



6th Framework Programme - Priority 2 "Information Society Technologies"
 "HUMAN centred design for Information Society Technologies"
 Proposal n° 507 420
 Contract n° 507420

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Inventory of existing simulation and multimedia tools for driver training and education

Deliverable G1 of Task Force G:
 Use of ITS to train and to educate drivers

Reference: **GUPM-041018T1-DA(2)**

Rev.	Issuing date	Pages	Written by	Visa	Verified by	Visa	Approved by	Visa
	10/10/18	47	Jose M. Pardillo	✓	TFG	✓		
Modifications: creation of the document								
1	31/10/18	47	Jose M. Pardillo	✓	Executive Committee	✓	Jean-Pierre Médevielle	
Modifications: pp13-14 have been changed to reflect DTF T. Trogaluer's comments on E-learning applications to driver training								

TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
1 INTRODUCTION	4
2 METHODS.....	5
3 RESULTS	6
3.1 INVENTORY OF DRIVING SIMULATORS.....	6
3.2 INVENTORY OF E-LEARNING APPLICATIONS	10
4 DISCUSSION	13
4.1 DRIVING SIMULATORS.....	13
4.2 E-LEARNING APPLICATIONS TO DRIVER TRAINING	14
5 CONCLUSIONS	16
6 LIST OF ABBREVIATION	17
7 LIST OF TABLES.....	17
APPENDIX A: DRIVING SIMULATORS INVENTORY	18
APPENDIX B: DATA FROM ADDITIONAL DRIVING SIMULATORS IDENTIFIED IN TRAINER.....	43
APPENDIX C: E-LEARNING APPLICATIONS INVENTORY	47

EXECUTIVE SUMMARY

The first activity of Humanist TFG has resulted in the preparation of an inventory of existing simulation and multimedia tools for driver training and education. This information is intended to provide the background for the assessment of the current situation in this field and to identify future research needs which is the next step in TFG work plan.

A survey of the existing applications in simulation and multimedia tools for driver education was conducted with the objective of gathering relevant information on ITS applications to train drivers. Two questionnaires were prepared and sent to TFG partners and other Humanist partners selected to represent all the countries that are part of the consortium. The results of the survey have been reported in document GUPM-040830-T1-DA(1) "Collation of information on existing simulation and multimedia tools for driver training and education". As a result data on 35 driving simulators and 7 e-learning applications has been obtained. The results of the survey has been supplemented with the information gathered in previous research projects (TRAINER) in which 21 additional simulators and 17 E-learning applications had been identified.

This document reports the resulting inventory of existing simulation and multimedia tools for driver education.

1 INTRODUCTION

Humanist Task Force G aims at describing and continuously updating the "state-of-the-art" on the application of ITS technologies to driver training and education by exchanging knowledge and experiences within the network.

Simulators and interactive multimedia training tools are starting to be used to train drivers paying significant attention to the enhancement of risk awareness and to improve driver training under high risk situations or certain difficult decisions to make that cannot be expected to emerge when training in real traffic. In addition to the application of ITS to train novice and professional drivers, other field that is being explored is the training of elderly and disabled people. In this context simulators can be of great use in helping the subjects to gain functional awareness of their abilities and to adapt their driving behaviour to them without being exposed to the risks of real traffic.

Simulators hold considerable promise for enhancing driver training, testing, and licensing and in consequence for improving driver performance and highway safety. One of Humanist TFG objectives is to assess the present state of the art in the application of driver simulators to driver training, and to identify what additional R&D effort is needed to achieve the potential effectiveness in using simulators to improve the driver training process at a European level with harmonized procedures.

New communication technologies may also be applied to enhance the effectiveness of driver training and education. E-learning techniques are starting to be used in this field. In general e-learning denotes all kinds of techniques using electronic means or multimedia to enhance traffic safety through improvement of drivers skills and knowledge. As such e-learning techniques can employ strategies, which ranges from training of certain skills or techniques to improvements in awareness of special subjects.

As means for training or knowledge enhancement e-learning is regarded as both an efficient and cost effective alternative to driving simulators. It is often proposed that within certain areas of driver training use of e-learning are better learned or that the format of e-learning is sufficient for particular skills or knowledge. Similarly, e-learning is also considered an alternative to human instructions in theoretical issues of driving or driving laws and regulations.

The first result of TFG activity is the Inventory of Existing Simulation and Multimedia Tools for Driver Training and Education. The results of this activity are reported in this document.

2 METHODS

A survey of the existing applications in simulation and multimedia tools for driver education was conducted with the objective of gathering relevant information on ITS applications to train drivers. The results of the survey have been reported in document GUPM-040830-T1-DA(1) "Collation of information on existing simulation and multimedia tools for driver training and education".

Responses to the survey were received from BAST, CDV, CUT, IFADO, INRETS, SWOV, UPM, BIVV, NTUA, TOI and TRL.

The results of the survey were discussed at the Humanist TFG meeting, held in Toulouse as reported in document GUPM-040916-M0-DA(A) "TFG Toulouse Meeting Minutes Sept 9, 2004". It was agreed to use them in conjunction with the information gathered in previous research projects (TRAINER) to prepare an inventory of existing driving simulators and e-learning applications. UPM has been responsible for analysing the information and compiling the inventory of driving simulators and DTF has prepared the inventory of e-learning. The resulting products have been reviewed to the rest of the Task Force members.

3 RESULTS

3.1 Inventory of driving simulators

The following table includes the list of the 35 simulators for which information was gathered from the responses to the survey.

Table 1. Simulators included in the Humanist TFG survey

CODE	SIMULATOR /OWNER	OWNER CATEGORY	CITY/COUNTRY	MAIN USE
S1	Drive Station International KG	Private company	Frankfurt/ Germany	Commercial product for driver training
S2	Krauss Maffei Wegmann GmbH	Private company	Munich/ Germany	Commercial product for driver training
S3	DLR Institute of Transportation	Research centre	Braunschweig/ Germany	Research
S4	Dr. Ing. Reiner Foerst GmbH	Private company	Gummersbach/ Germany	Commercial product for driver training
S5	Fraunhofer IAO University of Stuttgart	Research centre	Stuttgart/ Germany	Research
S6	Nightdriver L-LAB/ Hella KgaA	Private company	Paderborn/ Germany	Product development and testing
S7	Kartsim Simtec GmbH	Private company	Braunschweig/ Germany	Research
S8	MARS Simtec GmbH	Private company	Braunschweig/ Germany	Research
S9	Helmut Schmidt University (German Army)	Research centre	Hamburg/ Germany	Research
S10	Würzburger Institut für Verkehrswissenschaften WIVW GmbH www.wivw.de	Private company	Würzburg/ Germany	Commercial product for driver training
S11	German Army Driving School	Military drivers training centre	Bremen/ Germany	Professional, drivers training
S12	ASF GmbH	Private company	Bremen/ Germany	Professional drivers training
S13	Rheinmetall Defence Electronics GmbH	Private company	Bremen/ Germany	Commercial product for driver training
S14	Rheinmetall Defence Electronics GmbH	Private company	Bremen/ Germany	Commercial product for drivers training Research

CODE	SIMULATOR /OWNER	OWNER CATEGORY	CITY/COUNTRY	MAIN USE
S15	Dutch Police Academy	Police training centre	Rotterdam, Apeldoorn, Lelystad/ Netherlands	Professional drivers training
S16	Rehabilitation Clinic "Godeshöhe"/ ZNS	Health care centre	Bonn/ Germany	Drivers with disabilities training
S17	Berlin Public Transport BVG	Public Transport Company	Berlin/ Germany	Professional drivers training
S18	Bavarian Alert Police	Police training centre	Rosenberd/ Germany	Professional drivers training
S19	e-com Systems	Military training centre	Slavkov u Brna/ Czech Republic	Professional drivers training
S20	Traffic Academy of Bohemia	Private drivers training centre	Prague/ Czech Republic	Professional drivers training
S21	AT 99 VRT/2M Driving Trainer JKZ spol sro	Private company	Olomuc / Czech Republic	Commercial product for driver training
S22	INRETS	Research centre	Arcueil/ France	Research
S23	INRETS	Research centre	Bron/ France	Research
S24	INRETS	Research centre	Salon de Provence/ France	Research
S25	FAROS	Private company	Lannion/ France	Commercial product for driver training
S26	TRL	Research centre	Crowthorne/ UK	Research
S27	TRL	Research centre	Crowthorne/ UK	Professional drivers training
S28	VVCR/ ANWB	Private company	Netherlands	Commercial product for novice drivers training
S29	Green Dino/ De Nedrlandse Rijsimulator	Private drivers training centres	25 locations/ Netherlands	Commercial product for novice training
S30	BIVV CARA.	Research Centre	Brussels/ Belgium	Research
S31	Onyros Simulations SPRL	Private company	Brussels/ Belgium	Commercial product Road safety awareness demonstrations

CODE	SIMULATOR /OWNER	OWNER CATEGORY	CITY/COUNTRY	MAIN USE
S32	Katholieke Universiteit Leuven Faculteit Bewegingswetenschappen en Revalidatie	Research Centre	Leuven/ Belgium	Research
S33	CEDINT UPM	Research Centre	Madrid/ Spain	Research
S34	CITEF UPM	Research Centre	Madrid/ Spain	Research
S35	EMT (Madrid Public Transport Company) CEFTRAL	Public Transport Company	Madrid/ Spain	Professional drivers training

Appendix A includes the complete information that was obtained through the survey classified in the following categories:

1. General Characteristics
2. Technical data. Image
3. Technical data. Sound
4. Road& roadside environment modelling
5. Vehicle & base
6. Computer / software

The results of TRAINER (System for driver Training and Assessment using Interactive Evaluation tools and Reliable methodologies) have been used to supplement this information. This project collected information on 23 simulators, most of them in countries not covered by the Humanist NoE, particularly the US, Japan and other American, Asian, and African countries. Simulators T8 and T22 are also included in the TFG inventory. Therefore the TRAINER inventory provides information on 21 additional simulators. Table 2 includes the list of simulators in the TRAINER inventory.

Table 2. Simulators included in the TRAINER inventory

.CODE	Institutions and companies	Country
T1	Systems Technology Inc.	USA
T2	Immersive Technologies PTY Ltd.	USA
T3	Imago Systems Inc.	Canada

.CODE	Institutions and companies	Country
T4	NADS, National Advanced Driving Simulator. University of Iowa	USA
T5	Institut für Straßen- und Schienenverkehr	Germany
T6	University of Leeds	Great Britain
T7	BWB, The Federal Office for Defense Technology and Procurement	Germany
T8	FAROS	France
T9	University of Michigan Transportation Research Institute	USA
T10	Human Interface Technology Laboratory, University of Washington	USA
T11	SoftLab-Nsk Ltd	Russia
T12	Kobitec	Republic of South Africa
T13	FAAC Inc.	USA
T14	Hyperion Technologies	USA
T15	Autosim	Norway
T16	Doron Precision Systems, Inc.	USA
T17	VA Center of Excellence on Mobility	USA
T18	Warsaw University of Technology	Poland
T19	AFT-IFTM	France
T20	Japan Automobile Research Institute	Japan
T21	Kookmin University. Vehicle Control Laboratory	Korea
T22	University of the Federal Armed Forces Munich	Germany

.CODE	Institutions and companies	Country
T23	STN ATLAS Elektronik GmbH	Germany

Source: Hoeschen, A. and Bekiaris, E. eds (1999): TRAINER Deliverable No 2.1 “Inventory of driver training needs and major gaps in the relevant training procedures”

Appendix B includes the basic information reported in the TRAINER project on these 23 simulators. Full details can be found in TRAINER Deliverable 2.1.

3.2 Inventory of e-learning applications

The list of e-learning applications for which information was received in response to TFG survey is included in table 3.

Table 3. E-learning applications included in the Humanist TFG survey

CODE	APPLICATION OWNER	OWNER CATEGORY	CITY/ COUNTRY	USES
E1	KRONE, ÖAMTC, FÜRBOCK	Driving Schools	Vienna/Austria	Virtual driving license for novice drivers. Computer based test with questionnaire. The test is based on existing driving curriculum.
E2	SPIS	Unknown	Prague, Czech Republic	Training of novice drivers in traffic regulations particularly in the Czech Republic and other European countries
E3	Jan Dobew	Unknown	Unknown Czech Republic	Training programme for novice drivers and re-training for the final driving examination. Both the curriculum and the test questions All traffic rules included as well as explanations of traffic situations at intersections
E4	KONTIS	Private company	Prague, Czech Republic	Training of professional drivers in traffic rules, animated intersection and other exercises.
E5	Different publishing houses in Germany	Private companies		Training for the theoretical driving test for novice and professional drivers. Programme is based on existing driving curriculum.

CODE	APPLICATION OWNER	OWNER CATEGORY	CITY/ COUNTRY	USES
E6	OCTRU (training centre of the Dutch Army)	Military driving centre	Oorscot, The Netherlands	Training novice and professional army drivers. Updating experienced drivers. Programmes are based on the official theoretical driving test
E7	TRL, TruckSim facility	Research Centre	Crowthorne, UK	Training of professional truck drivers on hazard perception through examples

Appendix A reflects the complete information that was obtained through the survey

Additionally, data about 17 driver training tools in Sweden (5), Greece (2), The Netherlands (3), Belgium (3), Spain (2) and Germany (2) was obtained in TRAINER. Table 4 includes the list of these applications.

Table 4. E-learning applications included in the TRAINER report

CODE	APPLICATION	OWNER	COUNTRY
TE1	Bonniers Traficskola 3	Bonnier Multimedia	Sweden
TE2	En god hjälp med teorin	STR Media AB	Sweden
TE3	STR Media AB	STR Media AB	Sweden
TE4	Körkörtstest 2	STR Media AB	Sweden
TE5	TK 2000	STR Media AB	Sweden
TE6	Driving Skills	Backs Electronic Publishing Ltd.	Greece
TE7	Feu Vert pour le permis de conduire	Gutenbic S.A.	Greece
TE8	TRUST 800	Thomson Training & Simulation	Netherlands
TE9	Zebra	UGA media	Netherlands
TE10	De nieuwe Rijes	VekaBest	Netherlands
TE11	Mijn rijbewijs zonder omwegen	De Boeck & Lancier	Belgium
TE12	Wees wegwijs	Wees Wegwijs N.V.	Belgium

CODE	APPLICATION	OWNER	COUNTRY
TE13	Interactief Defensief Autorijden	Commercial Union Belgium N.V.	Belgium
TE14	Autosim	GSC Grupo de Simulación de Conducción	Spain
TE15	SEVIAL	INTRAS Instituto Universitario de Trafico y Seguridad Vial	Spain
TE16	SCAN & TEACH	Degener Lehrmittel GmbH	Germany
TE17	Speedy	Vogel Verlag	Germany

Source: Hoeschen, A. and Bekiaris, E. eds (1999): TRAINER Deliverable No 2.1 “Inventory of driver training needs and major gaps in the relevant training procedures”

13 of these are PC based software CD-Roms, 2 are PC based simulators (TRUST 800, Autosim), 2 are based on a CD-I player without PC and need a TV set (SCAN & TEACH, VekaBest). The most frequent mean of presentation are computer animations, followed by images, sound, photo and video.

Bonniers Trafikskola, En god hjälp, Körkortstest, Vägmarken, Feu Vert, and ZEBRA are software tools with a focus on home use, partially also for training in the driving schools. The rest is software which is sold to the driving schools only. Detailed information can be found in the TRAINER report.

4 DISCUSSION

4.1 Driving simulators

Out of 35 simulators included in the Humanist survey 10 are distributed as commercial products for driver training; 8 are used in company for professional drivers training; 1 is used for the rehabilitation of drivers with disabilities training; 13 are used mainly for research, 2 for industrial products development and testing and 1 for road safety demonstrations.

The vast majority of the simulators is adaptable to be used in driver training. In total, 31 of the simulators are used or may be adapted for driver training, in 3 cases the adaptation is considered possible, and only in 1 case the response was that the adaptation is not possible.

On the contrary, the existence of well adapted simulators for persons with special needs is very limited. Only 3 simulators (9%) are adapted, while in 1 more the adaptation would be possible.

Concerning validation of the simulators, 6 have been validated to some extent in research projects (5 in Trainer, Agile and 1 in other projects). In addition, 12 have been validated by the customer (10 of them by public institutions and 2 by private companies), and 2 by the simulator developer. In 2 cases validation is under way, while 12 simulators (34%) have not been validated at all. Even in the cases in which some kind of validation has been conducted, no common protocol or procedure has been applied.

The summary of the technical characteristics of the 35 simulators is:

a) Image

29 simulators (77%) use white screens as main projection device, while only 6 (23%) use monitors. The number of projectors varies from 1 in the more simple solutions to 8 in the most sophisticated. The vertical field of view ranges from 50° to 270°, while the horizontal field of view ranges from 30° to 50°.

32 simulators (91%) admit at least two different sight conditions, and 17 (49%) are able to reproduce clear, night, rain, and fog conditions.

b) Sound feed back to drivers

All the simulators provide some sound feedback to the drivers. The most common is the engine sound, supported in all cases. Other sounds that are included in the simulation are those originated by the tyres (43%), by other vehicles (71%), by radios or CD players (26%), and by rain or other weather conditions (20%). In addition, 28 simulators (80%) are able to transmit voice messages from instructors.

c) Virtual reality devices

Only 9 simulators incorporate some kind of virtual reality devices. The most common are head trackers.

d) Road and roadside environment modelling

The road and roadside modelling presents flexibility in most simulators. 27 (77%) admit changes in road curvature, although in 8 cases a special tool is required to implement the changes. 26 (74%) support changes in road friction and the number of lanes. 30 simulators (86%) include scenarios located in freeways, 30 in urban areas (86%), 28 in residential areas (71%), and 25 in industrial areas.

Scenarios include other road users in most cases. 30 simulators include other cars in their simulation (71%): 25 include trucks and buses (71%), 19 bicycles (54%), 25 pedestrians (71%), and 5 animals (14%).

e) Vehicle and base

27 simulators (77%) use passenger cars as base vehicle, 5 are designed for trucks primarily, 1 for buses, 1 for trams, and 1 for military tanks. In 18 simulators it is possible to change the base vehicle to an alternative of a different class (from light vehicle to heavy vehicle). The simulator cabin is a full car in 18 simulators (51%), half car in 10 (29%), a cabin reproduction in 9 (26%), a cabin simplification in 5 (14%). Only 4 simulators do not incorporate a cabin (11%).

13 simulators (35%) have a fixed base without a motion system., while 14 (40%) have a 6 degrees of freedom hydraulic platform. The rest have simpler motion systems with fewer degrees of freedom.

18 simulators (51%) support vehicle headlight simulation in night time driving conditions.

d) Computer and software

18 simulators (51%) are based on personal computer with MS Windows. 9 (26%) use PCs with other operating systems, 4 (11%) are Onyx based.

The software scenarios admit minor changes in 6 simulators (17%); 18 simulators (51%) only admit changing complete scenarios, while in 9 (26%) cases scenarios cannot be modified.

In 26 simulators (74%) it is fully possible to incorporate ITS in vehicle devices to the simulation, while in 5 cases (14%) the ITS devices would not be coordinated with scenarios, and in 2 it is not possible (6%).

4.2 E-learning applications to driver training

Only a few institutions had been involved in either development or use of e-learning applications. Most of the applications were only developed and used as supplement to existing training courses. For the majority of applications the purpose was to give the driver additional possibilities of learning existing curriculum and were based on existing training programmes (though not interactive programs).

The target groups were either novice drivers or professional drivers, whereas neither elderly or drivers with license were targeted.

The length of usage between the applications varied substantially from less than one year to 8 years.

Almost all applications focused on skill learning (understood as knowledge of rules, regulations, signs etc.). A few applications also employed knowledge of defensive driving techniques and a single application also addressed attitudinal elements. In case of interactive applications many of these also presented the driver with a test result of the performance of the students.

None of the applications has been evaluated scientifically. This was the case for both learning potentials or the transfer effects, though some applications had been evaluated internally or through systematic dialogue with the users.

Compared to the driving simulator survey relatively few institutions responded to e-learning applications questionnaire. However, this should not be taken as an indication of less profound use of these applications. As the TRAINER survey showed e-learning applications seem to be more widespread than the survey would indicate. There could be several reasons for this. Firstly, it is a cost effective training tool to use, both for development and running, for any purpose such as increase specific knowledge, raise awareness or simply illustrate certain traffic situations. Secondly, e-learning applications can be used in conjunction to other training courses or as activity in simulator courses. It is however beyond the scope of this survey to give answers on the extent of e-learning activities within driver training in general.

5 CONCLUSIONS

The results of the driving simulator survey shows that a wide variety of driving simulators is available nowadays. They are already being used in driver training, both of novice drivers and of professional drivers, as well as for research, and other applications. On the contrary, there are few alternatives to cover the needs of disabled drivers. This is a field that requires further development.

The technical characteristics of the simulators cover a wide range of specifications. The present state of the technology seems to make it possible to implement different driver training applications with a growing level of complexity and fidelity to real driving conditions. Nevertheless, there is a lack of common technical specifications both at national level and at European level that define the minimum conditions that a simulator should have to be suitable for use in the different levels of driver training applications. A framework for this specifications needs to be defined.

The validation of simulators is also an area where there is still a need for further advance. There have been some efforts in this field, but without a systematic approach that enables to compare results or to derive general conclusions. A methodological approach to driver simulator validation for driver training is required as a key step towards extended use of simulators as standard tools in the driver training process in Europe.

E-learning techniques should be regarded as an alternative or supplement to traditional theoretical training as it holds great illustrative value. On the other hand it is unlikely that e-learning could replace real driving. As most e-learning applications are not yet used as compulsory training tools little knowledge exists on the learning potential compared to traditional driver training (both theoretical and real driving).

As the applications do not seem to stand alone but are either used as a supplement or based on existing schemes they target groups of drivers who traditionally are already targeted in training, typically novice or professional drivers.

In this survey elderly drivers, impaired drivers or drivers with special needs are not targeted in any of these applications though many of these driver groups could potentially benefit from certain elements of these applications. As a general notion it could be stated that e-learning applications potentially could have good chances of reaching these drivers as use of e-learning does not require physical presence of a driving instructor. On the other hand it could be argued that many of these groups are not familiar with these types of training tools meaning they would not necessarily be interested in this form of training. However, it is likely that as the extent of the media of e-learning becomes more and more widespread so will the e-learning applications within the areas of driver training.

In general little scientifically validated knowledge exists on the transfer effects of e-learning in regards to driving behaviour, situation awareness or anticipatory behaviour. In this area an analytical review of driver training and education to use in formulating guidelines and goals for future development of learning tools is required.

6 LIST OF ABBREVIATION

dof: Degrees of freedom

7 LIST OF TABLES

Table 1. Simulators included in the Humanist TFG survey

Table 2. Simulators included in the TRAINER inventory

Table 3. E-learning applications included in the Humanist TFG survey

Table 4. E-learning applications included in the TRAINER inventory

APPENDIX A: DRIVING SIMULATORS INVENTORY

1. General Characteristics

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
Drive Station International KG www.drive-station.com	Private company	Frankfurt/ Germany	Commercial product for driver training	Y		Car and truck simulation 80% reliability	By the developer
Krauss Maffei Wegmann GmbH www.kmwsim.de	Private company	Munich/ Germany	Commercial product for driver training Research Vehicle testing	Y Emergency vehicles		ACS /truck driving simulator with 210° field of vision, car driving cockpit and sound simulation.	No
DLR Institute of Transportation www.dfoerst.de	Research centre	Braunschweig/ Germany	Research	Y	Possible	Large scale driving simulator, 6-dof motion base, 240° outside view projection (8 channels, mounted on motion base), full passenger vehicle as driver cockpit. Flexible and modular software architecture using high fidelity vehicle dynamics, traffic simulation, etc.	Will occur 1st half 2005
Dr. Ing. Reiner Foerst GmbH www.dfoerst.de	Private company	Gummersbach/ Germany	Commercial product for driver training Research Traffic Safety	Y Alcohol simulation Driver assessment		Simulators used for: traffic safety, driver training, demonstration and research . Various wooden cabins, real cars cabin versions	Research projects: TRAINER, AGILE

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
Fraunhofer IAO University of Stuttgart www.zve.iao.fraunhofer.de	Research centre	Stuttgart/ Germany	Research	Y		Driving simulator based on a real (complete) car, surrounded by 6 projection screens. Actuators at the wheels, vibration devices and a surround sound system Software application allows easy integration of ADAS and IVIS as well as data and video analysis.	Validation under way
Nightdriver L-LAB/ Hella KgaA www.hni.uni-paderborn.de /rip/vr/night	Private company	Paderborn/ Germany	Research Product testing (vehicle headlamps)	Possible with improvement s		Realistic real time light rendering from virtual headlamps. Combined with a model of a proving ground which exists in the real world alllows to interact with virtual prototypes of automobile headlights.	As part of diploma thesis for light distribution. Not published
Kartsim Simtec GmbH	Private company	Braunschweig/ Germany	Research Vehicle testing	Y		Interactive driving simulator with control load system, a hexapod motion platform. It is a one seater system with integrated cabin	No

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
MARS Simtec GmbH	Private company	Braunschweig/ Germany	Research Vehicle testing	Possible with improvement s		Full car body simulator fixed on a hexapod motion platform. Single channel visual system (rear projection), real film projection, no control load, no interactivity	No
Helmut Schmidt University (German Army)	Research centre	Hamburg/ Germany	Research Vehicle testing	Possible with improvement s		Originally built for simulating the off-road- drive of a truck. Use under on road conditions and other types of vehicles is possible. Hexapod motion system, additional 7th actuator for motion in sway, turntable (unlimited) between hexapod and drivers cab. Extensive measurement equipement (kin, dyn, bio)	German Army
Würzburger Institut für Verkehrswissenschaften WIVW GmbH www.wivw.de	Private company	Würzburg/ Germany	Commercial product for driver training Research Vehicle Training	Y		High-Fidelity Simulation, 6-dof- movement system, 180° front view, 3 rear views. On-line generation of driving scenarios	No

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
German Army Driving School	Military drivers training centre	Bremen/ Germany	Professional, novice and elder drivers training	Y		Truck cabin mounted on a driving optimised motion system with a fixed cylindrical screen, 1 instructor station for 3 simulators Database consists of a road network with more about 100 km street length comprising city, rural and highway parts, each in summer and winter version. In use since 1999 for driver licence training and preparation for drivers in foreign countries.	German Army

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
ASF GmbH	Private company	Bremen/ Germany	Professional drivers training	Y		Truck cabin mounted on a 6 dof motion system a fixed spherical screen, 1 instructor station for 3 simulators and a monitoring station with replay functionality. The database consists of a road network with more about 80 km street length comprising city, rural and highway parts, each in summer and winter version In use for several years for professional driver training for safe and fuel efficient driving.	Rheinmetall Defence Electronics

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
Rheinmetall Defence Electronics GmbH	Private company	Bremen/ Germany	Commercial product Professional drivers training Research	Y		Truck cabin mounted on a 6 dof motion system a fixed spherical screen, instructor station with replay mode. Database with more about 100 km road length comprising city, rural and highway parts, each in summer and winter version In use since 1999 for driver licence training and preparation for drivers in foreign countries.	German Army
Rheinmetall Defence Electronics GmbH	Private company	Bremen/ Germany	Commercial product for drivers training Research	Y		Generic cabin (driver place only) with integrated motion system and seat shaker, fixed cylindrical screen, instructor station and a monitoring station with replay functionality. Database with more than 100 km street length comprising city, rural and highway parts, each in summer and winter version. Used for development and research purposes.	No

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
Dutch Police Academy	Police training centre	Rotterdam, Apeldoorn, Lelystad/ Netherlands	Professional drivers training	Y		Generic cabin (driver place only) with integrated motion system, 180° horizontal field of view, fixed screen, instructor station and a monitoring station with replay functionality. Database with more than 100 km street length comprising city, rural and highway parts, each in summer and winter version customized to the Dutch environment. In use since 2003 for teaching decision making during typical police emergency rides.	Dutch Police
Rehabilitation Clinic “Godeshöhe”/ ZNS	Health care centre	Bonn/ Germany	Drivers with disabilities training	Y	Y	Generic cabin (driver place only) with integrated motion system, a fixed screen, instructor station and a replay functionality. Database with more than 100 km street length comprising city, rural and highway parts, each in summer and winter version.	Rehabilitation Clinic “Godeshöhe”

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
Berlin Public Transport BVG	Public Transport Company	Berlin/ Germany	Professional drivers training	Y		2 tram cabins mounted on a big 6 DOF motion system, back light projection system, cylindrical screen, instructor station and a monitoring station with replay functionality. Database with more 64 km street length original Berlin streets. In use since 1999 for professional driver training, driver licence training and driver assessment.	BVG
Bavarian Alert Police	Police training centre	Rosenberd/ Germany	Professional drivers training	Y		BMW cabin with 6 dof motion system, flying screen, instructor station and monitoring station with replay functionality. Database with more than 100 km street length comprising city, rural and highway parts, each in summer and winter version. In use since 2002 for teaching decision making during typical police emergency rides.	Bavarian Police

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
e-com Systems	Military training centre	Slavkov u Brna/ Czech Republic	Military vehicles drivers training			Military tank and armoured vehicles simulators on 3 or 6 DOF motion bases	
Traffic Academy of Bohemia	Private drivers training centre	Prague/ Czech Republic	Professional and novice drivers training	Y			
AT 99 VRT/2M Driving Trainer JKZ spol sro	Private company	Olomuc / Czech Republic	Commercial product for driver training	Y		Fixed base driver training simulator. Training is subdivided into systematic blocks so that students can gradually acquire car- driving skills Evaluation of the training process. The training is controlled by voice instructions given by an electronic instructor	
INRETS www.inrets.fr/ur/simus/sim2e.htm	Research centre	Arcueil/ France	Research	Y		Fixed base., 6 monitors, spatialised sound, "traffic centered" architecture (i.e the simulator is embedded within a "true" traffic simulation model)	INRETS (research topic)
INRETS www.inrets.fr/ur/simus/sim2e.htm	Research centre	Bron/ France	Research	Y		Fixed base, 1 front view screen, spatialised sound, "traffic centered" architecture	INRETS

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
INRETS www.inrets.fr/ur/simus/sim2e.htm	Research centre	Salon de Provence/ France	Research	Y		Fixed base, front and rear view screens, spatialised sound, "traffic centered" architecture	INRETS
FAROS www.faros.com	Private company	Lannion/ France	Commercial product for driver training Research	Y	Y Automatic and manual gearbox; gas and brake controls both foot and hand activated	Fixed base, true cab includes adjustable seat, steering wheel, pedals, gearshift, handbrake, seatbelt, and dashboard. Primary controls equipped with a force feedback system. Based on real time interactive software that reproduces an unpredicted landscape and car environment.	INRETS
TRL www.trl.co.uk/1024/mainpage.asp?page=93	Research centre	Crowthorne/ UK	Research Vehicle testing	Y		3 dof electric motion system, 210° forwards field of view, 60° rear field of view; used mostly for research	TRL
TRL www.trucksim.co.uk	Research centre	Crowthorne/ UK	Professional drivers training	Y		Full mission truck simulator, 6 dof hydraulic motion system, 270° forward field of view+wing and kerb mirrors	Dornier

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
www.vvcr.nl/trainingen/Simulator/ENG/SimulatorMainENG.html	Private company	Leiden/ Netherlands	Commercial product for novice drivers training	Y		PC-based fixed base simulator based on the mock up of a Volkswagen Golf with a 180° view on a cylindrical screen and a lcd screen as rear mirror. The steering wheel has feedback.	No
Green Dino/ De Nedrlandse Rijsimulator www.denederlandserijsimulator.nl/	Private drivers training centres	25 locations/ Netherlands	Commercial product for novice training	Y		Fixed base simulator consisting of a seat and a simple dashboard in a cabin. Inside a view (210 degrees is projected and the rear view is projected in the main screen..	No
BIVV CARA www.drfoerst.de/simulator.htm .	Research Centre	Brussels/ Belgium	Research	Y		Semi-moving base, medium cost driving simulator. Used for research in Agile and Trainer projects. Different scenario's (for both projects) but closed environment.	Research project TRAINER

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
Onyros Simulations SPRL	Private company	Brussels/ Belgium	Commercial product Road safety awareness demonstration s	Y		Fixed base single screen simulator built upon a PC architecture (multiple screen possible). Can be operated on a standard PC or in an arcade type cabinet. Used by MAAF in France to raise awareness on its road security policy and some of the most accident prone situations.	No
Katholieke Universiteit Leuven Faculteit Bewegingswetenschappen en Revalidatie www.systemstech.com	Research Centre	Leuven/ Belgium	Research Training drivers with disabilities	Y	Y	Fixed base PC based simulator with flexible hardware definitions and scenario settings	www.systemstech.com / SIM_RWA.htm
CEDINT UPM	Research Centre	Madrid/ Spain	Research	Y		Simulator under development as part of research activity to test the usage of 3D devices (Head-mounted helmet and white-wall projection screen) to simulate a driving system with immersive capabilities	No
CITEF UPM	Research Centre	Madrid/ Spain	Research	Y		Urban environment driver training simulator with virtual reality displays, 6 dof movement platform	EMT

SIMULATOR /OWNER Web page	OWNER CATEGOR Y	CITY/COUNTR Y	USES	ADAPTABILITY		SUMMARY OF MAIN CHARACTERISTIC S	VALIDATION
				Driver training	Drivers with disabilitie s		
EMT (Madrid Public Transport Company) CEFTRAL www.ceftral.es	Public Transport Company	Madrid/ Spain	Professional drivers training	Y		Heavy truck simulator. Admits different weather conditions and vehicles profiles. Used to train professional drivers.	EMT

2. Driving simulators technical data. Image

SIMULATOR /OWNER	Projection device		Screen Size		Number of monitors/ projectors	Sight conditions	Rear view		Virtual reality devices
	Monitor	White screen	Horizontal degrees	Vertical degrees			N° of mirrors	Image inserted in	
Drive Station International KG	X 80 cm diag.		210°	45°	5	Clear/Night/ Rain/Fog	3		
Krauss Maffei GmbH		X	210°	45°	5	Clear/Night/ Rain/Fog	3	ACS: Forward view Trucks: mirrors	
DLR Institute of Transportation		X	240°	40°	8 channels (DLP)	Clear/Night/ Rain/Fog	3	Mirrors	
Dr. Ing. Reiner Foerst GmbH	X 17" to 98"	X	200°	40°	1-8	Clear/Night/ Rain/Fog/Snow	3	Forward view (separate monitor possible)	Head mounted vision device can be added as sight system
Fraunhofer IAO University of Stuttgart		X	180°		6	Clear	3	Projection screens behind the car	
L-LAB/ Hella KgaA		X 145"	120°	90°	3	Clear/Night/ Rain/Fog	0		
Simtec GmbH	X 42"				1	Clear/Night/ Rain/Fog			
Simtec GMBH		X			1				
Helmut Schmidt University (German Army)	X	X	Varies	Varies			0		
Würzburger Institut für Verkehrswissenschaften WIVW GmbH		X	180°	40°	3	Clear/Night/ Rain/Fog	3		
German Army Driving School		X	210° (spherical)	40°	7	Clear/Night/ Fog	4	Mirrors	Head tracker
ASF GmbH		X	180° (spherical)	50°	3	Clear/Night/ Fog	2	Mirrors	
Rheinmetall Defence Electronics GmbH		X	180° (spherical)	50°	3	Clear/Night/ Fog	2	Mirrors	

SIMULATOR /OWNER	Projection device		Screen Size		Number of monitors/ projectors	Sight conditions	Rear view		Virtual reality devices
	Monitor	White screen	Horizontal degrees	Vertical degrees			N° of mirrors	Image inserted in	
Rheinmetall Defence Electronics GmbH		X	180° (cylindrical)	40°	3	Clear/Night/ Rain/ Fog	3	Mirrors	
Dutch Police Academy		X	180° (cylindrical)	40°	3	Clear/Night/ Rain/ Fog	3	Mirrors	
Rehabilitation Clinic "Godeshöhe"/ ZNS		X	180° (cylindrical)	40°	3	Clear/Night/ Rain/ Fog	3	Mirrors	
Berlin Public Transport BVG		X	210° (spherical)	53°	7	Clear/Night/ Fog	1	Mirrors	Head tracker
Bavarian Alert Police		X	210°	40°	7	Clear/Night/ Fog	3	Mirrors	
e-com Systems									
Traffic Academy of Bohemia		X 80x430 cm	180°	32°	4	Clear/Night/ Rain/ Fog	3	Mirrors	
JKZ spol sro	X 180x130 cm					Clear/Night/ Rain/ Fog	2	Rear view monitors	
INRETS	X	X	3x50°	40°	3/3	Clear/Night/ Fog	3	Mirrors	Haptic steering wheel force feedback and vibrating seat
INRETS		X	65°	40°	1	Clear/Night/ Fog	2	Mirrors	Haptic steering wheel force feedback and vibrating seat
INRETS		X	52°	40°	2	Clear/Night/ Fog	1	Inlaid	
FAROS	X	X	120°	40°	1-5	Clear/Night/ Fog	3	Mirrors/ forward view	
TRL		X	210°	40°	4	Clear/Night	3	Standard mirror/ rear screen	
TRL		X	270°	40°	7	Clear/Night/ Rain/ Fog	3	Standard wing mirror- rear screen TFT screen for kerb mirror	Infra-red head tracker for checking line of sight
VVCR/ ANWB		X	180°		3	Clear/Night	3	Mirrors	

SIMULATOR /OWNER	Projection device		Screen Size		Number of monitors/ projectors	Sight conditions	Rear view		Virtual reality devices
	Monitor	White screen	Horizontal degrees	Vertical degrees			N° of mirrors	Image inserted in	
Green Dino		X	210°		3	Clear/Rain/ Fog			
BIVV CARA	X		90°	35°	3	Clear/Night/ Rain/ Fog	2		
Onyros Simulations SPRL	X 32"				1	Clear/Night/ Rain/ Fog	1	Forward view	
Katholieke Universiteit Leuven		X 250x 180 cm	45°	45°	1-3	Clear/Fog	3	Forward view	Head mounted vision device, limited resolution
CEDINT UPM		X 250x 300 cm			2	Clear/Night			Head mounted helmet Gloves with simple 4 dof tracking system
CITEF UPM		X	180°	60°	3	Clear/Night/ Rain/ Fog	3	Mirrors	Cloves with sensors and 3D trackers
EMT (Madrid Public Transport Company) CEFTRAL		X 79"x 59"			3	Clear/Night/ Rain/ Fog	2	Forward view	

Driving simulators 3. Technical data. Sound

SIMULATOR /OWNER	Sound feedback to driver	Type of sound						
		Engine	Tyres	Other vehicles/ road users	Weather conditions (rain, snow, ...)	Radio, CD player	Voice messages from instructor	Other
Drive Station International KG	X	X	X	X	X	X	X	Crash sound
Krauss Maffei GmbH	X	X	X	X	X	X	X	
DLR Institute of Transportation	X	X	X			X	X	
Dr. Ing. Reiner Foerst GmbH	X	X	X	X	X	X	X	
Fraunhofer IAO University of Stuttgart	X	X		X		X	X	
L-LAB/ Hella KgaA	X	X						
Simtec GmbH	X	X						
Simtec GmbH	X	X						
Helmut Schmidt University (German Army)	X	X					X	
Würzburger Institut für Verkehrswissenschaften WIVW GmbH	X	X	X	X	X	X	X	
German Army Driving School	X	X		X			X	Automatically generated hints from driver evaluation and monitoring system
ASF GmbH	X	X		X			X	Automatically generated hints from driver evaluation and monitoring system

SIMULATOR /OWNER	Sound feedback to driver	Type of sound						
		Engine	Tyres	Other vehicles/ road users	Weather conditions (rain, snow, ...)	Radio, CD player	Voice messages from instructor	Other
Rheinmetall Defence Electronics GmbH	X	X		X			X	Automatically generated hints from driver evaluation and monitoring system
Rheinmetall Defence Electronics GmbH	X	X		X			X	
Dutch Police Academy	X	X		X			X	
Rehabilitation Clinic "Godeshöhe"/ ZNS	X	X		X			X	Automatically generated hints from driver evaluation and monitoring system
Berlin Public Transport BVG	X	X		X			X	Automatically generated hints from driver evaluation and monitoring system
Bavarian Alert Police	X	X		X			X	Automatically generated hints from driver evaluation and monitoring system
e-com Systems								
Traffic Academy of Bohemia	X	X	X	X			X	
JKZ spol sro	X	X		X			X	
INRETS	X	X	X	X			X	
INRETS	X	X	X	X			X	
INRETS	X	X	X	X			X	
FAROS	X	X	X	X	X	X	X	

SIMULATOR /OWNER	Sound feedback to driver	Type of sound						
		Engine	Tyres	Other vehicles/ road users	Weather conditions (rain, snow, ...)	Radio, CD player	Voice messages from instructor	Other
TRL	X	X	X	X			X	
TRL	X	X	X	X			X	
VVCR/ ANWB	X	X					X	Virtual instructor
Green Dino	X	X					X	Virtual instructor
BIVV CARA	X	X	X			X		Road departure Crash
Onyros Simulations SPRL	X	X	X	X	X		X	
Katholieke Universiteit Leuven	X	X	X	X	X	X	X	Any *.wav file
CEDINT UPM	X	X						
CITEF UPM	X	X		X				
EMT (Madrid Public Transport Company) CEFTRAL	X	X		X			X	

Driving simulators 4. Road& roadside environment modelling

SIMULATOR /OWNER	Changeable road features			Road categories available for scenarios						Other road users in scenarios					
	Curvature	Road Friction	Number of lanes	Motorway	Rural	Industrial	Urban	Residential	Other	Cars	Buses/trucks	Bicycles	Pedestrians	Animals	Other
Drive Station International KG	X	X	X	X	X		X	X		X	X	X	X		
Krauss Maffei GmbH	X	X	X	X	X	X	X	X		X	X	X	X		
DLR Institute of Transportation	X	X	X	X	X	X	X	X	X	X	X	X	X		
Dr. Ing. Reiner Foerst GmbH	X	X	1-2	X	X	X	X	X		X	X	X	X	X	Road works machinery
Fraunhofer IAO University of Stuttgart	X	X	No	X	X		X			X		X			
L-LAB/ Hella KgaA	X		No		X			X	X	X					
Simtec GmbH	X	X	X	X	X	X	X	X	X						
Simtec GmbH	X	X													
Helmut Schmidt University (German Army)															
Würzburger Institut für Verkehrswissenschaften WIVW GmbH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Emergency vehicles
German Army Driving School	X (Special tool required)	X	X	X	X	X	X	X		X	X		X		Train
ASF GmbH	X (Special tool required)	X	X	X	X	X	X	X		X	X		X		
Rheinmetall Defence Electronics GmbH	X (Special tool required)	X	X	X	X	X	X	X		X	X	X	X		Train
Rheinmetall Defence Electronics GmbH	X (Special tool required)	X	X	X	X	X	X	X		X	X	X	X		Motorbike Tram

SIMULATOR /OWNER	Changeable road features			Road categories available for scenarios						Other road users in scenarios					
	Curvature	Road Friction	Number of lanes	Motorway	Rural	Industrial	Urban	Residential	Other	Cars	Buses/trucks	Bicycles	Pedestrians	Animals	Other
Dutch Police Academy	X (Special tool required)	X	X	X	X	X	X	X		X	X	X	X		Motorbike
Rehabilitation Clinic "Godeshöhe"/ ZNS	X (Special tool required)	X	X	X	X	X	X	X		X	X	X	X		Motorbike
Berlin Public Transport BVG	X (Special tool required)	X	X					X		X	X		X		
Bavarian Alert Police	X (Special tool required)	X	X	X	X	X	X	X		X	X		X		
e-com Systems															
Traffic Academy of Bohemia		X		X	X	X	X	X	X	X	X		X		Tram
JKZ spol sro			X	X	X		X	X							
INRETS	X		X	X	X	X	X	X	X	X	X	X	X		Open
INRETS	X		X	X	X	X	X	X	X	X	X	X	X		Open
INRETS	X		X	X	X	X	X	X	X	X	X	X	X		Open
FAROS	X	X	X	X	X		X	X	X	X	X	X	X	X	
TRL	X	X	X	X	X	X	X	X		X	X	X	X		
TRL	X	X	X	X	X	X	X	X		X	X	X	X	X	
VVCR/ ANWB	X	X	X	X	X	X	X	X	X	X	X				
Green Dino	X	X		X	X	X	X	X	X	X	X	X	X		
VIV. CARA				X	X		X	X		X			X	X	
Onyros Simulations SPRL	X	X	X	X						X					
Katholieke Universiteit Leuven	X	X	X	X	X	X	X	X	X	X	X	X	X		Open
CEDINT UPM							X			X					
CITEF UPM			X				X			X	X		X		Emergency vehicles
EMT (Madrid Public Transport Company) CEFTRAL				X	X	X	X	X		X	X	X	X		

Driving simulators 5. Vehicle & base

SIMULATOR /OWNER	Vehicle type		Simulator cabin					Moving base					Lights Half beam/ Full beam	
	Main	Alternatives	Complete body	Front half	Driver seat in cabin reproduction	Driver seat in cabin simplification	No cabin	Vibration	Lateral pitch	Lateral roll	Bilateral pitch	Bilateral roll		Pot hole simulation
Drive Station International KG			X	X	X			X	X	X	X	X	X	X
Krauss Maffei GmbH	Car Truck	Van Bus	X	X	X			X	X	X	X	X	X	X
DLR Institute of Transportation	Car	Truck Van Bus	X					X	X	X	X	X	Possible	Future
Dr. Ing. Reiner Foerst GmbH	Car	Truck	X	X	X	X		X	X	X	X	X	X	X
Fraunhofer IAO University of Stuttgart	Car		X					X	X	X			X	
L-LAB/ Hella KgaA	Car		X											X
Simtec GmbH	Car	Truck Van Bus					X	X	X	X	X	X	X	X
Simtec GmbH	Car		X					X	X	X	X	X	X	
Helmut Schmidt University (German Army)	Truck	Car Van Bus		X		X		X	X	X	X	X		
Würzburger Institut für Verkehrswissenschaften WIVW GmbH	Car	Truck Van Bus		X									X	X
German Army Driving School	Truck		X					X	X	X	X	X	X	X
ASF GmbH	Truck	Bus	X					X	X	X	X	X	X	X
Rheinmetall Defence Electronics GmbH	Car	Truck Van Bus	X					X	X	X	X	X	X	X
Rheinmetall Defence Electronics GmbH	Car	Van			X			X	X	X				X
Dutch Police Academy	Car	Van			X			X	X	X				X
Rehabilitation Clinic "Godeshöhe"/ ZNS	Car	Van			X			X	X	X				X

SIMULATOR /OWNER	Vehicle type		Simulator cabin					Moving base					Lights Half beam/ Full beam	
	Main	Alternatives	Complete body	Front half	Driver seat in cabin reproduction	Driver seat in cabin simplification	No cabin	Vibration	Lateral pitch	Lateral roll	Bilateral pitch	Bilateral roll		Pot hole simulation
Berlin Public Transport BVG	Tram			X				X	X	X	X	X	X	
Bavarian Alert Police	Car		X					X	X	X	X	X	X	X
e-com Systems	Tank	Armoured vehicles												
Traffic Academy of Bohemia	Car			X				X			X			
JKZ spol sro	Car	Military vehicles		X										
INRETS	Car	Truck Van Bus	X											X
INRETS	Car	Truck Van Bus	X											X
INRETS	Car	Truck Van Bus			X									X
FAROS	Car	Truck Van	X	X	X	X								X
TRL	Car		X					X	X	X				
TRL	Truck		X					X	X	X	X	X	X	
VVCR/ ANWB	Car			X										
Green Dino	Car						X							
BIVV CARA	Car				X			X	X					
Onyros Simulations SPRL	Car					X	X							
Katholieke Universiteit Leuven	Car	Truck Van Bus	X											
CEDINT UPM	Car	Bus					X							
CITEF UPM	Car	Bus				X		X	X	X	X	X	X	
EMT (Madrid Public Transport Company) CEFTRAL	Bus	Car	X					X	X	X	X	X	X	X

Driving simulators 6. Computer / software

SIMULATOR /OWNER	Computer type and operating system	Software scenario changes			ITS in vehicle devices simulation		
		Minor changes possible	Complete scenarios	Not possible	Fully possible	Not coordinated with scenarios	Not possible
Drive Station International KG	PC MS Windows	X				X	
Krauss Maffei GmbH	PC MS Windows	X			X		
DLR Institute of Transportation	Multiple PCs		X		X		
Dr. Ing. Reiner Foerst GmbH	PC MS Windows		X		X		
Fraunhofer IAO University of Stuttgart	PC MS Windows		X		X		
L-LAB/Hella KgaA	PC MS Windows			X	X		
Simtec GmbH	PC MS Windows	X			X		
Simtec GmbH	PC MS Windows			X	X		
Helmut Schmidt University (German Army)	PC MS Windows+ Vehicle dynamics application & database		X		X		
Würzburger Institut für Verkehrswissenschaften WIVW GmbH	PC MS Windows	X			X		
German Army Driving School	Onyx 2 (SGI)		X		X		
ASF GmbH	Onyx 2 (SGI)		X		X		
Rheinmetall Defence Electronics GmbH	PC		X		X		
Rheinmetall Defence Electronics GmbH							
Dutch Police Academy	PC		X		X		
Rehabilitation Clinic "Godeshöhe"/ ZNS	PC		X		X		
Berlin Public Transport BVG	Onyx 2 (SGI)		X		X		
Bavarian Alert Police e-com Systems	Onyx 2 (SGI)		X		X		

SIMULATOR /OWNER	Computer type and operating system	Software scenario changes			ITS in vehicle devices simulation		
		Minor changes possible	Complete scenarios	Not possible	Fully possible	Not coordinated with scenarios	Not possible
Traffic Academy of Bohemia	PC MS Windows			X	X		
JKZ spol sro				X	X		
INRETS	PC Windows+ linux (visual) or SGI(visual)		X		X		
INRETS	PC Windows+ linux (visual) or SGI(visual)		X		X		
INRETS	PC Windows+ linux (visual) or SGI(visual)		X		X		
FAROS	PC MS Windows			X	X		
TRL	PC/ Silicon Graphics Computers (images)		X			X	
TRL	PC	X				X	
VVCR/ ANWB	PC MS Windows		X			X	
Green Dino	PC MS Windows		X		X		
BIVV CARA	PC MS Windows			X		X	
Onyros Simulations SPRL	PC MS Windows			X			X
Katholieke Universiteit Leuven	PC MS Windows		X		X		
CEDINT UPM	PC MS Windows			X	X		
CITEF UPM	PC MS Windows			X	X		
EMT (Madrid Public Transport Company) CEFTRAL	Silicon Graphics	X					X

APPENDIX B: DATA FROM ADDITIONAL DRIVING SIMULATORS IDENTIFIED IN TRAINER

QUESTION	SIMULATOR No.																							
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	
Is there a computer generated image system?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Is the image system developed by your company / institution?	Y	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	Y	N	Y	N	N	Y	Y	N	N
Is it equipped with rear view images?	Y	Y	Y	Y	Y	Y	Y	Note (Y)	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y
Is there any feedback sound to the driver?	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Is the sound-system stereophonic?	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y	N	Y	Y
Is it possible to reproduce precisely, the same scenarios several times?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Is it possible to vary the friction of the road surface?	Y	Y	Y	Y	Y	Y	Y	Note (Y)	N	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y
Is it possible to change roads (i.e. urban-, rural - and highways)?	Y	Soon	Y	Y	N	Y	Y	Note (Y)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Is it possible to vary the sight conditions?	Y	Y	Y	Y	N	Y	Y	Note (Y)	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y
Is it possible to vary the curves, i.e. the linearity of the curve?	Y	Soon	Y	Y	Y	Y	N	?	Y	Y	Y	I	N	Y	?	Opti on	Y	Y	N	N	Y	Y	Y	Y

QUESTION	SIMULATOR No.																						
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23
Is there any kind of motion system, generating motion feedback to the driver?	N	Y	N	Y	N	N	Y	N	N	Y	Y	Y	Y	Y	Y	Opti on		N	Y	Y	Y	Y	Y
Is it possible to vary between different brands of cars?	Y	Y, Mini ng truck s	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	N	Y	
Is the simulator vehicle front wheel driven?	Y	I	N	Y	Y	Y	N	Y	N	I	Y	Y	Y	Y	Y	Opti on	N	Y	N	N	Y	Y	I
Is the simulator vehicle rear wheel driven?	Y	I	Y	Y	Y	N	Y	N	Y	I	Y	N	Y	Y	Y	Y	I	Y	Y	Y	N	Y	I
Is it possible to change between front- and rear wheel drive?	Y	I	Y	Y	Y	Y	N	N	N	Y	Y	N	Y	Y	Y	Opti on	I	Y	N	N	N	Y	Y
Is the simulator vehicle equipped with a gear lever?	Y	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Does the simulator vehicle have automatic gearbox?	Y	Y	Y	Y	Y	N	N	Opti on	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y
Does the simulator vehicle have manual gearbox?	Y		N	Y	N	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Opti on	N	Y	Y	N	Y	N	Y
Is it possible to change between automatic and manual gearbox?	Y		N	Y	N	Y	N	Opti on	N	N	Y	Y	Y	Y	Y	Opti on	N	N	N	N	Y	N	Y
Are there passenger seats?	N	N	N	Y	Y	Y	N	N	Y	Y	N	N	N	Y	Y	Opti on	I	Y	Y	N	Y	Y	N
Is it possible to use it as a truck/ lorry simulator?	Y	N	Y	Y	I	N	Y	Note (N)	N	N	Y	Y	Y	Y	Y	Y	I	Y	Y	Y	N	Y	Y

QUESTION	SIMULATOR No.																							
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	
Is the simulator adapted for drivers with special need (disabled persons)?	Y	I	Y	N, Could be	N	N	N	Opti on	N	N	N	N	Y	Not yet	Y, Not stand ard	Y	N	N	N	N	N	N	N	Y
Is the simulator accessible for manual wheelchair users?	Y	I	Y	N, Could be	N	Y	N	Y	N	N	N	N	Y	Y	Y, Not stand ard	Opti on	Y	N	N	N	N	N	N	Y
Is the simulator accessible for electric powered wheelchair users?	Y	I	Y	N, Could be	N	Y	N	Y	N	N	N	N	Y	Y	Y, Not stand ard	Opti on	Y	N	N	N	N	N	N	N
Is the simulator vehicle equipped with servo/power steering?	Y	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y
Is the simulator vehicle equipped with electrically controlled driver seat?	N	N	N	Y	N	N	N	N	Y	N	N	N	N	Y	N	Opti on	I	N	N	N	N	N	N	I
Is the driver seat electric powered heated?	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	Y	Opti on	I	N	N	N	N	N	N	I
Are the door windows electrically powered?	I	N	N	Y	N	Y	N	N	N	N	N	N	N	Y	Y	N	I	N	Y	N	Y	N	I	I
Are the mirrors electrically adjustable?	N	N	N	Y	N	N	N	Note (Y)	N	N	N	N	N	Y	Y	Opti on	I	N	Y	N	Y	N	N	N
Is the steering wheel adjustable?	Y	Y	N	Y	N	Y	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
Is the simulator vehicle equipped with a cruise control?	N	Can be	N	Y	N	Y	N	N	Y	N	N	N	N	Y	N	Opti on	N	N	N	N	N	N	N	I

QUESTION	SIMULATOR No.																						
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23
Is there an electronic gear selector?	Y	Y	N	Y	N	N	N	N	N	N	Y	N	Y	Y	N	Y	N	N	N	N	N	Y	Y
Does the simulator have electrically controlled brakes?	Y	Y	N	Y	N	N	Y	N	N	N	Y	N	Y	Y	Y	Y	Y	N	N	N	Y	N	Y
Is the driver seat an original car seat?	Y	Truck seat	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	I	Y	Y	Y	Y	Y	Y

Y= Yes, N= No and I= Irrelevant

APPENDIX C: E-LEARNING APPLICATIONS INVENTORY

APPLICATION OWNER	OWNER CATEGORY	CITY/COUNTRY	USES	MEDIA	VALIDATION
KRONE, ÖAMTC, FÜRBÖCK	Driving Schools	Vienna/Austria	Virtual driving license for novice drivers. Computer based test with questionnaire. The test is based on existing driving curriculum.	Web-page with interactive programs	No
SPIS	Unknown	Prague, Czech Republic	Training of novice drivers in traffic regulations particularly in the Czech Republic and other European countries	CD-ROM	No
Jan Dobew	Unknown	Unknown Czech Republic	Training programme for novice drivers and re-training for the final driving examination. Both the curriculum and the test questions All traffic rules included as well as explanations of traffic situations at intersections	CD-ROM	No
KONTIS	Private company	Prague, Czech Republic	Training of professional drivers in traffic rules, animated intersection and other exercises. The training program	Interactive CD-ROM	No

APPLICATION OWNER	OWNER CATEGORY	CITY/COUNTRY	USES	MEDIA	VALIDATION
Different publishing houses in Germany	Private companies		Training for the theoretical driving test for novice and professional drivers. Programme is based on existing driving curriculum.	Video, CD-ROM, Interactive CD-ROM, Web-page with interactive programs	Yes, by the publishing houses through pre-test and assessment by driving schools
OCTRU (training centre of the Dutch Army)	Military driving centre	Oorschot, The Netherlands	Training novice and professional army drivers. Updating experienced drivers. Programmes are based on the official theoretical driving test	CD-ROM	Yes, Training candidates evaluate the application through a form including suggestions for improvement
TRL, TruckSim facility	Research Centre	Crowthorne, UK	Training of professional truck drivers on hazard perception through examples	Not available	No