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REPORT

**D2.2: Report on introduction strategy for safe eco-driving
training programmes**

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Advanced Training and Education for Safe Eco-driving of Clean Vehicles



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1) Introduction

This report presents the introduction strategy for safe eco-driving training programmes for clean vehicles in the course of the ACTUATE project.

ACTUATE focuses on the importance of safe eco-driving of clean vehicles and provides public transport operators with the opportunity to introduce and test safe eco-driving trainings. Starting from the principle functions of clean vehicles, ACTUATE develops training materials and raises awareness about the role of drivers in improving the environmental performance of vehicles. Besides technical improvements, the correct vehicle handling in terms of safety and eco-driving has a distinctive influence on both aspects the environment protection and the economics due to energy savings and optimised operation costs.

It's a general expert opinion that eco-driving in terms of skills of vehicle handling and driver behaviour as measure for environment protection will gain in importance in the future (ACTUATE expert questionnaire result progress; in progress).

Therefore, the safe eco-driving training programmes of ACTUATE shall raise awareness for the knowledge, skills and competencies necessary to perform safe eco-driving as a professional driver of the clean vehicle types tram, hybrid bus, trolleybus or ebus equipped with supercapacitors.

The following report describes the strategy how to introduce safe eco-driving training programmes for clean vehicles at public transport operators.

How to use this document?

This report is addressed to other public transport operators or driving schools who wants to introduce a safe eco-driving training programme for their clean vehicles. It describes an introduction procedure, compiled on the basis of ACTUATE's project partner's expertise and input, considering three different levels of determining factors: 1) Human Resources Development, 2) Management of Change and 3) Personnel and Labour Policy.

Furthermore it provides a generic approach for implementing safe eco-driving training programmes for clean vehicles along the phases 1) Design, 2) Introduction 3) Pilot and 4) Roll-out.

This document is aimed at those responsible for developing and implementing training programmes at public transport operators, like personnel officers, driving instructors and those responsible for Human Resource Management (HRM) and strategic planning.

2) Background

The arrival of alternative and clean fuels, new and renewed vehicle technologies (CNG, electricity, hybrid etc.) helps reduce energy consumption, greenhouse gas emissions and noise pollution. These new technologies require adaptation of how to use them in the best way. Professional driver training has to consider and to react on these new technologies and other changes in the work organisation.

Consequently, the introduction of new clean vehicles, like hybrid buses or trolleybuses, is accompanied by increasing demands into the qualification of professional drivers concerning driving behaviour or new safety standards. But, so far no specific requirements and vocational/further trainings for safe eco-driving of clean vehicles exist (so far only eco-driving training programmes for diesel buses exist and with regard to workshop/maintenance safety regulations)¹.

With the Directive 2003/59/EC on the initial qualification and periodic training of drivers of certain road vehicles for the carriage of goods or passengers², which came into force in September 2008, the training situation for drivers employed at public transport companies in the EU-27 improved, as all companies offer trainings for their drivers. This Directive requires compulsory ongoing training to be provided (35 hours per 5-year period).

The directive identifies eco-driving as a mandatory further education module³ and due to its strategic relevance for public transport operators in terms of economic operation of their diesel bus fleets, more than three fourth of public transport operator companies train their drivers in eco-driving (as per UITP's observatory of employment in public transport 2012

¹ Besides the introduction of a new clean vehicle by the manufacturers (which varies from several hours to several days).

² The directive 2003/59/EC of the European Parliament and the Council of 15 July 2003 on the initial qualification and periodic training of drivers of certain road vehicles for the carriage of goods or passengers, amending Council Regulation (EEC) No 3820/85) regulates basic and continuous (vocational) training for professional drivers in EU-27.

³ Eco-driving is part of the list of subjects of minimum qualification and training requirements (Annex I) of EU-Directive 2003/59/EC.

among more than 40 public transport companies from 18 EU-countries; see figure 1).

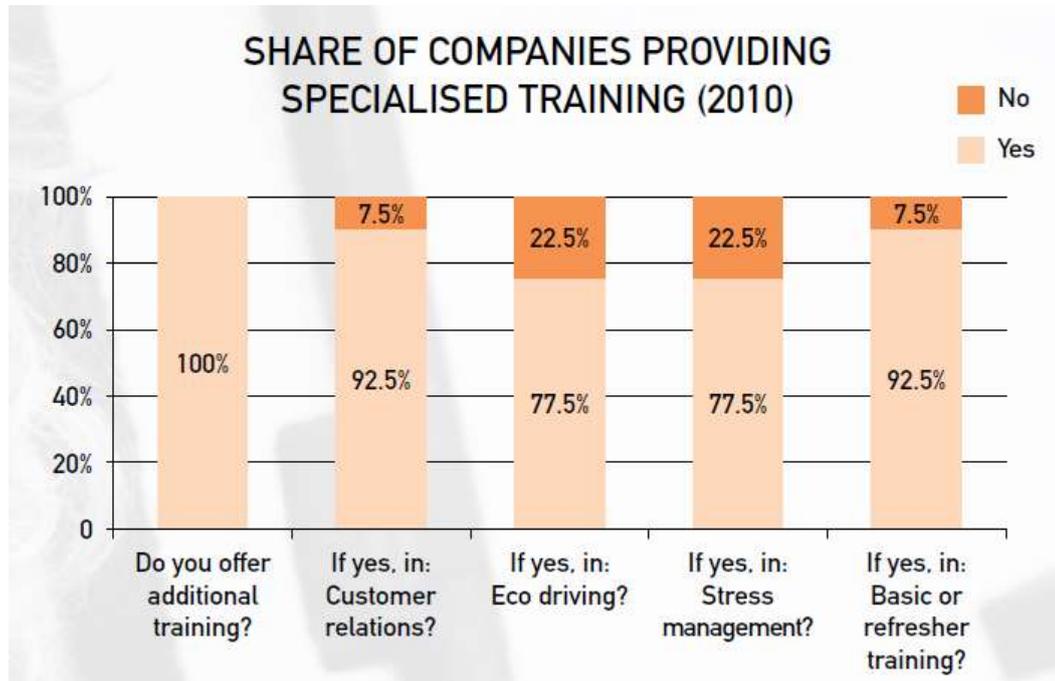


Figure 1: Main topics of training provided by PT operators (UITP 2012)

This mirrors the general expert opinion that eco-driving in terms of skills of vehicle handling and economical orientated driver behavior, also as measure for environment protection, will gain in importance in the future (ACTUATE: Deliverable D3.1: in between-result report on DELPHI expert interviews with 16 experts on clean vehicles and education of professional drivers (publication in progress)).

In response to the introduction of new clean vehicles and technologies, the ACTUATE partners therefore develop safe eco-driving training programmes to bridge the existing gap of non-availability of eco-driving trainings for these (new) clean vehicles like trolleybuses or hybrid buses. By this, ACTUATE matches (clean vehicle technology) market and skills needs.

Highly skilled drivers are necessary to exploit the (new) clean vehicle technologies in an optimised way and to realise the energy efficiency of these technologies maximising the impact of the investment into such (new)

clean vehicles. But due to the missing training options for safe eco-driving of clean vehicles, there is still a considerable difference between the level of driving performance required to successfully exploit the (new) clean vehicle technologies and the actual skill levels in the driver's workforce.

Thus, the purpose of the development of the safe eco-driving training programmes in the course of the ACTUATE project, is to close the skills, knowledge and competencies gaps - which were analysed during the proposal stage by the ACTUATE partners - between "what should be" and "what is" the driving behaviour of the driver's workforce regarding the ability to optimise energy (diesel fuel) consumption of (new) clean vehicles.

The introduction of safe eco-driving training programmes at public transport companies is thus of strategic relevance, involving the human resources development of drivers, which represents the majority of the staff in public transport companies⁴, and also the management level and the personnel and labour policy of the company. The safe eco-driving trainings of clean vehicles make the link tangible and demonstrate the direct relationship between technology direction (clean vehicle technologies) and the learning/training needs (of drivers of newly introduced clean vehicles).

Therefore, it is of particular importance to involve the different levels of (internal) determining factors: 1) Human Resources Development, 2) Management of Change and 3) Personnel and Labour Policy from the beginning to ensure sustainability of the introduction of safe eco-driving training programmes for clean vehicles.

⁴ As per UITP's observatory of employment in public transport report 2012, drivers account for between 61 and 74% of the total staff in companies which operate only one transport mode (bus or tram).

3) Determining factors for the introduction of safe eco-driving trainings

Based on the experiences of the ACTUATE partners and external stakeholders involved in the expert survey (DELPHI process) in the course of the project, a matrix of levels of (internal) determining factors at public transport companies and activities of relevance for the introduction of safe eco-driving training programmes has been developed. The matrix is exemplary and includes the most important levels of determining factors and relevant areas of activities from the ACTUATE partner's point of view and will be updated on experiences and lessons learned by the partners during the introduction process of safe eco-driving training programmes for drivers of clean vehicles.

	Data Monitoring and Analysis	Safe Eco-Driving Trainings	Communication and Consultation	Best Practice Exchange
Human Resources Development	Performance monitoring, potential assessment with regard to target corridors	Minimum quality criteria and EQF-based learning outcomes	Debriefings, in-house motivation campaigns	ACTUATE Network ↓ Lessons learned/ Standardisation
Management of Change	ISO-certifications (e.g. environment, quality, energy)	Group incentives, participation & empowerment (e.g. multiplier task)	Kick-off workshops, awareness raising	
Personnel and Labour Policy	Employer/ works council agreement	Consideration of Directive 2003/59/EC	Consultation of the works council	

Figure 2: Matrix structure for the introduction of safe –eco-driving training programmes for drivers of clean vehicles

In the following the main area of activities for the introduction process of safe eco-driving training programmes for drivers of clean vehicles will be described. The order of the description of these areas of activities has no relevance for the chronology of the implementation approach of safe eco-driving training programmes at a public transport company (see chapter 4 for a four-phase implementation approach).

Data Monitoring and Analysis

Before starting the development of a safe eco-driving training programme the responsible persons for *Human Resources Development* should have notice of the actual energy consumption related to the operation of clean vehicle fleets like trolleybuses or trams. Therefore, a monitoring of the energy consumption is a precondition to start eco-driving initiatives, as the actual energy consumption rates build the baseline against which improvement, thus, reduced energy consumption through a trained eco-friendly driving behaviour could be monitored/measured. The profound knowledge about actual energy consumption related to the drive train of a clean vehicle is basis for the formulation of targets, what wants to be reached by the safe eco-driving trainings. E.g. in terms of reduction of energy consumption a target corridor, for example reduction of diesel fuel of hybrid buses through eco-driving between 5% and 10%, could be set as the overall goal of the eco-driving initiative.

This needs generally technological knowledge and technical support by the engineering department of public transport company installing the hard- and software needed and to readout the monitored data.

Therefore, the matching equipment for monitoring the energy consumption should already be part of the tender process purchasing new clean vehicles and infrastructure needed to operate these. The polish trolleybus company PKT Gdynia for example is introducing safe eco-driving trainings for their trolleybus drivers as part of a wider modernisation strategy. Already, PKT has installed technical equipment to measure the energy consumption of single vehicles/ drivers and at power substations. The data, which has been

collected, will be analysed and in a second step used to localise sectors of Gdynia's trolleybus network with above average energy consumption. By using the built-in on-board cameras of their trolleybuses, PKT will then produce educational video clips that help their drivers to apply safe eco-driving techniques for precisely these sectors and routes.

A commitment from senior-level management must be a driving force for the introduction of safe eco-driving training programmes for clean vehicle drivers, as this initiative is not simply introducing training programme, but a **Management of Change** process related to the behavioural change of the drivers workforce and the learning culture of the company as well as regarding the alignment of corporate goals and management strategies. The eco-driving initiative should be integrated into existing management strategies, e.g. ISO certifications for environmental management (ISO 14000) or energy management systems efficiency (ISO 50001) could be improved by the safe eco-driving initiative and become part of the company's energy management plan.

The data monitoring of energy consumption shouldn't be misused for the purpose of controlling the single drivers driving performance. The work load and stress level is already higher-than-average for bus or tram drivers, leading for example to a high status of employee's illness of 10% of professional drivers employed at public transport companies in Germany (Hans Böckler Stiftung 2012). The most important parameter for the work load of the drivers workforce are the drivers working hours, which have been increased over the last years and turn over times have been reduced to the statutory absolute minimum leading to the situation that in cases of delays, these buffer and idle times for the drivers are even shorten or fall away completely (Hans Böckler Stiftung 2012). The first evaluation results of the safe eco-driving trainings for hybrid buses in Leipzig for example demonstrate the diesel consumption could be reduced by 5% of the hybrid bus' diesel consumption, but the eco-driving of hybrid buses led to a delay in the timetable of 5 to 10 minutes in average, which would result in an even higher stress level for drivers. This dilemma, as a result of the training's

evaluation, should be addressed by the management level involving also the works council (and maybe drivers) discussing possibilities of **personnel and labour policies** how to implement a reward system for safe and eco-friendly driving performance rather than a controlling system. Two thirds of the surveyed public transport companies by UITP's observatory (UITP 2012) make already use of surveys on driver morale, appraisal systems or offer official recognition. Furthermore, 40% of the polled companies organise competitions related to best driving performance.

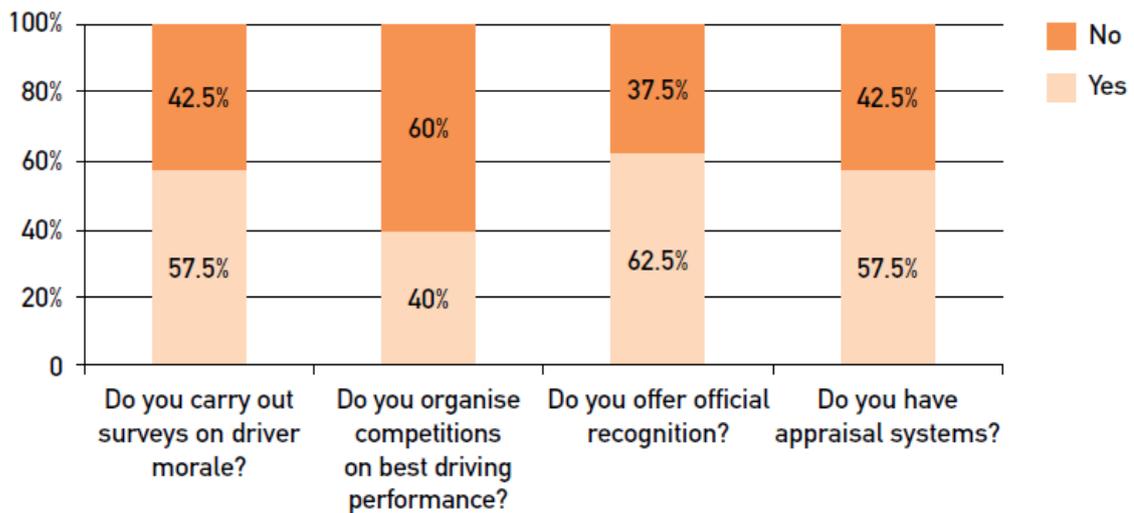


Figure 3: Reward systems by PT operators (UITP 2012)

By this, the social innovation “eco-driving training programmes” becomes a driver for the change of economic processes in the company (e.g. new bonus systems based on reduced energy consumption and costs) and the costs for setting up such a training programme shall be based on cost savings for energy due to this social innovation.

Safe Eco-Driving Trainings

The introduction of safe eco-driving trainings is based on several input- and output-related factors. On the one hand there are input-related factors like financial resources, legal regulations (e.g. through the implementation of the

Directive 2003/59/EC; in Germany for example the "Berufskraftfahrer-Qualifikations-Gesetz" (BKrFQG)) and training regulations or existing number of personnel in the field of human resource development, which influence the **personnel and labour policy** of a public transport company or is conditioned by it. For example, eco-driving is part of the list of subjects of minimum qualification and training requirements (Annex I) of EU-Directive 2003/59/EC on the initial qualification and periodic training of drivers and could be seen as an entry point for introduction and standardisation of safe eco-driving training for clean vehicle drivers (e.g. in Germany eco-driving is a mandatory subject of the periodic training of drivers due to the BKrFQG), so that national authorities acknowledge the validity of the training programmes.

But, different national implementation approaches of EU-Directive 2003/59/EC do not lead to a common level of initial qualification or training quality and professional drivers' abilities. Therefore, further input-related process factors and output-related factors are necessary and should be defined by the **Human Resources Development** department/involved persons to reach a sufficient level of training quality. Process-oriented input factors are related to didactical concepts and teaching methods, e.g. frontal or group learning settings or share of practical training parts during a training session. The ACTUATE partners agreed on Kolb's learning cycle as the main educational principle (Kolb 1984), which supports an experience-based learning approach meaning that learning is relating to or resulting from "own" experience.

Therefore, the ACTUATE partners integrated a practical session as a basic part of the trainings to let the participating drivers experience the newly-learned driving style. To experience the difference and the impact of the new safe and eco-friendly driving behavior, each driver should have two short practical driving sessions to enable a comparison between the "old" driving style and the "new" eco-friendly driving style. The first ACTUATE pilot trainings for trolleybuses and hybrid buses showed already that the biggest

“aha-experiences” linked to the learning effect during the first ACTUATE trainings for safe eco-driving were achieved during the practical sessions.

The output-related factors describe “learning outcomes”, thus what skills, knowledge and competencies will the drivers have gained through the training. The learning outcomes are preferentially defined in these three categories “skills”, “knowledge” and “competencies” as suggested by the European Qualification Framework (EQF). More information about the “European Qualifications Framework for Lifelong Learning” are available at: http://ec.europa.eu/eqf/documentation_en.htm.

The ACTUATE partners defined jointly input- and output-related factors as minimum criteria and learning outcomes for the development of the safe eco-driving training programmes. The minimum criteria and learning outcomes for the ACTUATE trainings can be seen via ACTUATE’s website: <http://www.actuate-ecodriving.eu/index.php?id=22>.

Furthermore, the introduction of safe eco-driving trainings could lead to a higher level of participation and empowerment of the driver’s workforce. As the job of driver normally offers limited career development opportunities, different new options of career management can be planned and organised in a **Management of Change** process. For example becoming a multiplier (status of a “driving tutor”) for the transfer and dissemination of training content to drivers during regular line operation, like it is planned for the ACTUATE partners LVB and LAB from Leipzig, or managing a group of drivers in the framework of the training programmes. Such internal promotion forms like guidance and support by multipliers or other learners are vital to get a collective view on the key learning and development issues addressed through the safe eco-driving training programme.

Communication and Consultation

Consultation of the driver’s workforce, e.g. of a few chosen drivers, at an early stage of the introduction process can lead to a feeling of “shared

ownership” of the training programme and can result in greater commitment to its implementation. Furthermore, a constructive feedback communication on the driver’s performance with regard to safe eco-driving by a driving instructor or mentor/multiplier staff as part of the training programme should be integrated on a continuous basis (at the best) by the ***Human Resources Development*** personnel.

To sustain the training effect with regard to an eco-friendly and economic driving behaviour in the long-term, an in-house (motivation) campaign, targeted at the driver’s workforce, could be implemented as additional measure. The ACTUATE partners developed different concepts for in-house campaigns ranging from poster campaigns and drivers championships to green licence with a bonus point system (as incentive system). Experiences made by the ACTUATE partners with these different concepts for in-house (motivation) campaigns will be described in the final lessons learnt brochure of the project.

Furthermore, informal, self-managed and self-paced on-the-job eLearning options could be offered as part of the ***Human Resources Development*** strategy for the topic safe eco-driving. The ACTUATE partners will develop simple non-interactive eLearning resources like short Power Point presentations, documents with photos from ACTUATE partner cities and experiences made with safe eco-driving trainings or formats like a short quiz etc. These eLearning resources shall have an “edutainment” (as mixture of education and entertainment) character and will be provided via web-based access on computers, e.g. in the break rooms of the driver’s workforce. The ACTUATE partners will evaluate the use (via the possibility to track learner’s access to the web-based eLearning resources) and acceptance of these simple eLearning resources. The results will also be described in the final lessons learnt brochure of the ACTUATE project.

The senior management level of the public transport company should promote and communicate a learning culture among the driver’s workforce as part of the ***Management of Change*** process when introducing a safe

eco-driving training programme. This senior management “engagement” is critical to the effective implementation of the safe eco-driving training programme as the management level should set the overall aim of the training initiative and also raise awareness for it, e.g. through a company-wide kick-off communication or the participation of decision makers at a safe eco-driving training during an early implementation phase of the training programme.

The consultation of the works council should be realised at an early stage and should become part of the ***personnel and labour policies*** when introducing a social innovation like the safe-eco driving training. The eco-friendly and economic driving of a clean vehicle goes hand in hand with more responsibility, but also empowerment, and could lead, in worst case, to more stress than before, if the dilemma of eco-driving style and keeping the time table won't be solved on management level. The consultation of the works council might lead to a higher “open mindedness” of the driver's workforce for changes in their field of work. And in case of energy consumption savings (which is a matter of money for the public transport company), new options for welfare programmes for the driver's workforce could be discussed and initiated as part of a participation and empowerment strategy of ***personnel and labour policy*** of a public transport company.

4) Implementation approach

In the following an implementation approach for the introduction of a safe eco-driving training programme for drivers of clean vehicles is described. The approach is based on experiences made by the ACTUATE partners so far and on conclusions drawn during discussions among the partners.



Figure 4: Implementation phases and relevant activities for the introduction of safe eco-driving training programmes

Design Phase

While not everyone in the company needs to be involved in the introduction process a core working team of relevant actors (e.g. driving instructors, personnel developer, technician) for the implementation process should be built. Roles and responsibilities should be identified among these members and reporting arrangements – to the senior management level at best –

should be established. Furthermore, first basics like organisation (e.g. the provision of training rooms and training vehicles) and structure of the trainings incl. minimum criteria and prioritised training needs and learning outcomes (see above) and resources needed for the introduction process should be clarified.

The core team should discuss the identified training learning and development needs with the management level and the driver's workforce before agreeing on a learning plan or training concept. The concept should be consistent with the legal regulations (e.g. through the implementation of the Directive 2003/59/EC; see above) and training regulations.

Finally, the current energy consumption should be identified during the design phase and used as a base line for setting-up a target corridor and an appropriate evaluation approach for the later phases.

Introduction Phase

Main activities during the introduction phase, besides the development of the training material(s) based on defined minimum criteria and learning outcomes, should be the early communication of the training initiative – at best by the senior management level (see above - and the involvement of (selected) drivers into the development process to get feedback on wordings of the training material to make the training material more understandable (in particular for drivers with foreign mother languages).

For the training of the driving instructors regarding the content and methodology of the new training programme a "train-the-trainer" concept should be realised and the implementation of necessary legal requirements should be checked.

Furthermore, the needed hard- and software should be purchased/provisioned and implemented to start with test series regarding the influence of the driving style on new and more effective clean vehicle technologies like for example "supercaps" or the hybrid technology.

Therefore, also the choice of an appropriate test route, on which eco-driving effects become obvious (under highest possible real life conditions), is very important.

Pilot Phase

The aim of the pilot phase is to test a full workable training session in a sense of a "final rehearsal". This pilot test training should be carried out with representatives from the (senior) management level and selected drivers, who should be widely accepted and experienced at best. This will support communication about the benefits of the safe eco-driving training and hopefully the training will become already a "success story" in the "office grapevine".

A detailed and comprehensive feedback from the participants is important after the planning, organisation and implementation of the pilot training. Each pilot training should give opportunities to practice the eco-driving style, to assess comprehension of the training material and to document the progress in terms of energy savings reached by the drivers during the training. Also the feedback/evaluation template should be tested at the end of the pilot training.

The feedback of the pilot trainings should give information about the following aspects (according to the four levels of evaluating training programmes by Kirkpatrick (1994)):

- How well did the drivers/participants like the training?
- What did the drivers learn? (feedback about the extent to which the drivers gained "knowledge" and "skills" as learning outcomes of the training; the level of "competencies" as learning outcome of the training will be evaluated in the long-term assessment/evaluation as the capability to perform the newly learned skills in terms of "safe eco-driving" while on the job and will be based on the question: What

changed in the (eco-)driving performance of the drivers as a result from the safe eco-driving training?)

- What are the tangible results of the training in terms of reduced energy consumption? (based on data collection)

The feedback to these aspects should be reviewed and the training should be adopted afterwards, if necessary, and configured for the roll-out phase.

Roll-out Phase

Having developed the final training for safe eco-driving, the training need to be put to use and can rolled-out. Main activities during this phase are measuring the performance indicators to help assess the specific impact of the training and communication to the driver's workforce who will be affected by the training (see above). The main task during this phase will be the monitoring and responding to difficulties during the implementation of the training programme (e.g. related to negative feedback about the training quality or problems with the measurement equipment) to enhance and optimise the safe eco-driving trainings for clean vehicle drivers.

It is important to review possible implementation risks beforehand and to allocate sufficient resources to provide appropriate response capacity, including the worst-case option to pause or roll back the implementation of the training programme if serious difficulties emerge.

Note: This report on introduction strategy for safe eco-driving training programmes will remain a 'living' document and will be updated periodically during the project, as the fine tuning of the document will follow up after first experiences made by the ACTUATE partners during the implementation of the different phases of the ACTUATE introduction strategy.

5) List of references

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