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Surfacing Materials for New and Maintenance Construction for Use in Ireland

DN-PAV-03023
October 2020

DN Design

Standards

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TII Publications

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Contents

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Amendment Details:

Correction of references to section 5 in Annex C and D.

Update of notes on Table 2.1 to remove reference to AADF.

Remove reference to urban and rural roads in site category heading Table 3.1.

Include request for information on competent person in Annex C.

Contents Table

Table of Definitions

Heading	Definition
Aggregate Abrasion Value	Aggregate Abrasion Value (AAV) gives a measure of the resistance of aggregate to surface wear by abrasion under traffic.
Competent Person (Professional Geologist)	Person possessing sufficient training, experience and knowledge appropriate to the nature of the work to be undertaken having regard to the task he or she is required to perform and taking into account the complexity of the work. The competent person will be listed as a Professional Member of the Institute of Geologists of Ireland, or an equivalent professional body, with an established record of a minimum of 5 years of practical assessment of geological resources, with experience of quarries and aggregate deposits and assessment of aggregates for proposed end-use suitability.
Economic Operator	Any natural or legal person or public entity or group of such persons and/or bodies which offers on the market, respectively, the execution of works and/or a work, products or services. These include entities such as contractors, suppliers and service providers.
National Road Network	The national primary and secondary roads network in Ireland which is operated and maintained by Transport Infrastructure Ireland (TII) and which comprises motorways and dual carriageways, including their interchanges/junctions, merge and diverge ramps, circulatory elements of roundabouts; and national primary and national secondary single carriageway roads.
Polished Stone Value	Polished Stone Value (PSV) is a measure of the resistance of coarse aggregate to the polishing action of vehicle tyres under conditions similar to those occurring on the surface of a road.
Sideway-Force Coefficient (SFC)	SFC is the ratio between the vertical force (load) and the horizontal force (sideway-force) normal to the test wheel maintained in a controlled slipping condition. The SFC is the individual frictional measurement as recorded by the Sideway-force Coefficient Routine Investigation Machine for a single sub-section (5, 10 or 20 metres long according to recorder setting). SFC is expressed as a decimal number, to two decimal places, for a pre-determined length of road, normally 10m. (Note: SFC can vary depending on the wheel angle of the type of equipment used and the survey speed).
Site Category	One of the levels within a broad classification of the road network according to the risk of skidding.
Skid Resistance	Skid resistance is the characterisation of the friction of a road surface when measured in accordance with a standardised method.
Surfacing	The uppermost pavement layer in contact with the vehicle tyre, including surface courses and surface treatments.

Table of Abbreviations

Abbreviation	Definition
AAV	Aggregate Abrasion Value
CPR	Construction Products Regulation
TII	Transport Infrastructure Ireland
PSV	Polished Stone Value
AADF	Average Annual Daily Flow
HFS	High Friction Surfacing
SMA	Stone Mastic Asphalt
HRA	Hot Rolled Asphalt
MSA	Market Surveillance Authority
EOP	Extraction Operation Plan

Summary

This Standard gives the requirements for Surfacing Materials for New and Maintenance Construction, for use in Ireland as directed by Transport Infrastructure Ireland (TII). This Standard includes mandatory and advisory parts in relation to the following aspects;

- Surfacing Options;
- Texture, Skid Resistance and Noise; and
- Selection of Aggregate

1. Introduction

1.1 Scope

This Standard provides a summary of surfacing options available for use on both flexible and rigid pavements and advises on current requirements. DN-PAV-03023 also details the requirements for aggregates to ensure that appropriate skid resistance is provided and should be read in conjunction with AM-PAV-06045. DN-PAV-03023 also includes details of surface texture and how this affects skid resistance and surface noise at the tyre/road interface.

Detailed information on bituminous material types, and surfacing processes, together with advice on their use, is presented in DN-PAV-03024. Reference should also be made to the TII Publications CC-SPW-00700, CC-SPW-00900 and CC-SPW-01000, together with the TII Notes for Guidance on the Specification for Road Works.

1.2 Implementation

This Standard shall be used forthwith for all schemes for the construction, improvement and/or maintenance of National Roads projects, except where the scheme has received, prior to publication of this Standard, its statutory approvals to allow it to proceed. If this exception applies, the standard to be used may be either this current Standard or the Standard applicable preceding the May 2020 version of the Standard. Where the previous Standard is to be used, Design Organisations shall confirm this by e-mail to the Standards Section of TII at infoPUBS@tii.ie.

1.3 Mutual Recognition

The construction of road pavements will normally be carried out under contracts incorporating the TII Specification for Road Works. In such cases works, goods or materials conforming to harmonised European Standards (hEN) will be acceptable in accordance with the terms of the Clauses 104 and 105 of CC-SPW-00700. Any contract not containing these clauses must contain suitable clauses of mutual recognition having the same effect regarding which advice should be sought.

Construction products must be supplied with requisite CE marking in accordance with the Construction Products Regulation (CPR).

1.4 Departures from Standards

In exceptional situations, Transport Infrastructure Ireland (TII) may be prepared to agree to a Departure from Standards. Design Organisations wishing to consider pursuing this course shall discuss any such option at an early stage in design with TII. Proposals to adopt Departures from Standard must be submitted by the Design Organisation to TII and formal approval received BEFORE incorporation into a design layout.

2. Surfacing Options

2.1 Background

The choice of surfacing materials/systems plays a vital role in providing roads that meet the needs of the user, are safe and give value for money. For many years hot rolled asphalt with chippings rolled into the surface was the most widely used surfacing on National Roads, including motorways, for both new construction and major maintenance. Surface dressing is also widely used on National Secondary Roads. In recent years new materials and techniques have been developed, many of which are proprietary, which offer significant advantages not just to the road user but also to the environment. For example, noise generation may be reduced, delays at road works curtailed, ride quality improved and deformation resistance enhanced, all while maintaining existing safety levels. Furthermore, new products such as energy efficient 'cold-lay' materials are in their development phase. This Chapter gives guidance on the range of surfacing options that are now available for both new construction and maintenance.

2.2 Choice of Surfacings

Apart from the suitability of surfacing materials in terms of safety and robustness, the permitted pavement surfacing options for use on National Roads, have been determined by the TII, as indicated in Table 2.1.

Where Porous Asphalt is proposed for use on high speed roads (see Table 2.1) the approval of TII shall be sought and a Departure from Standards agreed prior to incorporation in the permanent works.

Advice on the different types of surfacings is given in DN-PAV-03024.

However, although information on various surfacings and treatments is DN-PAV-03024, it should not be assumed that their use is permitted on the National Road network. Advice is provided for certain treatments for information only. Reference should be made to Table 2.1 to check permitted options.

The surfacing options permitted shall be those shown in Table 2.1. Where an option is permitted under the column marked "Departure required", a Departure from Standard will be required from TII.

For the purpose of this Standard high-speed roads are defined as those with a posted speed limit above 60 km/h. The various pavement construction types are defined in DN-PAV-03021.

TII should be contacted for advice on suitable materials for use on concrete pavements.

Mechanical retexturing of existing surfaces can provide a short-term improvement in microtexture and macrotexture and therefore skid resistance. It is recommended that the use of retexturing should be discussed with the TII Network Management Inspector section prior to works and written approval received from the TII Network Manager. Selection of the appropriate retexturing treatment shall be in accordance with CC-SPW-00900 Clause 8.2.

Fully Flexible and Flexible Composite Pavements

Table 2.1 Permitted Pavement Surfacing Materials for the Construction, Improvement or Maintenance of National Roads

Posted speed limit	Use without restriction	Departure required
Above 60 km/h	Stone Mastic Asphalt [1] Hot Rolled Asphalt [2] Surface dressing [2, 5] High Friction Surfacing [3]	Porous Asphalt
60 km/h or below	Stone Mastic Asphalt [1] Hot Rolled Asphalt Asphalt Concrete surface course [4] Surface dressing [5] High Friction Surfacing [3]	Microsurfacing

Notes:

1. *Stone Mastic Asphalt using binder grade 40/60 shall not be permitted on roads with an AADF greater than 1000.*
2. *See Annex F in relation to noise.*
3. *Use of high friction surfacing is subject to requirements of a prTAIT and approval by the TII Network Management Inspector. The use of HFS should be substantiated through a Life Cycle Cost Analysis of the proposed HFS and other possible solutions.*
4. *For use only where the posted speed limit is 50km/h or less.*
5. *Use of surface dressing shall be in accordance with DN-PAV-03074 and CC-SPW-00900.*

3. Selection of Aggregate

To deliver the levels of skid resistance required by AM-PAV-06045, the aggregate used in the surfacing will need to provide adequate microtexture and macrotexture during the life of the surfacing. Additional information on the texture and skid resistance of pavement surfacings is provided in Annex F.

3.1 Microtexture

The fine scale micro-texture of the surface aggregate is the main contributor to skid resistance and is the dominant factor in determining skid resistance at lower speeds. The microtexture characteristics of a particular stone depend on its polishing susceptibility under the action of tyre forces. This is assessed based on the Polished Stone Value (PSV) and Aggregate Abrasion Value (AAV) of the stone as specified in I.S. EN 1097-8.

The PSVs required for different categories of site are related to traffic flow and are given in Table 3.1. The appropriate AAVs are given in Table 3.2. Tables 3.1 and 3.2 apply to new works, improvement and maintenance works. In specifying surfacing materials, the minimum values of PSV and maximum values of AAV given in Tables 3.1 and 3.2 must be used and, where applicable, inserted into the appropriate part of Appendix 7/1 of the TII Specification for Road Works.

The traffic flow used to determine the appropriate PSV and AAV for a particular surfacing must be the Average Annual Daily Flow (AADF) predicted to be using the lane at opening – see PE-SMG-02002. Estimates of traffic growth rates and life of the surfacing may be based on local experience.

Currently there are insufficient methodologies available to determine the performance of PSVs differing to those given in Table 3.1. Therefore, the specification of PSVs differing to those given in Table 3.1, pending conclusion of ongoing TII friction research, will not be accepted.

To gain further information on the performance of aggregates in road surfacings two additional tests on the aggregate shall be specified and, where applicable, inserted into the appropriate part of Appendix 7/1 of the TII Specification for Road Works. These tests are a Flakiness Index test as specified in I.S. EN 933-3 and a friction after polishing test. The test method for the latter should be based on I.S. EN 12697-49, but the test specimens should be aggregate mosaics rather than asphalt specimens (see Annex A for further details). No thresholds for the results of these tests are included in this standard but records of the test results must be retained by the economic operator for possible inspection for a minimum of 5 years after the date of construction. The results must also be forwarded to the TII at the time of construction.

The TII will also undertake more detailed monitoring of skid resistance at selected sites, in addition to the annual Sideway-force Coefficient Routine Investigation Machine survey, to gain further understanding of the performance of aggregates and surfacing materials in service. Further details of this strategy are also given in Annex A.

The PSVs given in Table 3.1 will normally provide satisfactory skid resistance on sites of average difficulty within the site category for the life of the surfacing.

To determine the correct PSV and AAV for a particular site the designer should have regard to the extent and scale of the work. When specifying a PSV, it is undesirable to have too frequent changes of aggregate and the aim should be to specify and provide the most economical aggregate available over the longest possible lengths. The highest PSV aggregates should be restricted to those locations where they are required such as on bends and gradients, and at intersections and junctions.

For a multiple lane carriageway, the same PSV and AAV must be used on all lanes with traffic travelling in the same direction (including the hard shoulder).

Where aggregates are used for demarcation, a maximum difference of 5 PSV points may be allowed. Selection of the appropriate PSV and AAV must be based on the lane carrying the most vehicles.

Where a Stone Mastic Asphalt surfacing is used on the circulatory part of a roundabout, a maximum nominal aggregate size of 10mm should be used in the surfacing as research has demonstrated that this will provide greater durability.

Some sections of Table 3.1 require either the use of high friction surfacing (H) or the use of aggregates in the surfacing with a PSV in excess of 70 (70+) because of the combination of high risk, high stress and high traffic at a site. Given its relatively high cost and short lifetime in comparison with surfacings using natural aggregate, the use of high friction surfacing shall only be permitted at the locations specified in Table 3.1 and requires the prior approval of the Head of Pavements of TII. Evidence must be provided that a site investigation has been carried out to determine the underlying risk factors and to consider the most appropriate solution. Options should include: the use of engineering measures to reduce the risk and/or stresses (e.g. minor realignment or signage); the use of a natural aggregate with a PSV of 70+; High Friction Surfacing in accordance with Clauses 7.3 and 10.2.4 of CC-SPW-00900. The options considered must be compared on a whole life cost basis.

High friction surfacing complying with CC-SPW-00900 Clauses 7.3 and 10.2.4 are generally unable to meet the texture depth requirements given in Series 900. They do present a high surface contact area and are an effective solution. However, on high speed roads, attention must be given to the need to drain water off the surface by profiling or by other means.

Where HFS is used on the approaches to a hazard, the minimum treatment length must be 50m. This may be extended where queuing traffic or sightlines indicate that 50m may not be sufficiently long. When used on bends, transitions between surfacing types should be avoided within the extent of the bend. HFS should not normally be used on the circulatory area of roundabouts even if traffic signal controlled. Further guidance on the use of HFS is provided in DN-PAV-03024 (Section 7.5.2).

Table 3.1 specifies the minimum values of PSV, and Table 3.2 specifies the maximum values of AAV, to be included in the contract specification. The Contract Specification shall also state that the actual PSVs, AAVs and texture depths as built must be recorded and maintained in a readily available form, (e.g. the safety file for new construction, or close out report for maintenance works). Standards to be adopted in subsequent renewal work may then be determined in the light of the skid resistance performance set against those initial recorded values.

Table 3.1 Minimum PSV of Chippings, or Coarse Aggregate in Unchipped Surfaces, for new Surfacings

Site category and Definition (see AM-PAV-06045)		Minimum PSV required for given traffic level and type of site						
		Annual Average Daily Flow (AADF) at opening						
		<2500	2501-5000	5001-7500	7501-10000	10001-20000	20001-30000	Over 30000
Speed Limit > 60km/h								
A	Motorway	55	55	55	60	60	60	60*
B	Non-event carriageway with one-way traffic	55	55	60	60	60	60	60*
C	Non-event carriageway with two-way traffic	60	60	60	60	65	65	68+
Q	Approaches to and across major and minor junctions, Approaches to roundabouts	60	60	65	65	68+	68+	68+
K	Approaches to traffic signals, pedestrian crossings and railway crossings	65	65	68+	H / 70+	H / 70+	H / 70+	H / 70+
R	Roundabout	60	65	65	68+	68+	68+	68+
G1	Gradient 5-10% longer than 50m	60	60	60	65	65	68+	68+
G2	Gradient >10% longer than 50m	60	60	60	65	65	68+	68+
S1	Bend radius <250m – carriageway with one-way traffic	60	65	65	68+	H / 70+	H / 70+	H / 70+
S2	Bend radius <250m – carriageway with two-way traffic	60	65	65	68+	H / 70+	H / 70+	H / 70+
Speed Limit ≤ 60km/h								
U1	Approaches to traffic signals, pedestrian crossings and railway crossings	65	65	68+	H / 70+	H / 70+	H / 70+	H / 70+
U2	All other urban locations	60	60	60	60	65	65	68+

Notes:

1. *For roads in site categories A, B and C where some braking regularly occurs (e.g. on 300m approach to an off-slip) there may be increased polishing stresses compared with most locations in these categories. In such situations add 5 to the PSV value where it is marked with an asterisk.*
2. *Throughout this Table, H means specialised High Friction Surfacing (HFS) conforming to Clauses 7.3 and 10.2.4 of the CC-SPW-00900. The use of HFS should be substantiated through a Life Cycle Cost Analysis of the proposed HFS and other possible solutions.*
3. *Although minimum PSV values have been included for all types of site and traffic level, some combinations are unlikely to occur in practice.*
4. *The process of requesting a departure from standard should be followed where evidence of adequate field performance of an aggregate exists and the declared PSV of that aggregate does not meet the requirements of this standard.*

Table 3.2 Maximum AAV of Chippings, or Coarse Aggregates in Unchipped Surfaces, for New Surfacings

AADF at opening	<2500	2501-10000	10001-17500	17501-25000	>25001
Max AAV for chippings for hot rolled asphalt and surface dressing, and for aggregate in microsurfacing systems	14	12	12	10	10
Max AAV for aggregate in Stone Mastic Asphalt and asphalt concrete	16	16	14	14	12

Notes:

1. The maximum AAV requirement for porous asphalt is specified in Table 10 of CC-SPW-00900.

The requirements of Tables 3.1 and 3.2 cover:

a) chippings for surface dressing;

b) the coarse aggregate in Stone Mastic Asphalt systems, porous asphalt, asphalt concrete surface courses and surface courses of hot rolled asphalt without coated chippings applied to the surface;

c) coated chippings applied to the surface of hot rolled asphalt,

d) coarse aggregate in microsurfacing.

Where asphalt binder courses and bases are used as temporary surfaces by general traffic, reference should be made to Clause 10.1.12 of the CC-SPW-00900 and to Annex B of this Standard.

3.1.1 Measurement

Samples of the aggregate representative of those to be incorporated into the Works must be tested in accordance with I.S. EN 1097-8 for compliance with the specified PSV and AAV properties. It is important to demonstrate consistency of production and robustness of testing. Compliance for the latter requires a “suite of tests” be carried out; a “suite of tests” for PSV shall comprise three separate valid individual PSV tests carried out on a single stockpile bulk sample, where each individual test must be undertaken by a different laboratory. A result that is more than 5 units above or below the mean value of the three tests shall be deemed invalid and shall be replaced by a further test or tests undertaken from the original stockpile bulk sample, until there are three valid results. For AAV only one test shall be undertaken per bulk sample. To satisfy the consistency requirement, a suite of tests shall be been carried out every six months such that the average is always based on two sets of results within any 12 month period The aggregate will be deemed to comply if the mean of the two most recent consecutive “suite of tests”, relating to the material to be supplied, is greater than or equal to the specified PSV and less than the specified AAV. However, where a PSV of 68+ or 70+ is specified, none of the three valid results obtained from the entire testing regime shall be less than 68 or 70 respectively.

Tests must have been carried out by a laboratory accredited by INAB or equivalent for these tests.

Alternatively, the laboratory must be accredited to EN ISO/IEC 17025 for the required testing to EN standards. Production verification to harmonised EN standards for these products requires this process to be overseen by a notified body from within the EU for the required testing to EN standards.

It is essential that the aggregate supplied to site must be the same in all respects to the sample submitted for acceptance and compatible with the Declaration of Performance.

Details of procedures to maintain this consistency is the responsibility of the economic operator who must maintain appropriate quality procedures and records to ensure the declared performance of the aggregate supplied.

These testing requirements must be included in the contract specification / method of measurement, for example Appendix 7/1 of the TII Specification for Road Works.

3.2 Macrotexture

For many years it has been the practice to ensure that there are interconnecting drainage paths within the surface over which the tyre runs to help disperse water and improve skid resistance, particularly at high speeds. It was also recognised that the coarseness of the surface contributes to traffic noise. Macrotexture provides rapid drainage routes between the tyre and the road surface and contributes to the wet skid resistance at higher speeds. It also allows air trapped beneath the tyre to escape. Minimum levels of texture depth for new roads therefore apply at construction or major maintenance. These are given in CC-SPW-00900.

3.2.1 Measurement

Compliance measurements against the CC-SPW-00900 requirements (Clause 10.1.11) must be made using the volumetric patch method in which a known volume of solid glass spheres is spread into a circular patch. The diameter of the patch is measured and the average depth under the peaks in the surface calculated. The technique is described in I.S. EN 13036-1. CC-SPW-00900 specifies limits with respect to pavement texture and mean profile depths as work requirements for a surfacing constructed.

Laser-based techniques are also available which can measure texture depths at speeds up to 100 km/h and are consequently more appropriate for monitoring the texture depth of high-speed roads in service.

4. Performance and Recipe Specifications

Performance-related specification clauses have been included in the CC-SPW-00900 covering products such as microsurfacing (Clauses 7.1 and 10.2.2), surface dressing product (end performance) (Clauses 7.2.3 and 10.2.3.2), high friction surfacing (Clauses 7.3 and 10.2.4), porous asphalt (Clauses 6 and 10.1) , stone mastic asphalt (SMA) (Clauses 5 and 10.1) and hot rolled asphalt (HRA) (Clauses 4 and 10.1). Performance of bituminous mixtures is assessed by testing samples taken from the laid material and testing the laid material in-situ. Performance of surface treatments is assessed by visual inspections and measurement of macrotexture.

A recipe specification clause has been included in the CC-SPW-00900 covering recipe surface dressing (Clauses 7.2.2 and 10.2.3.1).

5. Registration of Aggregate Products for Use in Surfacings

5.1 Introduction

TII maintain a central product register of aggregates made available on the market in accordance with the Construction Products Regulation (CPR). The register is specific to aggregates for use in surfacing applications.

The register is held on behalf of TII Head of Pavements for use by TII as the Competent National Authority, it is not a replacement for a contract between the economic operator and the end user.

The register is available for use by the Market Surveillance Authority (MSA) to facilitate the role that the MSA has with regards to monitoring Construction Products under the CPR.

5.2 Scope

This section specifies the characteristics of aggregates obtained by processing natural aggregates for use in surface courses and surface treatments, also referred to as surfacings, for the National Road network. The requirements are derived from I.S. EN 13043 'Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas'

5.3 Registration process

The Economic Operator is responsible for submitting the data required to TII on a frequency as determined by this procedure.

The key aspects of the registration process are:

- Who is placing products on the market;
- What those products are in the context of the specific characteristics of this procedure;
- Traceability of those products with the specific characteristics required in this procedure.

Whilst TII maintain the central register, any issues that may arise on a contract shall be dealt with via the conditions specified within that contract. Where specific contract requirements demand, samples of aggregates for use on the contract shall be provided to the Employer's Representative in accordance with Appendix 1/6 of the Specification for Road Works.

Annex C contains a summary of the data that is required to be submitted by the economic operator when seeking registration of a specific product for inclusion on the product register. Annex D provides a template for the declaration by the applicant that they can meet the FPC requirements detailed in this document. Annex E details the information relating to the surfacing aggregate product register which will be published by TII.

Economic operators wishing to include product information on the aggregate register can do so by contacting TII via email at aggregateregister@tii.ie.

Those wishing to view the aggregate register can request access via email at aggregateregister@tii.ie.

5.4 Evaluation of Conformity

Guidance on the minimum frequency of tests for the following characteristics are contained in Table 5.2 of this document. It is however the responsibility of the economic operator to ensure adequate frequency of testing is carried out considering the natural variability of the parent material. The frequency of testing shall adequately characterise the aggregate product and ensure consistent product performance as reflected in the product register.

5.4.1 Geometrical characteristics

Grading and Flakiness as contained in the relevant Tables of CC-SPW-00900.

5.4.2 Physical characteristics

Resistance to Fragmentation (Los Angeles), Water Absorption, Density, PSV and AAV as contained in the relevant Tables of CC-SPW-00900. Friction After Polishing in accordance with Annex A.

5.4.3 Durability characteristics

Soundness as contained in the relevant Tables of CC-SPW-00900.

5.4.4 Chemical characteristics

In this document geological and petrographic characteristic fall under the general category of chemical characteristics of an aggregate.

5.4.4.1 Geological assessment of the raw material (i.e. the quarry deposit)

An initial assessment shall be carried out on the raw material followed by periodic assessments during the life of the quarry. These assessments shall of the raw material deposit shall be carried out by a Competent Person (Professional Geologist). The assessment shall include the on-site assessment be the more frequent of:

a) Every 3 years;

b) When there is a major change in the lithology in the quarry;

c) On the advice of the Competent Person (Professional Geologist).

The assessment of the deposit should identify and map the main lithologies. The identification and description of the rock shall be carried out on the basis of mineralogical composition, genetic aspects, structure, grain size, and other parameters in accordance with I.S. EN ISO 14689-1.

A written record should be maintained with photographs by the Economic Operator.

5.4.4.2 Geological examination of the finished aggregate product

The finished aggregate product shall be examined initially and then quarterly to establish its geological composition.

The objective of the geological examination is to determine if the sample is consistent with the product initially made available on the market for the proposed end-use as aggregates for surfacings. The geological examination shall be carried out by a Competent Person (Professional Geologist).

The identification and description of the rock from which the aggregate is produced shall be carried out on the basis of mineralogical composition, genetic aspects, structure, grain size, and other relevant parameters in accordance with I.S. EN ISO 14689-1. Procedures followed shall be in accordance with I.S. EN 932-3.

A representative sub-sample of the bulk sample shall be used to identify the different lithologies present. The assessment shall include the modal distribution of lithologies based upon their grain-size.

For igneous, metamorphic and calcareous sedimentary (limestones) rocks this can be achieved through the simplified scale set out in I.S. EN ISO 14689-1. For siliciclastic rocks (sandstones [arenites, greywackes], siltstones, mudstones), the grain-size description shall be based on the simplified Wentworth Scale classification (see Table 5.1). For gravels, the approximate percentage of each lithology present needs to be given. Where the predominant lithology is siliciclastic then this should be described, as above, using the simplified Wentworth Scale.

Table 5.1 Simplified Wentworth Scale of Grain-Size Classification

Simplified Wentworth Scale		
Millimetres (mm)	**Micrometres (µm)**	**Classification**
2		
		Very Coarse Sand
1		
		Coarse Sand
0.5	500	
		Medium Sand
0.25	250	
		Fine Sand
0.125	125	
		Very Fine Sand
	63	
		Silt
	3.9	
		Clay

Where the representative sample contains coatings (silt or clay), the fragments shall be washed and dried to permit accurate identification of each of the lithologies.

A written record should be maintained with photographs.

Where, in the opinion of the Competent Person (Professional Geologist), there is uncertainty regarding the nature or composition of the rock types, a petrographic assessment in accordance with Section 5.4.4.3, shall be undertaken.

Care shall be taken when riffling and quartering the bulk sample to reduce to the sub-sample (especially in the case of heterogeneous aggregates), to ensure the sub-sample is truly representative of the bulk sample. A minimum sub-sample size of 1 kg shall be utilised for the geological examination of the finished aggregate product.

If the modal percentage of any one lithology in the finished aggregate product shows a variability, from a previous test, that consequently affects the measured physical characteristics, then a separate product will require certification to reflect this change of properties.

For example, an increase in the percentage of 'fine-grained' lithologies (mudstone, siltstone, very-fine sandstone) can negatively affect physical properties such as PSV and AAV. This is particularly important in heterogeneous aggregates where two or more lithologies may be present (interbedded sequence).

5.4.4.3 Petrographic assessment of the finished aggregate product

Where a petrographic assessment involving transmitted light evaluation of thin-sections is required, it should be conducted, on each lithology in accordance with a documented method e.g. BS 812: Part 104 and ASTM C295. The purpose of this is to establish the petrography of lithologies, identified by the Competent Person (Professional Geologist), as uncertain in nature and composition. The assessment shall also describe any microstructural features present in the lithologies, such as cleavage or microfractures, that may affect the physical properties of the finished aggregate.

The petrographic analysis shall be carried out by a competent person with relevant professional training and experience.

Ensure due account is taken of the variability of the rock and that separate petrographic assessments are carried out on representative sub-samples of any lithologies previously identified as part of the geological examination.

A geological and petrographic assessment of the raw material (i.e. the quarry deposit) and of the finished aggregate product should be carried out at regular intervals.

This assessment includes:

a) the initial and ongoing assessment of the quarry deposit;

b) the initial type testing and ongoing conformity testing of the finished aggregate product;

c) factory production control of both the quarry and the product.

5.5 Factory Production Control

5.5.1 Documentation and data control

The FPC manual shall specifically refer to procedures in place to control aggregates for surfacings. Procedures should cover inspection of raw material, processing, inspection of finished product and traceability.

All records associated with this procedure shall be held in an easily retrievable manner for a period of 10 years.

5.5.2 Knowledge of the raw material

The assessments should identify and map the main lithologies within the quarry in accordance with I.S. EN13043.

It is a requirement that aggregates for surfacings be registered with TII and shall have an Extraction Operation Plan (EOP) as part of the factory production control. The EOP must be reviewed by a competent Professional Geologist who shall advise on the consistency of the geology within the planned extraction area. The purpose of the EOP is to provide a consistent methodology for traceability. This plan should be reviewed on a yearly basis taking into consideration known geology and physical test results from on-going/annual testing. Any intermediate revision to the extraction plan shall be reviewed by the Professional Geologist to ensure there is consistency of the properties of the resource to be quarried.

The EOP shall include blast records to include location, bench and estimated yield. Guidelines on the information required to manage material extraction and the development of an EOP are provided below:

a) Site location and authorised quarry extent (including site location map/folio map showing quarry);

b) Geological description including note on typical characteristics, borehole testing, and likely variation of key characteristics (reference to most recent geological review report);

c) Statement regarding timing of next review (at which time the current Extraction Plan should be reviewed – 1 to 3 year timeframe);

d) Map of proposed blasts between geological reviews (suggest stockpiling areas to be identified also on this map);

e) Record of blast information (co-ordinates of each blast, description, number of holes, depth, explosive tonnage, expected yield);

f) Description of site-specific processing set-up (primary to tertiary crushing, screening, re-processing of undersize, washing);

g) Description of stockpile locations (possible reference to quarry map);

h) Testing and product release procedures for finished aggregates (incl. FPCs and CE marking maintenance);

i) Re-cycling/re-purposing of non-conforming material.

j) Signature and dating by competent person (quarry manager)

5.5.3 Management of production

Procedures shall be in place to identify and control aggregates for surfacings. These procedures shall include inspection and testing raw feedstock, inspection and testing products sampled during processing, maintaining and adjusting processing equipment and modifying the process if the raw material lithology changes.

5.5.4 Traceability

Aggregates are produced from naturally occurring material and as a result, their characteristics can vary throughout the resource, which in turn may affect the performance of the aggregate products. It is essential that the product is consistent with declared values for its specified purpose in surface treatments.

The traceability of the aggregates will be facilitated through developing a level of knowledge of the aggregate and its source, as outlined in Sections 5.5.2.

5.5.5 Inspection and test

The FPC manual shall describe the frequency and nature of inspections in compliance with the requirements of I.S. EN 13043 and the specific requirements of this procedure for aggregates for surfacings.

Table 5.2 outlines guidance on the minimum test frequencies for properties of aggregates for surfacings; which in some cases are more frequent than the minimum test frequencies specified in I.S. EN 13043. The increased frequency is in order to improve confidence within the supply chain. The producer shall establish the consistency of the aggregate with the declared properties and the necessary levels of control required. On an ongoing basis the producer shall demonstrate that the controls remain relevant and can identify noncompliance.

The same bulk sample shall be used, where possible, to obtain the sub samples required to undertake the PSV, AAV and geological examination of the finished product.

5.5.6 Control of non-conforming product

Following an inspection or test that indicates that a product does not conform to a requirement of this procedure, the producer shall take the necessary corrective measures to bring that product into conformity, or, if appropriate, to withdraw or recall it.

Furthermore, where the product presents a risk, manufacturers shall immediately inform the competent national authorities of the Member States in which they made the product available to that effect, giving details, in particular, of the non-compliance and of any corrective measures taken.

Corrective action can include:

a) investigation of the cause of non-conformity including an examination of the testing procedure and making any necessary adjustments;

b) analysis of processes, operations, quality records, service reports and customer complaints to detect and eliminate potential causes of non-conformity;

c) initiating preventive actions to deal with problems to a level corresponding to the risks encountered;

d) applying controls to ensure that effective corrective actions are taken;

e) implementing and recording changes in procedures resulting from corrective action

Where an importer considers or has reason to believe that a product is not in conformity with the declaration of performance or not in compliance with other applicable requirements in the CPR, the importer shall not place the construction product on the market until it conforms to the accompanying declaration of performance and it complies with the other applicable requirements in the CPR or until the declaration of performance is corrected. Furthermore, where the construction product presents a risk, the importer shall inform the manufacturer and the market surveillance authorities there-of.

Table 5.2 Characteristics, tests and test frequencies for surfacing aggregate registered for use by TII

Characteristic	Test description	Test	Test method	Size for test	Test Frequency
Geometrical	Grading	Grading	EN 933-1	6/10; 10/14; 14/20[1]	1 per week
	Fines content	Grading	EN 933-1	6/10; 10/14; 14/20[1]	1 per week
	Particle shape	Flakiness	EN 933-3	6/10; 10/14; 14/20[1]	1 per week
Physical	Resistance to fragmentation	Los Angeles coefficient	EN 1097-2	As per standard	1 per 6 months
	Particle Density	Density	EN 1097-6	6/10	1 per 6 months
	Water absorption	Water Absorption	EN 1097-6	6/10	1 per 6 months
	Resistance to polishing	Polished Stone Value	EN 1097-8	As per standard (passing 10mm retained	2 suites per 12-month period (See DN-PAV-03023, 3.1.1)

Characteristic	Test description	Test	Test method	Size for test	Test Frequency
				7.2mm flake sieve)[2]	
	Resistance to surface abrasion	Aggregate Abrasion Value	EN 1097-8	As per standard[3]	2 per 12-month period
	Friction after polishing	Performed on aggregate mosaic	EN 12697-49 & Annex A	6/10; 10/14; 14/20[1]	1 per year
Durability	Resistance to weathering	Magnesium sulfate soundness	EN 1367-2	6/10	1 per year
Chemical & Geological classification	Geological assessment of raw material	Identify and map lithologies and proportions	I.S. EN ISO 14689-1 & see 5.4.4.1	Quarry deposit	1 per 3 years & see 5.4.4.1
	Geological examination of the finished product	Identify lithologies and proportions	I.S. EN ISO 14689-1 & EN 932-3 & see 5.4.4.2	6/10[2]	Quarterly
	Petrographic assessment of the finished product	Thin sections	BS 812: Part 104 & ASTM C295 & see 5.4.4.3	6/10	See 5.4.4.2

Notes

1. *According to end use*
2. *The same bulk sample shall be used to obtain the sub samples for these tests*
3. *The bulk sample for this test is to be obtained from the same as for note 2*

5.5.7 Handling

Product shall be separated from other products to protect from contamination. Stockpiles shall be labelled according to the specific end use i.e. surfacing aggregates registered for use by TII.

5.5.8 Delivery docket

The delivery docket shall include the identification code of the product from the products Declaration of Performance (DoP). This requirement shall apply to all delivery dockets in the supply chain up to the point of use. For example, the product used in Coated chippings shall include the identification code of the product from the products DoP on the aggregate delivery docket and the coated chipping delivery docket. The identification code of the product from the products DoP will be used as a unique product identifier on the TII register.

5.6 Consistency of Composition

Product for surfacings is a special end-use therefore the consistency of composition and each Declared Performance must be compatible and recorded to enable traceability.

Aggregate for surfacings must be registered with TII for use on the National Road network.

6. References and Bibliography

6.1 References

TII Publications

(https://www.tiipublications.ie gives access to the TII Publications documents)

a) PE-SMG-02002 Traffic Assessment.

b) DN-PAV-03021 Pavement & Foundation Design.

c) AM-PAV-06045 Skid Resistance Assessment.

d) DN-PAV-03024 Bituminous Surfacing Materials and Techniques.

e) DN-PAV-03074 Design of Bituminous Mixtures, Surface Treatments, and Miscellaneous Products and Processes.

f) CC-SPW-00900 Specification for Road Works Series 900 - Road Pavements - Bituminous Materials.

g) CC-GSW-00900 Notes for Guidance on the Specification for Road Works Series NG 900 - Road Pavements - Bituminous Bound Materials.

Irish Standards

a) I.S. EN 1097-8 Tests for mechanical and physical properties of aggregates - Determination of the Polished Stone Value (PSV), National Standards Authority of Ireland.

b) I.S. EN 13036-1 Road and airfield surface characteristics - Test methods - Measurement of pavement surface macrotexture using a volumetric patch technique, National Standards Authority of Ireland.

c) I.S. EN 12697-49 Test methods for hot mix asphalt - Determination of friction after polishing, National Standards Authority of Ireland.

d) I.S. EN 933-3 Tests for geometrical properties of aggregates. Determination of particle shape. Flakiness index

e) I.S. EN 13043 Aggregates for bituminous mixtures and surface treatments for roads, airfields and other trafficked areas

f) I.S. EN ISO 14689-1 Geotechnical investigation and testing. Identification, description and classification of rock

g) I.S. EN 932-3 Tests for general properties of aggregates. Procedure and terminology for simplified petrographic description

h) I.S. EN ISO/IEC 17025: 2017 General Requirements for the competence of testing and calibration laboratories

i) I.S. EN 933-1 Tests for geometrical properties of aggregates. Determination of particle size distribution - Sieving method

j) I.S. EN 1097-2 Tests for mechanical and physical properties of aggregates. Methods for the determination of resistance to fragmentation

k) I.S. EN 1097-6 Tests for mechanical and physical properties of aggregates. Determination of particle density and water absorption

l) I.S. EN 1367-2 Tests for thermal and weathering properties of aggregates Part 2: Magnesium sulfate test

British Standards

a) BS 812: Part 104 - Testing aggregates. Method for qualitative and quantitative petrographic examination of aggregates

American Standard Test Method

a) ASTM C295 Standard Guide for Petrographic Examination of Aggregates for Concrete

European Union

a) Regulation (EU) No 305/2011 of the European Parliament and of the Council (2011). Construction Products Regulation. OJEU.

6.2 Bibliography

a) ADEPT (2008). CSS guidance – use of high friction surfaces. Association of Directors of Environment, Economy, Planning and Transport.

b) Coyle F and Greene M J (2011). Friction measurements on a DBM trial site on the N30 Wexford. Client Project Report 999. TRL, Crowthorne.

c) Hosking J R and Woodford G C (1976). Measurement of Skidding Resistance: Part II, Factors Affecting the Slipperiness of a Road Surface. LR739. TRL, Crowthorne.

d) Road Note 27 (1970). Instructions for using the Portable Skid Resistance Tester. TSO, London.

e) Roe P G, Webster D C and West G (1991). The Relation between the Surface Texture of Roads and Accidents. RR296. TRL, Crowthorne.

f) Roe P G and Hartshorne S A (1998). The Polished Stone Value of Aggregates and In-service Skidding Resistance. TRL Report 322. TRL, Crowthorne.

g) Roe P G, Parry A R and Viner H E (1998). High and Low Speed Skidding Resistance: the Influence of Texture Depth. TRL Report 367. TRL, Crowthorne.

h) RSTA/ADEPT (2011). Code of practice for High Friction Surfacing. Road Surface Treatments Association

i) Szatkowski W S and Hosking J R (1972). The Effect of Traffic and Aggregate on the Skidding Resistance of Bituminous Surfacings. LR504. TRL, Crowthorne.

ANNEX A: ADDITIONAL TESTING AND MONITORING OF AGGREGATE AND SURFACING PERFORMANCE

Since the skid resistance standard was introduced in 2011, TII have undertaken extensive research on its compatibility with Irish conditions. Currently many revisions have emanated from this research however some aspects are still under consideration at this juncture. It is anticipated that any changes to in service skid resistance performance will only be possible on publication of the research outcomes. As such there is little evidence to support the use of aggregates with PSVs differing to those required by Table 3.1 (see Section 3.1). It is also recognised that the PSV test (I.S. EN 1097-8) has limitations and, whilst a good indicator, may not always accurately predict the in service skid resistance of aggregates for all stress and traffic combinations.

TII has therefore recognised a need to better understand the in service performance of aggregates to enable standards and product specifications to be refined in the future. The introduction of the CPR also increases the emphasis on the performance of construction products against standard property tests. To this end, TII are instigating an evidence gathering regime to supplement the data already obtained from construction works and routine skid resistance measurements.

Part of this regime will involve the testing of friction after polishing (based on the I.S. EN 12697-49). Initial testing undertaken on a small sample of aggregates suggests that the test may provide a useful additional guide to the performance of surfacings after polishing and enables comparisons to be made between the coarse aggregate when tested on its own and in an asphalt mix.

To gather data on aggregates, the need to undertake a friction after polishing test in addition to the standard PSV and AAV tests has been specified (Table 5.2). The test methodology should follow the European standard I.S. EN 12697-49, but with the test undertaken on an aggregate mosaic rather than an asphalt specimen. The aggregate used should meet the same grading requirements as for the PSV test (i.e. passing a 10mm sieve and retained on a 7.2mm flake sorting sieve) and individual chippings should be assembled and embedded in a mosaic with resin, using a flat circular former of about 225mm diameter, in a method analogous to that employed in the PSV test. It is sufficient for this process that the test is essentially source related so its required frequency is envisaged as per annum. The Flakiness Index test as specified in I.S. EN 933-3 is generally influenced by the production process rather than the source rock. It is considered that this may have an influence on the frictional characteristics of the finished road surface. It would consequently be beneficial to include this test to reflect the aggregate condition on a per contract basis.

The data collected from these tests will help to form a benchmark for the more detailed monitoring of individual sites that TII will be undertaking. These sites will be selected to provide a range of surfacing materials, site conditions and traffic levels. They will be subject to Sideway-force Coefficient Routine Investigation Machine surveys in addition to the annual network survey and friction after polishing tests may be undertaken on material samples extracted from the sites. This additional monitoring will enable the in-service performance to be compared to declared PSV and AAV values at the time of the works. This will allow future amendments to DN-PAV-03023 to better target the use of aggregates in delivering the levels of skid resistance on the National Road network required by AM-PAV-06045.

ANNEX B: MANAGEMENT OF SITES WHERE ASPHALT CONCRETE BINDER COURSE IS USED AS A TEMPORARY SURFACING

During road maintenance and improvement works, asphalt concrete binder course (dense/HDM bin des) may be operated as a temporary surfacing for an extended period. The period of trafficking could last from a few weeks to several months. Where this does occur, the following guidance on the management of such sites must be adopted in addition to the requirements of Clause 10.1.12 of CC-SPW-00900.

Sites with AADF < 2500

Such sites can be trafficked for periods of ten weeks without restrictions.

After this period a speed limit of 60 km/h should be imposed along with “Temporary Surfacing” warning signs.

The asphalt concrete material should be covered with a surface course material within six months of trafficking.

All other sites

A speed limit of 60 km/h should be imposed along with “Temporary Surfacing” warning signs from the time the asphalt concrete material is exposed to traffic.

The asphalt concrete material should be covered with a surface course material within three months of trafficking.

For large roadwork sites where the construction sequence may result in the possibility of the asphalt concrete material being trafficked for more than three months, then consideration should be given to reducing the speed limit further until a permanent surfacing is in place.

ANNEX C: DATA SUBMISSION REQUIRMENTS FOR AGGREGATE REGISTRATION

Data required to be submitted by the economic operator when seeking registration of a specific product for inclusion on the product register.

Please use the table below to ensure your submission is complete; under the 'Data submitted' column write Y (for yes) or NA (for Not Applicable) to indicate you have provided the information.

Item reference in document	Criteria or Requirement			Data required	Data submitted
5.3	Economic Operator details	Manufacturer	Contact	Correspondence address & contact	
		Authorised representative	If applicable	As per manufacturer	
		Importer	If applicable	As per manufacturer	
		Distributor	If applicable	As per manufacturer	
5.3	Product details		Quarry location	Address, Coordinates & contact details	
			Unique Identification	For each product	
			Sample	Size 6/10, 20kgs	
5.4.1 & Table 5.2	Geometrical	Grading	Grading	Test results	
		Fines content	Grading	Test results	
		Particle shape	Flakiness	Test results	
5.4.2 & Table 5.2	Physical	Resistance to fragmentation	Los Angeles coefficient	Test results	
		Particle Density	Density	Test results	
		Water absorption	Water Absorption	Test results	
		Resistance to polishing	Polished Stone Value	Test results	
		Resistance to surface abrasion	Aggregate Abrasion Value	Test results	
		Friction after polishing	Performed on aggregate mosaic	Test results	
5.4.3 & Table 5.2	Durability	Resistance to weathering	Magnesium sulfate soundness	Test results	
5.4.4.1 & Table 5.2	Chemical & Geological classification	Geological assessment of raw material	Identify and map lithologies and proportions	Test results	

Item reference in document	Criteria or Requirement			Data required	Data submitted
5.4.4.2 & Table 5.2		Geological examination of the finished product	Identify lithologies and proportions	Test results	
5.4.4.3 & Table 5.2		Petrographic assessment of the finished product	Thin sections	Test results	
5.4.4.1		Competent Person	Professional Geologist	Name, Registration Number and Date of Registration	
5.5.8	Delivery docket			Example	
5.6	Declaration of Performance			DoP	

ANNEX D

On letter headed paper of Entity:

Declaration that the Applicant can meet the minimum specific Factory Production Control requirements in 5.5.1, 5.5.2, 5.5.3, 5.5.4, 5.5.5, 5.5.6, 5.5.7 and 5.5.8 of DN-PAV-03023.

To: Head of Pavements
Transport Infrastructure Ireland
Parkgate Business Centre
Parkgate Street
Dublin 8
D08 DK10

Regarding: Product register of aggregates for use in surfacing applications

Date:

Minimum specific Factory Production Control requirements contained in 5.5.1, 5.5.2, 5.5.3, 5.5.4, 5.5.5, 5.5.6, 5.5.7 and 5.5.8 of DN-PAV-03023

A Dhaoine Uaisle

I declare that as an applicant interested in being registered for the supply of aggregates for use in Surfacing applications, I declare that I can meet the minimum Factory Production Control criteria contained in 5.5.1, 5.5.2, 5.5.3, 5.5.4, 5.5.5, 5.5.6, 5.5.7 and 5.5.8 of DN-PAV-03023. Furthermore, I will provide the required evidence within seven calendar days to support this declaration when requested to do so.

Is mise, le meas

Signed

On behalf of *[name of entity]*

In the capacity as [manufacturer / authorised representative / importer / distributor][1]

[1] Delete as appropriate

ANNEX E: PUBLISHED SURFACING AGGREGATE PRODUCT REGISTER

The following information will be published on the TII website.

Item		Description
Unique ID		To be determined
Economic Operator Name		Name of the organisation producing the aggregate
Economic Operator Address		Address of the organisation producing the aggregate
Economic Operator Contact details		Telephone and email of organisation producing the aggregate
Geological assessment of the raw material	Date	-
	Name and professional registration of competent person	-
Geological examination of the finished aggregate product	Date	-
	Name and professional registration of competent person	-
Petrographic assessment of the finished aggregate product	Date	-
	Name and professional registration of competent person	-
Polished Stone Value		EN 1097-8 as per standard (passing 10mm retained 7.2mm flake sieve)
Aggregate Abrasion Value		EN 1097-8 as per standard

ANNEX F: Texture, Skid Resistance and Noise

F1 Background

The interface between the tyre and the road surface contributes to both the generation of friction and traffic noise.

There are a number of factors related to the road surface texture that play significantly different roles in improving skid resistance and generating noise. These are related to the different scales of the texture (see Figure F1).

Microtexture describes the roughness of the surface aggregate which is associated with its crystalline structure.

Macrotexture represents the "gaps" between the individual aggregate particles in the surface material and is a factor of the size and shape of the aggregate.

Surface macrotexture takes two forms:

a) 'positive' texture: a cluster of angular peaks or series of ridges above a datum level, typical of surface dressings, hot rolled asphalt with chips and slurry and Microsurfacings;

b) 'negative' texture: a network of depressions or series of grooves below the general level, typical of Stone Mastic Asphalt and porous asphalt.

Megatexture represents the degree of smoothness of the surface.

Unevenness describes amplitudes of features with longer wavelengths.

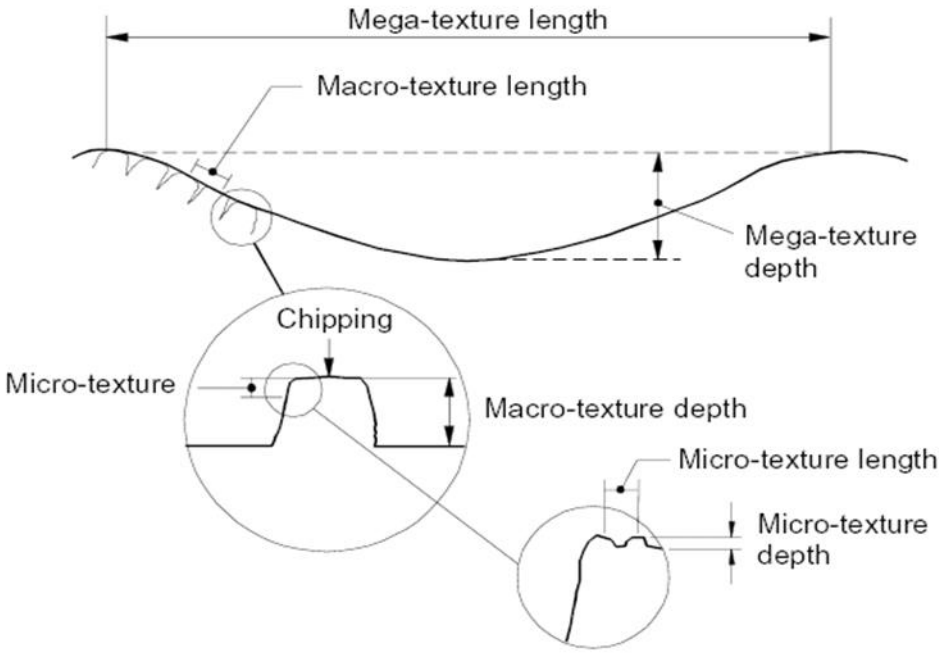

Figure F1 Details of texture length and depths

F2 Skid resistance

The friction available to a driver attempting a particular manoeuvre depends on many different factors including the road surface characteristics. Factors other than road surface characteristics include:

- the vehicle's speed
- the vehicle's tyres, tyre properties and braking system
- the dynamic interaction of the vehicle suspension with the road geometry
- environmental factors, such as the presence of water or other contaminants between the tyre and the road surface

In dry conditions clean, surfaced roads generally have a high skid resistance.

The skid resistance of wet roads is reduced by the lubricating action of the film of water on the wet road surface. Drainage channels, provided by the macrotexture and/or the pattern on the tyre, assist in getting rid of the bulk of the water and are of increasing importance the higher the speed. Penetration of the remaining water film can be achieved only if there are sufficient fine scale sharp edges (microtexture) on the road surface on which the tyre can build up high contact pressures to establish areas of 'dry' contact between the road and the tyre. The procedures for the assessment of skid resistance on National Roads is detailed in TII Publication AM-PAV-06045 Skid Resistance Assessment.

Aquaplaning is the condition where the vehicle tyres are completely supported by a layer of water and there is no contact with the road surface. High speed and a thick film of water on the road surface encourage a vehicle to aquaplane, but a relatively thin layer of water could cause a problem if combined with low texture depth and 'smooth' tyres.

Megatexture and unevenness do not have a direct effect on skid resistance, but poor road profile may have an adverse influence on vehicle handling.

It should be noted that road collisions are complex multi-factored incidents and there is seldom one single cause. Various elements come together and without them all, the incident would not happen or the consequence would be different. Within normal ranges, low skid resistance does not cause collisions on its own although, depending on the particular circumstances, it may be a contributory factor. Other contributory factors such as driver error/distraction, the road environment and vehicle defects often play a part.

F3 Noise

Where traffic speeds are less than 50km/h, traffic noise is mainly attributable to engine, transmission and exhaust noise, especially from lorries. Where speeds are higher, the major component of traffic noise comes from the tyre/road interface. This noise comes from, amongst other things, vibration of the tyre wall, compression of air within the contact area of the tyre, and the snapping out of the tread blocks as they leave the road surface.

Microtexture has a minimal effect on tyre/road noise.

Macrotexture allows air trapped between the tyre and the road to escape but the release of pressure causes noise. At larger lengths of macrotexture vibrations in a tyre wall are excited, which are a significant cause of tyre noise.

The nature of the texture also has an influence on noise and, for the same texture depth, surfaces with negative texture generate much less noise than those with positive texture.

High megatexture depths cause a tyre wall to deflect and vibrate under load and this is a major cause of tyre/road noise.

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Transport Infrastructure Ireland

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