

pavingexpert.com



Paving and Hard-landscaping Consultancy

32, Newchurch Lane, Culcheth, Warrington, England WA3 5RR
T: +44(0)1925 762034 | W: www.pavingexpert.com | E: info@pavingexpert.com

Stain testing of Hansebeton paving samples

1 - Introduction:

- 1.1 R2 Paving Solutions distribute a range of paving manufactured in Germany by HanseBeton. The most distinctive claim made by HanseBeton for their HanseClean system pre-sealed products is that they are practically stain-proof.
- 1.2 In March 2009, R2 Paving commissioned pavingexpert.com to undertake a series of tests over a period of several weeks to determine whether the paving could be stained by exposure to a range of products with which the paving could come into contact under typical everyday usage.
- 1.3 R2 Paving provided a selection of their HanseClean system pre-sealed paving products to pavingexpert.com. These are listed as Appendix I.
- 1.4 Pavingexpert.com collated a list of products that could be considered as potential stains for the paving when laid in scenarios that the manufacturer considers to be target markets. These target markets were defined as
 - residential patios
 - residential driveways
 - pedestrian areas within urban streetscapes
 - light traffic low-speed areas within urban settings (small car parks, podium decks etc)

- 1.5 Considering the stated target uses for the HanseBeton paving, a list of potential stains was prepared comprising products from a number of groups:

Foodstuffs -	patios are often used for barbecues and summer entertaining as are likely to encounter spilled food and drink; urban streetscapes are subjected to spilled and/or discarded takeaway foods and beverages
Motor -	driveways and car parks will be subjected to contamination from oils, fuels, lubricants, and tyre marking
Garden -	patios and driveways are likely to be exposed to fertilisers, biocides, timber preservatives and vegetation
Human usage -	most paving will, at some time, be subjected to staining by any number of cultural products such as sun cream, cosmetics, body waste, cigarettes and graffiti

The full list of potential stains is given as Appendix II

- 1.6 It was recognised that some products might stain immediately, while others would leave no trace unless allowed to remain in contact with the paving for an extended period. Accordingly, the trials were scheduled to test each of the stains over periods of:

12 hours
72 hours (3 days)
168 hours (7 days/1 week)

- 1.7 The trafficking tests were intended to observe tyre marking and therefore these trials were conducted based on the number of wheel passes rather than on a time basis. The methodology for these trials is detailed later in this report.

2 - Stain Testing Methodology:

- 2.1 Given that the sealant used on this paving creates a permanent barrier between the coloured substrate concrete and the environment, the actual colour of product should have no effect on the likelihood of staining but it was considered that a light background would make it easier to detect any faint discolouration or marking caused by the potential stains.
- 2.2 Four of the supplied 400x400mm Domino Facette flags were selected:
- | | | |
|---|---------------|-------------------|
| 1 | Red | Product code H113 |
| 2 | Diamond White | Product Code H110 |
| 3 | Crystal | Product Code H115 |
| 4 | White Rosso | Product Code H117 |
- 2.3 The flags were divided into a grid of 25 rectangles, each measuring approximately 80x80mm. Each rectangle was then labelled to identify the potential stain.
- 2.3.1 It should be noted that affixing a label to the surface of the flagstones proved to be quite difficult as most self-adhesive labels would not adhere to the surface. Following attempts with a range of proprietary label, it was found that the most effective method of labelling was to use a length of Scotch adhesive tape stretched from the left-hand unsealed edge face to the right-hand unsealed edge face, with labels attached directly to the tape. The tape was able to adhere to the bare concrete on each edge face although there was minimal, if any adhesion to the flag surface. See Figure 1

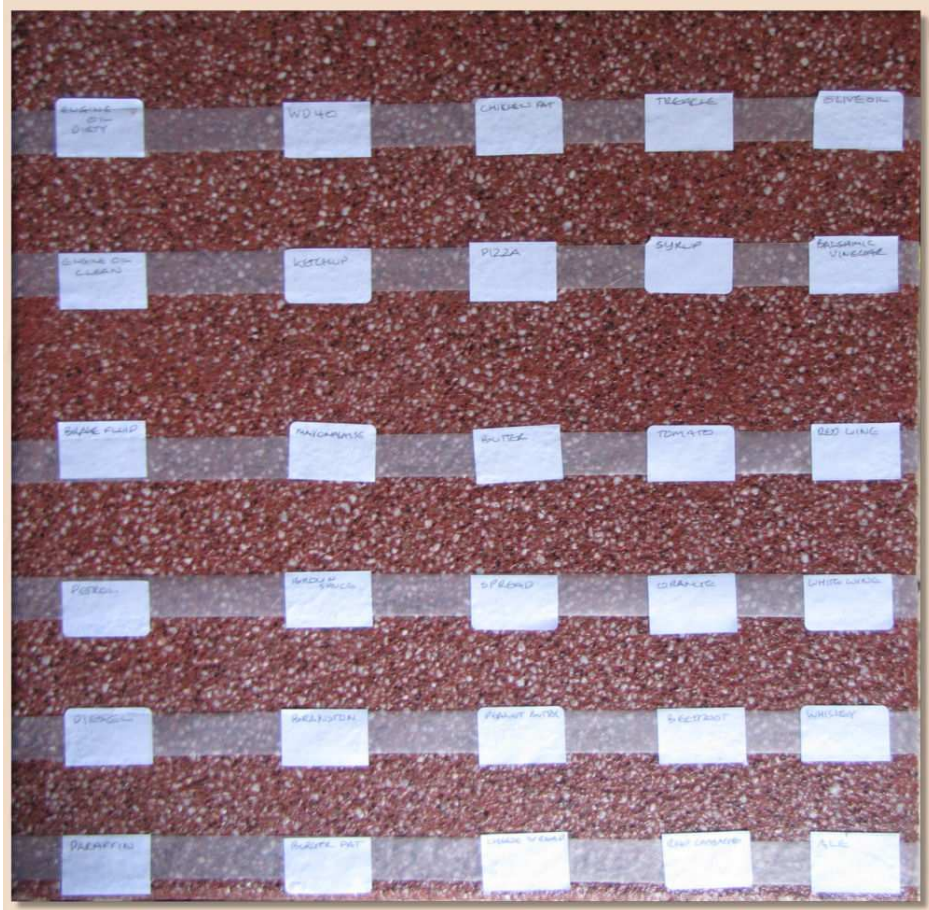


Figure 1 - Tape used to affix labels to flag samples

- 2.4 The flagstone was placed onto a level shelf within a steel racking system within a fully enclosed steel shed (Figure 2). A small quantity of each potential stain was then placed onto its allotted space. Care was taken with the liquids to prevent cross-contamination due to run-off (Figure 3).
- 2.5 Once prepared, the flags were left on the shelf for the prescribed period of time, with the shed doors closed to prevent contamination or disturbance from animals.
- 2.6 The 12 hour tests were undertaken first. On completion of the test period, the flags were removed from the shelf, photographed, cleaned, re-photographed and then set-up for the 3 day test. This procedure was repeated prior to the 7 days tests.



Figure 2 - Steel shelving used to store flags during testing

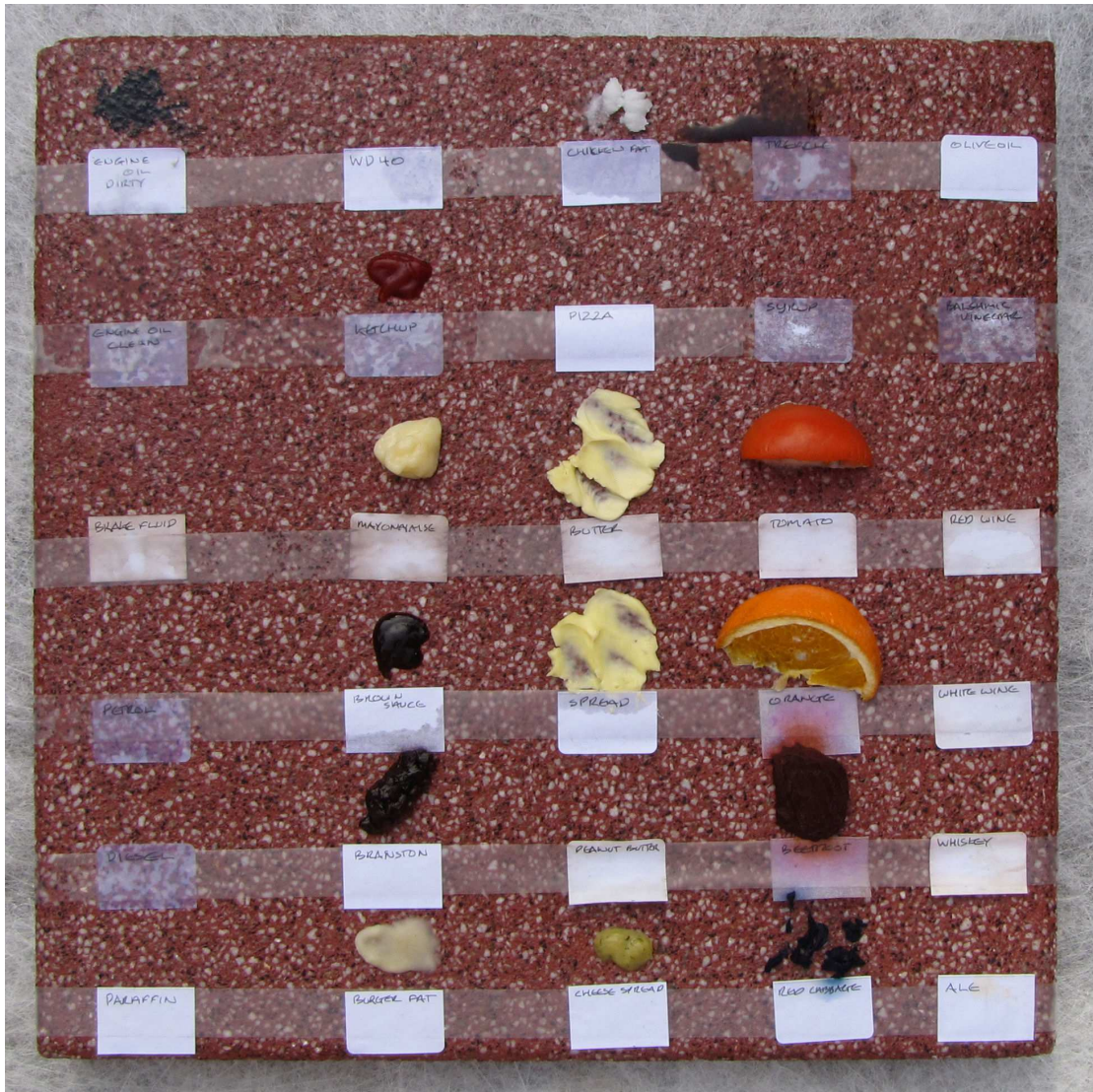


Figure 3 - stains in place on flagstone

3 - Cleaning:

- 3.1 Once the test period was completed, the flags were removed from the shelf within the shed, and any remaining product was removed from the surface of the flag by means of a steel spatula (Figure 4).
- 3.2 The labels were at risk of being dislodged or lost in the cleaning process, and so each horizontal 'strip' of labels was peeled off and placed to one side. This would allow the label strips to be put back into place once cleaning was complete in order to identify any remaining stains (Figure 5).
- 3.3 Once the labels were safely out of the way, the potential stains were wiped using a cotton cloth wetted with warm water and a typical wash-up detergent (Figure 6) and then rinsed with cold water (Figure 7).
- 3.4 Any samples that required further cleaning were identified, photographed and then re-cleaned using detergent and a plastic scouring pad. Stains not removed by the plastic scourer were then cleaned using a soap-filled wire-wool scouring pad (Brillo Pad). When this failed to clean off the residual product, the flag was declared stained.

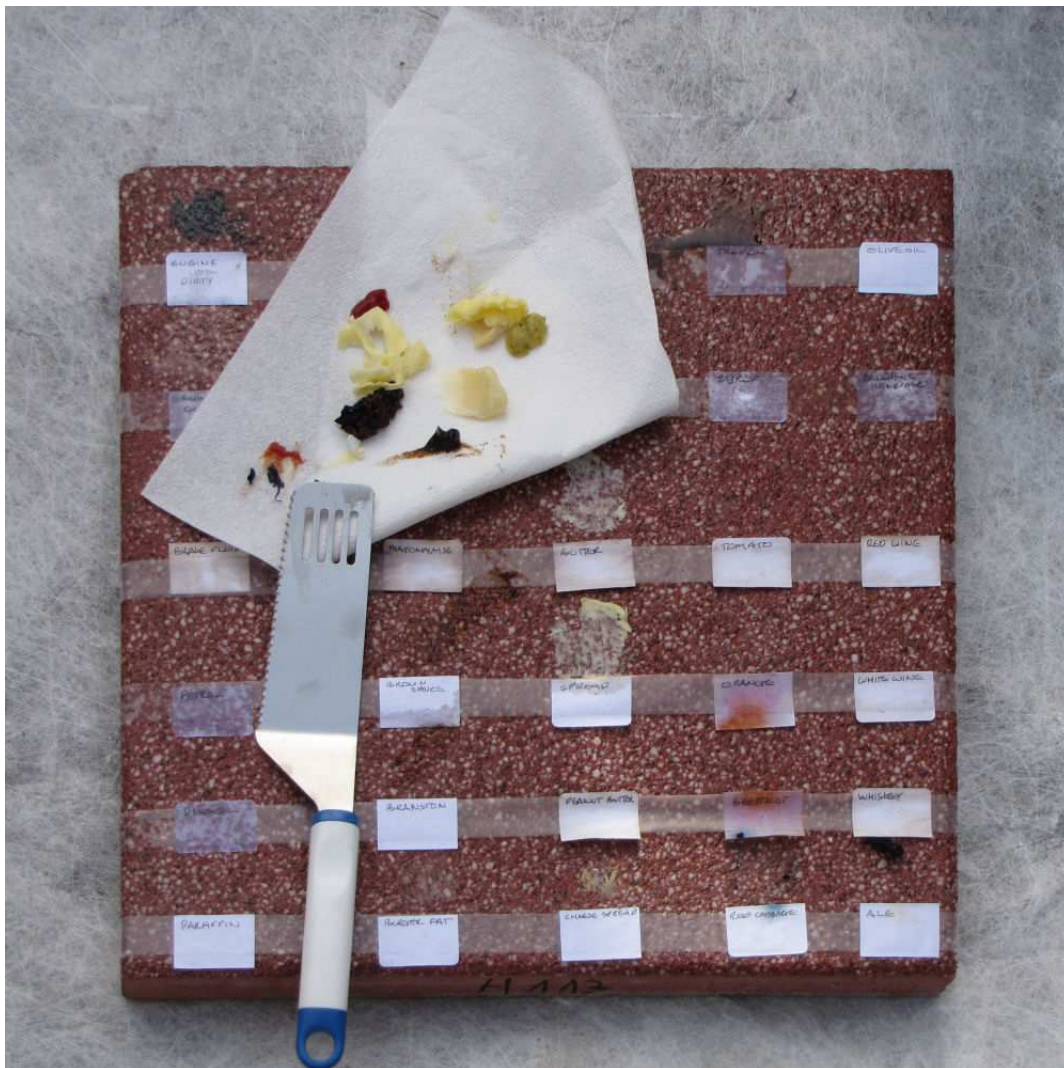


Figure 4 - Residual stain material removed using spatula



Figure 5 - Initial cleaning with warm water and detergent
Note how label strips have had to be peeled off and placed to one side



Figure 6 - Cleaning using detergent and water



Figure 7 - Rinsing with cold water

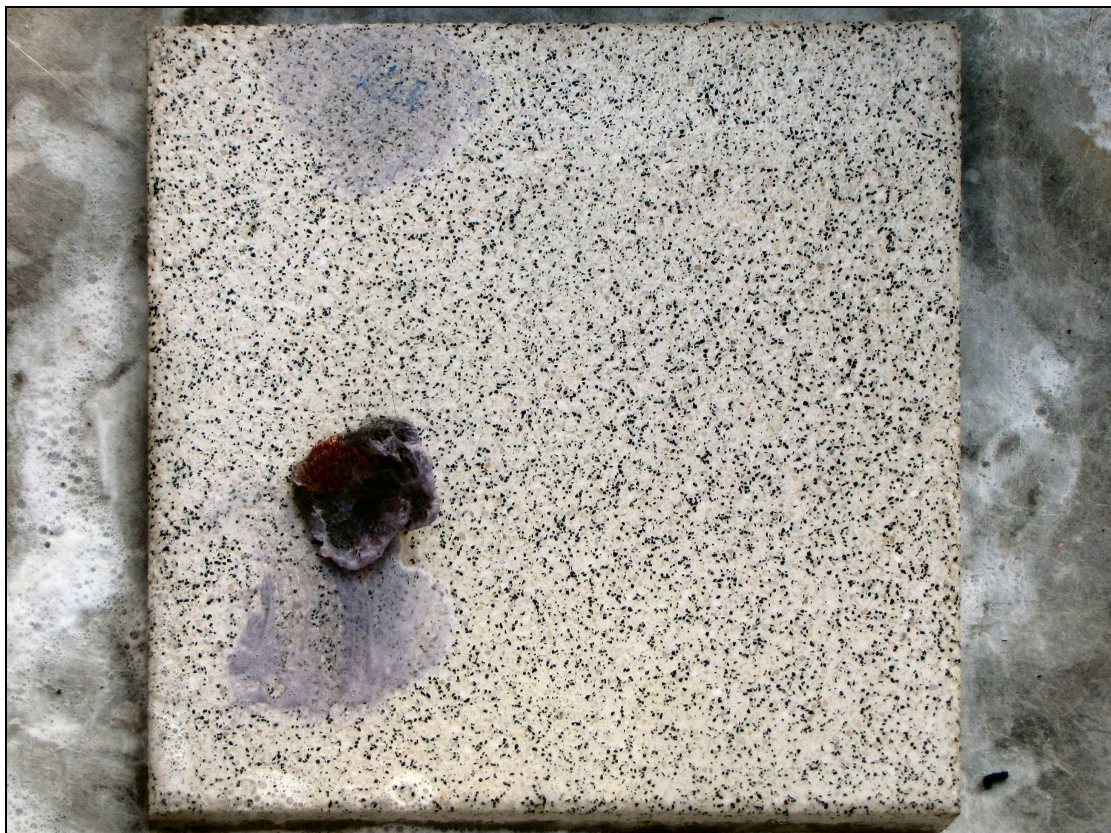


Figure 8 - Cleaning difficult stains with a wire-wool scourer

4 -Trafficking tests:

- 4.1 Two paving samples were selected to be tested for tyre marking. The first sample, a 400x400x40mm Domino Facette flagstone in White Rosso (H117) was laid onto an existing driveway surface where it would be repeatedly driven over by a VW Polo. The second sample, a 240x160x80mm Trento block paver in Yellow, was set up in the same manner but was to be trafficked by a heavy 4x4 vehicle, a Mitsubishi L200 (Figure 9).



Figure 9 - Trafficking test on 80mm Trento Block Paver

- 4.2 The number of passes made over each sample was recorded and at pre-determined intervals, the samples were examined and photographed, before being returned to testing without any cleaning. This was done to allow cumulative marking, rather than to have to re-start each test.
- 4.3 Each trafficked paving sample was examined after 50 passes, again after 100 passes and finally after 500 passes. The samples were then cleaned using the same methods as outlined above to determine whether tyre marking could be considered a permanent or transient stain.

5 -Results:

- 5.1 The results are most easily understood when presented in table format.
- 5.2 Potential stains that were completely removed using simple cleaning (detergent and cloth) are indicated by a dash (-). Those stains requiring additional cleaning or unable to be cleaned are indicated by numerical references, which are then expanded in the notes accompanying each table.

Flagstone #1 400x400x40 Domino Facette Flag - Red H113			
Stain	Results		
	12 hours	3 days	7 days
Engine Oil, Dirty	-	-	-
Engine Oil, Clean	-	-	-
Brake Fluid	-	-	-
Petrol	-	-	-
Diesel	-	-	-
Paraffin	-	-	-
WD40	-	-	-
Ketchup	-	-	-
Mayonnaise	-	-	-
Brown Sauce	-	-	-
Branston Pickle	-	-	-
Beefburger Fat	-	-	-
Chicken Fat	-	-	-
Pizza	-	-	-
Butter	-	-	-
Low-fat Spread	-	-	-
Peanut Butter	-	-	-
Cheese Spread	-	-	-
Treacle	-	-	-
Syrup	-	-	-
Tomato (Fruit)	-	-	-
Orange (Fruit)	-	-	-
Beetroot (Pickled)	-	-	-
Red Cabbage (Pickled)	-	-	-
Olive Oil	-	-	-
Balsamic Vinegar	-	-	-
Red Wine	-	-	-
White Wine	-	-	-
Whiskey	-	-	-
Ale	-	-	-

Table 1: Results from Flagstone #1

Flagstone #2 400x400x40 Domino Facette Flag – Diamond White H110			
Stain	Results		
	12 hours	3 days	7 days
Tea	-	-	-
Coffee	-	-	-
Drinking Chocolate	-	-	-
Diet Coke	-	-	-
Lemonade	-	-	-
Blackcurrant Cordial	-	-	-
Permanent Marker	1	1	1
Felt Tip Pen	-	-	-
Watercolour paint	-	-	-
Fountain pen ink	-	-	-
Biro ink	-	2	3
Blood	-	-	-
Bleach	-	-	-
Toilet Cleaner	-	-	4
Oven cleaner	-	-	-
Shampoo	-	-	-
Urine	-	-	-
Fake tanning lotion	-	-	-
Lipstick	-	-	-
Mascara	-	-	-
Acetone	-	-	4
Paint Stripper	5	6	7
Jeyes Fluid	-	-	-
Mosskiller (liquid)	-	-	-
Weedkiller (liquid)	-	-	-
Lawn Food (granular)	-	-	-
Plant Food (granular)	-	4	4
Manure	-	-	-
Dilute Hydrochloric Acid	-	-	-

Table 2: Results from Flagstone #2

Notes:

- 1 Stain not removed by washing with detergent but was completely removed by heavy scrubbing using a soap-filled wire-wool scourer aka a Brillo Pad (See Figures 11-13)
- 2 Ink partially dried but removed using heavy scrubbing with cotton cloth
- 3 Ink dried but removed using Brillo pad (See Figures 11-13)
- 4 A faint green tinge developed in this area and these products were initially suspected of being responsible. Further testing was undertaken and is detailed later in this report
- 5 Slight discolouration or marking of surface
- 6 Damage to surface detectable to finger tip (See Figure 14)
- 7 Distinct damage to surface which seems to have been blistered (See Figure 15)

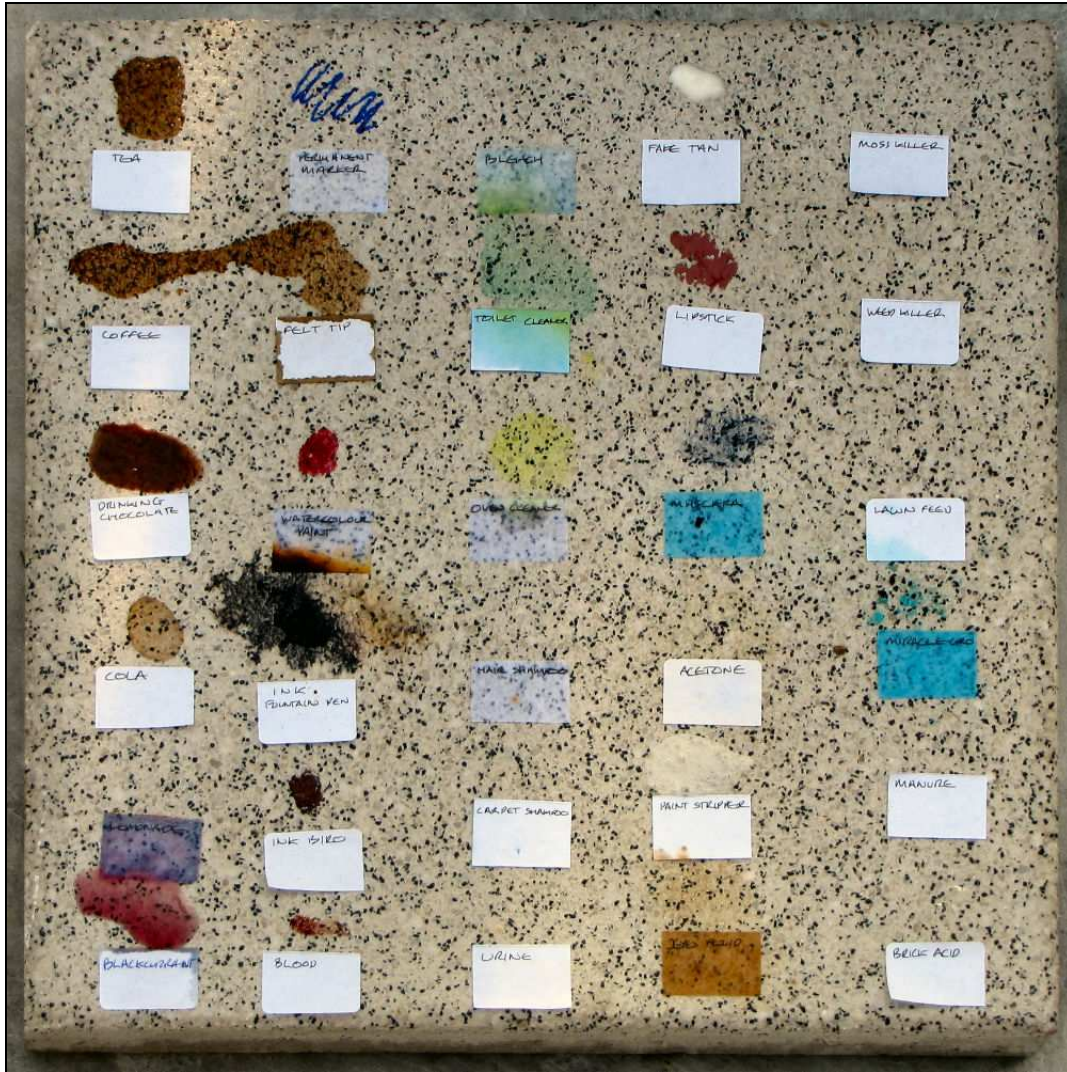


Figure 10 - Testing stains on flagstone #2

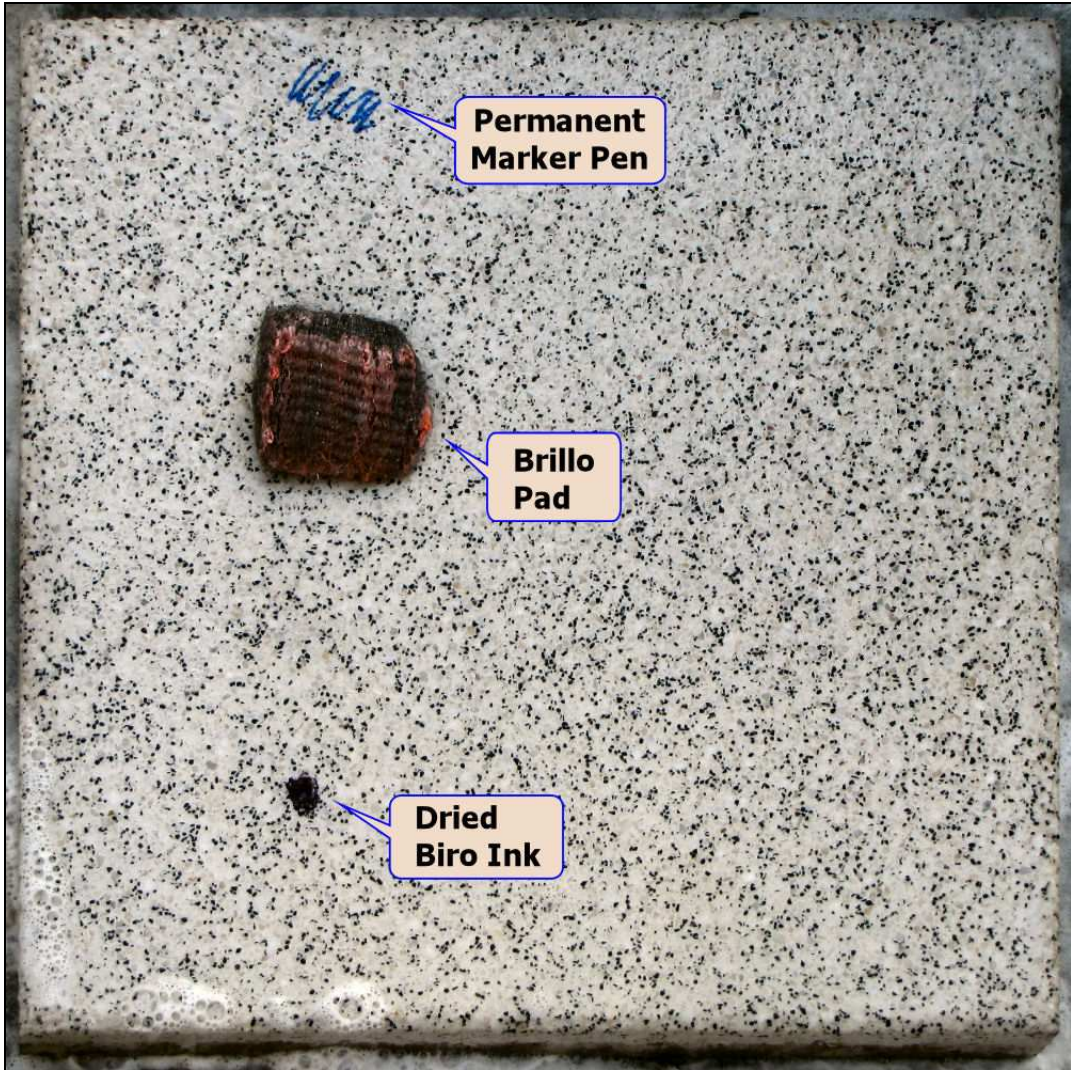


Figure 11 - Marker and ink stain to flag #2



Figure 12 - Stains still faintly visible after first scrubbing



Figure 13 - Stains completely removed
Other marks visible in this image arise for subsequent testing on this flagstone



Figure 14 - A faint lightening of the surface where it has been in contact with paint stripper for 3 days



Figure 15 - Distinct damage to surface after 7 days in contact with paint stripper

Flagstone #3 400x400x40 Domino Facette Flag – Crystal H115			
Stain	Results		
	12 hours	3 days	7 days
Guinness	-	-	-
Lager	-	-	-
Orangeade	-	-	-
Cider	-	-	-
Milk	-	-	-
Vimto cordial	-	-	-
Sun Cream	-	-	-
Drain Cleaner	-	-	-
Mustard	-	-	8
Lawn Feed'n'weed Granules	-	9	10
Mosskiller liquid	-	-	-
Timber Preservative	11	11	11
Mortar dye liquid	-	-	-
Oil removal liquid	-	-	-
Mud	-	-	-
Anti-freeze	-	-	-
Pollen	-	-	-
Curry sauce	-	-	-
Cigarette	12	12	12

Table 3: Results from Flagstone #3

Notes:

- 8 A faint yellow stain was detected but was removed by heavy scrubbing with cloth and detergent (See Figures 17 and 26)
- 9 A faint rust like stain was detected but was removed by scrubbing with a wet cloth and detergent
- 10 A distinct stain was apparent. It was removed by light scrubbing with a Brillo pad but further testing was deemed necessary
- 11 Definite and permanent stain (See Figures 18 and 26)
- 12 A cigarette was lit and allowed to burn down while lying on the flagstone. Although light tar deposits were initially visible, these were easily removed using a damp cloth with detergent, and there was no discernible damage to the surface of the flagstone. See Figures 19-25

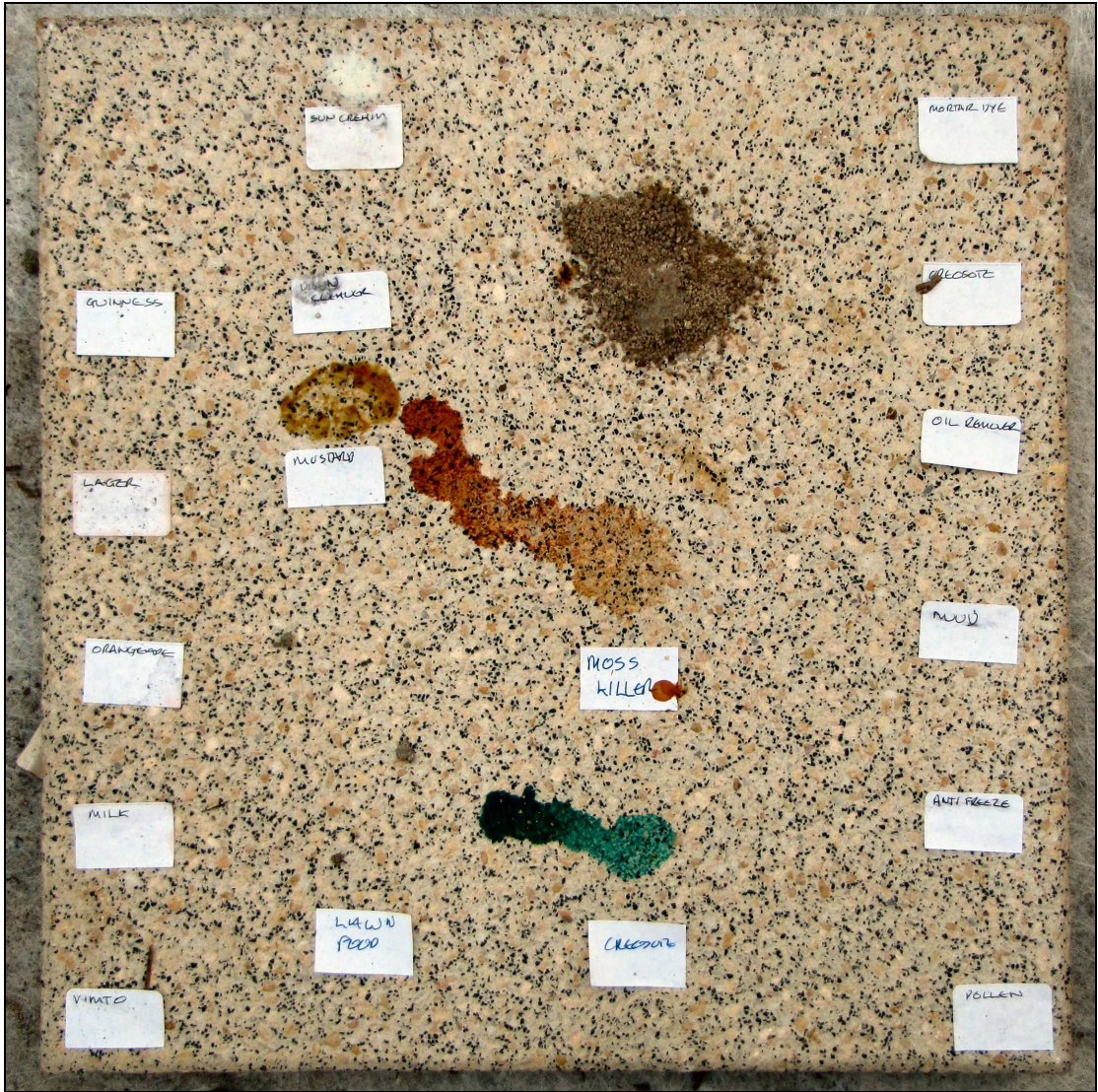


Figure 16 - Testing stains on Flagstone #3



Figure 17 - Faint staining from mustard was cleaned by scrubbing



Figure 18 - Permanent staining caused by timber preservative



Figure 19 - Cigarette testing on Flag 3



Figure 20 - Cigarette test



Figure 21 - Cigarette test



Figure 22 - - Cigarette test



Figure 23 - - Cigarette test

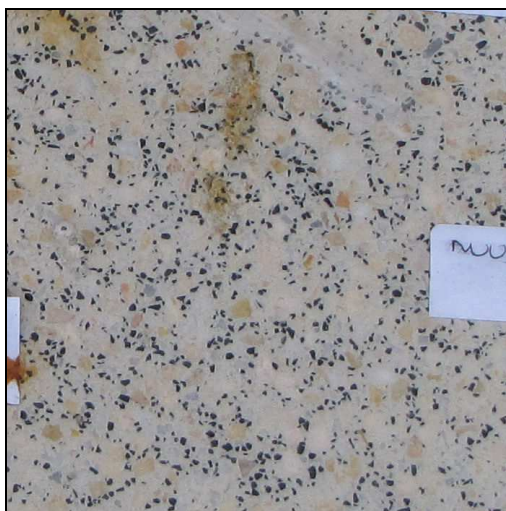


Figure 24 - Tar residue is washed off

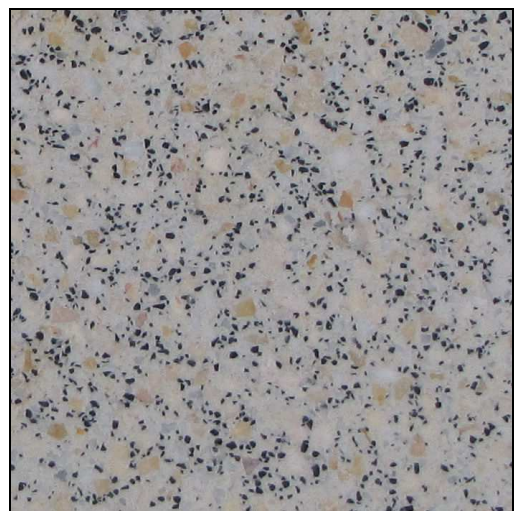


Figure 25 - No discernible stain or burn marks



Figure 26 - Flag 3 after cleaning. Faint mustard stain is highlighted in blue circle

Flagstone #4 – Re-testing 400x400x40 Domino Facette Flag – Crystal H115			
Stain	Results		
	12 hours	3 days	7 days
Miracle Gro Plant Food	-	-	-
Acetone	-	-	-
Toilet Cleaner	-	-	-
Lawn Feed'n'Weed Granules	-	-	-
Turmeric	-	13	13

Table 4: Results of re-testing from Flagstone #4

- 5.3 A re-test of certain potential stains was undertaken as Test #4.
- 5.4 The first three potential stains were suspected of being responsible for a faint blue-green tinge observed on the Diamond White flagstone following the first series of tests. Despite numerous efforts, all attempts to photograph the green tinge on the Diamond White flagstone were unable to reproduce the appearance either as digital files or as high-quality print-outs. Two other observers were able to detect the very faint discolouration, and all agreed on both colour and position on the flagstone itself, but it is not apparent on any of the photographs.
 - 5.4.1 It had not been possible to determine which of the stains was responsible for this effect, and so the three prime most likely potentials were re-tested on a different flagstone, the Crystal H115.
 - 5.4.2 The Miracle-Gro plant food contains a distinctive blue-green colouring and was therefore perceived to be the most likely culprit. The crystal nature of the product required it to be diluted with clean water before applying to the flagstone. In an attempt to delineate any effect, the test area upon the flagstone was banded using Blu-Tak. As with the attempts to affix labels, creating an intact seal using the Blu-Tak was difficult because it refused to adhere to the surface, but a partial seal was eventually achieved.
 - 5.4.3 The Acetone was able to be applied via a dropper and the liquid did not spread too far. Similarly, the thick, almost gelatinous nature of the toilet cleaner ensured it did not spread excessively.
 - 5.4.4 Despite all these efforts, it was not possible to replicate the blue-green discolouration observed on the Diamond White flagstone.

- 5.5 Lawn Weed'n'Feed contain ferrous Sulphate which is a notorious stain of paving within garden settings. The initial tests on Flag #3 had produced a stain that was eventually removed by scrubbing. However, it was decided to re-test this product as it would normally be expected to impart a distinctive rust-coloured stain to any concrete or stone surface. A different brand of Weed'n'Feed was used for the re-test, but once again, there was no permanent stain even after 7 days of contact.
- 5.6 Turmeric is the main colouring agent used in curries and is a notorious stain. The original testing of a proprietary jalfrezi curry sauce on Flag #3 had resulted in no discernible stain. A colleague had questioned this result and suggested that it would be more appropriate to re-test using turmeric rather than a proprietary sauce that may have used an artificial colour rather than natural turmeric.
- 5.6.1 The turmeric did indeed produce a stain. After 12 hours, the stain was washed away with minimal effort, but after 3 days exposure, the stain was far more resilient and required scrubbing with a plastic scourer to remove. The 7-day stain was much more intense and even scrubbing with a Brillo Pad was not able to completely remove the yellowy-orange discolouration.

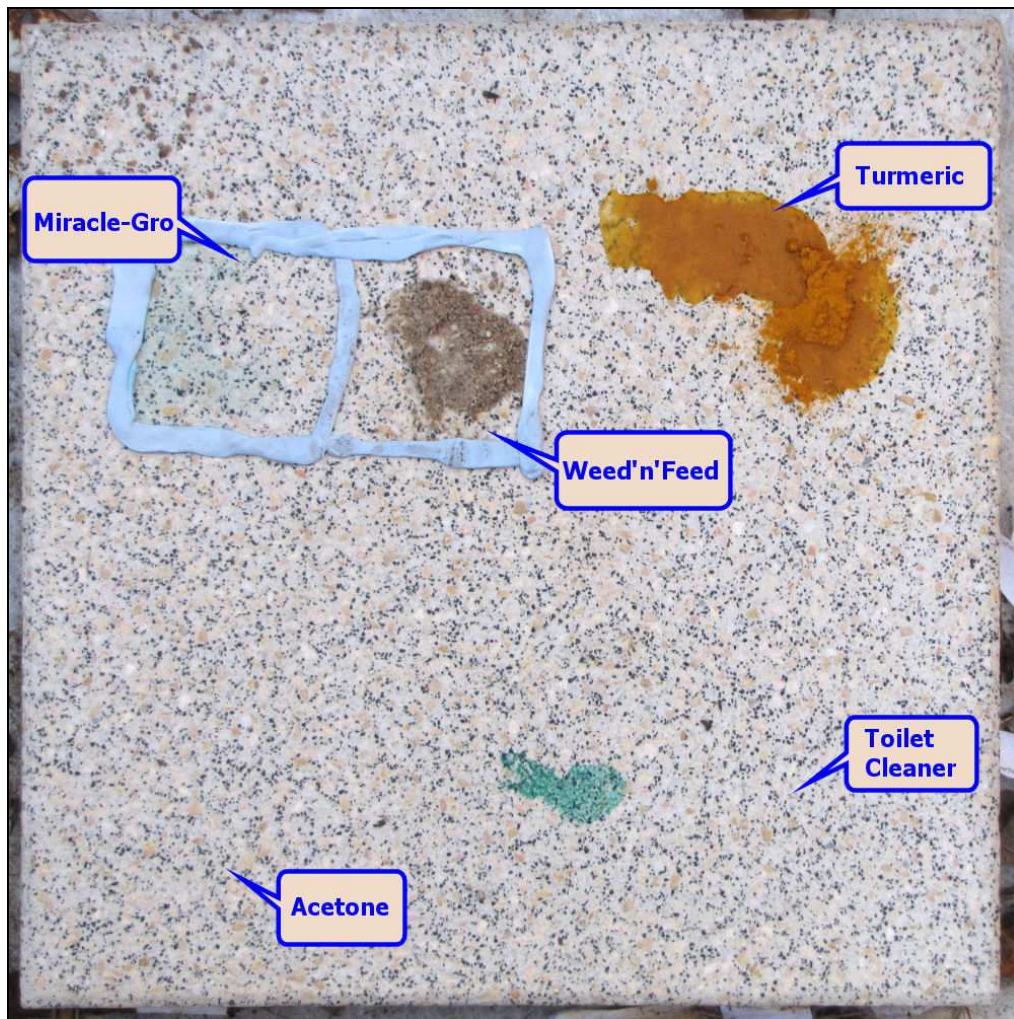


Figure 27 - Re-testing of selected stains



Figure 28 - Washing off re-test stains



Figure 29 - Faint residual stain from Turmeric

5.7 Tyre mark tests

Samples #5 and #6 – Tyre Mark testing			
Paving	Results		
	50 passes	100 passes	500 passes
	-	-	-
400x400x40mm Flagstone H117 White Rosso	-	Faint marks	Distinct marks
225x140x80mm Block Yellow Trento	-	Faint Marks	Faint marks

Table 5: Results of tyre-mark testing

- 5.7.1 The flag trafficked by the small car showed faint marking after 100 passes (Figure 30) and by the end of the test, with 500 passes completed over a period of 4 weeks, the flags was distinctly marked (Figure 31). The light colouring of the flagstone emphasised the black tyre marks and there were very distinct marks along the arris of the flagstone where the sealed top surface meets the unsealed concrete of the edge face.
- 5.7.2 The block trafficked by the heavier 4x4 vehicle showed similar markings although the slightly darker colouring of the block made these less noticeable. Again, there were heavy markings on the arris of the blocks which had been repeatedly 'rubbed' by the tyre as the vehicle mounted the 80mm high block.
- 5.7.3 Both the flagstone and the block were washed down using a cotton cloth with warm water and a small amount of the same wash-up detergent used with the other stain tests and it was surprisingly easy to remove all marks other than those made on the unsealed concrete of the edge faces.



Figure 30 - Flag after 100 passes



Figure 31 - Flag after 500 passes



Figure 32 - Cleaning tyre marks using soapy water



Figure 33 - Cleaned flag after being allowed to dry off



Figure 34 - Block showing tyre marks remaining on arris after cleaning

6 - Conclusions:

- 6.1 No surface can be completely stain-proof, as there are products that are intended to stain. This is shown quite clearly by the timber preservative used in the stain tests on Flag #3. Indeed, it could have been considered a failure of the timber preservative had it been unable to impart a permanent stain.
- 6.2 The ability to repel stains caused by everyday products is a significant advantage for a paving product, as it allows owners and users to maintain the paving in pristine condition with minimal maintenance. None of the stains examined in this assessment required high-pressure water jetting to effect removal, and most stains were removed with nothing more than washing with soapy water. On a larger scale, this cleaning effort could be equated to mopping a floor.
- 6.3 While many of the candidate stains were forecast as being likely to have no discernible effect on the paving, several could be regarded as likely to impart permanent and irreversible stains which under normal circumstances could not be removed without significant specialist cleaning. That some of these 'difficult' stains were effectively and completely removed by light cleaning with soap and water was a pleasant surprise. In particular, the ability to completely remove stains resulting from a market-leading permanent marker, along with those from notorious staining products such as moss-killer/ferrous sulphate and turmeric far exceeds the expectation of the tester.
- 6.4 Similarly, the ease with which tyre marks were removed from the trafficked surfaces was remarkable, and considerably easier than the removal of similar markings from paving treated with a post-installation sealant.
- 6.5 The cigarette test suggested that the sealant is capable of coping with high temperatures, but the one-off test undertaken here can not realistically be taken as conclusive proof of heat-resistance.
- 6.6 The results of these tests clearly show that the HanseClean system provides a superb degree of protection to the paving from the type of stains that many pavements can reasonably expect to encounter during their service life.

7 - Recommendations:

- 7.1 While a wide range of potential stains were used in this assessment, there are many more that remain untested. It would be illuminating to test a wider range of stains over longer periods, and to expose stained paving to an unprotected environment to assess the effect of normal trafficking from pedestrians and vehicles on the stain and how this affects the eventual removal.
- 7.2 The tyre marking tests were crude and unrealistic. The paving being tested was simply laid over an existing surface and relied on the vehicles carefully 'bumping-up' over the sample at low speed. It would have been more instructive to have the samples installed within a larger pavement where the vehicles could pass directly over with no 'bump-up'.
 - 7.2.1 It would also be useful to determine the effect of turning-on-the-spot, a common cause of tyre marks on actual driveways.
- 7.3 R2 claim that the Hanseclean system is UV stable and offers enhanced long-term colour stability, along with associated environmental benefits in the form of climate-neutral manufacturing and a reduced requirement for detergents and water when cleaning. This series of tests did not address these claims, and while none of the observations give reason to suggest otherwise, it might be beneficial to devise a follow-up test to assess these claims.

Appendix I – Paving supplied

Hansebeton Hanseclean System Paving

Domino Facette Flagstones ~ 400x400x40mm

Diamond White (H110)	1 piece
Red (H113)	1 piece
Crystal (H115)	1 piece
White Rosso (H117)	1 piece

Trento Block Pavers

Traditional	225x140x80mm	3 pieces
	225x280x80mm	1 piece
Sandwall	225x140x80mm	2 pieces
Yellow	225x140x80mm	1 piece

Appendix II - Stains

Foods and beverages:

Tomato Ketchup (Heinz)
Mayonnaise (Hellman's)
Brown Sauce (HP)
Branston Pickle
Burger Fat
Chicken Fat
Pizza (Dominos)
Butter
Low-fat Spread (Flora)
Peanut Butter (Sun-Pat)
Cheese Spread (Primula)
Treacle (Lyle's)
Syrup (Tate & Lyle's)
Tomato Fruit (salad variety)
Orange Fruit (Jaffa)
Beetroot (Pickled, Asda own brand)
Red Cabbage (Pickled, Barton's)
Olive Oil (Beretti)
Balsamic Vinegar (Modena)
Mustard (Colman's English)
Curry (Jalfrezi, local takeaway)
Turmeric (Schwartz)

Red Wine (Hardy's Stamp Cabernet)
White Wine (Chablis)
Whiskey (Jameson's Irish)
Ale (Boddington's bitter)
Guinness
Lager (Tennants)
Cider (Strongbow)
Tea (Yorkshire Brand)
Coffee (Nescafe Instant)
Drinking Chocolate (Cadbury)
Diet Coca Cola
Lemonade (Sainsbury's own brand)
Blackcurrant (Ribena)
Vimto (fruit cordial)
Orangeade (Fanta)
Milk (pasteurised, full cream)

Household Comestibles:

Permanent Marker (Sharpies)
Felt Tip (unbranded)
Watercolour Paint (Windsor & Newton Artist range)
Ink, Fountain Pen (Quink)
Biro Ink (Staedler)
Bleach
Toilet Cleaner (Toilet Duck)
Oven Cleaner (Mr Muscle)

Cosmetics and personal hygiene:

- Hair Shampoo (Head & Shoulders)
- Carpet Shampoo (Rug Doctor)
- Fake Tan (Avon)
- Lipstick (Boots No. 7)
- Mascara (Maybelline)
- Acetone (Avon brand)
- Sun Cream (Ambre Solaire SPF30)

- Blood (Human)
- Urine (Human)

- Cigarette (lit and burning)

Garden and Construction:

- Paint Stripper (Nitromors)
- Jeyes Fluid
- Moskiller (Doff Liquid)
- Weedkiller (PathClear)
- Lawn Feed (B&Q Own Brand)
- Lawn Weed'n'Feed (Evergreen Brand)
- Miracle-Gro Plant Food
- Composted manure
- Brick cleaning Acid (Wolseley Own Brand)
- Drain Cleaner (Mr Muscle)
- Granular lawn food/moskiller (B&Q)
- Moskiller Liquid (Bio)
- Timber Preservative (Cuprinol)
- Mortar Dye Liquid (Sealocrete)
- Mud
- Pollen (from Daffodils)

Motor Stains:

- Engine Oil, Dirty
- Engine Oil, Clean
- Brake Fluid
- Petrol
- Diesel (Derv/white diesel)
- Paraffin
- WD40
- Oil Remover (Bettaware)
- Anti-freeze (Holts)