

HI-SPEQ ERPUG

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HI -SPEQ



- **Hi**-speed survey **SP**ecifications, **E**xplanation and **Q**uality
- Commissioned under the CEDR Ageing Infrastructure Management Call – High-speed non-destructive Condition Assessment. Managed by Ireland National Roads Authority
- 6 project partners (TRL, AIT, VTI, ZAG, COWI, Fugro). Start April 2014, Duration: 24 months

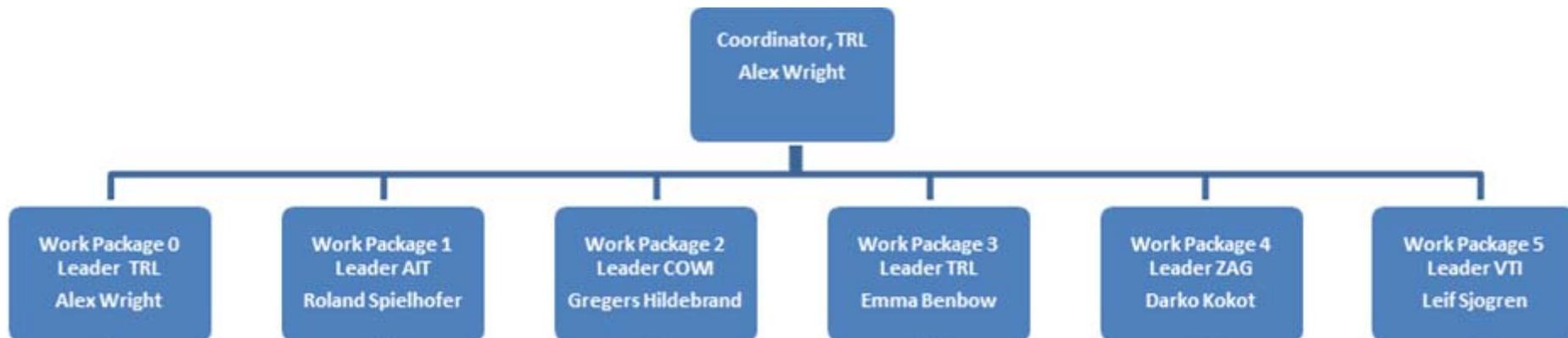


Stimulus for HI-SPEQ project

- High speed non-destructive condition assessment
 - Need for reliable consistent asset data
 - Collected in a way that minimises impact on users, traffic etc.
 - Surface condition surveys now widely undertaken at high-speed
 - Recent introduction of TSD for structural surveys
- The call:
 - Guidance on traffic-speed measurement of surface and structural condition
 - Consistent descriptions of equipment
 - Consistent survey specifications
 - QA requirements
 - Data processing and interpreting



HI -SPEQ – project structure



HI-SPEQ project – aims



- HI-SPEQ aims to
 - Identify the requirements of authorities for high speed data collection on road networks to measure surface condition, structural condition and road structure at
 - Identify how these surveys are being specified
 - Identify the type of equipment being used to collect this data.
 - Identify what quality regimes are being applied
 - Identify how the data is being delivered and processed

HI -SPEQ project – aims



- Having undertaken this work, HI-SPEQ aims to
 - Develop templates for specifying surveys of surface and structural condition on the European road network, accompanied by guidance.
 - Develop templates and best practise guidance for describing the equipment used on the network.
 - Identify the processes that should be applied to ensure that these surveys meet their expected levels of quality,
 - Provide guidance to help Authorities specify suitable QA regimes for their network surveys.
 - Recommend the most effective ways to convert survey data into meaningful condition parameters that can be input to asset management systems.
- The focus of the project is on the data collection methods and surveys

Current work



- Current focus is on collation of information “describing the equipment”
 - Shortlisting key surface/structural condition information required at project and scheme level
 - Summarising the core capabilities of the current equipment in terms of systems and capabilities
 - Identifying how structural (TSD) data are being used in current surveys to assess the condition of road networks at the project and network level
 - Identifying how measurements of structure (GPR) are being used to assess the construction of road networks at the scheme and network



Current review

- Initial objective to include “stakeholder consultation” / development of questionnaire
- Review by project team raised question over scope / extent of questions
 - Reluctant to “drown” stakeholder group
- Hence shortlisting the key properties identified in previous work on surface condition and structure/structural condition
 - Previous research
 - Examining existing specifications



Cracking/Surface Defects			
What is the manufacturer of the equipment that you use to measure cracking and/or surface defects?			
What is the name of the equipment?			
Does the equipment fulfill a certain national/international standard or norm? If yes, please name the standard			
How many do you survey with this equipment annually?			
How is the data locally/usually referenced in the network survey?			
Which defects are identified?			
Cracking			yes/no
Single cracks			yes/no
Longitudinal cracks			yes/no
Orthogonal cracks			yes/no
Transverse cracks			yes/no
Scaling / Spalling			yes/no
Potholes			yes/no
Falling particles or loose edges			yes/no
Crack width			yes/no
Other [specify]			yes/no
For each defect identified, please describe how they are defined in the customer [i.e. images plus area affected by defects/crack map (including location, size and direction of each crack)]			
What type of equipment do you use for data collection?			
Layer laser scanner		yes/no	yes/no
If layer laser scanner			
Resolution measured	by		mm
Layer slope			
Layer width measured			m
Vertical resolution			mm
If images are collected			
Camera type	lensless	yes/no	yes/no
Resolution of camera [area]	horizontal		px
	vertical		px
Resolution of camera [distance]	hor		px
Shutter frequency	range		s
	or	range	ms
Resolution measured	by		mm
Layer width measured by an individual camera			m
Number of cameras used to cover whole layer width			
Width covered by all cameras used			m
Operating speed	from		to km/h
Lighting system	if yes	yes/no	
		LED	
		Strobe	
If the images are provided in the customer:			
How is this achieved [i.e. via the internet]?			
Resolution of images delivered	horizontal		px
	vertical		px
Do you provide an image survey, where the images are locally/usually referenced in the network?			
How is the cracking or surface defect data obtained from the images?			
		Manual analysis of images	yes/no
		Semi-automatic analysis of images	yes/no
		Automatic analysis of images	yes/no
		Other [please specify]	
If automatic or semi-automatic analysis is carried out, does this use in-house software, or proprietary software [please specify]?			
		in-house software	yes/no
		proprietary software	yes/no
		Will-be	yes/no

Current review



- Reviewing previous research
 - Confirmed assumptions of requirements for durability (shape, cracking, profile)
 - And strength (deflection)
- Reviewing several survey specifications
 - Australia
 - Canada
 - UK
 - France
 - Germany
 - Ireland
 - Netherlands
 - New Zealand
 - USA (various states)
 - Africa (Uganda, Morocco)
 -

Excel Online HiSPEQ

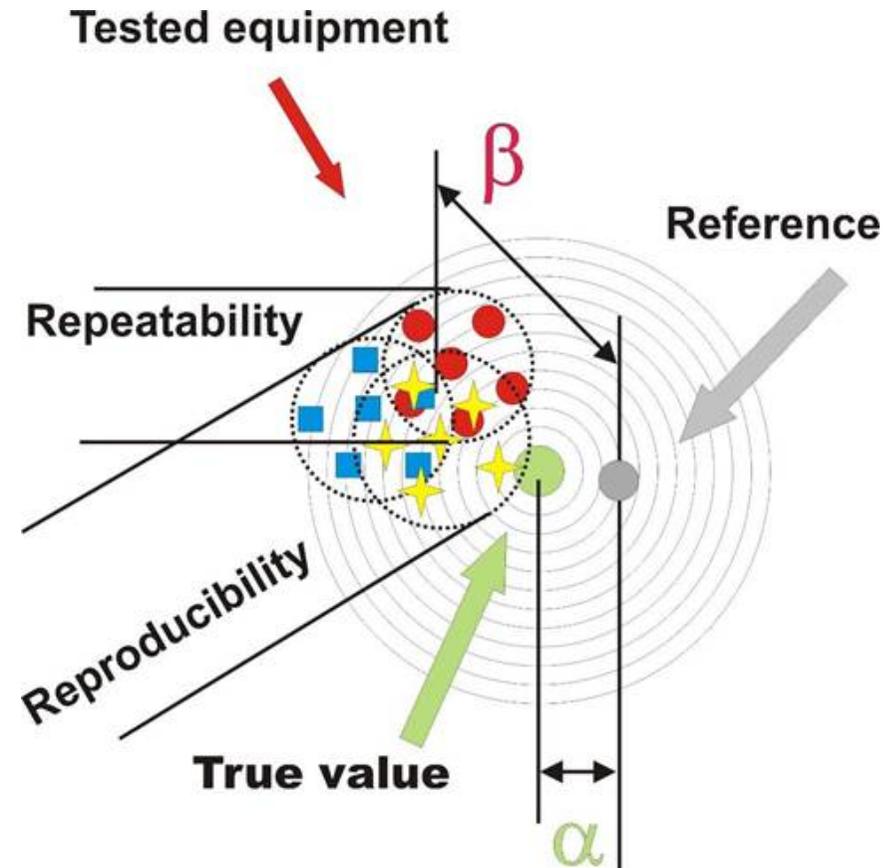
FILE EDIT WORKBOOK SHARE DATA FIND COMMENTS

	A	B
1	General information	
2	Which country's road network is this spec applied to?	Germany
3	What class of road is covered (e.g. motorway and high volume roads, low volume roads)?	Motorways, Primary roads (all roads maintained by state)
4	Is the specification for network-wide surveys, or scheme-level surveys?	network
5	What length is the network that is surveyed?	52.000 km (12900 km motorways, 39100 km primary roads)
6	Which organisation owns the spec (e.g. Highways Agency, DRD)?	FGSV (Die Forschungsgesellschaft für Straßen- und Verkehrswesen), an expert organisation
7	Is this spec published or only available to potential applicants for the survey contract?	published
8	Is the measurement speed defined; minimum and/or maximum speed?	no
9	Are survey conditions specified? (road condition, temperature, season)	yes, dry and clean road
10		
11	Transverse Shape	
12	What does the contract require to be delivered: Rutting, transverse profile, something else?	profiles, all indicators are derived by a centralized software (rut depth left/right, water film thickness left right - for all parameters min, max and standard deviation per 100 m section
13	Does the specification state what type of equipment should be used to collect the data? (E.g. does it state that 32kHz lasers, with a vertical resolution of 0.01mm should be used, or does it just require transverse profile, consisting of 100 measurement points to be delivered?)	vertical resolution of 0.2 mm, linearity of <0.2 over the whole measurement range
14	How is the data related to the network being measured? (i.e. Use of GPS and distance measurements to fit the data to a road and distance)	use of GPS mandatory, each second 1 position
15	Is the lane width that measurements should be made over specified? If so, what is this?	covered lane width is 3.2 m
16	Is the number of data points in the transverse profile specified? If so, how many?	33 points
17	Is the distance between each transverse profile data point specified? If so, what is this?	10 cm
18	Is the longitudinal spacing of the transverse profiles specified? If so, what is this?	1 profile per meter
19	Is delivery of road marking profile a requirement (i.e. information that provides the location of road markings on the carriageway)?	no
20	If so, what lane width does this cover, how many points transversally, what longitudinal spacing?	.
21	If delivery of rutting is a requirement, does the specification state exactly how rut depths should be calculated from the transverse profile?	only profile points are delivered, central software does all calculations
22	What reporting length is used for rutting?	100 m
23	Any other relevant information?	
24		
25		
26	Longitudinal Shape	
27	What does the contract require to be delivered: Longitudinal Profile and/or derived parameters?	only the profile, parameters are derived with a centralized software (AUN, w, LWI, standard deviation and deviation from

Current review



- Excel based summary
 - Surface
 - Structural
 - QA requirements
- Extracting technical detail:
 - Technical requirements for surface condition (survey equipment or end result, definition of shape required, spacing, image resolution, location referencing etc., what analysis is required...)
 - Technical requirements for structure/strength (what are the deliverable data (TSD), is it GPR survey equipment or end result? calibration, accuracy requirements....)
 - QA requirements (accuracy, repeatability, accreditation, ongoing QA testing etc.)



Outcomes of review

- HI-SPEQ will propose the summary core condition parameters leading to:
 - Development of an initial set of technical requirements for condition measurements
 - Data needs (e.g. data, frequency, accuracy)
 - QA requirements
- Ultimately will lead to requirement specifications...
 - Outline specifications that could be used by road authorities to procure surveys
- Also equipment descriptions
 - What key info should manufacturers include to inform authorities on their systems
 - In the context of the proposed requirements



CEDR Transnational Road Research Programme
Call 2013: Aging Infrastructure Management

funded by Denmark, Germany, Ireland,
Netherlands, UK and Slovenia



**HiSPEQ: Hi-speed survey
Specifications, Explanation and Quality**

**Key Requirements to Include in
HiSPEQ Specifications**

Report No 1
Month, Year



Stakeholder engagement

- The findings will be taken to stakeholders for peer review
 - Review and challenge our proposed technical requirements
 - Leading to outline survey equipment specification for surveys
- We want to engage in peer review between now and Feb 2015
- We also want to seek input from Equipment Manufacturers on the way equipment should be described



Cracking/Surface Defects			
Who is the manufacturer of the equipment that you are measuring cracking and/or surface defects?			
What is the name of the equipment?			
Does the equipment fulfill a certain national/international standard or norm? If yes, please name the standard			
How many do you survey with this equipment annually?			
How is the data functionally referenced in the network survey?			
		numerical	yes/no
		linear referenced	yes/no
Which defects are identified?			
	Cracking		yes/no
	Single cracks		yes/no
	Longitudinal cracks		yes/no
	Oblique cracks		yes/no
	Transversal cracks		yes/no
	Feeling / Raveling		yes/no
	Potholes		yes/no
	Falling patches or loose edges		yes/no
	Crack width		yes/no
	Other [specify]		yes/no
For each defect identified, please describe how they are delivered in the network (i.e. images plus area affected by defects) crack map (including location, size and direction of each crack)			
What type of equipment do you use for data collection?			
		linear laser scanner	yes/no
		numerical	yes/no
If laser line scanner			
Resolution as quoted		by	mm
Laser class			
Laser width measured			m
vertical resolution			mm
If images are collected			
Camera type	line scan	yes/no	
	area scan	yes/no	
Resolution of camera [area]	horizontal	mm	
	vertical	mm	
Resolution of camera [line scan]	line	mm	
Shutter frequency	range	mm	
	or	range	mm
Resolution as quoted		by	mm
Laser width measured by an individual camera			m
Number of cameras used to measure whole laser width			
Width measured by all cameras used			m
Operating speed		from	to
			km/h
Lighting system	if yes	yes/no	
		LED	
		Strobe	
If the images are provided in the network:			
How is this achieved (e.g. via the internet)?			
Resolution of images delivered	horizontal	mm	
	vertical	mm	
Do you provide an image viewer, where the images can be functionally referenced in the network?			
How is the cracking or surface defect data obtained from the images?			
		Manual analysis of images	yes/no
		Semi-automatic analysis of images	yes/no
		Automatic analysis of images	yes/no
		Other [please specify]	
If automatic or semi-automatic analysis is carried out, does this use in-house software, or proprietary software [please specify]?			
		in-house software	provided by Manufacturer
		proprietary software	Written by
			yes/no



Stakeholder engagement

- Current types of stakeholders
 - NRAs
 - Equipment manufacturers
 - Researchers
 - Groups
 - Etc.
- Each has own viewpoint
- Would you like to be included?
 - See www.hi-speq.com
 - Please tell us!
- Letter to be sent out



Cracking/Surface Defects			
Who is the manufacturer of the equipment that you are measuring cracking and/or surface defects?			
What is the name of the equipment?			
Does the equipment fulfill a certain national/international standard or norm? If yes, please name the standard			
How many km do you average with this equipment usually?			
How is the data locationally referenced in the network average?		coordinates	yes/no
		linear reference	yes/no
Which defects are identified?			
	Cracking		yes/no
	Single cracks		yes/no
	Longitudinal cracks		yes/no
	Oblique cracks		yes/no
	Transversal cracks		yes/no
	Feeling / Raveling		yes/no
	Potholes		yes/no
	Falling plates or brick edges		yes/no
	Crack width		yes/no
	Other (specify)		yes/no
For each defect identified, please describe how they are delivered in the network (i.e. images plus area affected by defects) crack map (including location, size and direction of each crack)			
What type of equipment do you use for data collection?			
	laser line scanner	yes/no	yes/no
If laser line scanner			
Resolution as ground	by		mm
Laser class			
Laser width sensor			m
vertical resolution			mm
If images are collected			
Camera type	lensless	yes/no	yes/no
	structure		
Resolution of camera (area)	horizontal	cm	
	vertical	cm	
Resolution of camera (lensless)	line	cm	
Shutter frequency	cm	cm	cm
	cm	cm	cm
Resolution as ground	by		mm
Laser width sensor by an individual camera			m
Number of cameras used to cover whole laser width			m
Width covered by all cameras used			m
Operating speed	from	to	km/h
Lighting system	if yes	yes/no	
		LED	
		Stroke	
If the images are provided in the network:			
How is this achieved (e.g. via the internet)?			
Resolution of images delivered	horizontal	cm	
	vertical	cm	
Do you provide an image viewer, where the images can be locationally referenced in the network?			
How is the cracking or surface defect data obtained from the images?			
	Manual analysis of images	yes/no	5h
	Semi-automatic analysis of images	yes/no	
	Automatic analysis of images	yes/no	5h
	Other (please specify)		
If automatic or semi-automatic analysis is carried out, does this use in-house software, or proprietary software (please specify)?			
	in-house software	provided by Manufacturer	yes/no
	proprietary software	Written by	yes/no



Later work in HI-SPEQ



- HI-SPEQ will consider the types of data processing required to provide guidance for this final stage of the survey process
 - Surface: the parameters that can be obtained from road surface laser profile
 - Visual: clarification and guidance on the types of parameters reported and how these might be applied within asset management systems.
 - Structural: Guidance on the various options for TSD data processing and application, the relative strengths and weaknesses of these
 - Structure: Provide guidance on the various options for GPR data processing and application
- How do the high speed techniques in HI-SPEQ complement one another within an overall regime for the assessment of structural condition?
- Focus will be on developing advice on processing of the data from the machines, to the “delivered parameter” stage