ICT-INEX Project

Deliverable 6 (IO3) version EN Guidelines for the integration of SBT with other methods of PD candidate training

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Deliverable:

Abstract: This report provides a summary of all the activities covered in the document Intellectual Output 3. The output will result in the development of structured guidelines for the integration of simulator-based training (both high-end and low-end) with other methods of PD candidate training.

The results will be designed according to the following steps:

- Analysis of state-of-the-art methodologies implemented in various simulator-based training techniques

- Evaluation of the quality of the training process during simulator-based training combined with other training tools

- Development of a training program which is based on the use of a variety of driving simulators and which involves pilot training that combines selected training techniques

- Analysis of the training results and the development of the methodology of simulator-based training combined with other training tools in the context of maximising the transfer of knowledge and skills as well as minimising stakeholder costs

- Development of an instructor competency profile and a training management system which introduces the approach of combining training tools and techniques in simulator-based training

- Development of legal and organisational recommendations for conducting effective, low-end simulator-based training in combination with other training techniques

- Analysis of the results and development of the recommendations for the integration of simulator-based training with other methods of PD candidate training

- Development of final guidelines for the integration of simulator-based training with other methods of PD candidate training

The deliverable is divided into three distinct parts. The first part introduces the theoretical description of VR technology, its vocational implementations and its potential to be implemented in professional driver training. The second part presents the results of all the piloting activities conducted during the project in Poland and Finland. The third part presents the final recommendations for implementing and combining VR-based training with other ICT-based training tools and methods.

Disclaimer

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Glossary

SBT	Simulator-based training
CBT	Computer-based training
VR	Virtual Reality
AR	Augmented Reality
High-end	High-level, large traditional vehicle body simulator (motion platform included)
Low-end	Light, easily movable (or entirely mobile simulator – usually without motion platform and vehicle body)

Summary

The study contains guidelines that present the methods for integrating existing driver training methods with low and high-class simulators. The results of pilots that combine selected teaching techniques in the project's participating countries have been presented.

The output will result in the development of structured guidelines for the integration of simulator-based training (both high-end and low-end) with other methods of PD candidate training.
The results will be designed according to the following steps:

- Analysis of state-of-the-art methodologies implemented in various simulator-based training techniques
- Evaluation of the quality of the training process during simulator-based training combined with other training tools
- Development of a training program which is based on the use of a variety of driving simulators and which involves pilot training that combines selected training techniques
  Analysis of the training results and the development of the methodology of simulator-based training combined with other training tools in the context of maximising the transfer of knowledge and skills as well as minimising stakeholder costs
- Development of an instructor competency profile and a training management system which introduces the approach of combining training tools and techniques to simulator-based training
- Development of legal and organisational recommendations for conducting effective, low-end simulator-based training in combination with other training techniques
  Analysis of the results and development of the recommendations for the integration of simulator-based training with other methods of PD candidate training
- Development of final guidelines for the integration of simulator-based training with other methods of PD candidate training.

1. Introduction

1.1 ICT-INEX Project

The main goal of the ICT-INEX project is to increase the accessibility and effectiveness of PD training with the use of ICT-based tools. This goal will specifically be oriented towards particular disadvantaged target groups on the labour market such as young unemployed people (up to the age of 29 years) described under the term 'NEET', older long-term unemployed people (over 50 years) and immigrants from outside of the EU. In addition to this, a special focus is placed on innovative training methods, such as virtual learning or the application of augmented reality and gamification. During the project, a coherent model of training for professional drivers will be developed taking into account e.g. legal and social-economic requirements raised in the partner countries and at an EU level.

1.2 Description of the work

In this section of the project, the goal was to:

- Analyse different techniques of simulator training that are in use

- Assess the quality of the training process during simulator-based training combined with other training tools

- Develop various training programs based on driving simulators and implement pilot training that combines selected training methods

- Analyse training outcomes and develop a methodology where simulator-based training is combined with other training tools to maximise knowledge transfer as well as to minimise stakeholder costs

- Develop the instructor competency profile and training management system which introduces the approach of combining training tools and techniques with simulator training

- Develop legal and organisational recommendations for conducting effective, low-end simulator-based training in combination with other training techniques

- Analyse the results and development of recommendations for the integration of simulator-based training with other methods of PD candidate training

- Develop the final guidelines for the integration of simulator-based training with other methods of PD candidate training.

1.3 Structure of the deliverable

This output initially involved the implementation of state-of-the-art analysis. The analysis focuses on how different simulator-based training (SBT) methods are implemented in partner countries, how SBT is combined with other training tools (in which PD candidate programs and which topics, are there variations between the three different disadvantaged groups vs. ”normal” groups) and the quality of the training process during SBT combined with other training tools (knowledge transfer, maximisation of skills and minimisation of stakeholder costs). We will also specify the instructor competency profile. In addition to this, we will review the management of the education system.

The second section includes the development of a training program based on the use of a variety of driving simulators. The topics we selected for the pilots are specified as well as how we developed the curricula for the pilot and how we planned the evaluation of the quality of the pilot training carried out for the three selected disadvantaged groups.

The third section is dedicated to the setup of the pilot training and the fourth section covers the results obtained from the pilot trainings organized in Poland and Finland.

The fifth section involves the analysis of the obtained results including the transfer of the knowledge, maximisation of skills, minimisation of stakeholder costs, instructor competence and the support of the training management system.

The last section comprises the recommendations on how to efficiently combine SBT with other training methods, including the specific national contexts of the project’s partner countries.

2. State-of-the-art analysis

The state-of-the-art analysis focuses on how the different simulator-based training (SBT) methods are implemented in the ICT-INEX partner countries, how SBT is combined with other training tools (in which PD candidate programs and which topics, whether there are any variations between the three different disadvantaged groups vs. ”normal” groups, the quality of the training process during SBT combined with other training tools (knowledge transfer, maximisation of skills and minimisation of stakeholders costs)) as well as specifies the instructor competency profile. In addition, we shall review the management of the education system. To gather information about the implementation of different simulator-based trainings with other methods of PD candidate training, we prepared a questionnaire. By implementing this questionnaire, our aim was to collect material for a guide dedicated to industry members which will indicate the current state of PD candidate training in Europe while taking into account the ICT context and the situation of the end users in this sector of the labour market.

We asked the respondents to fill in the questionnaire by referring to their national context. For sources of information and methods of research they were invited to use desk research and brief expert interviews as well as their own expertise.

The questionnaire included three different sections: Common knowledge about SBT training, instructor competency profile and the quality of the training process. The entire questionnaire can be found in Annex 1: Questionnaire O3 –Development of guidelines for the integration of simulator-based training with other methods of PD candidate training, including the combination of low-end and high-end simulator-based trainings.

2.1 General information about SBT training

A short review of the use of SBT in driver training (categories C and D), initial and/or periodic CPC training and other training indicated that there are some differences in partner countries’ implementations.

In Finland, high-end and low-end simulators are used in almost all fields of driver training (categories C and D). The best results are obtained in manoeuvring and reversing, driving in the flow of traffic and measuring the students’ knowledge of traffic rules etc. Legislation is the same with high-end and low-end simulators, but the instructor must be present or able to monitor training and practical training in real time. This is the only legal way to record the practical training and calculate the number of completed driving lessons. High-end simulators are used more frequently as instructor-led sessions (the instructor guides the trainee during the simulator training session) and low-end simulators are used for more independent sessions. In initial training both simulator types are used in the same way as in

driver training, but the topics are different (defensive driving, customer service and economic driving).

In Poland, SBT is limited to initial and/or periodic CPC training. The high costs of building a skid pan encourages driving centres to purchase driving simulators instead. Since there is no legal requirement to use a skid pan for category C & D driver training, the use of SBT is considered to be too costly, especially due to the extremely high competition on the Polish market. In addition to this there are specific types of non-obligatory training such as defensive driving or eco-driving which use driving simulators. They are usually provided by the employers for the employed driver due to their relatively high cost.

In Austria, SBT is used in periodic CPC training for lorry and bus drivers and in specific training (e.g. communications for bus drivers). It is offered as an additional (more expensive) component for clients with the promise of higher quality training. Higher quality, for example, comes from the fact that the behaviour of the driver can be proved and analysed. The price for training that includes SBT is around 40% higher. SBT is mainly used for training associated with vehicle technology (theory) and for driving skill training (e.g. train accident situations). For specific training, SBT can be tailored according to customer wishes (mainly companies with high demands of quality). For example, if drivers of a company work in an urban environment or if they are often confronted with snowy streets, SBT can be adapted to these conditions. For periodic CPC, the requirements and thus the application of SBT is more pre-determined. Only one out of nine Austrian provinces explicitly allow e-learning in driver training. The main problem is to do with being able to prove the identity of the attendant in an e-learning training session. However, an upcoming new federal regulation (2019) is expected to promote ICT in driver training. Other methods (e.g. the use of motor data in eco-driving lessons) shall also be applied. In case of the target groups, specific offers only exist towards e-learning; in case of one customer, a specific e-learning module focusing on German driver terminology was implemented. According to the company's experiences, older drivers occasionally struggle with ICT applications. Gamification is considered to be an important future trend e.g. by means of testing the drivers' current competency with a quiz etc.

In this section, we also wanted to find out whether SBT is being used differently when disadvantaged groups, such as unemployed young people (≤ 29 years), long-term unemployed people (50+ years) and immigrants (incl. refugees) are trained.

We found out that in Finland training is implemented in the same way for all groups, apart from immigrants who are offered more detailed lessons with language training. In Finland, simulators are used to present the entire terminology involved in driver training from the cab to parts of the road, lane markings and infrastructure. In Poland, the performance of young (up to 29) and older (50+) drivers is assessed with the implementation of SBT training. The selected

assessment factors consider the perceptual abilities of individuals. In Austria, there is no differentiation for training disadvantaged groups with SBT.

In Poland, disadvantaged groups are trained in a number of different ways, especially in case of young people up to the age of 29 years. It is easier for them to assimilate training material and they are faster in learning ICT methods. Based on the results from Poland, older people show more determination and commitment to be trained with SBT which in turn influences the results in a positive manner. There is no differentiation when training disadvantaged groups in Finland or in Austria.

2.2 Instructor Competency Profile

The training techniques, tools and methods that focus on disadvantaged groups in the different partner groups have been specified below.

2.2.1 Training techniques and tools in Finland

Table 1: Training techniques and tools

Unemployed young people (≤ 29 years) - Have you encountered any challenges with SBT? - Have you found any solutions for these challenges? If you have solved these challenges, please provide some examples of the used methods.	Young people are the most simulator-oriented group in driver training, so we have encountered very few problems. The most common problem is the experience of the simulator training: some students are unable to experience the simulator training as "real" driver training. These problems are usually solved when the first driving lesson in a real vehicle has taken place and the student can see how the skills (learned with the simulator) can be transferred into driving a real truck or bus.
Long-term unemployed people (50+ years) - Have you encountered any challenges with SBT? - Have you found any solutions for these challenges? If you have solved these challenges, please provide some examples of the used methods.	In this group, the most common problem concerns technology: they experience the simulators as a computer, i.e. it's not a real vehicle and it cannot be used in driver training. Motion sickness is also more common than in other groups (the reason is perhaps due to eyesight). However, this group is also extremely easy to guide and will obtain better driving skills with a simulator.

Immigrants (incl. refugees) - Have you encountered any challenges with SBT? - Have you found any solutions for these challenges? If you have solved these challenges, please provide some examples of the used methods.	Similar challenges as in the other groups (young immigrants vs older immigrants)

2.2.2 The training tools used with different disadvantaged groups in Finland

Table 2: Training tools used in Finland

Are you using any training tools with SBT?			
FINLAND			
Training tool	**Unemployed young people**	**Long-term unemployed people**	**Immigrants**
Video clips Video clips: example videos for different situations where drivers can achieve lower fuel consumption levels or point out safety factors	**x**	**x**	**x**
Mobile applications			
Software Software: programs for teaching the relevant traffic legislation and orders issued by authorities	**x**	**x**	**x**
Games Games: students can learn the correct usage of the steering wheel or gear shift by playing different kinds of games (e.g. rally simulator)	**x**		
E-Learning E-Learning: The "Webauto" driver training program, in which practical legislation knowledge can be tested and practiced	**x**	**x**	**x**
Pictures			

Sounds			
Practical exercises			
VR VR: the use of a driving simulator with VR glasses (HTC Vive)	**x**	**x**	**x**
AR			
MR			
Other tools			

2.2.3 Training techniques and tools in Poland

Table 3: Training techniques and tools

Unemployed young people (≤ 29 years) - Have you encountered any challenges with SBT? - Have you found any solutions for these challenges? If you have solved these challenges, please provide some examples of the used methods	" The issues concerning this age group involve low concentration levels on the task being performed as well as a tendency to aggressive driving. Solution: Detailed discussion of the issue and the demonstration of the negative effects of aggressive driving methods. Used tool: Truck and bus driving simulator. The program includes simulations of different road conditions (variable, unforeseen situations, varied weather conditions), software to measure the driver's reaction time, simulations of different loading levels for different types of vehicles."

Long-term unemployed people (+50 years) - Have you encountered any challenges with SBT? - Have you found any solutions for these challenges? If you have solved these challenges, please provide some examples of the used methods	"The problems encountered in this age group involve the limited perception of simulation. Solution: choosing the right training program and expanding the duration of training. Used tool: Truck and bus driving simulator. The program includes simulations of different road conditions (variable, unforeseen situations, varied weather conditions), software to measure the driver's reaction time, simulations of different loading levels for different types of vehicles."
Immigrants (incl. refugees) - Have you encountered any challenges with SBT? - Have you found any solutions for these challenges? If you have solved these challenges, please provide some examples of the used methods	"Problem: language barrier. Solution: employing people who speak the immigrant's native language."

2.2.4 The training tools used with different disadvantaged groups in Poland:

Table 4: Training tools used in Poland

Are you using any training tools with SBT			
POLAND			
Training tool	**Unemployed young people**	**Long-term unemployed people**	**Immigrants**
Video clips	**X**	**X**	**X**
Mobile applications	**X**	**X**	**X**
Software	**X**	**X**	**X**
Games			
E-Learning	**X**	**X**	**X**

Pictures	**X**	**X**	**X**
Sounds	**X**	**X**	**X**
Practical exercises	**X**	**X**	**X**
VR	**X**	**X**	**X**
AR			
MR (Mixed Reality)*			
Other tools (Specify)			

With regard to the table above it can be seen that practice videos concerning driver safety have been implemented in the e-learning training software used in driver training. These training sessions also have built-in graphics in the form of drawings, photographs, and animations. The use of these tools allows the participants to access training material on their mobile devices. The use of a driving simulator involves the creation of a virtual reality on the screen where the instructor specifies the time of the year and day as well as the surroundings of the virtual vehicle and any details that would be present in everyday life. In this virtual world, the trainees learn from their mistakes in an entirely safe manner.

The above-mentioned components are selected in relation to the requirements and perception abilities of the trainees. In the group of young people, we are able to pinpoint the danger associated with over-confidence in their own abilities and their vehicles' capabilities. This is undoubtedly related to their young age, and with age older drivers become more aware of the dangers involved as well as their abilities.

2.2.5 Training techniques and tools on Austria

Table 5: Training techniques and tools

Unemployed young people (≤ 29 years) - Have you encountered any challenges with SBT? - Have you found any solutions for these challenges? If you have solved these challenges, please provide some examples of the used methods	Not available.

Long-term unemployed people 50+ years) - Have you encountered any challenges with SBT? - Have you found any solutions for these challenges? If you have solved these challenges, please provide some examples of the used methods	In the company's experience, older drivers occasionally struggle with ICT applications. Therefore, ICT is used less often for training people over the age of 50.
Immigrants (incl. refugees) - Have you encountered any challenges with SBT? - Have you found any solutions for these challenges? If you have solved these challenges, please provide some examples of the used methods	Not available.

2.2.6 The training tools used with different disadvantaged groups in Austria:

Table 6: Training tools used in Austria

Are you using any training tools with SBT ?			
AUSTRIA			
Training tool	**Unemployed young people**	**Long-term unemployed people**	**Immigrants**
Video clips	**X**	**X**	**X**
Mobile applications			
Software	**X**		**X**
Games	**X**	**X**	**X**
E-learning Only e-learning tools are tailored for disadvantaged groups (immigrants) (see above).	**X**		**X**
Pictures			

Sounds			
Practical exercises	**X**	**X**	**X**
VR			
AR			
MR (Mixed Reality)*			
Other tools (Specify)			

2.3 Quality of the training process

We looked into the issues concerning the quality of education in different countries by asking three questions.

Table 7: quality of education in different countries

Short description of the quality of the training process and how to measure it:	**FINLAND**	**POLAND**	**AUSTRIA**
When using SBT – are there any quality or efficiency indicators to guide actions?	We measure the quality with different kinds of tests (how to drive economically, how to pass the practical manoeuvring tests, how to pass driver tests etc.)	The quality of training with the use of SBT is very much dependent on the physical state of the trainee. Due to the occurrence of simulator-related motion sickness it is important to monitor the trainee's condition throughout the training session. A driver's status can be monitored by handing out a dedicated motion sickness questionnaire before and after each exercise or by simply asking the trainee about his/her condition during the exercise. A driver who completes the training in a good physical condition is much more likely to benefit from the training (a trainee is focused on completing the exercises in the simulator rather than the motion sickness symptoms).	No information on SBT training.

How are specific learning outcomes ensured?	By regularly testing driver training students.	By focusing on the parts of the training that initially achieve the worst results. Repeat parts until a satisfactory result is obtained.	For specific training, only the customer's wishes are important. For periodic CPC training, there are strict legal regulations which are obligatory for any application.
How is the minimization of stakeholder costs measured?	By making sure that all students use the simulators.	By determining the minimum time needed to achieve a positive result. This in turn can be determined on the basis of the experience gained during the previous training, obtained with different age groups and different degrees of professional experience.	The implementation of SBT training actually means an increase in customer costs. (Optional) Training that includes SBT is offered at a price that is around 40% higher than standard training.

3. Development of a training program based on the use of a variety of driving simulators

3.1 Background

In this section, we wanted to specify the simulation training -related regulations concerning driving licenses and CBT 280/140h training in different countries. This was important in order to enable the development of pilot training. See Annex 2: category C&D driver training and initial qualification training programs.

3.2 Driver training (categories C & D)

Table 8: Professional driver training C and D category

	Theory			
	C	C1	D	D1
FIN	min 12h theory; in case of B licence: 3hr theory; in case of C1 licence and previously completed CPC: 1h	min 9h theory	min 27h theory; in case of B licence: 15h theory; in case of C licence: 6h theory; in case of D1 licence and previously completed CPC: 5h	min 15hr theory; in case of B licence: 9h theory; in case of C licence and previously completed CPC: 3h
PL	- 20h of theory is the recommendation to pass the exam	-	- 20h of theory is the recommendation to pass the exam	-
AUS	min 10h theory B licence 4h theory C1 licence	8h theory, if B licence	4h theory, if C licence	8h theory, if B licence 4h theory, if C/C1 licence
	Practical			
	C	C1	D	D1
FIN	10 h practical, if B licence 5 h practical, if C1 licence 2 h practical, if CPC +25min load security training in case of every licence	5 h practical	min 40h practical, if B licence 30h practical, if C licence 15h practical, if D1 licence 10h, if CPC	15h practical, if B licence 10h practical, if C licence 3 h practical, if CPC
PL	30 h practical, if B licence		60 h practical, if B licence 40 h practical, if C licence	
AUS	min 8h practical, if B licence 4h practical, if C1 licence	8h practical, if B licence	4h practical, if D1 licence	4h practical, if C1 licence

3.3 CPC Training

Table 9: CPC training in different countries

	CPC 280/140	
	280	140
FIN	240 h theory 20 h defensive driving (min 7 h practical training) 20 h driver training	116 h theory 14 h defensive driving (min 7 h practical training) 10 h driver training
PL	20 h driver training	10 h driver training
AUS	4.5h theory, 1.5 h practical if C1/C or D licence	4.5h theory, 1.5 h practical if C1/C or D licence

3.4 Using e-learning and SBT in driver training

Table 10: E-learning and SBT in driver training

	Driver training (categories C & D)	Implementation method (if legally indicated)	Use of e-learning or SBT
PL		Classroom or virtual learning environment	The theoretical training can be carried out traditionally or by means of e-learning. The use of a driving simulator for driver training in categories C/D is not legally binding, yet some companies use low-end simulators before initiating practical training.
FI		Classroom or virtual learning environment	Possible in all topics (the learning environment is approved by authorities)
AU		Classroom learning	

Table 11: Implementation

3.5 Implementation methods

	CPC 280/140	Implementation method (if legally indicated)	Use of e-learning or SBT
PL		Theory lessons (e-learning)/Driving (Driving simulator)	Driving at the lowest and highest power ranges with fuel consumption tracking
PL		Theory lessons (e-learning)/Driving (Driving simulator)	Learning through careful braking tests in a specific area, showing the braking effect with attention to the effect braking has on driving
FI		Decision made by the training provider in case of all topics	Possible in all topics (the learning environment or simulator is pre-approved by authorities)

See Annex 2: Category C&D driver training and initial qualification training programs.

Austria has a rather liberal market in terms of PD training providers. They are free to introduce e.g. simulator-based methods of training – but only as long as the student is physically present. However, providing training modules in the form of e-learning must be accredited by the responsible ministry. In Finland and Poland where training courses are much more pre-defined, the implementation of innovative methods might require more structural changes and adjustments with the legislator.

When comparing the Finnish, Polish and Austrian legislation concerning the arrangement of education, only two topics were found that can be trained with the use of a simulator:

1. Driving at the lowest and highest power ranges with fuel consumption tracking

2. Learning through careful braking tests in a specific area, showing the braking effect with attention to the effect braking has on driving

3.6 A training program based on the use of a variety of driving simulators

Based on the background material and IO2 results above, we decided to develop a training program for driving at the lowest and highest power ranges with fuel consumption tracking. The aim of the topic was to learn by means of careful braking tests in a specific area, showing the braking effect with attention to the effect braking has on driving.
The training programs were designed in cooperation by the project partners as group work. The group work dealt with the areas of eco-driving and defensive driving. At the same time, it was considered that pilot training should be carried out for all target groups with the same training program structure, in order to observe the maximization of skills and knowledge transfer.
The curricula for the pilot carried out for the three selected disadvantaged groups were decided to be implemented in accordance with the plan presented below. The training programs were selected within the limits of the law and there was no opportunity for alternative piloting. The training program was carried out with the same program, regardless of the trainee's background. In this way, it was possible to find learning differences between the disadvantaged groups.

3.6.1 Curricula

Simulator driving: Eco-driving (urban and rural "long-haul" truck and/or bus) + Defensive driving (braking distances, braking and avoiding, braking and returning to your own lane).
Eco-driving:

1) Before driving, video clips on topics concerning incorrect performance / correct performance are played

2) Use of the low-end simulator for "personal" performance driving followed by automatically controlled exercises before completing the high-end simulator exercises.

3) Studying the e-learning material on eco-driving before completing the high-end simulator exercises (made with iSpring program?)

4) Watch the video clips covering "incorrect / correct performance" with the simulator

5) Playing games before driving (e.g. Ecodriver on Google Play), some kind of PC game?

Defensive driving:

1) Watch video clips concerning braking distances and the incorrect / correct performance of braking and avoidance

2) Practice independently with low-end simulators before completing the training with the instructor on a high-end simulator.

3) Complete e-learning exercises on the topic before driving? (What would they be?)

4) Carry out teamwork on "How does the vehicle behave during sudden braking and how to prepare for it?"

5) How to control vehicle safety devices (ABS, braking assistant, etc.)

6) Play games before driving: (Safe Driver on Google Play), or a PC game

The second objective of the group work was to form the basis of the evaluation protocol to analyse the success of the pilot training. The goal was to find out how to combine learning tools to maximize learning outcomes and knowledge transfer in different target groups. Therefore, the aim was to find the differences between the different target groups. The draft assessment report is presented below.

3.6.2 Quality of the training

In order to ensure the quality of the training, it was agreed that the pilot training should be carried out in accordance with the regulations of each country. This meant that the simulators used in the training were approved by each relevant authority, and the students participating in the training were categorised into the different disadvantaged groups.

4. Conducting the pilot training by combining selected training techniques

4.1 Finland

In Finland, the first pilot training was carried out by TTS in Vantaa between 20th-22nd August 2018. The training was attended by 19 students from the three different target groups. The second pilot training was conducted on 24th September 2018 and 12 students from the different target groups participated in it.

A total of 31 students took part in the pilot training and they were not separated from the disadvantaged groups. Students were randomly divided into two groups in both pilots: Team 1 was called the "Volvo Group" and Team 2 the "Scania Group".

The pilot training days were carried out in such a way that during the day the students initially completed the "variable conditions" exercise (morning) and then the "braking test / reaction time measurement" exercise (afternoon). Both of these exercises took place with high-end simulators under the guidance of an instructor.

Between the morning and afternoon exercises, the students in the "Scania Group" independently practiced the "variable conditions" exercise on a low-end simulator without the guidance of the instructor. The "Volvo group" students did not participate in any independent training.

The aim was to find out if the use of a low-end simulator combined with the use of a high-end simulator will improve student learning outcomes.

4.2 Poland

In Poland, the pilot training was carried out at the CARGO Group office in Jaworzno on 20th and 22nd September 2018 and on 5th and 16th November 2018. A total of 45 students from different target groups participated in the pilot training. The pilots used high-end, low-end and EuroTruck (ETS) simulators.

In Poland, some of the students who participated in the pilot sessions only completed the exercises on a high-end simulator, while some completed them on a low-end simulator, and some completed the exercises in a combination of EuroTruck and low-end simulators.

The aim was to find out how the learning outcomes were affected by using a high-end simulator, a low-end simulator, and a combination of EuroTruck and low-end simulators. These results allowed us to find out whether there are differences between the results of different disadvantaged groups and to find simulation combinations that are suitable for different disadvantaged groups. It was also

possible to compare the differences between the learning outcomes of the low-end simulator and the combination of the EuroTruck and low-end simulators, i.e. whether independent training in the EuroTruck simulator improves learning outcomes.

In Annex 3 you can find the presentations of the pilot training sessions and the relevant results.

5. Analysis of the results of the pilot training

Generally speaking, it was visible that the learning outcomes in Finland improved when independent training using a low-end simulator was available to all target groups.

The results of the pilot training sessions in Poland were interpreted in relation to average results (fuel consumption and time). If the performance was less than 100%, the result was better than average (fuel consumption was smaller or speed was faster). And if the result was over 100%, the result was worse than average (fuel consumption was higher than normal or it took longer than the average result). The results did not indicate which competence was developed. The main reason for this is that the results varied a lot and didn't show any clear direction in the improvement of skills.

5.1 Young unemployed people (up to the age of 29 years) 'NEET'

In this target group, the results of the pilot training sessions in Finland were as follows:

- The range of the Volvo Group results was 96-119%

- The range of the Scania Group results was 92-117% (independent training was possible)

5.1.1 Results from pilots

Table 12: Finnish pilot training results: NEET's

Team 1: Volvo

1. Driving in the lowest and highest power ranges, with fuel consumption tracking.		DEVIATION % FROM A NORM	
Motorways			
the average fuel consumption	45,8	115 %	40
time of travel	13,9	116 %	12
average engine speed			
Mountainous area			
the average fuel consumption	44,5	114 %	39
time of travel	11,5	96 %	12
average engine speed			
Undeveloped area			
the average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
the average fuel consumption	41,3	98 %	42
time of travel	11,9	119 %	10
average engine speed			
2. Braking tests in a special area, with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency			
Undeveloped area - sunny weather	0,75	107 %	0,7
Undeveloped area - rainy weather	0,75	94 %	0,8
Built-up area - sunny weather	0,44	73 %	0,6
Built-up area - rainy weather	0,88	125 %	0,7

Team 2: Scania (+ low-end simulator)

1. Driving in the lowest and highest power ranges, with fuel consumption tracking.		DEVIATION % FROM A NORM	
Motorways			
the average fuel consumption	36,0	92 %	39
time of travel	12,4	103 %	12
average engine speed			
Mountainous area			
the average fuel consumption	37,2	98 %	38
time of travel	14,1	117 %	12
average engine speed			
Undeveloped area			
the average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
the average fuel consumption	38,4	94 %	41
time of travel	11,1	111 %	10
average engine speed			
2. Braking tests in a special area, with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency			
Undeveloped area - sunny weather	0,89	127 %	0,7
Undeveloped area - rainy weather	0,78	97 %	0,8
Built-up area - sunny weather	0,75	125 %	0,6
Built-up area - rainy weather	0,84	121 %	0,7

The results are very similar to each other. A more detailed analysis of the results indicates that the biggest differences occur when driving in a hilly area and the fuel consumption is monitored. In this case, independent training is shown to improve the learning outcomes.

In this target group, the results of the pilot training sessions in Poland were as follows:

- The range of the results with the high-end simulator was 94-117%.

- The range of the results achieved with the EuroTruck simulator was 92-100%.

- In the exercises that combined the use of the EuroTruck simulator and the low-end simulator, the range of the results was 94-99%.

- The range of the results of the young people who completed the exercises by only using the low-end simulator was 94-100%.

The results indicate that the combination of a low-end simulator and EuroTruck simulator is better than when using a high-end simulator. However, based on the results, there are indications that skills in eco-driving have developed.

5.2 Older unemployed people (over 50 years), long-term unemployment

In this target group, the results of the pilot training sessions in Finland were as follows:

- The range of the Volvo Group results was 115-122%

- The range of the Scania Group results was 81-99% (independent training possible)

5.2.1 Results from pilots

Table 13: Finnish pilot training results: long-term unemployment

Team 1: Volvo

Motorways			
the average fuel consumption	46,0	118 %	39
time of travel	16,3	136 %	12
average engine speed			
Mountainous area			
the average fuel consumption	44,5	117 %	38
time of travel	13,5	112 %	12
average engine speed			
Undeveloped area			
the average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
the average fuel consumption	45,8	112 %	41
time of travel	11,6	116 %	10
average engine speed			
2. Braking tests in a special area, with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the	RESULT	DEVIATION	
Undeveloped area - sunny weather	0,8	119 %	0,7
Undeveloped area - rainy weather	0,7	92 %	0,8
Built-up area - sunny weather	0,8	128 %	0,6
Built-up area - rainy weather	0,9	133 %	0,7

Team 2: Scania (+ low-end simulator)

Motorways			
the average fuel consumption	36,7	92 %	40
time of travel	14,0	117 %	12
average engine speed			
Mountainous area			
the average fuel consumption	35,8	92 %	39
time of travel	13,1	109 %	12
average engine speed			
Undeveloped area			
the average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
the average fuel consumption	34,5	82 %	42
time of travel	11,5	115 %	10
average engine speed			
2. Braking tests in a special area, with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the	RESULT	DEVIATION	
Undeveloped area - sunny weather	0,8	107 %	0,7
Undeveloped area - rainy weather	0,8	100 %	0,8
Built-up area - sunny weather	0,7	113 %	0,6
Built-up area - rainy weather	0,9	125 %	0,7

Here it is clear that independent training has improved the results. Independent training improved vehicle management and handling, and it increased the target group students' confidence when using high-end simulators.

In this target group, the results of the pilot training sessions in Poland were as follows:

- The range of results for high-end simulator exercises was 100-107%.

- The range of results achieved with the EuroTruck simulator was 96-102%.

- In the combined exercises of the EuroTruck simulator and the low-end simulator, the range of results was 85-105%.

- The range of results for the long-term unemployed people who completed the exercises by only using a low-end simulator was 101-109%.

The results indicate that long-term unemployed people over the age of 50 learn better through a combination of EuroTruck and low-end simulator exercises.

5.3 Immigrants

In this target group, the results of pilot training sessions in Finland were as follows:

- The range of Volvo results was 101-112% (Group 2: 108-138%)

- The range of Scania results was 103-115% (Group 2: 80-94%) (independent training was possible)

5.3.1 Results from pilots

Table 14: Finnish pilot training results: immigrants

Team 1: Volvo

1. Driving in the lowest and highest power ranges, with fuel consumption tracking.		DEVIATION % FROM A NORM	
Motorways			
the average fuel consumption	42,4	106 %	40
time of travel	13,8	115 %	12
average engine speed			
Mountainous area			
the average fuel consumption	43,7	112 %	39
time of travel	14,3	119 %	12
average engine speed			
Undeveloped area			
the average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
the average fuel consumption	42,3	101 %	42
time of travel	12,4	124 %	10
average engine speed			
2. Braking tests in a special area, with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency			
Undeveloped area - sunny weather	0,75	107 %	0,7
Undeveloped area - rainy weather	0,75	94 %	0,8
Built-up area - sunny weather	0,44	73 %	0,6
Built-up area - rainy weather	0,88	125 %	0,7

Team 2: Scania (+ low-end simulator)

1. Driving in the lowest and highest power ranges, with fuel consumption tracking.		DEVIATION % FROM A NORM	
Motorways			
the average fuel consumption	42,364	109 %	39
time of travel	13,76	115 %	12
average engine speed			
Mountainous area			
the average fuel consumption	43,672	115 %	38
time of travel	14,258	119 %	12
average engine speed			
Undeveloped area			
the average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
the average fuel consumption	42,264	103 %	41
time of travel	12,416	124 %	10
average engine speed			
2. Braking tests in a special area, with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency			
Undeveloped area - sunny weather	0,89	127 %	0,7
Undeveloped area - rainy weather	0,78	97 %	0,8
Built-up area - sunny weather	0,75	125 %	0,6
Built-up area - rainy weather	0,84	121 %	0,7

No conclusions can be drawn from the results due to external factors (lack of driving and language skills). In the pilot exercise, some students got lost while driving along the planned route and some of the other students collided. The age range of the students was 27-55 years.

In this target group, the results of pilot training sessions in Poland were as follows:

- The range of results for high-end simulator exercises was 100-111%.

- The range of results achieved with the EuroTruck simulator was 90-96%.

- The range of results achieved with the combined use of the EuroTruck simulator and the low-end simulator was 96-99%.

- The range of results of the immigrants who completed the exercises by only using a low-end simulator was 88-101%.

The results are very similar to each other. There are hardly any differences. Despite this, the results do not clearly indicate whether knowledge and skills have developed.

6. Conclusions in Finland

6.1 Transfer of knowledge

In general, it can be said that independent training improved the results. However, a particular target group cannot be clearly demonstrated for which self-study would add obvious value.

6.2 Maximisation of skills

By combining different (low-end and high-end) simulators into the same training, the results indicate that learning outcomes and skills are improved. The improved results were visible among young people and immigrants, but not as clearly among the group of over 50-year-olds.

It can also be said that additional training somewhat strengthens skills in all groups.

6.3 Minimisation of costs

Improved learning outcomes and the transfer of knowledge are partly achieved by increasing the amount of practice. In this case, the minimisation of costs should be directed towards enabling independent study and the cost-effectiveness of the training environment. Low-end simulators and other similar simulation environments are inexpensive as investments, and the simultaneous use of multiple devices when training groups of students results in time savings.

6.4 Instructor Competency Profile

During the pilot training, the instructors did not lack in know-how (i.e. we cannot identify any lack of skills or knowledge that would be required from simulator instructors in future training courses of this kind). On the basis of the results, further studies must be carried out to determine whether the instructors' competence has a major impact on the students' learning outcomes.

In general, it can be said that the instructor should be a professional in his/her field, and the instructor should be particularly attentive during simulation training. This is due to the fact that there are several aspects to be monitored, and the events are more intense than during normal driving lessons.

Training on the simulator requires the instructor to have both pedagogical simulation skills and technical skills to independently manage the devices.

Simulation training differs from ordinary driving lessons because many different events (effective exercises) are designed for the simulation environment which affect driving and they should be considered in the training.

The simulator instructor has the opportunity to design different learning aspects to be taught in the simulation environment, and is thus able to influence the development of individual student skills and learning outcomes more accurately.

6.5 Support of the training management system

Pilot training (eco-driving and braking distance / reaction time training) are already part of the training programs in both Finland and Poland. These topics have been specified by legislators.

Implementing simulation training is not the most cost-effective way to implement pilot training topics (eco-driving and braking distance / reaction time training) but it is the most effective way of developing skills. This is because most of the participants in the training can complete the exercises by combining high-end and low-end simulators during the same training programme. In addition, students receive immediate feedback on their performance, and they are able to monitor their own progress.

7. Conclusions in Poland

Polish participants taking part in the pilot training provided positive feedback on the training process. The topic that could not be prepared for with realistic conditions was the possibility of introducing various weather and terrain conditions to the training. Pilot simulators were used in 3-stage and 6-stage versions. They can create a virtual environment representing a diverse environment (rural, suburban, urban) and it is possible to choose vehicles with different parameters. The simulation also includes changing weather conditions. The simulator used by CARGO uses an innovative "on-screen" imaging technique. It is characterised by the possibility of displaying the image directly on the cab panes of the vehicle used by the student during the training. The vehicle cab model is equipped with all control devices. The driver is able to operate the controls as well as be in a typical vehicle cabin. Both automatic and manual transmission options are available. Thanks to the virtual projection which uses computer technology to generate a virtual terrain image, the generated image contains realistic scenes of the vehicle's surroundings, including acoustic effects. The impression of real driving is possible thanks to a mobile platform with six degrees of freedom. All the features that were used in the simulation were valued by the participants and the participants emphasised that the features increased the attractiveness of the training. A significant added value to the training process is the ability to show and practice situations that could not be implemented under traditional conditions.

As part of the conclusions drawn up after the pilot training, we recommend that traditional driving lessons are combined with training sessions that are conducted with the use of driving simulators, as follows:

- introduction of the stages of training - the necessity to complete part of the training under VR conditions prior to completing any training on a simulator
- training in road conditions should be completed before training on a simulator
- training in road conditions should provide registration options so that it can be recreated in simulated conditions
- after completing the training in road conditions, training should be continued on a simulator and the student’s progress is assessed in real conditions
- The results recorded during the training in real conditions should be analysed, and on their basis, a scenario can be chosen to be completed on the simulator. This will allow the driver to improve their skills.

8. National recommendations

8.1 National recommendations - Poland

8.1.1 Legal conditions - selection of training

As of now, there are several Polish Acts and regulations that govern the driver training process.
The fundamental act is the law of 5 January 2011 – the Motor Vehicle Drivers Act, the consolidated text of which was published as an attachment to the announcement of the Speaker of the Sejm of the Republic of Poland on 21 February 2019. It regulates the required age of individual driving license categories, it also defines the scope of qualifications for individual categories. In Chapter 4, it specifies the training process for obtaining a driving license in detail, indicates the necessary requirements for conducting training and the relevant documentation process. Chapter 5 sets out the requirements for training centres. Another important document is the amended "Regulation of the Ministry of Infrastructure on the training of drivers engaged in road transport" of 2010. In Chapter 3, it sets out the conditions for organising training referred to in Annex 1 and Tables 2 and 3 specify the topics related to category C & D driving licenses. We have listed recommendations below which must be implemented to improve quality, attractiveness, and effectiveness of training and at the same time enable costs to be reduced in a feasible way.
For example, Section 1.3 in Table 2 includes the topic of loading a vehicle in line with OHS requirements and the principles of operating a vehicle. As part of the exercises, a course participant should learn correct load distribution, techniques for securing loads and choosing the most appropriate methods. We recommend looking into the possibility of carrying out part of these exercises with the use of a VR simulator. It may result in a more intriguing offer for course participants as the training centres are able to provide more interesting configurations and the creation of situations which are unavailable in the specific area of the training centre. Simultaneously, it will reduce the financial expenses borne by training centres compared to having to organize traditional training.
Section 1.4, which includes the topics of mechanical and electrical failures of a vehicle, is considered to be perfectly suitable to be transferred into a virtual reality environment with the use of a simulator. This environment gives unlimited possibilities for creating various simulated failures, and these possibilities are only limited by the designer of the environment.
Table 3 specifies the topics for specialist trainings in category D, and Section 1.5 includes topics related to the simulation of failures, and Section 1.7 has calculations

of vehicle payload and passenger distribution. As we can see, these topics are perfect for training in the conditions of a simulator. We recommend that in the future our legislation allows for the legal implementation of a training method of this type.

8.1.2 Regulations specifying the choice of a simulator

The "Regulation of the Ministry of Infrastructure of 8 April 2011 on the device for driving simulation in special conditions" specifies the technical and organizational requirements and the scope of functionality to be performed by the simulator. According to the regulation, the simulator should meet the standards of EN 61010-1:2004 and PN-ISO 7000:2007. These standards and the content of the regulation require a simulator with six degrees of freedom. Therefore, combining different types of trainings with simulators of different levels of advancement is possible, and it is also possible to combine differentiated steps to the technical means used during the training. However, it must be remembered that part of the training, including the compulsory material resulting from the "Regulation of the Ministry of Infrastructure on the training of drivers engaging in road transport" from 2010, was carried out in AR, and in case of VR it was on a 6-stage simulator.

Our recommendations are summarised in the table below.

Table 15: Recommendations for SBT

Coherent training model	National law recommendations	EU law recommendations	Organisational / technical recommendations
We recommend introducing training that uses both programs; VR and driving simulators: with 3 degrees of freedom and 6 degrees of freedom	In Poland, the conditions for conducting training are specified in the amended "Regulation of the Ministry of Infrastructure on the training of drivers engaging in road transport" from 2010. We recommend supplementing the content of the regulation with the possibility of conducting classes in VR conditions using appropriate software and simulators with 3 and 6 degrees of freedom depending on	We recommend reviewing EU law in terms of its adaptation to the growing driver training market based on the use of VR and driving simulators of both low and high quality.	1. Development of training programs based on available methods 2. Assessment of training created in terms of qualitative and economic efficiency 3. Introduction of training levels aimed at grading difficulties

	the level of training. As part of the exercises, a course participant should learn correct load distribution, techniques for securing loads and choosing the most appropriate methods. We recommend looking into the possibility of carrying out part of these exercises with the use of a VR simulator. It may result in a more intriguing offer for course participants as the training centres are able to provide more interesting configurations and the creation of situations which are unavailable in the specific area of the training centre. Simultaneously, it will reduce the financial expenses borne by training centres compared to having to organize traditional training. The topics of mechanical and electrical failures of a vehicle are considered to be perfectly suitable to be transferred into a virtual reality environment with the use of a simulator. This environment gives unlimited possibilities of creation of various simulated failures, and these possibilities are only limited by the designer of the environment.		

8.2 National recommendations - Finland

In Finland, vocational training legislation already provides rather liberal ways of carrying out simulation training for professional drivers. Therefore, the recommendations focus more on improving the teaching methods of those who provide vocational training.
Since simulation and simulators are two different things, the first recommendation is focused on the preparation of exercises, so that simulators can provide the most realistic simulation possible. So, if necessary, driving exercises can be improved with a 3D sound landscape. In addition, training can be added to the e-learning related to a simulated topic (road signs, hazard descriptions of photographs, identification of risk situations) or for e.g. advanced professional driver training. In this case, the simulator can be mounted on a bus driver's sales device. In the context of the training, it was discovered that focusing on only one thing in a simulation – in which case the situation is as far away from the real situation as possible – the learning outcomes were not as good as the effectiveness of the simulation. If other aspects were connected to the simulation (in addition to driving, the possibility of monitoring the bus door, communicating with the work line, route planning, using the sales device, etc.), the simulation would be more efficient and would thus improve learning.
Among the three different target groups, there were no major differences when using different training tools, but they all benefited to some extent. The challenges experienced by the test group could not be explained on the basis of age or nationality, but rather by their learning capacity, which was weaker or stronger among some of the participants. The output levels were also influenced by the results: the weakest were driving out of the lanes or they got lost along the routes, and they were able to improve their results. Improved learning required clear baseline mapping and targeting teaching and exercises on weaker skills. Many needed process instructions, vehicle management instructions, and exercises for slippery driving, among others. The simulator is well-suited for all these purposes. In addition, the varied linguistic skills have influenced learning outcomes, since the instructions given by the instructor (or the simulator) may not be immediately understood. Learning the language required for occupation and teaching purposes would be beneficial.

Our recommendations are presented in the table below.

8.2.1 Recommendations for development of training and legislation

Table 16: Recommendations for legislation

Coherent training model	National law recommendations	EU law recommendations	Organizational / technical recommendations
IO3: Guidelines for increasing training efficiency through the combination of low-end & high-end simulators. Standards for low-end & high-end simulators and software and specifying the main aims and purposes for training.	**IO3:** Recommendations for the legal identification of low-end simulators in national legislation: what kind of technical solutions can be considered as low-end simulators (still of high enough quality to meet their purposes)	**IO3:** Recommendations for the identification of the role of combined (using multiple tools) ICT-based training (needs to be checked in EU law)	**IO3:** Stakeholder-oriented recommendations for training developers, training centres, transport companies: • cost efficiency • high training quality
	IO3: Recommendations for the instructor profile: a) familiarising with the simulator in both organisational and technical issues, b) achieving a certain level of student monitoring skills.	**IO3:** Recommendation for maximising possibilities of independent learning with low-end simulators and other e-learning platforms/training tools. What kind of independent learning can considered to be "high quality independent learning" and what kind of tasks and software does it need. (identification of the role of independent learning)	**IO3:** Recommendation for using different combinations of low- and/or high-end simulators and training tools in training.
			IO3: Recommendation for the training programs to be developed on the basis of several different learning methods.

8.3 National recommendations - Austria

In Austria, no pilots on the integration of SBT with other methods of PD candidate training were carried out during the course of the three-year ICT-INEX project.

Therefore, no concrete research results on SBT and its integration in the training methods of professional drivers are available.

In 2008, Directive 2003/59/EC was implemented into Austrian legislation (Bundesgesetzblatt, BGBL II Nr. 139/2008, Federal Gazette). In this regulation the use of SBT in PD training is mentioned in three paragraphs. In principle, all the paragraphs contain the same content when it comes to the compulsory initial qualification, the driving test, the accelerated initial qualification, and the compulsory periodic training.

A driver can drive a certain amount of hours in a real vehicle or "***on a top-of-the-range simulator"*** *so as to assess training in rational driving based on safety regulations,* ***in particular with regard to vehicle handling in different road conditions*** *and the way these conditions change in different weather conditions and the time of day or night*."

When it comes to the practical driving test, the directive says: "***The practical test may be*** *supplemented by a third test taking place on special terrain or* ***on a top-of-the-range simulator so as to assess training in rational driving based on safety regulations, in particular with regard to vehicle handling in different road conditions*** *and the way these conditions change in different weather conditions and the time of day or night*."

For the accelerated initial qualification, the message is similar: "***Each driver may drive*** *for a maximum of four hours of the 10 hours of individual driving on special terrain or* ***on a top-of-the-range simulator so as to assess training in rational driving based on safety regulations, in particular with regard to vehicle handling in different road conditions*** *and the way these conditions change in different weather conditions and the time of day or night*."

In addition to this, SBT is mentioned in connection with the 35h compulsory periodic training: "***Such periodic training may be provided, in part, on top of-the-range simulators***."

In Austria, SBT is still not an official part of the Driver CPC (Certificate of Professional Competence), although some transport companies and some training providers (e.g. in Tyrol and in Vienna) use high-end simulators as an addition to their PD training. Even when it comes to e-learning, the only province that has so far accredited e-learning modules into its periodic CPC training was Tyrol. In Tyrol, one training provider was accredited to offer three training modules as part of the compulsory periodic training. In the process of the accreditation of these three e-learning modules the Tyrolean provincial government contacted the Federal Ministry of Transport, Innovation and Technology (bmvit) and asked for clarification because

the directive neither allowed, nor prohibited, the use of computer-based training (CBT).

In 2010, bmvit reacted with a decree which stated that e-learning can only be used as a teaching method if the identity of the professional driver can be assessed and if it can be ensured that the trainee is completing the whole amount of training module hours himself/herself because otherwise the quality of the implementation of periodic training cannot be assured. Additionally, a combination of e-learning with blended learning was recommended. Apart from that, no further details were given (e.g. concrete quality management issues).

When talking to a state official of the Federal Ministry of Transport, Innovation and Technology responsible for the accreditation of e-learning and SBT in PD training, he stated that the Ministry does not intend to accredit more e-learning modules or SBT into the Austrian driver training until more details are provided in the EU directive.

A lot of hope was put into the new ***Directive (EU) 2018/645 of the European Parliament and of the Council of 18 April 2018 amending Directive 2003/59/EC*** *on the initial qualification and periodic training of drivers of certain road vehicles for the carriage of goods or passengers and Directive 2006/126/EC on driving licenses*" which must be implemented by all European member states.

With regard to CBT and periodic professional driver training, the new Directive 2018/645 states that "***Member States should be provided with a clear option to improve and modernise training practices with the use of information and communication technology*** *(ICT) tools,* ***such as e-learning and blended learning****, for part of the training, while ensuring the quality of the training. Practical training could, but does not have to, consist of driving."* When it comes to periodic training, the amendment states: *"Training shall consist of classroom teaching, practical training and****, if available, training by means of information and communication technology (ICT) tools or on top-of-the-range simulators****."*

From the point of view of the Austrian Ministry of Transport, Innovation and Technology it seems, that the hopes for more clarification on how to accredit e-learning and SBT into PD training were not fulfilled. After another conversation with a Ministry member in the accreditation office for PD training, a lot of frustration was expressed. On the one hand, the new Directive supports the modernisation of training practices by using ICT tools such as e-learning and blended learning. For the periodic training part, it is even recommended that ICT tools and "top-of-the-range simulators" are used, if they are available, but it is not specified what top-of-the-range simulators actually are. Are they high-end simulators or particularly good

low-end simulators? The Ministry official stated that they would like to accredit e-learning programmes and SBT into PD training but that they still do not know enough about the minimum standards to be able to do so. In the new Directive, the topic of Virtual Reality is not mentioned at all - only indirectly (ICT-tools). There are still no further details given on the minimum framework conditions for successful e-learning that includes SBT.

This concludes that, from the Austrian point of view, more information on the advantages and also disadvantages of SBT is urgently needed (e.g. studies in all important areas, such as economic, social, learning, health and security aspects). These should lead to a clear statement in yet another amendment of the EU-Directive on professional driving concerning the framework conditions of implementing SBT in professional driver training. In this context, Finland seems to have progressed much more and can contribute with a lot of valuable SBT experience. The research results from Intellectual Output 3 of the ICT-INEX project provide insight to some of the missing information on the integration of SBT into professional driver training. Austria is in the same situation as the rest of Europe when it comes to the intense lack of professional drivers. IO3 results in Finland and Poland indicated that the use of different simulators in PD training improved the learning outcomes and skills of the three target groups (NEETs, 50+ and immigrants). Even if the new Directive is not yet considered to be explicit enough when it comes to the integration of SBT into PD training, the Austrian driving schools seem to be getting more and more interested in the matter. If more and more providers begin to use low-end simulators, sooner or later it will become a state-of-the-art matter, and the pressure on their accreditation will increase.

Annex 1. Questionnaire

ICT-INEX Project

Questionnaire

O3 –Development of guidelines for the integration of simulator-based training with other training methods used in PD candidate training, including the blend of low-end and high-end simulator-based training

Prepared by: Työtehoseura ry (IO-leader)

Country:	
Filled-in by:	
Date of delivery:	

By implementing this survey, ICT-INEX intends to collect material for preparing a **guide for industry members** which will indicate the current state of PD candidate training in Europe, while taking into account the ICT context and the situation of the end-users in this sector of the labour market. This guide will provide a basis for the further tasks of the project.

Please fill in this questionnaire by referring to your **national** context. As sources of information and methods of research you are – besides your **own expertise** – invited to use **desk research** and brief **expert interviews**, the latter e.g. with employers (representatives), training providers or ministries/PES representatives. The final decision on the combination of research methods will be made by the responsible national partners – according to their specific demands and prerequisites. You will find further remarks and tips in the questionnaire. Please keep your answers brief and concise.

Please return the completed questionnaire by **15th June 2017** to Työtehoseura ry, Pirita Niemi (**pirita.niemi@tts.fi**). You can also send any questions or enquiries concerning this questionnaire to the previously mentioned email address.

A. Context of professional driving and professional driver training

Table 1: Question A.1

General knowledge about SBT training?	
Please provide a short review of the use of SBT in (please specify training with low-end and high-end simulators): - **Driver training (categories C and D)** - **Initial and/or periodic CPC training** - **Other training** Please provide concrete examples Please underline the most effective ones	
Do you implement any changes to SBT when training disadvantaged groups*?	
Do these changes differ among the groups?	
What kind of changes are made? **(If possible, please provide some examples)**	
***) Unemployed young people (≤ 29 years)** **Long term unemployed people (+50 years)** **Immigrants (incl. refugees)**	

Table 2: Question A.2

Instructor competency profile	
Short description of training techniques and methods that focus on <u>disadvantaged groups</u>:	
Unemployed young people (≤ 29 years) - **Have you encountered any challenges with SBT?** - **Have you found any solutions for these challenges?** - **If you have solved these challenges, please provide some examples of the used methods**	
Long-term unemployed people (+50 years) - **Have you encountered any challenges with SBT?** - **Have you found any solutions for these challenges?** - **If you have solved these challenges, please provide some examples of the used methods**	
Immigrants (incl. refugees) - **Have you encountered any challenges with SBT?** - **Have you found any solutions for these challenges?** - **If you have solved these challenges, please provide some examples of the used methods**	
Short description of different training tools <u>concerning the disadvantaged groups</u>:	
Unemployed young people (≤ 29 years) - **Have you encountered any challenges with SBT?** - **Have you found any solutions for these**	

challenges? • **If you have solved these challenges, please provide some examples of the used methods**	
Long/term unemployed people (+50 years) - **Have you encountered any challenges with SBT?** - **Have you found any solutions for these challenges?** • **If you have solved these challenges, please provide some examples of the used methods**	
Immigrants (incl. refugees.) - **Have you encountered any challenges with SBT?** - **Have you found any solutions for these challenges?** • **If you have solved these challenges, please provide some examples of the used methods**	

Are you using any training tools with SBT (tick (X) if used)?			
Training tool	**Unemployed young people (≤ 29 years)**	**Long-term unemployed people (+50 years)**	**Immigrants (incl. refugees)**
Video clips			
Mobile applications			
Software			
Games			
E-Learning			
Pictures			
Sounds			
Practical exercises			
VR			

AR			
MR (Mixed Reality)*			
Other tools (Specify)			
Please also list examples of each point and provide a short description of how you pay attention to the disadvantaged groups			

* https://www.foundry.com/industries/virtual-reality/vr-mr-ar-confused

Table 3: Question A.3

Quality of the training process?	
Short description of the quality of the training process and how to measure it:	
When using SBT – are there any quality or efficiency indicators to guide actions?	
How are specific learning outcomes ensured?	
How is the minimisation of stakeholder costs measured?	

Possible sources: interviews, personal opinions, scientific papers, industry reports, training providers

Annex 2. Guidelines for the translation of category C & D driver training and initial qualification training programmes

POLAND

This program complies with the Announcement of the Minister of Infrastructure and Development of 11 April 2014 concerning the uniform text of the Regulation of the Ministry of Infrastructure on the training of drivers engaging in road transport (Official Journal of Laws No. 1005), the Ordinance of the Ministry of Infrastructure and Construction Decree of the Minister of Infrastructure and Construction of 30 December 2016 on the publication of the uniform text of the Regulation of the Ministry of Infrastructure on the training of drivers engaging in road transport. The quoted regulations allow the use of e-learning methods in theory lessons and the use of a simulator for completing practical driving lessons.

Table 1. Initial qualification training programme –Poland

	Implementation method (if legally indicated)	Use of e-learning or SBT (if legally indicated)	Number of hours (if legally indicated)* Qualification/Accelerated qualification
QUALIFICATION - MAIN PART			
1. Section 1	Advanced training in rational driving, including safety regulations		
a. Topic 1	Learning the characteristics of the vehicle's transmission system and its optimal use		30/15
i.	Torque characteristics	Theory lessons (e-learning)	
ii.	Power characteristics	Theory lessons (e-learning)	
iii.	Characteristics of the engine's fuel consumption	Theory lessons (e-learning)	

iv.	Optimal service range of the tachometer	Theory lessons (e-learning)	
v.	Optimal speed range for gear shifting	Theory lessons (e-learning)	
b. Topic 2	Learning the technical characteristics and operation of safety equipment to ensure vehicle control, minimise wear and prevent accidents		25/15
i.	Particular features of a dual-circuit braking system equipped with a pneumatic conveying device	Theory lessons (e-learning)	
ii.	Limits on the use of braking systems and retarders	Theory lessons (e-learning)	
iii.	Combined use of a braking system and retarder	Theory lessons (e-learning)	
iv.	Optimal speed and gear ratio	Theory lessons (e-learning)	
v.	Use of vehicle capacity	Theory lessons (e-learning)	
vi.	Applying braking systems on slopes	Theory lessons (e-learning)	
vii.	Measures to be taken in situations of safety equipment failure	Theory lessons (e-learning)	
2. Section 2	Applicable regulations		

a. Topic 1	Learning social determinants of road transport and the rules governing it		30/15
i.	Maximum driver working hours in road transport	Theory lessons (e-learning)	
ii.	Applicable regulations: Council (EEC) No 3821/85 and of the European Parliament and of the Council (EC) No 561/2006; Regulation (EU) No 165/2014 of the European Parliament and of the Council of 4 February 2014, penalties for non-use, misuse, and interference with recording equipment	Theory lessons (e-learning)	
iii.	Driver's rights and obligations in terms of initial qualification and periodic training	Theory lessons (e-learning)	
3. Section 3	Safety, service, and logistics in terms of health, traffic and the environment		
a. Topic 1	Making drivers aware of the risks of accidents on the road and at work		30/15
i.	Types of accidents in road transport work	Theory lessons (e-learning)	
ii.	Statistics of road	Theory lessons (e-	

	accidents	learning)	
iii.	Share of lorries / coaches in road accidents	Theory lessons (e-learning)	
iv.	Statistics concerning fatalities and injuries in road accidents	Theory lessons (e-learning)	
v.	Material and financial losses	Theory lessons (e-learning)	
b. Topic 2	Ability to prevent crime and smuggling of illegal immigrants		15/7
i.	Problems related to cross-border crime and smuggling	Theory lessons (e-learning)	
ii.	Preventive measures	Theory lessons (e-learning)	
iii.	Methods and objectives of criminal activities	Theory lessons (e-learning)	
iv.	The law and obligations of the driver, and the relevant obligations of the transport company	Theory lessons (e-learning)	
c. Topic 3	Ability to prevent physical threats		20/10
i.	Principles of ergonomics	Theory lessons (e-learning)	
ii.	Behaviour and attitudes that pose a threat	Theory lessons (e-learning)	
iii.	Physical fitness and exercise	Theory lessons (e-learning)	
iv.	Personal safety	Theory lessons (e-learning)	

d. Topic 4	Awareness of the importance of physical and mental predispositions		10/5
i.	Principles of healthy, regular nutrition	Theory lessons (e-learning)	
ii.	Effect of alcohol, drugs or other substances on behaviour	Theory lessons	
iii.	Symptoms, causes, effects of fatigue and stress	Theory lessons (e-learning)	
iv.	Role of basic work / rest cycle	Theory lessons (e-learning)	
e. Topic 5	Ability to assess emergency situations, behaviour in critical situations		20/10
i.	Evaluation of critical situations	Theory lessons (e-learning)	
ii.	Avoiding complications in case of an accident	Theory lessons (e-learning)	
iii.	Calling for help	Theory lessons (e-learning)	
iv.	Helping injured people and providing first aid	Theory lessons (e-learning)	
v.	Dealing with fire	Theory lessons (e-learning)	
vi.	Evacuation of people from trucks / passengers from buses	Theory lessons (e-learning)	
vii.	Ensuring the safety of all passengers	Theory lessons (e-learning)	
viii.	Reacting to acts of	Theory lessons (e-	

	aggression	learning)	
ix.	Basic rules for compiling information about an accident	Theory lessons (e-learning)	
f. Topic 6	Ability to behave in a manner that promotes the image of the transport company		15/5
i.	Importance of the level of service provided by the driver	Theory lessons (e-learning)	
ii.	Role of the driver	Theory lessons (e-learning)	
iii.	Driver communications with other people at work	Theory lessons (e-learning)	
iv.	Maintenance of the vehicle	Theory lessons (e-learning)	
v.	Organisation of work	Theory lessons (e-learning)	
vi.	Commercial and financial consequences of disputes occurring in the work of the driver	Theory lessons (e-learning)	

QUALIFICATION - ADVANCED PART			
1. Section 1	Advanced training in rational driving, including safety regulations		
a. Topic 3	Ability to load the vehicle in accordance with safety and health requirements		30/18
i.	Factors that affect the vehicle while driving	Theory classes (e-learning)/ Driving	
ii.	Using a gear ratio corresponding to the vehicle load and the road profile	Theory classes (e-learning)/ Driving	
iii.	Calculation of the usable load of a vehicle or a combination of vehicles	Theory classes (e-learning)	
iv.	Calculation of usable volume	Theory classes(e-learning)	
v.	Distribution of cargo	Theory classes(e-learning)/ Exercises	
vi.	Consequences when the axle load is exceeded	Theory classes(e-learning)	
vii.	Vehicle stability and centre of gravity	Theory classes(e-learning)	
viii.	Types of packaging and pallets	Theory classes(e-learning)	
ix.	Basic categories of goods that require cargo security	Theory classes(e-learning)	
x.	Clamping techniques, including the use of ratchet straps and	Theory classes(e-learning)/ Exercises	

	chains		
xi.	Use of ratchet straps		
xii.	Inspection of clamping devices	Theory classes(e-learning)/Exercises	
xiii.	Use of internal transport equipment	Theory classes(e-learning)/Exercises	
xiv.	Laying the tarpaulin and removing it	Theory classes(e-learning)/Exercises	
b. Topic 4	Ability to optimise fuel consumption and drive in special conditions		20/10
i.	Driving a wide torque range and tracking fuel consumption	Theory classes(e-learning)/Driving	
ii.	Driving at the lowest and highest power ranges with fuel consumption tracking	Theory classes(e-learning)/Driving (Driving simulator)	
iii.	Driving at the lowest fuel consumption level	Theory classes(e-learning)/Driving	
iv.	Driving at the optimum engine speed range and maintaining an optimum speed, observing the engine manufacturer's recommendations	Theory classes(e-learning)/Driving	
v.	Driving at the optimum engine speed range by changing gears at the right moment	Theory classes(e-learning)/Driving	
vi.	Control of components in the two-circuit brake system (in particular removing the	Theory classes(e-learning)/Exercises	

	diaphragm cylinder, adjusting the brakes, checking the pneumatic couplings, checking the pneumatic lines, controlling the setting of the brake force regulator (manual and automatic)		
vii.	Learning through careful braking tests in a specific area, indicating the braking effect with attention to the effect braking has on driving	Theory classes(e-learning)/Driving (Driving simulator)	
viii.	Learning to drive down a hill using both braking systems simultaneously and separately	Theory classes(e-learning)/Driving	
ix.	Driving lessons with speedometer and tachometer readings at different speeds	Theory classes(e-learning)/Driving	
x.	Learning to drive a truck with a load: moving up a hill, accelerating to 50 km / h and time measurement in case of a loaded and unloaded vehicle	Theory classes(e-learning)/Driving	
xi.	Careful tests of truck braking systems when driving down a hill; Learning about the phenomenon of a decrease in braking force and	Theory classes(e-learning)/Driving	

	how to react		
xii.	Simulated collision in the vehicle, a description of the detected situation, an attempt to find a cause, a breakdown, if possible, and a decision to start driving or stay in the car park	Theory classes(e-learning)/Driving	
xiii.	Learning economical driving habits by improving fuel consumption through the optimisation of fuel consumption while driving	Theory classes(e-learning)/Driving	
2. Section 2	Application of regulations		
a. Topic 2	Learning the regulations governing the transportation of goods		20/10
i.	Conditions for licensing a road transport operator and accessing the road transport market	Theory classes(e-learning)	
ii.	Agreements and multilateral conventions	Theory classes(e-learning)	
iii.	Bilateral international agreements	Theory classes(e-learning)	
iv.	Technical regulations	Theory classes(e-learning)	
v.	Contractual relations in road transport; International and	Theory classes(e-learning)	

	national regulations		
vi.	Liabilities of the person engaging in road transport for deliveries, and the release of such liabilities	Theory classes(e-learning)	
vii.	Shipping documents; Proper use and completion of documents	Theory classes(e-learning)	
viii.	Special documentation attached to the goods	Theory classes(e-learning)	
3. Section 3	Safety, service, and logistics in terms of health, traffic and the environment		
a. Topic 7	Learning the economic determinants of road transport and market organisation		15/5
i.	Road transport in relation to other modes of transport (competition, forwarding);	Theory classes(e-learning)	
ii.	Road haulage business (transport and transportation for personal use)	Theory classes(e-learning)	
iii.	Organisation and forms of carrying out activities in the road transport of goods	Theory classes(e-learning)	

iv.	Transport specialisations (in particular the transport of dangerous goods, transport of perishable goods)	Theory classes(e-learning)	
v.	Combined transport	Theory classes(e-learning)	

Table 2. Category C/D driver training programme –Poland

The conditions for conducting trainings for drivers in the form of e-learning are in accordance with the Announcement of the Ministry of Infrastructure and Development of 11 April 2014 on the uniform text of the Regulation of the Ministry of Infrastructure on the training of drivers engaging in road transport (Journal of Laws, No. 1005), the Ordinance of the Ministry of Infrastructure and Construction of 10 February 2016 (Journal of Laws, No 251) on the training of drivers engaging in road transport, Announcement of the Ministry of Infrastructure and Construction of 30 December 2016 on the uniform text of the Regulation of the Ministry of Infrastructure on the training of drivers engaging in road transport. *Theoretical training for categories C & D is not compulsory in Poland (obviously, it is still compulsory to pass the theory exam). Therefore, the driving centres personally choose whether to conduct the theoretical training traditionally or by means of e-learning. The use of a driving simulator for category C/D driver training is not legally binding, yet some companies use low-end simulators before starting practical driving lessons.*			
Theoretical training program for the applicants of driving license categories C and D (20h in total)			
1. Section 1	Rules and regulations concerning the safe movement of the vehicle on public roads	Dependent on the company	
a. Topic 1	Warning signs		
b. Topic 2	Prohibiting and mandatory signs		
c. Topic 3	Informative signs, directions and locations,		

	complementary		
d. Topic 4	Horizontal road signs		
e. Topic 5	Light signals, directional signals given by a traffic warden		
f. Topic 6	Joining traffic, intersections, crossings with signs of priority		
g. Topic 7	Crossroads with signs of priority		
h. Topic 8	Intersections with traffic lights		
i. Topic 9	Crossings or pedestrian crossings, public transport stops		
j. Topic 10	Vehicle position on the road, entering and exiting junctions, stopping and parking		
k. Topic 11	Changing lanes, changing the direction of travel, safe driving in tunnels		
l. Topic 12	Overtaking		
m. Topic 13	Bypassing, overtaking, reversing		
n. Topic 14	Using external lights and vehicle signals		
o. Topic 15	Acceptable vehicle speed limits		
p. Topic 16	Vehicle equipment related to the safety, mass and		

	dimensions of the vehicle		
q. Topic 17	Rules related to the mode of transport, drivers' working hours and rest time, use of tachographs		
2. Section 2	Dangers associated with traffic	Dependent on the company	
a. Topic 1	The importance of special precautions related to other road users, getting out of the vehicle, securing the vehicle		
b. Topic 2	Behaviour towards pedestrians and towards people with limited mobility		
c. Topic 3	Behaviour towards cyclists and children		
d. Topic 4	Behaviour on railways and tram ways		
e. Topic 5	Safety distance and braking vehicles		
f. Topic 6	Risk factors associated with different road conditions, in particular the change of these conditions depending on weather conditions and the time of day or night, properties of different types of roads and associated requirements		
g. Topic 7	Drivers' different fields of view		

h. Topic 8	Driving techniques		
3. Section 3	Procedures in emergency situations	Dependent on the company	
a. Topic 1	General rules determining the behaviour of the driver in accident situations		
b. Topic 2	Providing first aid		
c. Topic 3	Observation, assessment of the situation and decision-making, especially in case of limited time and changes in driving behaviour caused by alcohol, drugs and medicinal products, the state of consciousness and fatigue		
d. Topic 4	Rescue operations after an accident		
4. Section 4	Duties of the driver and the owner of the vehicle	Dependent on the company	
a. Topic 1	Safety factors related to the vehicle, cargo and passengers, liability of the driver / vehicle holder		
b. Topic 2	Safety factors related to the vehicle, cargo and passengers, loading and unloading of the vehicle, liability of the driver / vehicle holder		
c. Topic 3	Vehicle and transport documents		

	required in national and international transportation of goods and persons		
d. Topic 4	Mechanical aspects of road safety, maintenance and current repairs		
Practical training program for the applicants of driving license categories C and D (30h for category C, 60h for category D in case of existing B license, 40h for category D in case of existing C license)			
1. Section 1	Manoeuvring area		
a. Topic 1	Preparing to drive, checking the technical condition of the basic components of the vehicle that are directly relevant to driving safety	-	
i.	Checking technical condition of basic components of the vehicle that are responsible for road safety		
ii.	Adjusting the seat, mirrors, head restraints, fastening seatbelts, making sure the vehicle door is closed		
iii.	Checking the bodywork, doors, emergency exits, required equipment		
b. Topic 2	Moving off, and driving forwards and reversing along the lane		
i.	Starting the engine of the vehicle		

ii.	Appropriate vehicle lights in traffic		
iii.	Ensuring the ability to drive: exclusion of probability for causing danger in traffic, assessment of the situation around the vehicle		
iv.	Smooth ignition		
v.	Driving forwards and reversing along the lane		
vi.	Stopping the vehicle before the end and beginning of a lane		
c. Topic 3	Inclined parking		
d. Topic 4	Perpendicular parking		
e. Topic 5	Parallel parking		
f. Topic 6	Moving off on a hill		
2. Section 2	Traffic	-	
a. Topic 1	Entrance to the road from a roadside facility		
b. Topic 2	Driving on two-way one-lane roads with different numbers of designated and undefined lanes that have straight sections and bends, elevations and falls, lowered and elevated admissible speeds		
c. Topic 3	Driving on two-way two-lane roads with different numbers of		

	designated and undefined lanes that have straight sections and bends, hills and slopes, lowered and elevated admissible speeds		
d. Topic 4	Driving on one-way roads with different numbers of designated and undefined lanes		
e. Topic 5	Crossing intersections with priority to the right		
f. Topic 6	Crossing intersections marked with signs that determine priority of passage		
g. Topic 7	Crossing intersections marked with traffic lights		
h. Topic 8	Crossing roundabouts		
i. Topic 9	Crossing two-level intersections		
j. Topic 10	Crossing pedestrian crossings		
k. Topic 11	Driving through tunnels		
l. Topic 12	Crossing tram ways and railways		
m. Topic 13	Passing tram or bus stops		
n. Topic 14	Overtaking manoeuvre		
o. Topic 15	Passing by manoeuvre		
p. Topic 16	Taking over		

	manoeuvre		
q. Topic 17	Changing lane manoeuvre		
r. Topic 18	Changing direction to the left manoeuvre		
s. Topic 19	Changing direction to the right manoeuvre		
t. Topic 20	Turning back at a crossroad manoeuvre		
u. Topic 21	Braking from a speed of at least 50 km / h to a stop at an indicated location		
v. Topic 22	Braking in emergency situations		
w. Topic 23	Correct gear for energy-efficient driving		
x. Topic 24	Use of engine torque during braking - application of engine braking		
The conditions for conducting trainings for drivers in categories C and D are in accordance with the Ordinance of the Ministry of Infrastructure and Construction of 4 March 2016 on the training of applicants for driving licenses, instructors and lecturers.			

FINLAND

Table 1. Category D driver training programme – Finland

•	Implementation method (if legally indicated)	Use of e-learning or SBT (if legally indicated)	Number of hours (if legally indicated)
Theoretical part	Classroom or virtual learning environment)	Possible in all topics (the relevant authority approves learning environment)	Minimum for category D license: 27 h (if B -> D) 15 h (if BC -> D) 6 h (if D1 -> D) 5 h (if CPC completed) Minimum for category C license: 12 h (if B -> C) 3 h (if C1 -> C) 1 h (if CPC completed)
1. Vehicle in category C/D (Environmental impact of the vehicle, vehicle and transportation)			
2. Driver of a category C/D vehicle (Transport system, social environment and interaction of transport, factors affecting driver's ability to drive)			
3. Road safety and driving with a category C/D vehicle (Safety factors, identifying and avoiding traffic incidents in challenging road circumstances and actions to be taken in case of an accident)			
Practical part	Practical exercises with vehicle as well	Possible in all topics (Simulators are	Minimum for category D license:

	as driving lessons	approved by relevant authorities)	40 h (if B -> D) 30 h (if BC -> D) 15 h (if D1 -> D) 10 h (if CPC completed) Minimum for category C license: 10 h (if B -> C) *) 5 h (if C1 -> C) *) 2 h (if CPC completed) *) *) Plus 25 min training concerning the securing of loads for category C license
1. Instructed driving and traffic environment (typical situations while driving a bus or truck)			
2. Documents and drivers' driving and rest periods (digital and analogue tachograph, vehicle documents etc.)			
3. Preparing to drive during driving lessons (how to carry out safety check of the vehicle and how to adjust mirrors and seat etc.)			
4. Driving during driving lessons (typical situations for the bus or truck, defensive driving, safety, fuel consumption etc.)			
5. Driving lessons on the highway and in suburban areas (risks involved and handling typical situations)			
6. Load securing (only category C): choosing appropriate securing devices, how to use them safely and how to distribute loads)			

Table 2. Initial qualification training programme – Finland

	Implementation method (if legally indicated)	Use of e-learning or SBT (if legally indicated)	Number of hours (if legally indicated)
			Overall training 280/140 hours
1. *Advanced training in rational driving based on safety regulations*	The decision of the training provider in all topics	Possible in all topics (learning environments and simulators are pre-approved by relevant authorities)	
1.1. Objective: to understand the characteristics of the transmission system in order to make the best possible use of it: curves relating to torque, power, and specific engine consumption, area of optimum torque use counter, gearbox-ratio cover diagrams.			Minimum: 1 hour (45 min or 50 min in case of individual driving)
1.2. Objective: to understand the technical characteristics and operation of the safety controls in order to control the vehicle, minimise wear and tear and prevent malfunction:			Minimum: 1 hour (45 min or 50 min in case of

specific features of hydraulic vacuum servo circuit, limits to the use of brakes and retarder, combined use of brakes and retarder, making better use of speed and gear ratio, making use of vehicle inertia, using ways of slowing down and braking on downhill stretches, action in the event of failure.			individual driving)
1.3. Objective: ability to optimise fuel consumption: optimisation of fuel consumption by applying knowledge specified in Sections 1.1 and 1.2.			Minimum: 1 hour (45 min or 50 min in case of individual driving)
Licence categories C, C+E, C1, C1+E 1.4. Objective: ability to load the vehicle in accordance with safety regulations and the appropriate use of the vehicle: forces affecting vehicles in motion, use of gearbox ratios according to vehicle load and road profile, calculation of payload of vehicle or assembly, calculation of total volume, load distribution, consequences of overloading the axle, vehicle stability and centre of gravity, types of packaging and pallets; main categories of goods needing securing, clamping and securing techniques, use of ratchet straps, inspection of securing devices, use of handling equipment, attaching and removing tarpaulins.			Minimum: 1 hour (45 min or 50 min in case of individual driving)
Licence categories D, D+E, D1, D1+E 1.5. Objective: ability to ensure passenger comfort and safety: adjusting longitudinal and sideway movements, road sharing, position on the road, smooth breaking, overhang allowances, using specific infrastructures (public areas, dedicated lanes), managing conflicts between safe driving and other roles as a driver, interacting with passengers, additional measures necessary in case of certain groups of passengers (disabled persons, children).			Minimum: 1 hour (45 min or 50 min in case of individual driving)
Licence categories D, D+E, D1, D1+E 1.6. Objective: ability to load the vehicle in accordance with safety			Minimum: 1 hour (45 min or 50 min in case of

regulations and the appropriate use of the vehicle: factors that affect moving vehicles, use of gearbox-ratios according to vehicle load and road profile, calculation of payload of vehicle or assembly, load distribution, consequences of overloading the axle, vehicle stability and centre of gravity.			individual driving)
2. *Application of regulations*			
All licence categories 2.1. Objective: to understand the social environment of road transport and the regulations governing it: maximum working periods specific to the transport industry; principles, application and consequences of Regulations (EEC) No 3820/85 and (EEC) No 3821/85; penalties for failure to use, improper use of and tampering with the tachograph; knowledge of the social environment of road transport: rights and duties of drivers in accordance with initial qualification and periodic training.			Minimum: 1 hour (45 min or 50 min in case of individual driving)
Licence categories C, C+E, C1, C1+E 2.2. Objective: to understand the regulations governing the transport of goods: transport operating licences, obligations under standard contracts for the transport of goods, drafting of documents which form the transport contract, international transport permits, obligations under the Convention on the Contract for the International Carriage of Goods by Road, drafting of the international consignment note, crossing borders, freight forwarders, special documents accompanying goods.			Minimum: 1 hour (45 min or 50 min in case of individual driving)
Licence categories D, D+E, D1, D1+E 2.3. Objective: to understand the regulations governing the transport of passengers: transport of specific groups of passengers, safety equipment on board buses, safety belts, vehicle load.			Minimum: 1 hour (45 min or 50 min in case of individual driving)

3. *Health, road and environmental safety, service, logistics*			
All licence categories 3.1. Objective: to make drivers aware of traffic-related risks and occupational accidents: types of occupational accidents in the transport sector, road accident statistics, involvement of lorries/coaches; human, material and financial consequences.			Minimum: 1 hour (45 min or 50 min in case of individual driving)
3.2. Objective: ability to prevent crime and the trafficking of illegal immigrants: general information, implications for drivers, preventive measures, check list, legislation on transport operator liabilities.			Minimum: 1 hour (45 min or 50 min in case of individual driving)
3.3. Objective: ability to prevent physical risks: principles of ergonomics; movements and postures which pose a risk, physical fitness, exercise, personal protection.			Minimum: 1 hour (45 min or 50 min in case of individual driving)
3.4. Objective: awareness of the importance of physical and mental capacity: principles of healthy, balanced nutrition, effects of alcohol, drugs or any other substance likely to affect behaviour, symptoms, causes, effects of fatigue and stress, fundamental role of the basic work/rest cycle.			Minimum: 1 hour (45 min or 50 min in case of individual driving)
3.5. Objective: ability to assess emergency situations: behaviour in an emergency situation: assessment of the situation, avoiding complications of an accident, calling for help, assisting casualties and providing first aid, reaction in the event of fire, evacuation of occupants of a lorry/bus passengers, ensuring the safety of all passengers, reaction in the event of aggression; basic principles for the drafting of an accident report.			Minimum: 1 hour (45 min or 50 min in case of individual driving)
3.6. Objective: ability to adopt behaviour to help promote the image of the company: behaviour of the driver and company image: importance of the			Minimum: 1 hour (45 min or 50 min in case of individual

standard of service provided by the driver on behalf of the company, the roles of the driver, people with whom the driver will be dealing with, vehicle maintenance, work organisation, commercial and financial effects of a dispute.			driving)
Licence categories C, C+E, C1, C1+E 3.7. Objective: to understand the economic environment of road haulage and the organisation of the market: road transport in relation to other modes of transport (competition, shippers), different road transport activities (transport for hire or remuneration, personal, auxiliary transport activities), organisation of the main types of transport company and auxiliary transport activities, different transport specialisations (road tanker, controlled temperature, etc.), changes in the industry (diversification of services provided, railroad, subcontracting, etc.).			Minimum: 1 hour (45 min or 50 min in case of individual driving)
Licence categories D, D+E, D1, D1+E 3.8. Objective: to understand the economic environment of the transport of passengers by road and the organisation of the market: transport of passengers by road in relation to other modes of passenger transport (rail, private car), different activities involving the transport of passengers by road, crossing borders (international transport), organisation of the main types of companies for the transport of passengers by road.			Minimum: 1 hour (45 min or 50 min in case of individual driving)

AUSTRIA

The tables below present the following information

- Table 1 Parts of initial training for driving license categories C or D

- Table 2 Training elements in the apprenticeship programme
- Table 3 Continuous training of holders of a category C driving license
- Table 4 Continuous training of holders of a category D driving license

Requirements for obtaining a category C driving licence:

- the applicant must hold a category B driving licence
- in case of category C1, the applicant must be at least 18 years old
- in case of category C, the applicant must either be 21 years old
    - or 18 and hold proof of a driving qualification
    - or 18 and have successfully completed the vocational training of a professional driver
    - or 18 and have a restriction to only drive specific vehicles with the purpose of fulfilling public duties or with the purpose of technical development during maintenance work.

If the applicant simultaneously applies for the driving licence categories B and C, the applicant can only take the driving exam for category C if he/she has already passed the theory exam and practical driving exam for category B.

Requirements for obtaining a category D driving licence:

- the applicant must hold a category B driving licence
- in case of category D1, the applicant must be at least 21 years old
- in case of category D, the applicant must either be 24 years old
    - or 21 and hold proof of a driving qualification
    - or 21 and have a restriction to only drive specific vehicles with the purpose of fulfilling public duties or with the purpose of technical development during maintenance work.
- the applicant must participate in a first aid course of at least 16 hours
- applicants who apply for a category D driving license must undergo a traffic psychological examination (in addition to obtaining a medical certificate). The main aspects of the examination include:
    - observational ability and power of concentration
    - ability to work under pressure and coordination
    - as well as the motivation to acquire the relevant driving licence.

Table 1. Category C & D driver training / initial qualification training programme – Austria

(Basic qualification of acquiring a driving licence or passing a qualification exam, if the applicant already holds a driving licence.)

	Implementation method (if legally indicated)	Use of e-learning or SBT (if legally	Number of hours (if legally indicated)

		indicated)	
1. Course for acquiring a driving licence			
a. theoretical part	Classroom learning		10 hours (C), 12 hours (D)
b. practical part	Driving lessons		Depends on whether C or C1, 8 hours (D)
2. Exam for acquiring a driving licence			
a. Qualification exam (?)			45 min
b. Practical exam			45 min
3. Exam for holders of a driving licence			
a. Qualification exam			90 min
b. Exam at federal government	Written and oral		

Table 2. Category C & D driver training / initial qualification training programme – Austria

(Basic qualification as vocational training of professional drivers – Grundausbildung als Lehre für Berufskraftfahrer)

	Implementation method (if legally indicated)	Use of e-learning or SBT (if legally indicated)	Number of hours (if legally indicated)
1. Theoretical part including general education and job-specific education	Classroom learning		General education at least 420 hours, job-specific education at least 780 hours
2. Practical part by means of an internship	On the job – practical – learning		240 hours total count of hours: 1,440
3. Exams			
a. Theoretical exam	Oral exam		30 min
b. Practical exam	Driving exam		90 min in total 2 hours of exams

Table 2. Category C driver training / further qualification training programme – Austria

	Implementation method (if legally indicated)	Use of e-learning or SBT (if legally indicated)	Number of hours (if legally indicated)
1. Further qualification			In total 40 hours
a. Module 1: driving safety and safety technology			8 hours 8 hours
b. Module 2: Eco-driving – saving fuel			8 hours
c. Module 3: labour law and traffic areas			8 hours
d. Module 4: securing loads and lorry regulations			8 hours
e. Module 5: health and safety training			8 hours

Table 3. Category D driver training / further qualification training programme – Austria

	Implementation method (if legally indicated)	Use of e-learning or SBT (if legally indicated)	Number of hours (if legally indicated)
2. Further qualification			Overall 40 hours
a. Module 1: driving safety and safety technology			8 hours
b. Module 2: Eco-driving – saving fuel			8 hours
c. Module 3: labour law and traffic areas			8 hours
d. Module 4: securing people and load, and bus regulations			8 hours
e. Module 5: health, traffic and environmental safety, service and logistics			8 hours

Some “driving school companies” offer e-learning programmes for further education that needs to be renewed periodically. This seems to be a rather convenient alternative for drivers that require flexibility, in comparison to being a legally binding element of the professional driver qualification.

ANNEX 3: Pilot training results

Pilot trainings August 2018

ICT-INEX IO3

- Implemented in TTS Vantaa, 20th – 22nd August
- 19 students participated
- 2 teams and each team has participants from all three groups

ICT-INEX pilot training IO3

The size of each team had to be at least five students. The training program for eco-driving was piloted with different training techniques and equipment.

Responsible partner: TTS / CARGO

Date: 20th – 22nd August 2018

*target group: 1 / 2 / 3

Types of simulators (high-end/low-end):

1. Session with Volvo (Volvo team)
2. Session with Scania (Scania team)

Team 1: Volvo

1. Driving in the lowest and highest power ranges with fuel consumption tracking.	RESULT	DEVIATION % FROM STANDARD	STANDARD
Motorways			
average fuel consumption	44,0	110 %	40
time of travel	14,45	120 %	12
average engine speed			
Mountainous area			
average fuel consumption	44,0	113 %	39
time of travel	13,	113 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up area			
average fuel consumption	42,9	102 %	42
time of travel	12,	121 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency			
Undeveloped area - sunny weather	0,75	107 %	0,7
Undeveloped area - rainy weather	0,75	94 %	0,8
Built-up area - sunny weather	0,44	73 %	0,6
Built-up area - rainy weather	0,88	125 %	0,7

Team 2: Scania (+ low-end simulator)

1. Driving in the lowest and highest power ranges with fuel consumption tracking.	RESULT	DEVIATION % FROM	STANDARD
Motorways			
average fuel consumption	39,447	101 %	39
time of travel	13,54	113 %	12
average engine speed			
Mountainous area			
average fuel consumption	40,322	106 %	38
time of travel	14,10	117 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
average fuel consumption	39,797	97 %	41
time of travel	11,70	117 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency			
Undeveloped area - sunny weather	0,89	127 %	0,7
Undeveloped area - rainy weather	0,78	97 %	0,8
Built-up area - sunny weather	0,75	125 %	0,6
Built-up area - rainy weather	0,84	121 %	0,7

Group 1: Unemployed young people (≤29 years)

Team 1: Volvo

1. Driving in the lowest and highest power ranges with fuel consumption tracking.	RESULT	DEVIATION % FROM	STANDARD
Motorways			
average fuel consumption	45,8	115 %	40
time of travel	13,9	116 %	12
average engine speed			
Mountainous area			
average fuel consumption	44,5	114 %	39
time of travel	11,5	96 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
average fuel consumption	41,3	98 %	42
time of travel	11,9	119 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency			
Undeveloped area - sunny weather	0,75	107 %	0,7
Undeveloped area - rainy weather	0,75	94 %	0,8
Built-up area - sunny weather	0,44	73 %	0,6
Built-up area - rainy weather	0,88	125 %	0,7

Team 2: Scania (+ low-end simulator)

1. Driving in the lowest and highest power ranges with fuel consumption tracking.	RESULT	DEVIATION % FROM	STANDARD
Motorways			
average fuel consumption	36,0	92 %	39
time of travel	12,4	103 %	12
average engine speed			
Mountainous area			
average fuel consumption	37,2	98 %	38
time of travel	14,1	117 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
average fuel consumption	38,4	94 %	41
time of travel	11,1	111 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)			
Undeveloped area - sunny weather	0,89	127 %	0,7
Undeveloped area - rainy weather	0,78	97 %	0,8
Built-up area - sunny weather	0,75	125 %	0,6
Built-up area - rainy weather	0,84	121 %	0,7

Group 2: Long-term unemployed people (50+ years)

Team 1: Volvo

1. Driving in the lowest and highest power ranges with fuel consumption tracking.	RESULT	DEVIATION % FROM STANDARD	STANDARD
Motorways			
average fuel consumption	48,7	122 %	40
time of travel	19,0	158 %	12
average engine speed			
Mountainous area			
average fuel consumption	45,0	115 %	39
time of travel	14,3	119 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
average fuel consumption	49,6	118 %	42
time of travel	11,3	113 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency			
Undeveloped area - sunny weather	0,75	107 %	0,7
Undeveloped area - rainy weather	0,75	94 %	0,8
Built-up area - sunny weather	0,44	73 %	0,6
Built-up area - rainy weather	0,88	125 %	0,7

Team 2: Scania (+ low-end simulator)

1. Driving in the lowest and highest power ranges with fuel consumption tracking.	RESULT	DEVIATION % FROM STANDARD	STANDARD
Motorways			
average fuel consumption	38,7	99 %	39
time of travel	17,0	142 %	12
average engine speed			
Mountainous area			
average fuel consumption	36,1	95 %	38
time of travel	13,4	112 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
average fuel consumption	33,3	81 %	41
time of travel	10,4	104 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency			
Undeveloped area - sunny weather	0,89	127 %	0,7
Undeveloped area - rainy weather	0,78	97 %	0,8
Built-up area - sunny weather	0,75	125 %	0,6
Built-up area - rainy weather	0,84	121 %	0,7

Group 3: Immigrants (including refugees)

Team 1: Volvo

1. Driving in the lowest and highest power ranges with fuel consumption tracking.	RESULT	DEVIATION % FROM	STANDARD
Motorways			
average fuel consumption	42,4	106 %	40
time of travel	13,8	115 %	12
average engine speed			
Mountainous area			
average fuel consumption	43,7	112 %	39
time of travel	14,3	119 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
average fuel consumption	42,3	101 %	42
time of travel	12,4	124 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency			
Undeveloped area - sunny weather	0,75	107 %	0,7
Undeveloped area - rainy weather	0,75	94 %	0,8
Built-up area - sunny weather	0,44	73 %	0,6
Built-up area - rainy weather	0,88	125 %	0,7

Team 2: Scania (+ low-end simulator)

1. Driving in the lowest and highest power ranges, with fuel consumption tracking.	RESULT	DEVIATION % FROM STANDARD	STANDARD
Motorways			
average fuel consumption	42,364	109 %	39
time of travel	13,76	115 %	12
average engine speed			
Mountainous area			
average fuel consumption	43,672	115 %	38
time of travel	14,258	119 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
average fuel consumption	42,264	103 %	41
time of travel	12,416	124 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)			
Undeveloped area - sunny weather	0,89	127 %	0,7
Undeveloped area - rainy weather	0,78	97 %	0,8
Built-up area - sunny weather	0,75	125 %	0,6
Built-up area - rainy weather	0,84	121 %	0,7

Driving background

GROUP 1

- B 2013
- B 2011
- B 2013
- B 2016
- B 2017
- B 2017

GROUP 2

- B 2005
- B 2008
- B 1995
- B 1988
- B 2004
- B 2009

Driving background

GROUP 3

- B 2017
- B 2014
- B 1997
- B 2004
- B 1995
- B 2010

Conclusions

There is no clear difference between the different groups in regard to their use of more than one simulator. On a general level, elderly people were more technically inadequate.

Independent training with a low-end simulator allowed more practice time and enabled participants to familiarize more in the route, but did not affect the results of eco-driving

- All students were halfway through their driver training (approx. 20 driving hours each)
- The skills of three students (from the Volvo group) were so weak that they collided during eco-driving
- Perhaps more pilot training sessions?

ICT-INEX IO3

Pilot training, September 2018

ICT-INEX IO3

- Implemented in TTS Vantaa, 24th September
- 12 students participated
- 2 teams and each team had participants from all three groups

ICT-INEX pilot training IO3

The size of each team consisted of at least five students. The training program for eco-driving was piloted with different training techniques and equipment.

Responsible partner: TTS / CARGO

Date: 24.9.2018

*target group: 1 / 2 / 3

Types of simulators (high-end/low-end):

1. Session with Volvo (Volvo-team)
2. Session with Scania (Scania-team)

Team 1: Volvo

1. Driving in the lowest and highest power ranges, with fuel consumption tracking.	RESULT	DEVIATION FROM	%	STANDARD
Motorways				
average fuel consumption	45,7	117	%	39
time of travel	14,8	124	%	12
average engine speed				
Mountainous area				
average fuel consumption	42,6	112	%	38
time of travel	12,3	102	%	12
average engine speed				
Undeveloped area				
average fuel consumption				
time of travel				
average engine speed				
Built-up areas				
average fuel consumption	43,7	107	%	41
time of travel	11,2	112	%	10
average engine speed				
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency				
Undeveloped area - sunny weather	0,78	111	%	0,7
Undeveloped area - rainy weather	0,76	95	%	0,8
Built-up area - sunny weather	0,68	113	%	0,6
Built-up area - rainy weather	0,82	117	%	0,7

Team 2: Scania (+ low-end simulator)

1. Driving in the lowest and highest power ranges, with fuel consumption tracking.	RESULT	DEVIATION FROM	%	STANDARD
Motorways				
average fuel consumption	35,9	90	%	40
time of travel	12,7	106	%	12
average engine speed				
Mountainous area				
average fuel consumption	36,4	93	%	39
time of travel	12,6	105	%	12
average engine speed				
Undeveloped area				
average fuel consumption				
time of travel				
average engine speed				
Built-up areas				
average fuel consumption	34,9	83	%	42
time of travel	11,0	110	%	10
average engine speed				
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency				
Undeveloped area - sunny weather	0,72	102	%	0,7
Undeveloped area - rainy weather	0,85	106	%	0,8
Built-up area - sunny weather	0,70	117	%	0,6
Built-up area - rainy weather	0,90	129	%	0,7

Group 1: Unemployed young people (≤29 years)

Team 1: Volvo

1. Driving in the lowest and highest power ranges with fuel consumption tracking.	RESULT	DEVIATION FROM	%	STANDARD
Motorways				
average fuel consumption	45,8	115	%	40
time of travel	13,9	116	%	12
average engine speed				
Mountainous area				
average fuel consumption	44,5	114	%	39
time of travel	11,5	96	%	12
average engine speed				
Undeveloped area				
average fuel consumption				
time of travel				
average engine speed				
Built-up areas				
average fuel consumption	41,3	98	%	42
time of travel	11,9	119	%	10
average engine speed				
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency				
Undeveloped area - sunny weather	0,75	107	%	0,7
Undeveloped area - rainy weather	0,75	94	%	0,8
Built-up area - sunny weather	0,44	73	%	0,6
Built-up area - rainy weather	0,88	125	%	0,7

Team 2: Scania (+ low-end simulator)

1. Driving in the lowest and highest power ranges with fuel consumption tracking.	RESULT	DEVIATION FROM	%	STANDARD
Motorways				
average fuel consumption	36,0	92	%	39
time of travel	12,4	103	%	12
average engine speed				
Mountainous area				
average fuel consumption	37,2	98	%	38
time of travel	14,1	117	%	12
average engine speed				
Undeveloped area				
average fuel consumption				
time of travel				
average engine speed				
Built-up areas				
average fuel consumption	38,4	94	%	41
time of travel	11,1	111	%	10
average engine speed				
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency				
Undeveloped area - sunny weather	0,89	127	%	0,7
Undeveloped area - rainy weather	0,78	97	%	0,8
Built-up area - sunny weather	0,75	125	%	0,6
Built-up area - rainy weather	0,84	121	%	0,7

Group 2: Long-term unemployed people (50+ years)

Team 1: Volvo

Motorways			
average fuel consumption	46,0	118 %	39
time of travel	16,3	136 %	12
average engine speed			
Mountainous area			
average fuel consumption	44,5	117 %	38
time of travel	13,5	112 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
average fuel consumption	45,8	112 %	41
time of travel	11,6	116 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)			
Undeveloped area - sunny weather	0,8	119 %	0,7
Undeveloped area - rainy weather	0,7	92 %	0,8
Built-up area - sunny weather	0,8	128 %	0,6
Built-up area - rainy weather	0,9	133 %	0,7

Team 2: Scania (+ low-end simulator)

Motorways			
average fuel consumption	36,7	92 %	40
time of travel	14,0	117 %	12
average engine speed			
Mountainous area			
average fuel consumption	35,8	92 %	39
time of travel	13,1	109 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
average fuel consumption	34,5	82 %	42
time of travel	11,5	115 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)			
Undeveloped area - sunny weather	0,8	107 %	0,7
Undeveloped area - rainy weather	0,8	100 %	0,8
Built-up area - sunny weather	0,7	113 %	0,6
Built-up area - rainy weather	0,9	125 %	0,7

Group 3: Immigrants (including refugees)

Team 1: Volvo

Motorways			
average fuel consumption	53,9	138 %	39
time of travel	15	125 %	12
average engine speed			
Mountainous area			
average fuel consumption	41	108 %	38
time of travel	10	83 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
average fuel consumption	47,3	115 %	41
time of travel	12,5	125 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)			
Undeveloped area - sunny weather	0,6	86 %	0,7
Undeveloped area - rainy weather	0,7	88 %	0,8
Built-up area - sunny weather	0,5	83 %	0,6
Built-up area - rainy weather	0,7	100 %	0,7

Team 2: Scania (+ low-end simulator)

1. Driving in the lowest and highest power ranges with fuel consumption tracking.	RESULT	DEVIATION % FROM STANDARD	STANDARD
Motorways			
average fuel consumption	32	80 %	40
time of travel	10	83 %	12
average engine speed			
Mountainous area			
average fuel consumption	36,82	94 %	39
time of travel	12	100 %	12
average engine speed			
Undeveloped area			
average fuel consumption			
time of travel			
average engine speed			
Built-up areas			
average fuel consumption	37,4	89 %	42
time of travel	11,33	113 %	10
average engine speed			
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency			
Undeveloped area - sunny weather	0,6	86 %	0,7
Undeveloped area - rainy weather	1	125 %	0,8
Built-up area - sunny weather	0,8	133 %	0,6
Built-up area - rainy weather	1,1	157 %	0,7

Driving background

Group 1

- B 2014
- B 2016
- B 2014
- B 2017

Group 2

- B 1978
- B 1998
- B 1989
- BD1 2017 (B 2014)
- BC 2007
- B 1991

Group 3

- B 2010 and B 1999

Conclusions

There is no obvious difference between the different groups in terms of the use of more than one simulator. On a general level, elderly people were more technically inadequate.

Independent training with a low-end simulator helped to acquire more practice time and to get to know the route better, but this did not affect the results of eco-driving.

- All students were at the beginning of their driver training (they had completed approx. 3 driving hours each)
- Difficulties in handling the vehicle
- A couple of students got lost along the route ☺

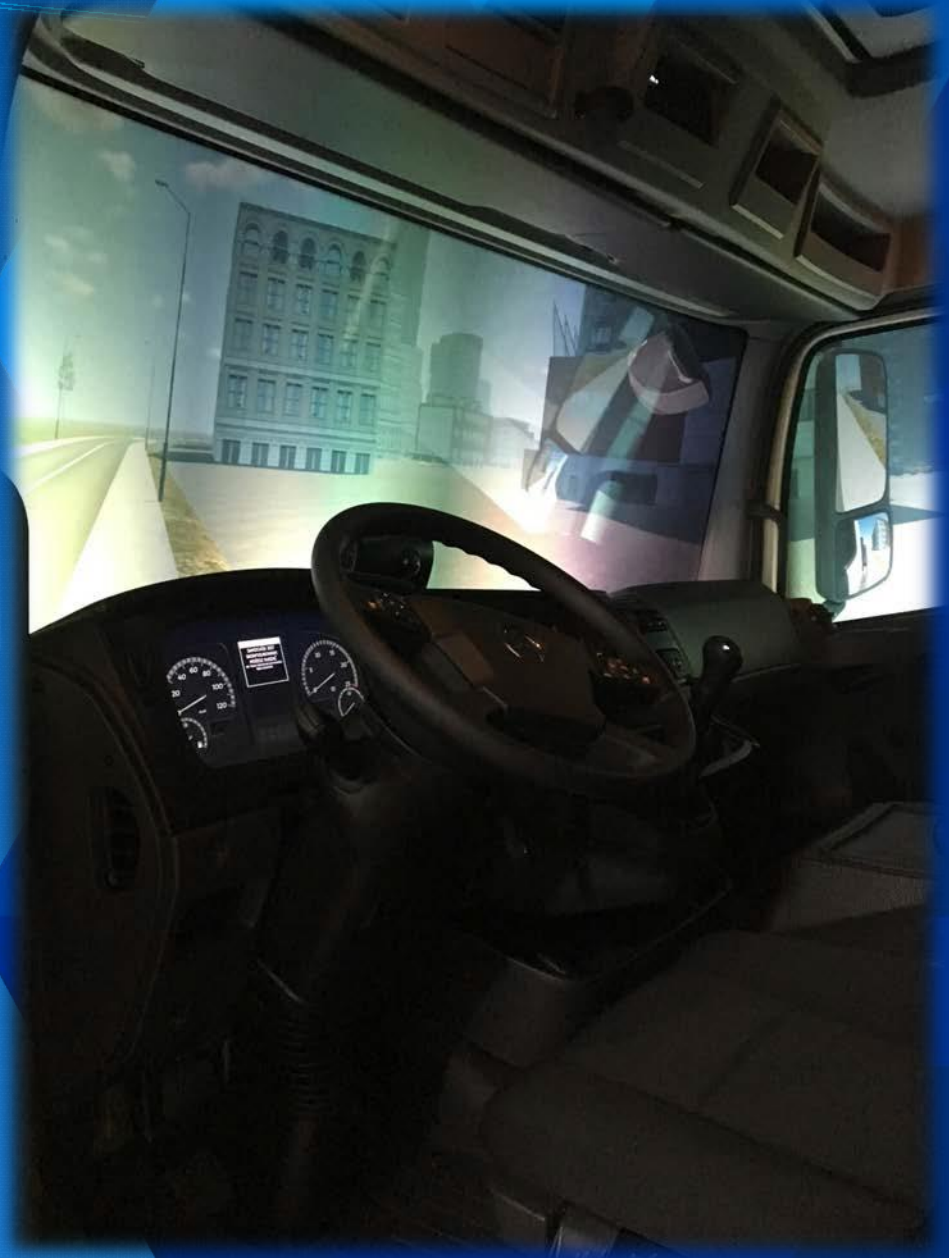
ICT – INEX IO3

ITS/CARGO Place of research: Jaworzno, Poland

Date of research: 20th – 22nd September 2018

ICT – INEX IO3

Pilot trainings
ICT – INEX IO3
Age range of respondents :
30- i 50+
Quantity of people: 15
Quantity of groups: 3
Group scale: 5 person
Type of simulator: high end



ICT – INEX IO3 – Group 1: people up to 30 years old

Responsible partner: ITS / CARGO
Date: 20 09 2018
Target group: 1 2 3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	24	96%	25	1
time of travel	15	100%	15	1
average engine speed	1400	93%	1500	1
Mountainous area				
average fuel consumption	35	117%	30	- 1
time of travel	15	100%	15	1
average engine speed	2100	105%	2000	- 1
Undeveloped area				
average fuel consumption	26	96%	27	1
time of travel	15	100%	15	1
average engine speed	1500	94%	1600	1
Built-up areas				
average fuel consumption	32	114%	28	- 1
time of travel	16	107%	15	- 1
average engine speed	1700	100%	1700	1
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM	STANDARD	AMOUNT OF POINTS
Undeveloped area - sunny weather	0,4	57%	0,7	5
Undeveloped area - rainy weather	0,76	95%	0,8	1
Built-up area - sunny weather	0,8	114%	0,7	- 1
Built-up area - rainy weather	1,2	150%	0,8	- 2
			TOTAL	**7**

ICT – INEX IO3

Responsible partner: ITS / CARGO
Date: 21 09 2018
Target group: 1 2_3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	25	100%	25	1
time of travel	17	113%	15	- 1
average engine speed	1300	87%	1500	2
Mountainous area				
average fuel consumption	32	107%	30	- 1
time of travel	18	120%	15	- 1
average engine speed	2200	110%	2000	- 1
Undeveloped area				
average fuel consumption	29	107%	27	- 1
time of travel	15	100%	15	1
average engine speed	1500	94%	1600	1
Built-up areas				
average fuel consumption	30	107%	28	- 1
time of travel	18	120%	15	- 1
average engine speed	1700	100%	1700	1
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM	STANDARD	AMOUNT OF POINTS
Undeveloped area - sunny weather	0,7	100%	0,7	1
Undeveloped area - rainy weather	0,9	113%	0,8	- 1
Built-up area - sunny weather	0,8	114%	0,7	- 1
Built-up area - rainy weather	1,2	150%	0,8	- 2
			TOTAL	**4**

ICT – INEX IO3 – Group 2: people over 50 years old

Responsible partner: ITS / CARGO
Date: 22 09 2018
Target group: 1 2 3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	25	100%	25	1
time of travel	13	87%	15	2
average engine speed	1500	100%	1500	1
Mountainous area				
average fuel consumption	32	107%	30	- 1
time of travel	17	113%	15	- 1
average engine speed	2400	120%	2000	- 1
Undeveloped area				
average fuel consumption	29	107%	27	- 1
time of travel	15	100%	15	1
average engine speed	1500	94%	1600	1
Built-up areas				
average fuel consumption	31	111%	28	- 1
time of travel	18	120%	15	- 1
average engine speed	1900	112%	1700	- 1
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM	STANDARD	AMOUNT OF POINTS
Undeveloped area - sunny weather	0,4	57%	0,7	5
Undeveloped area - rainy weather	0,76	95%	0,8	1

Built-up area - sunny weather	0,8	114%	0,7	-	1
Built-up area - rainy weather	1,2	150%	0,8	-	2
			TOTAL		**2**

ICT – INEX IO3 – Group 3: immigrants

ICT – INEX IO3

CONCLUSIONS

The subjects were professional driver training students. There were no clear differences between the various groups.

We can see only a small advantage in people aged up to 30 years.

In the future, we suggest that activities are performed on the simulator as part of the initial training. Completing these truck-related exercises before the main classes would allow future drivers to prepare for appropriate behaviour during their training in real conditions.

CONCLUSIONS

Tests planned in the next sequence will include:

- Practice on an ETS (Euro Truck Simulator) simulator
- Tests on a low-end simulator
- Validation survey

CONCLUSIONS

This will allow us to specify the following points:

- Adaptability to develop tests on the simulator
- Comparison of results obtained on low-end and high-end simulators
- The subjectivity of the tested person

ICT – INEX IO3

We anticipate further tests in November 2018.

Thank you for your attention!

ICT – INEX IO3

Grupa CARGO

Grupa CARGO

Knowledge | Innovations | Quality

- **The age range of the subjects: under 30 years to over 50 years**
- **Number of people: 30**
- **Number of groups: 6**
- **Group size: 5 people**

Grupa CARGO

ICT – INEX IO3

Group 1: people up to 30 years old

The three groups, which represented the age range of up to 30 years old, over 50 years old and immigrants, was divided into two subgroups: the first subgroup was initially tested using the Euro Truck Simulator program after which they used a low-end simulator. The second subgroup only used a low-end simulator.

Grupa CARGO

ICT – INEX IO3

Group 1: people up to 30 years old

To begin with, we present the results of the subjects who initially used the Euro Truck Simulator program and then continued on to use a low-end simulator.

ICT – INEX

Group 1: people up to 30 years old

RESULTS ETS (Euro Truck Simulator)

Responsible partner: ITS / CARGO
Date: 05 11 2018
Target group: 1 2 3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	21,6	90%	24	1
time of travel	15,2	101%	15	- 1
the number of errors	0,6	60%	1	5
number of brake pedal operations	2,8	56%	5	3
Mountainous area				
average fuel consumption	29	97%	30	1
time of travel	17	113%	15	- 1
the number of errors	0	0%	1	5
number of brake pedal operations	2	40%	5	4
Undeveloped area				
average fuel consumption	24	92%	26	1
time of travel	15	100%	15	1
the number of errors	0	0%	1	5
number of brake pedal operations	2	40%	5	4
Built-up areas				
average fuel consumption	28	100%	28	1
time of travel	16	107%	15	- 1
the number of errors	0	0%	1	5
number of brake pedal operations	2	40%	5	4
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Undeveloped area - sunny weather	0,6	86%	0,7	2

Undeveloped area - rainy weather	0,8	100%	0,8	1
Built-up area - sunny weather	0,7	100%	0,7	1
Built-up area - rainy weather	1	125%	0,8	- 2
			TOTAL	**39**

ICT – INEX IO3

Group 2: people over 50 years old

RESULTS ETS (Euro Truck Simulator)

Responsible partner: ITS / CARGO
Date: 07 11 2018
Target group: 1 2 3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	23	96%	24	1
time of travel	14,4	96%	15	1
the number of errors	1	100%	1	5
number of brake pedal operations	4,4	88%	5	1
Mountainous area				
average fuel consumption	30,6	102%	30	- 1
time of travel	17	113%	15	- 1
the number of errors	2,8	280%	1	- 2
number of brake pedal operations	4,8	96%	5	1
Undeveloped area				
average fuel consumption	25,6	98%	26	1
time of travel	14,4	96%	15	1
the number of errors	1,4	140%	1	- 1
number of brake pedal operations	4,4	88%	5	1
Built-up areas				
average fuel consumption	27,8	99%	28	1
time of travel	14,8	99%	15	1
the number of errors	2,2	220%	1	- 2
number of brake pedal operations	4,6	92%	5	1
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Undeveloped area - sunny weather	0,62	89%	0,7	2

DX.Y Title (edit custom properties to change)

Undeveloped area - rainy weather	0,76	95%	0,8		1
Built-up area - sunny weather	0,72	103%	0,7	-	1
Built-up area - rainy weather	0,9	113%	0,8	-	1
			TOTAL		**9**

ICT – INEX IO3

Group 3: Immigrants

RESULTS ETS

Responsible partner: ITS / CARGO
Date: 09 11 2018
Target group: 1 2 3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	21,6	90%	24	1
time of travel	13,4	89%	15	2
the number of errors	2	200%	1	- 1
number of brake pedal operations	4,4	88%	5	1
Mountainous area				
average fuel consumption	28,8	96%	30	1
time of travel	15	100%	15	1
the number of errors	2	200%	1	- 1
number of brake pedal operations	4,4	88%	5	1
Undeveloped area				
average fuel consumption	24,6	95%	26	1
time of travel	13,6	91%	15	1
the number of errors	1	100%	1	5
number of brake pedal operations	3,8	76%	5	2
Built-up areas				
average fuel consumption	26,8	96%	28	1
time of travel	15,6	104%	15	- 1
the number of errors	2	200%	1	- 1
number of brake pedal operations	2,8	56%	5	3
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Undeveloped area - sunny weather	0,62	89%	0,7	2
Undeveloped area - rainy weather	0,8	100%	0,8	1

Built-up area - sunny weather	0,58	83%	0,7	2
Built-up area - rainy weather	0,82	103%	0,8	- 1
			TOTAL	**20**

ICT – INEX IO3

Group 1: people up to 30 years old

The following table presents the results obtained from the subjects on a low-end simulator which was preceded by a session on the Euro Truck Simulator:

Responsible partner: ITS / CARGO
Date: 05 11 2018
Target group: 1 2 3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	22,6	94%	24	1
time of travel	14,4	96%	15	1
the number of errors	0,8	80%	1	5
number of brake pedal operations	4,8	96%	5	1
Mountainous area				
average fuel consumption	29,6	99%	30	1
time of travel	16,6	111%	15	- 1
the number of errors	3,4	340%	1	- 3
number of brake pedal operations	5,8	116%	5	- 1
Undeveloped area				
average fuel consumption	25	96%	26	1
time of travel	15	100%	15	1
the number of errors	2,2	220%	1	- 2
number of brake pedal operations	5,2	104%	5	- 1
Built-up areas				
average fuel consumption	27,8	99%	28	1
time of travel	16,2	108%	15	- 1
the number of errors	2,4	240%	1	- 2
number of brake pedal operations	5,4	108%	5	- 1
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS

DX.Y Title (edit custom properties to change)

Undeveloped area - sunny weather	0,6	86%	0,7	2
Undeveloped area - rainy weather	0,74	93%	0,8	1
Built-up area - sunny weather	0,7	100%	0,7	1
Built-up area - rainy weather	0,76	95%	0,8	1
			TOTAL	**5**

ICT – INEX IO3

Group 2: people over 50 years

The following table presents the results obtained from the subjects on a low-end simulator which was preceded by a session on the Euro Truck Simulator:

Responsible partner: ITS / CARGO
Date: 07 11 2018
Target group: 1 2 3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	25	104%	24	- 1
time of travel	15	100%	15	1
the number of errors	1,8	180%	1	- 1
number of brake pedal operations	4,6	92%	5	1
Mountainous area				
average fuel consumption	31,4	105%	30	- 1
time of travel	16,2	108%	15	- 1
the number of errors	2,8	280%	1	- 2
number of brake pedal operations	5	100%	5	1
Undeveloped area				
average fuel consumption	22	85%	26	3
time of travel	15,2	101%	15	- 1
the number of errors	1,8	180%	1	- 1
number of brake pedal operations	4,4	88%	5	1
Built-up areas				
average fuel consumption	28,8	103%	28	- 1
time of travel	15,4	103%	15	- 1
the number of errors	2,4	240%	1	- 2
number of brake pedal operations	5,4	108%	5	- 1

2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Undeveloped area - sunny weather	0,7	100%	0,7	1
Undeveloped area - rainy weather	0,92	115%	0,8	- 1
Built-up area - sunny weather	0,76	109%	0,7	- 1
Built-up area - rainy weather	1,04	130%	0,8	- 2
			TOTAL	**9**

ICT – INEX IO3

Group 3: Immigrants

The following table presents the results obtained from the subjects on a low-end simulator which was preceded by a session on the Euro Truck Simulator:

Responsible partner: ITS / CARGO
Date: 09 11 2018
Target group: 1 2 3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	23,2	97%	24	1
time of travel	14,2	95%	15	1
the number of errors	1,8	180%	1	- 1
number of brake pedal operations	5,4	108%	5	- 1
Mountainous area				
average fuel consumption	28,8	96%	30	1
time of travel	16,2	108%	15	- 1
the number of errors	1,6	160%	1	- 1
number of brake pedal operations	4,4	88%	5	1
Undeveloped area				
average fuel consumption	25,4	98%	26	1
time of travel	14,6	97%	15	1
the number of errors	1	100%	1	5
number of brake pedal operations	4,4	88%	5	1
Built-up areas				
average fuel consumption	27,8	99%	28	1
time of travel	15,2	101%	15	- 1
the number of errors	1,2	120%	1	- 1

number of brake pedal operations	3,8	76%	5	2
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Undeveloped area - sunny weather	0,64	91%	0,7	1
Undeveloped area - rainy weather	0,8	100%	0,8	1
Built-up area - sunny weather	0,68	97%	0,7	1
Built-up area - rainy weather	0,82	103%	0,8	- 1
			TOTAL	**11**

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ICT - INEX IO3

Group 1: people up to 30 years old

As shown, the obtained results suggest that an initial session on the Euro Truck Simulator may be of benefit.

The use of the ETS simulator prepares the examinee to practice on the low-end simulator.

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ICT – INEX IO3

Group 1: people up to 30 years old

The reaction times of the subjects, both on the ETS simulator and the low- end simulator, indicated "familiarity" and being accustomed to the three- dimensional reality. The following sessions on the simulator were held in conditions to which the person’s body adapted. This resulted in minor side effects in the form of "simulator motion sickness”.

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The second subgroup of people was only tested on a low-end simulator. These participants had no previous contact with the virtual reality of the ETS program.

The results are presented below.

ICT – INEX IO3

Group 1: people up to 30 years old

The table presents results for participants who had no contact with the virtual reality of the ETS (Euro Truck Simulator) simulator.

Responsible partner: ITS / CARGO
Date: 13 11 2018
Target group: 1 2 3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	22,6	94%	24	1
time of travel	16	107%	15	- 1
the number of errors	1,6	160%	1	- 1
number of brake pedal operations	4,8	96%	5	1
Mountainous area				
average fuel consumption	31,6	105%	30	- 1
time of travel	16,4	109%	15	- 1
the number of errors	2,6	260%	1	- 2
number of brake pedal operations	4,8	96%	5	1
Undeveloped area				
average fuel consumption	25,8	99%	26	1
time of travel	14	93%	15	1
the number of errors	1,4	140%	1	- 1
number of brake pedal operations	5,6	112%	5	- 1
Built-up areas				
average fuel consumption	28	100%	28	1
time of travel	15,4	103%	15	- 1
the number of errors	1,4	140%	1	- 1
number of brake pedal operations	5	100%	5	1
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Undeveloped area - sunny weather	0,64	91%	0,7	1
Undeveloped area - rainy weather	0,92	115%	0,8	- 1
Built-up area - sunny weather	0,72	103%	0,7	- 1
Built-up area - rainy weather	0,98	123%	0,8	- 2

DX.Y Title (edit custom properties to change)

TOTAL	**6**

ICT – INEX IO3

Group 2: people over 50 years

The table presents the results for participants who had no prior contact with the virtual reality of the ETS simulator.

Responsible partner: ITS / CARGO
Date: 13 11 2018
Target group: 1 2 3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	24,2	101%	24	- 1
time of travel	15,4	103%	15	- 1
the number of errors	1,8	180%	1	- 1
number of brake pedal operations	5,4	108%	5	- 1
Mountainous area				
average fuel consumption	32,6	109%	30	- 1
time of travel	15,4	103%	15	- 1
the number of errors	3	300%	1	- 2
number of brake pedal operations	5,6	112%	5	- 1
Undeveloped area				
average fuel consumption	26,2	101%	26	- 1
time of travel	14,8	99%	15	1
the number of errors	1,6	160%	1	- 1
number of brake pedal operations	5,6	112%	5	- 1
Built-up areas				
average fuel consumption	28,6	102%	28	- 1
time of travel	15,8	105%	15	- 1
the number of errors	1,6	160%	1	- 1
number of brake pedal operations	4,8	96%	5	1
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Undeveloped area - sunny weather	0,72	103%	0,7	- 1
Undeveloped area - rainy weather	0,9	113%	0,8	- 1

DX.Y Title (edit custom properties to change)

Built-up area - sunny weather	0,76	109%	0,7	-	1
Built-up area - rainy weather	1,08	135%	0,8	-	2
			TOTAL		**18**

ICT – INEX IO3

Group 3: Immigrants

The table presents the results for participants who had no prior contact with the virtual reality of the ETS simulator.

Responsible partner: ITS / CARGO
Date:14 11 2018
Target group: 1 2 3 (select the correct)
Type of simulator (high-end / low-end)
Gearbox: automatic/manual

1. Driving in the lowest and highest power ranges with fuel consumption tracking	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Motorways				
average fuel consumption	21	88%	24	2
time of travel	17,4	116%	15	- 1
the number of errors	0,8	80%	1	5
number of brake pedal operations	3,4	68%	5	2
Mountainous area				
average fuel consumption	30,4	101%	30	- 1
time of travel	16,2	108%	15	- 1
the number of errors	2	200%	1	- 1
number of brake pedal operations	5,8	116%	5	- 1
Undeveloped area				
average fuel consumption	24,6	95%	26	1
time of travel	15	100%	15	1
the number of errors	1	100%	1	5
number of brake pedal operations	5,4	108%	5	- 1
Built-up areas				
average fuel consumption	28,2	101%	28	- 1
time of travel	15,6	104%	15	- 1
the number of errors	1,2	120%	1	- 1
number of brake pedal operations	5,2	104%	5	- 1
2. Braking tests in a specific area with attention to different effects depending on the braking technique: reaction time from noticing an obstacle to the beginning of braking (emergency braking)	RESULT (reaction time)	DEVIATION % FROM STANDARD	STANDARD	AMOUNT OF POINTS
Undeveloped area - sunny weather	0,66	94%	0,7	1
Undeveloped area - rainy weather	0,84	105%	0,8	- 1
Built-up area - sunny weather	0,74	106%	0,7	- 1
Built-up area - rainy weather	0,86	108%	0,8	- 1
			TOTAL	**4**

CONCLUSIONS

The tested people were professional driver training students.
The research indicated that the pre-selection of appropriate tests that prepared the participants for the virtual reality of the ETS simulator allowed participants to assimilate to the low-end simulator in an easier manner. The subgroup that did not use the ETS simulator achieved worse results during the low-end simulator tests.
This applied to each of the studied target groups, to a greater or lesser extent. As part of the exercises, a course participant should learn correct load distribution, techniques for securing loads and selecting the most appropriate methods. We recommend looking into the possibility of carrying out part of these exercises with the use of a VR simulator. It may result in a more intriguing offer for course participants as the training centres are able to provide more interesting configurations and the creation of situations which are unavailable in the specific area of the training centre. Simultaneously, it will reduce the financial expenses borne by training centres compared to having to organize traditional training.

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Knowledge | Innovations | Quality

We suggest that in the future a virtual reality simulator is used in lessons during the initial training. Such training enables future drivers to better prepare for appropriate behaviour during subsequent training in real conditions.

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We anticipate further tests in 2019.

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Erasmus+

Funded by the European Union