

## **USE OF RUBBER PADS ON VARIOGUARD (TEMPORARY RESTRIANT)**

### **OVERVIEW**

During the ECI stage of A1 Dishforth to Barton in 2008 the project team working along side of Asset International (part of the Hill and Smith Group) identified the need to install rubber pads on Varioguard prior to installation on newly laid surface course which would cover a length of 22 kilometres of Varioguard was to be laid on new surface course.

### **Previous Lessons Learnt**

The last major issue was M25 J12-15, with Balfour Beatty, in 2004/ 2005, where the Varioguard was placed on the joint line between 'rips' without pads on newly laid surfacing. The total cost of resurfacing at that time was £499k. As a result pads became an option to A1 Dishforth to Leeming project at an additional cost of £72,000 which was included in target cost and accepted by Highways Agency as best practice.

### **TECHNICAL DATA**

The addition of the Asset International Varioguard Flexible Base represents a significant improvement in barrier sinkage performance on freshly laid asphalt surfaces. The castellated rubber pad, manufactured in 50<sup>o</sup> Shore hard Natural rubber, maximises efficient rubber usage whilst providing excellent deformation characteristics under load.

Laboratory based testing was performed at the Transport Research Laboratory (TRL) to map the deformation characteristics of Tarmac Masterflex asphalt under steady state conditions. The results showed acceptable surface deformation (0.35mm after 7 days) under controlled temperature conditions of 45°C when loads of up to 12 tonnes/m<sup>2</sup> (117.7 kPa) were applied. This figure has been taken as the control for subsequent trials to determine the relative performance of the Varioguard Flexible Base.

Extensive flatness trials were carried out at TRL on a number of Varioguard units. The results displayed a generalised trend which suggested that the majority of the barrier weight is carried by the two 'end feet'.

These findings were reflected in the physical trials of the Flexible Base. The barrier was placed on raised blocks under the two extreme feet to replicate the 'worst case' condition of deployment. The assumption was made that the mass of the barrier would be equally distributed between the two points. A computational pressure mat system was used to establish the loading conditions of the barrier with and without the Asset International Varioguard Flexible Base. The results of this can be seen in figures 1 & 2.

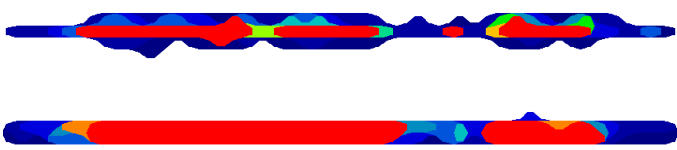


Figure 1 – No Rubber Pad – Total Area 21,058mm<sup>2</sup>

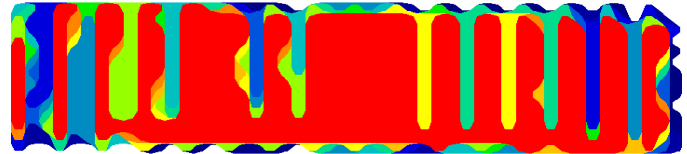


Figure 2 – Flexible Base – Total Area 66,890mm<sup>2</sup>

Although the pressure maps above show an uneven pressure distribution, this data sheet will assume uniformity due to the individual signature of each barrier.

Based on the figures presented for the difference in area between the standard barrier and the Flexible Base, a pressure difference can be calculated.

**These figures should be compared to the control for asphalt shear of 117kPa.**

**STANDARD BARRIER**  
**306.1 kPa**

**VARIOGUARD FLEXIBLE BASE**  
**96.4 kPa**

It can be concluded that whilst the standard barrier far exceeds the loading sustainable by the asphalt surface, the addition of the Flexible base significantly reduces this effect to a reasonable level.

### Existing Surfacing

The A1 D2L project did not install pads on existing A1 carriageway and encountered no damage to carriageway. This is due to the surface being fully cured and ‘work-hardened’ through use. The key factors in asphalt deformation are temperature, and curing time. Bitumen, the binder in asphalts, is a visco-elastic material whose strength is very dependant on the temperature. Deformation in the surfacing of roads tends to occur in the few hours each year when temperature is highest. This phenomenon is more acute in the early life of a surfacing when it is cleanest (ie black and absorbs more heat), and the exposed binder has not oxidised, increasing its stiffness. There may be some difference depending on the aggregate size, but this should be minor. As you move further away from the aggregate interlock type of mixture, the more the behaviour of the asphalt can be different. For instance, hot rolled asphalt, or mastic asphalt rely on the mortar for strength, and as a result are far more temperature susceptible (eg the wheel tracking rate at 60 degrees C of SMA will be two or three times that at 45 degrees C, but for HRA it will generally be an order of magnitude greater.)

### Lessons Learnt

The A1 Dishforth to Leeming scheme site team laid permanent lining prior to installation of Varioguard; the aim being when Varioguard was removed lanes could be opened without any other operations required.

On reflection the project would not have laid permanent lining as the rubber pads created indentations in line markings for around 11 kilometres of 2m lines, remedial action was scabbling damaged line markings within 1mm of surface course and relay at a remedial cost of £11,500. The cause of indentations on line markings could have been partly due to residual heat in surfacing, or heat transfer through Varioguard during the summer months.



### **Further Mitigation**

Before installation, it is essential that the main contractor establishes from the surfacing contractor both the asphalt shear data for a STATIC LOAD (as opposed to a wheel load[travelling]), and also details the curing time for the product, at different temperatures. This must be factored into the project so that sufficient lead time is allowed prior to installation of Varioguard.

### **CONCLUSION**

If the A1 joint venture Carillion Morgan Sindall had not installed rubber pads on Varioguard, then hypothetically Varioguard had been placed on newly laid surface course, the cost of resurfacing of 2 lanes (as Varioguard straddles joint line) without pads on newly laid surfacing lanes with longitudinal indentations requiring 160,600 m<sup>2</sup> of planning and resurfacing at a cost of £2.4 million plus attendances.

When the tolerance in flatness on the base of Varioguard is combined with tolerance in asphalt surfacing flatness, the surface pressure on the asphalt can be such that deformation occurs. The use of the Varioguard rubber pads, specifically designed by TRL for use with this product, considerably evens out, and thus effectively reduces the bearing pressure on the asphalt.

For future road projects Carillion Morgan Sindall will not be laying permanent line markings prior to installation of Varioguard on new surface course, however will always use rubber pads on newly laid surface course using all the considerations listed in this document.

The End