CEN/TC 226 Secretariat
"Road equipment"
"Equipements de la route"
"Straßenausstattung"

CEN/TC 226 N 1445

2015-04-10

CEN/TC 226 – prCEN/TR "Road marking materials — Conditions for removing/masking road markings":

- **Draft decision D 564c/2015, Addition of a NWI**
- **Draft decision D 565c/2015, Launching of the TCA on the prCEN/TR, attached**

Action : **Vote on CIB, deadline: 2015-06-01**

Source : CEN/TC 226/WG 2

Comments : -

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CEN/TC 226 Secretariat
"Road equipment"
"Equipements de la route"
"Straßenausstattung"

CEN/TC 226 Draft Decision 564c/2015
Per correspondence
Issue date: 2015-04-13
Deadline: 2015-06-01

Decision CEN/TC 226 xxx/xxx taken on 2015-06-xx

Subject: CEN/TC 226 - Adoption of a New Work Item

CEN/TC 226 - Road equipment

- having considered the proposal for a new work item as documented in CEN/TC 226 N 1445
- having considered the Guidance - Adoption of a new work item in a CEN Technical Committee as documented in the BOSS
- confirming that the new work item falls within its scope
- confirming that the new work item corresponds to real market needs
- confirming that the resources to complete the work below are available
- decides to register the work item described below in its active programme of work

Section	**Details**
1. Deliverable	TR
2. This item corresponds to	a new project
3. Document developed in drafting body	CEN/TC 226/WG 2 - Horizontal road signs
4. Title	Road marking materials — Conditions for removing/masking road markings
5. Scope	This document provides guidance for removal or/and masking existing road markings It includes methods of removal with criteria for the method selection as well as the requirements for the masking materials and the performance requirements of the resulting surface. It does not apply to removable temporary road markings which shall be removed in accordance to the manufacturer instructions Some recommendations are given for removing and masking road studs, removing wet paints, removing curing membranes in new cement concrete pavements and cleaning existing road markings
6. Environmental aspects	None of the above. Not relevant

Section	Details
7. How do you plan to address these environmental aspects?	Other: Not relevant
8.Vienna Agreement	No or expected CEN lead
9.The project is linked to	No document from another organization
10. Track	TC Approval (TCA) by correspondence
11. Related mandate(s)	No
12. Related directive(s)/regulation(s)	No
13. Commitment	The following CEN members (at least five) are committed to participate in the development of the project:
14. The decision was taken by	Simple majority Number of positive votes: Number of negative votes: number of abstentions:

To vote using CIB

CEN/TC 226 Secretariat
"Road equipment"
"Equipements de la route"
"Straßenausstattung"

CEN/TC 226 Draft Decision 565c/2015
Per correspondence
Issue date: 2015-04-13
Deadline: 2015-06-01

SUBJECT: CEN/TC 226 – WG 2 - Launching of the TCA on prCEN/TR 00226xxx, Road marking materials — Conditions for removing/masking road markings

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DRAFT Decision xxx taken by CEN/TC *226* on 2015-06-xx

Subject : Launching of TCA by correspondance

CEN/TC 226, Road equipment

- considering CEN/CENELEC Internal Regulations - Part 2, sub-clause 11.3, which lays down the rules related to the preparation of Technical Specifications;
- the work item being approved in the programme of work of the Technical Committee;

decides to launch a TC Approval by correspondence (TCA) on work item 00226xxx (see decision 564c/2015), prCEN/TR, Road marking materials — Conditions for removing/masking road markings

The decision was taken by unanimity or simple majority with N positive votes, N negative vote(s) and N abstention(s).

To vote using CIB

*Thanks to use the last version of "Commenting Form" for your comments (version 2012-03 **with 8 columns**)*

CEN/TC 226

Date: 2015-03

Draft Technical Report: TR XXXX

CEN/TC 226

Secretariat: AFNOR

Road marking materials — "Conditions for removing/masking road markings”

German title

French tille

ICS:

Descriptors:

Contents

Foreword

There are many situations in which road marking removing or masking become necessary. This document is intended to give some guidance about how to proceed in these cases.

This Technical Report (TR) describes a number of methods for removal and masking and gives guidance for the appropriate selection. Not all methods are valid or recommended in all cases; some methods are limited by the kind and nature of existing road marking and the pavement surface. Also the cost of the operation is depending on the amount of marking to be removed.

In some countries these operations are regulated, in particular in some countries masking the existing road marking only with black paint is forbidden.

The quality of the removal or masking or any combination of them may be not enough or resulting in a new “phantom road marking”, which, under some illumination conditions, may be more visible than the real road markings (introducing confusion) or may change the surface texture (introducing hazard). Works shall be done in such a way that the risk for confusion or hazard for drivers be minimized.

Furthermore, recommendations are given for some frequent works such as removing and masking road studs, removing wet paints, removing curing membranes in new cement concrete pavements and cleaning existing road markings

1 Scope

This document provides guidance for removal or/and masking existing road markings It includes methods of removal with criteria for the method selection as well as the requirements for the masking materials and the performance requirements of the resulting surface.

It does not apply to removable temporary road markings which shall be removed in accordance to the manufacturer instructions

Some recommendations are given for removing and masking road studs, removing wet paints, removing curing membranes in new cement concrete pavements and cleaning existing road markings

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1436:2007+A1:2008, *Road marking materials — Road marking performance for road users*

EN 1824:2011, *Road marking materials — Road trials*

EN 13197:2011, *Road marking materials — Wear simulator Turntable*

EN-ISO 2813: Paint and Varnishes – Determination of specular gloss on non metallic paint films at 20 degrees, 60 degrees and 85 degrees.

3 Definitions

3.1 Removal:

Permanently elimination of road markings. May be partial or complete

3.2 Masking:

Temporary hiding of road marking using a topcoat of a material similar in color, luminance and specular gloss, to the pavement surface.

3.3 Phantom line (shadow line):

Road marking or print resulting from the line removal or masking process.

3.4 Specular gloss:

Ratio of the luminous flux reflected from an object in the specular direction for a specified source and receptor angle to the luminous flux reflected from a glass with a refractive index of 1,567 in the specular direction

4 Criteria for selecting removal or/and masking procedure

There are situations in which existing road marking must be obliterated so as to not function as a recognizable road marking (phantom line). In order to do it, Removal or Masking techniques may be used. Removal may be done totally or partially and masking may be done as the unique procedure or after a partial removal. In order to take the good decision it is also important to know if the obliterated road marking shall be renewed or not and if the surface will be repaved or not. Table 1, gives a guidance to apply these criteria

Table 1: Guidance for removal/masking procedures in different situations

Situations for removal or masking			Removal/masking criteria			
			removal		Masking	
Work needed	Road marking renewal is foreseen?		Totally	Partially	Only	After partial removal
			1	2	3	4
Permanent change on the road marking lay out	NOT	A	YES	Only in some cases	NO	Only in some cases
Preparation of the substrate	YES	B	YES	YES	NO	NO
Hiding road marking on temporary basis	YES or NOT	C	YES	YES with masking	YES	YES

When a road marking has to be applied and removed after a short period of time (for instance less than 6 months) removable temporary materials, in accordance to EN 1824, shall be used.

Removal of such removable temporary materials shall be done in accordance to the manufacturer instructions

For each case, some criteria are given in the following:

A.1 When permanent changes in road markings lay out occurs (as for instance. new exits/entrances from main road, exchange from continuous line to interrupted line, direction of arrows, etc); unwanted road markings should be preferably totally removed.

A.2 When the existing road marking has good adhesion and more than 70% surface coverage; partial removal can be accepted. The removal processing must not adversely damage the pavement surface. There are limits (see clause 6.1.2) for changes in surface texture and grooving and for the residual road markings. If damage to the pavement could exceed the limits, then for a complete obliteration of the road marking a complementary masking with a blend of bitumen and fine aggregate may be used to minimize the difference in level and appearance..

A.3 When permanent changes in road marking occurs; unwanted road marking shall never be obliterated by masking

A.4 Same comments as in A.2

B.1 Existing road markings (formed for one or several layers) that have lost adhesion to the pavement or inter- layers (more than 30% of the marked area is affected) shall be totally removed before renewal.

B.2 Existing multilayer road markings not fulfilling with the essential requirements (EN 1436) may be renewed with a new layer whenever the resulting thickness of the whole multilayer system does not exceed 6000 microns. If this thickness is exceeded they shall be partially removed. The resulting surface shall be compatible (chemically) with the new material; otherwise the existing road marking should be totally removed or treated with a primer.

Existing structured road markings which have to be renewed with another structure pattern shall be fully or partially removed. The thickness extent will depend on the patterns of the existing and the renewed structure.

B.3 Masking is not accepted for preparing surfaces before renewal. Primers may be used in order to improve the adhesion and compatibility conditions of the existing substrate with the new material, but it cannot be considered a masking material

B.4 Partial removal followed of a masking is not a recommended procedure for preparing substrate for road marking renewal, with the exception mentioned in B-3 in the case of the application of a primer could be considered convenient.

C.1 Temporary hiding without subsequent renewal (because of changes in the lay out) and without repaving; a total removal should be done.

C.2 Temporary hiding with subsequent renewal: Totally removal is recommended but partial removal may be used in combination with masking. Removal is necessary when the existing road marking is a structured road marking Comments given in A.2 are applicable.

C.3 Temporary hiding with subsequent renewal or repaving: When the thickness of the existing road marking is lower than 3000 microns and the number of layers less than 3, just masking may be used.

C.4 Temporary hiding with subsequent renewal: When the thickness is higher than 3000 microns or there are more than 3 layers; totally removal is recommended but partial removal and masking may be allowed.

5 Removal methods and masking materials

5.1 Removal methods

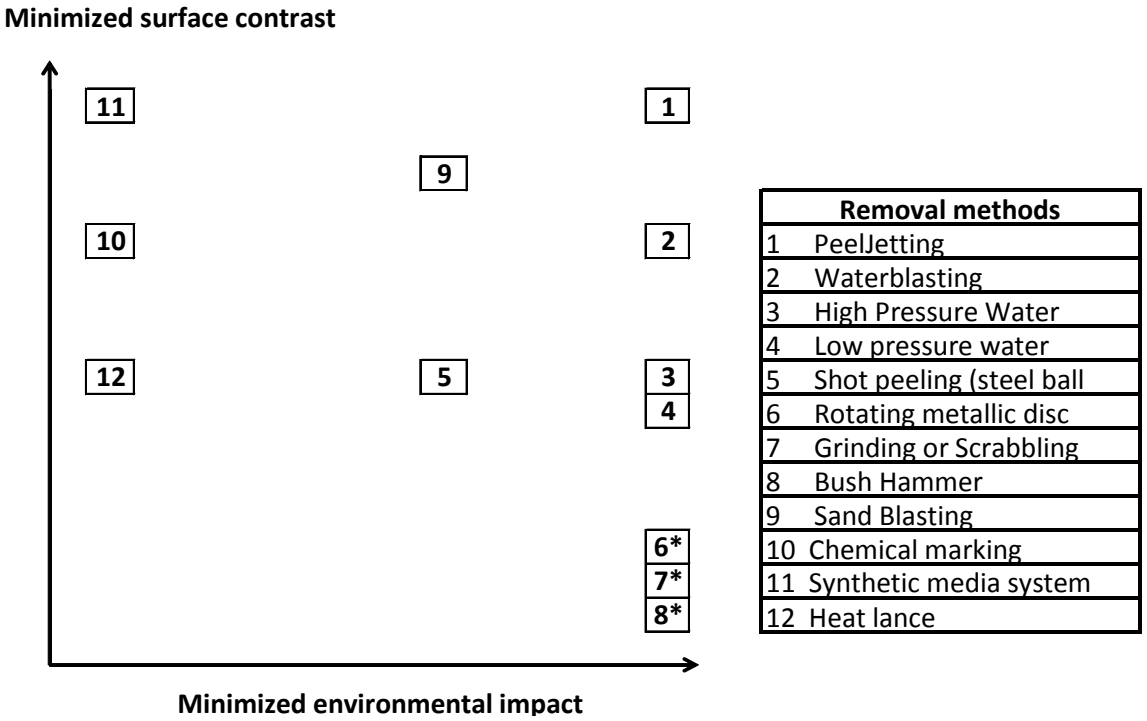
The selection of the most efficient method to remove road markings depends on the type of road marking material and on the type of pavement surface. Table 2 gives a list with the most common types of removal methods. A more detailed description of each of the removal methods listed in table 2 may be found in Annex A.

The selection shall take into account if the removal has to be done totally or partially and in which extent. The selection will take also into account thickness of the existing road marking and the nature and texture of the pavement surface.
The complete removal (with not more than a 5% of old marking particles remaining) means also removal of material in between the aggregates at the surface. The more important issue is the grade of aggregate (stone) loss – or “surface grooving” upon marking removal from asphalt surfaces.

Removal road marking formed by a multilayer system, thermoplastics and/or cold plastics will, in consequence, requires a more aggressive removal process; than removal of an old, worn, paint. Moreover

removal thermoplastic is recommended to be done at low temperatures (at cooler seasons and at night better than during hot and sunny days)

Table 2: List of removal methods all types of pavement and all types of road marking materials



Removal methods	
1	PeelJetting
2	Waterblasting
3	High Pressure Water
4	Low pressure water
5	Shot peeling (steel ball
6	Rotating metallic disc
7	Grinding or Scrabbling
8	Bush Hammer
9	Sand Blasting
10	Chemical marking
11	Synthetic media system
12	Heat lance

It is obvious that an easier, more worn material, will give a less impact than a new durable marking. Furthermore, it is clear that a hard concrete surface is less depending on a gentle removal technology than open porous asphalt

*6; 7; 8 is not recommended others than for partial removal, unless strong concrete surface or sealing component

5.2 Masking materials

Masking of existing road marking only may be used on temporary basis. Masking may be used as the unique method but also after a partial removal.

For masking the unwanted road markings, colored paints, thermoplastics, cold plastics and preformed road markings may be used. These materials may be removable or non-removable.

Application instructions may include drop-on materials or the addition of some dye in order to adjust the contrast (lower as possible) with the existing pavement and to avoid specular gloss. Suppliers are required to provide comprehensive application instructions.

Materials shall be tested on Road Trials (In accordance to EN 1824) or on Wear Simulator (in accordance to EN 13197). The application shall be done onto an previous existing white road markings. The requirements to be fulfilled by the masking products are:

- Luminance Factor (EN 1436): ≤ 0,06

- Specular gloss (EN ISO 2813) a 85º: ≤ 0,50
- Skid resistance (EN 1436) SRT units ≥ 45 SRT units
- Durability (EN 1824 or EN 13197) ≥ P2

6 Performance requirements

6.1 Removal

The main target of the work is that the quality of the removal shall minimize the risk for confusion and hazard for the drivers considering visual aspects and changes on surface properties.

Visual aspects: After removal the resulting shadow lines must not be visible at night or day, so that there will be some limits for:

- Retroreflection and luminance
- Luminance contrast with the adjacent pavement surface (minimized “Phantom lines”)
- Remaining road marking

NOTE 1: Normally the luminance deviation will be automatically evened out; by the normal dirt pick up and wearing from traffic. This will happen in a fairly short period of time (approximately 2 months depending on the ADT). However - if the initial values from the luminance deviation (contrast) are unacceptable; the contrast can be adjusted by a sprayable, colored, bitumen.

NOTE 2: The use of aggressive (Metallic) removal technologies, may require to “seal” the surface with some Sealing or masking material

Changes on surface properties: There will be some limits for:

- Changes in the surface texture
- Grooving

NOTE 3: After removal there are two things that may change: texture and level compared with the adjacent pavement. Texture may be measured with a simple test method (sand patch) by using the MTD (mean texture depth) and expressed as (MTD_d - MTD_u)= x mm (d damaged; u undamaged) or by a profilometer by using the MPD (mean profile depth) and expressed as)MPD_d - MPD_u)< y mm

NOTE 4: The level of the damaged area is lower than the adjacent level of the pavement. The texture can be rougher, similar or smoother. This damage is hereafter called “grooving” Level difference by measuring the depth of a groove (D)

6.1.1 Test methods

Test methods for visual aspects

6.1.1.1 Coefficient of retroreflected luminance R L: Shall be measured in accordance to EN 1436 (classes for road markings are not applicable)

6.1.1.2 Coefficient of retroreflected luminance under diffuse illumination Qd: Shall be measured in accordance to EN 1436 (classes for road markings are not applicable)

6.1.1.3 Qd contrast defined as (QdRM – QdP)/QdP. and expressed as a ratio; where QdRM is Qd on the road marking and QdP is Qd on the adjacent pavement)

6.1.1.4 Remaining road marking. This parameter may be evaluated with reference to a number of the photographic reference in Annex B or as the percentage of remaining road marking calculated with recognized electronic devices and image treatment

6.1.1.5 Test methods for evaluating changes in surface properties

Properties of texture depths following the original surface specifications, will be allowed, if there are changes they will be evaluated as follows:

- **x** is the difference between the mean texture depth between the zones damaged and the undamaged (MTD_d - MTD_u = x mm) and is measured in accordance to the test method defined in Annex C and expressed in classes X1 and X2 in accordance to table 3
- **y** is the difference between the mean profile depth between the zones damaged and the undamaged (MPD_d - MPD_u = y mm) and is measured in accordance to the test method defined in Annex C and expressed in classes Y1 and Y2 in accordance to table 3
- **D** is the difference between the level of the zones damaged and undamaged by measuring the depth of a groove and is measured in accordance to the test method defined in Annex C and expressed in classes DI and D2 in accordance to table 3

Table 3: Classes for the characteristics defining the changes in surface properties

Changes in surface properties	Characteristic and symbol		Requirement		Not requirement
			Classes		NPR is used when Not Performance is Requested
			1	2	
	Texture depth or	X	≤ 1mm	1mm ≤ x ≤ 2mm	
	Profile depth (optional)	Y	≤ 1mm	1mm ≤ y ≤ 2mm	
	Grooving	D	≤ 1mm	1mm ≤ D ≤ 2mm	

6.1.2 Table of performance requirements

For the parameters described above, when required, the threshold values are as in table 4

Table 4: Performance requirements for removal

Performance requirement	Parameter and expression		Removed	
			Totally	Partially
Visual aspects	Coefficient of retroreflected luminance R_L in mcd·m-2·lx-1		≤ 40	NPR*
	Contrast ratio of Qd defined as (QdRM – QdP)/QdP		≤ 0,5	NPR*
	Remaining road marking (optional)	Photographic reference nº	> 8	As necessary
		Image treatment %	≤ 5	
Surface changes	Mean Texture depth (MTD) or	X (class)	X2	NPR*
	Mean profile depth (MPD)	Y (class)	Y2	
	Deep of a groove	D (class)	D1	
* NPR: Not Performance Requested				

6.1.3 Environmental prescriptions

Removal shall be executed with technology, fulfilling the following requirements:

- It shall be a closed system (direct suction of residues and removal material)
- Removal technology shall be free from chemicals
- Burning fumes shall not be acceptable
- Noise reduced systems are required when working close to habitants (less than 80 db < 10 meters)
- Operators on the road will only be accepted during set-up process (technology shall be operated from the vehicle drivers cabin).

6.2 Masking

The main target of the work is that the quality of the masking shall minimize the risk for confusion and hazard for the drivers considering visual aspects and changes on surface properties.

Visual aspects; old road markings must not be visible at night and day, so that there will be some limits for:

- Minimum Luminance contrast with the adjacent pavement surface (minimized “Phantom lines”)
- Maximum specular gloss

Changes on surface properties: There wil be some limits for.

- Skid resistance

NOTE: When arrows, letters or symbols are to be masked, it has to be done in a rectangle or square pattern in such a way to minimize the drivers being confused.

6.2.1 Test methods

6.2.2 For visual aspects

Qd contrast defined as (QdRM – QdP)/QdP. and expressed a a ratio. (QdRM: Qd on the road marking and QdP : Qd on the adjacent pavement). Qd shall measured in accordance to EN 1436

Specular gloss: shall be measured in accordance to EN ISO 2813 at 85º

6.2.3 For changes on surface properties

Skid resistance: Shall be measured in accordance to EN 1436

6.2.4 Requirements

For the parameters described above, when required, the requirements values are described in table 5

Table 5: Performance requirements for masking

Performance requirement	Parameter and expression	Masking
Visual aspects	Contrast ratio of Qd defined as (QdRM – QdP)/QdP	≤ 0,5
	Specular gloss	≤ 0,50
Surface changes	Skid resistance SRT Units	≥45

7 Other works

7.1 Removal and masking road studs

Road studs are classified by their use in permanent or temporary and by their design in depressible or non depressible

Temporary road studs should be easily removed following the instructions of manufacturer without damaging the road surface and leaving little or no adhesive traces on the road surface

Masking of depressible road studs should be done by substituting the depressible insert by a black insert with no lenses.

Removing depressible and drilled road studs should be done with special equipment. The resulting hole needs to be filled and sealed.

Masking non depressible or bonded road studs has not successful solutions when running traffic over them. If something has to be done, road studs may be surface dressed around, sealed with a black coloured adhesive totally or only over the reflective part.

Bonded road studs must be removed by sliding a shovel along the surface and under the edge of the studs slicing them off the surface. Levering road studs from the road surface must be avoided because it may cause damage to then road surface.

7.2 Wet paint markings

Although this guide is aimed primarily at providing information on removal of markings that are set or dry, an explanation is provided of the methods and issues relating to immediate remedial actions or cleans ups of inadvertent transfers or damage of painted markings.

Crushed glass, sand or similar powdered material may be used to absorb incorrectly marked pavements, provided it is applied immediately, and at such a quantity that it blots up all free solvents. This material

is then swept up and disposed of in a controlled manner. Any remaining markings should be indiscernible to the drivers after light trafficking.

An alternative approach for small quantities is to wait for the paint to firm up before scraping off using a paint scraper. The remaining paint can be scrubbed off using solvent soaked rags and / or wire brush.

7.3 Cleaning/renovation of line markings

Several durable markings at the marked have in mixed glass beads and corundum. Renovation of a durable marking shall remove enough material from the marking to bring up in mixed aggregates to bring the system properties to prescribed levels. This, obviously, without damaging the glass beads. Normally Water Jetting is the prescribed technology for renovation of markings.

7.4 Removal of concrete curing membranes

To prolong the curing process (and optimize the hardness of the surface) of a new concrete road; the concrete surface is over sprayed with an (normally acrylic or paraffin based) film. Before application of durable marking; this film shall be 100% removed. (Normally, also, a base primer will be required by the authorities, in between the cleaned surface and the durable marking).

It is of outmost importance that this removal process is deep. As the surface is uneven it is necessary to have a removal ratio slow enough to compensate also for surface irregularity – so that concrete film will not remain in the “valleys” of the surface.

8 Bibliography

NZRF LINE REMOVAL GUIDE Rev 2 February 2011. Issued by the New Zealand Road markers Federation Inc.

BS 7962:2000: Black material for masking existing road marking – Specification

Annex A: Methods for removing road markings (informative)

A.1 General

Regardless which technology you will choose for your line removal; the removal process is dependent on good operators and especial education would be suggested.
All technologies will generate damage to the surface when the cleaning process is too agressive.
The removal technologies can be divided into three families:

- Removal through clean water (clause A.2)
- Removal through metallic technologies (clause A.3)
- Other removal technologies (clause A-4)

A.2 Removal through water

Basically there are four types of removal through water

A.2.1 PeelJetting

PeelJetting is a closed, high pressure water Jetting system, with a multiple nozzle disc configuration. The water is generating an exceptionally gentle cleaning effect (Peeling effect); as the water has an impact on the material/surface, with small radius.
In general can be said that, the best optimization of numbers of nozzles, nozzle sizes and nozzle angles; will generate the best results.
Some PeelJet system is computerized and is then not so dependent on good operators.
The advantage of this method is that surface impact is minimized and the removal efficiency is very high.

A.2.2 Waterblasting

Waterblasting is a closed, high pressure water jetting system, with a lower amount of nozzles mounted on one, or two, propellers. The technology is well recognized at the market and will generate sufficient results with good operator.
The surface impact is minimized but is much more depending on the good handling (skill operator). The removal efficiency may be high

A.2.3 High Pressure Water Jetting, others

There is a large number of high pressure water jetting systems for line removal at the market. Some are more primitive in respect of technology level, quality (in machinery and performance) and safety for the workers. Some are better or acceptable. This has to be proven by the ordering body/authorities.

The surface impact is depending on the kind of equipment and its correct handling and the efficiency is normally low.

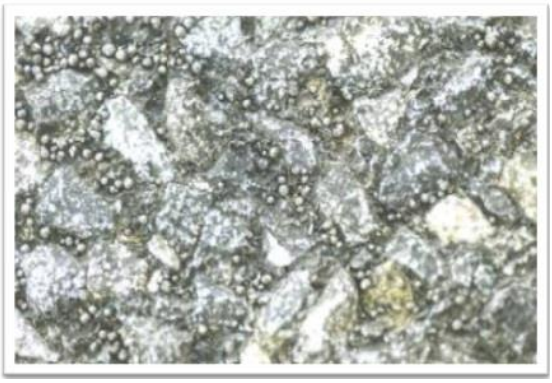
A.2.4 Low pressure water Jetting

Normally simply “open” systems (without suction system); normally operated by satellite devices (or handgun).
The surface impact is normally low but removal efficiency is also very low

A.3 Removal through metallic technologies

A.3.1 Shot peeling (steel ball technology)

A large number of steel balls are thrown out (propellered with great speed (normally) driven by compressed air) with high speed, crushing the material. The steel balls and residues are sucked up and separated; and the steel balls are circulated in the system. The system is fairly good to the surface; but is not optimal when it comes to 100% removal as the steel balls will not reach properly in between the aggregates of the surface. The “Ghost Line”/”Shadow line” will be more visual than with water based systems. Steelballs will remain in the surface.
Furthermore the system is not operable during wet conditions.
Surface impact is normally low. Removal efficiency is medium to high (depending on equipment size)



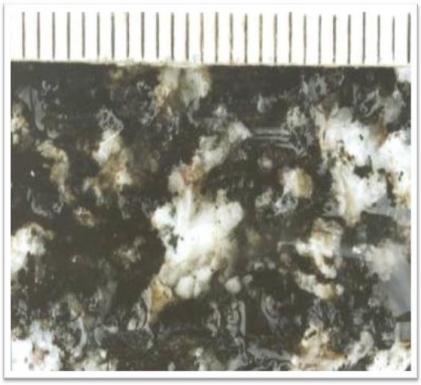
A.3.2 Rotating metallic disc

This technology is commonly referred to as “twister”. System is excellent for partial removal – leaving ~100 µ at the surface. It is highly effective. Disadvantages when you are angling the disc is that you can experience a U-shaped removal profile in the marking; which may give you disadvantages upon application of the new marking (especially if the second layer is sprayed).
This system is not recommended for 100% removal; as it does not reach in between aggregates. You will then need to remove also the surface – to get rid of the marking.
It is not recommended for 100% removal but it has an high efficiency on partial removal

A.3.3 Grinding or Scrabbling

This system is based on a motorized rotation of hardened steel with a “tooth”. It is commonly used, and cost effective, for partial removal of smaller areas of marking. 100% removal is only possible by removing asphalt surface – as this technology will not reach in between the aggregates. Therefore this technology requires “Strip Sealing” (see clause 3.3). There is unacceptable many deep cut’s (/scares) in road surfaces as a result of the usage of Grinding or Scrabbling technology. Most contractors have a small grinding machine – and it is

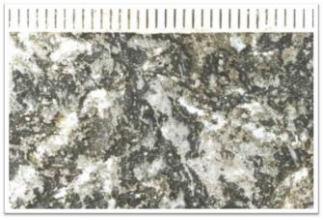
up to the ordering body/Authorities to decide the technology to be used at the jobsite; following the prescriptions in clause 3.3.
If used for 100% removal the resulting surface should be normally sealed. A variety from low to medium to high efficiency on removal (depending on equipment size)



2008 Swanston CT 2000 Line Removal Grinder with Vacuum,

A.3.4 Bush Hammer

A large number of steel shafts is hammering the marking material away. 100% removal is only possible by removing asphalt surface – as this technology will not reach in between the aggregates. Therefore this technology requires “Strip Sealing” (see clause 3.3).
If used for 100% removal the resulting surface should be normally sealed. A variety from low to medium to high efficiency on removal (depending on equipment size)



A.4 Others

A.4.1 Sand Blasting

Sand are thrown out (normally, driven by compressed air) with high speed, crushing the material. The system is normally “open”; i.e. requires separate suction/sweeper unit to collect sand and residues. The technology is considered to be environmentally hazardous; and requires special protection equipment.
The impact on the surface is low but the removal efficiency is also low!

A.4.2 Chemical marking removers

Normally a Methylene solvent is used to dissolve the marking; which is afterwards normally removed by low pressure water.

This technology is normally unacceptable form an environmental prospective

A.4.3 Synthetic media system

Normally Sodium Bicarbonate or dry ice, is mixed in a blasting head together with high pressure water jetting.
Field tests has shown system not to be effective

A.4.4 Heat lance

Burning the marking away.
This technology is environmentally hazardous and is not allowed in some countries.

A.5 Execution of work

It is strongly recommend that the ordering body survey the original set up of the removal technology. The work performance shall follow the prescriptions in clause 3.3.
After approval of original values – the removal contractor is responsible for obtaining the result throughout the jobsite.

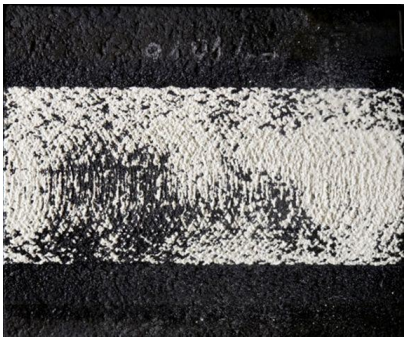
Annex B: Photographic references (informative)

Reference to one of the numbers bellow each picture may be done in order to ask for a required level of removing trough remaining amount of road marking. As additional information, next to each number and into brackets, are the percentages of remaining road marking in each picture

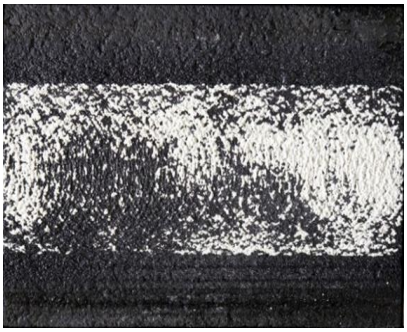
1 (100%)

2 (95% to 100%)

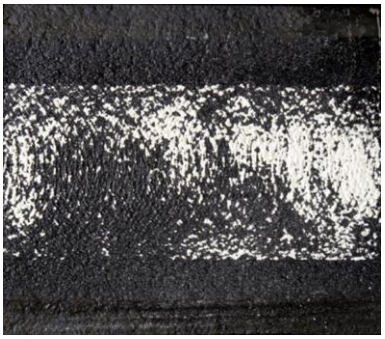
3 (80% to 95%)



4 (65% to 80%)



5 (50% to 65%)



6 (35% to 50%)

7 (20% to 35%)

8 (5% to 20%)

9 (0% to 5%)

Annex C: Assessing the damage to the pavement after the removal of road markings (informative)

C1 Introduction

The removal of a road marking can damage the wearing course of a road. One can have the following typical damage patterns:

- The pulling out of individual or groups of aggregates, small mastic particles etc. This local raveling leaves the level of the damaged area unaltered, but the surface becomes more textured in the macro- and even megatexture range, i.e. it becomes “rougher”. This damage type is hereafter referred to as “raveling”
- The appearance of a shallow groove in the pavement where the marking has been. E.g. the milling off of line markings can cause such damage. The level of the damaged area is lower than the adjacent level of the pavement. The texture can be rougher, similar or smoother. This damage is hereafter called “grooving”

In the present proposal, two different methods and criterions are suggested to assess the damage of these two types.

C.2 Raveling

A good measure for the macrotexture roughness of a pavement is the so called mean texture depth (MTD) or mean profile depth (MPD), which are similar parameters with a linear relationship. But the measurement method is different: the MTD is measured with the sand patch method (EN 13036-1:2010) and the MPD is calculated from a 2D texture profile measured with a profilometer (in most cases a laser profilometer), according to ISO 13473-1:2003[1]. Both MTD and MPD may be used to assess the raveling, the first one having the advantage that it is a cheap measurement method and the second that it is more precise.

C.2.1 Assessment of the raveling with MTD

Select visually a “suspect” zone with a length of about 1,5 m. Then one should measure on three spots in the damaged zone and in three nearby spots on the undamaged pavement the MTD. See the measurement positions in figure C.1.

[1] This standard is currently under revision and a first draft of the revision will soon be ready (around June 2013)

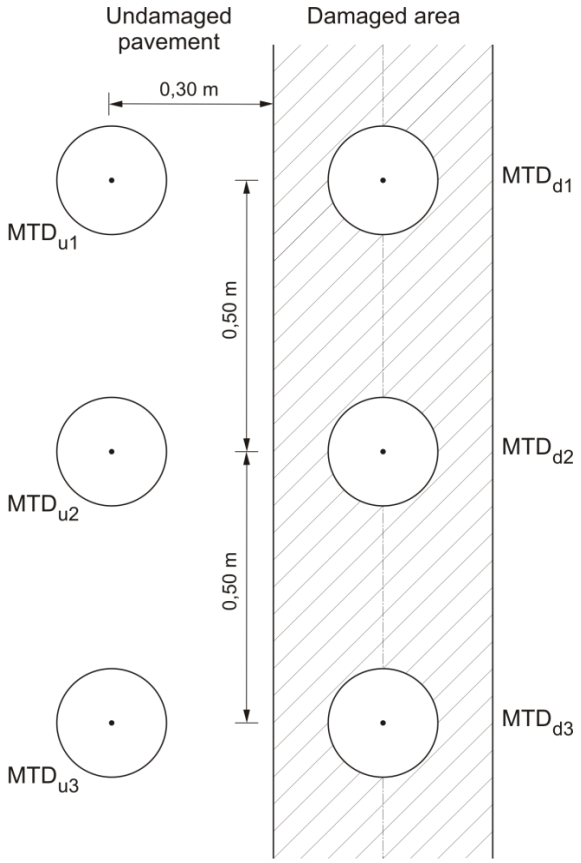


Figure 1: Suggestion for positions for MTD measurements; the circles represent the patches

Let $MTD_u = <MTD_{ui}>$ and $MTD_d = <MTD_{di}>$

The criterion for an acceptable raveling damage should then be: $(MTD_d - MTD_u) < x$ mm

C.2.2 Assessment of the raveling with MPD

If one has a linear[2] profilometer one can measure the MPD. This might be the only option in the case of e.g. a narrow line marking which has been removed, as for the volumetric patch method one needs some space to carry out the measurement (the patch has a certain size).

In this case one should visually select a “suspect” area and measure a texture profile of 1 m and calculate the ten corresponding MPD values[3]. One does the same on the undamaged pavement close to the measurement on the removed marking. An example on how one could measure on an area where a line marking has been removed is shown in Figure C.2.

[2] Measures along a straight line
[3] Each MPD value is calculated based on a 10 cm profile segment

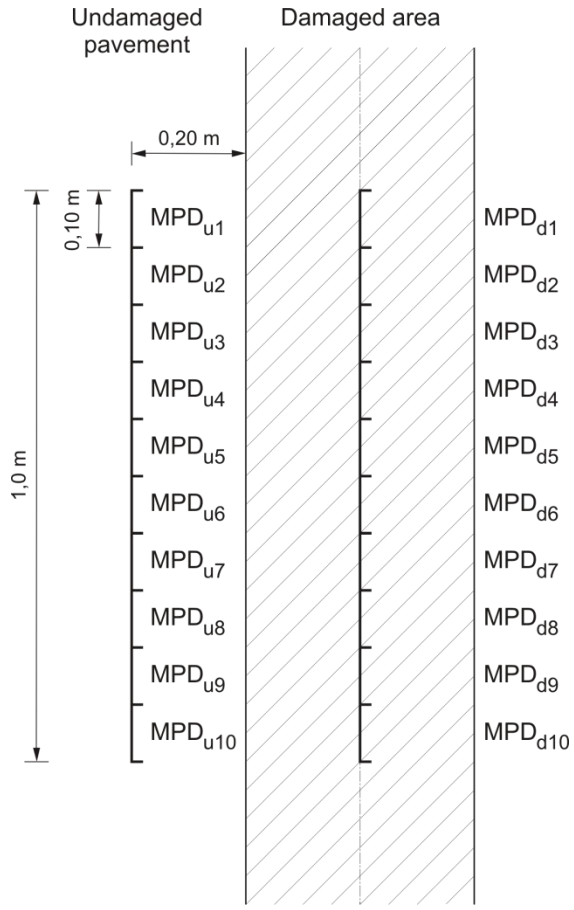


Figure C.2: Suggestion for positions for MPD measurements: texture profiles of 1 m length each (bold lines) are measured in the damaged and close by on the undamaged pavement. Each profile is divided in 10 equal segments of 10 cm leading to 10 MPD values per profile.

Let $MPD_u = <MPD_{ui}>$ and $MPD_d = <MPD_{di}>$

The criterion for an acceptable raveling damage should then be: $MPD_d - MPD_u < y$ mm

C.3 Grooving

The simplest is to measure the depth of a groove with a straightedge and a wedge as described in EN 13036-7:2003. Select an area with a visible groove. Put the straightedge in such a position that it touches both edges of the groove (see figure C.3) and measure the maximum depth D under the straightedge with the wedge.

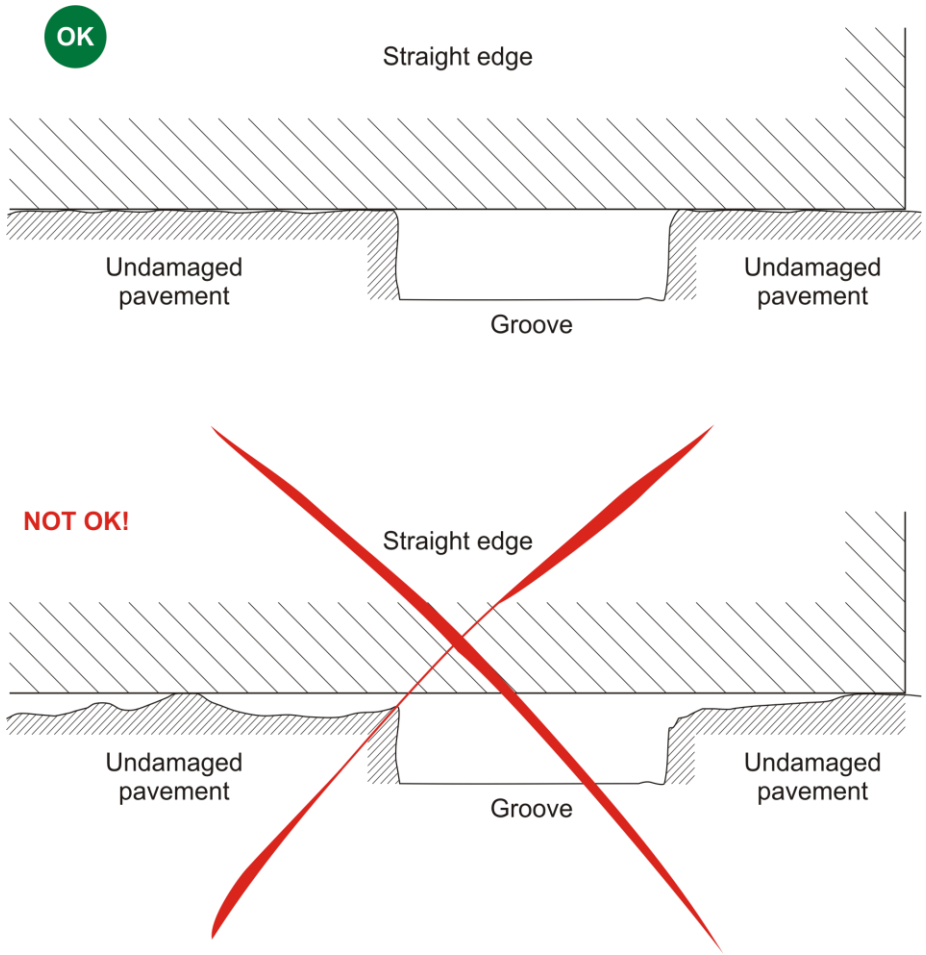


Figure C.3: Use of the straightedge to measure the depth of the grooved caused by the removal of a road marking. The straightedge MUST touch both edges of the groove, otherwise the measurement is invalid.