

# AV '19 KONFERENCE ASFALTOVÉ VOZOVKY 2019

## Perf. Specs. for Bit. Emulsions in Europe How to improve the present situation?

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**Motto: Spirit of Don Quixote**

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## Contents

- **THE BACKGROUND** – EU Regulation and CEN
- **EN 13808 AS IT IS TODAY** – Characteristics and test methods
- **EN 13808 AS IT IS TODAY** – Evaluation
- **HOW TO IMPROVE EN 13808** – Some proposals
- **CONCLUSION** – Future perspectives

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## THE BACKGROUND

EU Regulation and CEN

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## The CPR – Construction Products Regulation

### EU/305/2011 applies to all EU Member States

- To remove barriers to trade for construction products → CE marking
- Construction works must satisfy a set of 7 « Basic Requirements »

### Mandate M/124 (road construction products) – July 1998

- Given to CEN by the European Commission
- Identifies the Basic Requirements to be addressed by bituminous emulsions

### Task ascribed to CEN Tech.Com. (TC336/WG2 for bit. emulsions)

- Propose Essential Characteristics and test methods (Answer to the Mandate)
- Design harmonized product standard (EN 13808) accordingly

## Mandate M/124 – Bituminous emulsions

**C - Bitumen emulsion, fluxed bitumen emulsion, polymer modified bitumen emulsion, fluxed polymer modified bitumen emulsion**

ER	Performance characteristics	Durability
1 and 4	<p>Viscosity</p> <p>Water effect on binder adhesion</p> <p>Breaking behaviour</p> <p><i>after stabilisation of the resting binder:</i></p> <p>Hardness (including temperature dependence)</p> <p>Resistance to flow / deformation (including temperature dependence)</p> <p>Cohesion</p> <p>Adhesion</p>	<p><b>Y</b></p> <p>(Against ageing, weathering, oxidation, ... as relevant)</p>
2		
3	Release of dangerous substances*	

## New Standardization Request

### Background

- Citations issues with several Product Standards (e.g. EN 12591)
  - ➔ **TC 336 has decided to cancel revision of EN 13808 for the time being**
- EC wants to replace Mandate procedure by Standardization Requests
- TC336 has been invited to participate to the design of SRq for bituminous binders

### Some issues to be solved

- Definition of Essential Characteristics vs Installation (operational) Characteristics
  - Sieve Residue does not affect end product performance but is important for both producers and users
  - Should all the properties of the emulsion as such be considered as being Installation Characteristics but not Essential (in the sense of the CPR) ?
- Should Installation Characteristics be covered by a separate, non harmonized, Std.?

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## EN 13808 AS IT IS TODAY

Characteristics and Test methods

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## EN 13808 as it is today

### Essential Characteristics

#### ➔ Relating to the emulsion as such

- Viscosity : Efflux time or dynamic viscosity
- Resistance to displacement by water : on a coated reference aggregate
- Breaking behaviour via « exposure to filler » tests

#### ➔ Relating to residual binders

- Consistency at intermediate service temperature (Needle Penetration)
- Consistency at elevated service temperature (Softening point or Viscosity)
- Cohesion (for polymer modified emulsions only)  
*Pendulum test or Tensile test or Force-Ductility*



## EN 13808 as it is today

### Essential Characteristics – Residual binders

- ➔ **The binder « once on the road »** (just after the breaking of the emulsion)
  - EN 13074-1 plate test : thin film of emulsion: 1 day at ambient + 1 day at 50°C
  - Assumed to be close to the initial bituminous binder
- ➔ **Stage 1 for durability : stabilized binder**
  - EN 13074-2 = EN 13074-1 + 1 day at 85°C
  - Assumed to correspond to 1 or 2 years in service
- ➔ **Stage 2 for durability : long term aged stabilized binder**
  - EN 13074-2 followed by a PAV ageing procedure (EN 14769 – 65h at 85°C)
  - Not much experience so far

## EN 13808 as it is today

### Other specified characteristics – « Voluntary » characteristics

#### ➔ Not related to the Mandate

- Binder content
- Residue on 0,5 mm sieve
- Oil distillate content
- Residue on 0,16 mm sieve
- Storage stability and settling tendency

Compulsory

May be selected at national level













#### ➔ Related to Basic Requirements but not identified in the answer to the Mandate

- Viscosity through efflux time at 85°C
- Penetration power
- Fraass breaking point
- Elastic recovery

May be selected at national level

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## EN 13808 as it is today

			Performance Classes							
Technical Requirement (Mandated or voluntary characteristics)	Test standard	Unit	Class 0	Class 1	Class 2	Class 3				Class n
Requirement N°1	EN...	x	empty or NR	empty or DV						
Requirement N°2	EN...	y	empty or NR	empty or DV						
Requirement N°p	EN...	z	empty or NR	empty or DV						

NR No Requirement  
DV Declared Value



Specification ranges, lower or higher limits

**A product is to be specified by allocating the adequate performance class to each technical requirement**

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## EN 13808 AS IT IS TODAY

Evaluation

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## Evaluation of EN 13808 as it is today

### Structural shortcomings

- ➔ **Status of « Voluntary » vs « Essential » Characteristics is unclear**
  - Binder content & Sieve residue are important for the industry but not Mandated
  - Some « Voluntary » characteristics should in fact be « Essential » in the sense of the Mandate: e.g. Fraass breaking point, Elastic recovery
- ➔ **Several possible performance tests for a given Essential Characteristic**
  - Not in line with the requirements of the Mandate (a single test)
- ➔ **Extensive use of the « NR » (No Requirement) performance class**
  - Allows to select test methods proper to a given use and/or country

EN 13808 is indeed a “Framework” rather than a true product standard  
Not a strong help to the paving industry for the promotion of emulsion technology

## Evaluation of EN 13808 as it is today

### Test methods

#### ➔ Not always relevant

- Viscosity through efflux time (cannot account for dependency upon shear rate)
- Breaking behaviour through « filler » tests : their relevance is doubtful, especially for coating applications (e.g. micro-surfacing),

#### ➔ Poor reproducibility

- Recovery and stabilization procedures
- But also viscosity, breaking behaviour, .....

#### ➔ Still rather empirical

- Consistency and cohesion tests

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## HOW TO IMPROVE EN 13808

Some proposals

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## Possible ways to improve EN 13808

### Structure of the standard

#### ➔ Specifications to be related to intended uses

- Allows an optimized definition of the characteristics to be specified
- Much clearer for producers, contractors and road owners

#### ➔ Revision of Essential and Installation Characteristics

- Clearly identify the Essential Characteristics which are **relevant** and **needed** for each type of intended use
- Make a clear distinction between Essential and Installation Characteristics
  - Obvious for some (sieve residue, storage stability, ...)
  - May be debated for others (viscosity, breaking behaviour, water effect on binder adhesion)
- Make Installation Characteristics compulsory when they are needed (avoid NR)



## Emulsion-types described by their performance requirements


Type		SPRAYING APPLICATIONS General description	Typical application
A	SPRAYING APPLICATIONS	Emulsions which are used for spraying applications and for which: <ul style="list-style-type: none"> <li>- Breaking behaviour and adhesive bond to aggregates is a key requisite</li> <li>- The residual binder (after breaking of the emulsion) will be directly exposed to traffic and environmental constraints over a prolonged period of time.</li> </ul>	<b>Surface dressing</b> <b>Fog-seals</b>
B		Emulsions which are used for spraying applications and for which: <ul style="list-style-type: none"> <li>- Breaking and bonding has to be achieved onto an existing surface and not to a sprayed aggregate.</li> <li>- The residual binder (after breaking of the emulsion) is not intended to be directly exposed to traffic or environmental constraints for a long time.</li> </ul>	<b>Tack-coat</b> <b>Curing layers</b>
C		Emulsions which are used for spraying applications and for which: <ul style="list-style-type: none"> <li>- The main objective is to penetrate an existing surface of unbound materials as deeply as possible</li> <li>- The residual binder is intended to stabilize the upper part of the unbound layer but there is no particular requirement with regard to mechanical performance and durability.</li> </ul>	<b>Impregnation</b>


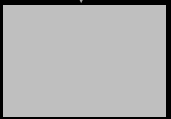

## Emulsion-types described by their performance requirements

Type		COATING APPLICATIONS General description	Typical application
D	COATING APPLICATIONS	Emulsions which are used for coating applications and which have to be formulated specifically in relation to a given type of aggregates and targeted aggregate grading curve. Formulation of the emulsion and assessment of the performance of the final aggregate-emulsion mixture is done via specific (sometimes proprietary) test methods. Type D emulsions are intended for wearing course mixes and may be more or less fluxed depending on the desired level of storability and requested mechanical performance.	<b>Micro-surfacing</b> <b>Cold mixes for wearing courses</b>
E		Similar description as for Type D emulsions except that Type E is to be used for mixes which are intended to be overlayed (typically gravel-emulsions). Type E should therefore not be highly fluxed.	<b>Gravel-emulsion</b>
F		Type F emulsions are used for open-graded cold mixes intended to be used for small and local repair operations. There are no strong mechanical nor durability requirements for such mixes. These emulsions are generally heavily fluxed to ensure storability over a certain period of time.	<b>Storable mixes</b> <b>Open-graded cold mixes for small repairs</b>
G		Type G emulsions are used for recycling operations in which the binder brought by the recycling emulsion is to have a "softening" effect on the residual bituminous binder of the recycled material (RAP). In this case, the relevant emulsion binder characteristics are those of the initial or recovered binder. Properties of the stabilized binder are no longer relevant since the binder "in-place" will be a combination of the new "virgin" binder brought by the emulsion and of the "old" binder (to be addressed by the performance assessment of the recycled mixture).	<b>Recycling</b> (with rejuvenating effect)

## Essential Characteristics of the emulsion as such ?

### A possible analysis

Impregnation  Other emulsions  
 Sprayed with aggregates (Surface dressing & similar) 

Essential characteristics applicable to the emulsion as such	Potential test methods			
Viscosity	EN 12846-1 or EN 13302	x	x	x
Breaking behaviour in the presence of mineral surfaces	EN 13075-1	x		
Penetration power	EN 12849		x	
Water effect on binder adhesion	EN 13614	x		

### But

- Viscosity is not directly impacting end performance
- Breaking behaviour and water effect on binder adhesion could rather be seen as Essential Characteristics for the ad-hoc end-product ( EN 12271, EN 12273, ....)

## Installation Characteristics

### Handling & Placing – Factory Production Control

Installation Characteristics	Test methods
Binder content	EN 1428 or EN 1431 or EN 16849
Oil distillate content	EN 1431
Sieve residue at 0.5 mm and 0.16 mm	EN 1429
Storage stability by sieving - 0.5 mm sieve	EN 1429
Settling tendency	EN 12847
Breaking value with mineral filler	EN 13075-1
Fines mixing time	EN 13075-2
Mixing stability with cement	EN 12848



For surface dressing emulsions, the operational standard must refer to hEN 13808 if the harmonised standard retains EN 13075-1 for the assessment of Breaking Behaviour

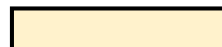
## Essential Characteristics applicable to residual binders

Other emulsions

"Thick" cold paving mixes

Tack-coats, Surface dressing, Microsurfacing

Essential characteristics applicable to recovered and stabilised binders	Potential test methods			
<b>Recovered binder</b>	EN 13074-1			
Consistency at intermediate service temperature	EN 1426	x	x	x
Consistency at high service temperature	EN 1427 / Dyn. or Kin. Visc.	x	x	x
Impact cohesion	EN 13588	x		
Tensile cohesion	EN 13587/EN 13589		x	
Elastic recovery at intermediate service temperature	EN 13398	x	x	x
<b>Stabilised binder</b>	EN 13074-1 & 2			
Consistency and evolution of consistency with temperature - Consistency at intermediate service temperature	EN 1426	x	x	x
- Consistency at high service temperature	EN 1427 / Dyn. or Kin. Visc.	x	x	x
Brittleness at low service temperature	EN 12593	x	x	x
Impact cohesion	EN 13588	x		
Tensile cohesion	EN 13587/EN 13589		x	
Elastic recovery at intermediate service temperature	EN 13398	x	x	x
Evolution of consistency at elevated service temperature after an accelerated ageing procedure	EN 14769 + EN 1427	x	x	x



Polymer or latex modified emulsions

## Possible ways to improve EN 13808

### Improved test methods

#### ➔ On the emulsion as such

- Replacement of efflux time by dynamic viscosity
- Breaking behaviour:
  - To be taken over by ad-hoc final product standards for coating emulsions
  - Filler test to be replaced by breaking on aggregate for surface dressing emulsions ?
- Search for alternatives to the plate recovery and stabilization tests

#### ➔ Characterization of residual binders

- Empirical tests may ultimately be replaced by DSR and BBR test methods
- In parallel to the proposed evolution the standards for paving bitumen and PmB
- But implementation will be hampered by missing field validation

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## CONCLUSION

Future perspectives

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## Will EN 13808 ever be a Performance Related Specification ?

### Will largely depend on the degree of freedom permitted by the future Standardization Request

#### ➔ **Revision of Essential Characteristics**

- Conversion of existing ones into Installation Characteristics
- Addition of new ones

#### ➔ **Agreement on the definition of Essential Characteristics in relation to intended uses**

#### ➔ **Agreement on how to cover (non harmonized) Installation Characteristics**

- Within the harmonized standard
- Through a separate, non harmonized, standard



## Will EN 13808 ever be a Performance Related Specification ?

### We need more efficient, reliable and performance oriented test methods

- Alternatives to plate recovery and stabilization methods
- Development of dynamic viscosity, alternatives to breaking index, ...
- Development of DSR and BBR criteria

### But resources and money are scarce

#### ➔ Lack of pre-normative research

- Not many experienced laboratories in this field
- Not enough interest from Administration and Academia

#### ➔ Field validation is even more problematic

- No funding available so far on European level

In Europe, progress will only become possible if the paving industry accepts to actively invest in the development and validation of better test methods

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