TAIT PROCEDURE FOR NEW SURFACING IN SCOTLAND

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ABSTRACT

Following issues with the quality and performance of SMA surface course, Transport Scotland issued a new national specification in December 2010. Known as TS2010, the new performance-based specification has the potential to see an increase in the use of locally won materials leading to more sustainable options. As part of a controlled introduction to the new specification, a Type Approval Installation Trial (TAIT) procedure is being developed. The overall aim of the TAIT is to ensure that the surfacing material is of a high quality and is consistently produced and laid correctly. It will also allow the collection of data that will be used to further refine and develop the TS2010 specification. The TAIT comprises a four stage process: Laboratory testing and design; Product mix trial, Trunk Road Network Trial (interim approval); and Final Approval. This paper describes the development of the TAIT in conjunction with industry. The TAIT requirements cover mixture composition, production, transport and laying operations and the training of operatives.

Keywords: surface course, durability, performance, quality, specification

1. INTRODUCTION

Following issues with the in-service performance of surface course in 2006, Transport Scotland commissioned research to review the performance of surfacing laid on the Scottish trunk road network. Industry professionals were invited to a series of workshops to discuss the findings of a survey that raised concern that the performance of the top layer of the road surfacing was not representing good value for money. One outcome of these workshops was the creation of the Transport Scotland Pavement Forum (TSPF) in 2007. This group was established to encourage two-way communication between clients, designers and suppliers/contractors and to promote, develop and implement best practice across the road industry. A major TSPF recommendation was that efforts should be made to reduce the open texture appearance of surface course by exploring the use of denser mixes utilising smaller aggregate sizes.

1.1 Road trials

Study visits to Germany were made to gain knowledge of current practices and experience. It was found that smaller stone mixes with a thicker binder coating result in an expected service life of sixteen years, with many heavily trafficked sites providing 20 years of service. The standard practice of treating newly-laid surfacing with an application of crushed grit to increase early-life skid resistance was also observed.

In 2008 a series of road trials based on German specifications were undertaken on the M8 between Edinburgh and Glasgow. Eight stone mastic asphalt (SMA) materials using nominal aggregate sizes of 14 mm, 10 mm, 8 mm and 6 mm were laid and industry representatives were invited to attend. The specific aims of the trial were to:

- evaluate the potential of SMA mixtures with smaller aggregate sizes;
- measure the effect of reduced texture depth on skid resistance;
- assess the influence of treating SMA with grit; and
- identify any difficulties in the design, manufacture and laying of the SMA.

1.2 New surface course specification

The findings of the research [1] were used to develop of a new national specification [2]. The new specification known as TS2010 is accompanied with Notes for Guidance and is expected to deliver significant improvements in material durability and ultimately reduce disruption to road users caused by road construction and maintenance. The traditional measurement of texture depth as a surrogate for skid resistance has been removed as research showed that strict grading requirements will inherently provide an adequate amount of texture. It marks a step change in approach for specifying surfacing material as it includes a performance-based in-service skid resistance requirement for the newly-laid and early-life condition. This creates an opportunity to adopt a more flexible approach than the traditional specification of PSV and the techniques used for the measurement of skid resistance. The performance-based requirement has the potential to see an increase in the use of locally won materials if they can demonstrate the required performance. In addition, the specification includes high polymer-modified binder contents, maximum and minimum air voids content, and the addition of cellulose fibres.

1.3 Controlling the introduction of TS2010

It was identified that the need to control the quality of materials and workmanship was a key factor in delivering the benefits of the new surface course specification. It was also recognised that the introduction of any new specification needs to be controlled and may require fine tuning over time. A Type Approval Installation Trial (TAIT) process was therefore developed to ensure that the new material is consistently produced in accordance with the requirements of the specification.

2. TAIT process

The TAIT comprises a four-stage process: Laboratory testing and design, Product mix trial, Trunk Road Network Trial (Interim Approval), and Final Approval. The Supplier is required to provide information to demonstrate compliance with each stage of the TAIT. Client approval is required at the end of each stage before the Supplier can to proceed to the next stage of the process. The Client provides a 'Feedback' report at the completion of each stage to encourage dialogue should improvements be required prior to approval to proceed to the next stage.

2.1 Stage 1: Laboratory testing and design

Stage 1 relates to designing a mixture in the laboratory that meets the TS2010 specification. It includes establishing important aggregate and binder properties and ensuring the composition of the mixture adheres to strict grading requirements to ensure the correct extent of gap-grading. Maximum and minimum air voids content need to be

demonstrated, and performance tests are required to demonstrate that high binder contents can be achieved in the mixture without binder drainage and that adequate deformation resistance is achieved. The importance of selecting the correct production method for test specimens is stressed as this can affect the results produced.

2.2 Stage 2: Product mix trial

The product mix trial forms Stage 2 of the TAIT and provides an opportunity for all those involved with the process to see the designed mixture being produced, laid and to assess its behaviour under laying and compaction. The mix trial enables the collection of important information of the laid and compacted material, such as air voids content, and permits correlations between certain destructive and non-destructive testing.

The product mix trial is intended to allow the Supplier to become familiar with the material and the process of paving, compacting and treating the surface with grit. The product mix trial also allows the Client to assess the competency of the Supplier's management and laying team in fulfilling compliance with the requirements of the TS2010 specification.

The product mix trial is not permitted to form part of any permanent works on the Scottish trunk road network.

2.3 Stage 3: Trunk road network trial

Following Stage 2 approval, the Supplier can propose to lay the TS2010 on the trunk road network. The Supplier must demonstrate that the laying team have received appropriate training, are familiar with the TS2010 specification and familiar with industry best practice. Method statements are required to cover key areas such as transport and delivery, site preparation and application of bond coat, laying, compaction and gritting.

In addition to testing requirements to confirm material composition, early-life skid resistance is measured using the GripTester braked-wheel fixed-slip device (Figure 1) with tests after four weeks and six months.

Figure 1: Low speed skid resistance measured by GripTester

Following completion of Stage 3 to the satisfaction of Transport Scotland, confirmation of formal Interim Approval to use the product on the Trunk Road Network is given.

2.4 Stage 4: Final approval

The TAIT process is completed after two years if the skid resistance measured using SCRIM is in accordance with HD 28/04 [3], and a visual assessment of surface condition has been satisfactorily concluded. The issue of a Final Approval is then made by Transport Scotland.

3. Experience of the TAIT process

The TAIT process was introduced at the beginning of 2011. It has encouraged constructive discussion between the Client and asphalt suppliers regarding the implementation of TS2010. The TAIT process also allows the collection of data that will be used to further refine and improve the TS2010 specification and notes for guidance. Some examples of the benefits of the TAIT process are described below.

3.1 Grading requirements

Conformity with TS2010 grading envelopes is required to ensure the correct extent of gap grading is produced. Good compliance with the TS2010 has been achieved. An example of meeting the grading requirements for a

0/10mm SMA is shown in Figure 2. The material produced at the plant possesses a very consistent appearance and surface texture. Owing to experience of high textured surfacing possessing poor durability [1], texture depth is not a specification requirement for TS2010. However, texture is being measured to gain a database of information that can be compared with the measured skid resistance performance as mixtures are developed and approved. Mean texture depth (MTD) measurements of different suppliers' TS2010 materials tested at Stage 2 can be seen in Table 1. The Table shows results for both ungritted and gritted areas.

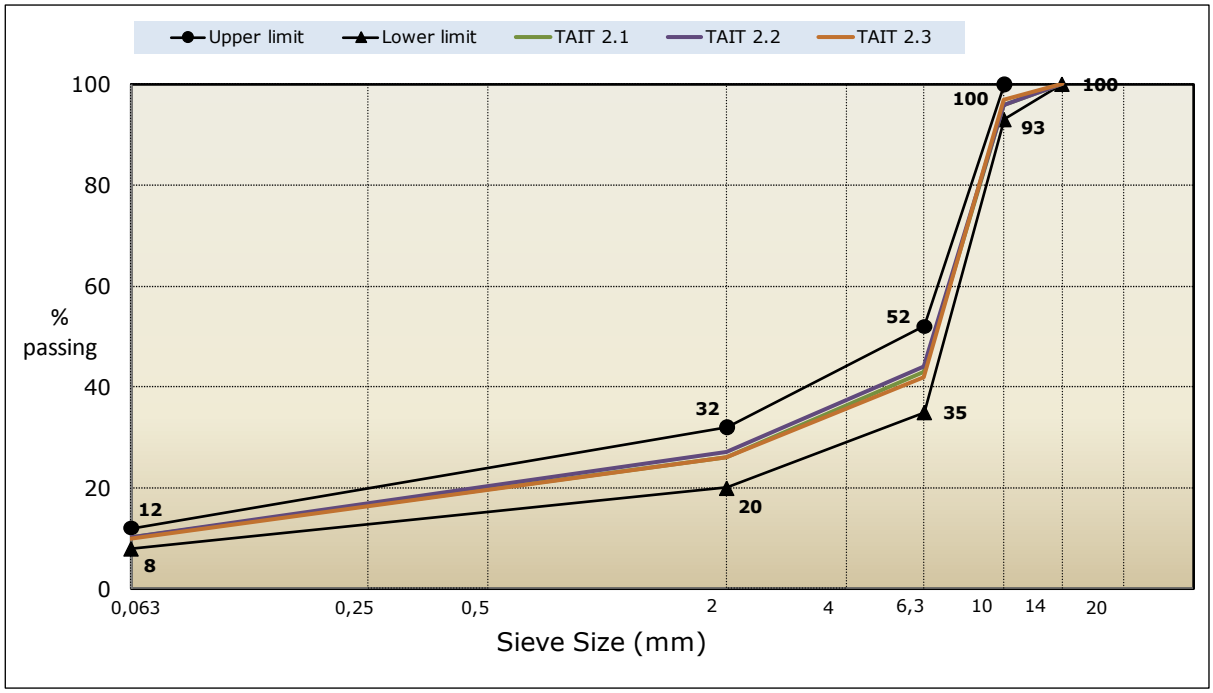

Figure 2: Compliance with TS2010 SMA 10 (surf) grading envelope

Table 1: MTD measurements on TS2010 SMA 10 (surf) using glass beads to form patches (mm)

Surface test area (average of 5 readings)	Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5
Ungritted	1.3 mm	1.2 mm	1.4 mm	1.1mm	1.4 mm
Gritted	1.0 mm	0.9 mm	1.3 mm*	1.0 mm*	1.2 mm

**Low gritting spread rate*

3.2 Application of grit

Figure 3: Application of grit

Figure 3 shows the application of grit during a Stage 2 trial. The TAIT process has been useful in improving the application of grit. In some instances grit treatment has not been particularly successful with only parts of the mat being covered, i.e. a uniform distribution of grit was not achieved. In some instances this has been due to defective plant, e.g. Grit was seen to leak from the side of the grit box. The most common problem stems from the

consistency of the grit size. If it contains too much oversized particles they block the aperture/slit in the gritting box which produces an inconsistent streaky application.

Grit is applied to the TS2010 SMA mixtures when new because they possess a thicker binder film than most conventional asphalts. In the surfacing's early life the binder film can prevent the microtexture on the aggregate particles making contact with a tyre, resulting in potentially lower wet friction than might normally be expected. Grit is therefore applied to the surface at the point of laying to increase the early-life skid resistance. The application of grit also assists in accelerating the removal of thick binder films from the aggregate at the top of the surface course. The grit is lightly coated to reduce dust and minimise the quantity required.

3.2 Improving joint construction

All asphalt surfacing joints are potential areas of weakness because they are likely to be less well compacted and can allow increased access to water penetration. Joints in the surface course are often the first place to show signs of deterioration which then migrates across the pavement. It is therefore important that they are well constructed and sealed to prevent water infiltrating and harming the surface course and lower pavement layers.

As part of the Stage 2 and 3 of the TAIT, a new approach to constructing longitudinal joints has been trialled. The technique involves using a special cutting wheel that creates a chamfered joint (Figure 4). The method appears to have several benefits that include reduced wastage of material, ease of joint preparation and a well sealed quality joint (Figure 5).

Figure 4: Chamfered Joint with roller in 'Crab-steer'

Figure 5: Ease of joint preparation

4 CONCLUSIONS

Transport Scotland is currently working closely with TRL and the road industry to implement a new surface course specification and improve quality control. The new specification marks a step change in approach for specifying surfacing material. It has been designed to deliver significant improvements in material durability and ultimately reduce disruption to road users caused by road construction and maintenance. It also has the potential to see an increase in the use of locally won materials leading to more sustainable options.

As part of the implementation of the specification, a TAIT process is being used to approve the use of new materials for use on the Scottish Trunk Road Network. The TAIT has four key stages covering laboratory validation, product mixture trial, trunk road network trial and final approval by Transport Scotland. The TAIT is seen as an integral part of the new specification as it will provide significant improvements in quality control leading to improved material durability and value for money. The TAIT has encouraged constructive discussion between the Client and asphalt suppliers that will lead to potential further refinements to the specification and notes for guidance.

5 ACKNOWLEDGEMENTS

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