



Towards requirements related to future CCAM services for road usage optimization

Florian Hofbauer, Manuel Walch, Wolfgang Schildorfer, Matthias Neubauer

University of Applied Sciences Upper Austria

Objectives of ESRIUM



ESRIUM is a Horizon 2020 project increasing the safety and resource efficiency of transport on European roads. Its key innovation is a digital map of road surface damage and road wear.

The digital road wear map will contain unique information for the road operators to enhance the road maintenance planning and to provide routing recommendations (in-lane and cross-lane) to automated vehicles and conventional vehicles to avoid road damages.

Through ESRIUM, transportation becomes...

- **Smarter:** Exploiting detailed driving recommendations received from the road operator in every automated and connected car.
- **Safer:** Allowing the vehicle to drive on undamaged road surface.
- **Greener:** A longer paving lifetime makes road operations greener and more resource-efficient.

Objectives of this study

1. Presentation of four use cases
2. Elaboration of non-technological requirements of the offered digital services

Aim of this project phase:

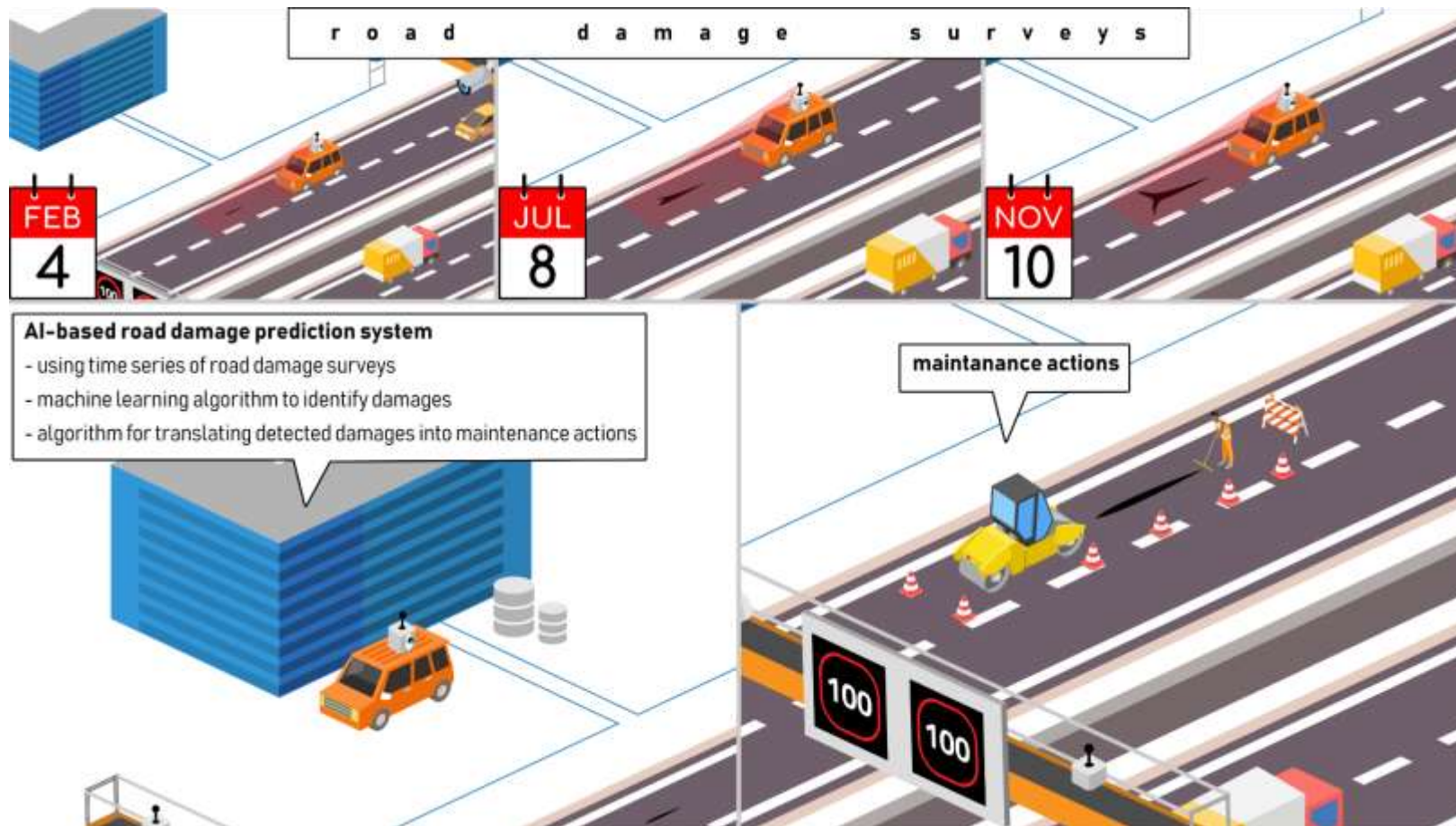
- Mapping of the requirements of the stakeholders
- Consideration of these requirements in the development of the ESRIUM services
- Optimizing the interaction between humans and the system and thus increase user and technology acceptance

Methodological approach

1. Use case analysis based on the project proposal: Development of four application scenarios including potential target groups, application prerequisites, challenges.
2. Validation within a bilateral workshop with key customer ASFINAG (road operator)
3. Internal review of updated version with all project partners: Developing consensus within the diverse and multidisciplinary team and taking advantage of multiple perspectives along the value chain
4. External confirmation of relevance of use cases from ASECAP¹

¹Also stated in ASECAP's C-ITS Manifesto (cf. ASECAP 2021, p.6, URL: http://www.asecap.com/images/News/PDF/2021_ASECAP_CITS_MANIFESTO_final.pdf)

EUC-001: AI-based road damage prediction to support enhanced road maintenance planning (Figure)



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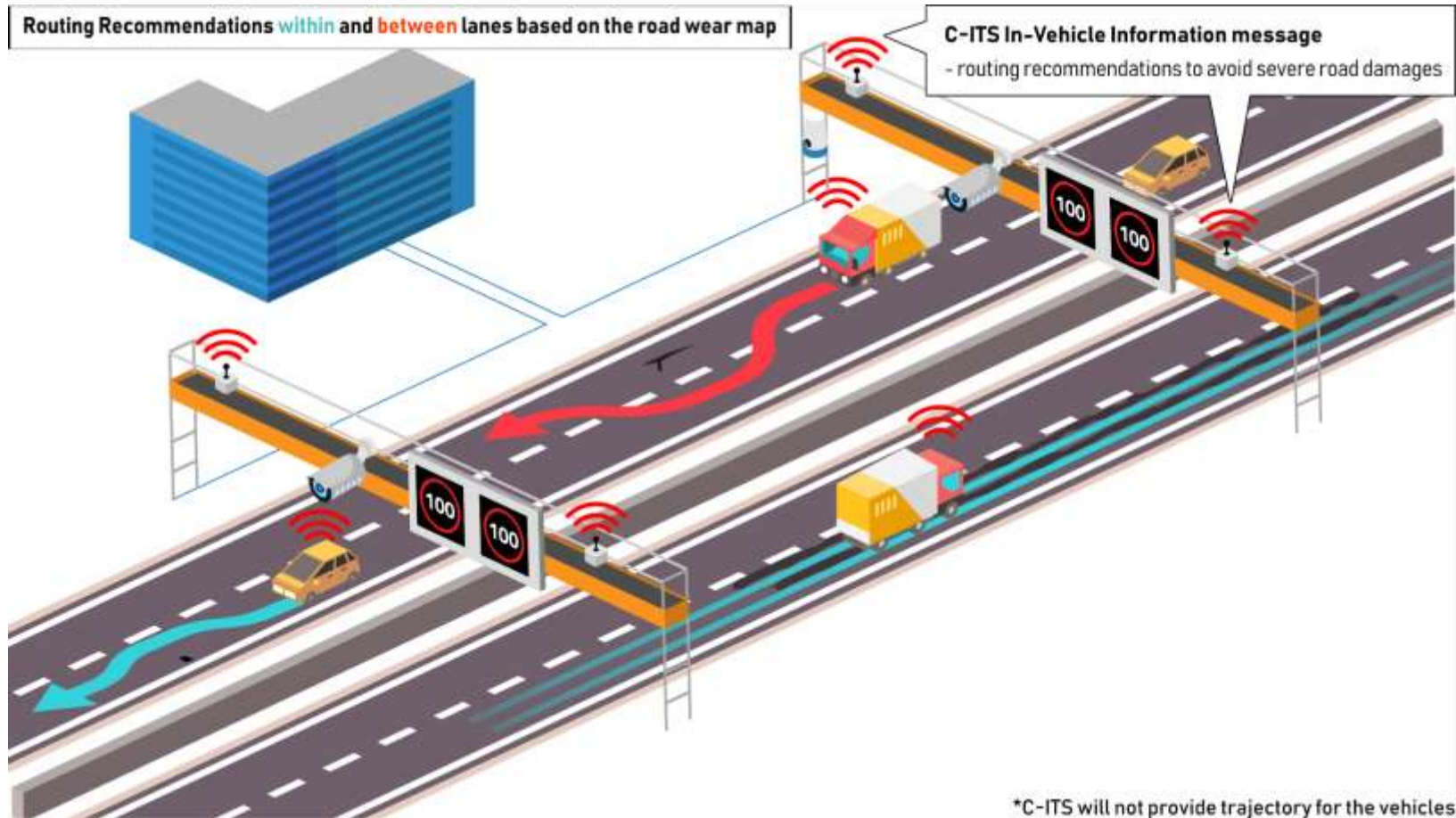
UC Description:

Based on the developed road sensing and damage mapping system, a road wear map layer utilizing AI-based road damage predictions is to be developed and provided to the road operator. Based on the predicted onset of road damages the road operator can set-up a derived predictive road maintenance and action plan to proactively reduce more severe road damages.

Target Group: Road Operators

Preliminary Pain Points	USP	Expected Benefits
<ul style="list-style-type: none"> • High costs due to late detection of road damages • Long-term construction sites (decrease in traffic efficiency and safety, higher CO₂ emissions) • High costs and impacts due to safety risk and caused incidents • Traffic jams and related customer complaints 	<p>Road maintenance service is</p> <ul style="list-style-type: none"> • safe (due to high validity of the service) • delightful (due to helping reduce CO₂ emissions) • and effective (due to using the right tools and cost efficient measures when it comes to road maintenance actions) 	<ul style="list-style-type: none"> • Enhanced road maintenance planning • Reduction of overall maintenance activities • Reduction of CO₂ emissions (avoidance of construction zones and therefore traffic jams)

EUC-002: Routing Recommendations within and between lanes based on the road wear map, provided via C-ITS messages (Figure)



EUC-002: Routing Recommendations within and between lanes based on the road wear map, provided via C-ITS messages

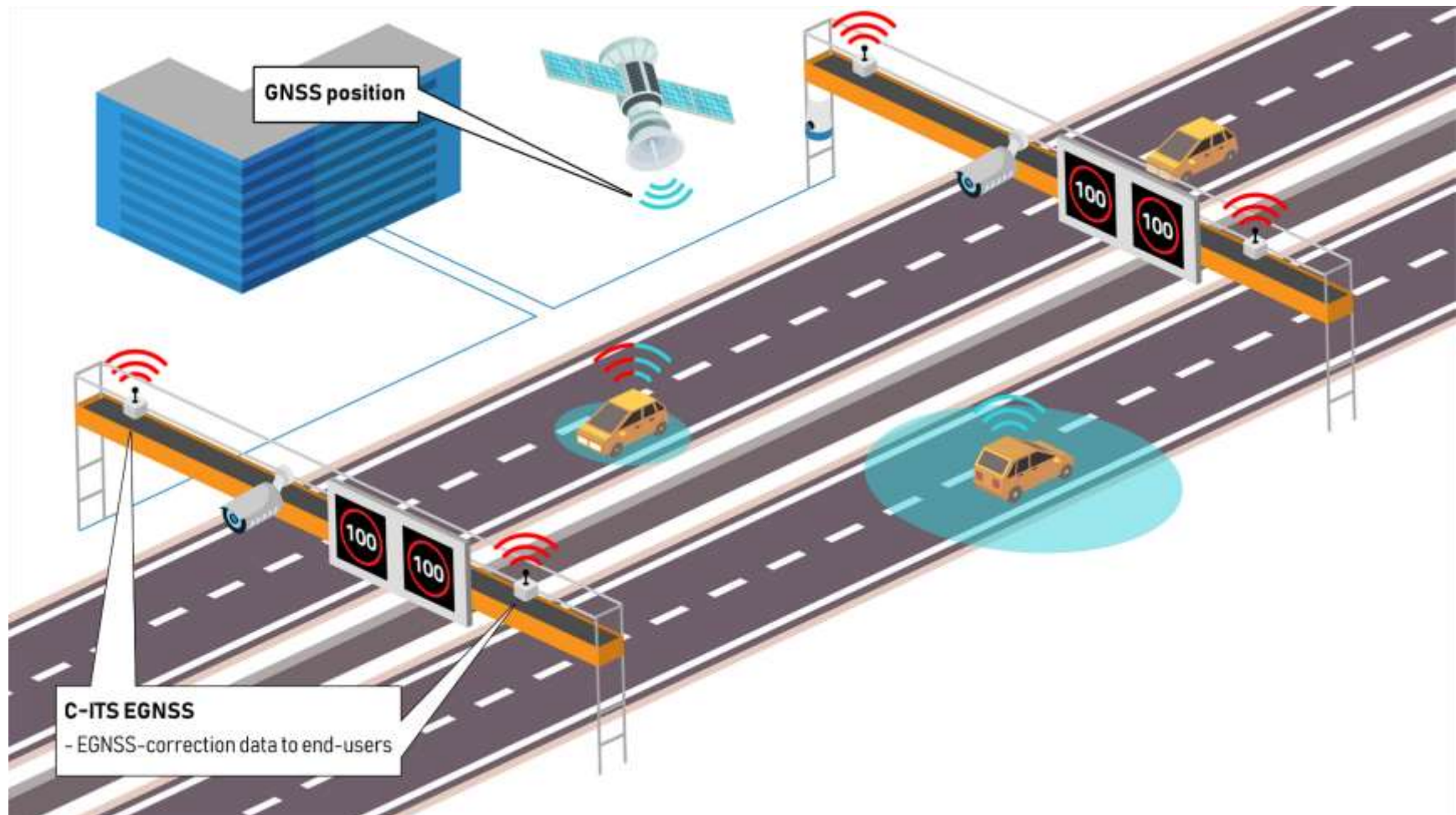
UC Description:

Based on very early damage prediction, the road operator can derive an enhanced action plan to proactively avoid severe road damages. One of the actions is to provide EGNSS-based lane change or in-lane offset recommendations for the drivers and end users in general, in order to avoid severe road damages and critical safety-related situations (vehicle side damage avoidance). User compliance-based incentive concepts (e.g. tolling) will be investigated in this scope.

Target Group: End users (drivers of automated trucks and passenger cars), OEMs, logistics operators

Preliminary Pain Points	USP	Expected Benefits
<ul style="list-style-type: none"> • Additional costs for on-board units (for receiving C-ITS messages) • Specific vehicle characteristics are not available for broadcast services - only generic recommendations may be provided • Safety risk due to road damages • Safety risk due to driver distraction from complex C-ITS messages 	<p>With this service, all the end users feel</p> <ul style="list-style-type: none"> • safe (due to high validity of the service) • relaxed (due to user-friendly service integration) • and effective (due to getting benefits from complying with road operators' recommendations) 	<ul style="list-style-type: none"> • Prevention of severe road damage • Equal / gradual utilisation of the road to prevent unequal road-surface wear

EUC-003: C-ITS Message 'GNSS-correction data' provision (Figure)



EUC-003: C-ITS Message ‘GNSS-correction data’ provision

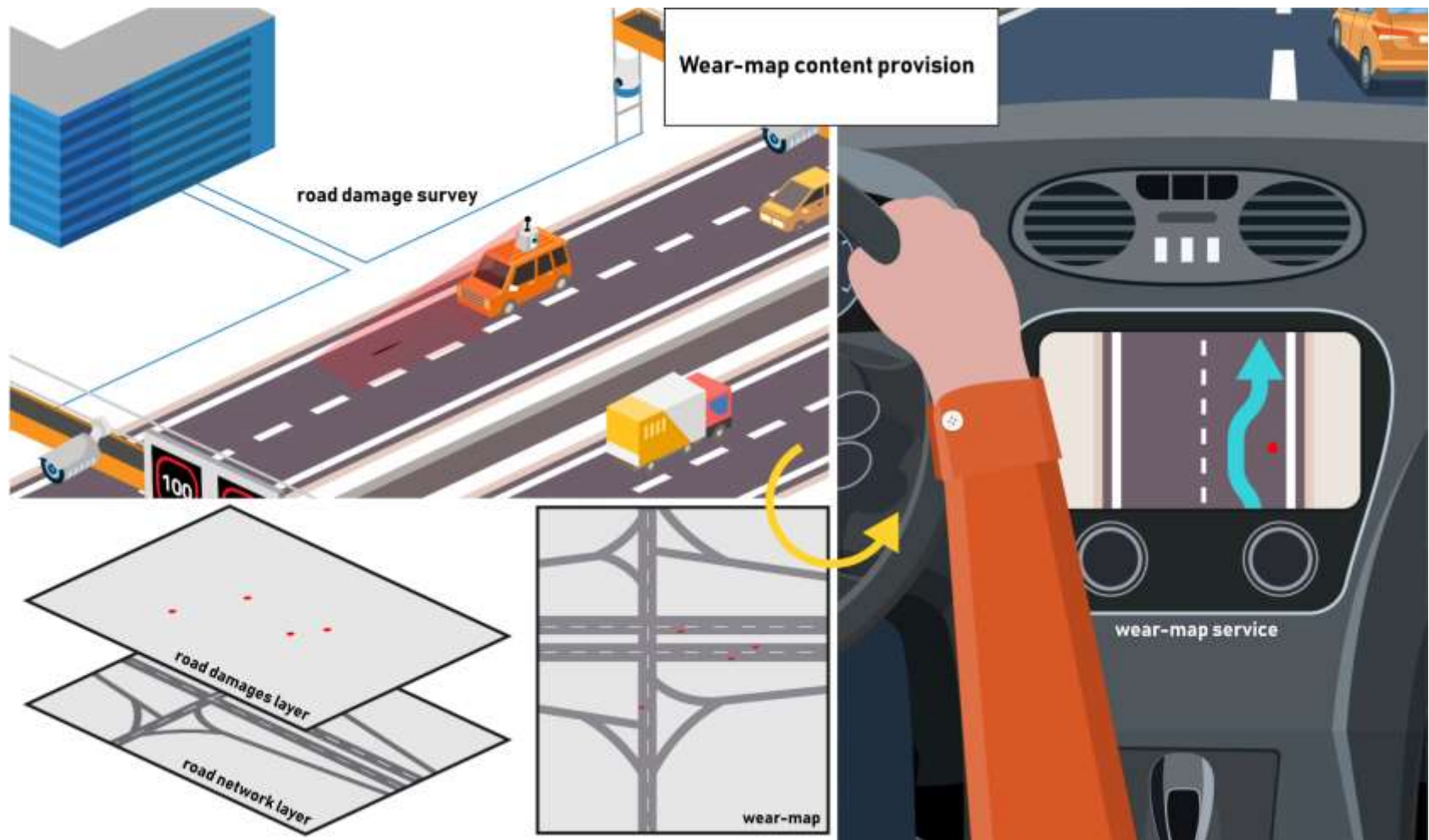
UC Description:

The road operator provides EGNSS-correction data to end users for enhancing the positioning accuracy of end users’ vehicles. Furthermore, vehicles carrying the sensor array uses that service

Target Group: End users (drivers of automated trucks and passenger cars) and vehicle provider (carrying sensor array), OEMs for optimising their ADAS systems (e.g. lane assist, C-ACC)

Preliminary Pain Points	USP	Expected Benefits
<ul style="list-style-type: none"> • Loss of high-precision positioning and therefore ADAS systems are not working correctly • Increased safety risk due to loss of high-precision positioning • Liability costs in case of accidents 	<p>We provide supportive localisation information to your infrastructure operations so that your customers feel safe (due to high validity of the service) with high convenience</p>	<ul style="list-style-type: none"> • Precise positioning allows following the lane change or in-lane offset recommendations and therefore avoid road wear • Providing the EGNSS correction data via C-ITS acts as an additional source of correction information and adds redundancy for requirements of functional safety for automated mobility.

EUC-004: Wear-map content provision (Figure)



EUC-004: Wear-map content provision



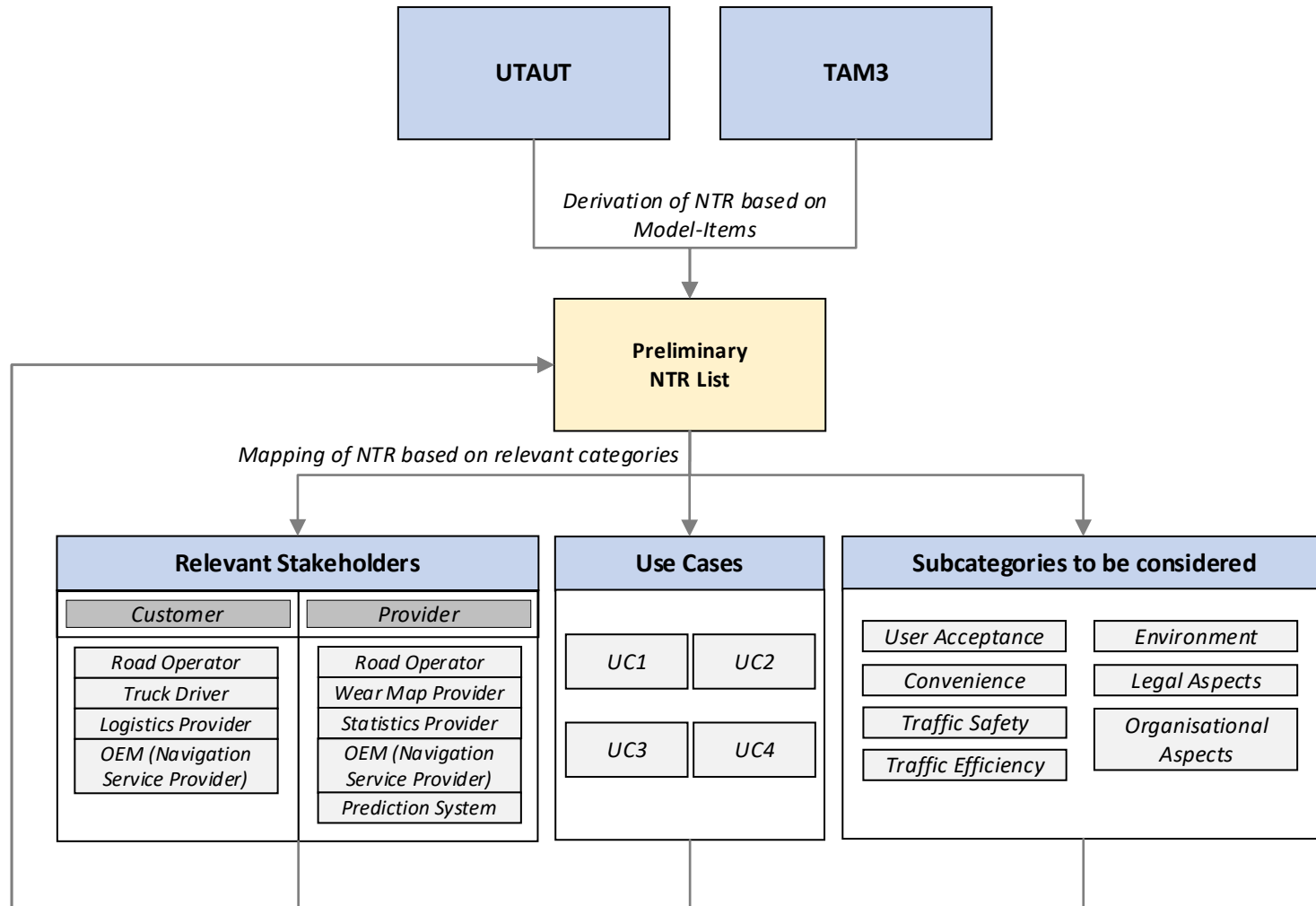
UC Description:

Based on the developed road sensing and damage mapping system a road wear map is provided to e.g. navigation service providers, OEMs and road operators to form a basis for convenient routing decisions

Target Group: End users (drivers of automated trucks and passenger cars)

Preliminary Pain Points	USP	Expected Benefits
<ul style="list-style-type: none">• Traffic safety risks due to construction works• Traffic safety risks due to damages on the road surface	<p>We support map providers to make the life of drivers safer and more convenient</p>	<ul style="list-style-type: none">• Increase driver convenience and traffic safety by proactive avoidance of road wear geo-located in the road wear map layer.

Process for the definition of non-technical requirements



Revision and inclusion of still unconsidered NTRs based on the respective categories

Preliminary list of non-technical requirements (examples)



ID	ENR-001	ENR-002
Title	Reduction of construction sites	Clear lane change recommendations
Description	Using the forecast model shall lead to a reduction of construction sites	Lane change recommendations for manual maneuvers must be clearly understandable and easy to learn
Subcategories	User acceptance	X
	Convenience	X
	Traffic Safety	X
	Traffic Efficiency	X
	Environment	
	Organization from data gathering to service provision	
	Legal issues including privacy	
Customer	End user (truck driver)	X
	End user (automated passenger vehicles)	X
	End user (logistics provider)	
	Road operator	X
	Navigation service provider/OEM	
Provider	Wear map provider	X
	Prediction system	
	Road operator	
	Navigation service provider /OEM	X
	Statistics provider	
Use case	UC1	X
	UC2	X
	UC3	
	UC4	X



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