakeholder consultation | M04 |
| D2.2 | WP report including specification of incident scenarios | M07 |
| D3.1 | Assessment results of incident management procedures | M16 |
| D3.2 | Description and results of the CBA and risk assessment | M18 |
| D4.1 | The PRIMA guidelines | M23 |
| D4.2 | Description of implementation steps for future TIM | M24 |

Figure 4: PRIMA Gantt chart

## *2.4 WP1 Project management*

**WP leader:** AIT (Philippe Nitsche)

**Objectives:**

- Bring the project to completion on time
- Keep the project in scope
- Keep track of the project costs and make adjustments if necessary
- Maintain high quality of project outputs
- Disseminate and publish project results

WP1 involves the overall consortium management, dissemination and reporting activities. With project teams in different countries working on interrelated tasks with research material in different languages, efficient project management is essential to ensure a successful outcome. The project will be managed by the project coordinator (AIT) with support from the leaders of the individual work packages. WP leaders are responsible for the content of their respective WP. WP1 is divided into four tasks as follows.

### 2.4.1 Task 1.1: Project start and planning

**Task leader:** AIT (Philippe Nitsche)

**Collaborating partners:** TNO, TRL, VTI

The goals of this task include the project kick-off and detailed planning, i.e. adaptation/enhancement of the description of work, if necessary. This task consists of the organisation and moderation of a kick-off meeting and a planning workshop with all consortium members. Based on this, the project coordinator will reflect planning issues such as tasks, quality management, timetables, deadlines, milestones, risks as well as project costs and resources. All planning details will be documented in this report. Furthermore, it is envisaged to foster close collaboration with the other projects funded within the CEDR programme topic “Traffic Management”. Within this task, this point implies building a collaboration plan together with the other project coordinators, which will be described in Section 4.

### 2.4.2 Task 1.2: Project coordination and controlling

**Task leader:** AIT (Philippe Nitsche)

**Collaborating partners:** none

This task encompasses all project management activities throughout the whole project duration, including:

- Monitoring progress and costs
- Financial management and distribution of funding to the project partners
- Coordination of meetings (4 physical consortium meetings and monthly teleconferences planned) and internal communication, including preparation of agendas, meeting minutes and activity lists
- Quality management and assurance (maintain technical quality of project outputs, keep costumer focus etc.)
- Risk management, including risk analysis and a periodically updated risk register and contingency plan
- Contractual issues (consortium agreement etc.)
- Correspondence and regular coordination with other project coordinators within the CEDR programme “Traffic Management”

### 2.4.3 Task 1.3: Dissemination and project marketing

**Task leader:** AIT (Philippe Nitsche)

**Collaborating partners:** TNO, TRL, VTI

The dissemination of the project content and results will be organized by the coordinator. Besides the coordinator, other consortium members will contribute to this task with dissemination activities such as publications, presentations and networking activities. The content of these activities will be part of the WP activities. Furthermore, national and international opportunities to meet representatives from National Road Administrations will be used to present the project results. The deliverables of the project will be available for the client and, if allowed, for all interested organizations, such as FEHRL members etc.

### 2.4.4 Task 1.4: Project reporting

**Task leader:** AIT (Isabela Mocanu)

**Collaborating partners:** TNO, TRL, VTI

This task will be coordinated by AIT with minor contribution of the other consortium members. All deliverables of WP1 will be completed within this task. Other project deliverables will be created within the respective work packages. Task 1.4 includes the following activities:

- Content-related and financial reporting to the funding organisation
- Writing an inception report based on Task 1.1
- Writing two progress reports
- Writing a final project report
- Coordination of inputs from consortium members
- Communication and coordination with the funding organisation

### 2.4.5 Deliverables of WP1

**D1.1 (30/07/2014): Inception report**

This report summarizes decisions and discussion points of the inception meeting and includes an enhanced description of work, collaboration plan with other projects within the programme, a risk register as well as an updated timetable if necessary.

**D1.2a (27/02/2015): Progress report 1**

This first progress report summarizes all activities performed in the first reporting period, considers any problems such as personnel, budget or time constraints and shows how to tackle them among the activities in the next period.

**D1.2b (30/10/2015): Progress report 2**

This second progress report summarizes all activities conducted in the second reporting period, considers any problems such as personnel, budget or time constraints and shows how to tackle them among the activities in the next period.

**D1.3 (31/05/2016): Final project report**

The last step in the project is to summarize the different stages into a final report. The document contains all necessary information regarding the project such as objectives, activities, results and how they can be implemented.

### 2.4.6 Milestones of WP1

M1.1 (30/06/2014): Inception meeting held

M1.2 (30/01/2015): First interim meeting held

M1.3 (30/09/2015): Second interim meeting held

M1.4 (31/05/2016): Final meeting held, project ready for closure

## 2.5 WP2 Best practice and needs in traffic incident management

**WP leader:** TRL (Christopher Kettell)

**Objectives:**

- Carry out a stakeholder consultation exercise to confirm the focus of the project and ensure the output is fit-for-purpose
- Review existing best practice in traffic incident management
- Identify and specify incident scenarios for the assessment in WP3

The research activities will start with a definition of the user needs and requirements in conjunction with a review of best practice in TIM. A focused literature review and expert discussions will be performed at first to identify the most relevant types of incidents and their subcategories.

It is planned that through stakeholder consultation, the incident categories and subtypes will be identified and their applicability across the range of stakeholders will be confirmed. The outcome of the consultation will be a number of clearly defined incident types, which are highly relevant and can be translated into TIM strategies in this project.

The aim is to perform research according to the needs of the NRAs, with particular focus on the high-level road networks at a transnational level. A review of the current state of the art of existing best practice in TIM will also be carried out.

In undertaking any form of stakeholder consultation and engagement there are two ever present risks, firstly the stakeholders are not as responsive / forthcoming in their participation as expected, secondly a single or small group of stakeholders have a disproportion representation in the area of study. In both cases, a number of challenges are presented; these are detailed within the project risk register and will be subject to continuous remove as part of the risk management process.

In defining the list of stakeholders to be engaged as part of this work package, TRL have drawn upon their significant experience in this field and contacts to ensure that representation of stakeholders engaged during this consultation exercise is both fit for purpose and provides adequate coverage. This approach ensures that the work package outcomes drive the project from a solid foundation. In conjunction with the Programme Executive Board, stakeholder contacts are to be identified in conjunction with wider project team contacts being sought and used.

Further details on how this consultation will be conducted can be found in the Task 2.1 description.

By considering all inputs, the most relevant TIM techniques will be selected for further assessment in specific traffic scenarios. Existing and novel techniques will be chosen according to their applicability in the different phases of TIM, with a focus on proactive incident management and innovative technologies.

This work package will be led overall by TRL, with partners taking responsibility for leading individual tasks within the work package. However, all partners will have some involvement in all tasks of this initial work package to ensure a common and consistent vision of the project outcome.

### 2.5.1 Task 2.1: Consult stakeholders

**Task leader:** TRL (Christopher Kettell)

**Collaborating partners:** AIT, TNO, VTI

Although there will be an informal process of stakeholder consultation throughout the project, the first task of this work package will be a formal consultation exercise to **establish stakeholder requirements** and input from the outset. This step is crucial as it will ensure that the project focus is aligned with the needs of the potential users and that the output is fit for purpose.

The aim is to use the initial meeting with the Programme Executive Board as a stakeholder consultation exercise, both to gather opinions and input and also to obtain other relevant contacts for further consultations. This initial meeting will inform the development of a web-mounted survey of relevant stakeholders, including (but not limited to) representatives of National Road Administrations, police and emergency services, traffic management practitioners, motoring organisations, local and regional highways authorities. The survey will be followed up with face-to-face or telephone meetings with selected stakeholders where possible.

Stakeholders will be consulted on a focused number of issues relevant to the project, with specific attention given to gathering input to inform Tasks 2.2 and 2.4, as detailed below, and most importantly, input regarding WP 4 to ensure that the output of the project is developed in conjunction with the end users and hence increase user acceptance by satisfying user needs and requirements.

The user requirements, derived from user needs will not only consist of a specification of what is required but also a range of relevant ancillary information, which aids clarification of the requirements. Where possible the approaches to stakeholder engagement will be used in a complimentary way, this includes the use of:

- User surveys: Relatively quick method of determining preferences of large user groups and allows for statistical analysis to be undertaken.
- Focus groups:Relatively quick method to obtain a wide variety of end user views, identification of common needs and requirements.
- Interviewing: Interviews allow for quick elicitation of ideas and concepts. Enables access to the users work environment and provides contextual information.
- Operational scenarios: Effective way of considering current and future planning tools use in context.

Because of the inherent risk in firstly gathering user requirements and secondly in their analysis, where the potential for errors to arise which then later impact on any TIM development, user requirements should be verified as soon as candidate TIMs strategies are available.

TRL will lead this task, with other partners carrying out relevant interviews and meetings with stakeholders in their respective countries and where relevant.

### 2.5.2 Task 2.2: Define and classify incidents

**Task leader:** AIT (Philippe Nitsche)

**Collaborating partners:** none

Following on from Task 2.1 Stakeholder Consultation, this work package will take the key outcomes from the consultation and will define and classify the incidents that will be the focus of this project, thus developing the framework on which subsequent work packages will be built. It will draw not only on the stakeholder feedback, but also on the specialist knowledge the Task Leader brings to the project.

In proceeding projects (e.g. RAIDER), incidents were roughly categorized into road accidents, vehicle breakdowns and extraordinary congestion. The initial planning workshop of PRIMA (as part of the kick-off meeting) resulted in an extended list of incident types, as follows:

1. Collisions
2. Stranded vehicles (due to breakdown)
3. Stationary objects on the road
4. Unpredictable congestion
5. Weather events (e.g. fog, ice)
6. Road infrastructure damage and distress

Those incidents may be classified using additional information such as

- road type,
- number of lanes available,
- lane width,
- number of vehicles and types involved,
- speed limit at the incident site,
- location of the incident (ramp, tunnel, bridge, road or shoulder),
- vehicle fire involvement,
- restrictions for specific vehicles,
- traffic flow and volumes on the incident stretch,
- driver information systems available (e.g. overhead gantries, variable message signs)
- injury severity or fatalities in case of a collision,
- type of stationary objects on the road,
- daytime of incident occurrence and
- others.

### *2.5.3 Task 2.3: Review existing best practice in traffic incident management*

**Task leader:** TRL (Christopher Kettell)

**Collaborating partners:** none

It is acknowledged that there has previously been a significant number of reviews of best practices in traffic incident management and so this tasks looks to start with the recent CEDR publication ‘Best practice in European traffic incident management’ (2011) and other relevant documents such as the accompanying Aide Memoire for responders, the EasyWay Guidelines for the deployment of incident management (2009) and similar guidance documents produced by individual national road administrations, including the Highways Agency, Rijkswaterstaat, FHWA, etc.

The existing documents and current operational best practice will be reviewed in line with the definitions resulting from Task 2.2 and in particular taking into account the stakeholder opinions and information gathered in Task 2.1. The aim is also to widen the scope by investigating any relevant best practice from countries not covered by previous reviews.

Currently, best practice in TIM is reactive and relies on coordination of various responders, who are suitably trained and equipped and provided with guidance and clear responsibilities. It therefore also depends on sufficient intensity of use of a road network to justify the level of provision. TIM is well developed in many European countries, where it is a part of an overall traffic information and management strategy. However, at this moment it is both *reactive* and largely reliant on fixed infrastructure; this review will have a particular focus on *proactive* incident management and research into relevant innovative methods.

### *2.5.4 Task 2.4: Identify and specify incident scenarios*

**Task leader:** VTI (Johan Olstam)

**Collaborating partners:** AIT, TNO, TRL

Through the stakeholder consultations, the classification of incidents and the review of existing best practice TIM, a set of the **most significant incident scenarios** will be identified and specified. For each such scenario, the **most relevant TIM techniques** will be defined. The number of combinations of incident scenarios will be influenced by the complexity of the scenarios themselves, as well as the complexity of the techniques employed. Therefore, the number will be limited, both in order to allow assessment of all combinations, as well as to make the guidelines practical. The set of combinations of incident scenarios and TIM techniques will be assessed in WP3.

### *2.5.5 Deliverables of WP2*

The work package leader is responsible for producing the deliverables in the WP as well as for editing and organising reviews. The project coordinator will then proofread and deliver the final deliverables to the NRA/PEB.

**D2.1 (30/09/2014): Summary of stakeholder consultation**

This report summarises the output from the stakeholder consultation activities, in particular the results of the survey and the input that will be taken forward into following work packages.

**D2.2 (19/12/2014): Work package report including specification of incident scenarios**

This report will summarise the work carried out in Tasks 2.2 and 2.3 and describe how it was used, in conjunction with the stakeholder consultation, to develop the specifications of the incident scenarios. The main element of this report will be to set up the framework for the rest of the project.

### *2.5.6 Milestones of WP2*

M2.1 (30/09/2014): Stakeholder needs obtained

M2.2 (19/12/2014): Relevant incident scenarios specified

## *2.6 WP3 Assessment of existing and novel traffic incident management techniques*

**WP leader:** VTI (Johan Olstam)

**Objectives:**

- Estimate costs and risks of the representative set of combinations of incident scenarios and incident management techniques defined in WP2
- Investigate the feasibility of novel incident management methods

The next step is to find out what are the most efficient and suitable techniques that could be applied for a specific scenario, at a certain phase in the TIM cycle. This will be done in two simultaneous steps.

First, existing management techniques will be evaluated through traffic models and microscopic traffic simulations. Estimation of the cost of congestion of different TIM procedures implies estimation of the level of service, e.g. in terms of travel time and delay. In addition, traffic safety will be estimated by simulating travel speed and by applying the speed power model. This allows the evaluation of the impacts concerning safety of road users. The choice of traffic models will depend on the complexity of the incident scenario and TIM technique. For less complex scenarios, estimations will be based on queuing - and traffic flow theory. For more complex scenarios, the traffic model will include a more detailed representation of the traffic dynamics, the queue build-up process, etc. Microscopic traffic simulation fulfils the requirements of this task and will be used as a tool for the delay estimation.

A different approach will be undertaken for innovative techniques. An assessment of their technical feasibility will be performed, based on performance evaluations, availability, etc. A set of key performance indicators will help weigh the techniques and provide a clear view of what are the most promising techniques that can improve the TIM cycle and timeline. Besides roadside technologies, special attention will be given to proactive techniques based on FVD (floating vehicle data) and cooperative traffic systems (wireless communication between vehicles and infrastructure). Hence, novel techniques for recognizing traffic states and congestion, for identifying incident severity and for identifying high-risk accident locations will be investigated.

Current and future active safety applications in vehicles make use of real-time information from in-vehicle sensors as well as external environmental perception sensors. This information can also serve as a useful source of information for proactive incident management on a larger scale. It is possible to monitor driver and vehicle occupants' behaviour of the host vehicle, as well as the behaviour of vehicles surrounding the host vehicle, by making use of its in-vehicle and environmental perception sensors. The information can be potentially used to monitor and estimate the risk level of a vehicle encountering an accident, the severity of the accident, how many lanes are probably blocked, as well as potential traumas of vehicle occupants and individual injuries in accordance with the Abbreviated Injury Scale (AIS). It will also be assessed if eCall systems can make use of this information, to allow emergency medical services to better respond to the incident.

Based on the results of these steps, risk assessments and cost-benefit analysis will be performed. The risk assessment will be conducted for the specific scenarios, using Risk Management techniques such as probability and impact assessment. Potential planned responses to these risks will be identified. In addition, existing risks will be identified that might be mitigated by the implementation of novel techniques. Typically, risks can include direct risks (e.g. to incident management workers) or indirect risks (e.g. to traffic affected by the techniques).

The cost-benefit analysis will be carried out using the Cost Benefit and Analysis (COBA) tool, developed and maintained by TRL, on behalf of the UK's Department for Transport. The tool is designed primarily to assess improvements to the highway, but it will be adapted to be

usable for assessing the effects of various incident management techniques. The Incident Cost-Benefit Assessment (INCA) tool will also be utilized to assess changes to journey time reliability, while also taking into account the outputs from the COBRA (Cooperative Benefits for Road Authorities) project.

The results will be utilized to derive cost benefit ratios for a specific TIM technique, given a specific incident scenario and traffic conditions. This will provide the necessary information for the production of the PRIMA guidelines for proactive TIM.

VTI will lead the WP, taking main responsibility for Task 3.1 as well as taking part in Task 3.3 as an active link between the estimation of congestion costs and the final assessment of costs, benefits and risks. AIT and TNO will assess novel TIM techniques based on promising new technologies such as FVD, cooperative traffic systems or eCall (Task 3.2). TRL will lead Task 3.3 and take main responsibility for the assessment of costs, benefits and risks.

### *2.6.1 Task 3.1: Model and simulate incident scenarios and management techniques*

**Task leader:** VTI (Johan Olstam)

**Collaborating partners:** none

The aim of this task is to conduct traffic analysis of a representative set of incident scenarios and existing TIM techniques (defined in WP2). The traffic analysis will be conducted using suitable traffic models, including **microscopic traffic simulation** models, as well as queuing and traffic flow theory based models. The outcome will be a set of performance measures such as travel time and delay for a set of combinations of incident scenarios, traffic demand and TIM techniques.

Each combination of incident scenario and TIM technique will be modelled in a microscopic traffic simulation model. For each scenario, a “Do Nothing” case will also be simulated, in order to allow calibration and evaluation of the impact of applying different TIM techniques compared to the base scenario of no remedial action. Each combination of incident scenario and TIM technique will be simulated using several traffic demand levels. This will be done in order to allow investigation of whether the suitability of different TIM techniques varies with traffic demand.

The main output of the simulations and this task are **travel time and delay estimations**, which will be one of the main inputs to Task 3.3 (Analyse costs, benefits and risks). The simulated travel speeds will also be fed into the speed power model in order to give estimates on how the different TIM techniques affect traffic safety.

Traffic analysis of novel TIM techniques was not foreseen in the proposal due to budget constraints. Instead, the focus is on traffic analysis of traditional techniques by traffic simulation.

Through combinations of incident scenarios and TIM techniques, similar incident scenarios or TIM techniques can be grouped. I.e. if two incident scenarios imply a similar number of lanes blocked, duration etc., they could be grouped together instead of treated as two separate incident scenarios. However, the scope of each scenario should neither be too wide nor too prescriptive, because then they would be difficult to adapt and of little use.

An open question remains regarding the interest of national road authorities regarding management techniques – if they prefer assessments of traditional or innovative techniques. The decision to focus on the assessment of cost of congestion for traditional techniques was based on the CEDR Traffic Management Description of Research Needs (DoRN). However,

the focus can be changed to an assessment of innovative techniques instead. This point will be discussed in the initial PEB meeting.

### *2.6.2 Task 3.2: Assess the feasibility of novel TIM techniques*

**Task leader:** AIT (Martin Reinthaler)

**Collaborating partners:** TNO

This task will assess novel and innovative techniques for incident detection and prevention. This involves solutions for detecting, classifying and handling incidents based on promising technologies that are likely to be wide-spread in the near future (e.g. nomadic devices, FVD, eCall, cooperative traffic systems).

AIT will investigate **innovative systems using traffic data**, in particular for incident detection and accident databases for detecting high-risk (accident) locations on the road network. According to the project RAIDER, a list of performance indicators (detection rate, false alarm rate, response time, etc.) for **incident detection** will build the basis for the assessment of the detection quality. Evaluation results from existing projects and research studies will be used to identify the most relevant quality indicators, like high false alarm rate, delay in detection or inaccurate location of incidents with essential impact for further decisions in the context of traffic incident management.

TNO will evaluate the feasibility of **incident classification** methods, which are based on sensor fusion of in-vehicle sensors such as accelerometers, yaw rate sensor, GPS receivers, radar, camera and airbag deployment. These data can be utilized to classify the type of accident, estimate the accident severity, the number of lanes blocked after the accident, as well as probable traumas of vehicle occupants according to maximum injury severity and individual injuries in accordance with the Abbreviated Injury Scale (AIS). The feasibility study will evaluate if parameters that affect incident management – location, number of blocked lanes, severity of personal injury – can be estimated using sensor fusion techniques and novel algorithms. This information could, in the future, be added to the eCall protocol, to arrive at so called Advanced eCall. In more detail, the following activities are foreseen:

- Assessment of a future Advanced eCall technology, through a comparison between consequences with and without the technology. An example is to evaluate the reduction in response time, or the decrease in risk of fatalities.
- Interpret the incident scenarios from Task 2.4 that may benefit from Advanced eCall, i.e. scenarios that resulted in collisions
- Obtain and interpret approximately 10 typical crash cases (e.g. from accident databases like GIDAS), in order to simulate realistic conditions and enrich the above incident scenarios
- Simulate crash cases with real-time human model state estimator and hence, provide additional injury risk information to a future eCall message in a few seconds time
- Compute accident severity, number of blocked lanes & injury probability for all cases

This task will deliver a set of novel methods with their technical capabilities and limitations according to the assessed performance indicators and provide real life evidence of proactive incident management techniques using traffic data.

No analysis will be conducted for evaluating changes in traffic flow. Since the analysis will deal with incident severity classification, at least one scenario must contain a collision, e.g. rear-end crash.

### 2.6.3 Task 3.3: Analyse costs, benefits and risks

**Task leader:** TRL (Tim Rees)

**Collaborating partners:** VTI

The aim of this task is to **identify and assess additional risks and costs**, using Risk Management techniques such as probability and impact assessment. A risk assessment will be carried out for the incident scenarios identified in Task 2.4 and the enhanced TIM techniques identified in Task 3.2. Potential planned responses to these risks will also be identified. Risks may be direct, e.g. to incident management workers, or indirect, e.g. to traffic on alternative routes utilised in the TIM techniques, or secondary accidents due to the original incident. In addition, existing risks that might be mitigated by the implementation of new procedures will be identified.

A **cost-benefit analysis** (CBA) will then be conducted based on these risks and their associated costs together with the costs of congestion. The cost-benefit analysis will be utilized to derive cost-benefit ratios for a specific TIM technique given a specific incident scenario and traffic condition.

### 2.6.4 Deliverables of WP3

The work package leader is responsible for producing the deliverables in the WP as well as for editing and organising reviews. The project coordinator will then proofread and deliver the final deliverables to the NRA/PEB.

**D3.1 (30/09/2015): Assessment results of incident management techniques**

This deliverable describes the design and results of the traffic model based assessment of the set of incident scenarios and traffic incident management techniques together with a description of novel incident techniques and their technical capabilities and limitations.

**D3.2 (30/11/2015): Description and results of the CBA and risk assessment**

This deliverable summarizes the activities in Task 3.3, explains the methodology and presents the results of the assessment of risks, benefits and costs.

### 2.6.5 Milestones of WP3

M3.1 (27/02/2015): Specification of traffic model scenarios completed

M3.2 (30/09/2015): Traffic analysis of incident scenarios completed

M3.3 (30/11/2015): Cost-benefit and risk analysis completed

## 2.7 WP4 Guidelines and future implementation

**WP leader:** AIT (Isabela Mocanu)

**Objectives:**

- Develop a guide with procedures on traffic incident management based on risks and costs

- Define implementation steps of procedures and business models for future traffic incident management

WP4 will synthetize all inputs provided by the previous work packages, by developing a guide with procedures on TIM based on risks and costs, transnational cooperation and innovative technologies. The aim is to provide a clear guidance for road authorities, by presenting the most effective steps for handling different types of incidents in various scenarios. PRIMA aims to clearly differentiate from existing guidelines due to the proactive approach. Instead of a single solution, a number of options (for specific scenarios) will be included.

The final step in PRIMA will be to show how to best integrate innovative techniques in incident management. This will be done by developing business models. The models will be selected to show implementations of the most promising techniques and will be visualized in value networks. They will include involved parties and flows of services, money and value.

AIT will lead the WP and take main responsibility for Task 4.1 with inputs from VTI for the layout of the final guideline document (Task 4.2). TRL will contribute to formulating recommendations by incorporating their inputs.

### *2.7.1 Task 4.1: Define recommendations for proactive TIM*

**Task leader:** AIT (Isabela Mocanu)

**Collaborating partners:** TRL, VTI

The aim of this task is to produce guidelines for proactive TIM. With the inputs provided from previous WPs on incident scenarios, existing and novel, enhanced TIM techniques and risks and costs analysis, the guide will convey in a comprehensive approach how to deal with different types of incidents in a proficient manner. Each specific incident scenario will be detailed in terms of applicable TIM techniques and risks and costs associated. The constraints and requirements for applying a specific technique will also be analysed, with particular focus on transnational cooperation. It is foreseen to discuss and review the PRIMA recommendations with stakeholders, before the guidelines will be produced in Task 4.2.

### *2.7.2 Task 4.2: Design and produce the guideline document*

**Task leader:** VTI (Johan Olstam)

**Collaborating partners:** AIT, TNO, TRL

The aim is to present the guidelines in a simple and practical format, such as a factsheet. Among other European and international guidelines, the CEDR Traffic Incident Management Aide Memoire will be taken into consideration. In close cooperation with AIT, VTI will be responsible for the design and layout of the guidelines, ensuring professional graphic design and easy readability. TNO and TRL will contribute by writing and reviewing the guidelines. In the first month of this task, it will be decided, what the format of the guidelines will be, i.e.

- Design in the form of a factsheet for each incident scenario
- A more comprehensive handbook covering all assessed incident scenarios
- A full-detailed report covering all incident scenarios and detailed assessment results

Regardless of the design layout, the guideline document will comprise recommended TIM techniques for each scenario and a summary of their assessed benefits, risks and costs.

### 2.7.3 Task 4.3: Define implementation steps for future TIM

**Task leader:** AIT (Isabela Mocanu)

**Collaborating partners:** none

The objective of this task is to identify the key control parameters that are essential in defining the business models for implementing future TIM techniques. Key control parameters define, who utilizes which resources and who does which activities and influences the distribution of cost, risks and benefits in the value network.

The scenarios and novel techniques selected in WP2 and WP3 will lead to the development of multiple business models for implementing future TIM procedures. Several applicable business model will be investigated, which will cover public, private or mixed partnerships. However, based on the assessment of risks and costs performed in Task 3.3, selected business models will be defined for specific scenarios with the most promising technologies. Value networks will be used to describe how organisations (roles) collaborate in creating value for TIM, while also taking into consideration input from the stakeholders.

Figure 5 shows an example of a value network for a FVD based business model, the technology being used in the discovery phase of the TIM cycle. The flow of goods, services, money and benefits are shown through arrows, while the stakeholders are shown in the bubbles.

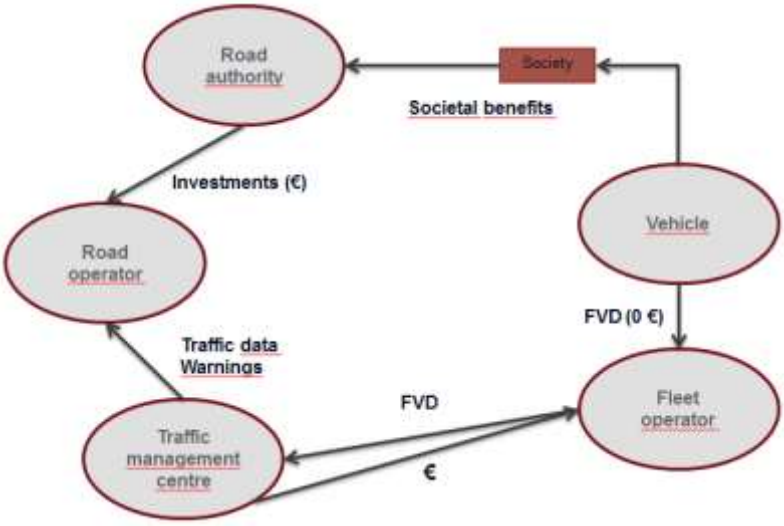



Figure 5: Example of a value network for the FVD business model

The fleet operator collects floating vehicle data from its fleet and sells it to the traffic management centre. The traffic management centre can receive and process the FVD in real-time and can send traffic data and congestion warnings to the road operator. The road authority invests in the acquisition of the FVD data and receives societal benefits.

During this task, the lessons learnt during the development of the business models presented in the ERA-NET project COBRA will also be taken into consideration.

### 2.7.4 Deliverables of WP4

The work package leader is responsible for producing the deliverables in the WP as well as for editing and organising reviews. The project coordinator will then proofread and deliver the final deliverables to the NRA/PEB.

**D4.1 (29/04/2016): The PRIMA guidelines**

This deliverable can be seen as the final output of PRIMA, giving recommendations and practical guidelines on traffic incident management techniques. The design layout and format will be concise and engaging.

**D4.2 (31/05/2016): Description of implementation steps for future TIM**

This deliverable is an important supplement to the PRIMA guidelines, because it describes how novel techniques can be implemented in future. It summarizes the activities and results of Task 4.3.

### *2.7.5 Milestones of WP4*

M4.1 (29/04/2016): Guidelines developed

M4.2 (31/05/2016): Implementation steps defined

# 3 Risk analysis

This section presents the results of the risk analysis performed at the initial project-planning workshop on 27/05/2014. A risk register (see Figure 6) was created showing each risk, its probability and impact assessed as well as mitigation measures.

| RISK ID | TYPE | RISK OWNER (Grp | RISK DESCRIPTION | Potential Impact | 1 | 2 | 3 | 4 | PROB | IMPACT | RISK LEVEL | RISK MITIGATION ACTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Operational | AIT-PM | Lack of accident data | Negative impact on project delivery: Novel technologies for incident classification (injury severity) cannot be fully assessed for collision scenarios | Yes | Yes | Yes | Yes | 1 | 2 | 2 | Possible incident scenarios involving collisions should be considered in an early project stage. |
| 2 | External | PEB | Negative publicity | Project results are not accepted by the public | Yes | Yes | No | Yes | 1 | 2 | 2 | Tolerate negative publicity. Try to emphasize the importance of PRIMA by certain dissemination activities |
| 3 | User requirements | AIT-PM | Scenarios cannot be applied by our methods | Not all scenarios can be assessed and included in the guideline, which may lead to unsatisfied stakeholders | Yes | Yes | Yes | Yes | 1 | 3 | 3 | Possible incident scenarios must be considered in an early project stage. 1) We only define TIM scenarios that we can assess, 2) We might consult a subcontractor for work we cannot assess by ourselves |
| 4 | Operational | AIT-PM | No adequate existing software tools available | Additional software must be purchased, which involved an internal shift of costs; OR not all scenarios can be assessed and included in the guideline | Yes | No | Yes | Yes | 1 | 3 | 3 | Purchase additional tools and shift costs, Only define scenarios that we can assess |
| 5 | User requirements | AIT-PM | Needs of stakeholders are not adressed | Stakeholders and the PEB are not satisfied with the guidelines | Yes | Yes | No | Yes | 1 | 3 | 3 | Regular consultation of stakeholders. Before producing the recommendations and guidelines in WP4, consult as many stakeholders as possible. |
| 6 | User requirements | AIT-PM | List of scenarios do not include collisions | Negative impact on project delivery: TNO cannot conduct the assessment of injury level classification methods | Yes | Yes | Yes | Yes | 2 | 3 | 6 | Stakeholders can be convinced that collisions are important in TIM and especially for PRIMA to cover a wider range of incidents. If collision scenarios are not seen as relevant by the stakeholders: Either TNO changes tasks/team members by focussing on other parts of assessing technologies (not eCall) OR TNO stops its activities in PRIMA and leaves the consortium |
| 7 | Legal | AIT-PM | Legal changes and their implications | Chance of legal circumstandes can lead to invalid recommendations for the PRIMA guideline, especially when it comes to data access, privacy or liability issues. | Yes | No | No | Yes | 1 | 3 | 3 | Check for legal developments in the field of TIM in order to react before writing the recommendations. |
| 8 | Operational | AIT-PM | Delays regarding the guideline | Project end must be postponed. | Yes | No | No | Yes | 2 | 2 | 4 | The production of the guidelines must be planned ahead. Upcoming delays must be communicated early enough. A cost-neutral project extension must be discussed with the NRA/PEB. |
| 9 | Operational | AIT-PM | Level of detail for guidelines is inadequate | Stakeholders cannot use the guide because it has not enough detail OR the guidelines are too comprehensive to be applied | Yes | No | No | Yes | 1 | 2 | 2 | Discuss with stakeholders early enough, what level of detail is desired. Also clarify the format to produce the guidelines. |
| 10 | Operational | AIT-PM | Change of key personnel | Key tasks cannot be fulfilled due to change of level of expertise or lack of available other persons. This can results in delays and/or modification of objectives. | Yes | Yes | Yes | Yes | 2 | 2 | 4 | Brief the new key personnel on PRIMA and clarify open questions. Choose an expert who is able to fulfill the tasks in PRIMA. Extend WPs or the project end date if necessary |
| 11 | User requirements | AIT-PM | Too many scenarios of interest | Not all scenarios can be assessed and included in the guideline, which may lead to unsatisfied stakeholders | Yes | Yes | Yes | Yes | 2 | 3 | 6 | If too many scenarios: Discard the ones we cannot assess with our methods OR Consult the stakeholders in a "second round" to limit the scenarios to an adequate number for PRIMA. |
| 12 | User requirements | AIT-PM | Conflicting needs/requirements of different stakeholders | Certain stakeholders and the PEB are not satisfied with the guidelines | Yes | Yes | No | Yes | 3 | 3 | 9 | Try to find a good mixture of different needs (covering different countries) and set the scenarios accordingly. Together with the stakeholders, find a consensus/common ground in the list of scenarios. Eventually, discard the scenarios we cannot assess with our methods and discuss it with the stakeholders. |
| 13 | User requirements | AIT-PM | Number of scenarios too low for guidelines for stakeholders | The PRIMA guidelines are not useful enough for the stakeholders, because they require more scenarios. | Yes | Yes | Yes | Yes | 2 | 3 | 6 | |
| 14 | User requirements | AIT-PM | Lack of stakeholder response and/or availability | Important information is delivered too late, which may lead to delays in the project AND/OR the guideline may miss the point and is not useful for TIM | Yes | Yes | Yes | Yes | 3 | 3 | 9 | Keep the effort for the respondents at a minimum. Inform the project officer and ask him to encourage the other PEB members to respond. Make separate phone calls to reach stakeholders who didnt respond. OR: accept the lack of response and produce the guidelines with limited inputs. |
| 15 | Operational | AIT-PM | Non-quantifiable assessment of costs, risks and benefits | TIM techniques cannot be compared, because they are not quantifyably measurable. This may lead to an incomplete assessment only based on qualitative performance of TIM techniques | Yes | No | Yes | Yes | 2 | 2 | 4 | |
| 16 | Operational | AIT-PM | Non-objectives and scope become unclear | Misunderstandings within the project team, without regular communication, WP subteams may work in the wrong direction, i.e. out of the scope | Yes | Yes | Yes | Yes | 2 | 2 | 4 | Clearly define the scope in the inception report. The coordinator always keeps the project in scope and recognizes deviation. Discuss possible scope changes, e.g. due to inputs from the PEB, within the team. |

Figure 6: PRIMA risk register

# 4 Collaboration plan with the other CEDR projects

It is of great importance to foster collaboration between the three projects funded in the CEDR 2013 Traffic Management call, namely

- **PRIMA** (Pro-Active Incident Management) in objective “Incident Management”,
- **METHOD** (Management of European Traffic Using Human-Oriented Designs) in objective “Human Factors in Traffic Management” and
- **UNIETD** (Understanding New and Improving Existing Traffic Data) in objectives “Implementation of Innovation in Traffic Management”.

The following two sections describe in detail the projects METHOD and UNIETD, along with their

## *4.1 METHOD project summary*

| | |
|---|---|
| **Acronym** | METHOD |
| **Duration** | 04/2014 – 03/2016 (24 months) |
| **Coordinator** | Dr. Nick Reed, TRL, UK, nreed@trl.co.uk |
| **Partners** | SWOV, The Netherlands |
| | VTT, Finland |
| | TNO, The Netherlands |
| | TML, Belgium |
| **PEB project manager** | Henk Schuurman, The Netherlands, henk.schuurman@rws.nl |

The METHOD (Management of European Traffic Using Human-Oriented Designs) project specifically addresses Objective 3: Human Factors in traffic management, in the Description of Research Needs (DoRN), in its entirety. It is understood that this programme of work is intended to develop a human factors perspective on traffic management measures, in order to get more out of existing and future measures taken by the national road administrations in terms of higher throughput and traffic safety.

Objective 3 is broken down into three component parts, which will be addressed as follows:

- Analysing road user needs and behaviours in relation to traffic management measures
- Conducting an inventory of current practices and experiences in European countries
- Assessing the effectiveness of traffic management measures from a human factors perspective (results to be written in thorough report)
- Producing an appealing, functional and useful guidance booklet that will present key lessons learned, international tips and tricks (Europe-centric) and recommendations that will be practical and of assistance for Traffic Management operatives, all from the perspective of human factors

Part 3.2 ‘Human factors framework’ will be addressed by:

- Reviewing the results of the feed-in project to be conducted in response to Objective 1 of the DoRN: ‘Incident Management’
- Reviewing best practice in traffic management operations

- Creating a human factors framework for traffic management professionals that will assist in the introduction of human factors right from the start in future applications of traffic management

Part 3.3 'Human Factors field trials and/or simulator studies' will be addressed by conducting two simulator studies (one in the Netherlands and one in the UK). These will explore new or additional ways to communicate with road users in order to get more insight in human factors in traffic management.

Throughout the project as a whole, special attention will be given to measures taken across Europe in order to understand the issues arising from, and obstacles to, harmonisation and interoperability. Results will be disseminated to traffic management professionals and the wider scientific community to ensure a lasting legacy and benefit from the project.

The team assembled to undertake this project is led by TRL (UK), in partnership with SWOV (Netherlands), VTT (Finland), TNO (Netherlands) and TML (Belgium-Flanders). The project team comprises research institutes and academic institutions with demonstrated expertise in the subject areas, including: human Factors, traffic management and driving simulators.

The TRL project manager has confirmed with the CEDR METHOD project that a collaborative and sharing approach in the two projects is beneficial to all parties involved.

## *4.2 UNIETD project summary*

| | |
|---|---|
| **Acronym** | UNIETD |
| **Duration** | 04/2014 – 06/2015 (14 months) |
| **Coordinator** | Dr. Ian Cornwell, Mott MacDonald Ltd., UK, ian.cornwell@mottmac.com |
| **Partners** | nast consulting ZT GmbH, Austria |
| | TRANSVER, Germany |
| | University of Leeds, UK |
| **PEB project manager** | Ben Catchsides, UK, Ben.Catchesides@highways.gsi.gov.uk |

The project "UNIETD" (Understanding New and Improving Existing Traffic Data) addresses "Innovative traffic management measures" stated in the Traffic Management DoRN of the CEDR 2013 call. The end goal is to improve the efficiency of road travel by providing better information to drivers and road operators. The UNIETD project supports that goal by addressing several of the innovations identified in the DoRN within a single coherent project.

The quantity, quality and potential of traffic data and information services based on mobile devices has increased and road administrations are now facing the question whether to build and operate their own detection infrastructure, to buy external traffic data or information, or both. However there are no standard methodologies or software tools available to allow the road administrations to efficiently check for themselves the quality of the traffic data and information based on mobile devices.

The primary objective of UNIETD is to guide the national road administrations' use of third party data such as crowd sourced / social media and floating vehicle data in place of traditional infrastructure-based techniques. The more detailed objectives of the project are:

- To develop, implement and test methods for quality assessment of traffic data and services based on mobile devices;
- To understand the potential of social media analysis for traffic management, through assessing relevance, penetration rates, and business models;
- To understand the implications of these new data sources and quality results for established techniques for data fusion and short-term traffic prediction, to support traffic management decision-making.

The UNIETD methodology has been designed to address multiple linked objectives by incorporating them in a single coherent project. A review of the state-of-the-art of traffic data and traffic management requirements will support research on both quality assessment of traffic data services and social media. Building on recent work of the partners, the project team will develop methodologies for quality assessment of floating vehicle data services, implement them in a software toolkit and then evaluate them through on-road tests in multiple European countries. Also building on current research, they will assess the traffic management potential of information that can be harvested from social media, looking at relevance, penetration rate and business models. The findings of these two major research packages will then be used to update the state-of-the-art in data fusion and short-term prediction. Finally the recommendations from each activity will be grouped, refined and disseminated thoroughly amongst road administrations and their suppliers.

The project partners have the necessary range of experience as researchers and implementers in multiple countries to be able to understand and address issues and risks and deliver valuable transnational research results. Mott MacDonald and nast consulting have brought together a team with members at the forefront of recent developments – TRANSVER for quality assessment of mobile-derived traffic data, University of Leeds for harvesting social media, Mott MacDonald for short-term prediction and fusion. The wider experience of the team in traffic management in multiple European countries will help ensure the research remains focussed on traffic management needs and delivery of transnational benefits.

## *4.3 Collaboration actions to be taken*

Table 1 shows the links between the two projects and PRIMA and which actions can be taken to avoid duplicated work and to use synergies.

Table 1: Links and collaboration between CEDR projects in Traffic Management

| Project | Link to PRIMA | Actions for collaboration |
|---|---|---|
| METHOD | Deals with human factors; The relevance for PRIMA could be the acceptability of drivers for certain TIM techniques. | • TRL stays in contact with the project coordinator Nick Reed<br>• Set actions in the PEB meetings |
| UNIETD | A review of traffic management measures is performed in both projects.<br>One of the objectives of UNIETD is closely linked to Task 3.2, because third party data (e.g. FVD) will be assessed. | • Exchange/share review results and literature on traffic management measures<br>• Define common assessment procedure for novel technologies that are addressed in both projects.<br>• Set actions in the PEB meetings |

# 5 Final remarks

The PRIMA project will deliver practical and cost-effective procedures on TIM, involving traditional as well as innovative techniques, to achieve pro-active incident management that can reduce the risk of secondary accidents, reduce response and clearance time, as well as increase responder's safety and overall road safety.

An important aim of this project is to further implement the results. This will be ensured by maintaining an active involvement with the stakeholders throughout the whole duration of the project. The discussion with the stakeholders will start in Task 2.1, when a first consultation will be held to find out what are the most relevant incident scenarios and techniques to consider in our project. The aim is to find a common set of incident scenarios, which will address most stakeholders' needs.

Consultations with the stakeholders will continue along different phases of the project, concluding with the design and format of the PRIMA guideline. It is paramount that the outputs of this project will be usable. Therefore, the guideline will be designed, with the stakeholders' inputs, in a way that will ensure its applicability among CEDR member countries, as well as ensure a high degree of dissemination.

A secondary aim of PRIMA is to foster a successful collaboration with the other projects in the CEDR programme topic "Traffic Management". While, the projects METHOD and UNIETD address different objectives, links could be identified. It is PRIMA's objective to maintain an open line of communication with the other projects, in order to exchange lessons learnt, provide/receive research results and to avoid duplication of work.

# 6 Acknowledgement

The work presented in this report was carried out as part of the CEDR Transnational Road Research Programme Call 2013. The funding for the research was provided by the national road administrations of Belgium-Flanders, Denmark, Finland, Norway, UK and Netherlands.