



# Digital Maps Supporting ADAS

-

## Overview of Results

**Stephen T'Siobbel**

**Tele Atlas**

**Strategic Research and Development**



European Commission  
Information Society and Media



# Overview of the Results



- Map Requirements
- Map Specification
- Map Certification and Business Model
- Map Data Sourcing
- Test Site Maps



# Digital Map Requirement



Priority	ADAS attribute	Alternative naming	Remarks
1	Legal speed limit	Speed Restriction	Static, incl. dependencies
2	Traffic signs	-	Warning, priority, prohibited, and subsigns (h-signs)
3	Lane information	-	Number, width, divider, direction, connectivity
4	Traffic lights	-	Presence of
5	Crossings	-	With other transport modes: pedestrian, bicycle, tram,
6	Accident Hot Spots	-	Increased accident risk location
7	Slope	Road grade	Longitudinal road gradient
8	Banking	Super elevation	Transversal road gradient

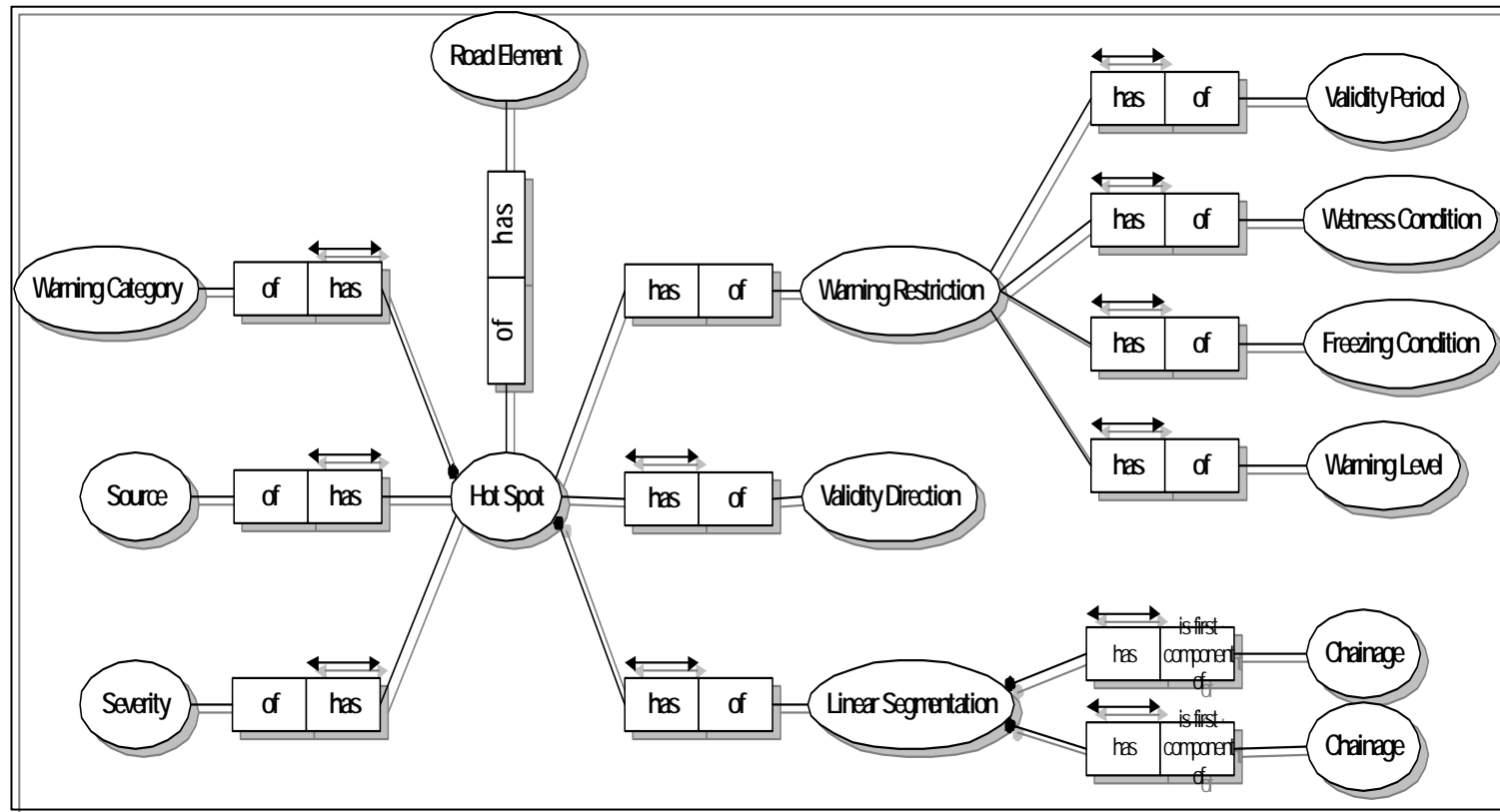
# Map Specification and Exchange Format



ADAS attributes	GDF 4.0	Updates to GDF 4.0
Legal speed limit	✓	<b>Extra sub-attributes needed</b> (Speed limit type, conditional validity, vehicle restriction)
Traffic signs	✓	<b>Update recommendable</b> (Solving ambiguities and inconsistencies)
Lane information	✓	<b>No urgent update necessary</b>
Traffic lights	✓	<b>No urgent update necessary</b>
Crossings	✓	<b>Update recommendable</b> (Bicycle model, extent pedestrian crossing)
Accident Hot Spots	-	<b>New road attribute and sub attributes are proposed: Change Request ISO 14825</b>
Slope	✓	<b>No urgent update necessary</b>
Banking	✓	<b>No urgent update necessary</b>



## Proposed GDF extension for Accident Hot Spot



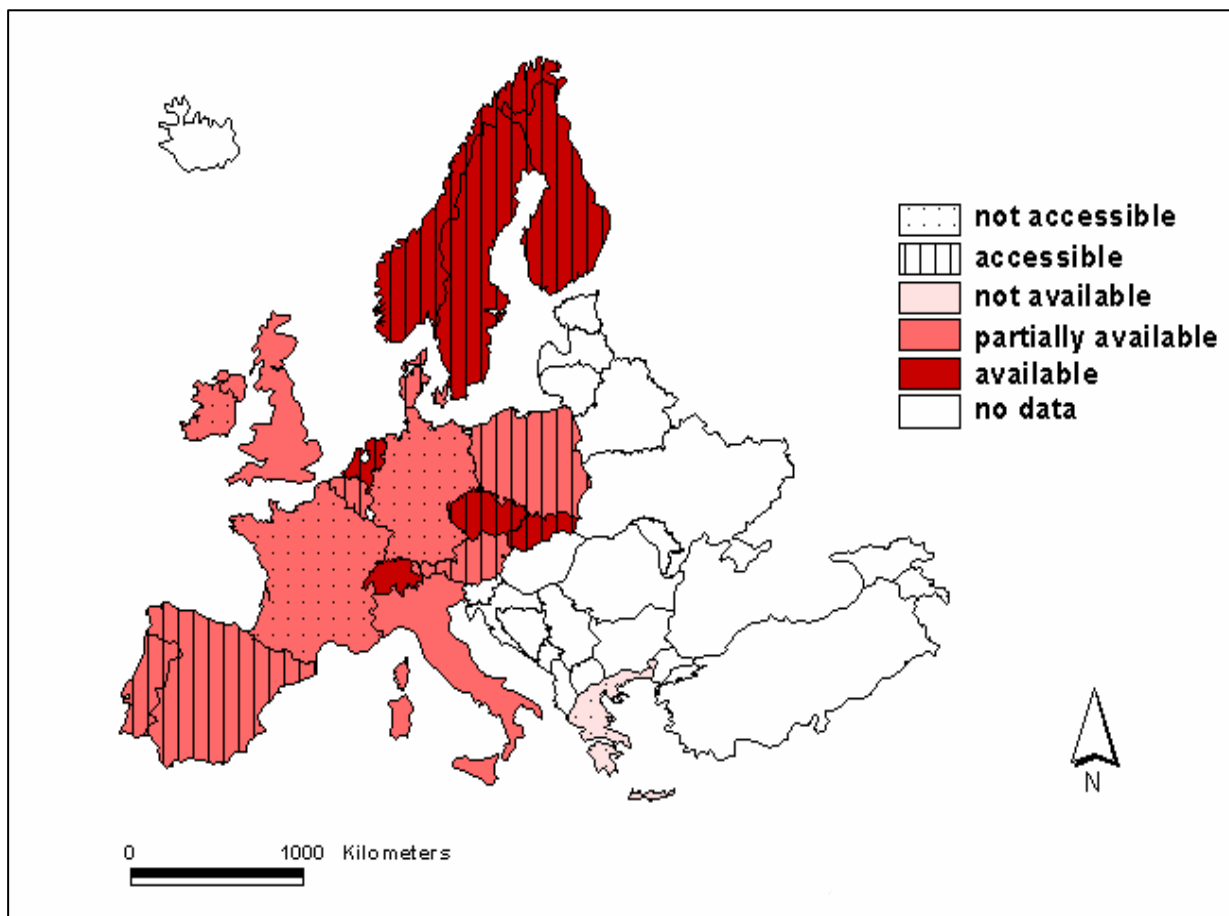
## Proposed GDF extension for Accident Hot Spot

Level	Name	O/M	Rep	D/I	Code
0	HotSpot	O	Rep	-	Composite
1	Linear Segmentation	O	Uniq	-	Composite
2	Chainage	M	Uniq	D	CH
2	Chainage	M	Uniq	D	CH
1	Warning Category	M	Uniq	D	WK
1	Warning Restriction	O	Rep	-	Composite
2	Validity Period	O	Uniq	I	VP
2	Wetness Condition	O	Uniq	D	WR
2	Freezing Condition	O	Uniq	D	WJ
2	Warning Level	O	Uniq	D	WL
1	Validity Direction	O	Uniq	D	7V
1	Severity	O	Uniq	D	WS
1	Source	O	Uniq	I	8W

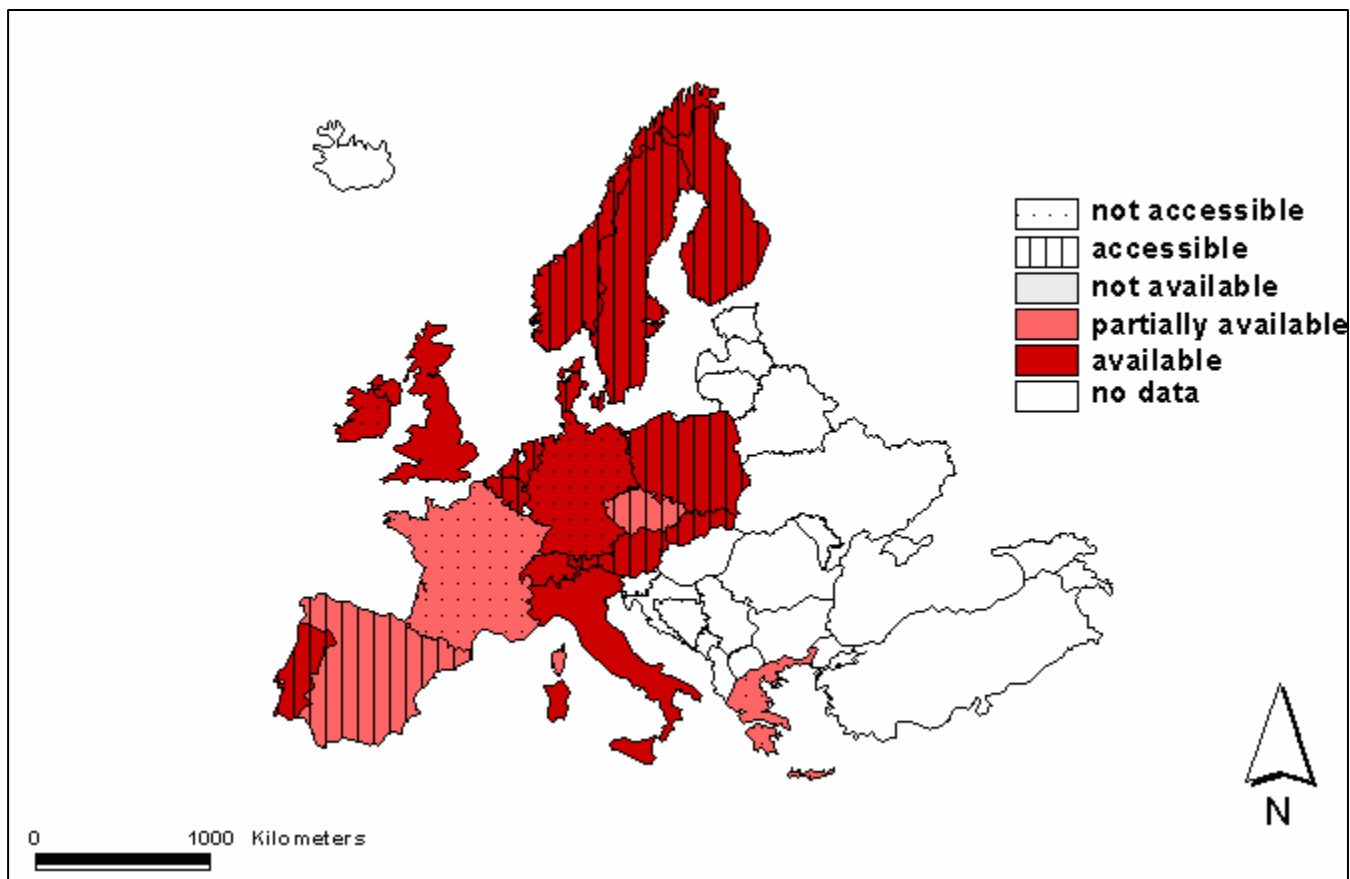
- Data Inventory for ADAS attributes
  - Public Authorities
  - Digital map providers
- Interfacing aspects
  - Organisational and technical issues related to public private exchange of safety relevant data
- Advanced data acquisition methods
  - Technologies for collecting ADAS attributes

- A quasi pan-European ADAS attribute **inventory**
  - National organisation of map providers guided surveys
  - Public Sector and leading map providers
- Two case studies on availability of ADAS attributes:
  - Driver Warning System, Accident & Speed limit data, Lower Saxony (Germany)
  - Lane keeping information (SAFELANE), general ADAS attributes, Gothenborg (Sweden)
- Relevant accident & road information:
  - Organisational aspects
  - Content & format accident and road data
  - Availability & accessibility

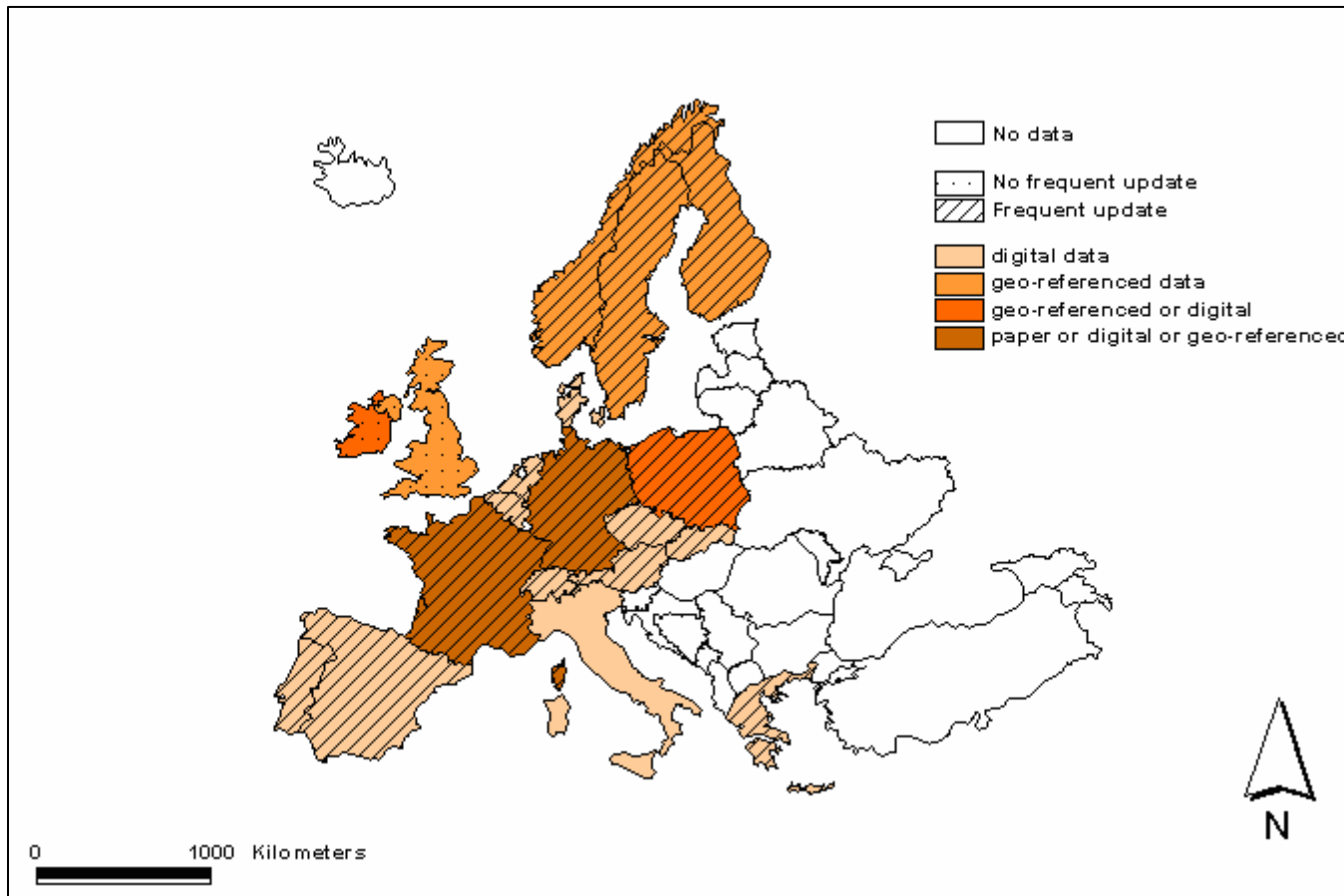
## ■ Speed limit Availability & Accessibility (Public Sector)



- Accident data: Availability & Accessibility (Public Sector)



- Accident data: format & updating freq. (Public Sector)



- Public Sector
  - Road & Accident data is available at different levels:
    - local, regional, national
  - Varying completeness and quality
    - Many manipulations of source information reduce content quality
    - Spatial reference of ADAS attributes is major challenge
  - Varying forms: paper records, digital DB, GIS
  - Varying levels of accessibility
    - „Sensitive“ attributes (e.g. accident information)
  - Many national activities on going... no emphasis on future use of ADAS attributes for safety applications
- Map Providers
  - Subset of attributes is collected for limited coverage
  - Maintenance for some safety attributes is challenge

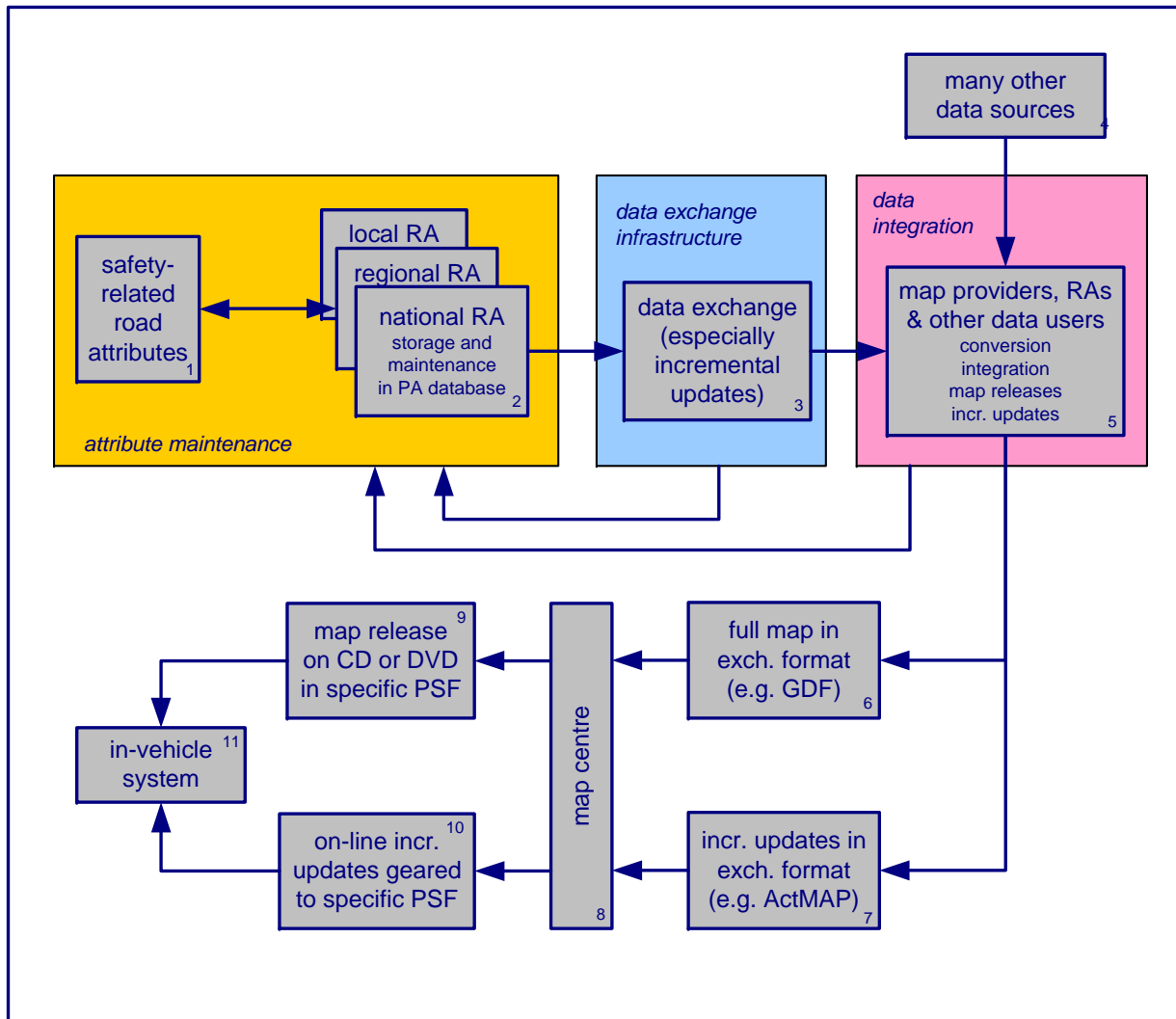
- Organisations and Technical Aspects
  - Set up Public Authorities Consultation Platform
    - Three dedicated workshops
    - Best practices from public authorities
      - PAs from NO, SE, SF, DK, UK, NL, BE, FR
    - Review and consolidation of results
      - ADAS attribute priority list
      - Data inventory
  - Cooperation with eSafety Digital Maps WG
    - Work sessions & plenary meetings
    - Contribution to recommendations in report
- => Need for more cooperation between public sector and map providers (cfr Rosatte)

# Interfacing: Public sector priorities

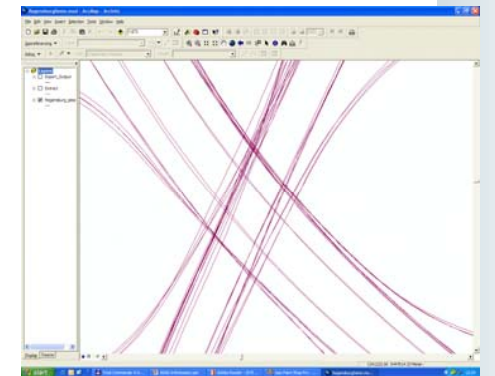
Industry Priority	Public Sector Priority	ADAS Attribute	FINRA FIN	NPRA NOR	SETR A FRA	AWV BEL	DfT UK	County Jutland DNK	RWS AVV NLD
1	High	Legal speed limit	High	High	High	High	High	High	High
2	Medium to Low	Traffic signs	Medium /Low	Medium	Low	Medium	Low	Medium	Medium
3	Low	Lane information	Medium /Low	Medium	Low	Low	Low	Medium	Medium
4	Low	Traffic lights	Low	Low	Low	Low	Low	Medium	Medium
5	Low	Crossings	Low	Medium	Low	Low	Low	Medium	Medium
6	High to Low	Accident hot spots	Low	High	None	Low	Low	High	High
7	Low	Slope	Low	Low	Low	Low	Low	Low	Low!
8	Low	Banking	Low	Low	Low	Low	Low	Low	Low



# Interfacing: ADAS data provision chain



- Advanced data collection technologies
  - Land Based Mobile Mapping
  - Remote Sensing (Earth Observation)
  - Enhanced Floating Car Data („probe data“)
  
- Applicability of technology
  - Possibilities per ADAS attribute for initial creation and maintenance
  - Opportunities for automisation
  - Limitations



# Advanced Data Collection: e.g. Applicability



Applicability of technology Initial Creation	Land based Mobile Mapping System		Space/Air Borne Remote Sensing		Enhanced Floating Car Data (Probe data)	
	Today	Mid Term	Today	Mid Term	Mid Term	Long Term
Legal speed limit	++	+++	NA	NA	NA	-
Traffic signs	++	+++	NA	NA	NA	-
Lane information	++	+++	++	++	-	+
Traffic lights	++	+++	NA	NA	+	++
Crossings	++	+++	+	++	NA	-
Accident hot spots	N/A	N/A	N/A	N/A	N/A	N/A
Slope	+ / ++	+++	- / +	++	-	++
Banking	+ / ++	+++	-	-	NA	-

# Data Sourcing: Overall results

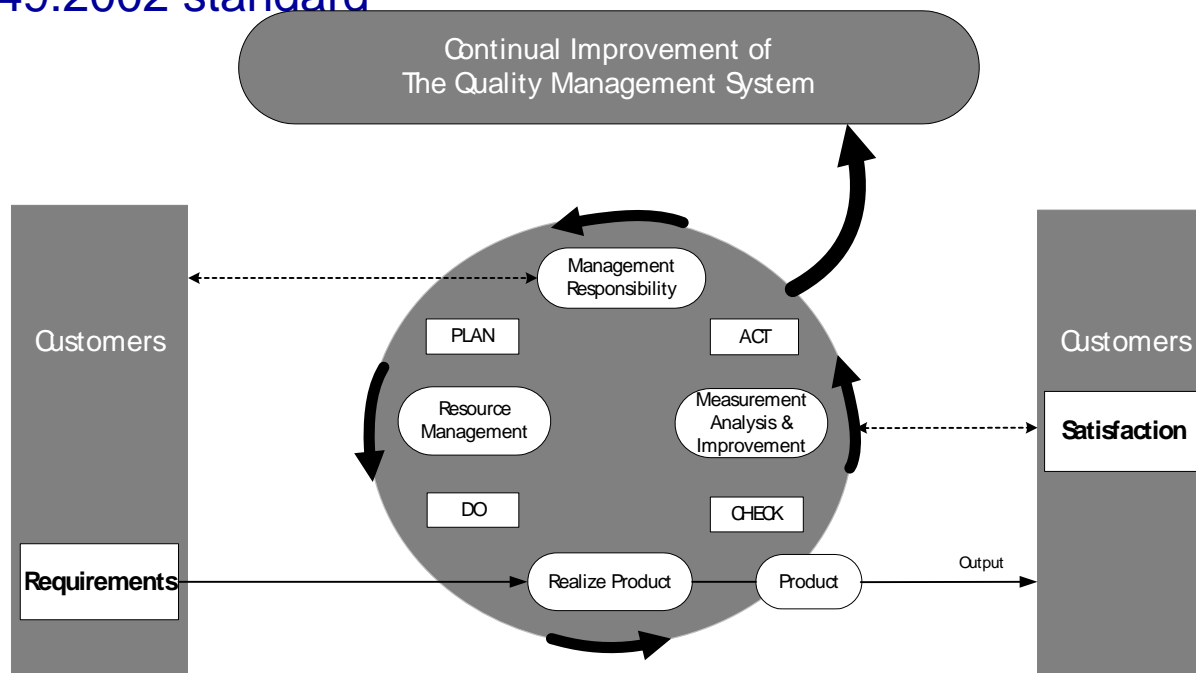


- Today's navigation maps represent the only pan European level road data containing a subset of ADAS attributes
  - ADAS maps require enhanced 3D geometry and additional safety related attributes from multi source data:
    - Public Authorities
      - Inventory reveals that ADAS attribute sourcing on pan European scale from PA is not possible today, but there are opportunities...
      - Support Phase 1 eSafety (Cooperation)
      - Explore Phase 2 eSafety (Qualification) & 3 (Optimisation)
    - Advanced data collection techniques
      - Focus to limited coverage and limited set of ADAS attributes
      - Maintenance remains a challenge
  - ADAS map feasibility
    - Initial data creation: realistic, already initiated
    - Maintenance: challenge!
- => Start with ADAS information applications**



# ADAS Maps Certification / Qualification

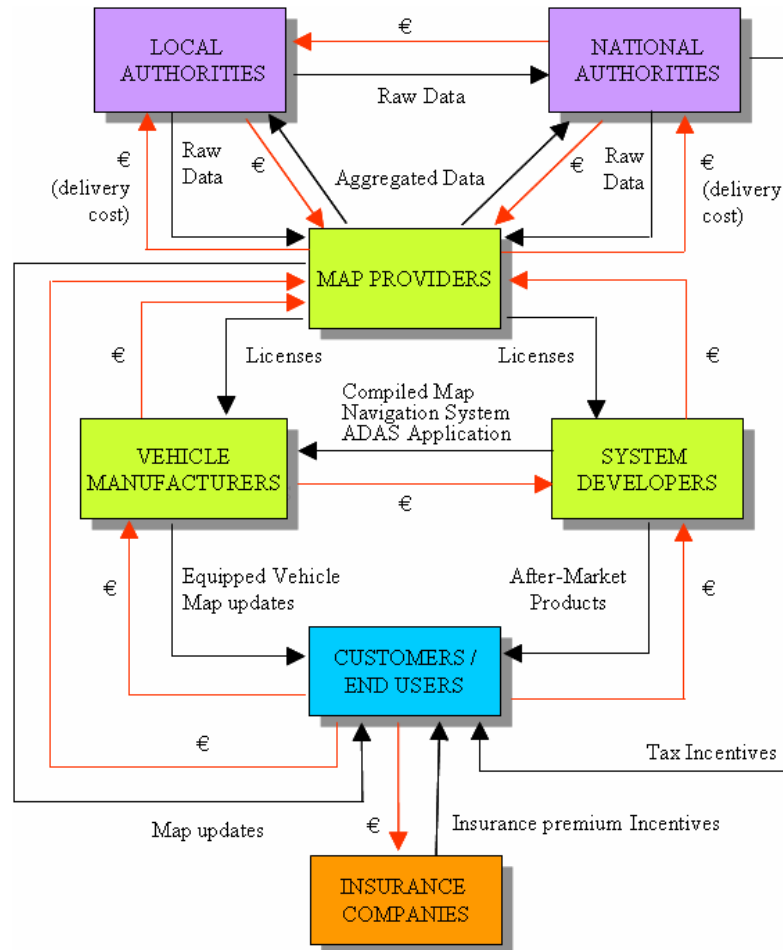
- First step: definition of a customer focused quality policy: achieving customer requirements is the highest priority
- Use adapted Quality Management System (QMS): set of agreements on how to perform standard activities
- A QMS which takes into account the automotive industry is the ISO/TS 16949:2002 standard



- **Survey with ADASIS Forum Members, Research Department from vehicle manufacturers, ADAS suppliers and navigation system suppliers (11 participants) reveals that:**
  - Certification is important business aspect for OEMs
  - Level of intervention of safety function and (re)liability issues dictates if certification is pre-condition to market introduction map-based / map-supported applications
  - Certification is relevant for public source data and/or commercial maps
  - No consensus on who should operate this certification scheme (public / private / independent body)
  - The main needs for certification are the availability, accuracy, up-to-dateness of the map information. Correctness, completeness, consistency are determined by map provider qualification scheme

- **Map Qualification Matters**
  1. Start with qualification then certification
  2. Adopt multi-step approach starting from existing navigation map scheme
  3. Develop requirements on realistic use cases by involving all actors in the data chain
  4. Top priority is on safety attributes maintenance and ADAS maps update

# Business Model : Interactions



- Societal Benefits**
- Health
  - Mobility
  - Environment

## Map-based / map-supported ADAS applications and ADAS maps value chain

# Business Model



Attributes	Initial data collection				Data Maintenance				
	Data source	Cost Index			Frequency	Data Source	Cost Index		
		Major roads	Urban	Rural			Major roads	Urban	Rural
Speed limit	PA	€€€	€€€	€€€€	High	PA	€	€	€
Speed limit	MP	€	€€	€€	High	MP	NCA	NCA	NCA
Traffic signs	PA	€€€	€€€€€	€€€€	Medium/ high	PA	€	€	€
Traffic signs	MP	€€	€€€€	€€€	Medium/ high	MP	NCA	NCA	NCA
Lane Information	MP	€€	€€€€	€€€	low	MP	€€€€	€€€€	€€€€
Traffic lights	MP	€€	€€€€	€€€	low	MP	€€	€€€	€€
Crossings	MP	€€	€€€€	€€	Low/ medium	MP	€€	€€€€-NCA	€€€€
Accident hot spots (statistics)	PA	€€-€€€€	€€-€€€€	€€-€€€€	medium	PA	€€-€€€€	€€-€€€€	€€-€€€€
Hazardous location (road)	PA	€€-€€€€	€€-€€€€	€€-€€€€	low	PA	€€	€€	€€
Slope	MP	€€€	€€€	€€€€	low	MP	€€	€€	€€
Banking	MP	€€€	N/A	€€€€	low	MP	€€	N/A	€€

## Data Collection and Data Maintenance Costs

# Business Model



Attributes	Initial data collection				Data Maintenance				
	Data source	Cost Index			Frequency	Data Source	Cost Index		
		Major roads	Urban	Rural			Major roads	Urban	Rural
Speed limit	PA	€€€	€€€	€€€€	High	PA	€	€	€
Speed limit	MP	€	€€	€€	High	MP	NCA	NCA	NCA
Traffic signs	PA	€€€	€€€€€	€€€€	Medium/ high	PA	€	€	€
Traffic signs	MP	€€	€€€€	€€€	Medium/ high	MP	NCA	NCA	NCA
Lane Information	MP	€€	€€€€	€€€	low	MP	€€€€	€€€€	€€€€
Traffic lights	MP	€€	€€€€	€€€	low	MP	€€	€€€	€€
Crossings	MP	€€	€€€€	€€	Low/ medium	MP	€€	€€€€-NCA	€€€€
Accident hot spots (statistics)	PA	€€-€€€€	€€-€€€€	€€-€€€€	medium	PA	€€-€€€€	€€-€€€€	€€-€€€€
Hazardous location (road)	PA	€€-€€€€	€€-€€€€	€€-€€€€	low	PA	€€	€€	€€
Slope	MP	€€€	€€€	€€€€	low	MP	€€	€€	€€
Banking	MP	€€€	N/A	€€€€	low	MP	€€	N/A	€€

## Data Collection and Data Maintenance Costs

## ■ Business Models

- A cooperation between public authorities and map providers for safety attributes that require frequent updates (e.g. speed limits, traffic signs) is essential otherwise it would not be commercially affordable.
- Direct benefits of digital road database containing safety attributes to public/road authorities at local and national levels need to be better identified and described to motivate them to adopt and use such database and associated exchange infrastructure on a voluntary basis.
- Map based/supported ADAS applications are an opportunity to integrated navigation system suppliers to innovate and to be more competitive in comparison with mobile navigation solutions.
- Tax and insurance incentives are a real opportunity to support end-user willingness to pay for safer, smarter and cleaner vehicles and therefore in depth discussion with concerned parties is needed.

# Thank you for your attention

More information, please visit web sites

[http://www.prevent-ip.org/maps\\_adas](http://www.prevent-ip.org/maps_adas)

Contact:

***Stephen T'Siobbel***

***Tele Atlas***

***Strategic Research and Development***

**[stephen.tsiobbel@teleatlas.com](mailto:stephen.tsiobbel@teleatlas.com)**