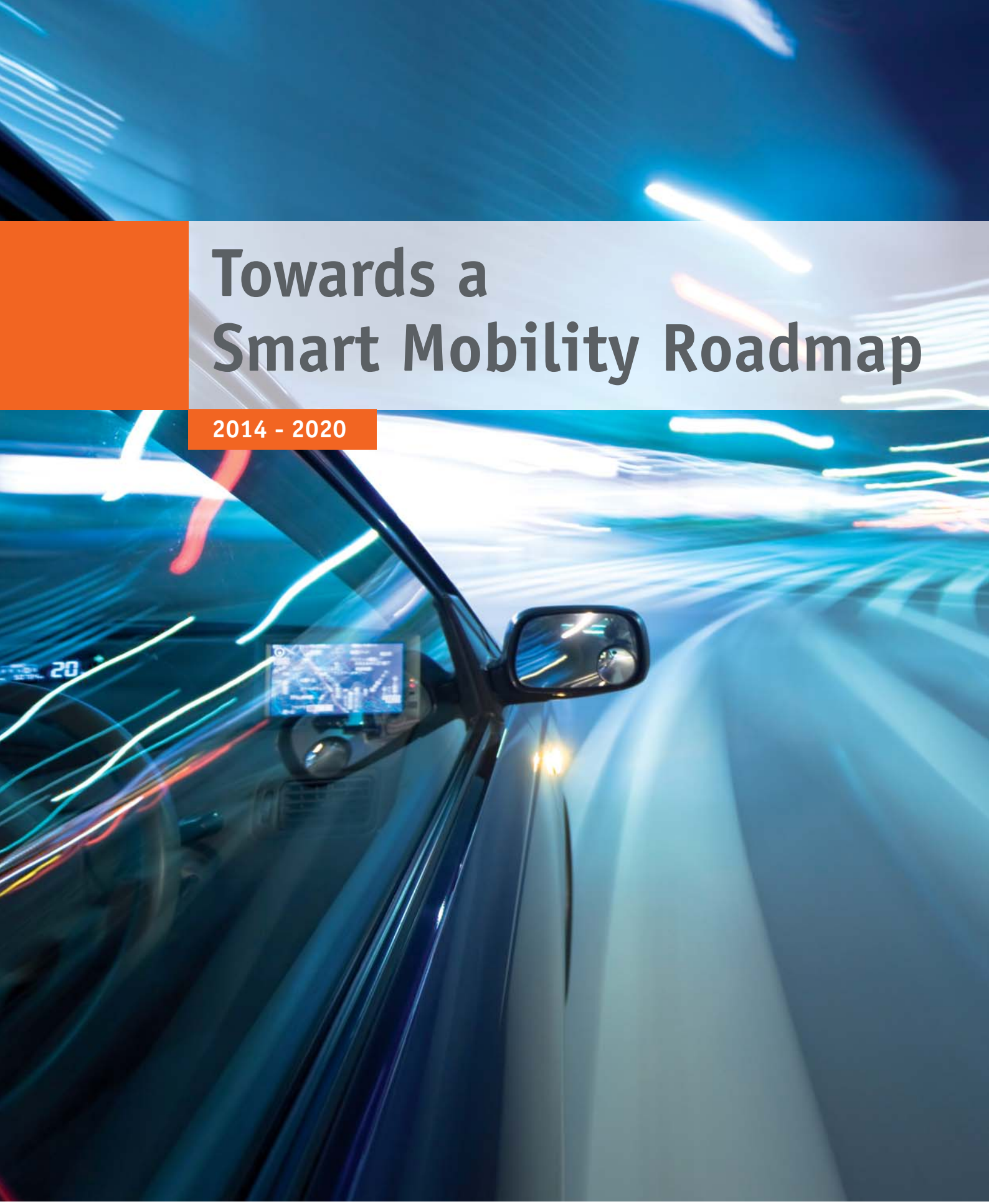


Towards a Smart Mobility Roadmap

2014 - 2020

AutomotiveNL

ITS Netherlands connekt

DITCM
Dutch Integrated Testsite Cooperative Mobility

Credits
This brochure presents an initial
'version 1' framework as at
March 2012 to define
the Smart Mobility roadmap.

Text: AutomotiveNL, Connekt, DITCM
Lay-out: KlasseOntwerp, Utrecht
Print: Drukkerij Gewoon Badoux, Houten

Contents

Introduction 5

1 Realising Smart Mobility solutions 7

2 Services for Smart Mobility 8
- Guide to the services 9
- Service sheets 10

3 Linking services to technologies 27
- Guide to the tables 27
- Tables 28

4 Enabling technologies 31
- Property definitions 31
- Tables 32

5 Milestones so far 34

Source 35

Introduction

The mobility challenge and its solutions

Mobility is essential, both for society and the economy. Projections show continuing growth in the number of person-kilometres travelled by road and in the number of freight kilometres. But if not addressed properly, increasing mobility also has downsides for society, economy and the environment. These include delays and uncertainty caused by increased congestion, health risks through emissions and noise, and lower safety levels for all road users.

Smart Mobility challenges these issues. The key enabler is ICT. Its application will lead to better use of the available infrastructure based on a paradigm shift towards a central point of user control.
By introducing new incentives, users will in the future base their mobility choices on real-time information on the performance level of the mobility system, before and even during their journeys. They will increasingly be able to choose between physical and virtual infrastructures, as these become more interrelated.

A recent study by TNO (Netherlands Organisation for Applied Scientific Research) shows that Smart Mobility initiatives will lead to 50% fewer traffic jams in the next 10-15 years, 25% fewer traffic fatalities,10% lower CO2 emissions and 20% lower air pollution.

These complex challenges demand the joint efforts of industry, knowledge institutes and government. In the Netherlands these three parties have joined forces in their ambition to challenge the issues and become forerunners in the Smart Mobility field.

The Smart Mobility roadmap

A Smart Mobility roadmap is being developed jointly by industry, knowledge institutes and government in the Netherlands represented in ITS Netherlands/ Connekt, DITCM and AutomotiveNL. These partners are working together to support, facilitate and accelerate the process from innovation to deployment. Their shared goal is to translate societal and policy goals into enabling technologies and practical applications.
The roadmap will form the basis on which choices are made and priorities set for future projects, with the aim of constantly updating and realising the defined Smart Mobility goals in the Netherlands.

The next step

This publication marks the start of a process, not its completion. The next step is defining the Smart Mobility Roadmap and using it to prioritise and focus innovation. This roadmap will be published in the second half of 2012, including the integrated roadmaps of DITCM and AutomotiveNL.
This brochure can be seen as 'version 1', a start document to define this roadmap.

The network organisation partners

AutomotiveNL
AutomotiveNL is the cluster organisation for the Dutch automotive sector, promoting collaborative innovation, ecosystem development and facility sharing. AutomotiveNL supports the sector in its ambition to grow from the present turnover of 17 billion euro to 24 billion euro, and from 45,000 jobs at present to 55,000 in 2020.

Connekt
ITS Netherlands/Connekt is an independent network of companies, government and research institutions that cooperates on the basis of mutual trust towards smart and sustainable mobility in the Netherlands.

DITCM
DITCM (Dutch Integrated Testsite Cooperative Mobility) is an open innovation initiative in which 20 public and private parties collaborate in the area of cooperative mobility. DITCM has two pillars: DITCM Facilities (facility sharing) and DITCM Innovations (realising a shared roadmap).

AutomotiveNL

ITS Netherlands connekt

DITCM
Dutch Integrated Testsite Cooperative Mobility

1 Realising Smart Mobility Solutions

Smart Mobility to meet tomorrow's demands

Smart Mobility solutions are essential to meet tomorrow's increasing travel and transport demands and challenges. In Europe as a whole but certainly in the Netherlands, investments in large new infrastructure is more and more seen as being the last step, if all other options fail. First of all it is our societal duty to use as best as possible the existing infrastructure. ITS, Smart Mobility, Cooperative Systems, it is all about new technologies aiming at optimising the use of the infrastructure. Not only to reduce congestion, but also expectations are high on the potentials of smart mobility solutions to solve the challenges of climate change and to improve road safety. For these reasons, ITS and Smart Mobility are much more than just providing new services and products by industry. It will provide solutions fit for for example the Dutch Beter Benutten (better utilisation) programme aiming at a 20% reduction of traffic congestion in key areas in the Netherlands.

Also, it will provide solutions for the European objectives as described in the European White Paper on Transport. This document should be seen as a first, but very important starting point to bring the enormous possibilities from research and industry in line with the societal goals and objectives of the government. A starting point, that will be followed by intensive cooperation in the next half year. The objective is to have a common agreed but dynamic roadmap in the second half of 2012.

Working together on practical solutions

Industry, knowledge institutes and government in the Netherlands are working together to develop a wide range of practical Smart Mobility solutions that are ready for roll-out. With the combined power of AutomotiveNL, Connekt/ITS Netherlands and DITCM, a wide range of industries from automotive to service providers and from large multinationals to SMEs are involved. But as well as industry, all the relevant knowledge institutes with a focus on Smart Mobility are linked; universities, polytechnics and TNO. And to complete the triple helix, local, provincial and national government is connected as launching customer and 'owner' of the societal mobility challenges.

All these parties are working on initiatives based on a combination of targeted innovation and entrepreneurship. They combine traffic management, information services and intelligence in the vehicle to achieve smart, safe and sustainable mobility, thereby accommodating our welfare without threatening our well being.

Links for solutions

The set of solutions provided and their realisation is built on combining three main elements: end user focus, innovative technology and the implementation process. In the following chapters two of these three elements are linked: the Smart Mobility services for the end-user and the enabling technologies for these services. The Smart Mobility roadmap will form the final link to the implementation and realisation of the set challenges.

2 Services for Smart Mobility

Effective implementation of Smart Mobility depends on the development and roll-out of a wide range of services across all travel and transport modalities. The services that are currently under development are listed below, and are described in more detail on the following pages.

Forecast and real-time event information services
How can event information services effectively be deployed for road users?

Traffic conditions information
How can road users efficiently be provided with information on traffic conditions through a multimedia network?

Speed limit information
How can static or dynamic speed limit information be displayed?

Travel time information
How can road users efficiently be provided with travel time information through a multimedia network?

Co-modal traveller information services
How can road users be provided with comprehensive information on co-modal travel?

Dynamic speed limits
How can variable speed limit solutions be implemented?

Incident warning management
How can road users efficiently be warned about abnormal situations on the network?

Strategic traffic management (TMP)
How can traffic management strategies be deployed on TEN-T roads and corridors?

Incident management
How best to respond to road incidents and restore the normal situation?

Intelligent truck parking
How can truck drivers and haulage operators be provided with relevant information to optimise the use of truck parking facilities?

Road user charging
How can road users and authorities be provided with a comprehensive system for road charging?

Travel time prediction in transport (RITS)
How can transport planners and truckers be provided with accurate travel time predictions?

Dynamic traffic management waterways
How can marine logistics planners and shippers be provided with dynamic capacity information for waterways?

Synchro-model freight costing
How can freight planners be provided with comprehensive information on multi-modal freight logistics optimisation?

ADAS: Safe distance warning
How can car drivers be provided with 'safe distance' information based on speed and car to car distance?

ADAS: Vulnerable road users
How can car drivers be provided with timely information to prevent accidents with vulnerable road users?

Guide to the services

The following pages describe the above services in more detail. For each service the following components are described:

Criteria (Level 0 - Level 4)

Levels of deployment of ITS services, ranging from basic to more advanced. The criteria can also serve as a tool for step-by-step deployment of the service.

Projects

Projects that have been or are being carried out to explore, pilot, demonstrate or even commercially exploit the service - possibly in combination with other services - as described.

Evaluation

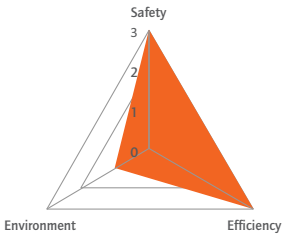
The services are evaluated from three perspectives which are described below. The goal of the evaluation is to provide policy-makers with a reference and a guide when considering investments in ITS services.

Deployment Readiness Level (DRL)
This covers the level (1-5) of the service in relation to reliability, stability, interoperability, user acceptance and economic feasibility. A low score indicates an exploratory stage of the application of a particular service; a high score means a proven, operational and widely practiced service.

Leverage
Driven by market developments, technologies can be applied to single services or can potentially cover a broad range of (integrated) services. A low leverage typically means a 'single technology - single service' (1 to 1) application; a high leverage refers to a 'single technology – multiple services' situation (1 to n).

Performance/costs ratio
This ratio describes the costs involved in delivering a specific result in the deployment level of the service. A high performance/costs ratio (high performance, low cost) is not by definition 'cheap'. If the particular level of deployment turns out to have a 'low leverage', it will be difficult to add new ITS services to the specific technology platform, and expanding ITS may therefore have a disproportionate cost effect.

FORECAST AND REALTIME EVENT INFORMATION



How can event information services effectively be deployed for road users?

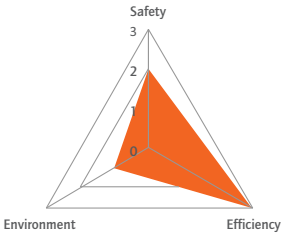
'*Forecast and Real Time Event Information Services*' are defined as the provision of information about both expected and unexpected events to road users on specific road segments of the TENT-T network and interfaces. This predictive or real-time information could be provided both on-trip and pre-trip using different information channels, accessible by road users through different end-user devices. The service may provide common as well as individual (personalised, on-demand) information. 'Events' are defined as - expected or unexpected - abnormal situations that may lead to adverse effects on the road in relation to traffic safety, efficiency and environmental effects.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
User interface	One fixed language (all official languages)	English + one fixed language (all official languages)	If applicable (for end user terminals): data available is capable of being provided independent of language	
Neigbouring provision	No information exchange	Information exchange to neighbouring only	Neighbouring and beyond IP exchange	
Local and secondary network information	Information on T-ENT Road Network only	Exchange and use of information for strategic roads not part of T-ENT Road Network	If necessary, additional information on local routes with impact on T-ENT Road Network	
Level of detail (location reference)	None	Route specific segments (between 2 junctions)	Road segment specific (approx. 1 km)	Exact location (coordinates)
Level of information	Event (e.g.'Traffic Jam')	Event + duration	Event + duration + consequence	Event + duration + consequence + alternative + predictive

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Connect & Drive, GCDC, SPITS www.htas.nl www.gcdc.net www.spits-project.com			SPITS Traffic Incident Monitoring www.spits-project.com	Smart In-car www.bbzob.nl

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●●●	●●●●
Leverage	●	●●	●●●	●●●●
Performance/costs	●●	●●	●	●●●●

TRAFFIC CONDITIONS INFORMATION



How can road users efficiently be provided with information on traffic conditions through a multimedia network?

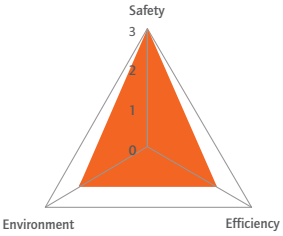
'*Traffic conditions information (predictive and real-time)*' means providing road users with information on traffic conditions in specific road segments of the TEN-T network and interfaces. This predictive or real-time information could be released pre-trip and on-trip, and provided through different media: roadside information panels, Variable Message Signs (VMS), websites, radio/TV, mobile phones, navigation computers etc. The service is dedicated to road users, and could include both common and personalised (individual) information. The focus is on road traffic information.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
User interface	One fixed language (all official languages)	Data available is capable of being provided in a common and shared language (English)	Data available is capable of being provided independent of language	
Neigbouring provision	No information exchange	Information exchange to neighbouring only	Neighbouring and beyond IP exchange	
Local and secondary network information	None	Travel information for key routes	Relevant travel information beyond key routes can be provided	
Level of detail (location reference)	None	Route specific segments (between 2 junctions)	Road segment specific (approx. 1 km)	

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Drive C2X, CVIS (urban), COOPERS www.drive-c2x.eu www.cvisproject.org/en/home www.coopers-ip.eu		SafeSpot www.safespot-eu.org	TomTom HD Traffic www.tomtom.com/hdtraffic	Smart In-car www.bbzob.nl

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●●●	●●●●
Leverage	●	●	●●●	●●●●
Performance/costs	●●	●●	●	●●●●

SPEED LIMIT INFORMATION



How can static or dynamic speed limit information be displayed?

Speed limit information deals with the different ways of informing drivers of the speed limits on the sections on which they are driving. This information may be either static or dynamic (provided by road operators for traffic management purposes, such as heavy traffic, roadworks, weather, pollution etc.).

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
User interface	One fixed language	Data avaliable in different or common shared languages	Data provided independent of language	
Neigbouring provision	No information exchange	Information exchange to neighbouring only	Neighbouring and beyond IP exchange	
Local and secondary network information	Not relevant			
Level of detail: display on infrastructure	Geographic area	Route specific segments (between 2 junctions)	Road segment specific (approx. 10 km)	
Level of detail: navigation systems	Not complete, lots of gaps	Some gaps	Few gaps	No gap
Static/Dynamic	Static only	Static and partly dynamic/temporary	Static and fully dynamic	

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Safespot, CVIS www.safespot-eu.org		CCC www.htas.nl	SPITS Front view mirror www.spits-project.com	SPITS Shockwave Damping www.spits-project.com

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●●●	●●
Leverage	●	●●	●●●	●●●●
Performance/costs	●●●	●●	●●	●●

TRAVEL TIME INFORMATION

How can road users efficiently be provided with travel time information through a multimedia network?

Travel Time Information Services means providing road users with the travel times on specific road segments of the TEN-T network and interfaces. This accurate, real-time information could be released pre-trip and on-trip. Different media may be required to provide it: roadside information panels (Variable Message Signs - VMS), websites, radio/TV, mobile phones, navigation computers etc.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Neigbouring provision	No Travel Time information exchange	Travel Time information exchange to neigh-bouring only	Neighbouring and beyond Travel Time information provide exchange	
Local and secondary network information	None	Travel Time information for key routes	Relevant Travel Time information beyond key routes are provided	
Level of detail (location reference)	None	Specific route segments (between 2 junctions)	Specific road segment (approx. 1 km)	
Static/dynamic	Static/historical only	Static/historical and partly dynamic	Static/historical and fully dynamic	

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
			SPITS Driving Time assistance (Greencat) www.spits-project.com	Spitsmijden www.spitsmijden-inbrabant.nl

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●●●	●●
Leverage	●	●●	●●●	●●●●
Performance/costs	●●●	●●	●	●

CO-MODAL TRAVELLER INFORMATION SERVICES

How can road users be provided with comprehensive information on co-modal travel?

Co-modal traveller information services offer in parallel comparative information about different modes of transport (multi-modal) and/or combinations of different modes of transport, over the same route (intermodal).

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Neigbouring provision	Two different data sources	Three different data sources	Four different data sources	> 4 different data sources
Local and secondary network information	TEN-T Road network	TEN-T Road network and strategic TEN-T roads	TEN-T Road network and secondary road network	Whole road network
Static/Dynamic	Individual transport static, PT static	One transport mode real-time (PT or individual)	Real-time for individual and PT	All other levels + airports real-time
Geographical area	Local	Regional	National	International
Modes/means of transport	One mode/means of transport	Two	Three	> 3 Modes/ means of transport
Public transport operators involved	One PT operator	Operators from major cities	All major PT operators	Al other levels + small private operators
Co-modality (multimo-dality, intermodality)	Two modes/means of transport compared	All modes/means of transport compared	All modes/means of transport compared, two connected	All modes/means of transport compared and connected
Route visualisation	Lists	Lists + static maps of exchange points	Lists + static maps of routes	Lists + interactive maps
Mobile device support	Yes	N/A	N/A	N/A

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
		SPITS Traffic Incident monitoring www.spits-project.com	Sensorcity Assen www.sensorcity.nl	

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●●●	
Leverage	●	●●	●●●	●●●●
Performance/costs	●●	●●	●	●●

DYNAMIC SPEED LIMITS

How can variable speed limit solutions be implemented?

Speed Control means the use of *Variable Speed Limits (VSL)* as a means to help drivers travel at speeds that are appropriate to the prevailing traffic or weather conditions. To do this, VSL uses Variable Message Signs (VMS) to display speed limits (advisory or mandatory) that are matched to the prevailing road and/or traffic conditions.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Speed signs	Flap signs, turnable signs and similar	Dynamic prisms	LED technology	On board systems through C2X infra
Activation and control	Manual on-site	Manual, remote controlled	Automatic	Dynamic
Detection	None	Clock and/of calendar control	System equipped with camera's, sensors adapted to purpose	+ X2C Communica-tion and/or camera recognition
Communication to TMC	None, stand alone	Temporary connection, i.e. Dial up telephone of GPRS	Permanently connected via broadband	Permanently connected via broadband

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
	Safespot www.safespot-eu.org	Speed Advice ++, DynaMax In-car	Odysa in car greenwave www.odysa.nl	TNO/ SPITS Shockwave mitigation project www.spits-project.com Freilot Helmond www.freilot.eu

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●●●	●●●
Leverage	●	●●	●●●●	●●●●
Performance/costs	●●	●●	●●●●	●●●●

INCIDENT WARNING MANAGEMENT

How can road users efficiently be warned about abnormal situations on the network?

Incident warning allows advance warning to be provided of dangerous spots, traffic or environment and weather-related conditions and/or accidents, roadworks or objects on the carriageway. Communication of warning messages is driver-oriented, and may be provided through infrastructure–vehicle interface or vehicle–vehicle interface, using either audio or visual media.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Automation	Assisted	Semi-Assisted	Fully automated	Fully automated, interactive
Detection	Loops, video detection	Wireless sensors	C2X Communication	+ C2X Communication
Analysis/processing	Human verification	Human assisted	Automatic processing	Automatic processing
Capillarity of information	At the beginning of a stretch	At the beginning of a stretch + on trip	At the beginning of a stretch + on trip + each access	At the beginning of a stretch + on trip + each access
Accuracy and consistency	Alert focused	Alert location/ details/consequences	Dedicated/ specific per user	Dedicated/ specific per user
Presentation	Manual	VMS	+ C2X Communication	+ C2X Communication

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
	Safespot, COOPERS, DRIVEC2X, VBM www.safespot-eu.org www.coopers-id.eu www.drive-c2x.eu www.tno.nl			SPITS Traffic Incident Monitoring www.spits-project.com

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●●●	●●
Leverage	●	●●	●●●	●●●●
Performance/costs	●	●	●●●	●●

STRATEGIC TRAFFIC MANAGEMENT (TMP)

How can traffic management strategies be deployed on TEN-T roads and corridors?

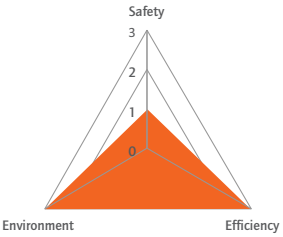
The European Core Service '*Strategic Traffic Management for Corridors and Networks*' defines Traffic Management Plans (TMPs) as appropriate instruments for the management of the European network and corridors including regional and cross-border aspects and multi-modal capacities. A TMP is the predefined allocation of a set of temporary information and control measures for specific recurring or non-recurring traffic situations.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Coverage	Critical spots only	Spatial expansion of the service, linkages	100% of black spots covered	+ C2X Communication
Availability to time	Service periodically ensired during critical periods	Extended availability, when required	Service 24/7 ensured, when needed	Dynamic service
System availability	One sole system available	Diverse (information) systems, when needed	Diversity of systems: consistent information and traffic manage-ment measure support	Diversity of systems: consistent informa-tion and traffic management measure support
Consistency	Consistent destination advice along the routes		Global consistency of road users information through any media along the route	Global consistency of road users information through any media along the route
European network approach	Knowledge and strategy sharing between neighbouring regions, when needed	Cross border strategy consistency, when applicable	Coordinated deployment of common measures, including conurbation areas.	

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
FOTSIS www.fotsis.com				Spitsmijden www.spitsmijden-inbrabant.nl Smart In-car www.bbzob.nl

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●●●	●●
Leverage	●	●	●●●	●●
Performance/costs	●●	●●●	●●	●

INCIDENT MANAGEMENT



How best to respond to road incidents and restore the normal situation?

Incident Management (IM) is defined as the process of systematic, planned and coordinated use of measures and resources to safely handle an incident from incident detection to restoration of normal traffic conditions. The partners in incident management are typically the road authority, the road operator (public or private), the police, the fire brigade, ambulance services, recovery services and the media.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Coverage	Critical spots/ critical periods	Critical spots/ critical periods	100% of TEN-T/ 24/7	+ C2X Communication
Incident detection and verification	Patrol/112	Camera	Automatic Incident Detection	+ C2X Communication
Cooperation and coordination	Individual systems and procedures	Partially common systems and procedures	Fully common systems and procedures	Integrated systems and procedures
Road authorities involvement	Info display through VMS and radio	Info display through all media/traffic regulation	Rerouting through Traffic Management Plan (TMP)	+ C2X Communication

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
FOTSIS www.fotsis.com		Video Based Monitoring (VBM), RAMON, ATOL www.tno.nl		

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●●●	●●●
Leverage	●	●	●●●●	●●●●
Performance/costs	●●	●●	●●●●	●●●●●

INTELLIGENT TRUCK PARKING

How can truck drivers and haulage operators be provided with relevant information to optimise the use of truck parking facilities?

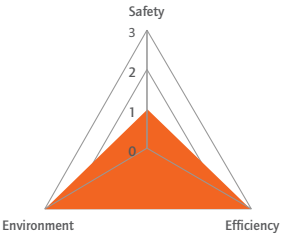
Intelligent Truck Parking is implemented to optimise the use of the existing infrastructure in terms of parking facilities, and to provide relevant information to European truck drivers, haulage operators and service providers. The guideline therefore does not address simply building new parking areas, although integration of the 'intelligent' aspect is recommended right from the planning stage of new truck parking areas.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Service levels	Provision of static information in parking area (pre-trip)	+ Real-time information (on-trip)	+ Short term forecast (on-trip) on a section	+ Pre-trip and on-trip forecast on a larger area, including corridor guidance system	+ Provision of facilities for booking

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
	CVIS www.cvisproject.org	SPITS parking demo www.spits-project.com	ParckR www.bbzob.nl Stockholm congestion charge www.stockholms-forsoket.se	Toll Collect (German Truck Tolling system)	

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●●●	●●●
Leverage	●	●●	●●	●●
Performance/costs	●●	●●	●●	●

ROAD USER CHARGING



How can road users and authorities be provided with a comprehensive system for road charging?

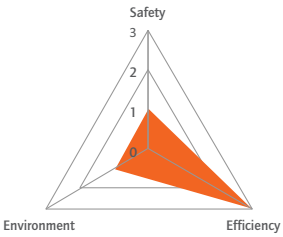
Road user charging is a mechanism through which motorists pay to use defined areas of road (for example by tolling), and is currently used extensively across Europe. It can also form larger schemes to charge for the use of road space, and provide a means through which road space can be reallocated in favour of public transport, for example.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Coverage	Specific services like a bridge	+ Specific roads/ motorways/sections	+ Specific time intervals	Dynamic, dependent on traffic situation
Access	Manual, toll	Manual + automatic	+ Cameras	+ C2X Communication
Costs strategy	Charge for use of feature	+ Distance dependent	+ Time of use dependent	Dynamic
Charging strategy	Manual	Manual	Automatic	Automatic

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
	CVIS www.cvisproject.org			

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●●●	●●●
Leverage	●●●●	●●●●	●●●●●	●●●●●
Performance/costs	●●	●●●	●●●●	●●●

TRAVEL TIME PREDICTION IN TRANSPORT (RITS)



How can transport planners and truckers be provided with accurate travel time predictions?

Travel time prediction in transport management provides planners and truck drivers with access to precise travel time information. This allows better trip planning and helps to prevent congestion. It also allows ETAs (Expected Time of Arrival) to be predicted more accurately.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Coverage	Regional	National	International	International
Modalities	Single	Single	Single, optional multi-modal	Multi-modal
Availability	statical, pre-trip, ETA	+ Real-time information (on-trip)	+ short term forecast (on-trip) on a section	+ pre-trip and on-trip forecast on a larger area, including corridor guidance system

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
	CVIS www.cvisproject.org	IBM-NXP-TomTom project road user charging www-03.ibm.com		

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	••••	•••	••	••
Leverage	•	••	••	••
Performance/costs	••	••	••	•

DYNAMIC TRAFFIC MANAGEMENT WATERWAYS

How can marine logistics planners and shippers be provided with dynamic capacity information for waterways?

This service focuses on information to allow more efficient use of the available capacity of waterways and shipping fleets, allowing sustainable growth of container transport.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Coverage	Specific waterways	Regional	National	Europe
Modalities	Single (waterways only)	Single	Single, optional multi-modal	Multi-modal, synchromodality
Availability and Accuracy	Central, gps, phone	Central, gps, phone	Central, decentral, dynamic	Central, decentral, dynamic
Marine authorities involvement	Info display through VMS and radio	Info display through all media/traffic regulation	Rerouting through Traffic Management Plan (TMP)	+ V2V Communication
European network approach		Knowledge and strategy sharing between neighbouring regions, when needed	Cross border strategy consistency, when applicable	Coordinated deployment of common measure

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●	●●●	●●	●
Leverage	●	●●	●●	●
Performance/costs	●●	●●	●●	●●

SYNCHRO-MODEL FREIGHT COSTING

How can freight planners be provided with comprehensive information on multi-modal freight logistics optimisation?

Multi-modal freight services facilitate the use of different transport modes for sustainable and economic utilisation of freight transport resources. Multi-modal logistics optimisation services enable strategic and real-time planning of freight transport networks.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Coverage	Regional	National	European	Global
Modalities	Road and train	Boat, rail, train	All modalities	All modalities, synchromodality
Availability and Accuracy	Statical, pre-trip, ETA	+ Real-time information (on-trip), facilitating door-to-door route planning over all modalities	+ Short term forecast (on-trip) on a section, dynamic and re-booking and economic impact	+ Pre-trip and on-trip forecast on a larger area, multi-modal freight - logistics planning- hub/ terminal throughput optimalisation

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
			Weastflows www.weastflows.eu	

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●	●●	●
Leverage	●	●●	●●	●●●
Performance/costs	●●	●●	●●	●●

ADAS: SAFE DISTANCE WARNING

How can car drivers be provided with 'safe distance' information based on speed and car to car distance?

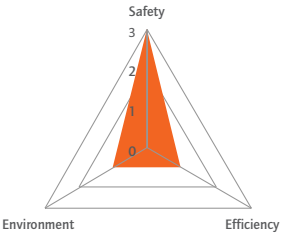
Safe distance warning systems typically relate to *Advanced Driver Assistance Systems (ADAS)*. Some ADAS features are already well known, and provide welcome increases in convenience and safety. These include Adaptive Cruise Control, blind-spot monitoring, lane-departure warning and night vision. The more advanced, and sometimes controversial, ADAS features are those that actively help drivers to avoid accidents. Adaptive Cruise Control (ACC), which uses sensors to detect vehicles ahead and adjust a car's cruising speed accordingly, is probably the most commonly known ADAS feature. The latest ADAS technologies also integrate a range of vehicle systems that communicate with each other.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Coverage	Single car	Single car	Connected cars	Connected cars
Modalities	Warning sound	Warning sound + automated brake	+ C2C Warning	+ C2C Automated brake
Availability and Accuracy	Depending on driver response	No driver response dependency, front car detection	Cooperative warning system, driver dependent adaptation	Cooperative driving, driver independent

Projects	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
SPITS, Connect & Drive www.htas.nl www.spits-project.com		CCC www.htas.nl	Invisible truck, Risk Estimation, CACC ADAS TNO www.nxp.com	Connect & Drive, ASA TNO www.htas.nl

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●●●	●●	●
Leverage	●●	●●●	●●●●	●●●●●
Performance/costs	●●	●●●	●●●●	●●●

ADAS: VULNERABLE ROAD USERS



How can car drivers be provided with timely information to prevent accidents with vulnerable road users?

Advanced Driver Systems (ADAS) are designed to support drivers and reduce accidents. Drivers are continuously supported by assistance systems that warn them of potentially dangerous situations. These systems not only react to driving situations, but can also actively intervene to protect occupants and vulnerable road users.

CRITERIA	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Coverage	Single car	Single car	Connected cars	Connected cars
Modalities	Warning sound	Warning sound + automated brake and steering movement	+ C2C Warning	+ C2C Automated brake
Availability and Accuracy	Depending on driver response	No driver response dependency, front car detection	Cooperative warning system, driver dependent adaptation	Cooperative driving, driver independent

Projects	LEVEL 0	LEVEL 1	LEVEL 2	
	SafeSpot, CVIS (urban) www.safespot-eu.org	SaveCap www.savecap.org www.tno.nl		

Evaluation	LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
DRL	●●●●●	●●●	●●	●
Leverage	●	●●	●●●	●●●●
Performance/costs	●●●	●●●	●●●	●●●●

3 Linking services to technologies

From services to technologies

(Table on page 28-29)

The services and applications described in the previous chapter are enabled by combinations of technologies. The required technologies will typically vary with the service levels: higher service levels often require other or more sophisticated technologies. The relationship between the various service levels and the technologies needed to implement them is shown in the services–technology overview.
For all services at the left of the page, an indicator is shown at the intersection with a technology that is relevant for that specific service. The appearance of the circular indicator shows which service level is enabled by this specific technology: the first slice of the pie represents level 0, the second slice represents level 1 and so on.

Example

indicates that levels 1, 2 and 3 are enabled.

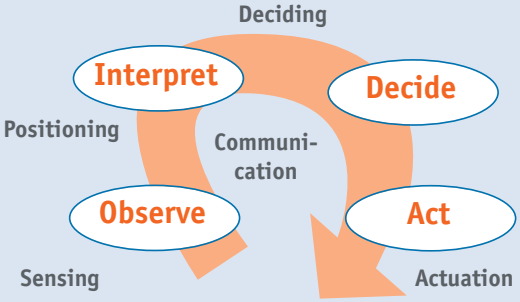
Enabling Technologies

(Tables on page 28-29 and 32-33)

For the purpose of the roadmap approach, technology selection is based on the following criteria:

- significant impact on the various services
- limited interdependency between technologies
- sufficiently high-level to keep the list manageable

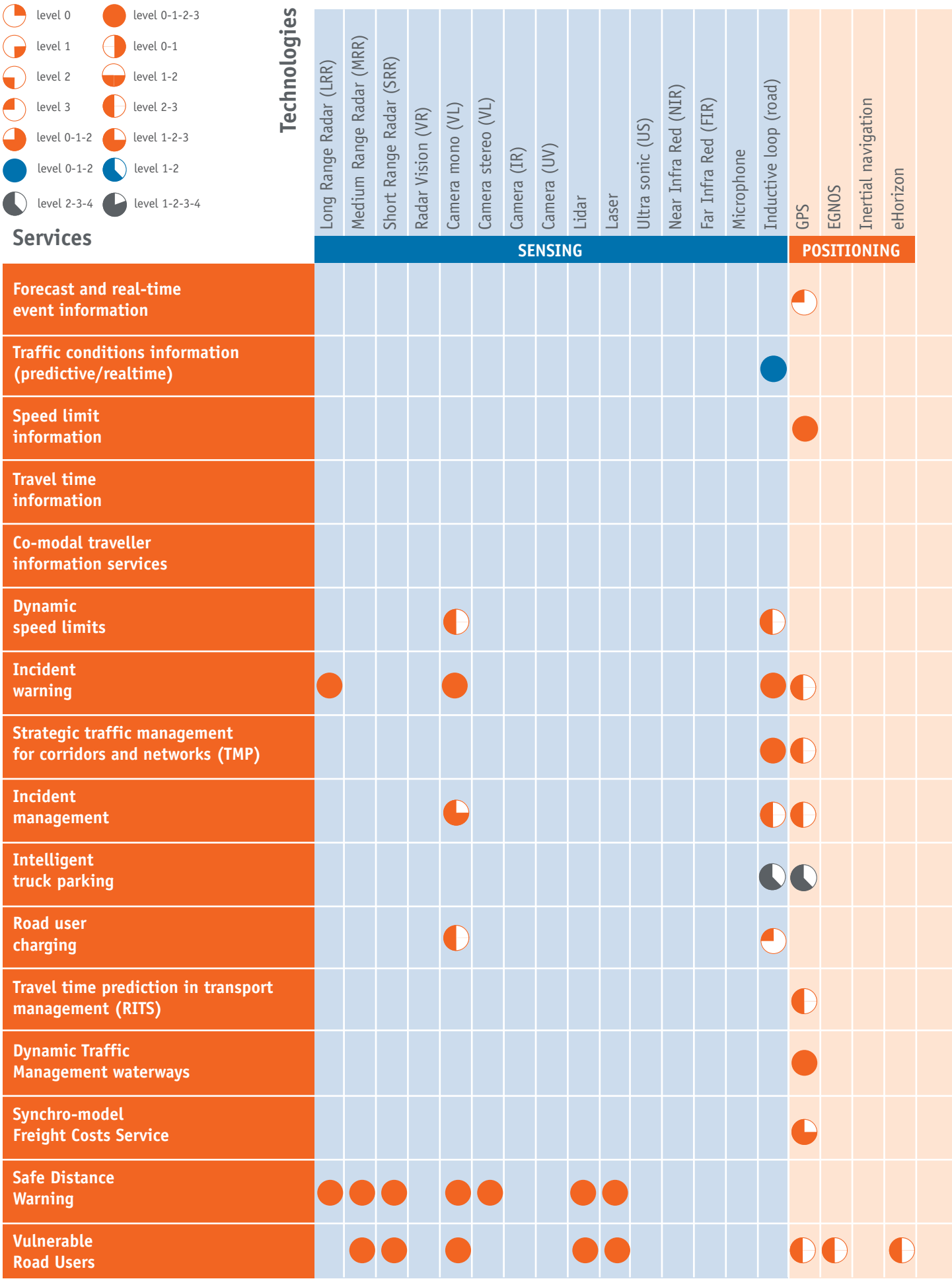
For clarity the technologies are clustered according to the system process cycle:



Technology properties

(Table on page 32-33)

For each cluster of technologies a number of properties (or characteristics) are defined that can be used to evaluate the technologies. Some properties are generic for all technologies, while some are linked to just a single cluster. For each individual technology the relevant properties result in a score, indicating its strength on that respective property. The resulting scores are shown in the technology-property overview.


level 0
level 1
level 2
level 3
level 0-1-2
level 0-1-2
level 2-3-4
level 0-1-2-3
level 0-1
level 1-2
level 2-3
level 1-2-3
level 1-2
level 1-2-3-4
Technologies
Long Range Radar (LRR)
Medium Range Radar (MRR)
Short Range Radar (SRR)
Radar Vision (VR)
Camera mono (VL)
Camera stereo (VL)
Camera (IR)
Camera (UV)
Lidar
Laser
Ultra sonic (US)
Near Infra Red (NIR)
Far Infra Red (FIR)
Microphone
Inductive loop (road)
GPS
EGNOS
Inertial navigation
eHorizon
SENSING
POSITIONING
Services
Forecast and real-time event information
Traffic conditions information (predictive/realtime)
Speed limit information
Travel time information
Co-modal traveller information services
Dynamic speed limits
Incident warning
Strategic traffic management for corridors and networks (TMP)
Incident management
Intelligent truck parking
Road user charging
Travel time prediction in transport management (RITS)
Dynamic Traffic Management waterways
Synchro-model Freight Costs Service
Safe Distance Warning
Vulnerable Road Users

COMMUNICATION
802.11p
GSM
GPRS
UMTS
LTE
Bluetooth
Infra Red (IR)
RFID
DECIDING
Traffic sign recognition
Vehicle recognition
Speed measurement
Acceleration measurement
Traffic intensity measurement
Voice recognition
Voice Synthesis
ACTUATION
Lateral control (corrective)
Lateral Control (full)
Longitudinal control (forward)
Longitudinal control (reverse)
Lights (front)
Lights (rear)
HMI (visual)
HMI (audio)
HMI (haptic)
Seatbelt
Airbag (internal)
Airbag (external)
Roadside HMI -VMS/DRIP
Roadside HMI -Traffic lights

4 Enabling technologies

Property definitions

Technology Readiness Level
Technology Readiness Level according to NASA, adapted for ITS (rescaled to scale of 5): 5 = actual system 'deployment proven'; 1 = basic principles observed and reported.

Performance/cost
Ratio of performance/cost (at system level, not only user-incurred costs) relative to other technologies performing similar functions:
5 = high performance/cost ratio; 1 = low performance/cost ratio.

Reliability
Availability/uptime of system/data: 5 = high;
1 = low.

Position accuracy
P95% horizontal error:
5 = <0.1 m; 4 = <1 m; 3 = <10 m; 2 = <100 m;
1 = >100 m.

Vulnerability
Signal not dependent on external disturbances:
5 = absolutely independent; 1 = highly dependent

Coverage
Geospatial signal availability: 5 = global;
4 = developed world; 3 = parts of EU/US/Japan;
2 = selected areas; 1 = insignificant.

Latency
Delay between input and output signals:
5 = <10 ms; 4 = <100 ms; 3 = <1 s; 2 = <10 s;
1 = >10 s.

Bandwidth
Data density per unit of time:
5 = >100 Mbit/s; 4 = >10 Mbit/s; 3 = >1 Mbit/s;
2 = >0.1 Mbit/s; 1 = <0.1 Mbit/s.

Scalability
Feasibility of applying the technology to a large (global) scale: 5 = high feasibility (low cost, region independent architecture and interfaces, no legal/political/social barriers); 1 = low feasibility.

Ad hoc networking
Suitability for ad hoc networking:
5 = very well suited for ad hoc networking;
1 = low suitability for ad hoc networking.

Measurement range
Range between minimum and maximum values to be measured: 5 = unlimited; 1 = limited to a very small range.

Resolution
Resolution relative to other technologies performing similar functions: 5 = high resolution; 1 = low resolution.

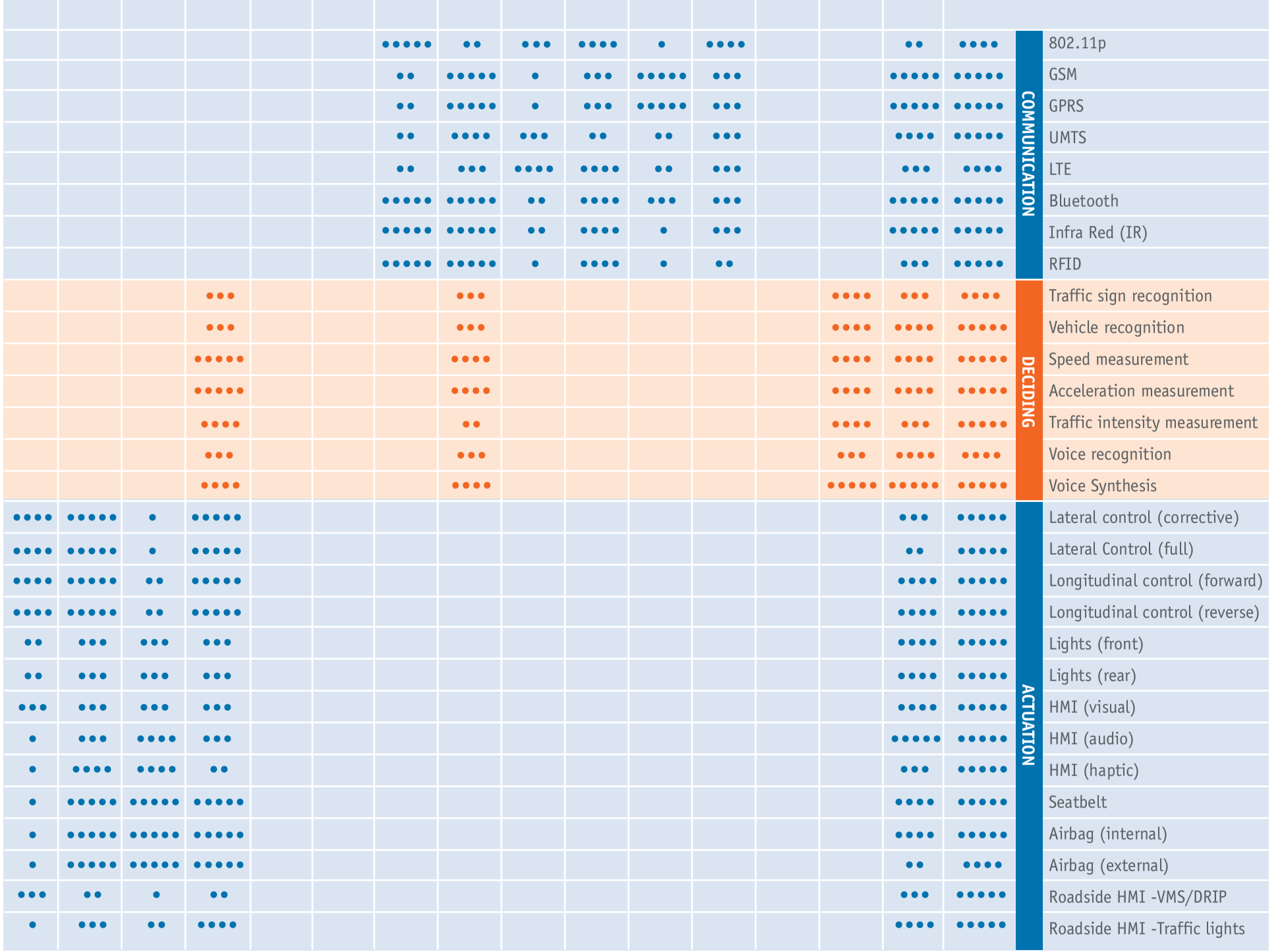
Unambiguity
Probability that different conclusions are drawn from a single dataset/representation: 5 = low probability;
1 = high probability.

Driver load
Level of user attention required to absorb information/perform a task: 5 = low level; 1 = high level.

Fit for impaired users
Usefulness of technology for users with functional impairments (colour-blind, blind, deaf, handicapped, elderly): 5 = useful for all user categories; 1 = only useful for fit and skilled users.

Information density
Amount of information that can be transferred to/absorbed by the user per unit time:
5 = high amount; 1 = low amount.

Properties \ Technologies	Long Range Radar (LRR)	Medium Range Radar (MRR)	Short Range Radar (SRR)	Radar Vision (VR)	Camera mono (VL)	Camera stereo (VL)	Camera (IR)	Camera (UV)	Lidar	Laser	Ultra sonic (US)	Near Infra Red (NIR)	Far Infra Red (FIR)	Microphone	Inductive loop (road)	GPS	EGNOS	Inertial navigation	eHorizon
	SENSING															POSITIONING			
Technology readiness level	●●●●●	●●●●●	●●●●●	●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●	●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●
Performance/cost	●●●	●●●	●●●	●	●●●	●	●	●	●	●	●●●	●	●	●	●	●●●●●	●●●●	●●●	●
Reliability	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●●	●●●●	●●●●	●	●●●●●	●●●●
Position accuracy																●	●●●	●	●
Vulnerability	●	●	●	●	●●●	●	●	●	●	●●●	●	●	●	●	●●●	●	●●●●	●●●●●	●●●●
Coverage																●●●●●	●●●●	●●●●●	●
Latency																			
Bandwidth	●●●●	●●●●	●●●●	●●●●	●●●	●●●●	●●●	●●●	●●●	●●●	●	●●●	●●●	●	●				
Scalability																			
Ad hoc networking																			
Measurement range	●●●	●●●	●●●	●●●	●●●●	●●●●	●●	●●	●●●	●●	●	●	●	●●●●	●●●				
Resolution	●	●	●	●●●	●●●●●	●●●●●	●●●●	●●●●	●●●	●●	●	●●●	●●●	●●●●	●				
Unambiguity	●	●	●	●●●	●●●●	●●●●	●●●	●●●	●●●	●●●	●	●●●	●●●	●●●	●				
Driver load																			
Fit for impaired users																			
Information density																			


COMMUNICATION
802.11p
GSM
GPRS
UMTS
LTE
Bluetooth
Infra Red (IR)
RFID
DECIDING
Traffic sign recognition
Vehicle recognition
Speed measurement
Acceleration measurement
Traffic intensity measurement
Voice recognition
Voice Synthesis
ACTUATION
Lateral control (corrective)
Lateral Control (full)
Longitudinal control (forward)
Longitudinal control (reverse)
Lights (front)
Lights (rear)
HMI (visual)
HMI (audio)
HMI (haptic)
Seatbelt
Airbag (internal)
Airbag (external)
Roadside HMI -VMS/DRIP
Roadside HMI -Traffic lights

5 Milestones so far

The partnerships between industry, government and knowledge institutes are currently building on what has already been achieved, with the focus on achieving the defined goals in the Netherlands. A few of the most important milestones in these partnerships are listed below.

- **March 2012:** Joint Smart Mobility Connekt - DITCM - AutomotiveNL at the Intertraffic 2012
- **January 2012:** The ministry gives the starting signal for the implementation of measures in the Brabant region to improve traffic flows
- **January 2012:** Launch of AutomotiveNL
- **October 2011:** Winning two of the three iMobility awards for GCDC and pilots in the 'Brainport' region
- **October 2011:** Ertico - ITS Europe and ETSI organise the first interoperability testing event for cooperative mobility services, hosted by the Netherlands
- **September 2011:** DITCM - Automotive Smart Mobility roadmap integrated
- **August 2011:** HTSM Automotive Smart Mobility roadmap with three programme lines: Vehicle State Estimation; Connected Car; and Traffic Management
- **June 2011:** DITCM Roadmap with three programme lines: Human Factors on Cooperative Driving; Development environment for Cooperative Driving; and Effect studies
- **June 2011:** The ministry announces an investment of more than 1 billion euro in the Beter Benutten ('better utilisation') programme in which government and the most important economic regions in the Netherlands aim to reduce traffic congestion at the busiest intersections by 20%
- **May 2011:** GCDC (Grand Cooperative Driving Challenge): Promoting cooperation and standardisation in an informal setting to accelerate innovation on smart mobility
- **May 2011:** DITCM: Signing of a letter of understanding by 15 parties for collaboration on cooperative mobility, sharing of facilities and implementation of a shared roadmap
- **January 2011:** TU/e starts Smart Mobility strategic area
- **November 2010:** Meeting of top managers from industry, government and knowledge institutes. These parties have committed to investigate the feasibility of setting up an integrated test environment for smart traffic systems.

Source

The format for the Smart Mobility Services: EasyWay deployment guidelines brochure 2011

EasyWay is a multi-annual project for the deployment of harmonised Intelligent Transport Systems and services across Europe in fields like traveller information, traffic management, freight and logistics.

The project is in line with the directive recently adopted by the European Commission.
The EasyWay partners have defined the deployment guidelines for harmonised services across Europe that have been validated by the member states and are now being implemented by road authorities across Europe. For further information, see www.easyway-its.eu

AutomotiveNL
Herm Verbeek
P.O. Box 1015
NL-5700 MC Helmond
T +31 492 562 500
info@AutomotiveNL.com
www.automotivenl.com

Connekt
Paul Potters
P.O. Box 48
NL-2600 AA Delft
T + 31 15 251 65 65
info@connekt.nl
www.connekt.nl

DITCM
Joëlle van den Broek
P.O. Box 756
NL-5700 AT Helmond
T +31 88 866 57 34
info@ditcm.eu
www.ditcm.eu

TOWARDS A SMART MOBILITY ROADMAP