ROlling resistance, Skid resistance, ANd Noise Emission measurement standards for road surfaces

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Report on feedback from and cooperation with CEN/TC 227/WG 5 and updated standardization roadmap

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Control Sheet

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Abbreviations

Abbreviation	Meaning
BT	CEN Technical Board
PMG	Project Management Group
SRG	Stakeholder Reference Group
TC	CEN Technical Committee reporting to BT
TG	Task group reporting to WG
WG	CEN Working Group reporting to TC
WP	Work Package
D	Deliverable

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Executive Summary

The objective of the project ROSANNE is the harmonization of measurement methods for skid resistance, noise emission and rolling resistance of road pavements. This deliverable is part of WP5 which aims to summarize the findings of WP1 – WP4 and prepare them for introduction into the actual standardization process as well as for dissemination to the scientific community, road industry, road administrations, policy makers and other relevant stakeholders.

The main targeted standardization body of the project is Working Group 5 of the CEN Technical Committee 227 for "Road materials" with the title "Road surface characteristics", which supports CEN/TC 227 developing European standards on road surface characteristics. ROSANNE project partners develop drafts for standardization which are distributed to WG 5 as a possible basis for standards.

This document outlines the cooperation with Working Group 5 and surveys the possibilities of feedback options with regard to ROSANNE deliverables. As a first draft for the standardization roadmap to be provided with deliverable D5.1 is still outstanding this report cannot provide a specification of the standardization roadmap as of yet.

1 Introduction

ROSANNE is a collaborative project in the Seventh EU Framework Programme which aims at harmonising measurement methods for skid resistance, noise emission and rolling resistance of road pavements. The objective is to provide proposals for standardization and cooperate with the CEN Working Group 5 of CEN Technical Committee 227 for road materials. More specific objectives are:

1. Harmonisation of **skid resistance** measurements in Europe to a point where a common scale is established that can be applied to a significant number of the measurement devices currently used in Europe, either for maintenance management purposes or for new product acceptance.
2. **Noise emission:** Development of a procedure for harmonized characterization of road surfaces in regards to road surface noise properties across Europe based on the available measurement methods for standardization.
3. **Rolling resistance:** Development of a draft for standardization of a procedure for harmonized rolling resistance classification of road surfaces across Europe, based on the available measurement methods and results obtained in the project MIRIAM.
4. Part of the project ROSANNE is the exploring of the potential for recent developments in the measurement of surface texture to deliver parameters that better reflect the physical process of tyre/road interaction. This will improve the understanding of how the texture influences skid resistance, noise emission and rolling resistance.

The work is being performed in the following seven Work Packages (WPs):

- WP1: Measurement methods for the skid resistance of road surfaces
- WP2: Measurement methods for the noise emission properties of road surfaces
- WP3: Measurement methods for rolling resistance properties of road surfaces
- WP4: Common issues: Texture influence, reference tyres and reference surfaces
- WP5: Implementation and dissemination of results
- WP6: Scientific project management
- WP7: Administrative project management

This deliverable is part of WP5. The aim of WP5 is to summarize the findings of WP1 – WP4 and prepare them for introduction into the actual standardization process as well as for dissemination to the scientific community, road industry, road administrations, policy makers and other relevant stakeholders.

The main targeted standardization body of this project is Working Group 5 (WG 5) of the CEN Technical Committee 227 (CEN/TC 227) for "Road materials" with the title "Road surface characteristics", which supports CEN/TC 227 developing European standards on road surface characteristics.

The ROSANNE project and its progress is presented and discussed at every meeting of the WG and technical subgroups (TGs) by Mr Haider as member of WG 5 and project coordinator representative from AIT.

The final deliverables of ROSANNE Work Packages are distributed to WG 5. The idea is to use the findings as technical basis for the development and improvement of standards in the field of working group CEN/TC 227/WG 5. For standardization purposes a close cooperation with ISO Technical Committee 43, Subcommittee 1, Working Group 33: "Measuring method for comparing traffic noise on different road surfaces" (ISO/TC 43/SC1/WG 33)) is established.

2 Overview of the CEN system

2.1 European Standardization

The objective of European standardization is to harmonize national standards in member countries. This is achieved by adopting International Standards or alternatively the development of European Standards.

Today, between 85 and 90 % of all DIN's standardization projects are European or international. By comparison, 80 % of all DIN standardization projects were still national in origin in 1984.

2.2 CEN

CEN is one of the European standards organizations that are the umbrella organization for all national standards bodies in Europe. CEN co-ordinates and co-operates with CENELEC and ETSI both on strategic issues and the actual process of standardization with regards to new technologies, mandated work and areas of common interest.

In CEN there is one member each per country, representing the standardization interests of that country. German interests are represented by DIN in CEN.

Members are active in the organs of CEN, the General Assembly, policy and technical steering committees and technical committees, to which national delegations are sent to represent the represent the consolidated standpoint of their countries. Delegates from European organizations representative of the respective subject area may participate as observers.

2.2.1 National Standardization Body

European standardization is overseen by the National Standardization Body (NSB) of each country representing the CEN National Member, e.g. DIN is the national standardization body from Germany. The decision whether to actively participate at European level is taken by a national standards committee. Technical input and consultation is provided by a national mirror committee, which determines the member's opinion on a standards topic, develops its own proposals, and sends delegates to the European committee to represent the national position and partake of the consensus process.

2.2.2 CEN Technical Board

The CEN Technical Board (CEN/BT) is responsible for co-ordinating and managing the standards development work that is being carried out in more than 320 Technical Committees. In addition to overseeing these activities, as well as their related processes, the CEN Technical Board is also responsible for evaluating and addressing requests for standardization on new subjects. Technical Board (BT) members are appointed by the CEN National Members, i.e. EU member countries.

2.2.3 Technical Committee

A Technical Committee (TC) is the decision making body reporting to and established by the Technical Board (BT). Its main purpose is to manage the preparation of CEN deliverables.

This includes the delivery of the work programme and the establishment of Working Groups (WG) as well as the systematic review of published documents. Technical Committee members are appointed by the participating CEN National Members.

2.2.4 Working Group

A Working Group (WG) is reporting to and established by a Technical Committee (TC) or Subcommittee (SC) and undertakes a specific task, in the context of the TC business plan, usually resulting in the provision of (a) draft standard(s). It works within clearly defined policy guidelines from its parent body. Working Group members are appointed by the participating CEN National Members. [1]

2.2.5 CEN Deliverables/Documents

CEN produces a set of deliverables - differing in the levels of transparency, consensus and approval required before issue – offering a flexible means to meet market needs for technical requirements and information. Amongst these, the European Standard (EN) is the major deliverable, besides which CEN produces other publications with different objectives, such as the Technical Specification (CEN/TS) or the Technical Report (CEN/TR) that are of interest for ROSANNE.

a) European standard

   A standard is a document that provides rules, guidelines or characteristics for activities or their results, for common and repeated use. Standards are created by involving all stakeholders and a transparent, open and consensus based process. European Standards relate to products, services or systems. A European Standard automatically becomes a national standard and therefore is included in the standards catalogue of CEN's Members, the National Standardization Organizations in 33 countries.

   A European standard is reviewed systematically every 5 years by the responsible TC.

b) Technical Specification

   A Technical Specification (TS) is a normative document, the development of which can be envisaged when various alternatives that would not gather enough as to allow agreement on a European Standard (EN), need to coexist in anticipation of future harmonization, or for providing specifications in experimental circumstances and/or evolving technologies.

   A Technical Specification is established by a CEN Technical Body and approved by CEN National Members. The TS is announced at national level and may be adopted as a national standard, but conflicting national standards may continue to exist. However a TS may not conflict with a European Standard and if a conflicting EN is subsequently published, the TS is withdrawn.

   No time limit is specified for the lifetime of TSs, but the responsible Technical Body shall ensure that they are reviewed at intervals of not more than 3 years, starting from their date of publication.

c) Technical Report

A Technical Report (TR) is an informative document that provides information on the technical content of standardization work. It may be prepared when it is considered urgent or advisable to provide additional information. A TR is established by a CEN Technical Body and approved through a simple majority vote by the CEN National Members. It involves no obligation at national level.

No time limit is specified for the lifetime of TRs, but may be reviewed to ensure they remain valid.

2.3 Development of a European Standard

2.3.1 General Procedure on a European standard

The procedure on the development of a European Standard and of the transition of a European standard into a national standard is defined with the CEN/CENELEC Internal Regulations. [2]

European standardization work begins with a proposal for a standard, which might come from a CEN National Member, the European Commission, or another European or international organization.

If the proposal is accepted, a sufficient number of national standards bodies agree to participate and adequate financial resources are available, CEN allocates the work to an existing working group of the responsible technical committee, or sets up a new working group with appropriate experts.

One of the national standardization bodies assumes responsibility for running the secretariat for the Technical Committee. The responsible Working Group prepares a draft (taking into account any International Standards that have already been published on the subject) on the basis of consensus. CEN-CENELEC Management Centre launches the public enquiry by releasing English, French and German versions of a European draft Standard (prEN).

Participating CEN National Members are requested to submit the consolidated national standpoint. On the basis of the comments received a formal vote is launched. Participating CEN National Members are requested to decide whether to accept this final draft as a European Standard.

In case of disapproval the responsible TC will decide the next steps which can be the development of a second draft and enquiry or formal vote. In case of approval the standard is published by CEN after official ratification.

After ratification by CEN a European Standard must be implemented by all CEN National Members as a national standard. Any conflicting national standard must be withdrawn.

The procedure for other CEN Deliverables such as Technical Specification (CEN/TS), CEN Workshop Agreement and the Technical Report (CEN/TR) is similar but shorter as the formal vote is skipped. Those deliverables are used often to prepare for the development of European standards.

2.3.2 Adoption of ISO standards

With the proposal for new work the existence of published international work in the field on the particular topic, i.e. ISO standards, is checked. TC may decide to adopt the ISO standard as either an EN ISO standard without changes to the original. The document will be assessed by participating CEN National Members for suitability for progressing to a formal vote as a European Standard. For European Standards adopting ISO publications no review process is initiated at European level. These standards will be subject to the review carried out by ISO. [2]

New work may also be jointly developed with ISO under the Vienna Agreement. The Vienna Agreement (from 1991, revised in 2001) provides a framework for technical cooperation between CEN and the International Organization for Standardization (ISO). It provides provisions relating to the exchange of information between ISO and CEN, mutual representation at meetings, and parallel approval of standards.

The work may be offered to be carried out within ISO with parallel approval conducted by CEN under the terms of the Vienna Agreement. One of the two takes the lead in the standardization process. The other is supporting the development of the deliverable in parallel procedures which aligns the enquiries.

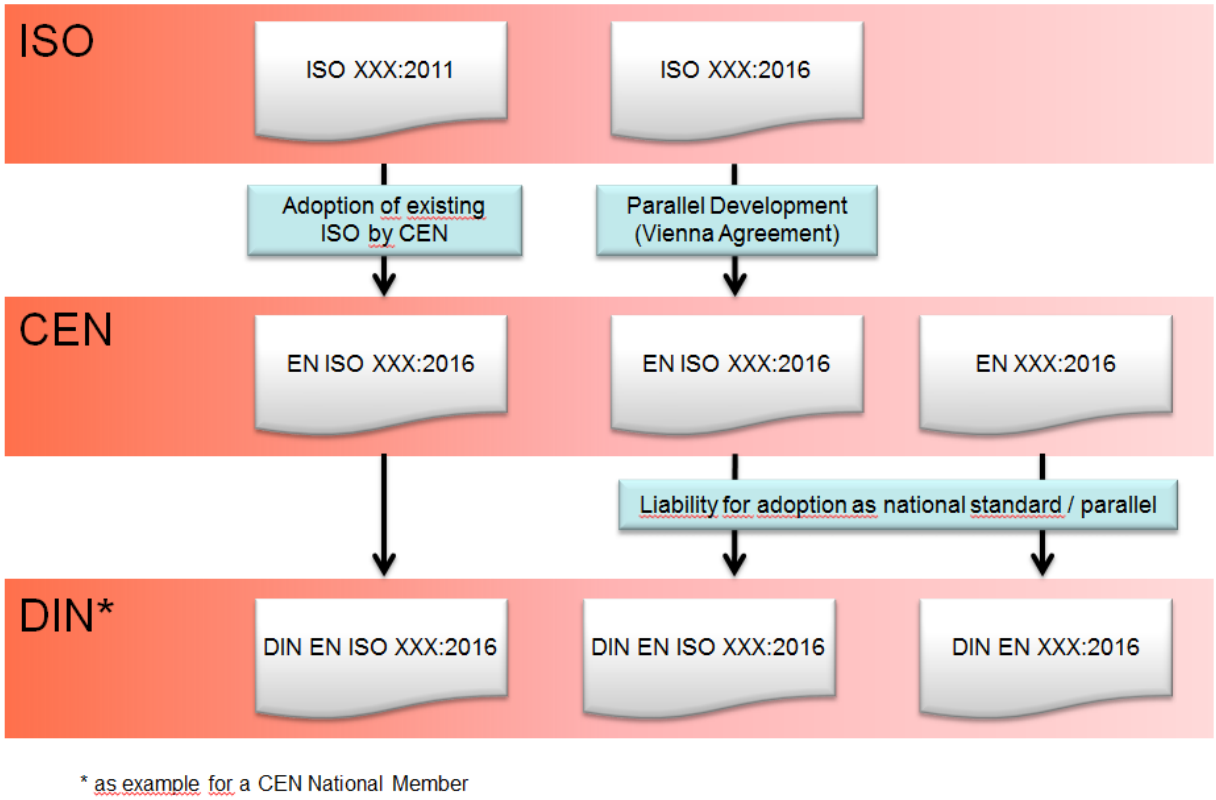

Figure 1: Overview of the development of a standard

2.3.3 Stakeholders for European standards

All interested parties including manufacturers, users, consumers and regulators of a particular material, product, process or service are involved in standardization.

CEN distinguishes between different stakeholders in standardization. This includes Industry and commerce with the subcategory of small and medium enterprises (SMEs < 250), Government, Consumers, Labour (social interests), Academic and research, Standards application, Environmental interests and other societal interests.

3 CEN/TC 227 "Road materials" and WG 5 "Surface characteristics"

3.1 General

The work program of CEN Technical Committee 227 (CEN/TC 227) includes the preparation of specifications, test methods and compliance criteria for materials for construction and maintenance of roads, airfields and other trafficked areas.

The work programme is treated in following Working Groups:

— WG 1 "Bituminous mixtures";

— WG 2 "Surface dressing and slurry surfacing";

— WG 3 "Materials for concrete roads including joint fillers and sealants";

— WG 4 "Hydraulic bound mixtures and unbound mixtures (including by-products and waste materials)";

— WG 5 "Surface characteristics";

— WG 6 “Sustainability”.

Special requirements for airfield pavement are discussed in parallel in Ad hoc group (AHG) "Airfields" in respect of the requirements of ICAO (International Civil Aviation Organization).

The convenor and the chairman discuss general issues at the Chairman's Panel which acts as an advisory group with CEN/TC 227 and also for preparation of TC meetings and such.

Liaison and Partner organizations of CEN/TC 227 are:

EAPA	European Asphalt Pavement Association
ECOBA	European Coal Combustion Products Association
EUROSLAG	The European Association representing metallurgical slags producers and processors
EuLA	European Lime Association

CEN/TC 227 cooperates with the following committees:

— CEN/TC 154 "Aggregates"

— CEN/TC 336 "Bituminous binders"

— CEN/TC 339 "Slip resistance of pedestrian surfaces – methods of evaluation"

— CEN/TC 350 "Sustainability of construction works"

— CEN/TC 351 "Dangerous substances"

— CEN/TC 396 "Earthwork" (planned)

3.2 Organization of WG 5

CEN/TC 227/WG 5 work program includes the preparation of European Standards on test methods to measure surface characteristics as required by CEN/TC 227.

For this purpose 3 Task Groups (TG) for preparations of work reporting to WG 5 have been established:

a) TG 1 "Longitudinal and transverse evenness"
   - liaison with ERPUG

b) TG 2 "Texture and skid resistance"
   - liaison with ISO/TC 43/SC 1/WG 39 and ROSANNE project

c) TG 3 "Acoustic properties of road surfaces"
   - liaison with ISO/TC 43/SC 1/WG 33 and ROSANNE project

WG 5 consists of representatives from all CEN National Members and stakeholders such as European national road administrations (NRAs), industry and research. See also chapter 2.3.3 for information about stakeholders in European standardization.

The secretariat of WG 5 was held by France (AFNOR) with the convenor Mr M. Boulet but will change in the near future. The secretariat of WG 5 will be held by Austria (ASI) with a new appointed convenor Mr. M. Haider.

3.3 Communication

The communication within the CEN system and all committees either European or national is based on Livelink, a Web-based collaboration and document management system.

As the circulation of documents is restricted to the responsible secretariat the communication the communication of results and deliverables is coordinated by DIN via the secretariat of WG 5 and/or directly by the delegates from CEN National Members (experts of WG 5).

A platform exclusive to ROSANNE project documents within the WG 5 Livelink will be established to make all deliverables and informative material available for the experts of WG 5.

4 Cooperation with CEN/TC 227/WG 5

4.1 Deliverables of ROSANNE

Many tasks of ROSANNE ask for cooperation with WG 5. DIN holding the secretariat for CEN/TC 227 coordinates the work also to WG 5 in collaboration with the secretariat of WG 5.

The following table shows the deliverables of ROSANNE Work Packages and how they are relevant for standardization.

Table 1: List of deliverables and relevance in regards to CEN/TC 227/WG 5

Del. No	Deliverable Title	Responsible	relevance for WG 5	due	Status ROSANNE
D1.1	Definition of boundaries and requirements for the Common Scale for harmonization of skid resistance measurements including draft standard outline	BASt	outline for standardization	2014-02	08.03.2015 Received
D1.2	Analysis of data from the first round of tests and initial development of the common scale	TRL	technical information	2015-02	
D1.3	Report describing the analyses and the development of the Common Scale options and the associated recommendations for implementation	TRL	technical information	2016-02	
D1.4	Quality Assurance Procedures to accompany proposed Common Scale(s)	BASt	technical information	2016-06	
D1.5	Draft prEN for harmonized skid resistance measurement for proposal to CEN/TC227/WG5	BASt	draft for standardization	2016-08	
D2.1	Outline of a draft standard for a procedure for the characterization of noise properties of road surfaces	AIT	outline for standardization	2014-02	08.03.2015 Received
D2.2	Report on temperature influence and possible corrections for measurement of noise properties of road surfaces	VTI	technical information	2014-10	
D2.3	Report on the analysis and comparison of existing noise measurement methods for noise properties of road surfaces	DRD	draft for standardization	2014-12	
D2.4	Draft standard for a procedure for the characterization of noise properties of road surfaces	AIT	draft for standardization	2015-10	
D2.5	Report on the compatibility of the proposed noise characterization procedure with CNOSSOS-EU and national calculation methods	IFSTTAR	technical information	2016-04	

Del. No	Deliverable Title	Responsible	relevance for WG 5	due	Status ROSANNE
D2.6	Report on the experimental validation of the procedure for characterization of noise properties of road surfaces including an updated draft standard	AIT	draft for standardization (update of D2.4)	2016-08	
D3.1	State of the art on rolling resistance measurement devices including draft standard outline	BASt	outline for standardization	2014-02	14.03.2014 Received
D3.2	Results of rolling resistance laboratory drum tests	TUG	technical information	2014-10	
D3.3	Parameters influencing rolling resistance and possible correction procedures	TUG	technical information	2014-12	
D3.4	Comparison of alternative test methods and theoretical models	VTI	technical information	2015-06	
D3.5	Draft standard for a trailer-based rolling resistance measurement method including robust calibration procedures	BRRC	draft for standardization	2015-10	
D3.6	Experimental validation of the rolling resistance measurement method including updated draft standard	IFSTTAR	draft for standardization (update of D3.5)	2016-08	
D4.1	State of the art concerning texture influence on skid resistance, noise emission and rolling resistance	BRRC	technical information	2014-04	08.03.2015 Received
D4.2	Texture-based descriptors for road surface properties and how they can be used in the appropriate standards	BASt	technical information	2015-02	
D4.3	Reference tyres and road surfaces for skid resistance, noise and rolling resistance measurements	VTI	technical information	2015-06	
D4.4	Variation of road surface texture and other geometric properties in transverse direction	VTI	technical information	2015-06	
D5.1	Draft roadmap for the standardization process	BASt	draft roadmap	2014-02	
D5.4	Report on feedback from and cooperation with CEN TC 227/WG5 and updated standardization roadmap	DIN	information	2015-04	
D5.6	Report on the cooperation with CEN/TC 227/WG5 including road map and implementation plan for future standards	DIN	information	2016-08	

The findings in form of deliverables will be communicated to WG 5. This will be the basis of cooperation.

4.2 Cooperation with CEN/TC 227/WG 5

4.2.1 ROSANNE projects presented at WG 5 meetings

- **25th & 26th April 2013, Prague**

The project ROSANNE and close cooperation with WG 5 was announced.

- **17th & 18th October 2013, London**

The project ROSANNE was presented and details of the project and expected deliverables were shown.

Skid resistance	Noise emission	Rolling resistance
Skid resistance tests as part of WP1 have been discussed briefly. The standardization strategy for skid resistance was discussed but no decision was made. The necessity to liaise with CEN/TC 227/WG 2 was highlighted as CEN/TS 13036-2 is specified in some countries with a minimum threshold level for some WG 2 products.	ISO/TC 43/SC 1/WG 33 (Measuring method for comparing traffic noise on different road surfaces) activities were observed and progress of ISO 11819-1 and ISO 11819-2 were reported. A first draft about pavement performance evaluation for noise indicating the structure of the document and the link to ROSANNE project findings were presented. The existence and purpose of the Stakeholder Reference Group (SRG) was announced. Meetings are planned in connection with WG 5 meetings	No detailed information was presented.

- **10th & 11th April 2014, Vienna**

This was the first meeting during the project duration. The planned activities were presented and details of the project and expected deliverables were shown.

Skid resistance of road surfaces	Noise emission of road surfaces	Rolling resistance of road surfaces
WG 5 supports a two steps strategy for future European harmonization of the measurement methods for the assessment of the skid resistance of road pavements. It is planned to address different	The planned adoption of ISO 11819-2 as EN ISO was confirmed. The Unique acceptance procedure as a faster standardization process is preferred.	There is no standard for the practical characterization of rolling resistance of road surfaces. This topic was discussed within WG 5. Relevant findings of ROSANNE project WP 3 will be reviewed in

measurement concepts in two parts. This will be based on the results of the findings of ROSANNE. EN/TS 13036-2 will be revised for this purpose.	the future.

- **9th & 10th of October 2014, Helsinki**

The progress of the project ROSANNE was presented and details of the project and expected deliverables were shown.

Skid resistance of road surfaces	Noise emission of road surfaces	Rolling resistance of road surfaces
The enquiry about the 5-years revision of EN 13036-2 confirmed the current standard, which means that there is currently no new Work Item for its updating. However, a first internal draft for a sideways friction method based on some of the existing technical specifications was discussed, which may be supplemented by ROSANNE results later.	Several comments have been received by WG33 for ISO 11819-2 (CPX) which need to be addressed in an updated document.	The ongoing activities in ROSANNE were presented to WG5.

- **28th & 29th April 2015, Utrecht**

The progress of the project ROSANNE was presented and details of the project and expected deliverables were shown.

Skid resistance of road surfaces	Noise emission of road surfaces	Rolling resistance of road surfaces
The promising results from the analysis of the first round of skid resistance tests in ROSANNE were presented and positively received by WG5. The data from the second round are being processed and WG 5 looks forward to reviewing the results.	ISO 11819-2 (CPX) will be resubmitted into the CEN processes as an updated document.	The ongoing activities in ROSANNE were presented to WG5.

- **The next meeting of CEN TC 227 WG 5 is planned for 12th & 13th of November 2015**

4.3 Report on feedback from WG 5

One objective of ROSANNE is to enhance harmonizing measurement methods for skid resistance, noise emission and rolling resistance of road pavements and provide proposals for standardization.

WG5 is requested to review the relevant deliverables when available and may evaluate the possibility of standardization if applicable. The objective in general is for WG 5 to use the drafts for standardization provided by ROSANNE for the development of new standards. On the basis of the drafts WG 5 is expected to proceed with the standardization process outlined in chapter 2.3.1.

Deliverables considered as technical information may be used as reference material and for technical input for standardization.

The following table will be updated in the process.

Table 2: Overview of WG 5 activities

Del. No	relevance for WG 5	due	Status ROSANNE	action in WG 5 / feedback
D1.1	outline for standardization	2014-02	finished	noted
D1.5	draft for standardization	2016-08		
D2.1	outline for standardization	2014-02	finished	noted
D2.3	draft for standardization	2014-12	finished	
D2.4	draft for standardization	2015-10		
D2.6	draft for standardization (update of D2.4)	2016-08		
D3.1	outline for standardization	2014-02	finished	noted
D3.5	draft for standardization	2015-10		
D3.6	draft for standardization (update of D3.5)	2016-08		
D5.1	draft roadmap	2014-02	finished	noted

4.3.1 Skid resistance of road surfaces

As significant number of the measurement devices currently used in Europe one objective of ROSANNE project WP1 is the harmonization of the various measurement methods for the

assessment of the skid resistance of road pavements. Two general concepts or principles have been identified.

WG 5 supports a two steps strategy for future harmonization of the measurement methods for the assessment of the skid resistance of road pavements. It is planned to address the different concepts in two parts. Technical input from ROSANNE is expected for a future skid resistance standard. This standard will be based on the results of the findings of ROSANNE. CEN/TS 13036-2 (Dynamic Skid Resistance measurement method) will be revised for this purpose. Furthermore the correlation between different measurement methods for skid resistance is discussed within WG 5. A close cooperation with CEN/TC 227/ WG 2 (Surface dressing, Sprays and Slurry Surfacing) is necessary as CEN/TS 13036-2 is specified in some countries with a minimum threshold level for some WG 2 products.

WG 5 planned to propose an internal draft for EN 13036-2 in 2015 (about transversal friction measurements) and finalize a document in 2016 with (longitudinal friction measurements).

The start of the revision of CEN/TS 13036-2:2010-09 is planned for 2016.

4.3.2 Noise emission of road surfaces

In 2011 WG 5 decided to develop a methodology for characterizing road surfaces according to their acoustical properties. With regards to findings from ROSANNE the concept may be extended to other properties in the future.

WG 5 proposed to adopt two ISO standards describing test methods:

- EN ISO 11819-1 (Acoustics - Measurement of the influence of road surfaces on traffic noise - Part 1: Statistical Pass-By method (SPB)), Vienna Agreement project with ISO lead (drafting body ISO/TC 43/SC 1/WG 33), status unchanged due to technical issues that need to be addressed first
- ISO 11819-2 (Acoustics - Measurement of the influence of road surfaces on traffic noise - Part 2: The close-proximity method (CPX)), Vienna Agreement project with ISO lead (drafting body ISO/TC 43/SC 1/WG 33, ISO/DIS status since 2014-10, will be adopted as EN ISO)

Technical input in regards to combination of SPB and CPX methods into a consistent harmonized method is expected from ROSANNE project Work Package 2 (WP2): Measurement methods for the noise emission properties of road surfaces.

Drafting of a European specification based on the ROSANNE findings and these ISO standards is considered to specify a procedure for testing noise emission of road surfaces.

The drafting of this specification is linked to the schedule and deliverables of WP2. Depending on the nature of the deliverables and the transferability of results of WP2 to standardization work results or answers may be expected as follows:

4.3.3 Rolling Resistance measurement method

WG 5 is waiting for results of ROSANNE project. Reviewing deliverables is not expected before 2016.

Table 3: Active Work Items within WG 5

Reference	Title	Standard Status
EN 13036-3:2002	Road and airfield surface characteristics - Test methods - Part 3: Measurement of pavement surface horizontal drainability	Published
EN 13036-7:2003	Road and airfield surface characteristics - Test methods - Part 7: Irregularity measurement of pavement courses : the straightedge test	Published
EN ISO 13473-1:2004	Characterization of pavement texture by use of surface profiles - Part 1: Determination of Mean Profile Depth (ISO 13473-1:1997)	Published
EN ISO 11819-1:2001	Acoustics - Measurement of the influence of road surfaces on traffic noise - Part 1: Statistical Pass-By method (ISO 11819-1:1997)	Published
EN 13036-8:2008	Road and airfield surface characteristics - Test methods - Part 8: Determination of transverse unevenness indices	Published
EN 13036-6:2008	Road and airfield surface characteristics - Test methods - Part 6: Measurement of transverse and longitudinal profiles in the evenness and megatexture wavelength ranges	Published
CEN/TS 15901-1:2009	Road and airfield surface characteristics - Part 1: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal fixed slip ratio (LFCS): RoadSTAR	Published
CEN/TS 15901-2:2009	Road and airfield surface characteristics - Part 2: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal controlled slip (LFCRNL): ROAR (Road Analyser and Recorder of Norsemeter)	Published
CEN/TS 15901-3:2009	Road and airfield surface characteristics - Part 3: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal controlled slip (LFCA): The ADHERA	Published
CEN/TS 15901-4:2009	Road and airfield surface characteristics - Part 4: Procedure for determining the skid resistance of pavements using a device with longitudinal controlled slip (LFCT): Tatra Runway Tester (TRT)	Published
CEN/TS 15901-5:2009	Road and airfield surface characteristics - Part 5: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal controlled slip (LFCRDK): ROAR (Road Analyser and Recorder of Norsemeter)	Published
CEN/TS 13036-2:2010	Road and airfield surface characteristics - Test methods - Part 2: Assessment of the skid resistance of a road pavement surface by the use of dynamic measuring systems	Published
CEN/TS 15901-6:2009	Road and airfield surface characteristics - Part 6: Procedure for determining the skid resistance of a pavement surface by measurement of the sideway force coefficient (SFCS): SCRIMÂ®	Published
CEN/TS 15901-7:2009	Road and airfield surface characteristics - Part 7: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal fixed slip ratio (LFCG): the GripTesterÂ®	Published
CEN/TS 15901-8:2009	Road and airfield surface characteristics - Part 8: Procedure for determining the skid resistance of a pavement surface by measurement of the sideway-force coefficient (SFCD): SKM	Published

Reference	Title	Standard Status
CEN/TS 15901-9:2009	Road and airfield surface characteristics - Part 9: Procedure for determining the skid resistance of a pavement surface by measurement of the longitudinal friction coefficient (LFCD): DWWNL skid resistance trailer	Published
CEN/TS 15901-10:2009	Road and airfield surface characteristics - Part 10: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal block measurement (LFCSK): the Skiddometer BV-8	Published
EN 13036-1:2010	Road and airfield surface characteristics - Test methods - Part 1: Measurement of pavement surface macrotexture depth using a volumetric patch technique	Published
EN 13036-4:2011	Road and airfield surface characteristics - Test methods - Part 4: Method for measurement of slip/skid resistance of a surface: The pendulum test	Published
EN ISO 13473-5:2009	Characterization of pavement texture by use of surface profiles - Part 5: Determination of megatexture (ISO 13473-5:2009)	Published
CEN/TS 15901-11:2011	Road and airfield surface characteristics - Part 11: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal block measurement (LFCSR): the SRM	Published
CEN/TS 15901-12:2011	Road and airfield surface characteristics - Part 12: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal controlled slip: the BV 11 and Saab friction tester (SFT)	Published
CEN/TS 15901-13:2011	Road and airfield surface characteristics - Part 13: Procedure for determining the skid resistance of a pavement surface by measurement of a sideway force coefficient (SFCO): the Odoliograph	Published
CEN/TS 15901-15:2014	Road and airfield surface characteristics - Part 15: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal controlled slip (LFCI): The IMAG	Published
prEN ISO 13473-1 rev	Characterization of pavement texture by use of surface profiles - Part 1: Determination of Mean Profile Depth	Not Published
	Road and airfield surface characteristics - Test methods - Part 5: Determination of longitudinal unevenness indices	Not Published
prEN ISO 11819-2	Acoustics - Method for measuring the influence of road surfaces on traffic noise - Part 2: Close-proximity (CPX) method	Not Published
FprCEN/TS 15901-14	Road and airfield surface characteristics - Part 14: Procedure for determining the skid resistance of a pavement surface using a device with longitudinal controlled slip (LFCN): ViaFriction (Road Analyser and Recorder of ViaTech AS)	Not Published

5 Updated standardization roadmaps

5.1 Harmonization and standardization of the measurement of skid resistance of road surfaces

5.1.1 Background

While it is recognised that skid resistance is a major contributor to road safety, it is difficult to compare the levels of skid resistance provided by roads in different countries across Europe. This is because the countries of the EU use different systems to measure skid resistance on their roads and they also have different approaches to the required level of skid resistance as an indicator for safety on the roads. There have been previous attempts to harmonise skid resistance measurements from different devices, such as The World Road Association (PIARC) experiment and the European HERMES project organised by FEHRL. However these ambitious projects and other smaller scale experiments have not been able to establish a common scale or algorithm which is sufficiently robust or has the required precision for it to be used for routine monitoring of skid resistance on road networks or for acceptance testing of new pavement constructions or construction materials.

The TYROSAFE project reviewed those earlier studies and concluded that, given the number of different devices operating on various principles and with different responses to the road and test conditions, it would be difficult to achieve a common scale that accommodates all devices and still obtains a sufficient precision. However, an acceptable precision using a common scale might be achievable if restrictions are placed on the range and types of devices in combination with their operating principles and conditions. Other devices could be accommodated by assigning them a “class” which indicates their reliability and precision in relation to the common scale. A different scale for different groups of operating principles was seen as a necessary first step.

TYROSAFE therefore proposed a road map with four different routes that could be taken to achieve harmonisation and, in the longer term, standardisation of skid resistance measurement within Europe (see Figure 2).

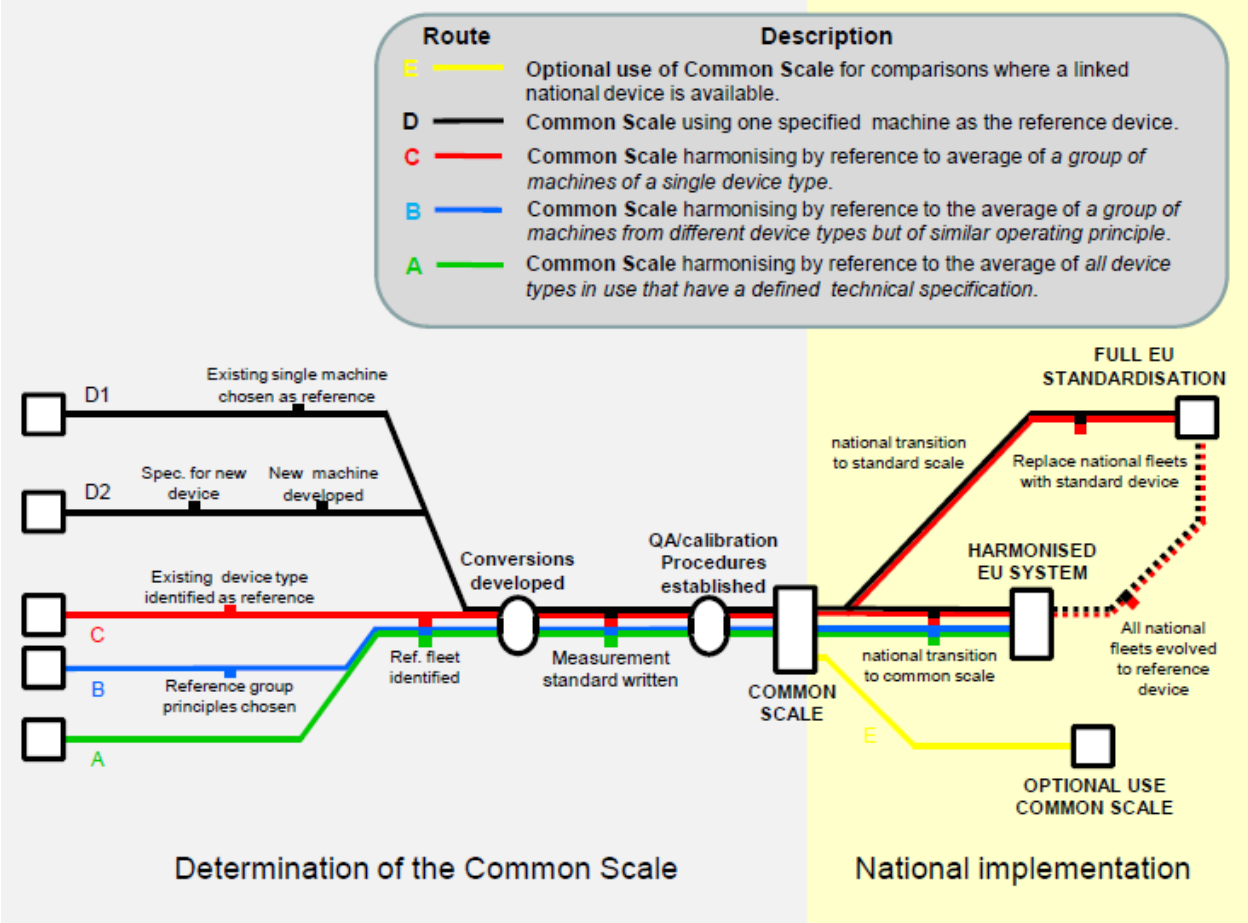

Figure 2: Road map developed by the TYROSAFE project

5.1.2 Prenormative research to be performed in ROSANNE

This project will undertake the research required to implement a part of the TYROSAFE road map. A combination of Route B and C of the TYROSAFE road map will be followed by grouping the existing devices according to the two different main measuring principles of side-force and longitudinal fixed-slip friction. By separating these groups, harmonisation and eventual standardisation will be made easier. The final objective is to achieve a standardized common evaluation scale for each principle which makes it possible to use any device from the respective group for the actual measurement. Results from these devices can then be converted into values on the common scale and are thus made comparable. The project will focus on continuously operating measurement devices (as opposed to locked-wheel and static devices). Within the studies, data will be collected and analysed to establish their precision. The analysis will also consider if a “Golden Device” might provide an effective means of reference to a common scale for both types (this is Route D1 on the TYROSAFE road map).

As well as a Common Scale, recommendations for Quality Assurance procedures and associated criteria will be defined. This will allow individual devices or groups of similar

devices to be assigned to an accuracy class that provides users of data with confidence in their measurement results.

Currently a set of technical specifications (TS) has been created in WG 5 to better define each of the separate measurement devices, as it was found that some devices which were nominally of the same type differed in relevant aspects which had not been regulated. Working with the CEN committee TC227/WG5, the existing technical specifications for the specification and operation of different devices will be reviewed and improved so they can be used to provide measurements to meet the classification requirements of the common scale.

Recommendations will be made for an on-going structure of occasional testing that will provide a mechanism for maintaining the validity of the common scale and the calibration of devices in different countries to it.

5.1.3 Input to standardization

The key deliverables which can directly be used as a basis for standardization for skid resistance are shown in Table 4.

Table 4: Skid resistance – key deliverables

Del. or MS no.	**Deliverable name**	**WP no.**	**Performance indicator**	**Delivery date (Project month)**
D1.1	Definition of boundaries and requirements for the Common Scale for harmonisation of skid resistance measurements including draft standard outline	1	Agreed definition of boundaries and limitations for Common Scale achieved. Draft standard outline provided.	4
D1.3	Report describing the analyses and the development of the Common Scale options and the associated recommendations for implementation	1	Common Scale for harmonization with acceptable accuracy of conversion formulas developed on the basis of validation tests.	28
D1.5	Draft prEN for harmonised skid resistance measurement for proposal to CEN/TC227/WG5	1	Draft standard created and presented	34

5.1.4 Special considerations for the standardization process

Road safety and the associated pavement property of skid resistance have already had a high priority on the agenda of road administrations across Europe for a considerable time. For this reason not only measurement devices but also evaluation systems, approval testing and asset management system have been built on the nationally collected skid resistance data. This means quickly transitioning to another measurement system means a loss of connection to a huge amount of historical data, the invalidation of evaluation schemes and limit values, and possible legal uncertainties. For this reason the approach was taken to use the existing measurements devices, to specify them more closely, to define their scope of use, to group comparable devices and to create a common scale for each group with satisfying precision. For this reason the resulting standards will describe the common scales and not individual devices. This approach was supported by CEN TC 227/WG5 and the details of the process will be worked out based on the scientific results from WP1, 2 and 3.

5.1.5 Update after the end of reporting period 1

The general strategy for skid resistance remains unchanged. However the following developments will be taken into account:

- Based on results from the first measurement campaign of WP1 the common scale appears to work quite well. However, the standard deviations on the common scale are still somewhat higher than those achievable for single-device fleets.
- Results from WP1 have shown that a subdivision of the group of devices measuring a longitudinal friction coefficient (LFC) into two subgroups with low and high slip ratio may be needed. This will be further discussed with CEN TC227/WG5 with regard to keeping the necessary number of final standards limited.
- In CEN TC227/WG5 a preference for creating single standard with two or three parts instead of two or three separate standards has been expressed and fixed in a resolution. However, this does not impact the technical content of the documents.
- Tyre grip is one of the three parameters to be shown in tyre labelling according to EU regulations 2009/661/EC and 2009/1222/EC.

5.2 Harmonization and standardization of the measurement of noise emission properties of road surfaces

5.2.1 Background

In recent years low-noise road surfaces have become more and more accepted as an effective means of road traffic noise abatement which has some key advantages over other options like noise barriers. Low-noise pavements reduce tyre/road noise at the source and the noise reduction does not depend on the relative position of noise source and receiver. Significant and beneficial noise reduction up to 10 dB(A) can be achieved in addition to other noise limitations on vehicles and tyres. The European Environmental Noise Directive 2002/49/EC (END) obliges the Member States to create noise maps around the major roads and inside the main agglomerations and to accompany them with action plans which could employ low-noise pavements as a key element. Therefore it is crucial to correctly characterize the acoustic performance of pavements for approval testing, monitoring and in connection with environmental noise calculation methods. Road authorities need such a characterization method in order to introduce specifications in the tenders for road surface renewals. Furthermore, road manufacturers also need a characterization method to compare their products, develop quieter products and thus increase their competitiveness. Because the noise performance of a given type of pavement are difficult to reproduce from one site to another, it is also very important for road authorities to dispose of a measuring method for checking the actual noise reduction once the new pavement is laid down. And because noise properties of road surfaces are not stable over time, there is a need for road owners to monitor the acoustic performances of their network. Finally, to draw the strategic noise maps as requested by END and design appropriate action plans, the responsible authorities need accurate and comparable input data related to the noise quality of the road surfaces. The acoustic properties of low-noise road surfaces have been or are being investigated in European projects like SILVIA, SILENCE or PERSUADE, among others.

The key standards for determining the pavement influence on road traffic noise emission are ISO 11819-1 (Statistical Pass-By or SPB method) and ISO/DIS 11819-2 (Close ProXimity or CPX method). While the SPB method relies on recording the sound pressure levels and speeds of passing by vehicles at the roadside, CPX uses trailers or special vehicles fitted with microphones close to the tyre/road contact of selected reference tyres. They offer complementary advantages and are continually improved by the responsible ISO working group, ISO/TC 43/SC 1/WG 33. Existing national noise characterization procedures typically use different variants of one or both methods.

Figure 3: CPX noise measurement trailer (DRD)

Noise characterization methods for approval testing, monitoring or the determination of input values for noise calculation procedures are available in several European countries at the national level. However, they use a variety of methodologies, based on several measurement methods and different references. Input road data for environmental noise calculations are currently often linked to the various national noise calculation schemes, and exhibit other national specifics, which makes results in general incomparable. However, with the common noise calculation method envisaged in the END and defined within the CNOSSOS-EU project, a common European method is under discussion to determine road surface noise correction and supply the CNOSSOS-EU method with a consistent set of input parameters for any type of road surface. It is of importance to check the applicability of this method to the more general purpose of road surface classification and its consistency with other envisaged methods. Within the European project SILVIA, a first proposal for such a common European noise characterisation methodology was presented. The data it delivered were as far as possible suitable for adaptation for input into national noise calculation schemes and the HARMONOISE/IMAGINE noise prediction model which was, at the time, expected to be the future European harmonised noise prediction model. The SILVIA project concluded before any validation of the characterisation methodology was performed and there has, at best, only been a very limited adoption of the principles of the methodology.

To achieve this objective, it is necessary to settle some remaining technical issues with the basic SPB and CPX standards, to more closely define the procedure by fixing additional parameters and topics not treated within the measurement standards and to evaluate the achievable precision and accuracy of the proposed combined procedure. In this project the necessary steps in the field of pre-normative research will be taken to achieve these objectives.

5.2.2 Prenormative research to be performed in ROSANNE

While the SPB and CPX methods already exist as ISO standards or at least drafts, they do not constitute a common consistent procedure for assessing the pavement influence on road

traffic noise emission. Due to the required measurements of a substantial number of vehicle pass-bys with a microphone at the roadside, the SPB method yields results which are only valid for a short pavement section of about 100 m length and can be very time-consuming if traffic is too dense or too sparse to isolate enough vehicle pass-bys. In addition to this measurement locations are more and more difficult to find, as they need to be sufficiently free from reflecting objects. Nevertheless most noise emission characterizations of pavements for noise mapping purposes have been based on SPB-type measurements so far. The CPX method based on a trailer with selected reference tyres on the other hand is very suited to measuring long road sections efficiently, and is largely independent of the traffic situation and the acoustic properties of the surroundings, as measurements are taken very close to the tyre/road interface. However, CPX only captures the tyre/road noise portion of road traffic noise and currently only a proxy tyre is used to represent heavy vehicle tyre/road noise, so there are some issues concerning representativeness.

For these reason the ROSANNE project will perform the following activities:

- Evaluation of both SPB and CPX methods and especially their relationship with each other, to determine if a conversion of results is possible with sufficient accuracy
- Investigation of open questions which are still present in the current methods like the correct temperature correction or the properties of the reference tyres
- Use of one or both of the methods to define a noise emission characterization procedure which also covers topics not addressed in the current standards like the required number and selection procedure of test pavement sections
- Development of a draft standard text for the procedure and validation of its workability through a measurement campaign

5.2.3 Input to standardization

The key deliverables which can directly be used as a basis for standardization for noise emission are shown in Table 5.

Table 5: Noise emission – key deliverables

Del. or MS no.	Deliverable name	WP no.	Performance indicator	Delivery date (Project month)
D2.1	Outline of a draft standard for a procedure for the characterization of noise properties of road surfaces	2	Draft standard outline provided.	4
D2.2	Draft standard for a procedure for the characterization of noise properties of road surfaces	2	Updated draft of the method completed.	24

Del. or MS no.	Deliverable name	WP no.	Performance indicator	Delivery date (Project month)
D2.4	Report on the experimental validation of the procedure for characterization of noise properties of road surfaces including an updated draft standard	2	Successful validation testing. Final draft standard created and presented.	34

5.2.4 Special considerations for the standardization process

Different variants of the CPX and SPB methods are currently used in national procedures for type approval and approval testing of low-noise road surfaces across Europe. As they are currently linked to national noise mapping procedures, their results are usually not comparable. With the impending introduction of common European noise calculation methods for environmental noise there is a good chance for also harmonizing the way that pavement influence on road traffic noise emission is determined across Europe.

5.2.5 Update after the end of reporting period 1

The general strategy for noise emission remains unchanged. However the following developments will be taken into account:

- Based on results shown in D2.3 and after the discussions in the MS05 workshop the experts in the consortium have decided to use the CPX method as the primary basis for the noise characterization method to be developed in ROSANNE.
- This decision will be discussed with CEN TC 227/WG5 and the SRG at the next meetings.
- Using CPX as primary method provides a lot of practical advantages. However, especially if the results are to be used for noise mapping purposes, there may be limits to the validity of the results which still have to be checked.
- The common European Noise calculation method has been decided on and will be an annex to the next version of the European Environmental noise directive. While default values for the pavement influence on road traffic noise are given, only a limited set of pavements is covered. It is possible to use user-defined emission parameters for other pavements. It is intended to design the ROSANNE procedure to be able to deliver these types of parameters if possible.
- Noise emission is one of the three parameters to be shown in tyre labelling according to EU regulations 2009/661/EC and 2009/1222/EC.

5.3 Harmonization and standardization of the measurement of rolling resistance properties of road surfaces

5.3.1 Background

Rolling resistance is generally defined as the force F_r acting on a tyre or vehicle and opposite to the speed vector, mainly due to the hysteresis of the deformation of the tyre in the contact zone with the road surface, which gives rise to energy losses. As a measure for the rolling resistance, one generally uses the *rolling resistance coefficient* $C_r = F_r / F_z$. This coefficient depends on several tyre and road surface parameters as well as the vehicle speed. As the road surface properties play an important role in the exact mechanics of the tyre-road contact (deformation, adhesion, sliding, etc.) it is reasonable to attempt to optimise road surfaces for low rolling resistance when confronted with typical tyres and driving speed patterns. The reliable measurement of rolling resistance coefficients is a necessary basis for such optimisations, which can be further enhanced by modelling and understanding the underlying mechanisms.

However, the overall driving resistance is also influenced by other effects, some of which can also in turn be influenced by the design of the road infrastructure. Longitudinal unevenness of the road can induce losses in the vehicle suspension. Gradient resistance is related to general layout of the road. In mountainous regions gradient resistance can easily become the dominant component of driving resistance. Moreover, the road trajectories govern the possible speed patterns and driver reactions, which in turn determine the level of tyre road interaction effects like rolling resistance in different driving situations.

Currently there is an existing international standard for the measurement of the rolling resistance of tyres in a laboratory environment on a steel drum (ISO 28580). However there is no corresponding standard for the contribution of pavements to rolling resistance, which is clearly a tyre/road interaction phenomenon.

To reduce CO_2 emission and fuel consumption in Europe it is essential to have a sound technical and scientific understanding of the contributions of the various factors affecting rolling resistance. This knowledge is crucial for the new design of road infrastructure and pavements able to reduce the fuel consumption and CO_2 emission. To address these knowledge gaps, robust methods of measuring rolling resistance in the field and laboratory are required. Although various methods, such as trailer methods, laboratory test on drums and coast down methods for measuring rolling resistance are available, the methods are associated with uncertainty and other unknown factors, which include:

- the repeatability of rolling resistance measurements on short and medium term
- the length of the test section for field tests, and the required number of test runs
- the optimum reference tyre to be used for field and/or laboratory measurements
- the effects of drum curvature for laboratory tests
- the effects of surface temperature, grade, tyre inflation, and travel speed

In 2011 the MIRIAM project conducted a round robin test of the three trailer devices existing in Europe, demonstrating that additional comparing and analysing of specific parameters are needed. This step is crucial for a European harmonisation that shall lead to a European standard on trailer-based rolling resistance measurements shall be achieved. The MIRIAM project pointed out a set of issues which need be investigated to obtain harmonisation of rolling resistance measuring devices.

Figure 4: Rolling resistance measurement trailer (BASt)

5.3.2 Prenormative research to be performed in ROSANNE

This work package will fine-tune and harmonize the trailer measurement method for rolling resistance. Currently, there is not even a common description of the method; just some practices by the organizations having such equipment. To improve the trailer method all factors influencing the measurements have to be assessed and described. This includes macrotexture, megatexture, unevenness, temperature, tyre load and inflation, surface stiffness, surface wetness, lateral and longitudinal slopes of surfaces, air drag and test speed. Some of the factors have to be corrected to a standard to be able to compare measurements done with for example different ambient temperature. Furthermore to get repeatability over time and reproducibility between different trailers a calibration procedure has to be described. To get the connection from trailer measurements and alternative test methods such as the full vehicle energy consumption and the ISO standard on tyre rolling resistance measured in a drum facility, it is necessary to conduct comparison tests ultimately leading to the link between trailer measurements and vehicle CO_2 emission. When all the necessary tests and measurements will have been conducted, a draft standard for rolling resistance measurement with the trailer method will be described.

While it may not be possible to describe one complete procedure to be used for all trailers, a framework with requirements will be developed in order that measured results can be harmonized. The final report will be a firm recommendation of a CEN and/or ISO standard for trailer measurements. To validate the factor corrections and calibration procedures described in the draft standard a round robin test will be carried out with rolling resistance trailers and comparable measurement as coast down and fuel consumption measurements of full vehicle controlled drive cycle.

5.3.3 Input to standardization

The key deliverables which can directly be used as a basis for standardization for noise emission are shown in Table 6.

Table 6: Rolling resistance – key deliverables

Del. or MS no.	Deliverable name	WP no.	Performance indicator	Delivery date (Project month)
D3.1	State of the art on rolling resistance measurement devices including draft standard outline	3	Draft standard outline provided.	4
D3.5	Draft standard for a trailer-based rolling resistance measurement method including robust calibration procedures	3	Updated draft of the method completed.	24
D3.6	Experimental validation of the rolling resistance measurement method including updated draft standard (report)	3	Successful validation testing. Final draft standard created and presented.	34

5.3.4 Special considerations for the standardization process

Rolling resistance is currently mainly recognized as a tyre-related issue and the possible contribution of pavements is often neglected. However, even limited improvements of the rolling resistance a pavement surface can help to achieve substantial reductions of fuel consumption and CO_2 emission considering the high traffic volumes and significant lifetimes of pavements.

5.3.5 Update after the end of reporting period 1

The general strategy for rolling resistance remains unchanged. However the following developments will be taken into account:

- Research on several influencing factors has been performed in WP3, however, the main input to standardization will be provided in RP2 with D3.5.
- So far no work item exists in CEN TC 227/WG5 for rolling resistance. Creation of a work item will depend on the progress achieved in ROSANNE.
- Rolling resistance is one of the three parameters to be shown in tyre labelling according to EU regulations 2009/661/EC and 2009/1222/EC.

References

[1] CEN BOSS http://boss.cen.eu

[2] CEN/CENELEC Internal Regulations, ttp://boss.cen.eu/reference%20material/RefDocs/Pages/default.aspx