ALTERNATIVE TO SAND CIRCLE TEST FOR MEASURING TEXTURE DEPTH

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ALTERNATIVE TO SAND CIRCLE TEST FOR MEASURING TEXTURE DEPTH

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EXECUTIVE SUMMARY

The sand circle test has traditionally been used as an indication of pavement texture depth in chipseal design and skid resistance measurements. The continued use of the sand circle test is in question because the precision (reproducibility and repeatability) of it can be operator biased and the use of the test on fine textures is considered inappropriate.

Recently a performance-based specification for chipseals and slurry seals has been developed in which the contractor has to obtain a minimum texture depth for the seal at an age of one year. As the sand circle test is used to indicate texture depth, the precision of the test can be a major factor in the level of payment to the contractor - a function the sand circle test was not initially intended to perform.

The objectives of this research project are as follows:

- Develop an alternative test using a product capable of measuring a wide range of surface textures;
- Determine the repeatability and reproducibility of the alternative test using ten operators performing tests on six different road surfaces;
- Summarise and tabulate existing (1993) data on the repeatability and reproducibility of the sand circle test;
- Determine the repeatability and reproducibility of the sand circle test using seven operators (who regularly carry out the sand circle test), performing tests on six different road surfaces; and
- Compare the alternative test with the sand circle test and the Transit New Zealand stationary laser profilometer (the output of which is the basis of a draft international standard for mean profile depth, ISO 13473-1, 1996).

Wallpaper size mixed with water was selected as a suitable alternative material because it is readily available, cheap, easy to prepare and store, it has "jelly-like" characteristics, low elasticity, suitable viscosity, spreadability and is not hazardous to the user or to traffic nor is it harmful to the environment.

This alternative test requires a measured amount of wallpaper size being placed in a mound on the road surface. A perspex plate and rubber mat are placed over the mound of wallpaper size then the operator stands on the rubber pad for 3 seconds. After the rubber pad and perspex plate are lifted off, the diameter of the resulting wet patch is measured in four locations and the average diameters used to indicate mean profile depth.

The alternative test data compared better with the Transit New Zealand stationary laser profilometer mean profile depths than the sand circle data. The reproducibility of the alternative test was found to be 18% of the mean and the repeatability 12% of the mean.

In comparison, the reproducibility of the current sand circle test trial was found to be 41% of the mean and the repeatability 11% of the mean.

This project indicates the alternative test is less operator dependent than the traditional sand circle test for measuring texture depths of road surfaces.

ABSTRACT

The reproducibility and repeatability of the sand circle test for measuring texture depth in pavement surfaces was compared with a new test using wallpaper size and a flexible perspex plate covered by a rubber pad. The new test was found to be more precise.

1. INTRODUCTION

The sand circle test has traditionally been used as an indication of pavement texture depth in chipseal design and skid resistance measurements. The continued use of the sand circle test is in question for the following reasons:

- The precision (reproducibility and repeatability) of results can be operator biased; and
- The use of the test on fine textures is considered inappropriate, especially when the texture is below approximately 0.9 mm when the size of the sand particles (0.6 mm to 0.3 mm) tend to approach the size of the texture.

Because of the recent inclusion of the sand circle test in the Transit New Zealand P/17 "Performance Based Specification for Bituminous Reseals" and the Bitumen Contractors Association (BCA) "Performance Based Specification for Slurry Seals", payment to the contractor is now based on the sand circle test. This use of the sand circle test means that the precision of the test can be a major factor in the level of payment to the contractor and therefore is now used for contractual payment as well as its original design function of indicating texture depth.

A previous study carried out by Central Laboratories in 1993, showed a significant operator bias in the sand circle test. A Federal Highway Administration report (1978) stated that mixed results had been obtained from use of the "sand patch" method because of operator error. The sand patch test is similar to the sand circle test and is used in many countries including the USA, the UK and Australia.

In 1976 Central Laboratories developed a test for measuring fine texture depths of road surfaces. The test consisted of placing a known volume of a "bentonite/water jelly" on the road surface and spreading the jelly by applying a load to a transparent plate. The diameter of the resulting "bentonite/water jelly" circle was measured and the texture depth calculated. The test method was simple but as the texture depth became smaller larger loads were required to shear the "bentonite/water jelly". An outline of the method was reported in the National Roads Board's "Road Research Unit Newsletter No. 50".

This current research report, "Alternative to Sand Circle Test for Texture Depth", elaborates on the idea of a "jelly-like" material to replace sand as an indicator of texture depth.

The objectives of this project were to:

- Develop an alternative to the sand circle test using a product similar to "bentonite/water jelly", capable of measuring a wide range of surface textures;

- Determine the reproducibility and repeatability of the alternative test using a minimum of 10 operators and performing tests on six different road surfaces;

- Summarise existing data, on the repeatability and reproducibility of the sand circle test, collected by Central Laboratories in 1993;

- Determine the repeatability and reproducibility of the sand circle test by carrying out a trial using seven operators (who regularly carry out the sand circle test), performing tests on six different road surfaces; and

- Compare the results of the alternative test with the sand circle test and the mean profile depth obtained with the Transit New Zealand stationary laser profilometer (the output of which is the basis of a draft international standard for mean profile depth, ISO 13473-1, 1996).

2. DEVELOPMENT OF AN ALTERNATIVE TEST

2.1 Selection Criteria

Jelly-like materials were investigated in the search for a suitable alternative to the sand circle test and bentonite/water jelly to indicate texture depth. The general criteria considered in the selection were:

- Availability;
- Cost;
- Ease of preparation;
- Ease of storage;
- Ease of use; and
- Non-hazardous to traffic.

The physical criteria consisted in the selection were:

- Viscosity;
- Non-elastic; and
- Spreadability.

The chemical criteria considered in the selection were:

- Safety of operator during use;
- Effect on the environment; and
- Reaction with the road surface.

2.2 Alterative Materials

A range of "jelly-like" materials were considered, including wallpaper size, Vaseline and yoghurt. The materials considered were generally from clay, cellulose and petroleum by-products and common household substances.

In the search to find an alternative, less viscous "jelly-like" material than bentonite/water jelly, substances such as milkshake thickener and flour were trialed, to overcome the shearing problem. Milkshake thickener was discarded because it trapped large quantities of air and was too viscous, and the flour mixture would not form a uniform paste. Fruit jelly was also considered but discarded as it did not spread uniformly under pressure.

2.3 Wallpaper Size

Wallpaper size was selected as it had the required physical and chemical qualities together with the other general criteria such as ready availability, low cost, ease of storage and ease of preparation.

Selleys sure bond wallpaper size was made according to the manufacturers instructions ie. "*add 60 gm of wallpaper size to 2 litres of water, stir briskly until all the powder has been added, and*

allow 15 minutes for the size to develop full consistency". One other brand of wallpaper size was found on the market and trialed - Polycell Polysize wall size. The Polycell wall size instructions required that whilst *"stirring briskly, slowly sprinkle 37.5 gm of Polysize into 2 litres of warm water (40 °C). Continue mixing for 2 minutes, leave for at least 45 minutes to completely dissolve, stirring occasionally"*.

2.3.1 Testing Brands of Wallpaper Size

To investigate the differences between the two brands of wallpaper size, Selleys and Polycell, the size was mixed according to the manufacturer's instructions and three sites tested.

Table 1. Results of two available brands of wallpaper size versus texture depth at three sites.

Brand of wallpaper size	**Texture depth (mm)**		
	Riverside Drive test area 3 asphaltic concrete	**Melville Grove test area 9 slurry seal**	**C/L, front garden test area 16 chipseal grade 4**
Selleys	0.73	1.54	4.08
Polycell	0.72	1.53	3.04

The Polycell wallpaper size was less viscous than the Selleys wallpaper size. The wallpaper size viscosity did not seem to have any effect on the finer textured road surfaces, but on the chipseal the Polycell wallpaper size was running away as the diameter of the circle was being measured.

Thus, the comparative and precision tests were carried out using Selleys sure bond wallpaper size because it was more convenient to mix and had a more suitable viscosity then the Polycell product.

2.3.2 Testing Consistency of the Wallpaper Size

Different consistencies of the wallpaper size were considered to determine:

- The effect of incorrectly mixing the wallpaper size; and
- The possible effect of using wallpaper size on a hot road surface.

Mixing instructions on a packet of Selleys sure bond wallpaper size require the equivalent of 15 g of size to be mixed with 500 ml of water. To investigate the effect of consistency, the size was mixed at 12 g, 17 g and 20 g to 500 ml of water, i.e. one less viscous (thinner) and two more viscous (thicker) mixes. Tests were performed by one operator and the results given in Table 2.

The consistency of the wallpaper size has a larger effect the greater the texture depth of the road surface, i.e. the effect is greater on a chipseal surface than on the asphaltic concrete surface.

Table 2. Trial to investigate the consistency of wallpaper size versus texture depth at three sites.

Consistency of wallpaper size (ws) (grams of ws per 500 ml water)	**Texture depth (mm)**		
	Riverside Drive test area 3 asphaltic concrete	**Melville Grove test area 9 slurry seal**	**C/L, front garden test area 16 chipseal grade 4**
12	0.71	1.56	3.80
15	**0.73**	**1.54**	**4.08**
17	0.75	1.62	4.53
20	0.79	1.59	4.39

To gauge the effect of wallpaper size being used on a hot road surface the size was heated and the consistency observed. It was noted that over about 40°C, the viscosity of the wallpaper size decreased as the temperature increased.

2.4 Alternative Test Method

An alternative test method was developed along the lines of the bentonite-jelly test (Patrick 1976). The draft test procedure and worksheet for the alternative test are in Appendix 1.

2.4.1 Equipment

Following is the equipment and materials list taken from the draft test procedure:
Mixing/storage container and stirring tool.

- Wallpaper size.
- 3 mm thick flexible perspex plate of 300 mm diameter.
- 10 mm thick rubber pad of 300 mm diameter.
- A steel or plastic ruler or a tape graduated in millimetres, at least 300 mm in length.
- Syringe or measuring cylinder.
- Paper towels or cloth for cleaning purposes.
- Hand broom or soft brush.

Except for the perspex plate and the rubber pad, these items of equipment are non-specific to this test and are readily available.

2.4.1.1 Perspex plate

Consideration was given to the flexibility and hence the thickness of the perspex plate. A 3 mm thick perspex plate was chosen so that it would flex into the undulations of the road surface reducing the effects of high points. A diameter of 300 mm was selected for practical reasons (the diameter of the circle could be measured by a common 300 mm ruler and the plate is a reasonable size to handle and transport).

2.4.1.2 Rubber pad

During the development of the test procedure it was noted that there was a difference in the diameter of the wet patch obtained by lightweight and heavyweight operators. A flexible rubber pad over the perspex plate was designed to help spread the load of the operator, stop the operator being able to see what was happening to the wallpaper size (and hence try to influence the outcome) and to help even out any high points as with the flexible perspex plate. The difference between the heavyweight and lightweight operators was overcome with the addition of the rubber pad.

2.4.2 Test Procedure

The test procedure is generally straightforward but the following points were noted:

2.4.2.1 Standing on the rubber pad

How the operator stood on the rubber pad and perspex plate influenced the results. The simplest way and the way involving least operator error was to step onto the rubber pad, one foot after the other, stand with both feet side by side, together and centred over the wallpaper size mound. Stay stationary without transferring weight from side to side, wait for three seconds and step off, one foot after the other.

2.4.2.2 Stabilising the perspex plate and rubber pad

Where the road surface was sloping the perspex plate tended to slide downhill on the wallpaper size. The best way to avoid the perspex plate from slipping was to either carefully bed-in the perspex plate by putting some weight on it or put one foot or hand alongside the downslope side of the perspex plate.

2.4.2.3 Volume of wallpaper size

Forty millilitres (ml) of wallpaper size was required for the alternative test, unless the diameter of the circle formed was greater than 225 mm (nearing the diameter of the perspex plate). If the diameter of the circle was greater than 225 mm the test was required to be repeated using 17 ml of wallpaper size. During the alternative test trial, this occasion arose on an asphaltic concrete surface. Seventeen millilitres was selected based on a sensitivity analysis of the expected diameter of the wallpaper size circle for different texture depths.

3. PRECISION TRIALS

In 1993 a sand circle trial was carried out by Works Consultancy Services Ltd, Central Laboratories. Four local locations were selected for the trial covering a range of texture depths. The "Standard Test Procedure for Measurement of Texture by the Sand Circle Method", Transit New Zealand T/3 : 1981, was used for the trial.

In 1997 the BCA (Bitumen Contractors Association) requested that a trial of the sand circle test be carried out by contractors and people who regularly use the sand circle test. The tests were carried out at the same six site locations where the alternative test was trialed, so that a comparison of results could be made. The "Standard Test Procedure for Measurement of Texture by the Sand Circle Method", Transit New Zealand T/3 : 1981, was used for the trial.

4. DETERMINATION OF TEST PRECISION

The determination of repeatability and reproducibility of the tests was evaluated in terms of the definitions and analysis methods given in ASTM E691-1987 "Standard Practise for Conducting an Inter-Laboratory Study to Determine the Precision of a Test Method".

Table 3. Alternative test and sand circle test - reproducibility sites.

Site location	Road surface	Mean profile depth* (mm)
Test Areas A and B Site 1	Chipseal grade 4	2.09 - 2.29
Test Areas C, D, E and F Site 2	Asphaltic concrete	0.54 - 0.62
Test Areas G, H, I and J Site 3	Slurry seal	0.89 - 0.97
Test Areas K, L and M Site 4	Chipseal grade 5	Not measured
Test Areas N, O and P Site 5	Chipseal grade 4	3.08 - 3.75
Test Areas Q, R and S Site 6	Chipseal grade 4	1.96 - 2.24

*Mean profile depths are those measured with the Transit New Zealand stationary laser profilometer.

4.1 The Alternative Test

Ten operators were used in the evaluation of the alternative test, none of whom had ever seen the alternative test performed and thus could not be considered biased. Each operator was given a copy of the draft test procedure before going to site. They were advised to carefully read through the draft test procedure so they understood the method. Each operator worked independently; travelling to and working alone at each site.

The reproducibility trial involved 10 operators, working on 19 test areas, over six sites, using the alternative test to measure texture depth. Of the 10 operators, two did not comply with the test procedure so their data was not included in the statistical analysis. Details of the six sites are in Table 3.

The repeatability trial involved four operators, at sites 2, 3 and 5, carrying out three repeats on one test area per site, using the alternative test to measure texture depth. At each location the area was washed and then lightly brushed between tests.

4.2 Sand Circle Test

4.2.1 1997 Bitumen Contractors Association (BCA)

Seven independent operators (four contractors, two City Council employees and one Central Laboratories employee) carried out sand circle tests at the same six site locations and exactly the same spot as the alternative test was trialed. The operators repeated the sand circle test three times on one test area at each of the six site locations (Table 3).

Each operator worked independently of the others. Some used their own sand circle sand and equipment while others used sand and equipment provided by Opus, Central Laboratories. Each operator was given a copy of the Transit New Zealand standard sand circle test method before the trial, for reference.

4.2.2 1993 Central Laboratories

Six sand circle operators were used at four different locations repeating the sand circle test three times. Four of the six operators were experienced at the sand circle test the other two were not. Only the data from the experienced operators has been included in this analysis to enable the influence of experienced trained operators to be gauged. The four experienced operators had all observed each other performing the test and could therefore be considered biased. The sites and results are in Table 4.

Table 4. Test areas for the 1993 Central Laboratories sand circle trial.

Site location no.	Road surface	Average sand circle texture depth (mm)
Test area W	Chipseal grade 3	2.06
Test area X	Chipseal grade 3	1.94
Test area Y	Chipseal grade 5	2.30
Test area Z	Chipseal grade 5	1.72

4.3 Results

4.3.1 Alternative Test

A summary of the results is given in Table 5.

The reproducibility of the alternative test indicates that "*the results of two properly conducted tests by two operators on the same spot should not differ by more than 18%*".

The repeatability of the alternative test indicates that "*the results of two properly conducted tests by the same operator in the same spot should not differ by more than 12%*".

Table 5. Statistical analysis for the alternative test - reproducibility data.

Test Areas	Average texture depth (x)	Standard deviation of operator (SR)	Standard deviation of reproduc.	Reproduc. (95% confidence)	SR/x	Reproduc. of mean (%)
A-B	2.93	0.21	0.21	0.59	0.07	20.0
C-F	0.77	0.06	0.06	0.16	0.08	20.5
G-J	1.49	0.09	0.09	0.23	0.06	15.3
K-M	2.42	0.14	0.14	0.38	0.06	15.5
M-P	4.11	0.28	0.28	0.77	0.06	18.3
Q-S	2.83	0.17	0.17	0.46	0.06	16.3
Average	**2.31 mm**	**0.15 mm**	**0.15**	**0.40 mm**	**0.06**	**18%**

Table 6. Statistical analysis for the alternative test - repeatability data.

Test area	Average texture depth (x)	Standard deviation of operator (SR)	Standard deviation of repeatib.	Repeatib. (95% confidence)	SR/x	Repeatib. of mean (%)
C	0.77	0.13	0.03	0.08	0.04	10.6
I	1.60	0.07	0.09	0.25	0.06	15.6
P	4.04	0.02	0.15	0.43	0.04	10.6
Average	**2.14 mm**	**0.07 mm**	**0.09**	**0.25 mm**	**0.05**	**12%**

4.3.2 Sand Circle Tests

4.3.2.1 1993 Central Laboratories sand circle trial

Table 7. A summary of the statistical analysis of reproducibility for the 1993 sand circle trial.

Test method	Standard deviation	Reproducibility (mm)	Overall mean	Reproducibility as % of mean
Sand circle	0.18	0.51	2.09	24

4.3.2.2 1997 Bitumen Contractors Association sand circle trial

The reproducibility of the sand circle test indicates that *"the results of two properly conducted tests by two operator on the same spot should not differ by more than 41%".*

The repeatability of the sand circle test indicates that *"the results of two properly conducted tests by the same operator in the same spot should not differ by more than 11%"*

Table 8. Statistical analysis for the 1997 Bitumen Contractors Association sand circle trial - reproducibility data.

Test Area	Average texture depth (x)	Standard deviation of operator (SR)	Standard deviation of reproduc.	Reproduc. (95% confidence)	SR/x	Reproduc. of mean (%)
A	2.07	0.27	0.28	0.79	0.14	38
C	0.65	0.07	0.07	0.21	0.12	32
I	0.89	0.09	0.09	0.26	0.10	29
K	2.17	0.33	0.34	0.95	0.16	44
P	2.27	0.35	0.36	1.00	0.16	44
Q	2.58	0.50	0.52	1.46	0.20	57
Average	**1.77 mm**	**0.27 mm**	**0.28**	**0.78 mm**	**0.15**	**41%**

Table 9. Statistical analysis for the 1997 Bitumen Contractors Association sand circle test - repeatability data.

Test area	Average texture depth (x)	Standard deviation of operator (SR)	Standard deviation of repeatib.	Repeatib. (95% confidence)	SR/x	Repeatib. of mean (%)
A	2.07	0.27	0.06	0.17	0.03	8
C	0.65	0.07	0.02	0.06	0.03	9
I	0.89	0.09	0.02	0.07	0.03	7
K	2.17	0.33	0.09	0.26	0.04	12
P	2.27	0.35	0.07	0.20	0.03	9
Q	2.58	0.50	0.17	0.47	0.06	18
Average	**1.78 mm**	**0.27 mm**	**0.07**	**0.20 mm**	**0.04**	**11%**

4.4 Correlation of Test Results

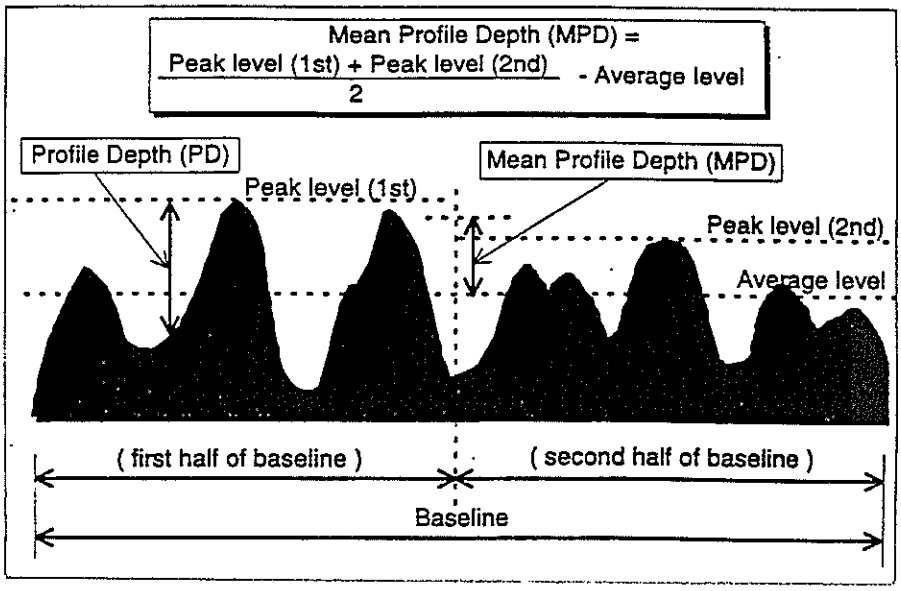
A comparison was made between texture depth results obtained using the sand circle test, the alternative test and the mean profile depth (MPD) using the Transit New Zealand stationary laser

profilometer. Five of the six sites previously mentioned, were selected to cover a range of texture depths from 0.5 mm to 3.8 mm.

The stationary laser profilometer essentially consists of a laser device which measures the height of the surface below it, using a 0.5 mm diameter laser light spot. The laser device travels along a rail, and so provides a precise vertical cross-section of the surface. The surface height is measured to within an accuracy of ±0.03 mm. The stationary laser profilometer has been fully described in Transfund NZ Research Report No. 84 "Replication of VTI's Stationary Laser Profilometer for Measuring Road Surface Profile". It allows calculation of the mean profile depth (MPD) in accordance with ISO 13473-1. The MPD is calculated in millimetres. It is the average of a series of individual MPD values calculated for 100 mm long profile segments (or baseline lengths).

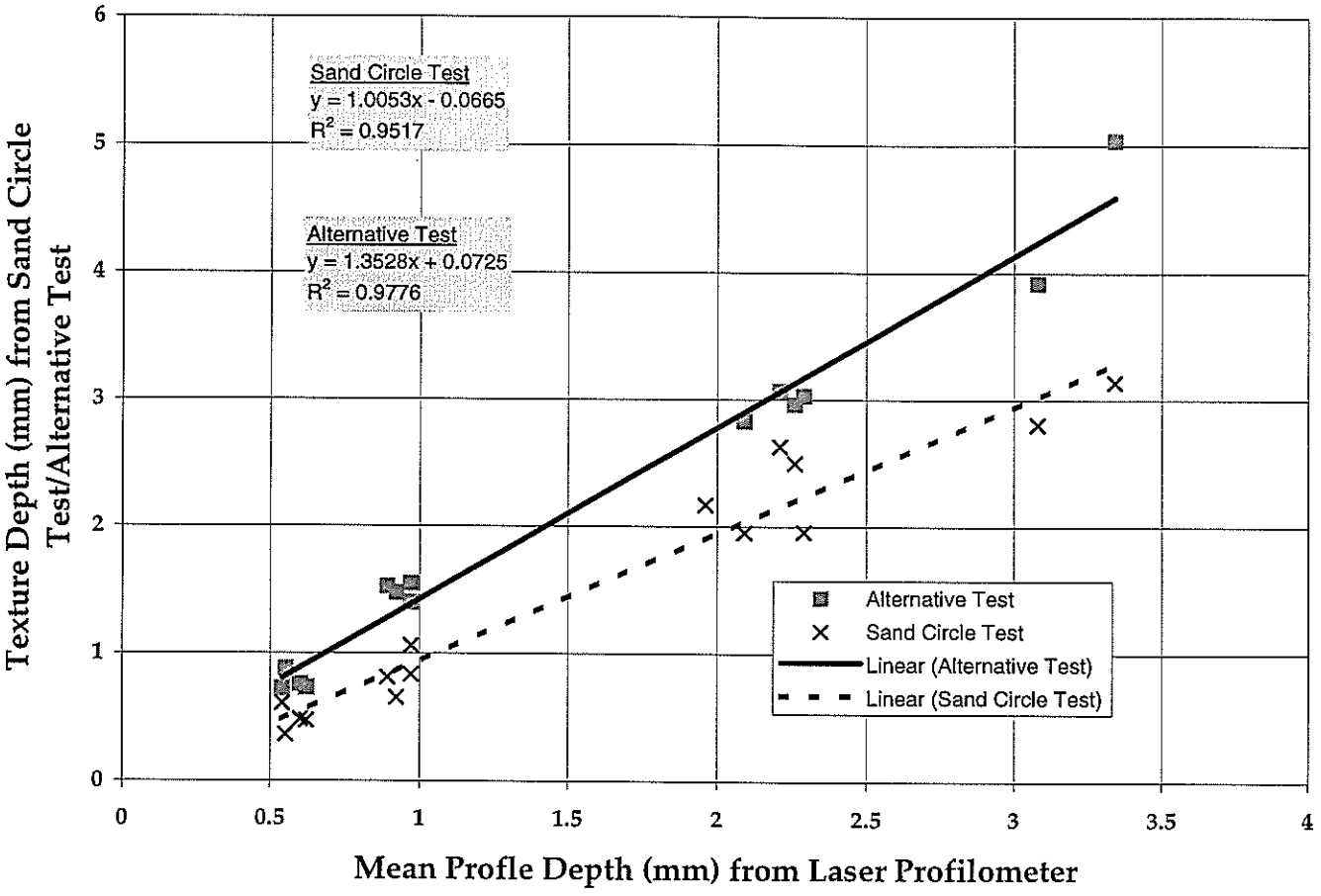
For each segment the measured profile is filtered to obtain wavelengths in the 2.5 to 100 mm range, and the average depth of the segment profile is then calculated using the average of the highest peak in each of two 50 mm sub-segments as the reference height. The concept and terms are illustrated in the following figure.

Figure 1. Illustration of the terms *Baseline, Average Level, Peak Level, Profile Depth (PD) and Mean Profile Depth (MPD).*



For each test site the average texture depth value obtained in the reproducibility trials for the sand circle and alternative test was used in an analysis of the relationship with the MPD. The results are illustrated in Figure 2. Where it can be seen that there is a slightly better correlation between the alternative test and MPD than that obtained with the sand circle. The sand circle data can be seen to give approximately a 1:1 relationship with MPD whereas the alternative test has a greater slope.

Figure 2. Plot of texture depths from the sand circle trials and the alternative test versus the mean profile depth from the Transit New Zealand stationary laser profilometer result.



5. CONCLUSIONS

This research project has successfully developed a test to measure pavement texture depth that significantly improves reproducibility, but is simple and quick to perform and uses inexpensive and easy-to-obtain materials.

The main conclusions are:

- The repeatability of the alternative test compared with the sand circle test is similar - 12% compared with 11%.

- The reproducibility of the alternative test is significantly lower - 18% compared with 41% for the sand circle test. The reproducibility analysis indicates the alternative test is less operator dependent than the sand circle test.

- The 1993 sand circle data indicates the sand circle test to be operator dependant with a reproducibility of 24%. The 1993 sand circle trial was performed with operators who had similar training while the 1996 trial, which used operators who had not been influenced by each other, had nearly double the reproducibility.

- The alternative test data and the sand circle test data compare well with the Transit New Zealand stationary laser profilometer test data.

6. RECOMMENDATIONS

It is recommended that further trials of the alternative test be performed before it is adopted as a method for measuring texture depth in order to determine the effect, if any, of the:

- Consistency of wallpaper size;
- Effect on hot road surface;
- Stabilising of plate before stepping on it;
- Sloping road surfaces; and
- To investigate standard weight rather than operators weight.

7. REFERENCES

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APPENDIX 1 : DRAFT TEST PROCEDURE

DRAFT

STANDARD TEST PROCEDURE FOR THE MEASUREMENT OF PAVEMENT TEXTURE DEPTH USING WALLPAPER SIZE

1. SCOPE

The test method describes the determination of the average texture depth of a paved surface using a known volume of wallpaper size to estimate the volume of voids. The method can be used for texture depths greater than 0.4 mm.

2. APPARATUS AND MATERIALS

2.1 Mixing/storage container and stirring tool.
2.2 Wallpaper size.
2.3 3 mm thick flexible perspex plate of 300 mm diameter.
2.4 10 mm thick rubber pad of 300 mm diameter.
2.5 A steel or plastic ruler or a tape graduated in millimetres, at least 300 mm in length.
2.6 Syringe or measuring cylinder.
2.7 Paper towels or cloth for cleaning purposes.
2.8 Hand broom or soft brush.

3. PROCEDURE

3.1 Prepare a mix of Selleys Sure Bond wallpaper size as per the manufacturer's instructions on the packet (NB. need to leave wallpaper size for approximately 15 minutes to develop full consistency. Stir thoroughly without entrapping any air before using).
The mixed wallpaper size can be stored for up to two weeks in an airtight plastic container. Note the safety directions on the packet.

3.2 Determine the location of the proposed test area.

3.3 Ensure there is no free water or wallpaper size on the pavement.
If present use paper towels and/or brush to remove.

3.4 Sweep the road surface free of dirt and loose chips within a diameter of approximately 350 mm.

3.5 Measure 40 ±0.5 ml of wallpaper size (taking care not to suck up any air if using a syringe), and place in the centre of the test area.

3.6 Place the centre of the perspex plate on the mound of wallpaper size.
Place the rubber pad over the perspex plate taking care not to move the perspex plate sideways.
Step onto the rubber pad. Place your feet together, side by side and centred over the wallpaper size.
Do not move around on the plate other than to step on and off.
Wait three seconds and step off the rubber pad.
This process forms a wet patch on the surface of the road.

3.7 Remove the plate and rubber pad together by lifting vertically.

3.8 Measure the diameter of the wet patch (to the nearest millimetre) four times, at approximately 45 degrees intervals.

3.9 Calculate the mean of the four measurements and record as the representative diameter of the patch.

3.10 Remove the wallpaper size from the road surface using the paper towels and the hand broom to brush away what remains.

3.11 If the diameter of the patch is greater than 225 mm, repeat steps 3.2 to 3.10, using 17 ml of wallpaper size.

4. CALCULATION

The average texture depth is calculated by dividing the volume of wallpaper size by the spread area of the wet patch.

$$\text{Average texture depth} = \frac{1000 * \text{Volume of size}}{\frac{\pi}{4} * D^2}$$

$$\text{For 40 mls, average texture depth} = \frac{50930}{D^2}$$

$$\text{For 17 mls, average texture depth} = \frac{21645}{D^2}$$

texture depth in mm, volume of wallpaper size in ml, D = diameter of patch in mm

5. REPORTING

5.1 Report date and time of testing and name of the operator performing the test.

5.2 Report the location of the test in accordance with the Transit New Zealand Specification T/4 "Standard Procedure for Description of Test Locations on Highways".

5.3 Report the average wet patch diameter to the nearest 1 mm.

5.4 Report the average texture depth to the nearest 0.1 mm.

DRAFT

STANDARD TEST PROCEDURE FOR THE MEASUREMENT OF PAVEMENT TEXTURE DEPTH USING WALLPAPER SIZE

TNZ Test ### : 1997

Job:

Location:

Operator: Checked by:

Date: Date:

Pavement Details:

Construction Materials: chipseal, grade / slurry seal / asphaltic concrete

Pavement Condition: dry / damp / repeat test

Other Comments:

Site										
Identification of test area										
Volume of wallpaper size used (ml)										
Diameter 1 (mm)										
Diameter 2 (mm)										
Diameter 3 (mm)										
Diameter 4 (mm)										
Mean diameter (mm)										
Surface texture depth* (mm)										

* For 40 ml, average texture depth = $50930/D^2$
For 17 ml, average texture depth = $21645/D^2$