TS 2010 a surface course designed for safety

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ABSTRACT

This paper will describe the introduction of the new performance based specification which is expected to deliver significant improvements in material durability, value for money, safety, and potentially allow for the use of locally won materials and reduce disruption to road users caused by road construction and maintenance.

Further research as demonstrated that the SMA provided a larger contact area between the vehicle tyre and the surface of the road. This provided the 'grip' that is apparent in the testing completed to date. This would suggest that smaller nominal size SMA's should be used for increasing stress sites as they will provide higher skidding resistance and be more durable and less likely to fret.

The specification TS2010 is now available and it is hoped that it will be used on all new pavements and on pavements that are structurally sound from a maintenance point of view. The policy is that this material should not be used on unsound pavements, as we expect this material to perform for 16 years plus.

TS 2010 SMA in Scotland

In Scotland the use of SMA type thin surfacing course systems have effectively replaced hot rolled asphalt (HRA) as the standard surface course material for trunk roads and motorways. The use of HRA has diminished considerably but still remains a popular choice for specific parts of the network, such as bridge decks and roundabouts.

The first SMAs used in Scotland were based on modified German mixture designs. An important difference was that the gradings and nominal aggregate sizes were adjusted to meet UK surface texture depth requirements. SMAs using smaller aggregates (0/10 mm, 0/6 mm) were considered to be unable to routinely meet the 1.5 mm texture depth required for new surfacing used on high speed roads.

Taking on board the advice from all the consultations and the lessons learned from the M8 trials, a Transport Scotland Interim Amendment (TSIA) was issued on 10th December 2010 to introduce a new specification for surface course known as TS2010 SMA. The key elements of the specification are:

- strict grading requirements to ensure the correct extent of gap grading;
- high polymer modified binder content;
- maximum air void contents;
- gritting of all new surfaces;
- the addition of cellulose fibres; and
- performance based in-service low-speed skid resistance requirement.

The approval of new materials, under the new specification, for use on the Transport Scotland Network is through a Type Approval Installation Trail (TAIT) which has 4 key stages covering laboratory validation; product mixture trial; trunk road network trial including Skid resistance measurements and formal approval by Transport Scotland.

1.0 Introduction

This paper will describe the introduction of the new performance based specification which is expected to deliver significant improvements in material durability, value for money, safety, and potentially allow for the use of locally won materials and reduce disruption to road users caused by road construction and maintenance.

2.0 TAIT Procedure

2.1 Since the introduction of the specification over 20 Type Approval Installation Trials (TAITs) have been started and approvals are now coming through as the TAIT process takes two years to complete.

2.2 Stage one of the TAIT requires the mix design to meet exacting parameters. The lessons learned at this stage are that poor aggregate shape affects the voids content adversely. The use of gyratory compaction in the lab provides a better understanding of the sensitivity of the mixture. There have been no issues on achieving the binder drainage and rutting requirements.

2.3 Stage two consists of the plant trial where Transport Scotland staff meet and discuss the following issues with the operatives who indeed must have training and records of understanding the fundamentals of the issues in laying this material, as installation is just as important if not more so as to the exacting compliance of the mixture. The longitudinal joints are required to be side compacted/chamfered (see figures 1, 2 and 3)

Figure 1; Tandem roller in crab steer showing side compaction

Figure 2; Pouring bitumen to chamfered joint

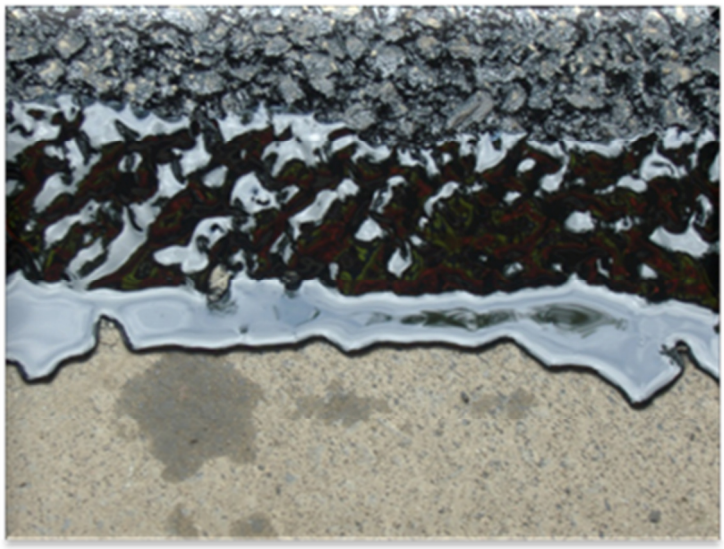

Figure 3 Finished painted joint

This improves the sealing of the joint which is a common fault and the weakest area of the laid mat. It can be seen that the tandem roller is used in crab steer (Figure 1) to 'knock down' the raised edge caused by the 'pinch roller', pouring of the bitumen is then much easier on the sloping surface (Figure 2), therefore more likely to be completed properly.

Figure 4 Gritting Box, grit applied when mat is hot.

2.4 Stage three is where the skid resistance and visual inspection is undertaken. Initially with the GripTester at four weeks and six months to give early indication of 'grip' bearing in mind that the mat is gritted during laying (Figure 4) immediately behind the paver to a hot mat. This is performed to minimise the so called 'early life' skid resistance issue, but in effect, the grit gives enhanced skid resistance and allows the bitumen to be scrubbed off under traffic. Indications are that the traffic intensity affects this 'scrubbing', high levels of traffic means the bitumen is removed relatively quickly and low traffic volumes means the elevated skid resistance lasts longer, a win-win. Interim approval for the material is given at this point assuming that the specification requirement is met. This means that the material can be used on the network without going through the TAIT process again.

2.5 The following charts show the effects of the performance of the surfacing over time and gives confidence that the pavement will provide adequate skid resistance but also longer life due to the low voids and higher bitumen content in the mix.

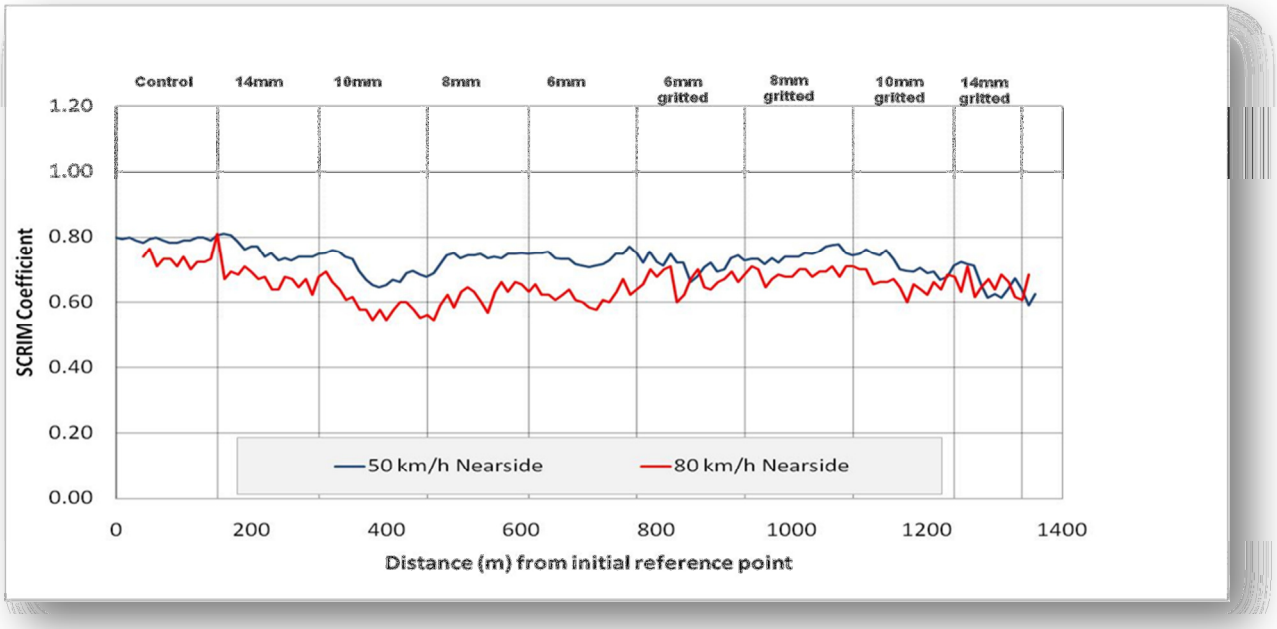

Figure 5 SCRIM Value before opening to traffic

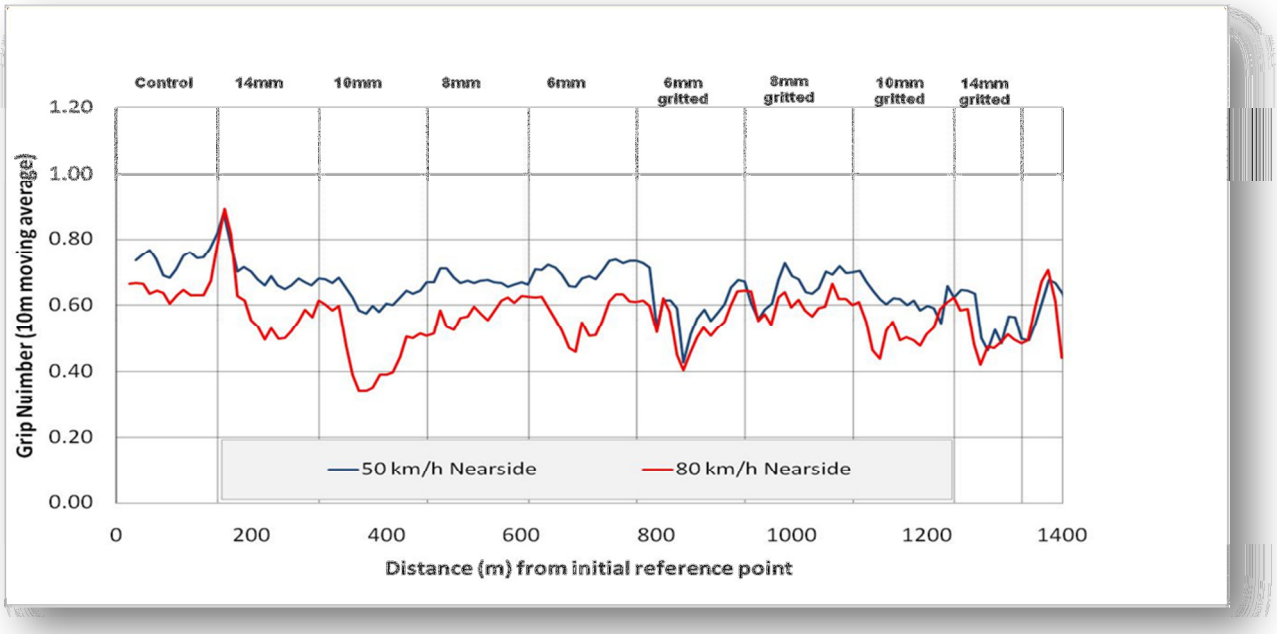

Figure 6 Grip Number before opening to traffic.

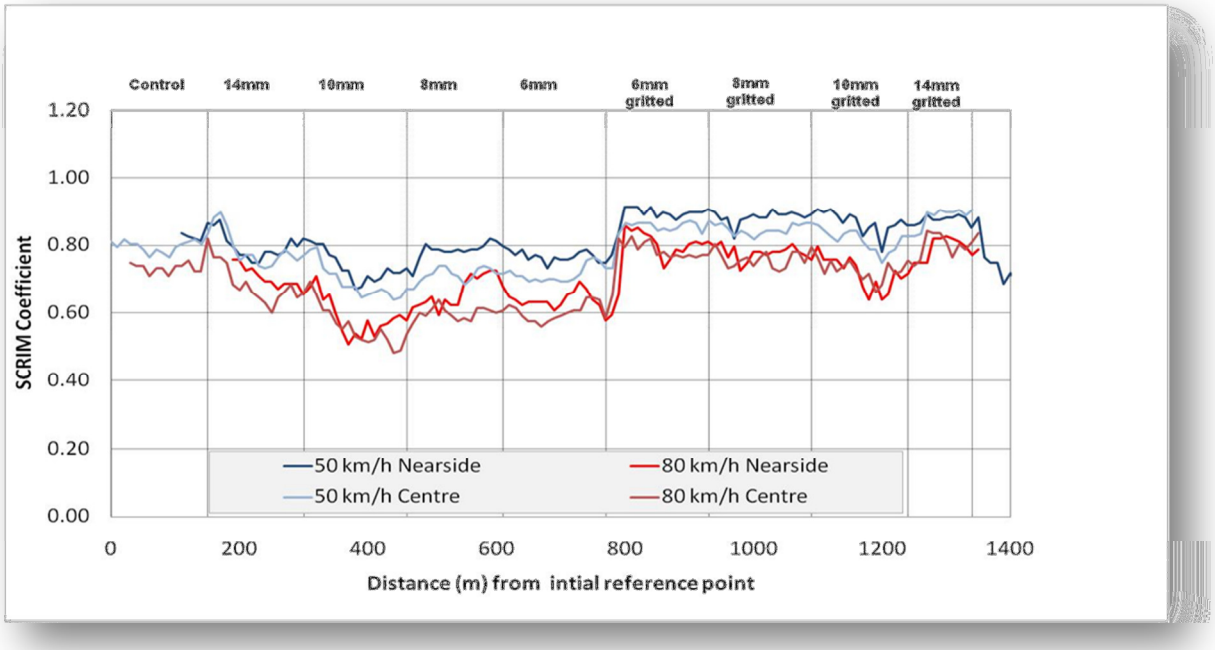

Figure 7 SCRIM value after 3 days of traffic

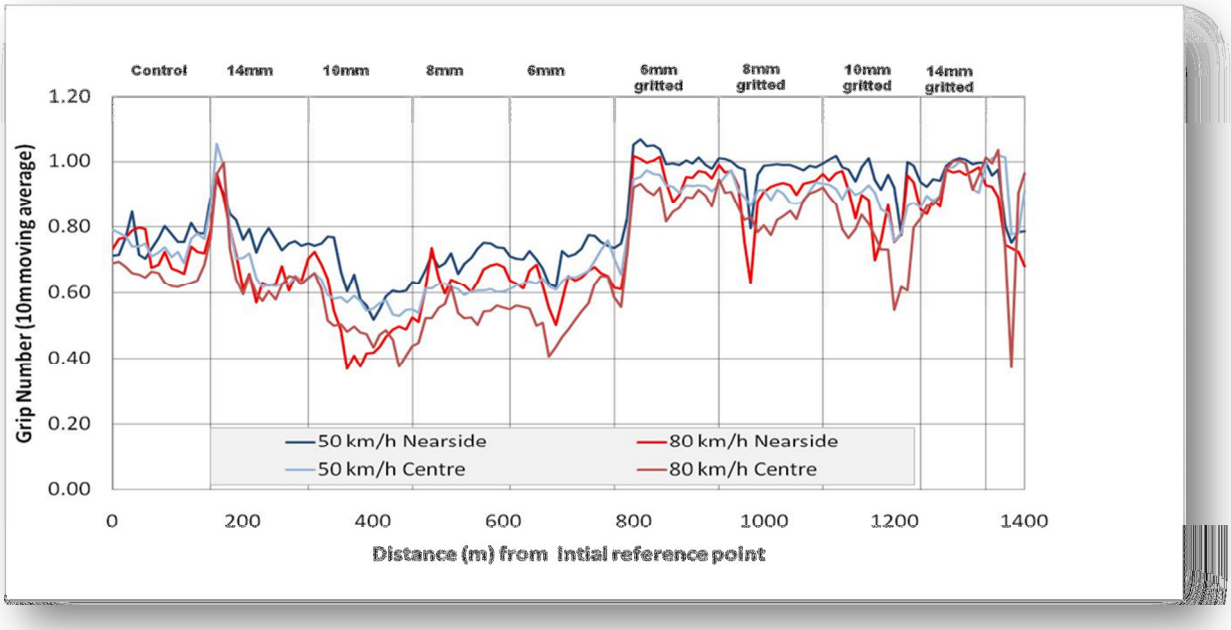

Figure 8 Grip Number after 3 days of traffic

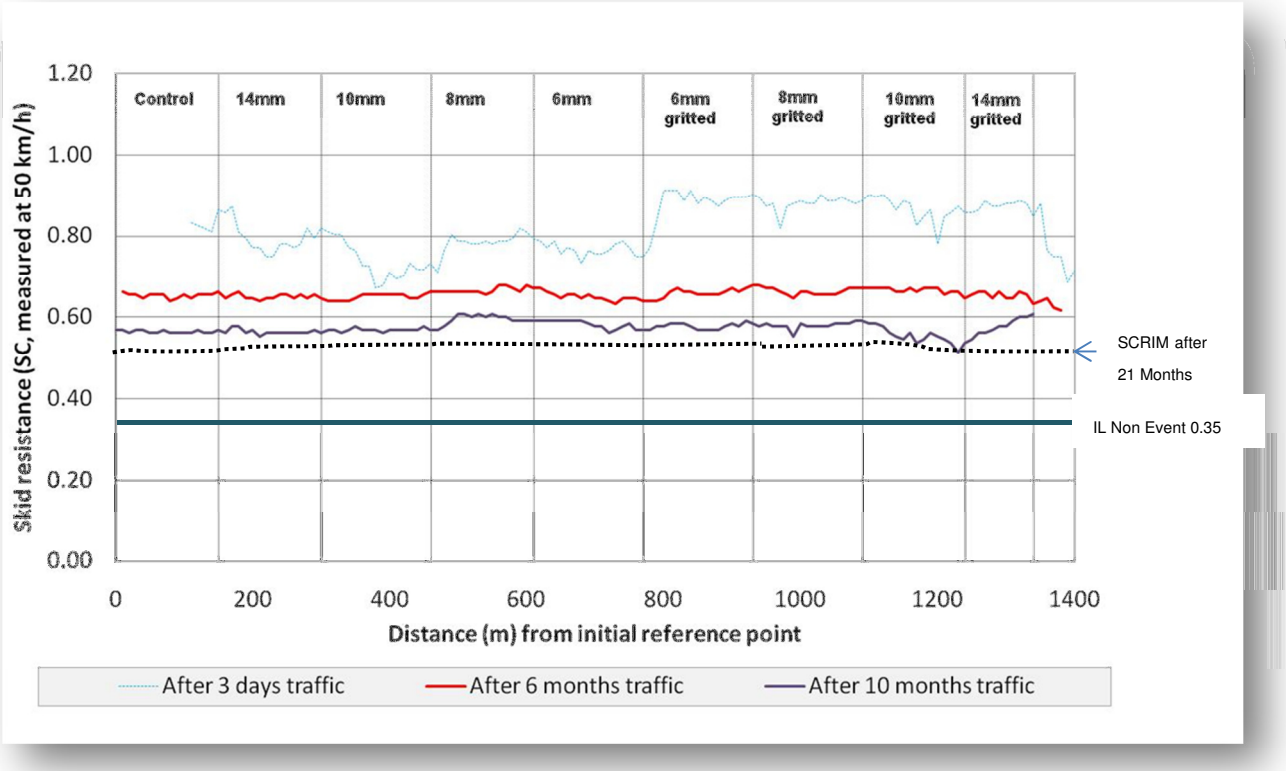

Figure 9 Showing IL and most recent SCRIM values

2.6 The SCRIM and Gip Number values in early life are elevated due to the grit. It can also be seen from the Skid Resistance diagrams that the performance of the surface course is more than adequate for the category of a non-event site and is well above the Investigatory Level (IL) of 0.35 SCRIM after 21 months. Up until the introduction of the TS2010 specification, grip values of any sort were only available following routine SCRIM measurements; this could be 1 to 2 years. It is thought that having measurements of skid resistance at 4 weeks and 6 months provides more certainty of safety. The previous use of Texture and PSV as a surrogate to provide comfort that the surface would be safe was based on Hot Rolled Asphalt (HRA), which has, positive texture, does not fit comfortably with thin surfacing or SMA type negatively textured materials. Hence this performance specification was written to demonstrate that SMA is fit for purpose and safe for the user.

2.7 Further research as demonstrated that the SMA provided a larger contact area between the vehicle tyre and the surface of the road. This provided the 'grip' that is apparent in the testing completed to date. The diagram below shows that with decreasing aggregate size there is a corresponding increase in contact area. This would suggest that smaller nominal size SMA's should be used for increasing stress sites as they will provide higher skidding resistance and be more durable and less likely to fret.

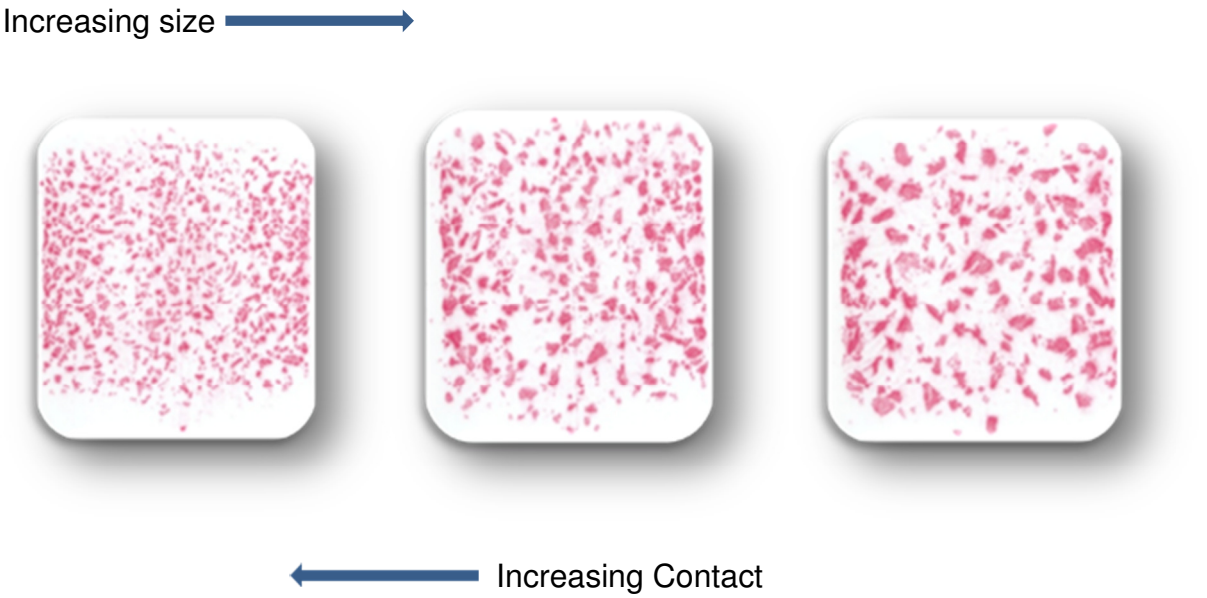

Figure 10 Pressure diagrams

2.8 Stage four is completed by Transport Scotland using SCRIM (Sideway-force Coefficient Routine Investigation Machine) to measure the skid resistance at two years whereupon final approval is given subject to meeting the skid resistance values in the specification.

3.0 TS2010 Project

3.1 TS2010 has been laid on the M90 Forth Crossing southbound section of Fife ITS (Intelligent Transport System) with huge success. In all 3.2km of existing M90 motorway, two lanes and hard shoulder, to be used as a bus lane, was laid in two weekends in echelon (no longitudinal joints) with minimal traffic delays.

3.2 The Project was planned for four weekends with full closure of the southbound carriageway but the logistics and planning surrounding this laying was so effective that it was completed in just two. Some 3,500 tonnes of material is the largest ever laid in this timescale in Scotland. It's fair to say that the ride quality is impressive and the noise reduction afforded by the material (10 mm nominal size) significant, indeed the public has reported this noise and quality to Transport Scotland.

Figure 11 M90 Fife ITS Project: 3 Pavers in Echelon 3 point rollers and tandems with gritting boxes

Figure 12 Junction 1a M9 again echelon paving no joints

3.4 The specification TS2010 is now available and in the rates for the operating companies in Scotland in the 4G contracts and it is hoped that it will be used on all new pavements and on pavements that are structurally sound from a maintenance point of view. The policy is that this material should not be used on unsound pavements, as we expect this material to perform for 16 years plus.

3.5 In conclusion, Transport Scotland is pleased with the way the specification has performed on the network and will continue to monitor and improve it, with the help of the Scottish industry through the IAT, MPA and the Transport Scotland Pavement Forum. Safety is always at the forefront of all Overseeing Organisations and this performance based approach is providing confidence to take the specification forward.

Author Biography

Dougie Miller

Dougie has over 40 years of experience in the road construction industry. From 1999 to 2013 he was employed as Transport Scotland's Materials & Quality Assurance Advisor responsible for advice on construction materials. As the first Chairman of the Transport Scotland Pavement Forum he initiated the Scottish Inspection Panel. Dougie has managed and contributed at a technical level to many government funded projects, notably research that led to the new TS2010 Surface Course Specification and Guidance, and the Crack, Seat and Overlay Simplified Design Method. Dougie has extensive experience of reviewing Departures from Standards for road pavement submissions, and advising fellow professionals on materials issues arising on the Trunk Road network.

Prior to joining Transport Scotland, Dougie provided specialist advice and assistance to Clients seeking to achieve UKAS accreditation in the construction materials testing industry. In his early career Dougie was responsible for setting up and running NAMAS Accredited Materials Testing Laboratories, both for the Scottish Office Industry Department and a private sector employer and became an operational UKAS Lead Assessor.