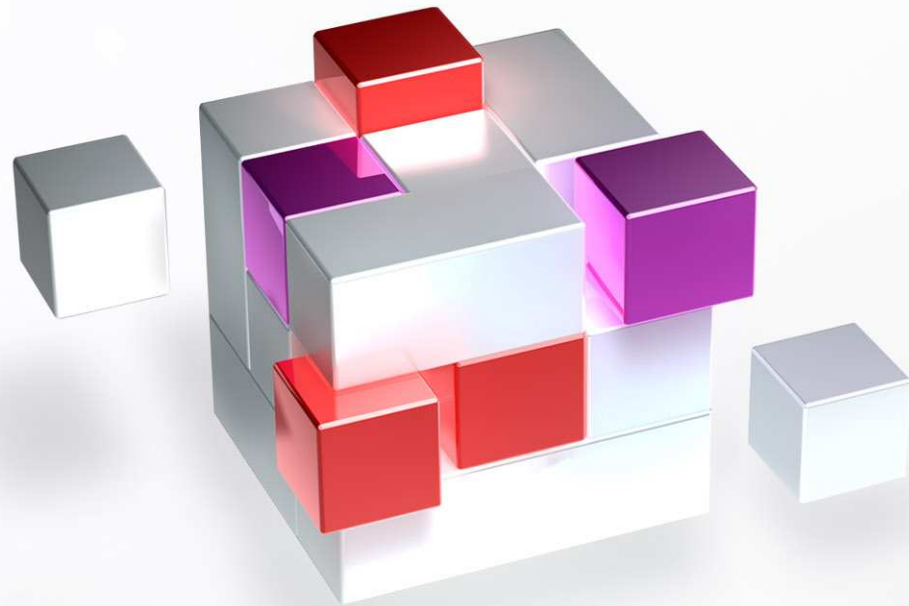


**CEN TC256 – SC1 Seminar
ZAGREB 2012-10-12**

**Track Geometry Activities
WG28**



TRACK GEOMETRY QUALITY – Summary

➤ **Historical considerations**

➤ **Scope of WG28**

➤ **Work program of WG28**



NEED OF A STANDARD ON TRACK GEOMETRY

- **In early 90's, the new processes of European Railways needed a clear and common description of track geometry:**
 - Interoperability
 - Separation between infrastructure and train operator companies
- **3 CEN WGs requested a description of track geometry quality for their own works :**
 - WG 7 Ride comfort for passengers
 - WG10 Vehicle acceptance
 - WG 15 Track alignment design parameters
- **Creation of a Survey Group in October 1994 (SG8)**



WORK DONE BY SG 8

- **SG8 Started in 1996: Review of how track geometry is handled by different activities (CEN, UIC, ERRI...)**
- **Survey of the current situation of track geometry by means of a questionnaire sent to each participating country to the SG :**
 - Management of track geometry
 - Track recording vehicles
 - Relevant parameters
 - Processing and analysis of parameters
 - Track geometry standards
 - Correlation methods



CONCLUSIONS OF SG 8

➤ SG 8 gave 4 recommendations

- Development of a rigorous method enabling measured data to be compared when coming from two different systems
- Establishing derailment standards for track geometry quality
- Creation of an European Norm on track geometry quality
 - Description of parameters and filtering methods (“strong agreement”)
 - Track geometry standards values (“greater difficulty”)
- Creation of an European Norm on specification for future track recording vehicles

Scope of WG28

➤ Scope of the WG28

- To establish one or more European Standard covering the subjects:
 - Characterization of the track geometry
 - Specifications of measuring devices

➤ The WG 28 was created in 1998

- the 1st meeting took place on the 8th of April 1998 in Bern
- The 83rd meeting is scheduled on the 22nd of November 2012



Program of work of WG28

➤ EN 13848 Series

➤ WG 28 has worked on 3 main items:

➤ Characterisation of track geometry (Part 1)

➤ Measuring devices ⇒ This item has been divided in 3 parts:

- Part 2: Recording vehicle
- Part 3: Track construction and maintenance machines
- Part 4: Manual and light weight devices

➤ Geometric quality assessment

- Part 5: Geometric quality levels
- Part 6: Characterization of track geometry quality



Members of WG28

➤ 25 members from 14 countries:

- Austria
- Belgium
- Czech Republic
- Denmark
- Finland
- France
- Germany
- Italy
- Netherlands
- Portugal
- Spain
- Sweden
- Switzerland
- United Kingdom

➤ Experts coming from:

- Infrastructure Authorities
- Railway administration (including metros)
- Manufacturers of measuring systems
- Track works companies
- Vehicle manufacturer (one)



EN 13848-1 Characterization of track geometry

- **Requirements to be respected by the track geometric parameters when they are measured by a recording device.**
- **6 main parameters are described in the standard:**
 - Gauge
 - Longitudinal level
 - Cross level (or cant)
 - Alignment
 - Twist

- **Each parameter is characterized by its:**
 - Definition
 - Measurement method
 - Wavelength range
 - Resolution and Measurement uncertainty
 - Range of measurement
 - Analysis method
 - Output requirements

EN 13848-2: Measuring systems: Track recording vehicles

- **Minimum requirements for measuring vehicles in order to produce comparable results**
- **General description of the requirements for a track recording vehicle**
 - Measuring devices
 - Data localisation
 - Data processing
 - Data output and storage
- **Testing and validation of a recording vehicle**
 - Calibration
 - Validation by field tests
 - Repeatability and reproducibility tests
 - Procedures
 - Values to be respected (Annex C)
 - *Statistical analysis of parameter data → 95th percentile*
 - *Statistical analysis of standard deviation*
 - *Frequency analysis (Transfer and coherence functions)*

EN 13848-3: Measuring systems: Track construction and maintenance machines (TCMM)

- **Minimum requirements for measuring systems fitted on track construction and maintenance machines**
- **General description of the requirements for the measuring system**
 - Same principle as EN13848-2
- **Testing and validation of a system fitted on a TCMM**
 - Calibration
 - Validation by field tests
 - Repeatability and reproducibility tests
 - Procedures
 - Values to be respected (Annex C)
 - *Statistical analysis of parameter data → 95th percentile*
- **Annex A**
 - Parameters measured by TCMM and differences with EN13848-1 requirements
 - Taking account of the specificities of maintenance machines

EN 13848-4: Measuring systems: Manual and light devices

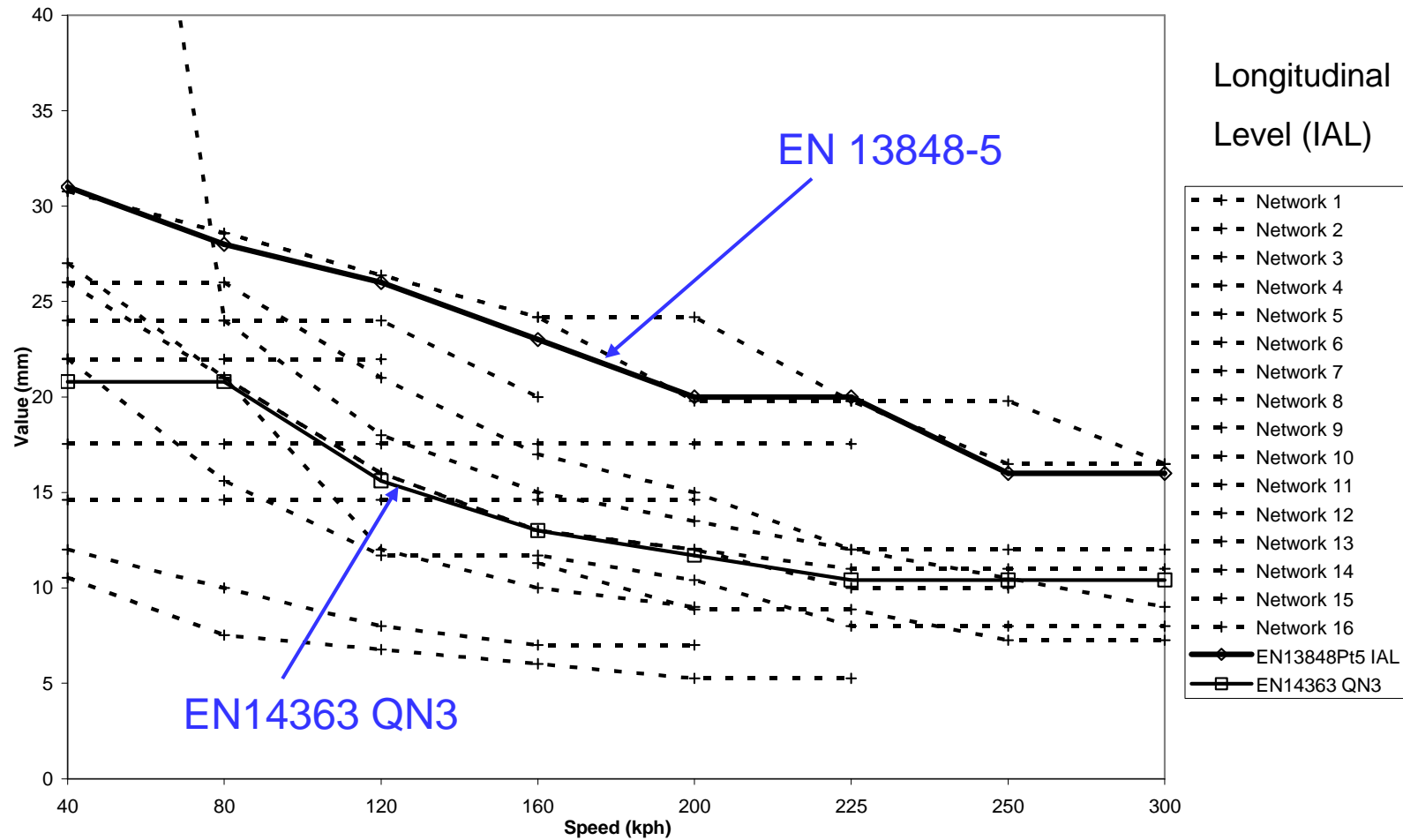
- **Minimum requirements for measuring systems fitted on**
 - track geometry measuring trolley (TGMT)
 - manually operated devices (MOD)
- **General description of the requirements for the measuring system**
 - Same principle as EN13848-2 / EN13848-3
- **Testing and validation of a system fitted on a TCMM**
 - Calibration
 - Validation by field tests
 - Repeatability and reproducibility tests
 - Procedures
 - Values to be respected (Annex C)
 - *Statistical analysis of parameter data → 95th percentile*
- **Annex A**
 - Parameters measured by TGMT & MOD and differences with EN13848-1 requirements
 - Taking account of the specificities of maintenance machines

EN 13848-5: Geometric Quality level

- **Safety levels required for the parameters defined in EN 13848-1**
- **This standard covers the following topics:**
 - Description of "quality levels" (AL, IL and IAL)
 - IAL: Immediate action limit for
 - Longitudinal level
 - Alignment
 - Twist
 - Track gauge
 - Considerations on other "quality levels" AL (Alert Limit) and IL (Intervention Limit)
 - Annex B
- **IAL are based on a survey of the current European practices in terms of safety limits**

EN 13848-5: IAL European survey

IALs are based on a survey of the European practices in terms of safety limits



prEN 13848-6: Characterisation of track geometry quality

↗ This standard covers the following topics:

- ↗ Description of track geometry quality (state of the art);
- ↗ Classification of track quality according to track geometry parameters;
- ↗ Considerations on how this classification can be used

↗ State of the art: methods for assessing track geometry quality

- ↗ Standard Deviation
- ↗ Isolated defects (counting)
- ↗ Combination of parameters
 - Combination of standard deviations
 - Standard deviation of combined parameters
- ↗ Point Mass Acceleration (PMA)
- ↗ Use of vehicle response
 - Calculated response with vehicle model and simulations (VRA method)
 - Use of direct measurement
- ↗ Use of power spectral density (PSD)

prEN 13848-6: Track Quality Classes

- **The track quality classes (TQC) are defined as standard deviation according**
 - 5 speed ranges
 - For each speed range, 5 classes ranging from A (good) to E (poor)
 - For both longitudinal level and alignment
- **The classes are based on actual European track quality evaluated by a survey of 13 Networks (length ca 60 000 km: 37% of the total)**
 - Description of track geometry quality;
 - Classification of track quality according to track geometry parameters;
 - Considerations on how this classification can be used
- **Possible application of TQCs**
 - Key performance indicator for an infrastructure manager
 - Establishment of a detailed working plan by an infrastructure manager;
 - Acceptance of track works
 - Contractual purposes
 - between Infrastructure manager and infrastructure owner
 - between train operator and infrastructure owner;
 - Design of a vehicle by a manufacturer according to ride quality requirements
 - Vehicle acceptance (selection of track sections)



European Track Quality Survey

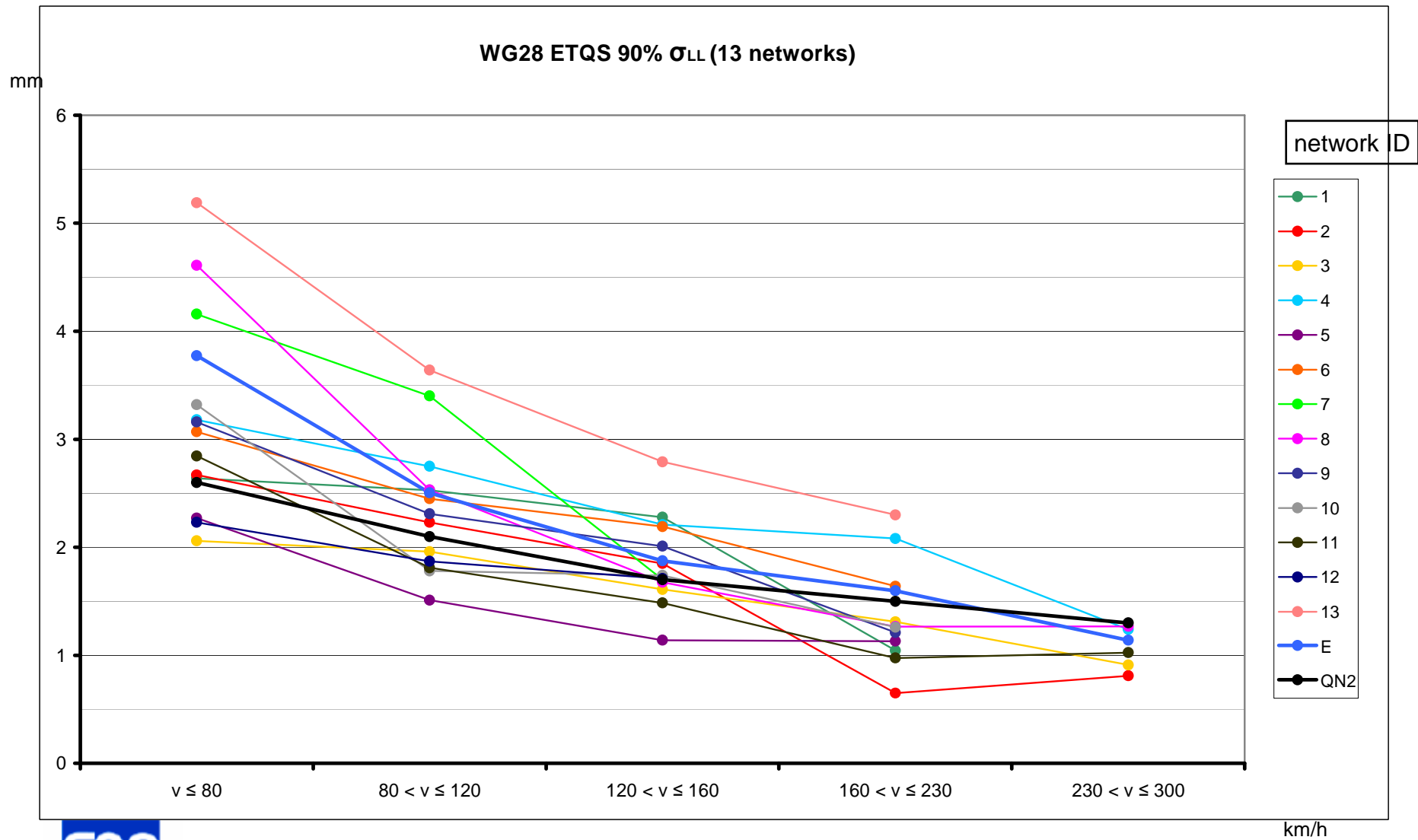
Participating Networks (in alphabetic order*)

Austria	ÖBB-Infrastructure
Belgium	Infrabel
Czech Republic	SŽDC
Denmark	Rail Net Denmark
Finland	FTA
France	SNCF / RFF
Germany	DB Netz
Italy	RFI
Netherlands	ProRail
Portugal	REFER
Switzerland	SBB
Sweden	Trafikverket
United Kingdom	NetworkRail

Data samples <5% not taken into account

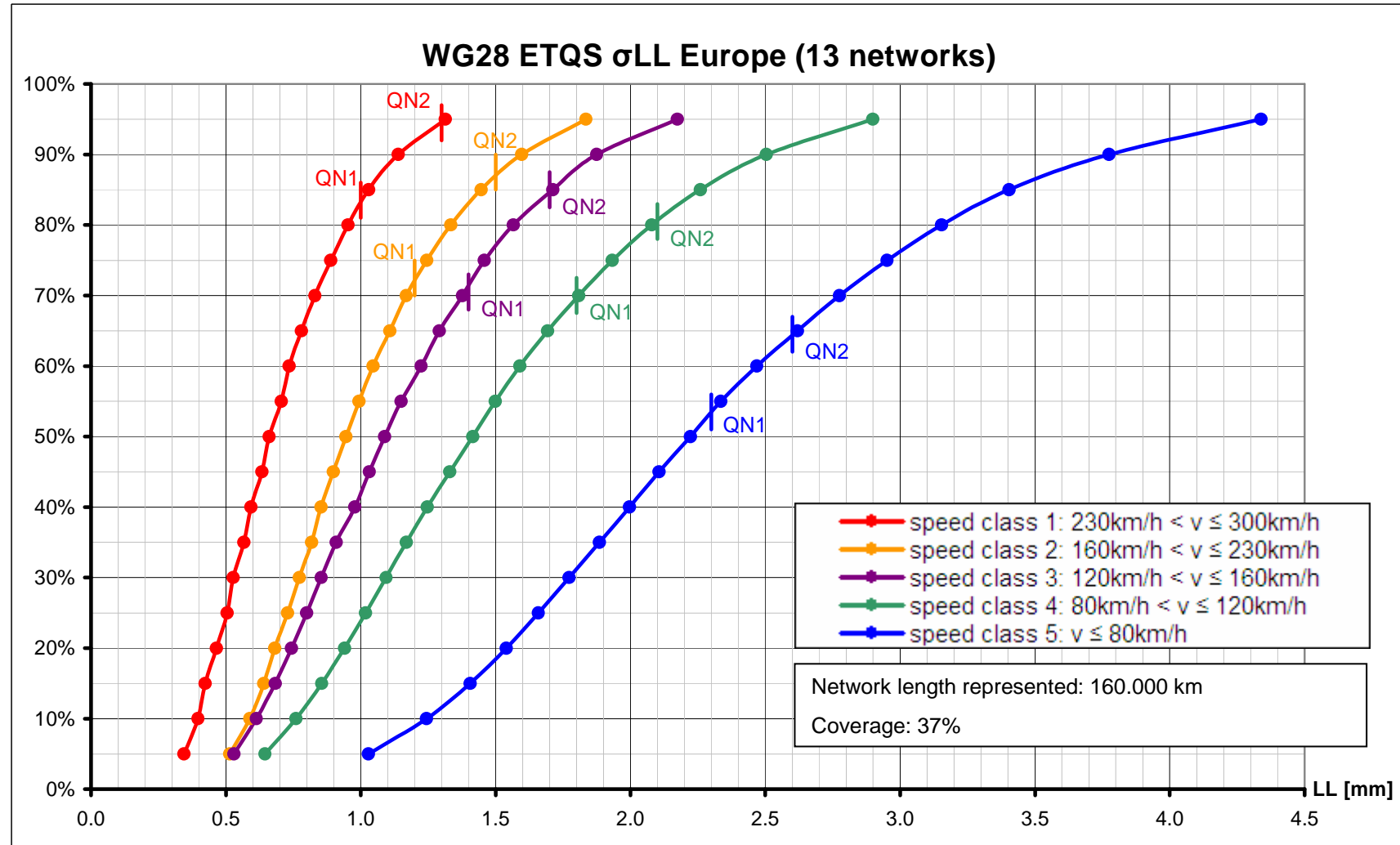


Longitudinal level: 90% percentile



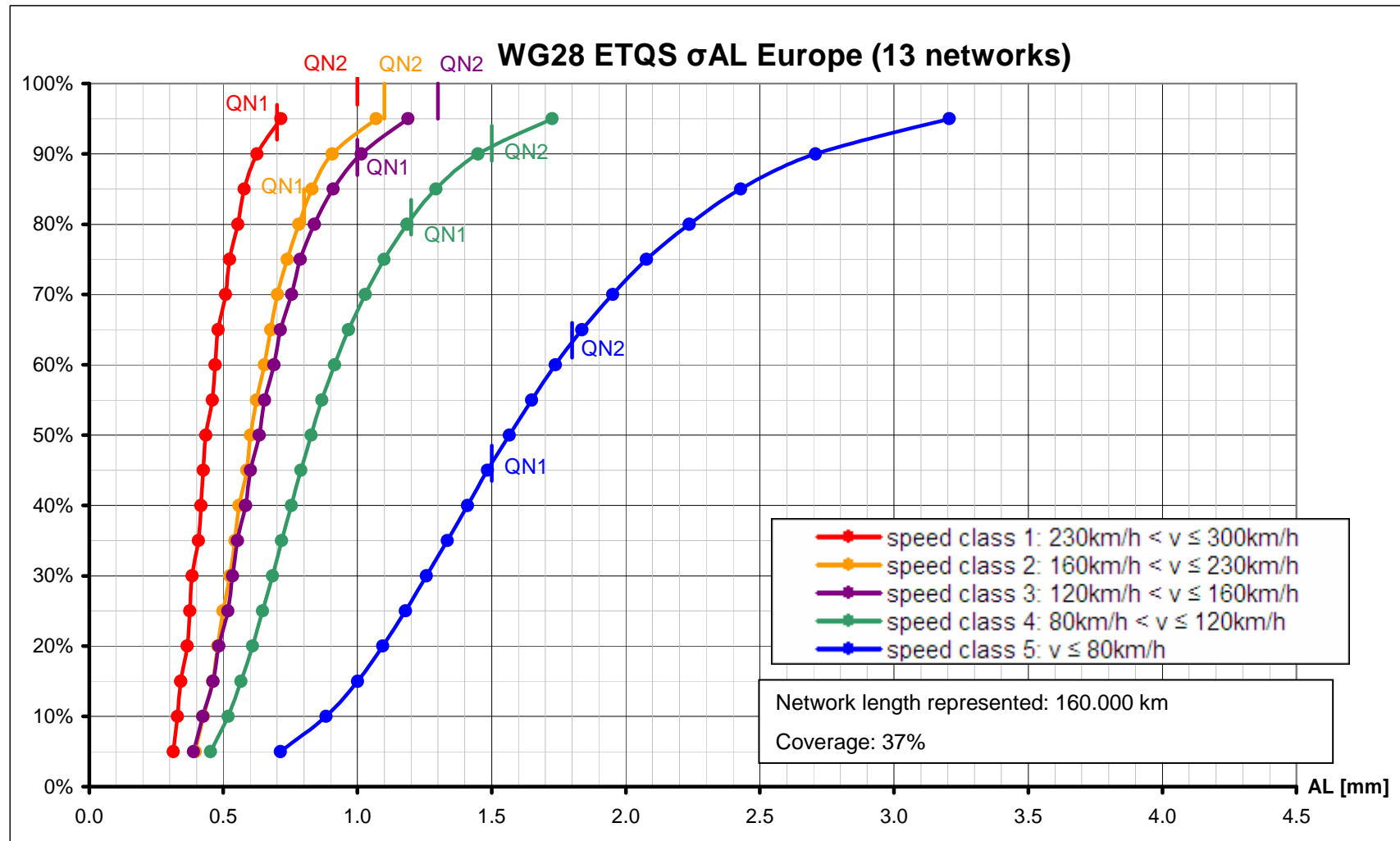
Longitudinal level

Cumulative frequency distributions of standard deviation



Alignment

Cumulative frequency distributions of standard deviation



WG28: Future activities

➤ **Revision of Part 5**

- Review of IAL value
- Carrying out a survey similar as Part 6 but dedicated to maximum values of isolated defects
- Taking account of speeds higher than 300 km/h

➤ **Revision of Part 2**

- **Possibly, work on Urban Rail, with the help of experts in that domain**

**THANK YOU
FOR
YOUR
ATTENTION**

