Validators, Demonstrators, Facilitators – The Roles of eHighway Field Tests on the Way to Large-scale Implementation.

ERS – Electric Road Systems 2019, Frankfurt am Main

Manfred Boltze, Technische Universität Darmstadt

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Technology Readiness Levels – General Concept and Status of the eHighway

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TRL 1 – basic principles observed

TRL 2 – technology concept formulated

TRL 3 – experimental proof of concept

TRL 4 – technology validated in lab

TRL 5 – technology validated in relevant environment (test under lab conditions; start of system integration)

TRL 6 – technology demonstrated in relevant environment (test under realistic conditions)

TRL 7 – system prototype demonstration in operational environment (1-5 years)

TRL 8 – system complete and qualified

TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies)

Sources: European Commission: HORIZON 2020, Work Programme 2014-2015, Annex G; Deutsches Institut für Normung (DIN): Raumfahrtsysteme – Definition des Technologie-Reifegrades (TRL) und der Beurteilungskriterien. Norm-Entwurf (ISO 16290:2013). Berlin 2014

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Testing Under Real Traffic and Real Road Operations

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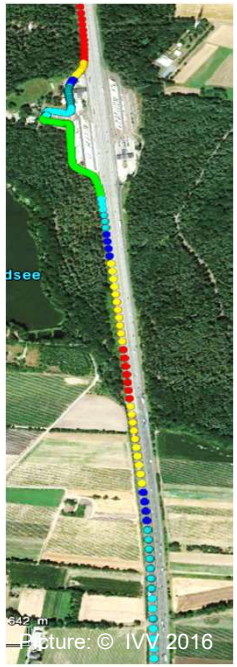
Real traffic and traffic composition

Real road operations

Real environmental conditions

Real incidents

Real constructional conditions …



ELISA: Sample Research Questions

- What are the impacts of the eHighway system on driving behaviour?
- Are there any problems regarding the visibility of traffic signs?
- Are there complications in cleaning traffic signs and cutting the green?
- Are there any impacts on traffic safety?

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Field Tests as Validators and Demonstrators

Testing with Real Transport Companies and Real Transport Processes

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Vehicle	ELISA Transport Partner	Vehicle Delivery *(Year/Month)*	Transported Goods	No. of vehicles in Rhein-Main
01	**Spedition Hans Adam Schanz** GmbH & Co. KG	2019/04	emulsion paint and other Caparol products	9
02	**Ludwig Meyer** GmbH & Co. KG	2019/07	consumer goods esp. refrigerated food	80
03	**Contargo** GmbH & Co. KG (**Rhenus** Trucking GmbH & Co. KG)	2020/02	containers	> 1.000
04	**Knauf Gips** KG	2020/02	construction materials	40
05	**Merck** KGaA	2020/06	liquid sludge	6

Status: March 2019

SPEDITION SCHANZ

MEYER LOGISTIK Kompetenz in Frische

CONTARGO® trimodal network

KNAUF Gips

MERCK

ELISA: Sample Research Questions

- What are the specific requirements of different types of transport companies on using the eHighway system?
- How can transport companies integrate the eHighway trucks into their daily tours?
- How robust is the eHighway technology under frequent use?

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Testing with a Real Electric Power System

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Real integration into the power grid

Real consumption and recuperation of energy

Real accounting and clearing

ELISA: Sample Research Questions

- How can the eHighway system be integrated into the overall power grid?
- Which impact has a larger number of eHighway trucks on the power supply network?
- How to design the accounting and clearing system for electric energy?

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Testing Acceptance with Real People

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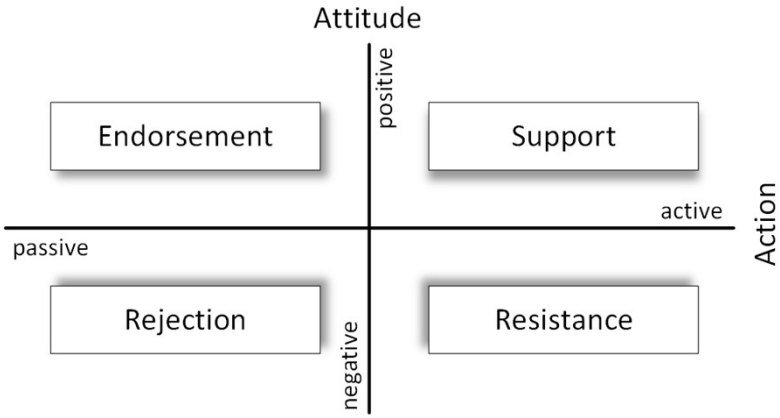
Analyzing acceptance by different stakeholders

Identifying (critical) influencing factors

Analyzing changes of acceptance over time

Relevant stakeholder groups:

- transport companies
- eHighway truck drivers and other truck drivers
- other road users and the general public
- road operators and electricity suppliers
- emergency and rescue service operators
- …



Forms of Acceptance (Schweizer-Ries et al. 2008)

socio-political acceptance	market acceptance	local acceptance

ELISA: Sample Research Questions

- How are different stakeholder groups perceiving the eHighway system?
- Which factors are influencing the acceptance rate?
- How are the acceptance rates changing over time?

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Developing Sub-systems

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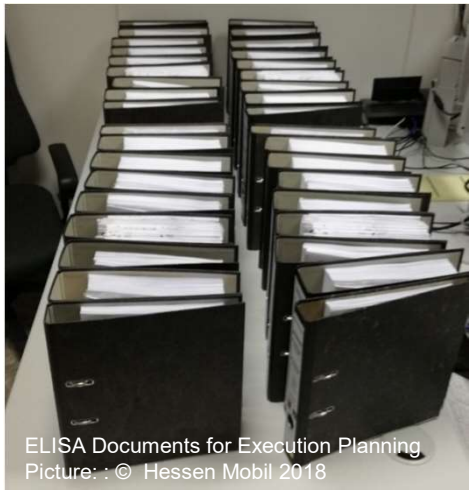
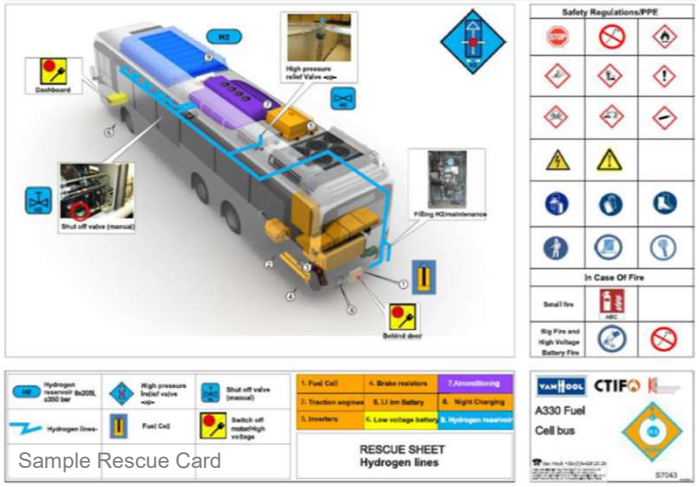
Further development of eHighway vehicles and infrastructure

Development and specification of many processes and procedures to deal with practical aspects of system implementation and operation



ELISA Documents for Execution Planning
Picture: : © Hessen Mobil 2018



Picture: © IVV 2019

Picture: © Scania 2018

ELISA: Sample Sub-System Developments

- Planning, approval and tendering process for the eHighway infrastructure
- Processes for emergency and rescue services
- Software and processes for control center operations
- Specific aspects of formal vehicle registration

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Field Tests as Facilitators

Creating Awareness and Acceptance

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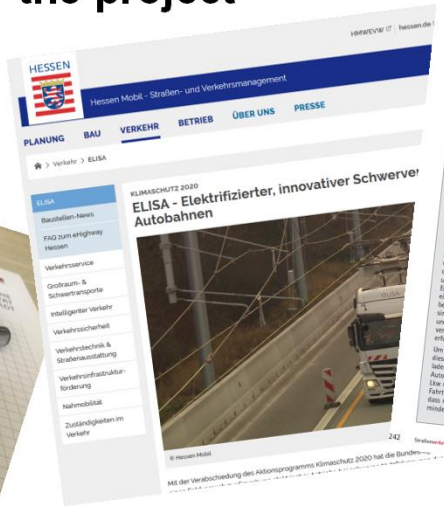
Supporting the visibility of the system

Create possibilities to see, “feel” and test the system

Clear communication about the reasons for the project

Careful public relations management



ELISA: Sample Activities to Create Awareness and Acceptance

- Information booths and visitor centre at the test track
- Project website, information and marketing materials
- Press conferences, interviews for press and other media
- Targeted stakeholder communication

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Disseminating Results

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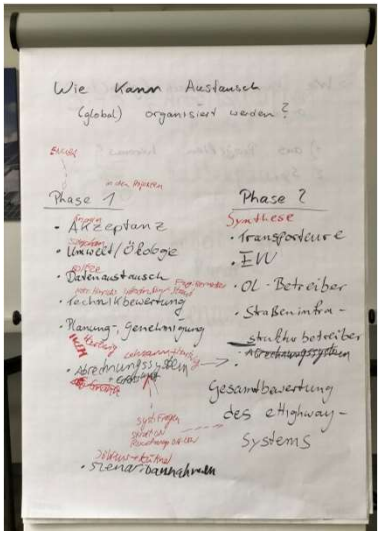
Presentations and publications

Placing the topic in journals and conferences (as editor or organizer)

Contributing to working groups for standardization

National + international exchange

Teaching



ELISA: Sample Activities for Disseminating Results

- Conference presentations: ERS, Hypermotion, DSVK, CIGOS, TRB, ICPLT, …
- Publications: Book „eHighway Implementation Manual“, various journal articles
- Development of implementation guidelines for specific stakeholder groups
- Bringing the topic into working groups for national standardization (FGSV etc.)

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Identifying Needs for System Amendments and Further Potential Users

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Analyzing real use cases and user requirements

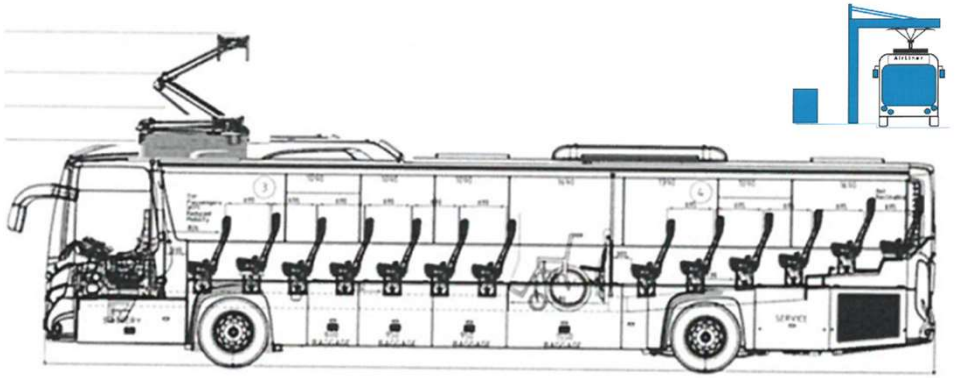
Identifying needs for system amendments

Identifying further potential users

LKW_Hegro Eichler GmbH
Quelle www.stepstone.de


https://www.flickr.com/photos/lavulv/47426909792/in/photostream/

Pictures: © Boltze 2000 (Bus in Havanna) and Scania 2018



ELISA: Sample Activities for Identifying Needs for System Amendments

- Questionnaire for Transport Companies on Vehicle Requirements
- Identifying demand for other vehicle types (e.g. 16 t trucks)
- Identifying useful truck equipments (dumper hydraulics, PTO for cooling, …)
- Feasibility Study of eHighway Buses

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Providing a Nucleus for Large-scale Implementation

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Supporting the development of large-scale implementation strategies

Developing a plan for using the test track after the testing period

Developing a plan for local system expansion

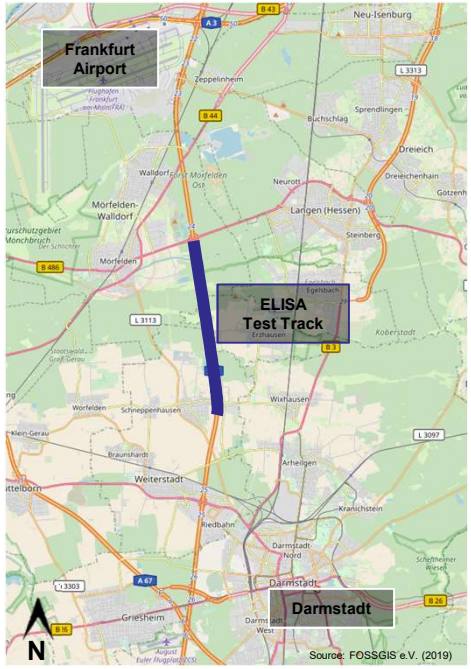
Bewertungskriterien	
Verfügbarkeit von Flächen und Raum	Seitenraumverfügbarkeit
	Höhenrelevante Einschränkungen
	Mindestabstände zu…
	Landeplätze Hubschrauber
	Entwässerung
Planungsrelevante Kriterien	Umweltverträglichkeit
	Schutzgebiete
	Flurbereinigung
Energieversorgung	Erdkabeltrassen-Verläufe
	Fläche für Unterwerke
	Zugang zum Mittelspannungsnetz
	Abstand zur nächsten Ladestation
Bau, Betrieb und Verkehrs-management	Temp. Seitenstreifenfreigabe
	Anzahl Fahrstreifen
	Höhenprofil
Verkehrsnachfrage	Anzahl Logistikstandorte in d. Nähe
	Logistikflächen in Entwicklung
	Integrationsfähigkeit in Tourenmuster

Farbkodierung und Nutzwerte

4	3	2	1	0

Ohne Einschränkungen → Nicht möglich

Bewertung		Gewicht	Punkte	Nutzen	Code
Verfügbarkeit von Flächen und Raum	Seitenraum-verfügbarkeit	5	4	20	
	Höhenrelevante Einschränkungen	5	0	0	
	Mindestabstände zu…	5	2	10	
	Landeplätze Hubschrauber	5	4	20	
	Entwässerung	5	4	20	
Weitere		75	…	…	…
			Total	…	



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ELISA: Sample Activities for Providing a Nucleus for Large-scale Implementation

- Tool for assesing the eHighway equipment potential of road sections (BeTSIE)
- Optimimal allocation of charge-in-motion infrastructure for trucks on German motorways (dissertation Kevin Rolko)
- Planning extension and follow-up use of the test track (e.g. Airliner)

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Summary

Field Tests – Important Milestones on the Way to Large-scale Implementation

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The Roles of eHighway Field Tests

Validator and Demonstrator

Testing in a realistic environment:

– Real traffic and road operations

– Real transport companies and transport processes

– Real power supply system

– Real people (Acceptance)

Facilitator

Developing sub-systems

Creating awareness and acceptance

Disseminating results

Identifying needs for system amendments and further potential users

Providing a nucleus for large-scale implementation

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Thank you!

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