Automatische Fahrzeuge

(SAE Level 5)

Auswirkungen auf Gesellschaft, Sicherheit Mobilitätund Technologie

R. Pfliegl, 2. Februar 2017

Utopie oder Realität?

AD

ist es eine…

…technische/ technologische Herausforderung?

…eine gesellschaftliche Zielsetzung…oder

JUST 4 FUN ?

mobility tomorrow

3A mobility

WEDER………NOCH !

Agenda

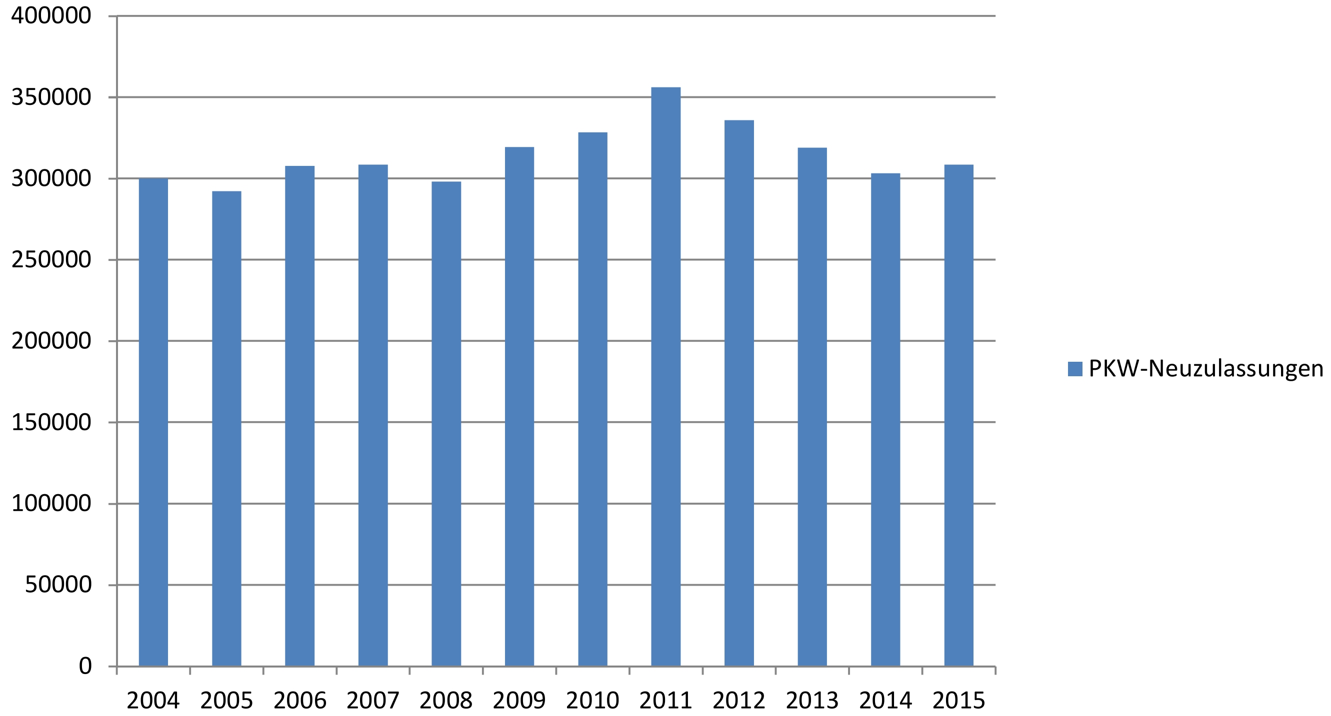
- Einleitung
- Hauptprobleme
- Steuerung des Verkehrs
- Schlüsseltechnologien
- Europäische Initiativen und Projekte
- Roadmaps
- Zusammenfassung

Wachstum

White Book of European Commission 2010:

+50% Truck transport till 2025
+30% Passenger cars till 2025
-25% CO_2 emission till 2030
-80% CO_2 emission till 2050

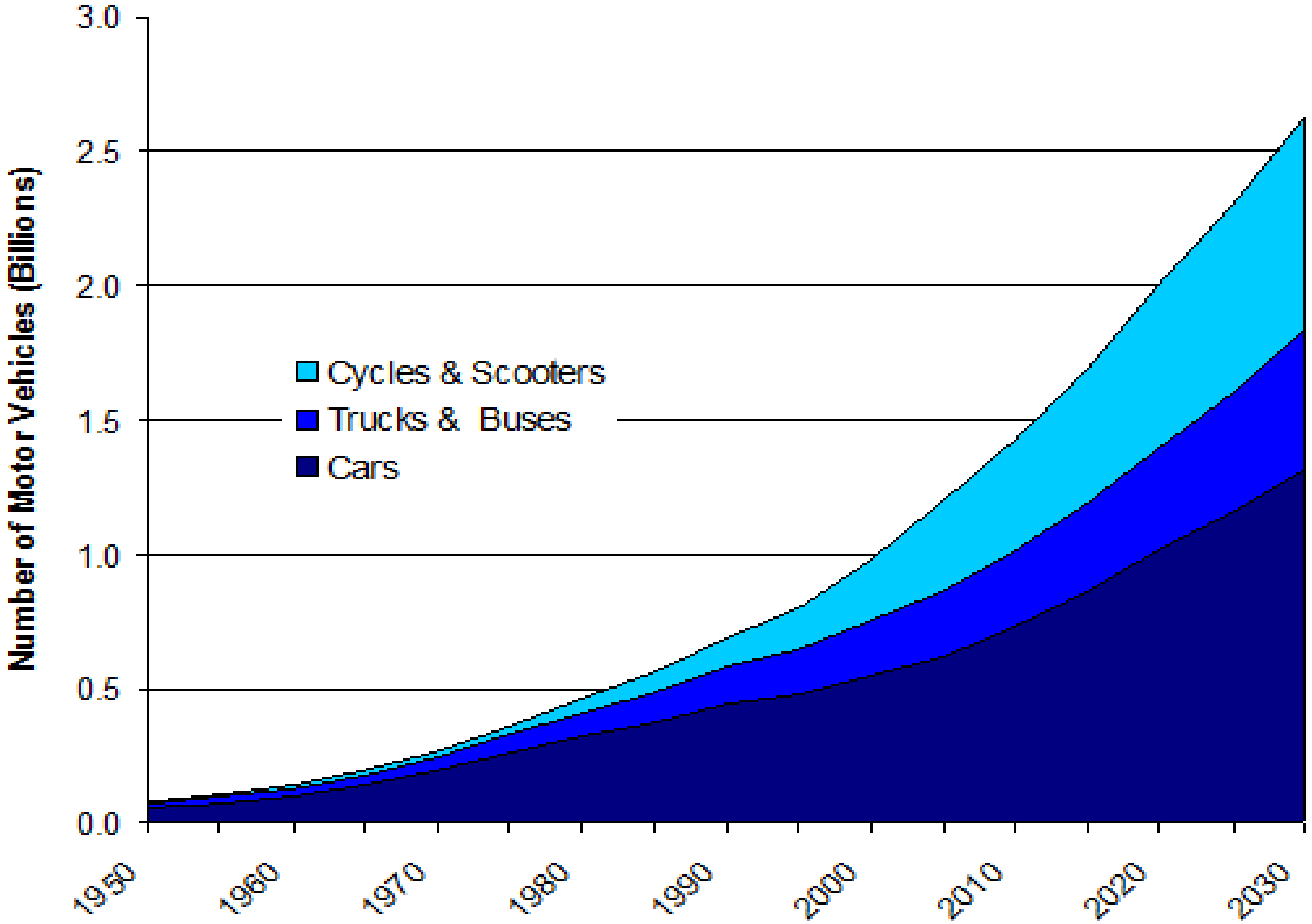
PKW-Neuzulassungen in Österreich

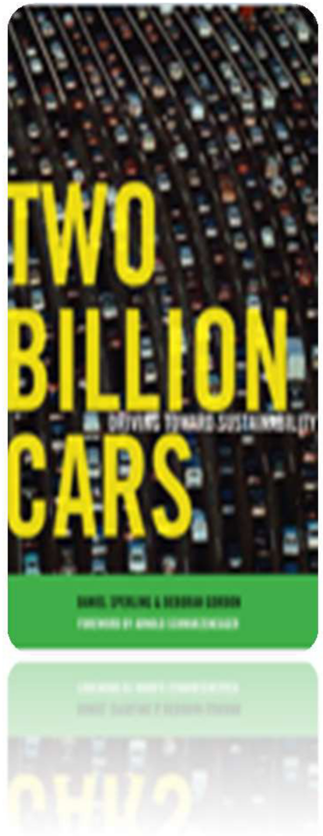


Zulassungen in Österreich gesamt

PKW	**4753812**
Motorräder	762647
LKW	428017
Busse	9755
Sonstige (inkl. Anhänger)	1342044
Gesamtzulassungen	7295275

2 Milliarden Fahrzeuge Global 2020





- Das fördert einerseits die ‚Accessibility' …… also die Möglichkeit Zugang zu Beschäftigung und Freizeitbetätigung zu gewährleisten

- Ist aber andererseits verbunden mit zahlreichen Problembereichen……

Verkehrssicherheit I

mobility tomorrow
3Amobility

Verkehrssicherheit **II**

mobility tomorrow
3A mobility

Volkswirtschaftliche Unfallkosten mit Personenschaden pro Kopf

Volkswirtschaftliche Unfallkosten [Angaben in Euro]

Anteil der Kosten für ...	alle Straßen	Autobahn	Schnellstraße
Getötete pro durchschnittlichem Unfall mit Personenschaden (UPS)	44.905	91.854	140.288
Schwerverletzte pro durchschnittlichem UPS	114.044	132.107	140.704
Leichtverletzte pro durchschnittlichem UPS	26.430	31.437	27.232
Sachschaden pro durchschnittlichem UPS	5.245	5.245	5.245
Summe Kosten pro durchschnittlichem UPS	**190.625**	**260.644**	**313.469**

Gesamte volkswirtschaftliche Unfallkosten mit Personenschaden

volkswirtschaftliche Unfallkosten der UPS im Jahr 2011 (inklusive des menschlichen Leids) [Angaben in Euro]

	Anzahl	durchschnittliche Unfallkosten	Unfallkosten 2011
Getötete	523	3.016.194	1.577.469.462
Schwerverletzte (inklusive 90% der Verletzten nicht erkennbaren Grades)	10.502	381.480	4.006.302.960
Leichtverletzte (inklusive 10% der Verletzten nicht erkennbaren Grades)	34.522	26.894	928.434.668
Sachschaden (pro UPS)	35.129	5.245	184.251.605
Summe			**6.696.458.695**

Effiziente Verkehrsabwicklung?

Effizienz I

Effizienz **II**

Effizienz **III**

Limitiertes Platzangebot der Verkehrsinfrastruktur

Mögliche Antworten

- Zugangsbeschränkungen

  oder

- Bessere Koordination der Nutzung der Infrastruktur (räumlich und zeitlich) !

Wer übernimmt die Verantwortung / Initiative

- Bundesregierung?
- Örtlichen Behörden?
- Infrastrukturbetreiber?
- Kapazitätsmanager?
- Jeder einzelne Benutzer?

=> Von Oben nach Unten oder umgekehrt ??

Motivation

1	Road Safety: Vision Zero	Road safety improvements by reducing human driving errors → **90% of all accidents are caused by human errors**	
2	Traffic Management	- Optimization of traffic flow management - Convenient, time efficient driving via automation → **80% improvement in traffic troughput**	
3	Reducing Emissions	Reduction of fuel consumption & CO^2 emission (through optimization of traffic flow management) → **23 to 39% improvement in highway fuel economy**	
4	Demographic Change	- Support unconfident drivers - Enhance mobility for elderly people → **Allow a variety of age ranges to be mobile** ***0-100+!***	
5	Innovation High technology	- New economic paradigm – supporting innovation policies of regions - Competitiveness / high skill employment → **56 minutes per day freed up for other uses (US)**	

Social equality!

[Source: Tech.AD, Conference on Automated Driving, Berlin, 2015]

Paradigmenwechsel

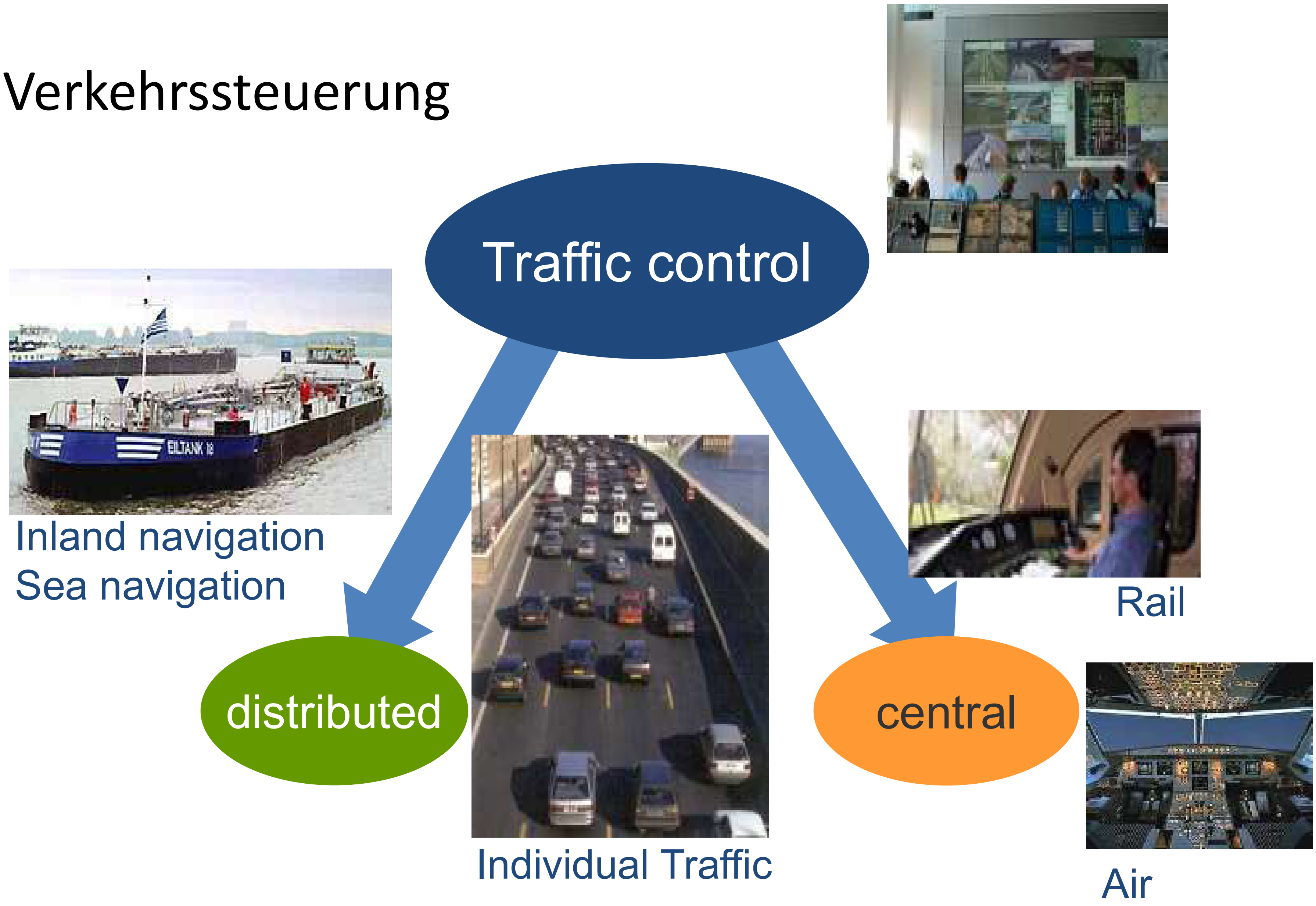
vom

Konventionellen Verkehrsmanagement auf den verschiedenen Verkehrsträgern

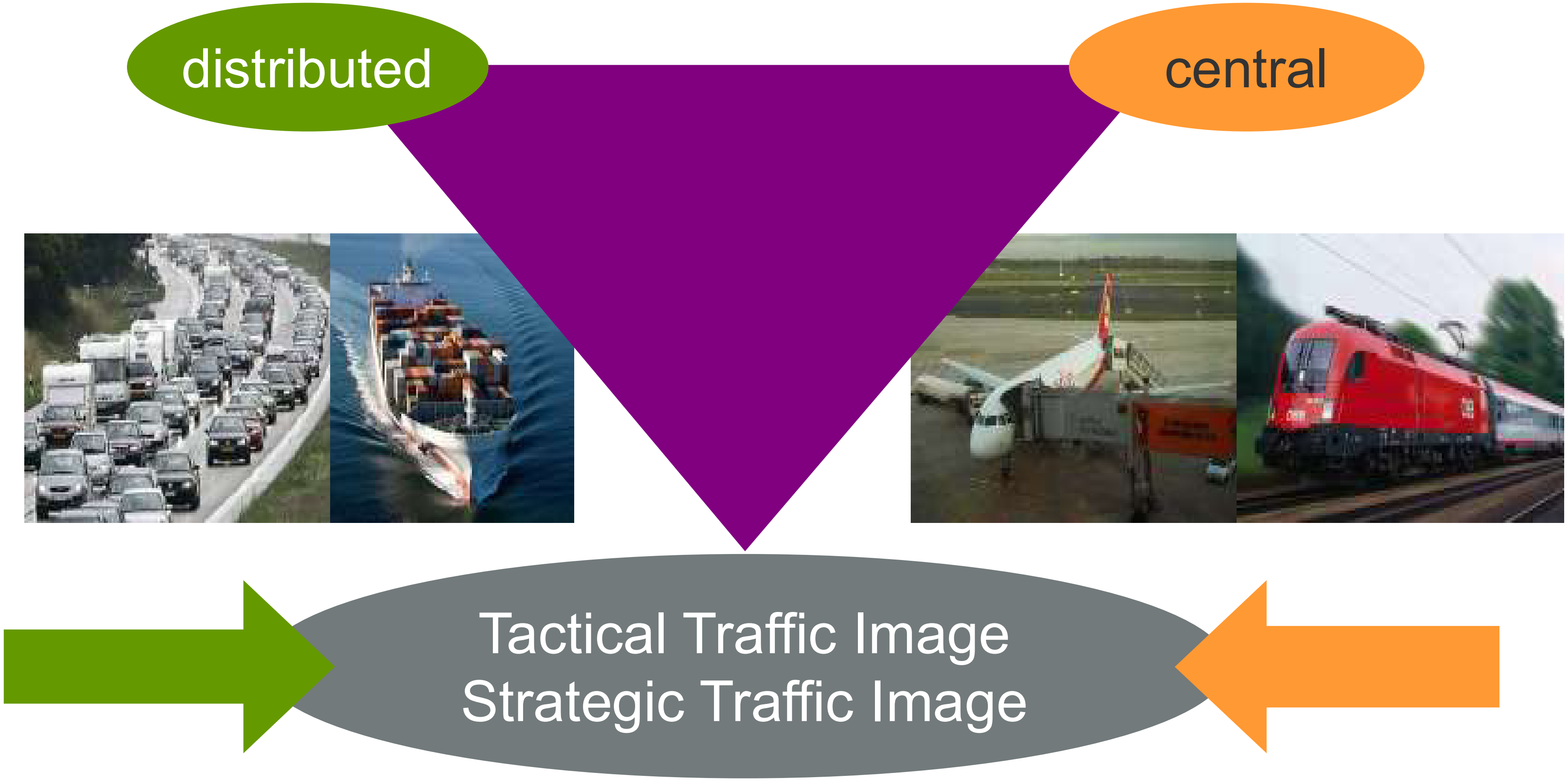
zum

Integrierten Infrastruktur Kapazitätsmanagement

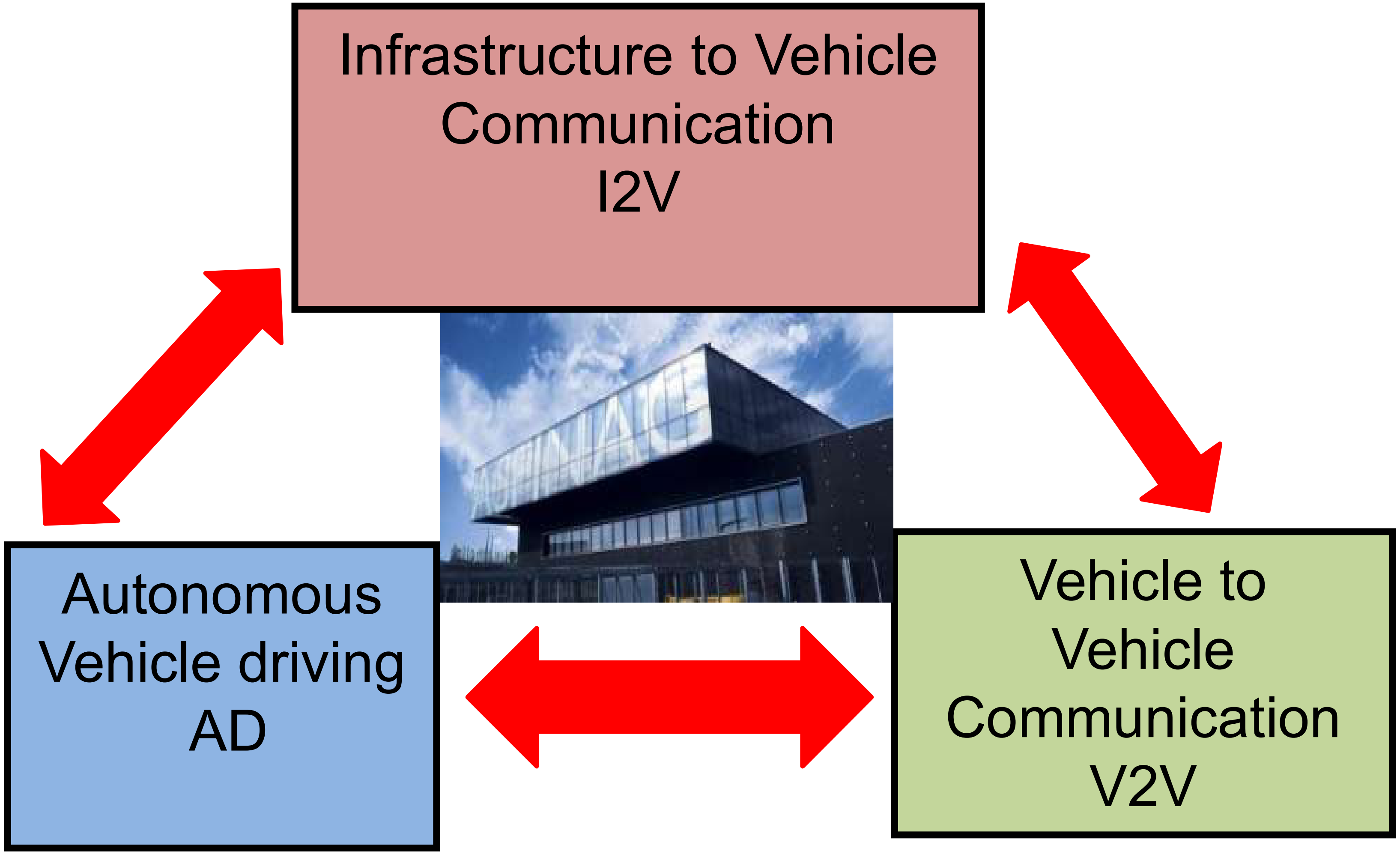
Verkehrssteuerung



Kernelemente – Integriertes Verkehrsmanagement



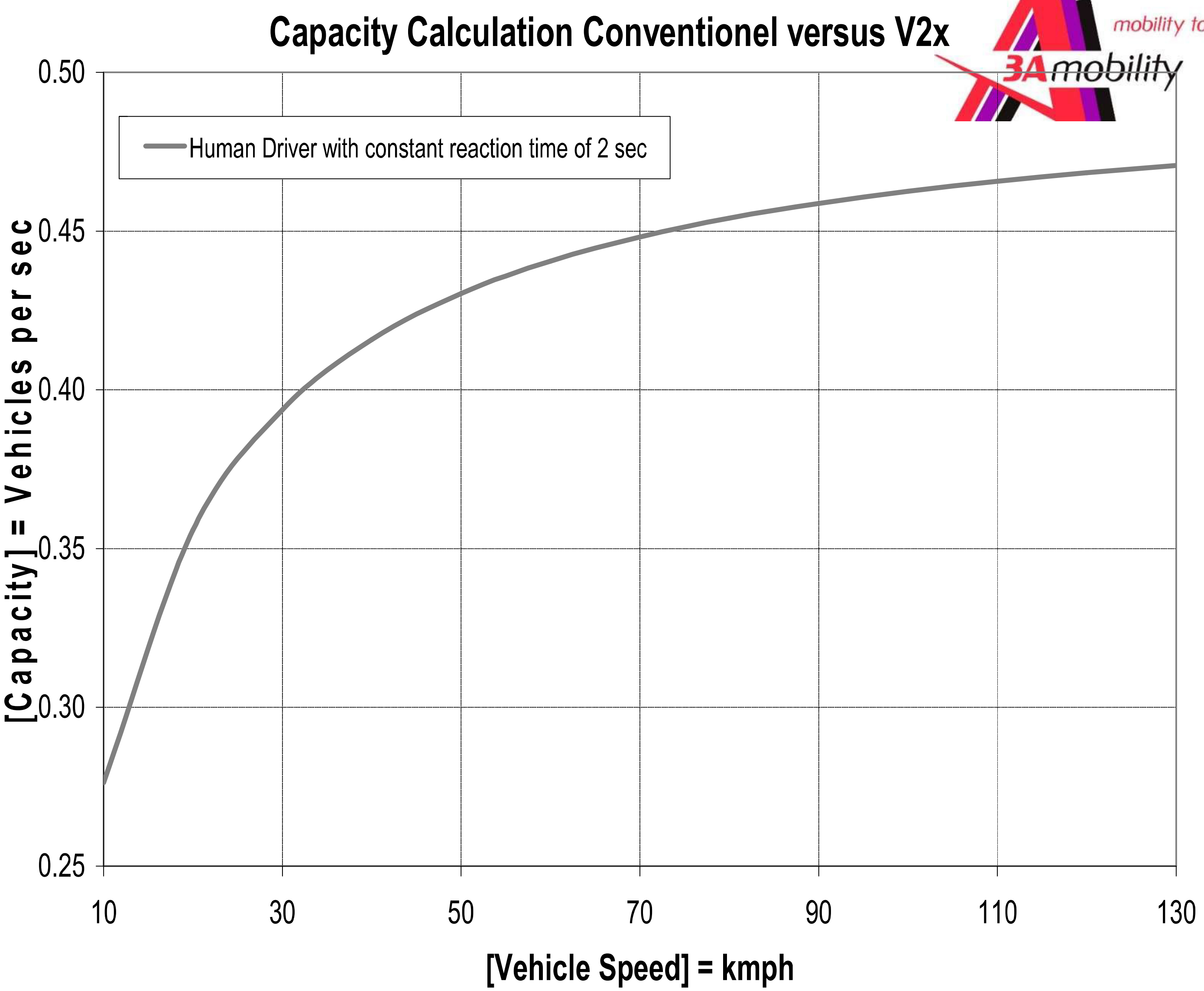
3 Säulen der zukünftigen Verkehrssteuerung



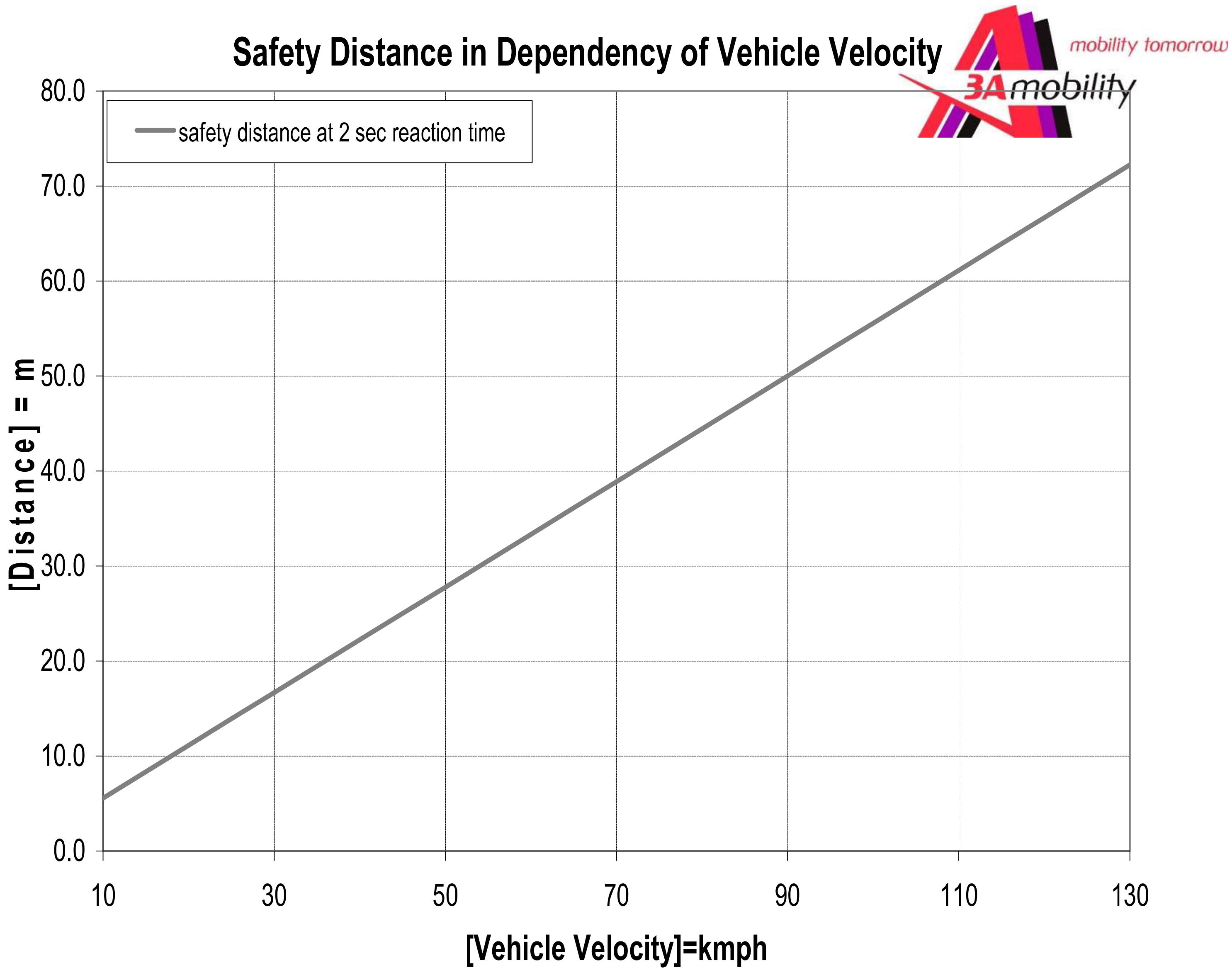
Nutzen wir heute die verfügbare Infrastrukturkapazität effizient aus???

- Wie ist der Abstand aufeinanderfolgender Fahrzeuge (z.B. PkW) gegenwärtig gesetzlich geregelt????

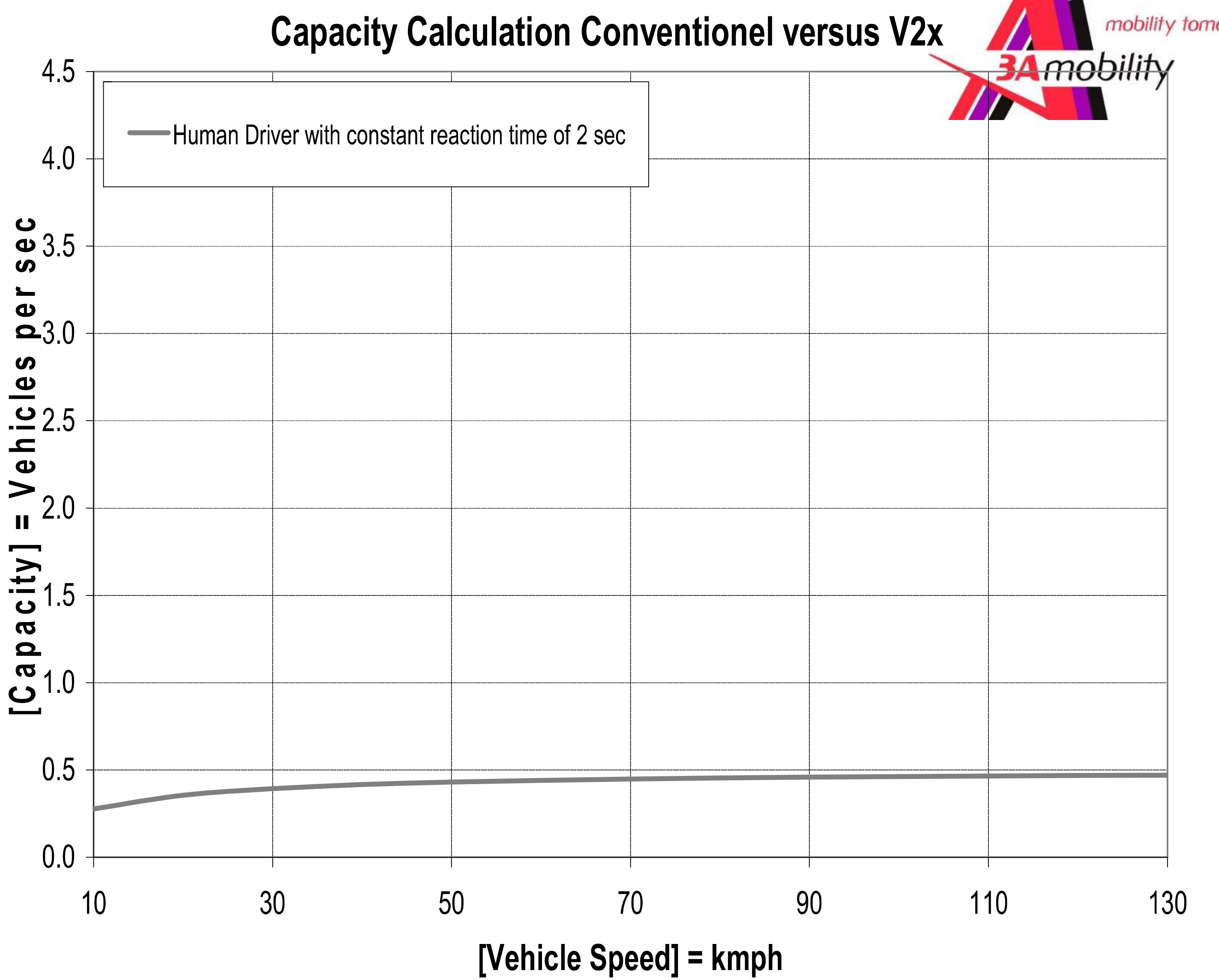
Kapazitätsberechnung



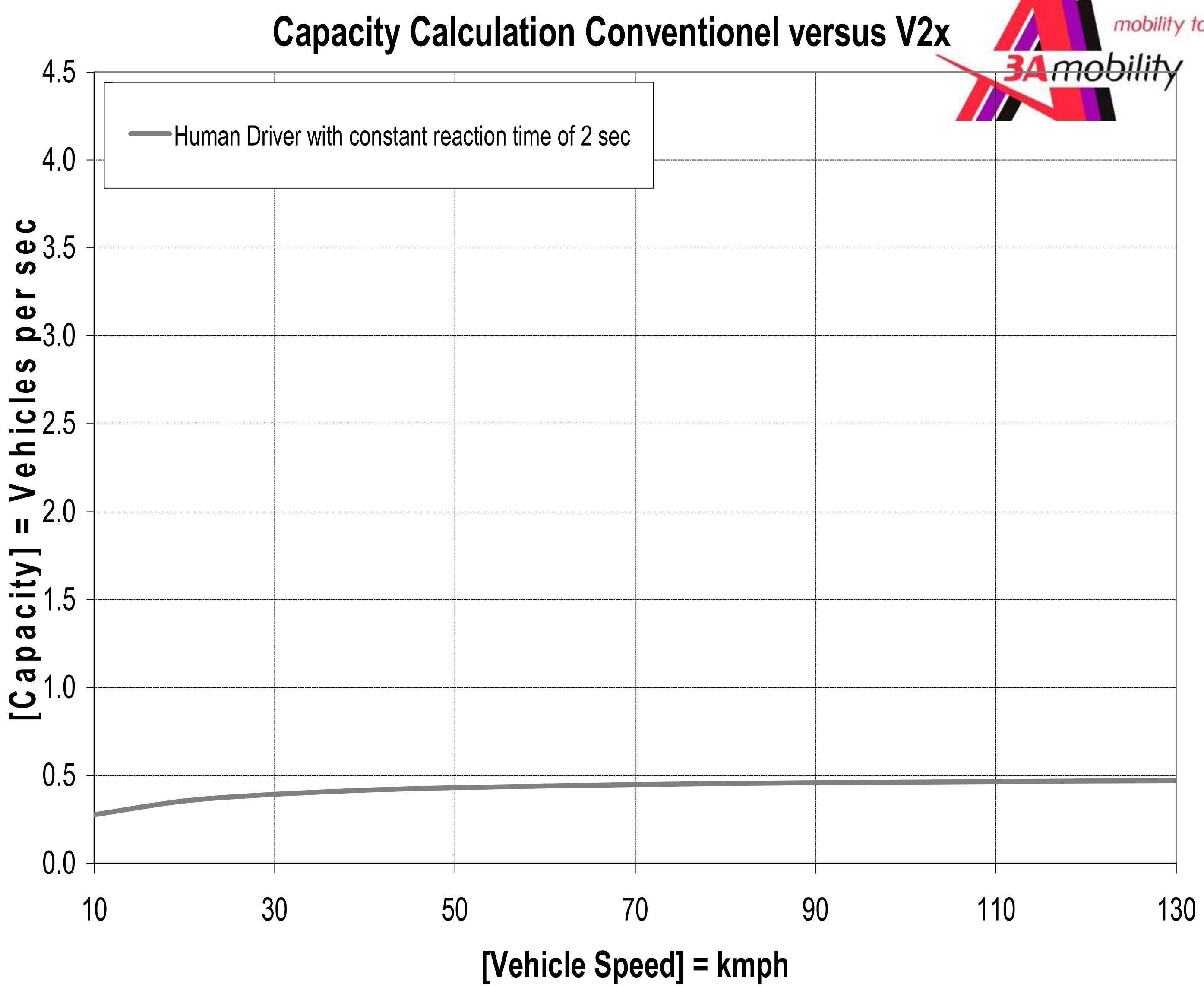
Kapazitätsberechnung II



Kapazitätsberechnung **III**

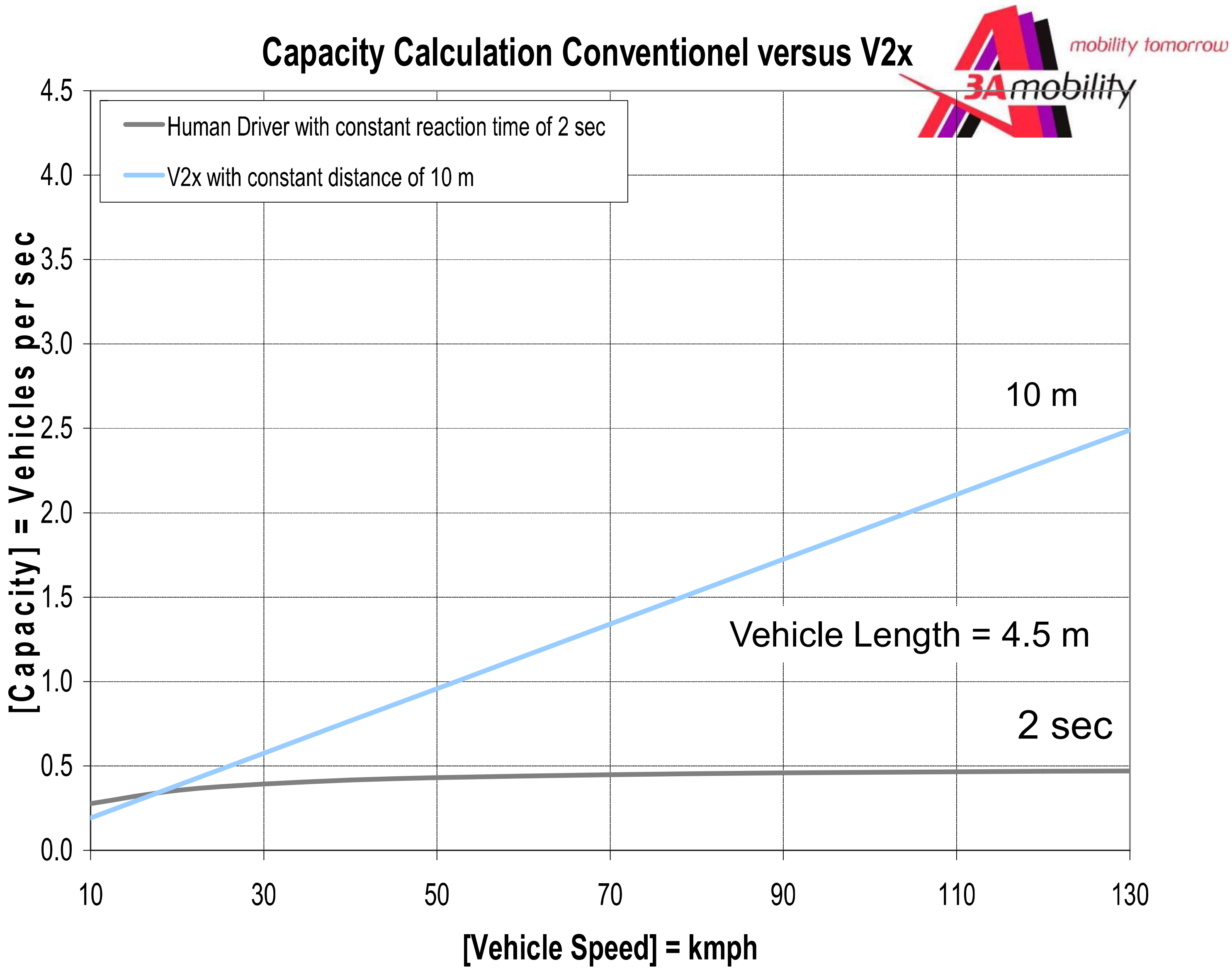


Kapazitätsberechnung **III**

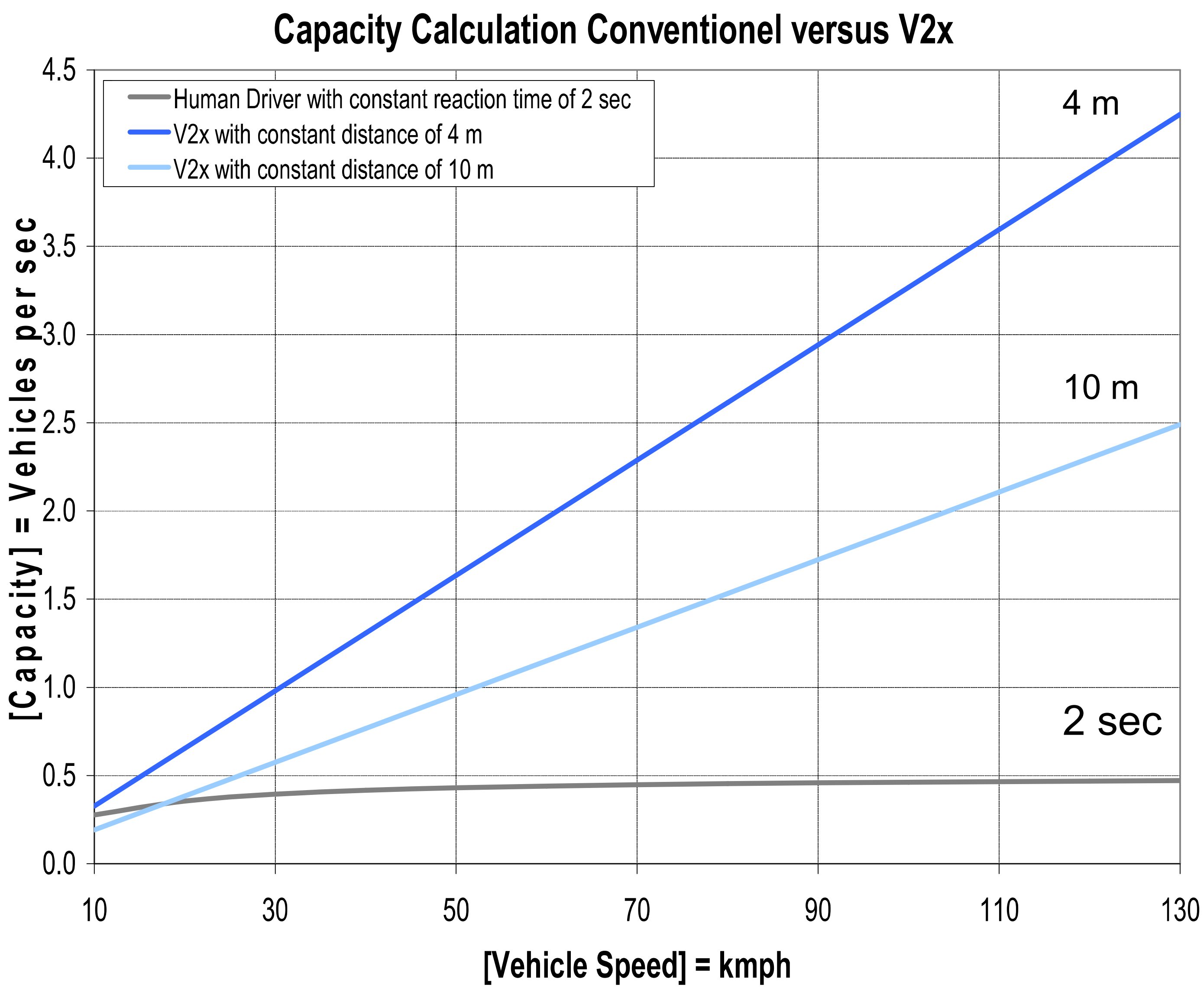


mobility tomorrow
3A mobility

Kapazitätsberechnung **IV**



Kapazitätsberechnung **VI**



mobility tomorrow
3A mobility

Schlüsseltechnologien für Automatische Fahrzeuge

Begriffsdefinition

Autonome Fahrzeuge (DARPA Challenge):
Das Fahrzeug erhält einen Zielpunkt (z.B. GPS Koordinaten) und hat ohne jegliche Einflussnahme den Weg zum Zielpunkt zu finden)

Automatische Fahrzeuge:
Das Fahrzeug folgt mittels eines Navigationssystems einen vorgegebenen Weg bis zum Ziel

SAE – Roadmap

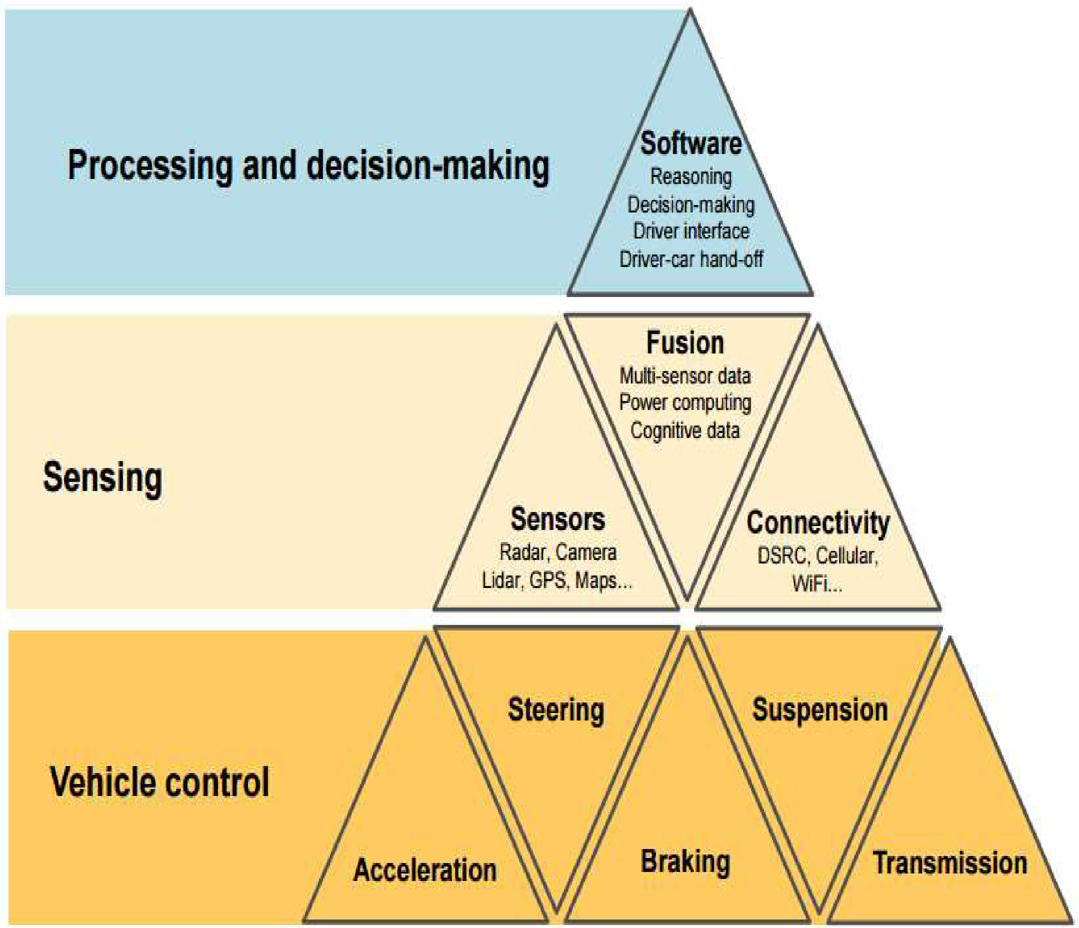
Summary of Levels of Driving Automation for On-Road Vehicles

This table summarizes SAE International's levels of *driving* automation for on-road vehicles. Information Report J3016 provides full definitions for these levels and for the italicized terms used therein. The levels are descriptive rather than normative and technical rather than legal. Elements indicate minimum rather than maximum capabilities for each level. "System" refers to the driver assistance system, combination of driver assistance systems, or *automated driving system*, as appropriate.

The table also shows how SAE's levels definitively correspond to those developed by the Germany Federal Highway Research Institute (BASt) and approximately correspond to those described by the US National Highway Traffic Safety Administration (NHTSA) in its "Preliminary Statement of Policy Concerning Automated Vehicles" of May 30, 2013.

Level	Name	Narrative definition	Execution of steering and acceleration/ deceleration	Monitoring of driving environment	Fallback performance of *dynamic driving task*	System capability (*driving modes*)	BASt level	NHTSA level
***Human driver* monitors the driving environment**								
0	**No Automation**	the full-time performance by the *human driver* of all aspects of the *dynamic driving task*, even when enhanced by warning or intervention systems	Human driver	Human driver	Human driver	n/a	Driver only	0
1	**Driver Assistance**	the *driving mode*-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	Human driver and system	Human driver	Human driver	Some driving modes	Assisted	1
2	**Partial Automation**	the *driving mode*-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the *human driver* perform all remaining aspects of the *dynamic driving task*	**System**	Human driver	Human driver	Some driving modes	Partially automated	2
***Automated driving system* ("system") monitors the driving environment**								
3	**Conditional Automation**	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task* with the expectation that the *human driver* will respond appropriately to a *request to intervene*	System	**System**	Human driver	Some driving modes	Highly automated	3
4	**High Automation**	the *driving mode*-specific performance by an *automated driving system* of all aspects of the *dynamic driving task*, even if a *human driver* does not respond appropriately to a *request to intervene*	System	System	**System**	Some driving modes	Fully automated	3/4
5	**Full Automation**	the full-time performance by an *automated driving system* of all aspects of the *dynamic driving task* under all roadway and environmental conditions that can be managed by a *human driver*	System	System	System	**All driving modes**	-	

Building Blocks of Automated Driving



Key Technologies I

- Autonomous Vehicle Functions (driving)

- V2X communication

- Mass Data Processing (simulation, forcast, capacity calculation, etc.)

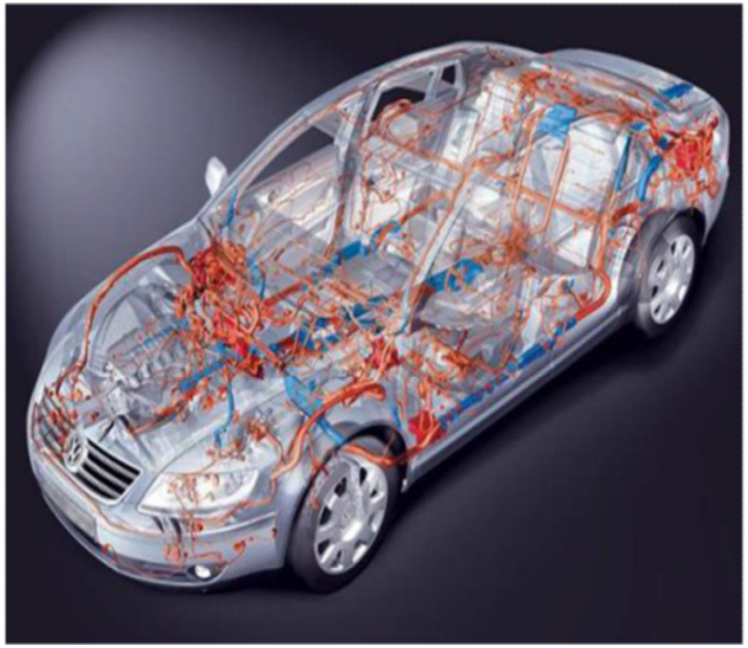
- Traveller Services Pre-trip/ on-Trip (information, planning, booking, real time notification, individualized services,..)

Key Technologies **II**

Satellite   Cellular   WiFi   Radio   DSRC

Blue Tooth & RF

Wireless Sensors



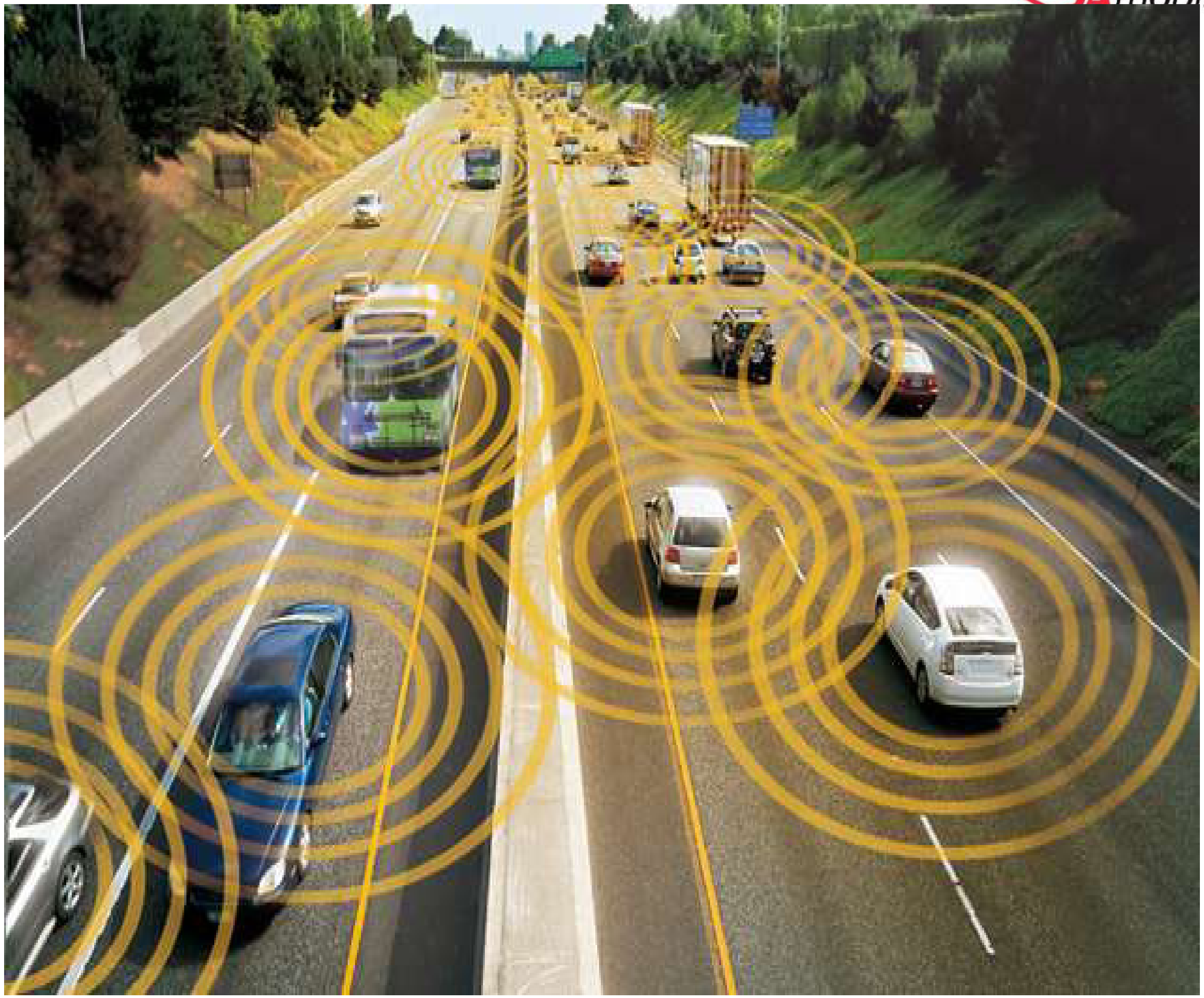
CD & MP3

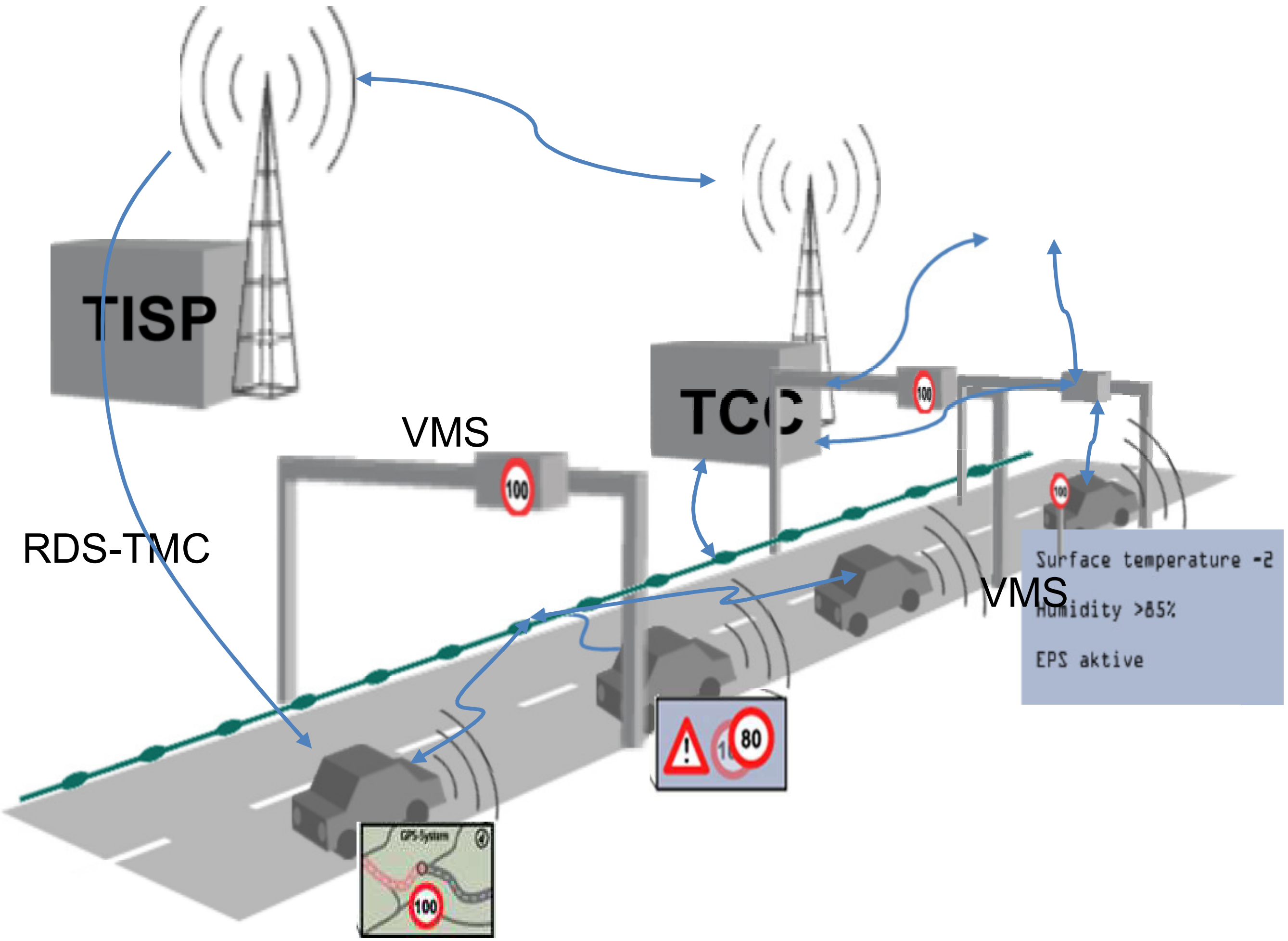
Mechanics' Diagnostic Tools

Key Technologies III

V2V

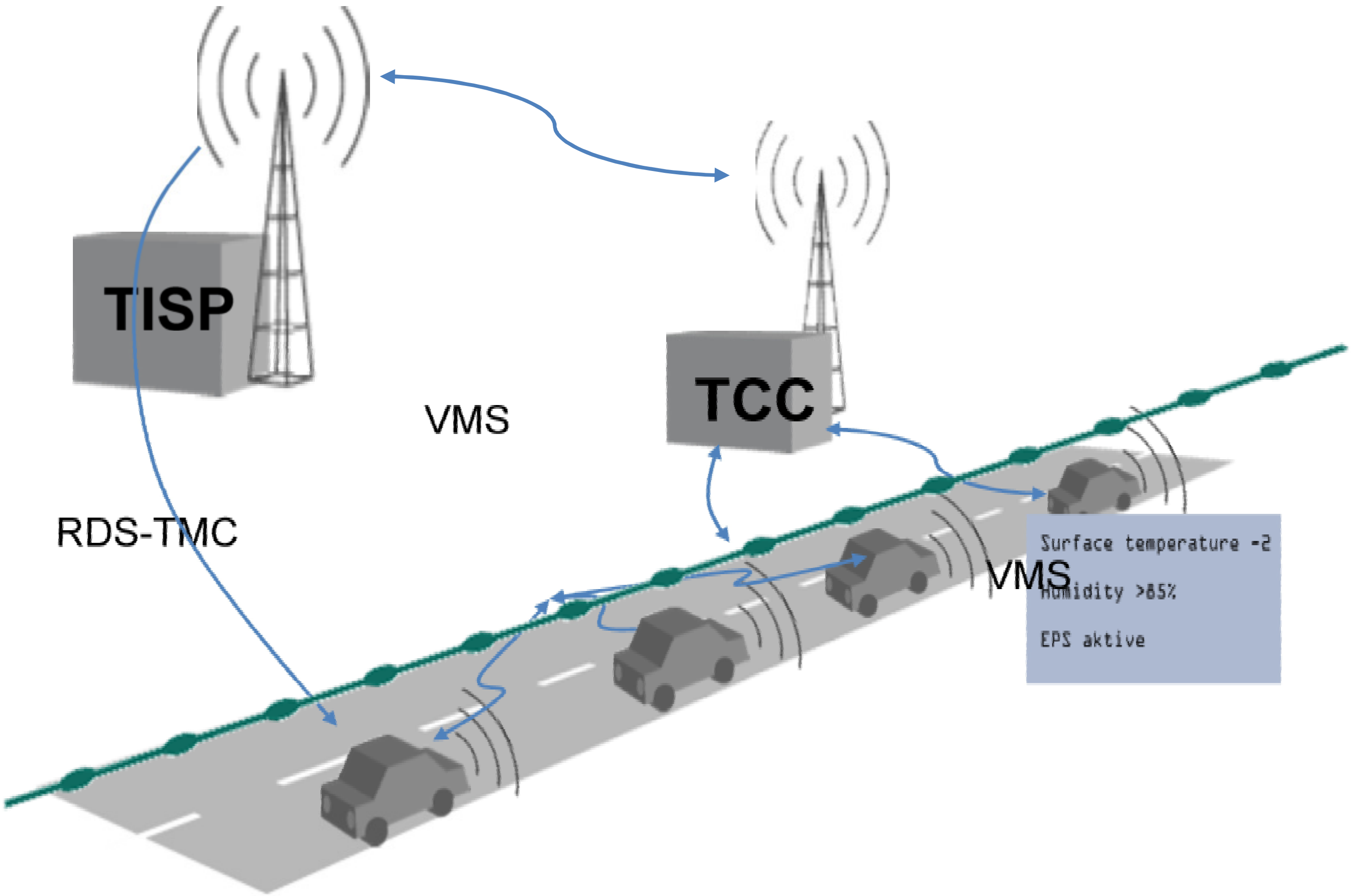
mobility tomorrow
3A mobility





TISP
TCC
VMS
RDS-TMC
VMS
100
80
Surface temperature -2
Humidity >85%
EPS aktive

V2I


TISP
TCC
VMS
RDS-TMC
VMS
Surface temperature -2
Humidity >85%
EPS aktive

V2X

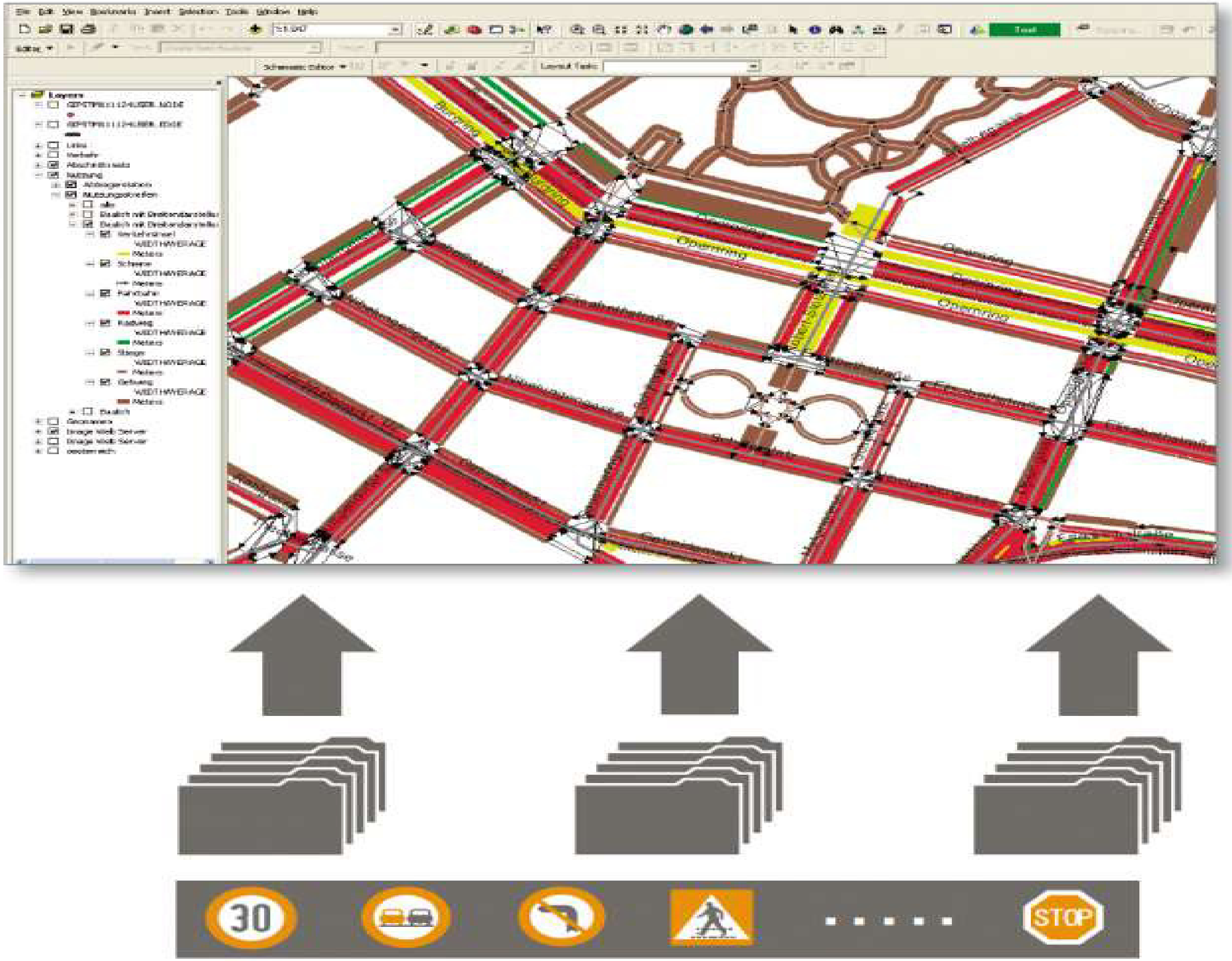
- Wie findet das automatische Fahrzeug den Weg von A nach B????

- Reichen die Funktionen und Technologien aus die wir bis jetzt besprochen haben???

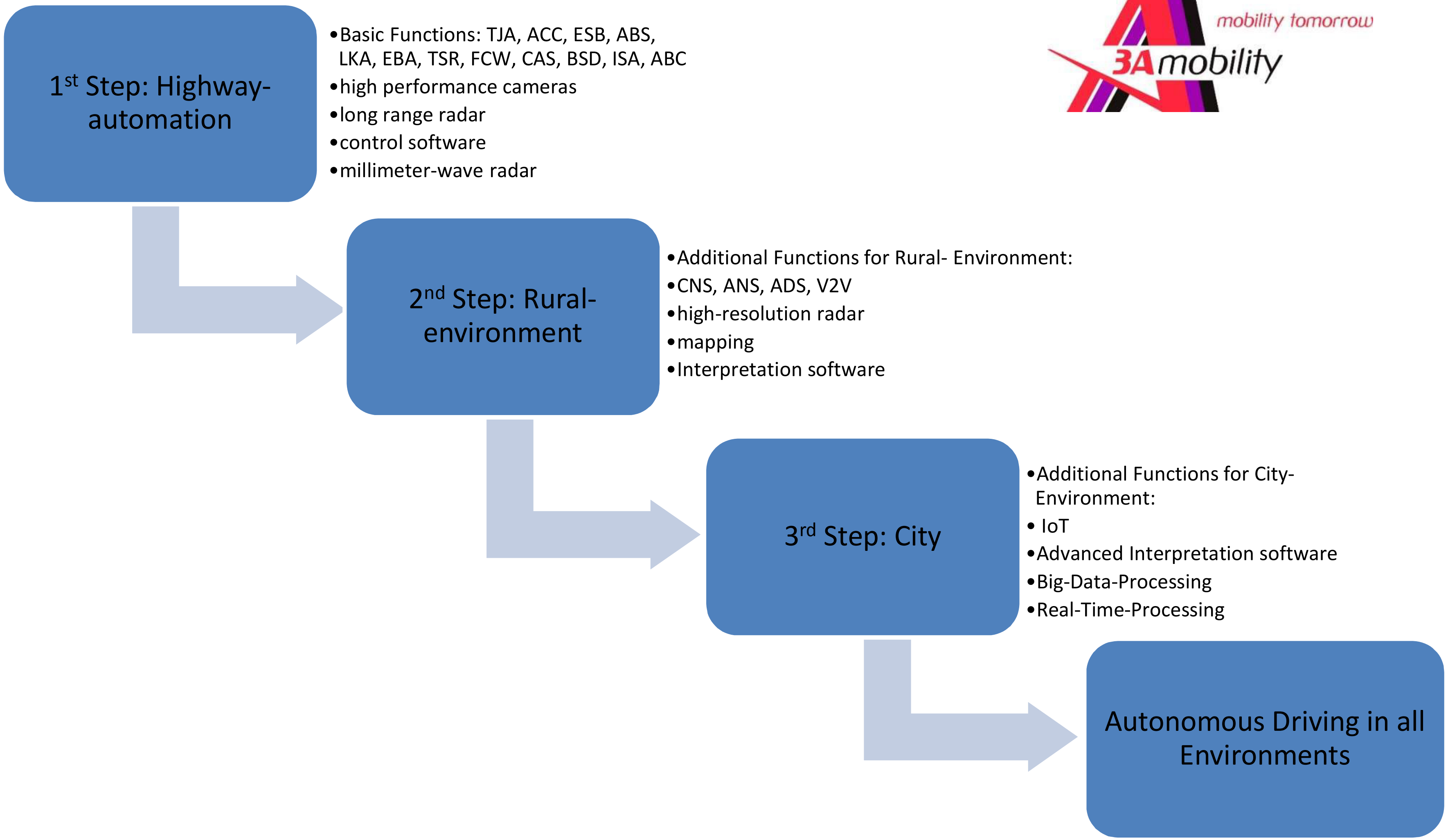
Navigationssystem

GIP.gv.at (Graph Integration Platform)

- Integriertes Informationssystem für die Vehicleführung basierend auf einem gemeinsamen Graph, e.g. GIP
- Für alle Verkehrsanforderungen:
  - Regional und Urban Transport Planning
  - e-Government Processes, Regulations, Notifications
  - Guidance , Logistics
  - Operations, Control and
  - Monitoring and Quality Assessment


30
STOP

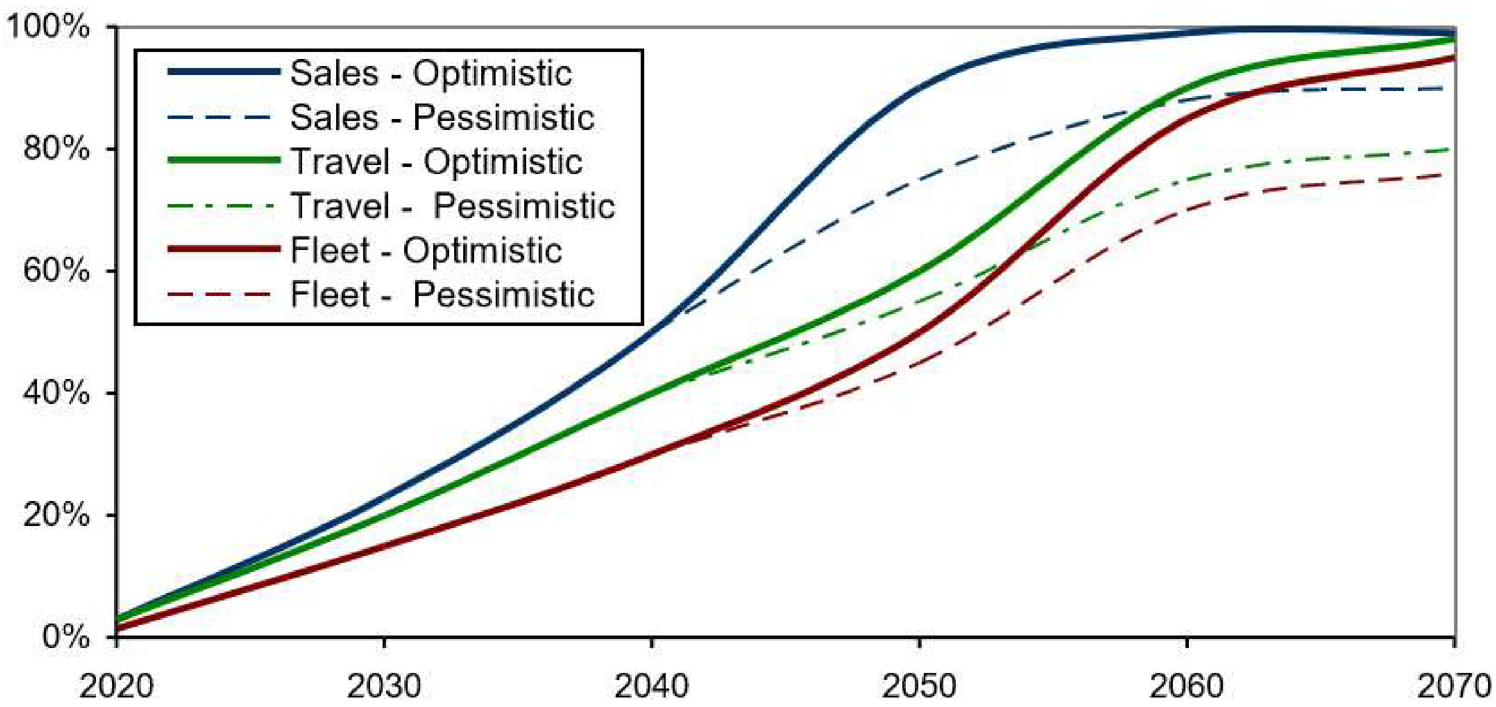
Stufenweise Einführung


1st Step: Highway-automation
•Basic Functions: TJA, ACC, ESB, ABS, LKA, EBA, TSR, FCW, CAS, BSD, ISA, ABC
•high performance cameras
•long range radar
•control software
•millimeter-wave radar
2nd Step: Rural-environment
•Additional Functions for Rural- Environment:
•CNS, ANS, ADS, V2V
•high-resolution radar
•mapping
•Interpretation software
3rd Step: City
•Additional Functions for City-Environment:
• IoT
•Advanced Interpretation software
•Big-Data-Processing
•Real-Time-Processing
Autonomous Driving in all Environments

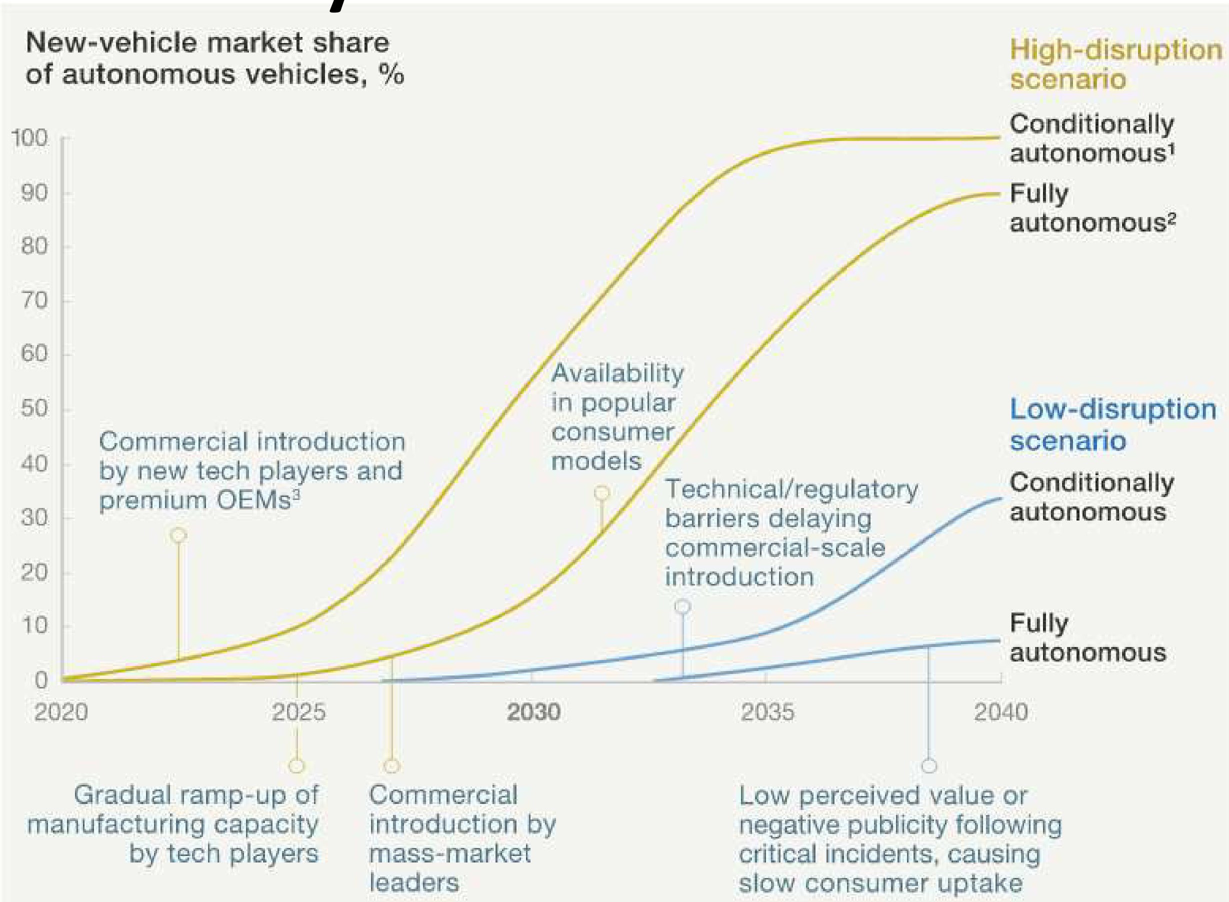
Autonomous Vehicle Sales, Fleet and Travel Projections (Based on Table)

Name	Deployment Cycle	Typical Cost Premium	Market Saturation Share
Air bags	25 years (1973-98)	A few hundred dollars	100%, due to federal mandate
Automatic transmissions	50 years (1940s-90s)	$1,500	90% U.S., 50% worldwide
Navigation systems	30+ years (1985-2015+)	$500 and rapidly declining	Uncertain; probably over 80%.
Optional GPS services	15 years	$250 annual	2-5%
Hybrid vehicles	25+ years (1990s-2015+)	$5,000	Uncertain. Currently about 4%.

Vehicle Technology Deployment Summary



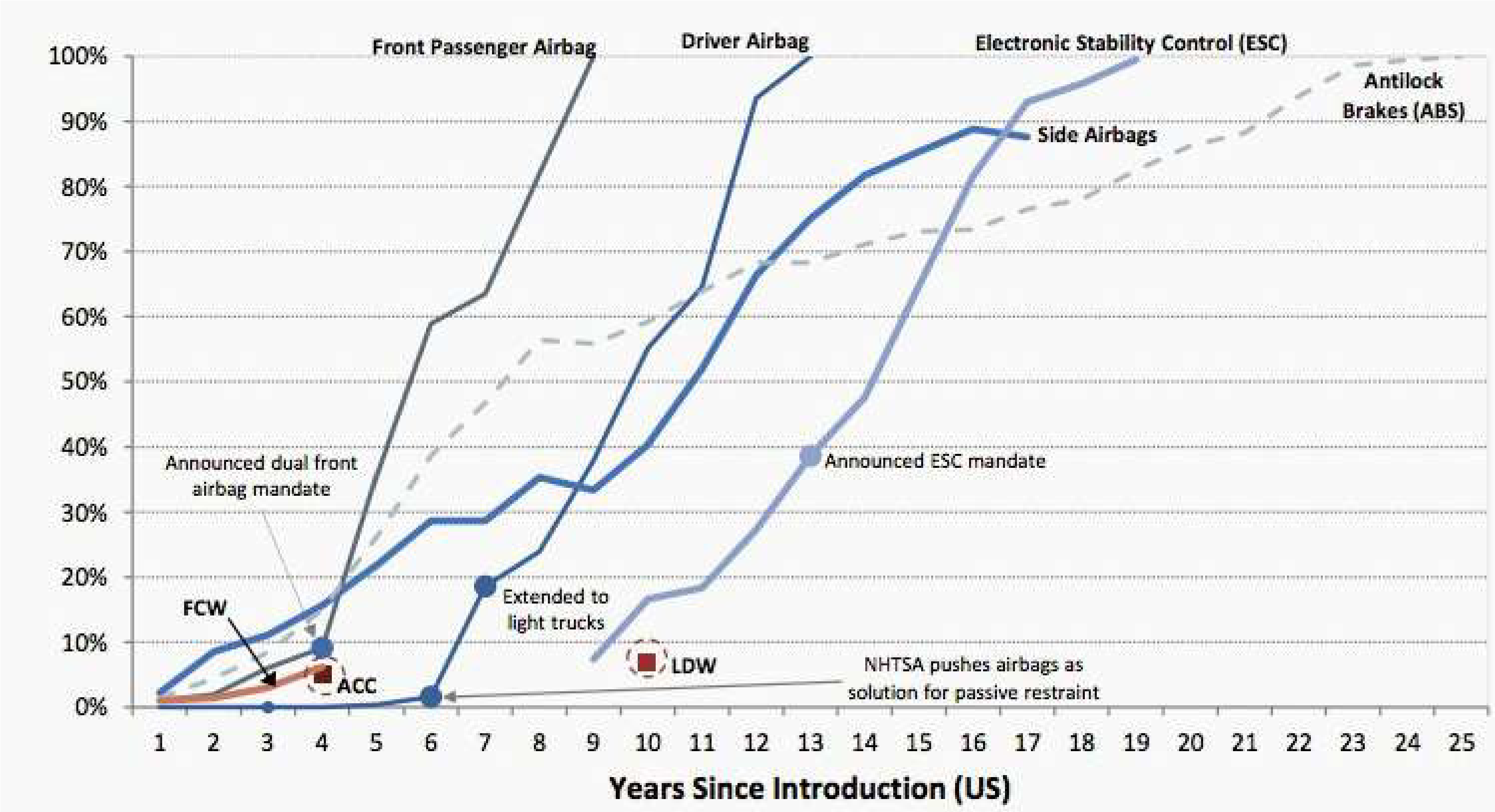
How many cars are L5 2030?



Factors in disruption scenarios	High disruption	Low disruption
Regulatory challenges	Fast	Gradual
Safe, reliable technical solutions	Comprehensive	Incomplete
Consumer acceptance, willingness to pay	Enthusiastic	Limited

[1]Conditionally autonomous car: the driver may take occasional control.
[2]Fully autonomous car: the vehicle is in full control.
[3]Original-equipment manufacturers.

Penetration of select safety features in US



Source: Wards, IHS, NHTSA, RBC Capital Markets estimates

The new EU Framework Programme for Research and Innovation, 2014-2020 Instrument for consistent development

What is Horizon 2020

The new EU Framework Programme for Research and Innovation, 2014-2020

- **A budget of € 77 billion for 7 years**

- **A core part of Europe 2020, Innovation Union and the European Research Area:**

  - **Responding to the economic crisis** to invest in future jobs and growth

  - **Addressing people's concerns** about their livelihoods, safety and environment

  - **Strengthening the EU's global position** in research, innovation and technology

A3PS

Rethinking Propulsion.

ERTRAC – Roadmap

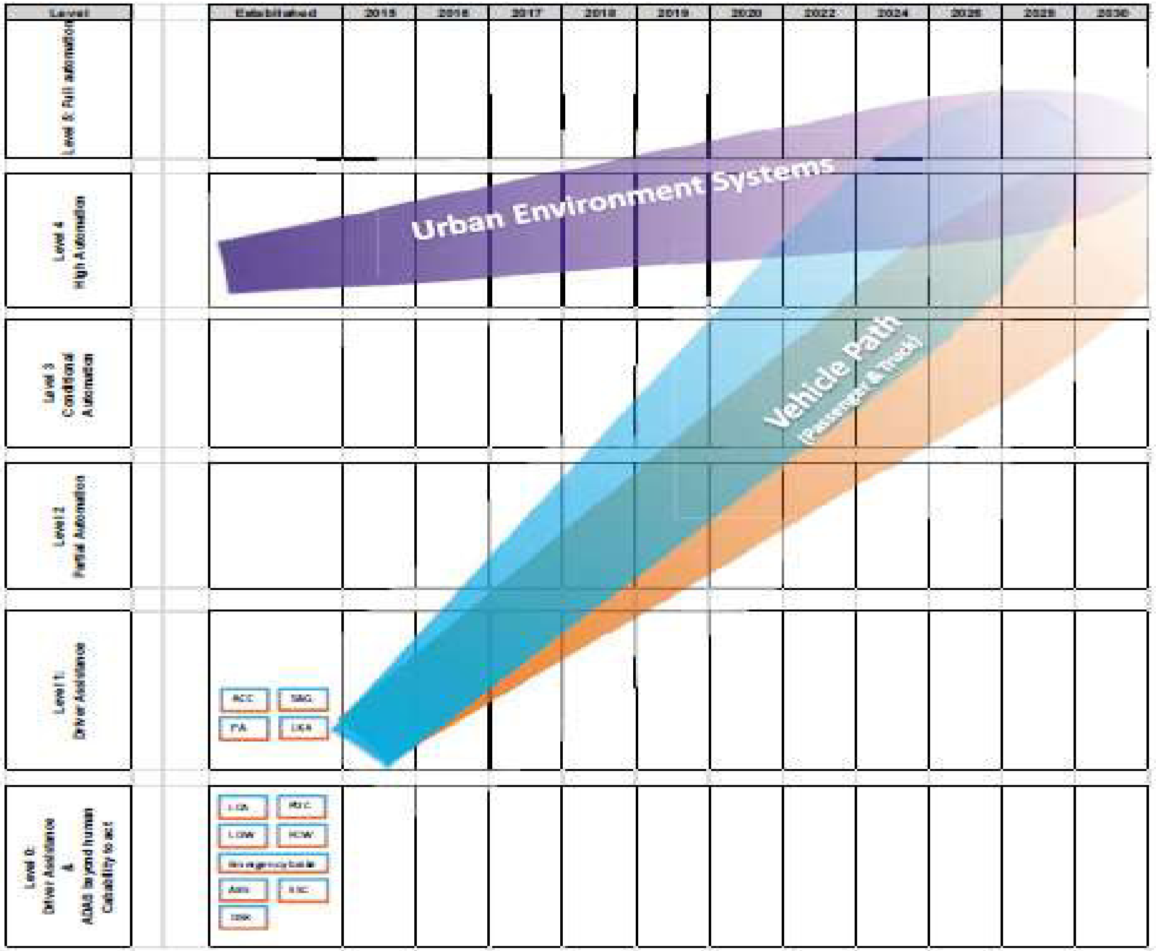
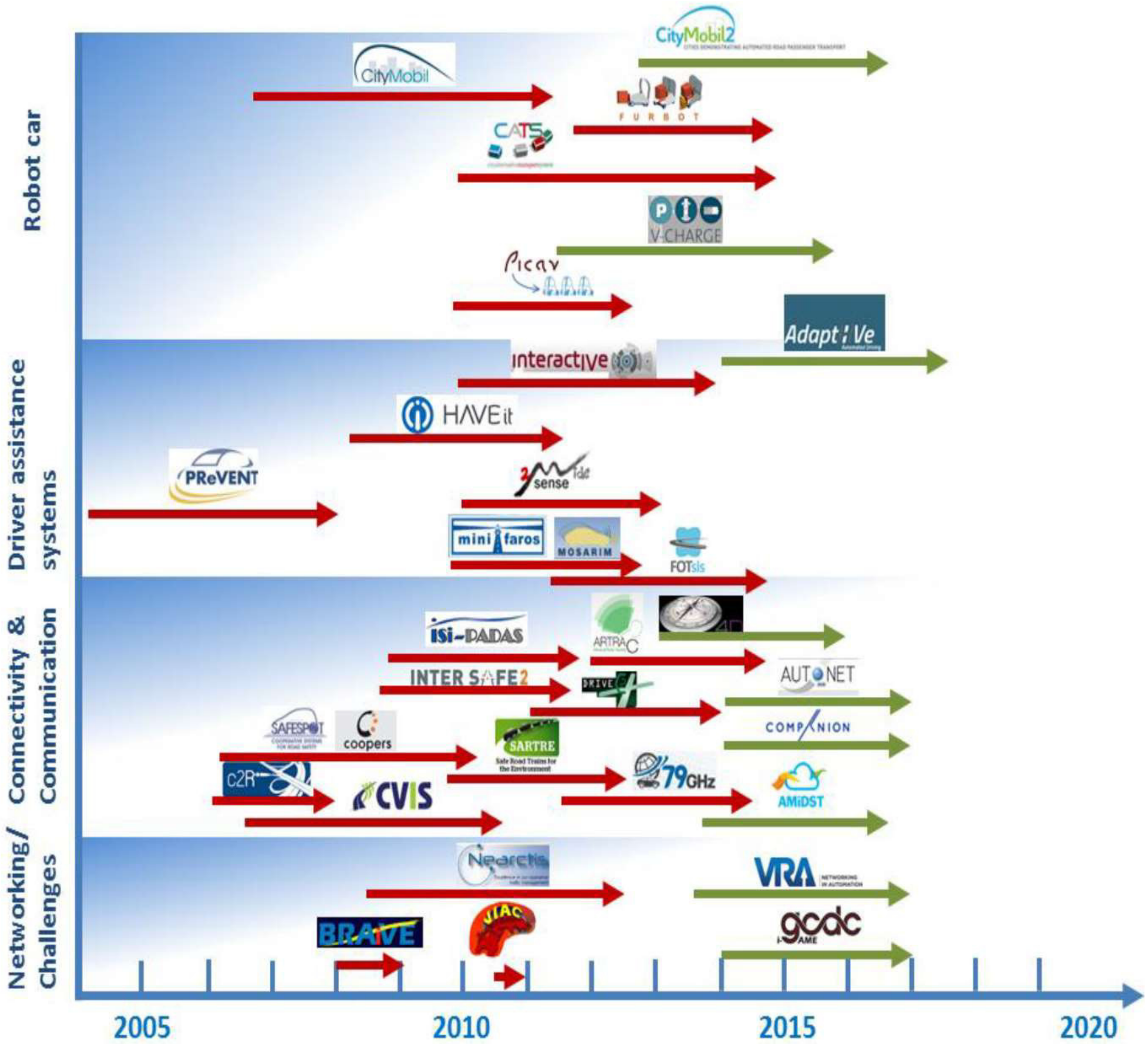


Figure 2: The main automation deployment paths

EPoSS – Roadmap



Roadmap III – ECo AT

The C-ITS Corridor NL-DE-AT

ECo-AT

Providing a basis for standardized, international, future-oriented cooperative ITS services

- A joint road map for the introduction of the initial cooperative ITS services
- Common functional descriptions of the initial cooperative ITS services and technical specifications
- Start of the actual implementation of the initial cooperative ITS services

Source:http://eco-at.info/home.html

Vielen Dank für Ihre Aufmerksamkeit!