Lancashire County Council

Determination of Polished Stone Values and High Friction Surfacing Requirements – Code of Practice

Determination of Polished Stone Values (PSV) and High Friction Surfacing (HFS) requirements

Introduction

This Code of Practice applies to vehicular highways maintainable at public expense which have a metalled carriageway surface. The specification of appropriate PSV and potentially HFS for a given carriageway surface is important for several reasons:

1. It contributes, in conjunction with the provision and retention of macrotexture[1], to ensuring adequate levels of skid resistance commensurate with the level of risk, are provided, and maintained.
2. It contributes to responsible management of finite high PSV resources and the overall sustainability of highway surfacing
3. It minimises whole life costs and reduces ongoing maintenance burdens.

[1]The level of macrotexture to be provided is a function of road class and traffic speed. Appropriate levels are provided within the LCC Pavement and Surfacing Matrix. In general macrotexture provided should be sufficient to ensure specified retained levels of macrotexture are provided but not over specified, such that it is detrimental to the durability of the surfacing.

Procedure for the determination of PSV and HFS for classified roads

1. Obtain the site category and investigatory level (IL) from the Highways Asset Management team for the pavement sections within the scheme.

   The site category is applied dependent upon the geometry and characteristics of the section while the investigatory level is applied as a result of local risk factors. More information on the application of site categories and investigatory level is available in the skid resistance code of practice however it should be noted that site categories and investigatory levels are reviewed annually based upon risk factors and collision statistics and are held within a third-party GIS system, currently Causeway (Yotta) Horizons.

2. Obtain detailed traffic count information.

   For some routes detailed classified counts may be available from the DfT database (https://roadtraffic.dft.gov.uk/#6/55.254/-6.064/basemap-regions-countpoints). If detailed DfT classified counts are not available then a traffic survey, split by length (under/over 7m), which also includes speeds should be commissioned.

3. The traffic count information shall then be transposed into a traffic assessment to determine the commercial vehicle flow at the surfacing materials End of Service Life (ESL).

   While traffic growth on local roads is hard to predict, and with the promotion of active travel it may be expected that traffic flows would decrease, it is

considered that a risk averse approach is taken and growth factors in accordance with CD224 are applied. In addition, this may also mitigate potential wear and polishing attributable to the ever-increasing mass of standard passenger car units, which are normally not considered in regard to structural wear.

a. *Surfacing service lives are considered to be; Asphalt Surface Course – 15 years, Cold Applied High Friction Surfacing – 10 years, Hot Applied High Friction Surfacing – 5 years.*

4. Divide the scheme up into its relevant Site Categories and Investigatory levels and then in conjunction with the ESL commercial vehicle flow read off table 1 to obtain the correct PSV for each section.

   This will result in many schemes having differing PSV values dependent on the number of different site categories present. For small schemes it may not be viable to utilise low PSVs on lower risk sections, and the higher PSV will have to be applied throughout. However, for larger schemes optimisation of PSV will provide sustainability and economic benefits. Liaison with the surfacing operations team at the earliest opportunity is advised to ensure deliverability of such benefits.

Site Category	Site description	Relative Risk Level	IL	PSV required for given Il, traffic level and site category									
				Commercial Vehicle Flow (cv/l/d)									
				1-250	251-500	501-750	751-1000	1001-2000	2001-3000	3001-4000	4001-5000	5001-6000	Over 6000
A	Motorway	Standard	0.30	50	50	50	50	50	50	50	53	63	63
		High	0.35	50	50	50	50	50	53	53	53	63	63
B	Non-event carriageway with one-way traffic	Low -	0.30	50	50	50	50	50	50	50	53	63	63
		Standard	0.35	50	50	50	50	50	53	53	53	63	63
		High	0.40	50	50	50	50	53	58	58	58	63	68+
C	Non-event carriageway with two-way traffic	Low -	0.35	50	50	50	50	50	53	53	58	63	63
		Standard	0.40	50	53	53	58	58	63	63	63	68+	68+
		High	0.45	53	53	58	58	63	63	63	63	68+	68+
Q	Approaches to and across minor and major junctions, approaches to roundabouts and traffic signals	Low -	0.45	60	65	65	68+	68+	68+	68+	68+	68+	HFS
		Standard	0.50	65	65	65	68+	68+	68+	HFS	HFS	HFS	HFS
		High	0.55	68+	68+	HFS	HFS	HFS	HFS	HFS	HFS	HFS	HFS
K	Approaches to pedestrian crossings and other high-risk situations	Standard	0.50	65	65	65	68+	68+	68+	HFS	HFS	HFS	HFS
		High	0.55	68+	68+	68+	HFS	HFS	HFS	HFS	HFS	HFS	HFS
R	Roundabout	Low – (<30mph)	0.40	50	55	60	60	65	65	65	65	68+	68+
		Standard	0.45	50	55	60	60	65	65	68+	68+	68+	68+
		High	0.50	68+	68+	68+	68+	68+	68+	68+	68+	68+	68+
G1	Gradients 5-10% longer than 50m	Low -	0.40	55	60	60	65	65	65	65	68+	68+	68+
		Standard	0.45	55	60	60	65	65	68+	68+	68+	68+	68+
		High	0.50	60	68+	68+	HFS	HFS	HFS	HFS	HFS	HFS	HFS
G2	Gradient >10% longer than 50m	Low -	0.45	55	60	60	65	65	68+	68+	68+	68+	68+
		Standard	0.50	60	68+	68+	HFS	HFS	HFS	HFS	HFS	HFS	HFS
		High	0.55	68+	HFS	HFS	HFS	HFS	HFS	HFS	HFS	HFS	HFS
S1	Bends radius <500m - ≥50mph carriageway with one-way traffic	Standard	0.45	50	55	60	60	65	65	68+	68+	HFS	HFS
		High	0.50	68+	68+	68+	HFS	HFS	HFS	HFS	HFS	HFS	HFS
S2a	Bends radius <250m - ≥40mph carriageway with two-way traffic	Low -	0.45	50	55	60	60	65	65	68+	68+	HFS	HFS
		Standard	0.50	68+	68+	68+	HFS	HFS	HFS	HFS	HFS	HFS	HFS
		High	0.55	HFS	HFS	HFS	HFS	HFS	HFS	HFS	HFS	HFS	HFS
S2b	Bends radius <100m - ≥30mph carriageway with two-way traffic	Low – (<30mph)	0.45	50	55	60	60	65	65	68+	68+	HFS	HFS
		Standard	0.50	68+	68+	68+	HFS	HFS	HFS	HFS	HFS	HFS	HFS
		High	0.55	HFS	HFS	HFS	HFS	HFS	HFS	HFS	HFS	HFS	HFS

Table 1: PSV requirements for Classified Roads

Procedure for the determination of PSV and HFS for unclassified roads

Unclassified roads typically carry significantly lower levels of traffic and commercial vehicle traffic and as such the lower level of skid risk associated with these roads means that management of skid resistance via annual SCRIM surveys and site investigations is not commensurate or economical to the level of risk. Therefore, site categories and investigatory levels are not set for the unclassified network, and as such an assessment must be undertaken on a scheme-by-scheme basis as this will ensure that any increased risks are managed in a safe, sustainable, and economical way.

1. Assign the site category and investigatory level (IL) for the scheme, there could be multiple sections dependent upon the characteristics of the road over a scheme length. This should be applied in line with the Skid Resistance Code of Practice and in with DMRB document, CS 228 Appendix A, to consider any relevant local risk factors when assigning a relative risk level/investigatory level that could give rise to an increased skid risk.

    a. In CS 228 the minimum lengths of higher risk site categories, such as K and Q are applied based on a high-speed road network, however most unclassified roads will be low speed (≤40mph). Therefore, the minimum length of high-risk site category has been calculated as a function of the stopping distance for the speed of the road being assessed. This is the sum of the thinking distance and braking distance from the Highway code, plus a factor of safety that increases with speed. If the traffic speed cannot be confidently assigned (i.e. traffic speeds ≠ speed limit) then a speed survey shall be commissioned.

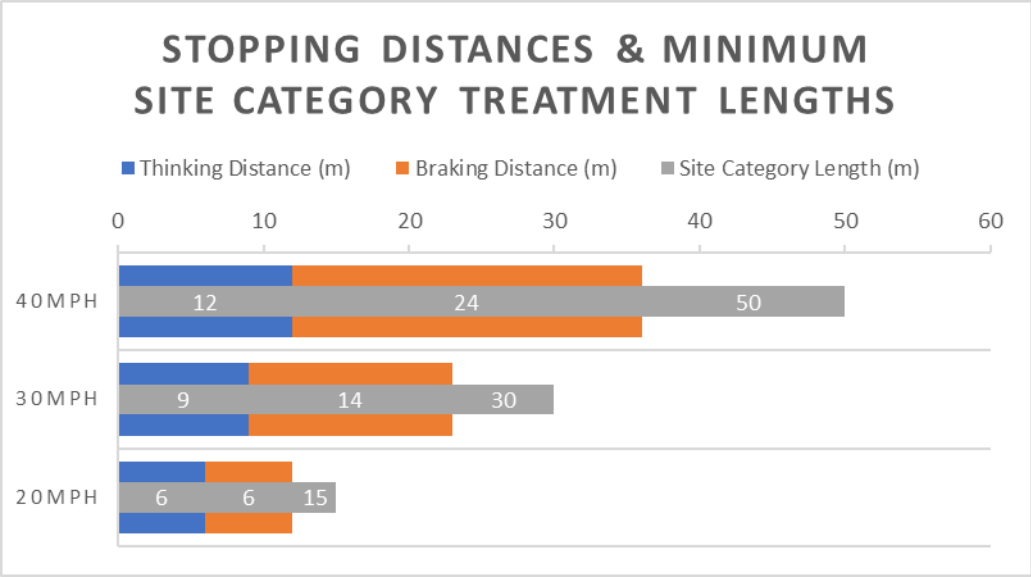

Figure 1: Stopping distance and minimum site category treatment lengths.

2. Obtain detailed traffic count information or assign an appropriate traffic level.

    a. For the majority of unclassified routes there will be an absence of detailed classified counts, however the DfT database shall be checked

as some manual counts are taken: (https://roadtraffic.dft.gov.uk/#6/55.254/-6.064/basemap-regions-countpoints). If detailed DfT classified counts are not available, then the Road Type/Classification from the National Street Gazetteer (NSG) shall be used. If local knowledge exists which runs contrary to the lower or upper commercial vehicle flow of the relevant NSG Road Type/Classification then this must be verified by a traffic survey, split by length (under/over 7m), which also includes speeds.

3. For unclassified roads, traffic growth is envisaged to be in the main, negligible, and the commercial vehicle bandings adopted have been rationalised to fit the NSG Road Type/Classificaiton, allowing a considerable margin within each band. Traffic growth is therefore not considered.

4. Divide the scheme up into its relevant Site Categories and Investigatory Levels and then in conjunction with the commercial vehicle flow read off table 2 to obtain the correct PSV for each section.

As with classified roads, this will result in many schemes having differing PSV values dependent on the number of different site categories present. For small schemes it may not be viable to utilise low PSVs on lower risk sections, and the higher PSV will have to be applied throughout. However, for larger schemes optimisation of PSV will provide sustainability and economic benefits. Liaison with the surfacing operations team at the earliest opportunity is advised to ensure deliverability of such benefits.

Site Category	Site description	Relative Risk Level	IL	PSV required for given IL, traffic level and site category			
				NRSWA Road Class (Commercial Vehicle Flow (cv/l/d))			
				Class 4 and 3 (1-250)	Class 2 251-500	Class 1 (501-1500)	Class 0 (1501-6000)
B	Non-event carriageway with one-way traffic	Low - (<30mph)	0.30	50	50	50	63
		Standard	0.35	50	50	50	63
		High	0.40	50	50	53	68+
C	Non-event carriageway with two-way traffic	Low - (<30mph)	0.35	50	50	50	63
		Standard	0.40	50	53	58	68+
		High	0.45	53	53	63	68+
Q	Approaches to and across minor and major junctions, approaches to roundabouts and traffic signals	Low - (<30mph)	0.45	60	65	68+	HFS
		Standard	0.50	65	65	68+	HFS
		High	0.55	68+	68+	HFS	HFS
K	Approaches to pedestrian crossings and other high-risk situations	Standard	0.50	65	65	68+	HFS
		High	0.55	68+	68+	HFS	HFS
R	Roundabout	Low – (<30mph)	0.40	50	55	65	68+
		Standard	0.45	50	55	65	68+
		High	0.50	68+	68+	68+	68+
G1	Gradients 5-10% longer than 50m	Low - (<30mph)	0.40	55	60	65	68+
		Standard	0.45	55	60	65	68+
		High	0.50	60	68+	HFS	HFS
G2	Gradient >10% longer than 50m	Low -	0.45	55	60	65	68+

Site Category	Site description	Relative Risk Level	IL	PSV required for given IL, traffic level and site category			
				NRSWA Road Class (Commercial Vehicle Flow (cv/l/d))			
				Class 4 and 3 (1-250)	Class 2 251-500	Class 1 (501-1500)	Class 0 (1501-6000)
		(<30mph)					
		Standard	0.50	60	68+	HFS	HFS
		High	0.55	68+	HFS	HFS	HFS
S1	Bends radius <500m - ≥50mph carriageway with one-way traffic	Standard	0.45	50	55	65	HFS
		High	0.50	68+	68+	HFS	HFS
S2a	Bends radius <250m - ≥40mph carriageway with two-way traffic	Low - (<30mph)	0.45	50	55	65	HFS
		Standard	0.50	68+	68+	HFS	HFS
		High	0.55	HFS	HFS	HFS	HFS
S2b	Bends radius <100m - ≥30mph carriageway with two-way traffic	Low – (<30mph)	0.45	50	55	65	HFS
		Standard	0.50	68+	68+	HFS	HFS
		High	0.55	HFS	HFS	HFS	HFS

Table 2: PSV requirements for Unclassified Roads

Specification of High Friction Surfacing Systems

There have traditionally been two primary types of high friction surfacing system, cold applied and hot applied. According to the Road Surface Treatments Association, these can be described as:

Cold applied

These systems comprise a resin adhesive that bonds the prescribed aggregate typically graded 1-3mm to the prepared substrate. The aggregate is very hard with a low Aggregate Abrasion Value (AAV) and with a high Polished Stone Value (PSV) that provides the necessary friction with the tyre. Cold applied resins include epoxy, polyurethane [PU], polyurea, methyl methacrylate [MMA] and polyurethane modified MMA.

Hot applied

For hot applied materials, the pre-mixed resin and aggregate is heated in a boiler at high temperature ensuring the material is mixed and workable. The hot thermoplastic material is screeded out in adjoining strips to cover the whole surface.

Cold applied systems are more durable but do come with seasonal constraints on laying, this however must be thought of in the context of the typical season for surfacing. i.e., it may be difficult to lay cold applied HFS after October, but resurfacing works should and normally are reduced to pre-patching in this period, owing to the reduced durability of asphalt when laid in cold conditions, as such this will have minimal operational impact for capital maintenance schemes. For third party, or new roads then this must be considered in the planning, programming and tendering stages of the projects.

Cold applied systems only shall be used; the operational constraints, such as seasonality and the period required between laying of fresh asphalt surfacing and application of cold applied HFS (typically 7 days) will need to be considered from the

outset when planning the scheme. Hot applied systems are not permitted to be used due to their short service lives.

Proprietary alternative high friction surfacing, which are essentially thin surface course systems incorporating a mixture of calcined bauxite and high PSV natural aggregates are available and marketed as a lower whole life cost alternative to conventional HFS systems. Currently these materials are not approved for use. This is owing to the significant additional use of high embedded CO_2e calcined bauxite and finite high PSV natural aggregates, much of which is not being utilised for its intended properties (i.e., the majority of a thin surface course layer is not in contact with the tyre) and due to the fact that research has indicated they do not reach or maintain the same levels of skid resistance as conventional HFS systems. (Further information is available in TRL Report PPR789). In addition, when compared to cold applied HFS systems, it is not clear cut that there are whole life cost savings.